Programme & Abstract Book

17th International Congress of Dentomaxillofacial Radiology

Imaging in Perspective

June 28-July 2, 2009

Amsterdam, The Netherlands
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Dear colleagues,

It is our pleasure to welcome you in Amsterdam. We hope you will enjoy your stay and we wish you a wonderful experience in Amsterdam, both from a scientific and from a social point of view.

The theme for the 17th ICDMFR is **Imaging in Perspective**. The field of dento-maxillo-facial radiology is constantly changing at the moment; technology is developing rapidly and many new imaging procedures were introduced over the last few years. The theme of the conference will offer many opportunities to focus on various aspects of new imaging modalities, on the role of maxillofacial radiology in dentistry and medicine, and on new teaching methods, to mention just a few “perspectives”.

The pre-congress course is named **CBCT exposed**. Five speakers will address various aspects of Cone Beam Computed Tomography, ranging from dosimetry to the clinical importance of this rather new imaging modality. They certainly will provide you with state of the art information on this timely theme.

We are pleased that well-known speakers, all experts in general, dental, and maxillofacial radiology, have accepted our invitation to present key-note lectures during the congress itself. Their lectures cover several important issues in dento-maxillo-facial radiology, but also interesting topics in adjacent fields.

This year’s congress has attracted a record number of abstracts from our members. They are a broad representation of the topics that are under investigation in dental and maxillofacial radiology. The results of these studies will be presented during oral and poster presentations with ample time for discussion.

The Technical Exhibition features all prominent manufacturers of dental and radiological equipment and tools. It is an excellent opportunity to get the newest information about new equipment and other developments directly from representatives of these companies. We also would like to take this opportunity to thank the sponsors and exhibitors for their support. Without this support, a congress like ours could not be organised.

We look forward to an exciting and stimulating congress.

Prof. Paul F. van der Stelt, DDS, PhD
President IADMFR

Dr. Gerard C.H. Sanderink, DDS, PhD
Chairman Organizing Committee
Acknowledgements

We thank our main sponsors:

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EUROPE
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- region 1: Faivovich, Gregorio, CHILE
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Coffee and tea breaks
For registered participants wearing their name badges, coffee and tea during the breaks are included in the fee.

Cloakroom facilities
A paid cloakroom is situated at the Forum Lounge, near the registration desk. The cloakroom will be guarded during Congress hours. The organizers cannot accept liability for loss or damage to property.

Currency and banking
The local currency is the euro (Eur/€). € 1 = 100 cents. Visa, MasterCard and American Express are accepted at the Registration Desk. Foreign currency will not be accepted. You are requested to pay with credit card or cash in Euros only. In general, all major credit cards are accepted for payment in hotels, restaurants and shops. There is an ATM machine in the RAI Convention Centre, accessible via the entrance K2 (exit the Auditorium Centre, keep to the left and walk up to the corner; turn left; the first entrance is K2. Please ask the receptionist for further directions). There is also an ATM machine in the square opposite the RAI (ABN AMRO Bank, Scheldeplein 1-5). Banks are open Monday to Friday from 10.00 - 16.00 hrs.

Disclaimer
All best endeavours will be made to present the program as printed. However, the organizers reserve the right to alter or cancel, without prior notice, any arrangements, timetables, plans or other items relating directly or indirectly to the Congress for any cause beyond it's reasonable control. In registering for the 17th ICDMFR you agree that neither the organizing committee nor the congress secretariat accept any liability whatsoever. The organizers accept no liability for personal injuries or loss, of any nature whatsoever, or for loss or damage to property either during or as a result of the Congress. Participation is completely at the delegate's own risk. The organizers will not be liable and will not compensate for any damage incurred to delegates during the Congress. Dutch laws apply. Delegates are advised to acquire their own travel insurance and to extend their policy to cover personal possessions as the Congress does not cover individuals against cancellation or bookings or theft or damage to belongings.

Dress code
Recommended dress code for the Congress and social functions is smart casual. For the dinner and dance the dress code: lounge suit/cocktail.

Electricity supply
Electricity in the Netherlands is supplied at 230V - 50Hz AC. USA, English and some other foreign appliances require an adapter for the voltage as well as an adapter for the plug. There are no adapters available at the RAI Convention Centre.

Emergencies
If you or any other delegate is unwell, an accident or any other emergency occurs, while at the Amsterdam RAI Convention Centre, please contact the registration desk or any staff member.

Internet
Internet will be available in the congress centre. You can buy an access card for this at the reception of the Auditorium Centre (Entrance G).

Language
The official congress language will be English. No translation arrangements will be made.

Lost Property
If you see any unattended parcel, please report to one of the Congress staff members. Should you loose anything at the Amsterdam RAI Convention Centre, please enquire at the Registration Desk.

Lunches
For registered participants wearing their name badges lunch is included in the fee. The lunch on Monday is sponsored by: the British Institute of Radiology Lunches are provided in the exhibition area.
Messages
Messages for delegates should be handed in at the Registration Desk. Notification of messages will be displayed on the message board next to the Registration Desk. Please check the board daily and pick up your messages – they may be urgent.

Mobile phones
Mobile phones must be switched off in the meeting rooms.

Name badges and tickets
For security purposes, delegates and exhibitors must wear their name badges at all times during the Congress. Entrance to the Amsterdam RAI Convention Centre will be limited to badge holders only. Replacement of lost name badges can be requested at the registration desk (costs €25). Tickets for social events and excursions will be issued to delegates who have booked for these events. Please present your tickets at these events and excursions.

Oral Presentations
Speakers should make sure that at least 1 day before the start of the session, their PowerPoint presentations are uploaded in the Speaker Ready Room. Computers are available for a last minute check of the presentation and a technician will be there to assist.
The Speaker Ready Room is located in Press Room Forum and will be open at the following hours:
- Sunday, 28 June 09.00 - 19.00 hrs
- Monday, 29 June 07.30 - 17.15 hrs
- Tuesday, 30 June 08.30 - 15.30 hrs
- Wednesday, 1 July 08.30 - 16.00 hrs
- Thursday, 2 July 08.30 - 16.00 hrs
Speakers are requested to be present in the meeting room at least 10 minutes prior to the start of the session to meet the chairperson and to check with the audiovisual assistant. All meeting rooms are equipped with data projection, a PC and a laser pointer. The chairperson will time all presentations. It is essential that all presentations are kept to the program timetable.

Orange Student Brigade
A team of enthusiastic students will be at your service. During Congress hours, they will provide hospitality support and steward services. They will also serve in most of the meeting rooms as technical assistants and can be easily recognized by their orange shirts.

Poster sessions
TUESDAY 30 JUNE 2009

POSTER SESSION 1 - DIAGNOSTICS: BONE TISSUE, SALIVARY GLANDS, MISCELL.
09.00-09.45 hours

POSTER SESSION 2 - ANATOMY: INTRAORAL, 3D IMAGING: INTRAORAL, CBCT
09.45-10.30 hours

POSTER SESSION 3 - RADIATION, DECISION MAKING, EDUCATION, IMAGING CBCT/3D
11.45-12.30 hours

THURSDAY 2 JULY 2009

POSTER SESSION 4 - DIAGNOSTICS, ULTRASOUND, OTHERS
09.45-10.30 hours

POSTER SESSION 5 - DIAGNOSTICS: IMPLANTS, PRESURGICAL PLANNING, ORTHODONTICS, TMJ, OTHERS
11.45-12.30 hours

POSTER SESSION 6 - POSTER 6 IMAGING: CT MICRO-CT, OTHERS, DIAGNOSTICS: CARIE, ENDODONTICS, PERIODONTOLOGY, MISCELL.
13.30-14.15 hours
Poster Viewing
Posters will be on display in the exhibition and poster area during a period of two days.
- Period 1: Monday June 29 and Tuesday June 30
- Period 2: Wednesday July 1 and Thursday July 2
Poster sessions will be held at designated times where authors will have the opportunity to present their work. Presenters are expected to be present at their poster during this session.
For Period 1 poster sessions are held on Tuesday
For period 2 poster sessions are held on Thursday.

Build up and removal of Posters:
Build up for period 1: Sunday June 28 or Monday morning June 29 until 9.00 hrs and removal on Tuesday June 30 after 15.00 hrs.
Build up for period 2: Wednesday July 1 before 9.00 hours and removal on Thursday July 2 after 15.00 hrs.
Posters must be displayed during the entire length of the specific period. When posters are not removed after a session the remaining posters will be removed by the congress organizer and destroyed in a later stage.

Programme changes
The organizers cannot accept liability for any changes in the program due to external or unforeseen circumstances.

Public Transport
Amsterdam is a very compact city where your destination usually will not be at a great distance. Therefore, Amsterdam is ideal for getting around by foot, bicycle or public transport. There is a dense public transport system and tram, metro or bus stops are usually around the corner. Cars are less suitable for navigating in Amsterdam. Moreover, parking must be paid for in almost the entire city and the rates can be substantial.
How to reach the Amsterdam RAI Convention Center:
From Amsterdam RAI railway Station: from this station it is a short walk (8 minutes) to the Convention Center. You can also take tram 4; first stop in front of the Convention Center.
From the Central railway Station: tram 4
From the Amstel railway Station: bus no. 15 or 62 to the Amsterdam RAI railway Station.
There will be no shuttle service available between Schiphol Amsterdam International Airport, the Amsterdam RAI or the Congress hotels.

Registration and Information:
The registration desk is located on the ground Floor of the Forum Center (Entrance E of The Rai Convention Center).
Opening hours:
- Sunday, 28 June 09.00 - 19.00 hrs
- Monday, 29 June 07.30 - 17.30 hrs
- Tuesday, 30 June 08.30 - 15.30 hrs
- Wednesday, 1 July 08.30 - 17.00 hrs
- Thursday, 2 July 08.30 - 17.00 hrs

Registered participants and students are entitled to:
* Participation in scientific sessions
* Entrance to exhibition
* Meeting documentation
* Admission to the opening ceremony and welcome reception on Sunday
* Admission to the welcome reception on Monday
* Admission to the social event on Tuesday (although admission is free, pre-registration before 28 June is required for this event since maximum numbers apply)
* Admission to the Farewell Party
* Coffee, tea and lunch services during the scheduled breaks
Registered accompanying persons are entitled to:
* Admission to the opening ceremony and welcome reception on Sunday
* Admission to the welcome reception on Monday
* Admission to the social event on Tuesday
* Admission to the Farewell Party
* Possibility to take part in the excursion programme (at additional costs)

Research Award
This Award for junior/trainee Dentomaxillofacial radiologists will again be awarded at the 17th congress of the IADMFR in Amsterdam. The purpose of this award is to encourage research in maxillofacial imaging and to stimulate interest in the IADMFR.
Original research limited to any aspect of maxillofacial imaging will be considered. It will be judged on:
1. Originality and design of the investigation.
2. Quality of the data produced.
3. Suitability of the methods of analysis used.
4. Scientific value of the work.
5. Quality of the presentation.
6. Demonstrated mastery of the subject.
All the finalists will present their oral presentation during a dedicated session on Monday June 29.
The first prize will be: USD 7,500
The second prize will be: USD 2,500

Services for the Disabled
All the rooms at the Congress venue are fully accessible to delegates with disabilities.

Smoking Policy
In the RAI Convention Centre, smoking is prohibited by law. Smoking is only permitted in a few designated areas outside the building.

Shopping
Most shops are open from Tuesday through Friday from 9.00 to 18.00 hours, Saturdays from 09.00 to 17.00 hours. On Mondays, many shops are closed in the morning. They open between 11.00 and 13.00 hours and close at 18.00 hours. Evening shopping (until 21.00 hours) is on Thursdays and many shops in the city centre open on Sundays from 12.00 to 17.00 hours.

Time
Amsterdam is 1 hour ahead of Greenwich Mean Time.

Tipping
Service is always included. However, it is customary to tip in restaurants and when paying for taxi’s. As a general rule tipping between 5 - 10% should be adequate.

Taxis
Taxis can be ordered at the Porter’s Desk in the access hall of the Forum centre.

Beach South
Behind the Auditorium Centre of the RAI Convention Centre you will find this upmarket city beach 'Strand Zuid' (Beach South), with elegant beach furniture and a nice bar. It borders the Beatrix Park pond, no swimming is allowed but showers are available. DJ’s are playing there during the weekends. It is open during the Congress for lunch, dinner or just to relax!
The Farewell Party will also be held at this location.
Social Programme

Sunday June 28, 2009 - Opening ceremony and welcome reception
Location: Amsterdam RAI Convention Centre
Time: 17.00-19.00 hours
Dress code: smart casual

Entrance: admission is included in the registration fees for participants and accompanying persons.

Monday June 29, 2009 - Reception City Council of Amsterdam
Location: City Hall (adjacent to the Stopera), Amstel 1
Time: 17.15-19.00 hours - Dress code: smart casual
17.15 hours: Canal Boats will transfer the participants directly from the RAI convention centre to the Reception in the City hall. Boats will depart from RAI Harbour (backside of the congress centre).
No return transport is provided!
Public transport: From RAI: metro 51 – Stop: Waterlooplein
From other directions: metro 53 or 54, tram 9, 14. Stop: Waterlooplein

From the stop Waterlooplein you can walk (5 minutes) to the entrance of the Stopera:

The Mayor of the city of Amsterdam will welcome all participants and accompanying persons at a welcome reception in the town hall. This town hall-cum-music theatre, designed by the Viennese architect Holzbauer, was built in 1986 and soon nicknamed “Stopera”.
The building is situated in a bend of the river Amstel.

Entrance: admission is included in the registration fees for participants and accompanying persons.

Tuesday June 30, 2009
Social event: Zuiderzee Museumpark, Enkhuizen
15:15h Departure from RAI
22.30h busses return at RAI
Dress code: casual

A short bus trip and a boat transfer along the beautiful ‘Hanze’-city Enkhuizen will bring you to the Zuiderzee Museum Park’s bumpy roads. The old village of the Museum Park is full of authentically build houses and will put you in mind of a century old Dutch world. Many of those villages existed alongside the former Zuiderzee, currently IJsselmeer. In the village you will find a church, a harbour, a school, a fish smoker, a smith etc. After a guided tour we will enjoy dinner/barbeque in the ‘Amsterdam House’ in the Museum Park. In the evening the busses return to RAI.

Entrance: admission is included in the registration fees for participants and accompanying persons.
Wednesday July 1st, 2009 - Congress Dinner and Dance
Venue: Westerkerk, Prinsengracht 281 Amsterdam
Time: 19.00 -23.30 hours

Anybody who has read Anne Frank’s diary will be familiar with the Westerkerk. She wrote about hearing the bells from inside the secret annexe, her hiding place from the Nazis.
In 1966 Queen Beatrix and Prince Claus were married in the church and the famous Dutch painter Rembrandt was buried in the Westerkerk on October 8, 1669. The tower, which occupies a unique place in the affections of the people of Amsterdam, bears the symbol of the imperial crown of Maximilian of Austria, which was his gift to the city in gratitude for support given to the Austro-Burgundian princes. It has inspired many songs and poems and remains a symbol of the city for Amsterdammers abroad.
In this historic place in the city centre of Amsterdam we like to welcome you for the official Dinner and Dance.

Dress code: lounge suit/cocktail
Public transport: From RAI: tram 4 – Stop: Amsterdam Central Station (approx. 20 minutes)
From Amsterdam Central Station: Tram 13, 17 or Bus 142, 170, 171, 172 – Stop: Westermarkt (approx. 4 minutes)
From the stop Westermarkt you will directly see the venue for the dinner, the church ‘Westerkerk’

Entrance fee: € 85.- (pre-registration is required since maximum numbers apply)

Thursday July 2nd, 2009 - Closing Ceremony and Farewell party
Time: 15.30 hours

After the Closing Ceremoy in the RAI convention Centre the Farewell Party will be held in the “Strand Zuid” pavillion located adjacent to the RAI Convention Centre.

Entrance: admission is included in the registration fees for participants and accompanying persons.

Social events 17th ICDMFR

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<th>PUBLIC TRANSPORT</th>
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<tr>
<td>Opening ceremony &amp; welcome reception</td>
<td>Sun June 28</td>
<td>RAI Convention Centre</td>
<td>17.00</td>
<td>ca. 19.00</td>
<td>smart casual</td>
<td></td>
</tr>
<tr>
<td>Reception City Council</td>
<td>Mon June 29</td>
<td>City Hall Amstel 1, Amsterdam</td>
<td>17.15</td>
<td>19.00</td>
<td>smart casual</td>
<td>Canal boat included Metro 51, 53, 54; tram 9, 14 Stop: Waterlooplein</td>
</tr>
<tr>
<td>Zuiderzee Museum</td>
<td>Tue June 30</td>
<td>Museum Park, Enkhuizen</td>
<td>15.15</td>
<td>22.30</td>
<td>casual</td>
<td>Bus included</td>
</tr>
<tr>
<td>Congress Dinner &amp; Dance</td>
<td>Wed July 1</td>
<td>Prinsengracht 281 Amsterdam</td>
<td>19.00</td>
<td>23.30</td>
<td>lounge suit/cocktail</td>
<td>tram 13, 17 bus 170, 171, 172 Stop: Westerkerk</td>
</tr>
<tr>
<td>Closing Ceremony &amp; Farewell party</td>
<td>Thu July 2</td>
<td>Strand Zuid Europaplein 22 Amsterdam</td>
<td>15.30</td>
<td>16.30</td>
<td>smart casual</td>
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</tbody>
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Exhibition information

The 17th ICDMFR expresses its warm thanks to our Exhibitors for supporting the Congress. We encourage all delegates to visit the Exhibition and to learn more about the products and services on show. The Exhibition is located in Lounge Forum (ground floor of the Forum congress centre).

Exhibition opening hours:
Sunday 28 June       18.00 – 20.00 hours (Welcome reception in exhibition area)
Monday 29 June        09.00 – 16.00 hours
Tuesday 30 June       09.00 – 15.00 hours
Wednesday 1 July      09.00 – 16.00 hours
Thursday 2 July       09.00 – 13.30 hours
Dismantling
Thursday 2 July       13.30 – 23.30 hours

Exhibition Information Desk opening hours:
Sunday 28 June       8.00-18.00 hours
Monday 29 June       9.00-17.00 hours
Tuesday 30 June       8.30-15.30 hours
Wednesday 1 July      8.30-17.00 hours
Thursday 2 July       9.00-16.00 hours
# Exhibitors

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P1 - DIAGNOSTICS: BONE TISSUE, SALIVARY GLANDS, MISCELL.
P2 - ANATOMY; INTRAORAL; 3D IMAGING; INTRAORAL; CBCT
P3 - RADIATION, DECISION MAKING, EDUCATION, IMAGING CBCT/3D

MONDAY 29 JUNE & TUESDAY 30 JUNE 2009

P4 - DIAGNOSTICS, ULTRASOUND, OTHERS
P5 - DIAGNOSTICS: IMPLANTS, PRESURGICAL PLANNING, ORTHODONTICS, TMJ OTHERS
P6 - IMAGING: CT MICRO-CT, OTHERS, DIAGNOSTICS: CARE, ENDODONTICS, PERIODONTOLGY, MISCELL.

WEDNESDAY 1 JULY & THURSDAY 2 JULY 2009
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<td>CBCT principles and performance characteristics.</td>
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<td>John Ludlow Chapel Hill, North Carolina, USA</td>
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<td>Guy Marchal Leuven, Belgium</td>
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<td>14.00</td>
<td>Bassam Hassan Amsterdam, The Netherlands</td>
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Dear colleagues,

Cone Beam CT was introduced in dental and maxillofacial radiology not long ago. Since then it has developed as an important and in many cases essential technique in our diagnostic routine. Because it is yet a rather new imaging modality, there is still much to learn about this imaging technique and its implementation in the diagnostic process. You will see that there are many presentations, both oral and posters, during the Congress presenting the results of studies on CBCT. The purpose of this pre-congress course is to provide a basis for the understanding of the principles, possibilities and constraints of CBCT. The pre-congress committee is pleased that several experts accepted the invitation to share their knowledge with the participants. A variety of aspects of CBCT will be presented, with ample time for discussion.

We wish you an interesting and informative day.

On behalf of the pre-congress committee,

Paul F. van der Stelt  
Chairman pre-congress Committee

---

**Pre-congress committee**

Chairman  
Paul van der Stelt

Member  
Reinhilde Jacobs

Member  
Bassam Hassan
ABSTRACTS

CBCT: Principles and Performance Characteristics
Willi A. Kalender, Erlangen/Germany

X-ray Computed Tomography (CT) has shown a tremendous development in the past two decades; clinical CT systems today allow for whole-body data acquisitions in 10 to 30 s with excellent image quality and isotropic spatial resolution of typ. 0.5 mm in spiral scan mode. Cone-beam CT (CBCT) is a new and innovative approach using wide area detectors with data acquisition limited to a single circle or less. The scan approach, the decisive hardware components and typical scanners will be presented and discussed. CBCT is used heavily by now in dento-maxillo-facial radiology, but even more so in interventional radiology and for special applications, e.g. micro-CT. In general, image quality and dose efficiency are inferior to that of dedicated clinical CT. CBCT is attractive nevertheless as it may provide increased spatial resolution and a design adapted to and optimized for the respective application.

Dosimetry of CBCT
John Ludlow, Chapel Hill, North Carolina, USA

More than 62 million CT scans per year are made on patients in the US alone. From 1.5% to 2% of all cancers in the United States may be attributable to the radiation from CT studies. CBCT examinations may be a dose-reducing alternative to medical MDCT for some maxillofacial examinations; however, as CBCT is increasingly used as a replacement for conventional dental imaging, population doses from these applications may actually increase. This presentation provides an overview of the dose and risk of ionizing radiation from a variety of imaging procedures used in dental practice. The advantages and disadvantages of different dose measuring techniques applied to maxillofacial imaging will be discussed. The rationale for using effective dose as a measure of examination risk will be explained. Alternative ways of explaining radiation risk to patients and referring practitioners will also be described. Doses from examinations from a variety of commercially available CBCT units will be discussed. Factors which increase or reduce patient dose, and strategies for reducing patient dose will be explored.

Large field CBCT versus volumetric CT: body applications
Guy Marchal, Leuven, Belgium

With the recent introduction of dynamic large size direct digital flat panel detectors in interventional x-ray rooms, it becomes possible to produce CT-like 3-D datasets with an acceptable contrast resolution. On the other hand, the width of CT detectors is also progressively increasing, with the advantage of high spatial, contrast and time resolution. CT fluoroscopy is possible allowing 3-D real time monitoring of anatomy. The drawback of CT is however limited patient access and the lack of 2-D fluoroscopy which is often needed for vascular procedures. An overview will be given regarding the current use of large field of view CBCT, as it becomes available for minimal invasive therapy.
Cone Beam CT 3D imaging and navigation:
Bassam Hassan, Amsterdam, the Netherlands

Cone Beam CT (CBCT) is a widely debated radiographic technique in dental imaging. The appearance of new systems on the market each year with different scan field sizes, spatial resolutions, image contrasts and artifacts made it increasingly more difficult to evaluate and compare the available systems for their applicability in certain applications. And while the differences in image quality of the different CBCT systems on two-dimensional (2D) slices are clearly visible, they are even more prominent when making three-dimensional (3D) models reconstructions. This presentation will look at the quality, applicability and constraints of the 3D models created from CBCT for selected clinical indications. Recent developments in 3D image navigation relevant to CBCT will also be addressed.

CBCT in Dentistry
Kostas Tsiklakis, Athens, Greece.

Cone Beam CT (CBCT) is the most recent development in the field of DentoMaxillofacial Radiology and its use is expanding rapidly throughout the world. It has been recently introduced as an alternative imaging technology, dedicated to maxillofacial region, for acquiring, three dimensional information. CBCT requires less expensive components than conventional CT can be easily installed in a dental clinical practice and reduces exposure by using lower radiation dose. The clinical use of this technology in all aspects of dentistry and in oral surgery has been well documented in the literature. The purpose of this lecture is to present the usefulness of CBCT, in imaging and diagnosing: teeth abnormalities, teeth pathology, benign and malignant lesions of the jaws, TMJ osseous changes, dental implant planning, impacted teeth, trauma of the maxillofacial region, facial deformities and clefts.
CV’s of the speakers of the pre-congress course

Willi A. Kalender was born on August 1, 1949. He received his Master’s Degree and Ph.D. in Medical Physics from the University of Wisconsin, Madison, Wisconsin, USA in 1979. He worked in the research laboratories of Siemens Medical Systems in Erlangen, Germany. He was appointed head of the Department of Medical Physics from 1988 to 1995 and has also worked at the University of Wisconsin, the Technical University of Munich, Germany, and Stanford University, Stanford, CA, USA. In 1995 he was appointed full Professor and Chairman of the newly established Institute of Medical Physics at the Friedrich-Alexander-University Erlangen-Nürnberg, Germany. His research is mainly in the area of diagnostic imaging, especially the development and introduction of volumetric spiral computed tomography. Other highly interesting fields of research were radiation protection and the development of quantitative diagnostic procedures, e.g. for the assessment of osteoporosis, lung and cardiac diseases. His work is documented in more than 700 scientific papers with more than 170 original publications among these. Willi A. Kalender is a Fellow of the American Association of Physicists in Medicine; from 2005 to 2007 he is elected Member of the Board of Directors of this society. He is member of the International Commission on Radiation Units and Measurement (ICRU). He organized and hosted numerous international workshops and conferences, among them the World Conference of Medical Physics in 2005 in Nuremberg, Germany.

Dr. John Ludlow is a Professor in, and Graduate Programme Director of, the Radiology Section of the Department of Diagnostic Sciences and General Dentistry at the University of North Carolina School of Dentistry. He received his DDS from the University of Michigan in 1978 and MS in Oral Diagnosis and Radiology in 1983. He joined the UNC faculty in 1989. He is a past president of the American Board of Oral Maxillofacial Radiology, and past secretary of the American Board of Oral Medicine. He Chairs the Board of Directors of the Caring Dental Professionals of North Carolina – a wellness programme for dentists and dental hygienists. He is a member of Omicron Kappa Upsilon National Dental Honor Society, a Fellow of the American College of Dentists, and a Fellow of the Royal College of Surgeons, Edinburgh. Dr. Ludlow has published over 75 papers and was the AAOMR Wuehmann Prize winner for the best radiology research paper of 2006-2007.

Guy Marchal was born on January 15, 1946. He received his Undergraduate medical education at the Catholic University of Louvain, Medical School and received his MD degree in 1970. Postgraduate training in Radiology was received at the University Hospitals in Leuven and concluded with the Board certification in Radiology in 1973. He obtained his PhD degree on a dissertation entitled: Contributions to tissue characterization in US, CT and MRI. Since 1985 he has been Assistant Professor, Associate Professor in 1989 and appointed as full professor in 1992. He is Chairman of the Department of Radiology of the University hospitals of Leuven as from October 1997, Research Director of the Laboratory for Medical Imaging (Radiology/ESAT), Past-President of the Royal Belgian Society of Radiology and Member of numerous committees/boards at the University and in different Scientific Organisations. His work is documented as Author or co-author of approximately 650 papers on Medical Imaging.
Bassam Hassan obtained his bachelor of dentistry from the University of Baghdad in 2004. He then joined the Oral Imaging Centre at the Katholieke Universiteit Leuven KUL under the supervision of professor Reinhilde Jacobs to finish his master degree in medical imaging. His thesis topic was the development of an interactive learning module for Cone Beam CT anatomy [www.cile.co.nr](http://www.cile.co.nr). He graduated with distinction in 2006 and then joined a PhD project regarding the applications of Cone Beam CT in endodontics and orthodontics at the Academic Centre for Dentistry in Amsterdam (ACTA) under the supervision of prof. Dr. Paul van der Stelt and Dr. Gerard Sanderink. In the past four years, he has been involved in several projects related to 3D imaging and Cone Beam CT.

Kostas. Tsiklakis, DDS, MSc, PhD is Vice Dean and Professor and Chairman of the department of Oral Diagnosis and Radiology, School of Dentistry, University of Athens, Greece. He has received his DDS and PhD degrees from the University of Athens. He has obtained his MSc degree from the Loyola University of Chicago and he has attended a two year Post Graduate Programme in Oral Diagnosis and Radiology in the same University. He has served as President of the Hellenic Society of Dentomaxillofacial Radiology and as a member of the European Union Committee for the study of Radiation Protection in Dentistry and for the development of the “European Guidelines” for Radiation Protection in Dental Radiology. He was elected as Vice-President of the Attica Dental Association for five years (2000 – 2005) and was elected Vice-President of the “European Academy of Dentomaxillofacial Radiology for the years 2004-2006 and President for the years 2006-2008. He has published more than 100 papers in Greek and international scientific magazines, he is co-author in two scientific books and has participated as a speaker in numerous Greek and International congresses.
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One software package to manage all your digital x-ray needs!

- Operate multiple digital x-ray systems from different manufacturers
  - Air Techniques
    - Gendex
    - Morita
    - Sirona
  - Dent-X
    - Instrumentarium
    - Planmeca
    - Soredex
  - Dürr
    - Kodak
    - Schick
    - Suni

- All digital x-rays archived in a single database
- Large collection of imaging tools to optimize your digital x-rays
- Direct connection to patient management software

Visit [www.emago.info](http://www.emago.info) to find more information about Emago and download the demonstration version
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**Monday 29 June 2009**

**REGISTRATION - INFORMATION DESK OPEN: 07.30 - 17.30 HOURS**

Robert Speller, UK

**Recent developments in X-ray sensor systems and their use in and outside medicine**

Inv1

**Age dependent cone beam computed tomography evaluation of midpalatal and zygomatic-maxillary sutures**

O-07

**Digital volume tomography for navigated foreign body removal**

O-08

**The accuracy of CBCT in the assessment of artificially induced periapical bone lesions for deciduous and permanent teeth**

O-09

**Thyroid gland absorbed radiation dose from intra-oral radiographs in children who suffered a dental alveolar trauma**

O-18

**Dose reduction of parotid gland in treatment of nasopharyngeal cancer with helical tomotherapy**

O-19

** Influence of thyroid collars in identification of cephalometric landmarks**

O-20

**Compliance of Iranian dentists with safety standards of oral radiology**

O-21

**Perineural spread of adenoid cystic carcinoma: evaluation with CT and MR imaging**

O-24

**Ultrasound-assessed salivary gland change in Sjogren’s syndrome – relationships to systemic and local indicators of primary and secondary Sjogren’s disease**

O-25

**Salivendoscopy: a minimally invasive procedure for diagnosis and management of obstructive salivary gland disorders**

O-26

**The reliability of ultrasound scanning in the management of head and neck infections**

O-27

**Ultrasonographic features of mandibular ameloblastoma**

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<td>Assessment of the relationship of disc position to disc configuration in TMJ internal derangement by using magnetic resonance imaging</td>
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<td>Temporomandibular joint involvement and craniofacial morphology in 60 adult patients with juvenile idiopathic arthritis</td>
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<td>Image analysis of a quality assurance phantom for cone beam CT</td>
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**MONDAY 29 JUNE 2009**

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<td>Temporomandibular joint involvement and craniofacial morphology in 60 adult patients with juvenile idiopathic arthritis</td>
</tr>
<tr>
<td>16.45 - 17.00</td>
<td>Image analysis of a quality assurance phantom for cone beam CT</td>
</tr>
</tbody>
</table>

18.00-19.00 Reception City Council of Amsterdam
O-01

Conventional radiography and CBCT for detection of artificial root resorption cavities

Hintze H¹, Frydenberg M²
Department of 1Oral Radiology and 2Biostatistics, Faculty of Health Sciences, Aarhus University, Denmark

Objectives
To compare the diagnostic accuracy of two conventional and two cone beam computed tomography (CBCT) systems for the detection of simulated external root resorption cavities.

Materials and methods
Cavities of three different sizes (0.6 mm ('small'), 1.0 mm ('medium') and 1.4 mm ('large') in diameter) were drilled in 53 roots of human extracted teeth. On each root cavities could be placed on nine different locations. The cavities were drilled randomly in accordance to location and size. In total 318 locations were without a cavity, 51 had a 'small', 56 a 'medium' and 52 a 'large' cavity. Thereafter, the tooth roots were placed in an empty, suitable alveolus in a dry skull and radiographed by conventional, periapical radiography using film (F, Insight, Kodak) and a digital sensor (D, Dixi, Planmeca) and by CBCT using Scanora 3D (S, Soredex) and NewTom 3G (N, QR s.r.l.). One radiographer examined the radiographs of each root from the different radiographic systems under common conditions (light box and magnification viewer for film radiographs, dedicated software for digital and CBCT radiographs; only 2D-reconstructed images for the NewTom radiographs, dark room light) for the identification of cavities of different sizes and locations. Diagnostic accuracy was expressed as sensitivity and specificity and percentage of correct registrations for specific cavity sizes. Differences between pairs of systems was tested using Wald test based on robust standard errors.

Results
The sensitivity for cavity detection irrespective of size was significantly highest for S (0.85) followed by N (0.65), D (0.33) and F (0.21). Differences between specificities of the systems (range: 0.91-0.95) were small and non significant. For correct identification of 'small' and 'large' cavities the CBCT systems were significantly more accurate than the two conventional radiographic systems, which did not differ significantly. S was significantly more accurate than N for correct identification of 'small' cavities.

Conclusions and discussion
CBCT was more accurate than conventional radiography for detection of root cavities in general, and Scanora 3D was superior to NewTom 3G in some cases.

O-02

On Cone Beam CT artifacts caused by titanium implants
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Poliklinik für Zahnärztliche Chirurgie, Johannes Gutenberg-University

Introduction
CBCT is widely used for implant planning, often also for evaluation of implant position and bone support. Well known streak artifacts mainly caused by beam hardening within the implant bodies may render the evaluation of periimplant tissue impossible.

Objectives
To briefly review the mathematical background of beam hardening artifacts in CBCT-reconstruction and to investigate geometrical properties relevant for these reconstruction errors. By means of simulated and experimental results, beam hardening effects caused by titanium implants are evaluated.

Materials and Methods
Geometrical as well as physical properties of the acquisition process of the projections used for 3D reconstruction are investigated and their effects on the CBCT images in the presence of titanium implants are derived. Beam hardening effects are computed for a simplified polychromatic situation (three energy subsets of 80kV and 110kV and compared to experimental results from a hard-plaster phantom containing two "implants" (pure titanium rods; 4mm diameter) exposed in two CBCT-machines (3DAccuitomo, J Morita Corp. Kyoto, Japan; 3DExam, KaVo Dental, Biberach, Germany).

Results
Massive absorption within a typical the implant body (diameter: 4,0 mm) was computed for the low energy subset of both energies (80kV: 99.7%; 110kV: 90.9%), whereas the high energy subsets are only marginally absorbed (80kV: 14.8%; 110kV: 11.3%). Accordingly, phantom data revealed drastically reduced gray values in artifact affected regions (3DAccuitomo: 65%) or (3DExam: 55%) plus increased noise (plus 75% versus 72.7%), when compared to unaffected regions.

Conclusions and Discussion
The most dominant artifacts due to light metal such as titanium are caused by beam hardening. From our theoretical as well as experimental results can be concluded, that the beam hardening effect de facto is massive for a typical implant diameter and typical energies of up-to-date CBCT machines.
Patient positioning protocols for imaging maxillary and mandibular teeth with the Accuitomo 3DX, small volume cone beam CT

White N., Whaites E.J.
King’s College London Dental Institute, London, UK

Background
The Accuitomo 3DX provides 4cm and 6cm cylindrical 3D volumes of the maxillofacial skeleton. The manufacturer’s guidance is that the patient’s head should be positioned with the midline sagittal plane vertical, the Frankfort plane (FP) horizontal and the cross lights centred on the middle of the region of interest. 1-dixel® software allows the volume data to be re-constructed so the images can be orientated in true cross-section. To re-slice volume data takes several minutes and to achieve the optimum image the data may need to be re-sliced in more than one plane. All patients imaged during the first month following installation of the unit were positioned as per the above guidance. To provide true cross-sectional slices all the resulting data volumes needed to be re-sliced. The aim of this project was therefore to capture optimum image data by optimal beam alignment and accurate positioning of the patient, so avoiding the need to re-slice the data, and to establish standard patient positioning protocols.

Methods
Test scans were performed on a human skull phantom to establish the optimum horizontal beam angles for mandibular and maxillary central and lateral incisors, canines, premolars, 1st, 2nd molars, and 3rd molars. 4 cm scans were taken of each of these teeth using a variety of different horizontal beam angles. The FP was also altered following clinical assessment to ensure the long axis of the tooth under investigation was in true vertical alignment.

Results
For each of the 6 regions in the maxilla and mandible optimal horizontal beam angles and FP position were determined, for example, lower 3rd molar: +/- 15°, FP tilted up so that the lower border of the mandible is horizontal. Together, these positioning adjustments produced optimal captured data which did not need to be re-sliced. As a result new patient position protocols were established.

Conclusion
Accurate positioning using a combination of the correct horizontal beam angle and vertical alignment of the tooth under investigation before the exposure results in optimum diagnostic information from the original data volume without the need to re-slice. These principles can also be applied to pre-implant imaging.
Are collateral pathologies in cone beam CTs made for orthodontic diagnostic purposes a concern?

Pazera P1, Bornstein M2, Pazera A3, Katsaros C1
1 Department of Orthodontics and Dentofacial Orthopedics and 2 Department of Oral Surgery and Stomatology, University of Bern and 3 Department of Radiology, Hospital of Neuchâtel, La Chaux-de-Fonds, Switzerland

Introduction
Cone Beam CT (CBCTs) is frequently used in orthodontics in order to clarify specific problems like tooth eruption disturbances or impacted teeth. However, besides the orthodontic indications other non-dental pathologies might be present inside the scanned volume.

Objectives
The aim of this study was to evaluate the frequency and the kind of collateral pathologies present in CBCTs made for orthodontic purposes.

Material and Methods
92 consecutive CBCTs (from 51 female and 41 male patients with a median age of 13.9 years) made for orthodontic diagnostic purposes were included in the study. All scans were obtained using a small volume CBCT (Accuitomo, Morita Corp, Japan) with a 4x4 cm or 6x6 cm field of view. An experienced radiologist and an orthodontist analyzed the CBCTs and recorded all collateral pathologies. Nasal septum deviations were not recorded because of the reduced size of the field of view used.

Results
In 27 CBCTs (29.3%) collateral pathologies not linked to the primary orthodontic indication were found. All of these were located in the maxillary sinus and were of three types: polypoid mucosal thickening (12 patients / 13%), flat mucosal thickening (11 patients / 11.9%) and signs of acute sinusitis (4 patients / 4.3%). No signs of osteomyelitis or malignant bone neoplasms were found.

Conclusions and discussion
A relatively high percentage of the CBCTs made for orthodontic diagnostic purposes showed pathologies not associated to the orthodontic indication. Although no osteomyelitis or malignant bone neoplasms were found in our patient group, collateral pathologies should be looked after carefully when analyzing CBCTs.

Digital volume tomography for navigated foreign body removal

Eggers G1, Senoo H2, Kane G1, Welzel T1, Mühling J1
1 Heidelberg University, Heidelberg, Germany; 2 Osaka University, Osaka, Japan

Introduction
Foreign bodies in the head can be a result of trauma or surgical interventions. Imaging is used to identify and locate the foreign body. With the use of navigation systems, the image data can also be used to support minimally invasive surgical removal of the object. For this task, predominantly is Computer Tomography (CT) employed.

Objectives
To investigate whether Digital Volume Tomography (DVT) is a suitable alternative to CT for image guided foreign body removal.

Materials and methods
Imaging was performed using both a Newtom 9000 DVT and for comparison a Siemens Somatom Emotion CT. In a phantom study, detection rates of typical foreign body substances were compared. Next, geometric accuracy of CT and DVT were compared. Finally, the targeting accuracy with a navigation system (Brainlab VectorVision) was compared based on either image data.

Results
Detection rates of radio-opaque foreign bodies were clinically equivalent between CT and DVT. The geometric accuracy of CT imaging was slightly better; however, there was no difference in navigation accuracy between the CT and DVT.

Conclusions and discussion
Technically, DVT is a good alternative to CT for image guided removal of radio-opaque foreign bodies. Clinically, the limitations of DVT in small objects can be a constraint. At our institution, DVT is used in clinical routine for navigated removal of foreign bodies.

Comparison of the image quality of CT and CBCT

Hirsch E.
University Leipzig

Aim
The aim of our study was to compare the image quality of a last generation CT-scanner with a state of the art CBCT.

Materials and methods
A human cadaver-head was examined using the CT-machine Brilliance iCT (Philips Healthcare, Eindhoven, Netherlands) and the CBCT-machine 3D Accuitomo FP 8x8 (J. Morita MFG, Kyoto, Japan). The examination on the Brilliance iCT was carried out using the protocol for inner ear (120 kV, 250 mA, 0.67 mm slice thickness) as mode that provides the highest resolution. The exposure parameters for the 3D Accuitomo were set on 90KV and 8mA, because we found the best image quality at these values in a former investigation. The perceptibility of 10 defined anatomical landmarks was investigated by 10 examiners (5 students and 5 dentists) using a five-point-rating scale.

Results
The image quality of the CBCT machine was superior in general. All anatomical landmarks were better perceptible on the CBCT- images than on the CT-images. The mean value of rating was 1,9 for the CBCT and 3,7 for the CT. Some of the landmarks weren’t visible on the CT-Images, e.g. the mandibular canal.

Conclusion
We recommend the use of CBCT-machines for dental 3D-imaging whenever possible, because some of the interesting structures are much better perceptible on the CBCT-scans.
KEYNOTE 1  
MONDAY 29 JUNE 2009  
Room Forum  
Session Chairs: Andre Mol, USA and David McDonald, Canada  

Recent developments in X-ray sensor systems and their use in and outside medicine  
Speller R  
University College London, London, UK  

The transition from analogue to digital X-ray recording of images is almost complete. It has taken approximately 30 years and the opportunities offered by the digital sensor are now maturing. Charge coupled devices were initially introduced into scientific/medical imaging in the 1970s/1980s respectively. The demand for large areas led to the development of amorphous silicon and amorphous selenium detectors and the need for lower noise, flexibility in design and lower power consumption has lead to major advances in active pixel sensors (APS) for both the commercial and scientific/medical sectors.  

There have been exciting developments in sensor technology driven by user demand. This is particularly the case for APS where novel design elements can be introduced through the use of CMOS technology. Sensors that have in-pixel intelligence can ensure that on-the-fly data corrections can be carried out; sensors where the dynamic range can be extended during data acquisition ensure you never take another image that saturates and those sensors can be used to ‘image’ information with a very wide dynamic range, i.e., tissue diffraction signatures. This talk will overview the current trends in sensor technology and their applications.  

Examples will be chosen to demonstrate the capabilities of the latest sensors and these examples will cover a range of medical and non-medical applications.  

Robert Speller, London UK.  
The development of new sensor systems and their use in and outside medicine.
Digital volume tomography for navigated foreign body removal

Eggers G, Senoo H, Kane G, Welzel T, Mühling J

1Heidelberg University, Heidelberg, Germany; 2Osaka University, Osaka, Japan

Introduction
Foreign bodies in the head can be a result of trauma or surgical interventions. Imaging is used to identify and locate the foreign body. With the use of navigation systems, the image data can also be used to support minimally invasive surgical removal of the object. For this task, predominantly is Computer Tomography (CT) employed.

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Imaging was performed using both a Newtom 9000 DVT and for comparison a Siemens Somatom Emotion CT. In a phantom study, detection rates of typical foreign body substances were compared. Next, geometric accuracy of CT and DVT were compared. Finally, the targeting accuracy with a navigation system (Brainlab VectorVision) was compared based on either image data.

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Detection rates of radio-opaque foreign bodies were clinically equivalent between CT and DVT. The geometric accuracy of CT imaging was slightly better; however, there was no difference in navigation accuracy between the CT and DVT.

Conclusions and discussion
Technically, DVT is a good alternative to CT for image guided removal of radio-opaque foreign bodies. Clinically, the limited field of view of some DVT devices can be a constraint. At our institution, DVT is used in clinical routine for navigated removal of foreign bodies.

The accuracy of CBCT in the assessment of artificially induced periapical bone lesions for deciduous and permanent teeth


1University of Cluj-Napoca, Romania; 2Oral Imaging Centre, School of Dentistry, Oral Pathology and Maxillofacial Surgery, Katholieke Universiteit Leuven, Belgium; 3School of Dentistry, University of Manchester, UK; 4Listing of partners on www.sedentexct.eu

Introduction
Cone Beam Computed Tomography (CBCT) may offer improved diagnosis of periapical disease, but the literature is still sparse on this subject.

Objectives
To assess the accuracy of CBCT for diagnosis of simulated periapical lesions in an animal model.

Materials and methods
Six pig mandibles (3 with mixed dentition, 3 with permanent teeth) were obtained with ethical approval and prepared by formalin fixation and with soft tissue simulation. Standardized periapical bone defects of 1x1mm; 2x2mm and 3x3mm were made in the premolar and molar regions after tooth extraction and root length measurement. Two different CBCT machines were used to image the mandibles, after repositioning of the teeth in the respective sockets. Seven examiners assessed the presence of apical periodontitis using a 5-point probability scale. Statistical analysis of CBCT accuracy for assessing simulated apical periodontitis was performed.

Results
The accuracy for periapical diagnosis was lower for deciduous teeth (57.8% accuracy) than for permanent teeth (71.6% accuracy). Sensitivity of CBCT for periapical lesion detection increased with lesion size for permanent teeth (65.3% for a 1mm defect, 82.1% for 2 mm and 93.9% for 3mm) but remained much lower for deciduous teeth (40.9% for 1mm defect, 35.7% for 2mm and 55.1% for 3mm).

Conclusions
CBCT was a useful method for diagnosis of simulated periapical lesions in permanent teeth.
CONE BEAM CT IN PERSPECTIVE: EMERGING TRENDS AND PRACTICES IN ORAL AND MAXILLOFACIAL IMAGING.

William Scarfe
Dept. of Surgical/Hospital Dentistry, University of Louisville School of Dentistry, Louisville, Kentucky, USA.

The introduction of Cone Beam Computerized Tomography (CBCT) has created an unprecedented revolution in oral and maxillofacial imaging, eclipsing the introduction of rotational panoramic radiography in the 1960’s. The adoption of this technology in dentistry has expanded globally both in terms of manufacturing centers, availability and clinical applications. More than a dozen CBCT systems are currently commercially available, all providing useful diagnostic images. This technology, together with the ability to output volumetric data as image files that are conformant with the Digital Imaging and Communications in Medicine standard version 3 (DICOM v3) for interoperability, has also facilitated a rapid evolution in the use of specific third-party compliant software applications for implant planning, orthodontic diagnosis, surgical simulation and image guided treatment.

While there are procedural similarities between CBCT and panoramic radiography, important distinctions between the two techniques exist including expanded choice of exposure and technique parameters, radiation dose and increased image display possibilities. The adoption of this modality has, in many instances, preceded the establishment of technical guidelines and clinical pre-requisites for optimal operation. However, there are also ethical, legal (national and regional), professional liability, reimbursement, manpower and educational issues surrounding the performance and interpretation of CBCT imaging in dentistry. The relationship between these factors is still evolving.

This presentation will review the adoption of maxillofacial CBCT imaging over the last 10 years, identify milestones and highlight emerging global and regional practice trends in the use and application of this modality. Based on this retrospective review and other data, current best practices for the patient selection, appropriate operation, use and application of CBCT technology will be summarized.

William Scarfe, Louisville, Kentucky, USA

CBCT in perspective: Emerging trends and practices in oral and maxillofacial imaging.

The use of cone beam computer tomography (CBCT) in Dentistry represents a technological "quantum leap" for diagnostic imaging. However, the adoption of this modality has, in many instances, preceded the establishment of technical guidelines and clinical pre-requisites for optimal operation. This presentation will outline best practices for the appropriate operation, use and application of CBCT technology.

Curriculum Vitae

Professor Scarfe graduated from the University of Adelaide School of Dentistry (1982) and was awarded Fellowship in the Royal Australasian College of Dental Surgeons (1986). He completed a certificate in Dental Diagnostic Science and a Masters from the Graduate School at the University of Texas Health Science Center at San Antonio (1992). He has been faculty at the University of Louisville School of Dentistry since 1993. He is a Diplomate of the ABOMR (1998) and currently Treasurer, American Academy of Oral and Maxillofacial Radiology and North American Regional Director of the International Association of Dento-Maxillofacial Radiology. In addition, he is Associate Editor of the Radiology Section of Oral Surgery Oral Pathology Oral Medicine Oral Radiology and Endodontology and a reviewer for the numerous other journals. He and Prof. Allan G. Farman have operated an intramural, private practice cone beam imaging (CBI) facility established in 2004. Dr. Scarfe has published extensively on CBI, presented internationally as well as nationally and is active in research on the clinical applications of CBI in Dentistry.
O-11

Three-dimensional cephalometric planar analysis: quest for hidden proportions of the face and skull

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Introduction

The development of three-dimensional cephalometry is essential for computer-assisted planning in orthognathic surgery and for computer-assisted orthodontics.

Objectives

We present a newly developed and validated three-dimensional (3D) cephalometric planar analysis and software (ACRO 3D).

Materials and methods

The analysis is composed of 19 landmarks and 13 planes. All landmarks are chosen on 3D low dose CT surface renderings. The planes are automatically constructed in ACRO 3D software. We propose three cranial planes (C1-C3), nine craniofacial planes (F1-F8, chin plane) and introduction of proportions to define the 3D cranial and 3D craniofacial reference frames. The sagittal plane is constructed on lateral landmarks belonging to the trigeminal and optic foramina. The user must compare anatomic structures with a constructed, planar 3D reference frame. The alignment (or lack thereof) of different structures along planes is indicative of the type of dysmorphosis present in the craniofacial skeleton. The planar reference frame illustrates the best 3D position for the maxilla and mandible in relation to individual craniofacial characteristics. We received the approval of the local ethical commission for the clinical validation of the 3D cephalometric analysis.

Results

We illustrate the use of the 3D cephalometric analysis based on clinical examples.

Conclusions and discussion

Three-dimensional cephalometric planar analysis based on individual characteristics and general proportions can help orthognathic surgeons in diagnostic, planning and correcting complex asymmetric faces in the three dimensions.

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O-10

Dosimetry from small volume cone beam CT of the posterior molar teeth

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1King's College London Dental Institute, London, UK; 2Guy's & St Thomas’ NHS Foundation Trust, London, UK

Aim

The purpose of the study was to calculate the effective dose delivered to patients undergoing small volume cone beam computed tomography (CBCT) using the Accuitomo 3DX FPD of the posterior molar teeth. The effective dose was calculated using both the 4 cm and 6 cm field of views.

Method

A Rando phantom containing thermoluminescent dosemeters located in 24 anatomical sites was scanned 10 times to enable a sufficient radiation absorbed dose to be recorded. Imaging protocols included a single scout view and 4 cm and 6 cm scans of the maxillary molars and 4 cm and 6 cm scans of the mandibular molars using standard patient positioning protocols.

Effective doses were calculated using both the 1990 and 2007 International Commission on Radiological Protection (ICRP) recommended tissue weighting factors.

Results

Effective dose varied between the mandibular and maxillary scans dependent on the volume of tissue irradiated and those radiation sensitive tissues in the field of view. The lowest effective dose was related to the 4 cm volume of the maxillary teeth and the highest dose related to the 6 cm volume scan of the mandibular teeth.

<table>
<thead>
<tr>
<th>Field of view</th>
<th>μSv (ICRP 60, 1990)</th>
<th>μSv (ICRP 103, 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 cm maxilla</td>
<td>4.29</td>
<td>22.15</td>
</tr>
<tr>
<td>4 cm mandible</td>
<td>11.76</td>
<td>59.08</td>
</tr>
<tr>
<td>6 cm maxilla</td>
<td>9.86</td>
<td>58.97</td>
</tr>
<tr>
<td>6 cm mandible</td>
<td>23.02</td>
<td>121.17</td>
</tr>
</tbody>
</table>

Conclusion

This study has confirmed the smallest field of view should be used to image the region of interest and thus delivers the lowest effective dose to the patient. Larger field sizes should only be used when clinically justified.
**O-12**

A comparison between bitewing radiographs taken with rectangular and circular collimators in UK military dental practice: a retrospective study

*Parrott LA1*

1Defence Dental Services, Aldershot, UK.

**Introduction**

Anecdotal reports suggest that rectangular collimation may result in more retakes with a possible net increase in patient dose. It is believed that the benefit from the use of rectangular collimation far outweighs any modest increase in individual dose especially since rectangular collimation offers dose reduction in the order of 60%. A preliminary study (questionnaire) showed that all responders used rectangular collimation, originally adopted by the Defence Dental Services in June 1997.

**Objectives**

The main aim of this study was to determine the effect of rectangular collimation, used with film holders (subset 3), on the incidence of cone cut error on a size 2 horizontal posterior bitewing radiograph in UK military dental practice. Comparisons were made with other film positioning errors that occurred when bitewings were taken with round collimation without film holders (subset 1) and with film holders (subset 2). The incidence of retakes was also recorded.

**Materials and Methods**

Permission was given for this anonymous, observational, retrospective study of bitewings which did not require Ethics Committee approval. 3000 bitewing radiographs from 285 patients were assessed for positioning errors and categorised using tables devised by the author. Chi-square test was used to test the significance of differences amongst the 3 subsets.

**Results**

There was an increase from 3.3% to 20.9% in the incidence of cone cut errors when rectangular collimation was used but the actual number of "rejects" was very small. Only 0.1% (1 of 1000 films) of subset 2 and 0.3% (3 of 1000 films) in subset 3 were considered "rejects".

**Discussion**

This study provides evidence that rectangular collimation did not significantly affect the diagnostic yield of bitewing radiographs despite the presence of cone cut. Therefore all practitioners should be strongly encouraged to adopt rectangular collimation.

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**O-13**

Peri-implant bone tissue assessment during osseointegration by comparing the outcome of 6 radiographic analysis methods to the histological standard.

*Corpas LS1, Jacobs R1, Duyck J2, Naert I2, Quirynen M3*

1Oral Imaging Center, 2BIOMAT research group and 3Periodontology Department, Dept Dentistry, Faculty of Medicine, Catholic University of Leuven, Leuven, Belgium

**Introduction**

Assessment of bone tissue is of utmost importance during implant planning and treatment follow up. Trabecular bone density and structure are crucial for initial bone healing after implant placement and further establishment and maintenance of osseointegration.

**Objectives**

The overall aim of the present study was to identify radiographic analysis methods revealing data that are most representative for the true peri-implant bone tissues as assessed by histology.

**Materials and methods**

Following a split-mouth design, four implants from two different implant systems were placed in both jaws of 10 Göttingen minipigs, resulting in a sample of 80 implants. Ethical approval was obtained from the local ethical committee for laboratory animal science. Standardized intra-oral digital radiographs were taken at baseline (implant placement) and after animal sacrifice (1-3 months after healing), when CBCT images and histological slices were also performed.

Six radiographic measurements with regard to bone level, bone density and bone fractal dimension were performed on both radiographic methods and compared to corresponding histological analyses. For statistical analysis, Statistica was applied with the level of significance set at 0.05. Kruskal-Wallis, Repeated Measures ANOVA and non-parametric Spearman’s tests allowed verifying the applicability of various radiographic methods to visualise peri-implant bone tissue, corresponding to the histological standard. Likewise, potential difference in peri-implant bone tissue changes during osseointegration could be studied using intra-oral radiography.

**Results**

Results showed significant correlations between bone level measurements on intra-oral images and histological slices ($r=+0.65$), as well as on CBCT images and histological slices ($r=+0.61$). Yet, no significant correlations were detected between fractal analysis as evaluated on CBCT, intra-oral radiography and histology. For bone density assessment, significant but weaker correlations ($p=+0.50$) were found for intra-oral radiography versus histology.

When monitoring changes over time using intra-oral radiography, the 3-months evaluation period allowed to see significant bone level and density changes for both implants systems.

**Conclusions and discussion**

The present study showed that minute bone changes during a short-term period can be followed up using digital intra-oral radiography. Surprisingly, radiographic fractal analysis did not seem to match histological fractal analysis. Furthermore, CBCT was not found reliable for bone density measures, but might hold potential with regard to structural analysis of the trabecular bone. In this perspective, there is a need to develop new dedicated analysis methods for bone quality assessment using CBCT.
O-14

The prevalence of lymphoepithelial cysts and the diagnostic ultrasound patterns of parotid glands in HIV positive patients in Mulago, Uganda

Kabenge C
Mulago Hospital, Uganda

Introduction Parotid swellings are a frequent finding in HIV positive cases. The lesions are often bilateral, asymmetrical, painless and slow growing and are associated with persistent generalized cervical lymphadenopathy.

Objectives To determine sonographically, in HIV positive patients, the condition of parotid glands with or without enlargement, determine the prevalence of lymphoepithelial cysts and observe the diagnostic ultrasound patterns of parotid glands.

Materials and Methods Ethics approval was obtained from the Infectious Disease Institute, Mulago Hospital, Uganda and King’s College London, UK (CREC/06/07/180). Two hundred patients of all ages were recruited mainly from Infectious Disease Institute, and a few from the Oral Surgery Outpatient clinic, both centers being at Mulago Hospital. Ultrasound scanning was performed in both longitudinal and transverse planes, using a broadband linear probe of 7-12 MHz frequency.

Results Of those patients without parotid enlargement, only 8% showed normal parotid ultrasound features, whilst 92% showed various abnormalities, including 34% with lymphoepithelial cysts. The overall prevalence of lymphoepithelial cysts in the study sample was 42%. There were 4 main distinct ultrasound pathological patterns in the parotid glands, i.e. lymphocytic aggregation, lymphoepithelial cysts, fatty infiltration and lymphadenopathy only. Unlike lymphoepithelial cysts, lymphocytic aggregations tended to be ill defined, less than 5mm and were not associated with posterior acoustic enhancement. Swellings were mainly bilateral though most were initially unilateral. Unilateral swellings displayed bilateral pathology. Parotid lipodystrophy was noted in patients on Highly Active Antiretroviral Therapy who showed lesser prevalence of cysts after 12 months of treatment. Lymphoepithelial cysts were multiple, mainly of size between 7-12mm diameter and 11% showed echogenic foci either mobile or stationary.

Discussion and Conclusion There was a wide spectrum of diagnostic ultrasound patterns. The prevalence of cysts, 42%, was high compared to other studies (3-10%) probably due to the large sample size and recruitment from an HIV research center.

Keywords: Parotid, HIV positive, ultrasound, lymphoepithelial cysts, lymphadenopathy

O-15

Assessment of vertical root fractures using three imaging modalities: cone beam computed tomography, intraoral digital radiography and film

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1University of Chiang Mai, Chiang Mai, Thailand

Introduction Cone beam computed tomography (CBCT) is a new imaging modality in dental radiography. The use of CBCT has increased in recent years in dental practices and there are many studies regarding its advantages. However, studies of CBCT for vertical root fracture detection have not been reported.

Objectives To assess the accuracy of CBCT in detecting vertical root fractures and to compare the accuracy with that of images from an intraoral sensor and with that of conventional intraoral film.

Materials and methods Sixty extracted, single-rooted, human teeth were divided equally into two groups; a control group of 30 teeth and an induced fracture group of 30 teeth. All teeth were randomly placed into sockets in six mandibles. Each tooth was imaged by three modalities; CBCT, intraoral digital radiography and intraoral F-speed film. Three beam angulations (90, 70 and 110 degrees to the long axis of the tooth) were used when radiographs were made using film and digital radiography.

Three dental radiologists evaluated the presence of root fractures in each image modality twice by using a five point confidence-rating scale. Receiver Operating Characteristic curves and the Kruskal-Wallis test were used for statistical analysis.

Results Cone beam computed tomography had the highest score in detecting vertical root fractures (mean of areas under the curve, AUC values: CBCT = 0.811, film = 0.797 and sensor = 0.775). However, there was no statistically significant difference between the three imaging modalities (p>0.05).

Conclusions and discussion CBCT is similar to intraoral film and intraoral digital imaging in detecting vertical root fractures. The observers’ experience with CBCT may play a role in the accuracy of CBCT interpretation.
O-16

Deriving hounsfield units using gray levels in CBCT

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University of Texas Health Science Center at San Antonio, San Antonio, Texas, USA

Introduction
Hounsfield units (HU) in medical computed tomography provide a standard scheme for scaling the reconstructed attenuation coefficients (AC). Dental Cone Beam CT systems, on the other hand, do not utilize a standard system for scaling the gray levels (GL) making it difficult to interpret the GL or compare the results from different machines. Presenting the GL as attenuation coefficients or HU offers a means for standardization.

Objectives
The objective was to develop and test a methodology for converting dental CBCT GL to HU in a standardized format for analysis and comparison.

Materials and methods
A phantom containing 8 reference materials (5 tissue equivalent materials, aluminum, air, and polymethyl(methacrylate) was imaged with 9 different dental CBCT machines and two medical CT scanners and exported to Cybermed’s On Demand 3D® software for analysis. The GL were plotted against the linear (AC) at various photon energies with the best linear fit being selected as the “effective energy”. Using the linear equation at the “effective energy”, GL were transformed to AC and entered into the HU equation. For clinical applications, a reference object with 5 of the 8 materials was scanned in the field of view to provide data for calibration. Utilizing the same method as the in-vivo study, HU were derived. Human studies approval was granted under Protocol #HSC20090033H.

Results
The technique was tested in-vivo and ongoing clinical studies yield corrected HU to be within a few percent of the HU at the “effective energy” in CBCT and medical CT units.

Conclusions and discussion
The ability to derive HU from GL allows comparison of results from different CBCT machines, bone quality assessment, and more accurate pathology analysis.

O-17

Image analysis of a quality assurance phantom for cone beam CT

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Introduction
There is a lack of tools for quality assurance (QA) testing of cone beam CT (CBCT).

Objectives
To perform an extensive evaluation of a prototype head-sized QA phantom for CBCT.

Materials and methods
A prototype phantom with inserts for image quality analysis was developed by Leeds Test Objects Ltd. The phantom was scanned on 6 CBCTs (3D Accuitomo®, SCANORA 3D®, GALILEOS®, ProMax 3D®, Picasso Duo®, Kodak 9000 3D®), one MSCT (SOMATOM Sensation 16®) and a high resolution microCT (SkyScan 1172®). Different image quality parameters were evaluated using the phantom’s inserts: spatial resolution, point spread function, line spread function, contrast resolution, image homogeneity, geometric accuracy, and metal artefacts.

Results
Spatial resolution proved to be dependent on voxel size, but also on the orientation of the inserts in the beam. Point spread function and line spread function estimation using, respectively, a steel wire and a Teflon® cube showed its potential for the analysis of spatial and contrast resolution. Further contrast resolution analysis on hydroxyapatite, aluminium and air in PMMA surrounding showed similar results for all CBCT scanners. Analysis of homogeneity of all previously mentioned materials proved to be dependent on voxel size, exposure (mAs), and the position of the ROI (central vs. peripheral). Geometric accuracy analysis using a 2D grid proved to be as useful as by means of a helix or another three-dimensional shape. Metal artefacts originating from titanium rods proved to be highly device-dependent in their manifestation, showing the need for an objective and clinically relevant artefact analysis.

Conclusions and discussion
All preliminary analyses of this first prototype QC phantom showed its potential for routine quality assurance on CBCT. Based on the initial evaluations, the phantom can be further developed, together with a software analysis tool for (semi-)automatic QA testing.
Introduction

Children who suffered a dento-alveolar trauma are subjected to an initial radiographic examination and in most cases follow-up radiographs are necessary. However, the angle of projection, particularly in children under the age of 10 and under critical conditions, frequently put the thyroid gland in the path of the X-ray beam.

Objectives

A retrospective assessment, by means of Personal Computer X-ray Monte Carlo calculations (PCXMC® versions 1.5 and 2.0), of the absorbed radiation dose by the thyroid gland from intra-oral and occlusal radiographs of the maxillary incisors, based on the projection angles, derived from the radiographs from the Ghent University Dental Outpatient Clinic in children aged 1 till 18 years old.

Material and methods

A random sample of 112 cases (between December 1992 and January 2008) from the dental outpatient clinic of the Ghent University Hospital was selected. From the files it was clear that, because of a lack of policy, a mixture of angulations (upper standard occlusal to bisecting angles and parallel technique) was used to visualize the maxillary incisor region radiographically. Elongation or foreshortening of the image provided an idea which vertical angles were used. In order to keep the number of calculations within reasonable limits, only 3 vertical angulations, namely 65, 45 and 30°, were selected to perform a retrospective theoretical calculation of effective dose in children, aged 1, 5, 10 and 15 versus an adult person (a 20 year old) using the PCXMC® software versions 1.5 and 2.0. Different exposure settings, as used in the Ghent University Dental Outpatient Clinic, were entered into the software programme; 70 kVp with 1 mAs, 70 kVp with 2 mAs, 60 kVp with 2 mAs and 60 kVp with 4 mAs. The statistical analyses were all carried out with the MedCalc® statistical software (Medcalc®, Frank Schoonjans; http://www.medcalc.be), which is developed especially for medical researchers. The level of significance was set at a P value of 0.05.

Results

From the clinical data it was observed that in children younger than 5 years, the occlusal radiograph was used in 87% of cases. For children older than 5, several projection techniques (e.g. parallel and bisecting angle technique) were used in equal proportions. Three projection angles, 30°, 45° and 65° respectively, were further used for PCXMC® calculations. It was found that irrespective of the exposure settings, the absorbed dose by the thyroid gland decreased with age and that there were significant differences between ages (1, 5, 10, 15 and 20 year olds). A projection angle of 45° caused a significantly higher absorbed dose by the thyroid gland than did 30° or 65°.

Conclusion and discussion

Radiation protection guidelines, in particular when children are involved, should always be respected. The results show the necessity of routine use of a thyroid radiation protection shield, when taking intra-oral radiographs of maxillary incisors, in order to reduce the dose to the thyroid gland.
O-20

Influence of thyroid collars in identification of cephalometric landmarks
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Introduction
Lead thyroid collars (TC), though a part of routine armamentarium of any Oral Radiology clinic, remains grossly underutilized. Thyroid collar for use in cephalometric radiography was introduced in 1977. Current guidelines like "Radiation protection guidelines for practicing orthodontists" are rather vague. The lack of unequivocal guidelines contributes to the underutilization of TCs. There seems to be no medical or ethical reasons for refusing a TC, except in cases of skeletal age estimation. It is assumed that a general apprehension by Orthodontist of masking some cephalometric landmarks thereby affecting the diagnostic quality of the radiograph may be the reason. This study was therefore carried out to test the hypothesis that use of TC in cephalometric radiography hampers its diagnostic quality.

Objectives
To study the influence of thyroid collars in identification of cephalometric landmarks.

Materials and methods
A randomized observer blind study was carried out in set of 2 groups. Lateral cephalometric radiographs were taken for two groups of patients, one with the use of TC (n=100) and other without TC (n=100). The reproducibility of 15 landmarks on cephalometric films taken for both the groups was evaluated. The findings were assessed using 1-way analysis of variance and independent samples t test was used to compare the groups. The data is presented in frequency and percentage and graphically presented by a bar graph.

Results
Of the 15 landmarks evaluated, 12 were identified consistently in the TC group. Three landmarks namely the ones on hyoid, second cervical vertebrae and third cervical vertebrae could not be identified on the TC group. Interobserver difference for landmarks identification for both the groups was not found to be significantly different.

Conclusions and discussion
The use of thyroid collars in taking cephalometric radiograph affects landmark identification. However the overall clinical effect is negligible as these affected landmarks are not commonly used by orthodontists. It is therefore encouraged to use thyroid collars during routine cephalometric radiography, namely when the landmarks above the second cervical vertebrae are of concern. This is to achieve optimal x-ray protection.

O-21

Compliance of Iranian dentists with safety standards of oral radiology
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Introduction
Dentists use x-rays in their daily practice quite often. Their knowledge and behavior toward radiographic exam can affect the population exposure to radiation. The aim of this study was to survey the behavior of Iranian dentists regarding oral radiology safety standards.

Materials and method
1000 Questionnaires were given to the participants of the 48th annual congress of the Iranian dental association (21 to 24th of October 2008) of which 701 were returned. They were asked about the following criteria: radiographic technique, film speed and exposure time, developing time of exposed films, type of the collimator and the use of digital radiography.

Results
In our studied group 12 % used paralleling technique and 86% used bisecting angle technique and the rest did not answer this question. F film was used by 9 %, E film by 62 %, D film by 8 %, D/E film by 5 %, E/F film by 3 % and 13 % did not know their film speed. Proper exposure time was used by 26.5 % and overexposure was present in 49% and 24.5% did not know about the exposure time. Proper developing time of exposed films was used only by 45 % of dentists and the rest underdeveloped their radiographs (which was compensated by overexposure). Long collimators were used by 15%, medium collimators by 49% and short collimators by 21 %. Round collimator was used by 88 % and rectangular collimation was used by 6 % and 6 % did not know about the shape of collimator. 2% used digital receptors, 95% used film and 3% used both.

Conclusion
It can be concluded that the majority of dentists in our study group did not select the proper method, material and equipment to minimize their patient exposure to unnecessary radiation in dental radiography.
O-22

Occupational exposure and effective dose estimation during CBCT examination

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Introduction

Cone beam CT (CBCT) provides three-dimensional imaging of the maxillofacial region and is increasingly being used in many of the dental specialties. Due to its widespread use in the everyday clinical work, the occupational exposure doses for the CBCT need to be estimated.

Objectives

To calculate the absorbed doses in the gonads area, the eyes and the thyroid gland and to estimate the effective dose with and without lead apron, on a phantom placed at predetermined positions around the CBCT NewTom 9000 unit.

Materials and Methods

Absorbed radiation measurements were performed on a water phantom simulating the head and the torso, using two dosimeters, a Thermo and a Polimaster. The dosimeters were placed on the phantom at heights of 1m, 1.60m and 1.70m (gonads, thyroid, and eyes height respectively). The phantom was placed at predetermined positions around the patient bed and five exposures were taken for each position. Statistical analysis was performed using the Factorial Anova (p<0.05) and LSD analysis.

Results

Absorbed dose of the gonads varied between 0.60 μGy to 7.42 μGy, of the thyroid gland 0.40 μGy to 4.34 μGy, and of the eyes between 0.23 μGy to 3.70 μGy. No statistically significant differences were found between the two dosimeters. The effective dose was estimated between $E_{2007}=0.071$ μSv and $E_{2007}=0.69$ μSv at the various positions around the scanner. The use of a lead apron reduced substantially the dose to the gonads and the thyroid gland.

Conclusions

Dose to the gonads was found to be higher compared to that of the other organs studied. Absorbed doses were found to be higher in positions closer to the CBCT gantry, particularly on its left side. The use of a lead apron proves to be essential for the radiation protection, if presence in the scanner room is required.
Ultrasound-assessed salivary gland change in Sjogren’s syndrome – relationships to systemic and local indicators of primary and secondary Sjogren’s disease

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Introduction
This study builds on previous work which showed a high sensitivity for ultrasound (US) when detecting salivary gland change in Sjogren’s Syndrome (SS), as diagnosed by application of internationally agreed American-European Consensus Group diagnostic criteria (Vitali et al 2002) by examining the links between degree of gland damage and abnormal factors in SS.

Objectives
The aim of the study was to examine the correlation between gland changes on US and local and systemic factors commonly measured in SS.

Materials and methods
US examination, (Philips iU22, 12-5MHz linear probe) by 4 experienced sonographers working to a standardised reporting template, investigated over 270 patients complaining of xerostomia. This examination revealed over 100 patients who were positive for SS under the American-European diagnostic criteria. US images were scored under 4 categories; gland echogenicity, parenchymal consistency, number of glands involved and for the presence of distinct hypoechoic and/or hypervascular foci. The total score was compared to ENA, ANA, Rheumatoid factor, IgG, whole salivary flow, stimulated parotid flow and a number of other variables. MALT lymphoma change was also investigated.

Results
Sensitivity, and particularly negative predictive value, of US remained high. US agreed with diagnosis in 97% of cases, showed specificity of 90% and negative predictive value was over 98%. Scores, reflecting severity of gland damage, were found to differ between primary and secondary SS. Correlations were found between variables such as ENA and ultrasound score, where further differences were observed between primary and secondary Sjogren’s cases.

Conclusions and discussion
The sensitivity and specificity of US in identifying parenchymal change in true SS is believed to be higher than for conventional sialography. It is possible to correlate the severity of ultrasound-demonstrated changes with local and systemic factors linked to SS.
O-26

Sialendoscopy: a minimally invasive procedure for diagnosis and management of obstructive salivary gland disorders
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Introduction
Salivary gland endoscopes provide an accurate and clear view of the entire lumen of the duct which is minimally invasive and at the same time could be interventional. The obstructive ductal pathologies such as salivary stones, mucous plugs, stenosis could be treatment with the use of sialendoscope.

Materials and methods
We describe the type of the endoscope that we use for diagnostic and interventional sialendoscopy, and we also report the treatment methods that we use. The observed disorders of the ducts were classified as mucous plugs, and Sialolithiasis.

Results
Diagnostic sialendoscopy was carried out in all glands with 100% success rate. Interventional sialendoscopy was carried out in 23 glands (2 parotid and 21 submandibular) with 75% success rate.

Conclusion and discussion
Sialendoscopy is a new promising technique which opens new horizon in salivary ductal pathologies. It has the advantage to explore the main duct of the major salivary glands, as well as secondary and tertiary branches, providing direct information for most ductal pathologies and reduces the need of gland excision and radiological investigations.

O-27

The reliability of ultrasound scanning in the management of head and neck infections
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Introduction
Head and neck swellings often present to departments of Oral and Maxillofacial Surgery (OMFS). It is often not clear whether a collection of pus is present. This is the key information for decisions about operative intervention. Although ultrasound scanning (USS) is safe and widely used to investigate the presence of a collection,(Peleg M. JOMS 56: 1129 – 1131, 1998) sensitivity and specificity of USS in OMFS has not been assessed. The reliability of USS in identifying the presence of head and neck collections was therefore examined.

Method
A review was undertaken of over 4000 consecutive head and neck USS reports over a four year period in the Cardiff and Vale NHS Trust. USS was used to look for evidence of a collection in 43 patients. The management and treatment outcome of these patients were subsequently reviewed and the degree of correlation between USS reports and clinical findings was calculated.

Results
36 out of 43 patients in the study had their swelling incised in theatre. Amongst these patients there was a 92% correlation between the USS report and the clinical findings. Seven patients were not taken to theatre. Three of these patients had a collection on USS which was not incised. In all seven cases the swelling resolved with antimicrobial therapy.

Conclusion
Sensitivity and specificity of USS imaging was very high. In only 7% of cases did USS and surgical findings conflict and even then, this can be explained by surgical difficulties. USS is a very reliable diagnostic tool in the management of head and neck swellings where pus is suspected.
Ultrasonographic features of mandibular ameloblastoma
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Introduction
Studies of bony tissues with ultrasonography (US) are very rare, especially for tumors of the mandible. Based on a search of PubMed from 1961-2008, there was no report regarding ultrasonographic appearances of ameloblastoma.

Objective
The purpose of this study was to demonstrate ultrasonographic characteristics and assess the value of US in diagnosis of mandibular ameloblastoma.

Materials and methods
The study was approved by the institutional research ethics committee. Nineteen subjects with ameloblastomas in the mandibles were examined with US. Appearances of the tumors were compared with histopathological findings. Sensitivity and specificity of Doppler flow signals for prediction of active tumor proliferations were calculated.

Results
The main sonographic features of the tumor appeared as a complex cystic mass with solid contents. Most tumors (15/19, 79%) showed no or minimal flow signals on color Doppler flow imaging (CDFI), while the remaining four lesions demonstrated abundant flow signals. The sensitivity and specificity of the Doppler flow signals for prediction of active tumor proliferations were 100% and 94%, respectively.

Conclusions and discussion
Ultrasonography can be used to distinguish cystic and solid components of ameloblastomas. CDFI of tumor vascularity could be used to predict active tumor proliferations.
Radiological evaluation of cystic lesions of the jaws in children
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Introduction
Radiological appearance of cystic lesions of the jaws is characteristic; a well defined radiolucency, associated with impacted teeth in many cases. Surrounding tissues may be displaced but not destroyed and the cortical bone could be expanded. Conventional plain radiography initially, followed by Dentascan, computed tomography (CT) and 3-dimensional one (3D CT) when needed, provide the required information. The treatment of choice in such cases is surgical removal, usually by enucleation, with preservation of the involved teeth and the surrounding tissues, approach important in children because of the continuous growing. Post operative imaging is very significant for the follow-up of the patient, especially in cases where recurrence may occur.

Objectives
The aim of this study is to discuss the crucial role of plain radiography and advanced imaging techniques in the overall treatment of cystic lesions of the jaws in children.

Material and methods
Forty-three young patients 2-14 years old, presenting with 47 cystic lesions and treated from 2000 to 2007 were included in the study. Pre-surgical diagnostic imaging and post-operative radiological follow-up were evaluated in every case studied.

Results
Enucleation of the cysts was performed in 35 cases (74.5%), marsupialization in 8 cases. The majority of jaw cysts (68.1%) were developmental, followed by 23.4% inflammatory cysts and 8.5% non-epithelial. In all cases pre-operative imaging contributed significantly to the treatment selected and post-operative radiological evaluation indicated the successful results; occasional recurrences were early detected also radiographically.

Discussion and conclusions
Plain radiography and advanced imaging techniques may be of great use in evaluating pre-operatively and post-operatively the treatment of cystic lesions of the jaws in children.
Introduction and objective
The purpose of this study was to examine the correlation between the size, shape, contrast enhancement ratio on CT images and histopathology of jaw cysts or cyst-like lesions.

Materials and methods
Ninety patients with odontogenic jaw cyst or cyst like lesions (histopathology; 30 radicular cysts, 27 follicular cysts, 29 keratocystic odontogenic tumors, and 4 ameloblastomas) were examined by pre- and post-contrast enhanced CT. CT images were obtained with a multidetector CT scanner at 120-140 kVp and 140-250 mA with 1.25-5 mm slice thickness. The infusion of 100 ml Iopamidol or Iohexol using auto injector pump was performed and CT images were taken simultaneously. The similar shape and scale down ROI was set in the maximum size area of the lesion on pre- and post-contrast enhanced CT images. The size, short and long axes of the lesion, and average CT value were measured.

Results
A significant difference was observed in the size between radicular cyst and keratocystic odontogenic tumor, and between follicular cyst and keratocystic odontogenic tumor (p<0.05). There were no significant differences about the ratio between short and long axes of the lesion, CT value on plain CT images, and contrast enhancement ratio (CER) among all cysts or cyst like lesions.

Conclusions and discussion
Multidetector CT examination provided the important diagnostic information such as the correct size, but it was difficult to show a complete agreement on clinical and pathological findings using CT value and CER for odontogenic cysts or cyst like lesions of the jaws.
O-34

The role of 3D-CT in evaluating the treatment of giant cell granulomas of the jaws in children
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Introduction
The 3-dimensional reconstruction features of the CT modalities offer a valuable visualization aspect, showing the exact extent and location of space-occupying lesions in the jaws from all possible perspectives.

Objectives
To examine the usefulness of the 3-Dimensional reconstruction features of the CT modalities, in the pre and post operative evaluation of the space occupying lesions in the jaws.

Materials and methods
12 young patients with CGC lesions of the jaws were treated at the Department of Oral and Maxillofacial Surgery of the A.& P. Kyriakou Children’s Hospital in Athens under general anaesthesia. All patients were previously referred for CT examinations.

Results
The exact extent, size, shape and localization of the lesion in the jaws, along with their relation to the adjacent structures, were accurately detected on the CT reconstruction, particularly the 3D reconstructions on the CT images, allowing for accurate surgical removal of the lesions.

Conclusions and discussion
The 3-Dimensional reconstruction features of the CT modalities may be of great use in evaluating pre-operatively and post-operatively the treatment of giant cell granulomas in the jaws.

O-35

Subgingival calculus and alveolar bone height in cigarettes and kreteks smokers
Assessed by Digital Panoramic
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Introduction
It is well accepted that smoking is a risk factor for periodontitis. Cigarette smoking is associated with several periodontal tissue breakdowns, but there is still limited evidence of kreteks smoking and periodontal health.

Objective
To study the differences of subgingival calculus and alveolar bone height in cigarette and kreteks smokers.

Materials and Methods
Subjects were divided into three groups, cigarette smokers (n=10), kreteks smokers (n=10) and non-smokers (n=10). The assessments of subgingival calculus and alveolar bone height were made based on Orthopantomogram (OPG)/Panoramic Digital using examiner’s blinded. Results were presented as means.

Results
Means subgingival calculus load in cigarette, kreteks and non-smokers were 29.2%, 22.8% and 10.1%, respectively, while means alveolar bone height were 72.7%, 75.3% and 83.1%, respectively.

Conclusion and discussion
The present study shows more subgingival calculus load and lower alveolar bone height in smokers compared to non-smokers. In addition, kreteks smokers had more prevalence of subgingival calculus and more severe alveolar bone loss compared to cigarettes smokers.
**O-37**

**MRI findings in temporomandibular joints of children suspected of juvenile rheumatoid arthritis**

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**Introduction**

Juvenile Rheumatoid Arthritis (JRA) may be the cause of serious disturbances in growth of facial area, depending on age of onset and duration of temporomandibular joint (TMJ) involvement.

**Objectives**

Our study is a retrospective analysis of findings on MRI investigation of TMJ, aiming to identify eventual redundancy within radiological investigations of Finnish children suspected of JRA.

**Materials and methods**

Between 01.01.2008 and 30.10.2008 there have been performed 84 MRI of TMJ in our imaging center, out of them 54 performed to patients under 18 years old. Only few were taken for trauma (3), idiopathic condylar resorption (1) and tumors (1), 49 were investigations for suspicion of arthritis (29 girls and 20 boys, mean age 12,08 years old).

14 patients were having their first investigation, 35 were follow ups.

**Results**

30,6% of the patients were referred to us by the rheumatologist, 69,4% by specialist dentist (in orthodontics or prosthetics). Positive diagnosis of JRA was found in 64,2% of first MRI and 91,4% of follow-ups. The onset of the disease seems to be different between girls and boys. Effusion was present in 27 joints (27,5%), but only 55,5% of these joint presented also a thickened and enhanced synovia. Soft tissue involvement without any modification of the synovia was found in 9 joints (9,2%). Bony tissues changes were present in 93 joints (93,5%), and 94,2% of the follow ups (25 unilateral and 25 bilateral changes). Negative diagnosis was more frequent among girls (20,6% comparing to only 10% among boys) and those referred by rheumatologist (20% versus 14,7% referred by specialist dentist). Discus presented dislocation and deformation in 35,7% of investigated joints, 24,5% of joints had no modification of discus. Availability of other investigation was also evaluated: 4 patients had no pantomography available, 13 patients had other TMJ radiography, 44 had other joints’ radiographs.

**Conclusions and discussion**

No redundancy or useless investigation was found. In this category of patients, the findings guide the treatment and thus, influence the outcome of the treatment.
Assessment of the relationship of disc position to disc configuration in TMJ internal derangement by using magnetic resonance imaging
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Introduction
Disc displacement with reduction (ADDR) or without reduction (ADD) is considered the most frequent abnormality in patients with pain and dysfunction of the TMJ. Disc displacement is infrequently associated with deformity which has been recognized as an important feature of internal derangement of the TMJ and as a suspect in functional impediment. In fact, shape of the disc is one of the determinants of type of surgical procedure selected. The relationship between disc position and configuration has not been fully studied.

Objectives
To assess the relationship between different types of disc position and disc configurations in TMJ with internal derangement.

Materials and methods
Twenty five patients with clinical diagnosis of internal derangement were examined using T1W sagittal MRI. Displacement and deformity were graded into 6 and 5 classes according to Nebbe and Murakami et al respectively. Relationships between categorical variables were assessed by chi-square and Fisher’s exact tests.

Results
The most prevalent disc deformity in cases of ADDR was lengthening followed by folding of the disc (28.6%, 23.8%). While the biconcave deformity followed by folding of the disc were the most prevalent in ADD (41.7%, 33.3%). Full disc displacement showed the highest percentage of deformity. However, no statistically significant difference was found between grades of disc displacement and disc configuration.

Conclusions and discussion
This study shows no association between disc position and disc configuration in patients with TMJ internal derangement. However, larger sample size and wider range of patients’ profile (age and duration of disease) may show otherwise.

TMJ: MR classification of internal derangement
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Introduction
There is a need to develop a more sophisticated magnetic resonance (MR) imaging classification of temporomandibular joint (TMJ) internal derangement including its early stage. It should then be possible to elucidate the natural of history of this disorder in prospective studies and to compare different treatment outcomes.

Objectives
To establish MR classification of TMJ internal derangement (ID), to test observer consistency, and to apply the classification on a consecutive series of patients.

Material and methods
From previous studies of asymptomatic volunteers and patients we developed a set of diagnostic criteria based on an analysis of all oblique sagittal and oblique coronal sections through the joint, to classify the joint as normal or as one of four ID categories. The proposed classification was applied by two observers on 165 consecutive patients referred for diagnostic TMJ imaging. Observer consistency was also analyzed.

Results
The following categories of ID were proposed: ID-1 = disk displacement (DD) in one portion of the joint, with reduction; ID-2 = DD in the entire joint, with reduction; ID-3 = DD in one portion of the joint, without reduction in that portion; ID-4 = DD in the entire joint, without reduction. An observer agreement of 91.3 % with a kappa value of 0.88 was obtained. Seventy-four (44.8%) of the 165 patients had a normal joint, or ID-1 or ID-2 categories.

Conclusions and discussion
MR criteria in a classification of TMJ internal derangement were established. All patients could fit into the proposed MR categories, and an acceptable interobserver consistency was found. About 4 of 10 patients had TMJ conditions that were similar to those reported in asymptomatic volunteers.
O-41
Temporomandibular joint involvement and craniofacial morphology in 60 adult patients with juvenile idiopathic arthritis
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Introduction
Craniofacial growth may be disturbed in patients with juvenile idiopathic arthritis (JIA) with temporomandibular joint (TMJ) involvement as the most important etiologic factor. There is no study that addresses the relationship between craniofacial growth and TMJ abnormalities in unselected adult patients.

Objective
To assess the outcome of TMJ involvement in relation to craniofacial morphology in 60 adult patients with JIA.

Materials and methods
60 of 103 patients participated in a re-examination on average 27 years after baseline. The size and position of the mandible was assessed in lateral cephalograms, and TMJ involvement was assessed by CT and MRI. Lateral cephalograms of 54 healthy adults were used as controls. The study was approved by the local ethics committee and all patients gave their informed consent.

Results
Almost three out of four adult JIA patients had TMJ involvement, mostly bilaterally, and the majority of these had some form of craniofacial growth disturbance. Micrognathia occurred in 36% of those with bilateral TMJ involvement and in 27% in the entire series of patients. Half of the patients without craniofacial growth disturbances had TMJ involvement and of those, more than half had TMJ involvement since before the age of 12. There were no differences in cephalometric measurements between patients without TMJ involvement and controls.

Conclusion and discussion
TMJ involvement is frequent in adult JIA patients, the majority with craniofacial growth disturbances. However, growth disturbances do not always follow involvement of the TMJ, even when affected in early age.
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<td>Diseases of the jaw bones with emphasis on the clinico-radiological features</td>
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<td>15.15 - 22.30</td>
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The Planmeca ProMax concept offers a full range of imaging volumes providing detailed information on patient anatomy. The comprehensive Planmeca ProMax platform complies with every need in dental radiology, offering digital panoramic, cephalometric, and 3D imaging together with advanced imaging software. At the heart of the concept is the robotic SCARA technology: the unique robotic arm enables any movement pattern required by existing or future program, eliminating all imaging restrictions. With the Planmeca ProMax concept superior maxillofacial radiography can be performed with a single platform, today and in the decades to come.
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**Tu.P1 - diagnostics: bone tissue, salivary glands, misc.**

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<td>Taisuke Kawai</td>
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<td>General profile of cases of ameloblastoma referred for computed tomography in an East Asian community.</td>
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<td>12.15 – 12.30</td>
<td>Antigone Delantoni</td>
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**Tu.P2 – diagnostics 5: others**

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<tr>
<td>11.00 – 11.45</td>
<td>Isaäc van der Waal, the Netherlands</td>
<td>Reliability of the sagittal planes for evaluating facial asymmetry on 3-dimensional cone-beam CT images</td>
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<td>12.00 – 12.15</td>
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<td>Dental CT dose evaluations using radiographic films: a preliminary study</td>
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<td>11.00 – 11.45</td>
<td>F.N. Boscio</td>
<td>Investigation of bond strength of dental adhesive systems irradiated with coning radiations</td>
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<td>Pegah Bromoah</td>
<td>Evaluation of carotid artery calcification in coronary artery disease patients by panoramic view</td>
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<td>Bo-ram Choi</td>
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<td>12.00 – 12.15</td>
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<td>Mihaela Hedeslu</td>
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<td>Hossen Kheirollahi</td>
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<td>Yoshinori Arai: A new CT image viewer for education; HexaViewer</td>
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<td>15.30 - 16.45</td>
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Effect of different tube voltage on detection of approximal caries in digital radiographs. An in vitro study

Hellén-Halme K1

1Department of Oral and Maxillofacial Radiology, Faculty of Odontology, Malmö University, Malmö, Sweden;

Introduction
Dental digital radiographic image quality depends on many factors. There are many technical parameters that can be altered in the digital equipment. Higher tube voltage gives higher penetration of the tissue and this should be better for dense tissues such as teeth, but it also gives a decreased amount of radiographic contrast in the image. Previous studies with analogue film technique found that 60 kVp provided a radiographic image that was well-balanced between absorbed radiation dose to the patient and diagnostic accuracy for radiographic caries diagnosis.

Objectives
The aim of this study was to evaluate if different tube voltages had any effect on the clinicians’ ability to diagnose approximal carious lesions in digital radiographs.

Material and methods
One hundred extracted teeth were radiographed twice, in a standardised way, with two different voltage settings, 60 kVp and 70 kVp. Seven observers evaluated the radiographs on a standard colour monitor pre-calibrated in accordance with DICOM part 14. The evaluations were made with ambient light level lower than 50 lux. Analyses from all observers were made with receiver operating characteristic curves (ROC). A paired t-test was used to analyse the effects of different kVp settings. The significance level was set to P < 0.05. Weighted Kappa statistics was used to estimate intra-observer agreement.

Results
No significant difference in diagnostic accuracy regarding approximal carious lesions was found between the different voltage settings. However the result showed that for two observers there was a tendency to score better for dentin lesions exposed with 70 kVp.

Intra-observer agreement differed from fair to moderate.

Conclusion
There was no significant difference in diagnostic accuracy of approximal carious lesions between digital radiographs exposed with 60 kVp or 70kVp.
**O-44**

**Automated image quality assessment in digital dental radiography based on contrast-detail images**

Bacher K², Claris T², Aps J², De Bruyn H², Thierens H²

²Ghent University, Department of Medical Physics, Gent, Belgium; ³Ghent University Hospital, Department of Dental Radiology, Gent, Belgium

**Introduction**

Recently, a dedicated contrast-detail phantom for digital intra-oral radiography (CDDENT) became commercially available. Present phantom could be used for quality control and/or optimization of the imaging settings.

**Objectives**

In present study, the computer-based analysis of digital CDDENT images was investigated and compared with the scores of human observers.

**Materials and methods**

The CDDENT phantom consists of an aluminum base with 10 rows and 10 columns. In each cell cylindrical holes are drilled which vary in diameter (0.1 to 1 mm) and depth (0.04 to 0.7 mm). Digital images of the phantom were generated using different kVp-settings and entrance phantom doses (10 images per setting). All images were acquired with both a CR-based and a CCD-based digital dental sensor and using a dedicated dental X-ray unit. The contrast-detail images were analyzed by means of the CDDENT Analyser computer software and results were compared with the mean readings of 5 experienced observers.

**Results**

Both human and computer-based analysis of the CDDENT images showed an excellent agreement in the detection of image quality variations resulting from changes in kVp and entrance phantom dose. However, depending on the x-ray sensor that was used for the acquisition, another correlation was found between human reading and computer analysis. Hence, the system should be calibrated in order to be useful for absolute image quality measurements and comparisons.

**Conclusions and discussion**

In combination with the Analyser software, the CDDENT phantom is an accurate tool for image quality analysis in digital dental radiography. The software provides an efficient quantification of the contrast-detail performance in an observer independent way.

**O-45**

**Lesion-size-specific filters for detection of approximal caries in digital radiographs**

Wenzel A³, Casanova MS², Frydenberg M³, Haiter-Neto F³

³Oral Radiology, School of Dentistry, Aarhus University, DK; ²Oral Diagnosis, Piracicaba Dental School, University of Campinas, Brazil; ³Biostatistics, Aarhus University, DK.

**Introduction**

Task-specific image enhancement, e.g. for the detection of caries lesions, may be helpful for clinicians. Few programmes offer this facility, and the effect of filters developed for particular caries lesion sizes is not well documented.

**Objectives**

The aim was to compare original digital images with images enhanced with lesion-size-specific filters for detection of approximal caries lesions of various sizes.

**Materials and methods**

Forty premolars and 40 molars with sound and non-cavitated, carious approximal surfaces were individually examined using a storage phosphor plate radiographic system (Vistascan Perio, Dürr Dental) and stored in original 8-bit format. The images were thereafter enhanced by three predefined filters: Fine-filter, Caries1- and Caries2-filters, each advocated for detection of lesions of specific sizes. Six observers recorded the presence/absence of a lesion with ... modalities in the 160 surfaces. After sectioning the teeth, microscopy served to detect and measure (height and depth) true lesion size. The difference in sensitivity, specificity and accuracy (true positives + true negatives / all) was estimated by analyzing the binary data in a generalized linear model. The lesions were divided in two groups by using the median value for depth and area (height x depth / 2) as threshold for “small” and “larger” lesions.

**Results**

101 surfaces were sound and 59 had lesions. The sensitivity of the Fine-filter images was significantly higher than the Caries1- and the Caries2-filter images (P < 0.005). The original images did not differ significantly from the Caries1- and Caries2-enhanced images. The Fine-filter and the original images had significantly higher specificities than the Caries2-filter (P < 0.005). The Fine-filter images had a higher accuracy than the Caries1- (P < 0.05) and the Caries2-images (P < 0.005). Observer variability was smallest with the Fine-filter. The sensitivities were higher for larger than for small lesions, but the mutual performance of the filters varied little with lesion size.

**Conclusions and discussion**

Fine-filter is a promising tool for enhancement of shallow caries lesions. The lesion-size-specific filters, Caries1 and Caries2 are less accurate and cannot be recommended when detecting lesion sizes included in this study.
O-46

Diagnostic accuracy of approximal caries by digital radiographs: an in vivo and in vitro comparative study
Li G1, Chen Y1, Zhang J1, Zhang ZY1, Ma XC1
1Department of Oral and Maxillofacial Radiology, Peking University School of Stomatology, Beijing, China

Introduction
Caries diagnosing is a common clinical task. However, only in vitro studies disclose radiographic accuracy of caries diagnosis.

Objective
To evaluate if accuracy of radiographic diagnosis of approximal caries is comparable in in vitro and in vivo conditions.

Materials and methods
Thirty-three noncavitated teeth were collected from 9 patients who had part of upper or lower jaws excised due to cyst or neoplasm. Prior to operation, radiographs of the teeth on site were taken with the digital imaging system Digora Optime (Soredex, Helsinki, Finland) and after operation, the extracted teeth that were mounted in plaster blocks, were exposed with the same digital imaging system. The teeth were subsequently sectioned for histological validation of the lesions. Five observers evaluated all radiographs according to a five-category scale. ROC analysis was performed. Student t-test was employed for the statistical analysis.

Results
The difference is not significant between the radiographic diagnosis of approximal caries in vitro and in vivo. (p=0.11).

Conclusion
The diagnostic accuracy of approximal caries in vivo and in vitro is comparable in digital radiographs.

Keynote 3
Tuesday 30 June 2009 11.00-11.45
Room Forum
Session Chairs: Tore Larheim Norway and Curly Nortje, South Africa

Diseases of the jaw bones with emphasis on the clinicoradiological aspects

Van der Waal I
Academic Centre for Dentistry Amsterdam/ VU University Medical Center, Amsterdam, The Netherlands

The radiograph is an important tool in the assessment of the diagnosis of diseases of the jaw bones, odontogenic cysts and tumours. However, the interpretation should be made in the proper perspective. Apart from the symptoms and the medical history of the patient also the clinical findings should be taken into account. In many cases the radiographic image alone allows the clinician to provide a differential diagnosis only, as will be demonstrated by a number of cases.

Isaäc van der Waal, Amsterdam, The Netherlands
Diseases of the jaw bones with emphasis on the clinicoradiological features.

In the lecture of diseases of the jaw bones an overview will be presented of some common and uncommon diseases that may arise from or occur in the jaw bones. The emphasis will be on the clinicoradiographic aspects.

Curriculum Vitae
Professor Isaäc van der Waal graduated from Dental School in 1968 at the University of Utrecht, The Netherlands, and took a one-year rotating internship at Eastman Dental Centre, Rochester, New York. From 1975-1976 he served a Fellowship in Oral Pathology at the Armed Forces Institute of Pathology in Washington D.C. In 1979 he was appointed full Professor in Oral Pathology at the University Hospital Vrije Universiteit. He is author and co-author of approximately 300 scientific papers. He wrote chapters in the field of Oral Pathology in several books and is (co)-author and co-editor of books on "Oral Oncology", "Oral Pathology", "The Burning Mouth Syndrome", "Diseases of the Tongue", "Diseases of the Jaws", "Diseases of the Salivary Glands", and "Histological Typing of Oral Cancer and Precancer" (WHO, 1997).
General profile of cases of ameloblastoma referred for computed tomography in an East Asian community.

MacDonald-Jankowski DS, Li TKL.
1 The University British Columbia.
2 The University of Hong Kong.

Introduction
Ameloblastoma is, in many East Asian reports, the most common odontogenic neoplasm. The clinical and conventional radiological presentations of this lesion as it presents within the jaws have already been systematically reviewed and published. Although computed tomography (CT) has a clear role in defining the extent of this lesion, the paucity of reports of CT being applied to case series, and even then only to a small sample, indicates that in the actual clinical situation CT is not routinely prescribed.

Aims
It is the purpose of this study to review the main features of those cases of ameloblastoma which have not been referred for CT prior to biopsy, as part of their initial clinical assessment.

Materials
Sixty-one consecutive cases of ameloblastoma presented to the University of Hong Kong’s Faculty of Dentistry. As part of the initial assessment, 22 patients were referred for computed tomography.

Results
The unicystic variant was significantly less likely to be referred in comparison to the non-unicystic variants (Solid/multilocular and desmoplastic). The most significant feature of those patients referred was that they were older males. There were no significant differences for gender or overall mean ages of those referred and those not referred. The presence of multilocularity on the conventional radiographs had no significant effect on referrals.

Discussion
It is possible that the desire to avoid increasing the radiation dose in general to young patients and more particularly to females of reproductive age inhibited the referral of these patients for CT.

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Differential diagnosis of advanced ossifying fibromas: a diagnostic challenge

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2 Oral Pathology and Oral Biology, Oral Health Center, Medunsa Campus, University of Limpopo, South Africa

Introduction
Clinical, radiological and histological correlation is required to establish a definitive diagnosis on an ossifying fibroma (OF). Currently applied diagnostic criteria are based on the presentation of OF’s that seldom measure more than a few cm in diameter.

Objectives
The objective of this study was to analyze the application of criteria for the diagnosis of advanced OF’s in a rural African population sample.

Materials and methods
Clinical-, radiological- and pathological data on OF’s diagnosed in a rural population sample in the northern sector of South Africa between 1982 and 2009 were retrieved and compared with current literature.

Results
Table: Patient data

<table>
<thead>
<tr>
<th></th>
<th>Number cases</th>
<th>Female</th>
<th>Male</th>
<th>Age range (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juvenile type</td>
<td>26</td>
<td>14</td>
<td>12</td>
<td>2 - 16</td>
</tr>
<tr>
<td>Adult type</td>
<td>88</td>
<td>59</td>
<td>24</td>
<td>16 - 74</td>
</tr>
</tbody>
</table>

The diameter of OF’s in the sample varied between 3 and 27cm. They presented as either well demarcated radiolucent or mixed radiolucent-radiopaque growths and showed an increase in fibrous content with a concomitant decrease in radiodensity beyond 10 cm in diameter. Aneurysmal bone cyst formation and extra gnathial location were more common in the juvenile type when compared to the adult type. Three adults presented with more than one OF. The main differential diagnosis included fibrous dysplasia, familial (tumorous) osseous dysplasia and low grade osteosarcoma.

Conclusion
This study demonstrated important differences in the diagnostic interpretation of advanced OF’s.
O-49

Carcinoma of the tongue. MRI staging and correlation with pathology
Delantoni A, Kehagias N, Palladas P 1, Antoniades K 4
1PostDoc Candidate, Aristotle University of Thessaloniki, Thessaloniki, Greece; 2Resident, Dept of Oral and Maxillofacial Surgery Aristotle University of Thessaloniki, Thessaloniki, Greece, 3Radiologist, Papanikolaou General Hospital Thessaloniki, Greece, 4Professor, Dept of Oral and Maxillofacial Surgery Aristotle University of Thessaloniki, Thessaloniki, Greece

Introduction
Tongue cancer is in the majority of cases treated surgically. A good radiological report is required for the effective surgical treatment as well as for the best outcome and survival rate of the patients

Objectives
To evaluate the use of presurgical MRI in the classification and staging of tongue cancer.

Materials and methods
45 presurgical MRI exams of patients with tongue cancer were viewed from the Dept. of Oral and Maxillofacial clinic files. The basic tumor's dimensions were measured by one oral radiologist and one general radiologist and were then compared with the histological findings of the tumor which were used as the gold standard. Besides the three dimensions of the tumor that were measured the overall volume of the tumor was measured and compared to the volume of the histopathology report.

Results
The images were in the majority T2-weighted images. The use of contrast media was evaluated in the 34 cases where it was available. The correlation between the tumor's dimensions was excellent in the cases of the length and width of the lesion (>0.9) but was not as efficient in the depth of the tumor. The volume estimate and measurement of the tumor was well correlated to the histopathological findings.

Conclusions and discussion
The present study showed that T2-weighted images is adequate to establish the dimensions of tumors and the depth of tumor invasion. Contrast media do not add much information except for cases of small in dimensions tumors. However, in the cases of tongue cancer, sections of 1mm should be used to evaluate the depth of the tumor which could alter the correlation between MRI findings and pathology in the overall tumor volume.

O-50

POSTGRADUATE DENTAL STUDENTS' KNOWLEDGE AND ATTITUDES CONCERNING CBCT
Kavadella A, Alexiou KE, Papadakis E, Tsiklakis K
University of Athens, Athens, Greece

Introduction
The Cone Beam Computed Tomography (CBCT) has recently entered the dental diagnostic imaging field offering a 3-D view of the anatomic structures, thus enabling the decision-making process and the clinical performance of dental practitioners. It seems necessary that dental schools incorporate into their curriculum the education on this new imaging modality, at both undergraduate and postgraduate level.

Objectives
The objectives of this research are a) to identify the level of basic knowledge of the postgraduate dental students of the University of Athens concerning CBCT and b) to assess their attitudes and opinions on this imaging modality.

Materials and methods
A questionnaire was developed and distributed to all postgraduate students who have been taught the subject of CBCT during their studies. The questionnaire included a) general data, b) specific questions to establish the knowledge acquisition and c) questions to reveal the students' opinions on the adequacy of the education they received and on the necessity and applications of CBCT. The questions were multiple choice, 5-point Likert scale and yes/no types. Data were evaluated using descriptive statistics, analysis of variance (ANOVA) and χ² test.

Results
Results were treated separately for Oral Radiology postgraduate students, who undertake more extensive and detailed teaching courses, and for all other students who receive basic education. 68% of both student groups think that the theoretical education they received is very/ enough sufficient, but 58% (Oral Radiology students) and 74% (other students) think that their practical training is moderately/barely/not at all sufficient. 90% and 74% state that CBCT is very/enough useful to the general dentist. Almost all (100% & 85%) think that they need more theoretical and practical education during their studies and most of them (95% & 85%) believe that they will have to attend continuing education courses on CBCT during their professional lives.

Conclusions and discussion
CBCT seems to have established a valid position among the other radiographic techniques. More education is needed during the University studies at the Dental School of Athens University, but also in the form of continuing education courses.
O-52

A new CT image viewer for education; HexaViewer
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2 Kitasenju Radist Dental Clinic, Tokyo, Japan
3 Nihon University School of Dentistry, Dept. of Anatomy, Tokyo, Japan

Introduction
Cone beam computed tomography for dentistry was developed and training is required to read the CT images correctly. Due to this, we developed educational software to study anatomy of teeth using a micro CT image viewer. We have named the software "HexaViewer".

Objectives
The aim was to develop a new CT viewer which is easy to use and also, operates high speed on notebook computer.

Materials and methods
The software was developed to display six images concurrently; three tomographic images and three rendering images from XYZ direction, on personal computer. The volume data of the teeth were taken by micro CT (R_mCT, Rigaku Co., Tokyo, Japan). The numbers of voxel was 300 x 300 x 300. Voxel size was 0.1 x 0.1 x 0.1 mm isotropic. Using the Microsoft Visual C# 2008, the software was designed to operate on multi-thread. Moreover, original Algorism was used to display 3D.

Results
Three tomographic and three rendering images from xyz were displayed concurrently on a personal computer. The could be rotated and changed arbitrarily. The software was operated at high speed.

Conclusions and discussion
HexaViewer which can handle six images concurrently is a powerful and useful tool for the education of tooth anatomy.

O-51

The SOLO (structure of observed learning outcome) taxonomy - a model to promote dental students’ learning
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Introduction
Selective memorizing of isolated facts or reproducing what is thought to be required – the surface approach to learning – is not the desired outcome for a dental student or a dentist in practice. The preferred outcome is a deep approach as defined by an intention to seek understanding, develop expertise and relate information and knowledge into a coherent whole.

Objectives
To investigate whether the SOLO taxonomy could be used as a model to assist and promote the dental students to evolve a deep approach to learning assessed as learning outcomes in a summative assessment.

Material and methods
Thirty-two students, participating in course eight in 2007 at the Faculty of Odontology at Malmö University, were introduced to the SOLO taxonomy and constituted the test group. The control group consisted of 35 students participating in course eight in 2006. The effect of the introduction was measured by evaluating responses to a question in the summative assessment by using the SOLO taxonomy. The analyzing group consisted of two teachers who performed the assessment of learning outcomes independently and separately on the coded material.

Results
The SOLO taxonomy as a model for learning was found to improve the quality of learning. Compared to the control group more facts, i.e. strings of details, as well as structured relations between these strings were present in the test group after the SOLO taxonomy had been introduced, (P<0.01).

Conclusions
Thus, the SOLO taxonomy is recommended as a model for promoting and developing a deeper approach to learning in dentistry.
O-53

MARCIANS! The digital solution for cone beam computed tomography (CBCT) education
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²Department of Diagnostic Sciences and General Dentistry, Dental School, University of North Carolina-Chapel Hill, North Carolina, United States

Introduction
Cone Beam Computed Tomography (CBCT) has evolved to become an important and well-established modality in dental and maxillofacial imaging. The three-dimensional (3D) nature of CBCT represents a paradigm shift in the way clinicians visualize and interpret diagnostic information. However, efficient interpretation of CBCT scans remains quite challenging. CBCT multi-planar reformatted (MPR) tomographic slices are quite new and unfamiliar to most clinicians since only recently CBCT radiographic anatomy and diagnostics have been incorporated in schools curriculums.

Objectives
To develop a dynamic and interactive web-based CBCT anatomy and diagnostics education system.

Materials and methods
Datasets were acquired from various CBCT systems. Ideal scans were selected to develop the anatomy interpretation module and radiographically documented cases were included in the pathology module. Thin 2D MPR slices, panoramic sections and 3D models were created, linked and colored in a dynamic atlas-style format. All data was processed in Adobe Photoshop and Dreamweaver CS3 was used to build the web module. A database system with instant search functions was developed with AJAX (asynchronous JavaScript and XML).

Results
An interactive multi-media based learning platform has been developed. The developed platform acts as a modular engine for learning anatomy and for pathology cases presentation. Several cases covering a wide range of clinical indications with CBCT have been incorporated in the web system.

Conclusions
An interactive module that could help clinician to better interpret anatomy and pathology with CBCT has been developed.

O-54

Digital volume tomography of the paranasal sinuses
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Introduction
Apart from the dentoalveolar region DVT offers a broad spectrum of diagnostic possibilities for the visceral skeletal cranium, i.e. the middle and inner ear, the skullbase and the Paranasal sinuses.

Objectives
Prerequisites for DVT diagnostics of the Paranasal sinuses – especially the Sinus maxillaris – were to be established.

Materials and methods
In preceding experiments with the Aldersen Rando phantom head SK100, positioning and dosage parameters were established in the 3D Accuitomo 80 DVT unit. In clinical trials out of 311 patients that underwent DVT’s, 192 were taken from the Sinus maxillaris and 4 from the Sinus frontalis, Cellulae ethmoidales were partially covered in these. No Sinus sphenoidalis was taken.

Results
Out of 192 Sinus maxillaris DVT’s 80 (40.8%) were indicated in pre- and post implantological diagnoses, 67 (34.2%) in odontogenic paranasal sinus diseases, 41 (21%) in odontogenic infections and 4 (2%) in others.

Conclusions and discussion
The clarity of the 3D DVT imaging enhances the quality of radiological diagnostics of the paranasal sinuses and the therapeutic consequences for the patient considerably. In our unity, indication for traditional radiological diagnoses of paranasal sinus diseases (occipitomental X-ray, waters view) has decreased to almost zero in favour of DVT.
Validation of the CBCT-based stereolithographic surgical guide aiding autotransplantation of teeth: clinical case-control pilot study

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2Pediatric Dentistry, Dental School, University of Leuven, Leuven, Belgium

Introduction

Autotransplantation of teeth is a valuable treatment option for replacing missing teeth, especially in children, as it does not interfere with natural craniofacial growth and development. Careful pre-operative planning is essential to decrease the risk for post-transplantation complications such as anklylosis and external resorption.

Objectives

To evaluate the surgical outcome of a CBCT-based surgical planning technique including stereolithographic surgical guide fabrication to attempt diminishing time-consuming donor tooth manipulation and optimal preparation of the receptor site.

Material and methods

An initial in vitro validation with an accuracy of ≤ 0.25 mm (Shahbazian et al. 2009, Part I), allowed a clinical pilot on 12 subjects (9-13 yrs, male=7, female=5) with a clinical need for autotransplantation. They all gave informed consent to participate. Six subjects received a Scanora 3D CBCT of the jaws, allowing CBCT-based planning and production of stereolithographic surgical guides for autotransplantation. Surgical outcome of this group was then compared to the results of an age-, gender-, and case-matched control group of 6 subjects, receiving a conventional autotransplantation procedure.

Results

Preliminary results showed a significant reduction in surgical time with a significant decrease in extra-oral time and manipulation of the donor tooth.

Conclusion and discussion

Autotransplantation may become a more reliable treatment method for tooth replacement by using 3D CBCT-based planning and stereolithographic surgical guidance. Surgical outcome may benefit from a reduced surgical time, a more accurate recipient site preparation, and a better position of the donor tooth. Whether this can give better long term results remains to be evaluated.
O-57

The use of a specifically developed CBCT quality control phantom for examining the correlation between CBCT pixel intensity values and medical CT numbers

Stamatakis H\(^1\), Manousandis G\(^1\), Tsiklakis K\(^1\), Karayianni K\(^1\), Mitsea A\(^1\), Pauwels R\(^2\), Bosmans H\(^2\), Jacobs R\(^2\), Walker A\(^2\), the SedentexCT Project Consortium\(^3\)

\(^1\)Department of Oral Diagnosis and Radiology, Dental School, University of Athens, Greece;
\(^2\)Oral Imaging Centre, School of Dentistry, Oral Pathology and Maxillofacial Surgery, Faculty of Medicine, Catholic University of Leuven, Belgium;
\(^3\)Department of Radiology, University Hospital Gasthuisberg, Leuven, Belgium;

Introduction
The relation between CBCT pixel intensity values and medical CT numbers using specially designed phantoms has been under investigation since the appearance of this new technique.

Objectives
To examine the use of a specially designed prototype CBCT Quality Control phantom in investigating the correlation between pixel intensity values as recorded by the NewTom3G CBCT unit and medical CT numbers for given materials.

Materials and methods
A prototype Quality Control phantom with test inserts of different materials, developed under the ongoing SedentexCT project, is used. The phantom includes inserts with areas of pmma, hydroxyapatite in different concentrations, aluminium and air. CT numbers of the different materials were recorded with a medical CT unit and consequent scans with a NewTom3G unit were performed. The consistency of the NewTom 3G pixel intensity values for each material and the correlation with the respective CT numbers were investigated.

Results
A correlation between the NewTom 3G CBCT pixel intensity values and medical CT numbers is found, although a non-linear relation is more apparent. Non-uniformity issues have been observed, mostly between the circumference and the central parts of the field of view.

Conclusions and discussion
The use of specifically designed phantoms for QC tests on CBCT units may prove helpful for determining the degree of uniformity of the CBCT scans and investigating the relation between CBCT pixel intensity values of different materials and the respective CT numbers.

O-58

Volumetric quantification of bone loss for determination of bone grafting accuracy: a pilot study

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\(^2\)Academic Centre for Dentistry Amsterdam (ACTA), The Netherlands;
\(^3\)Private practice, Virginia, USA.

Introduction
At present, Cone Beam Computed Tomography (CBCT) has become a powerful diagnostic tool in dentistry. Following up changes in bone volume after bone grafting is important to determine treatment outcome. Literature on the subject, however, is scarce. Published studies employing conventional 2D radiographs are deficient since bone remodelling is a 3D process. A robust technique to follow-up changes in bone volume with CBCT is required.

Objectives
To investigate the accuracy of several image analysis approaches to quantify changes in bone volume with CBCT.

Materials and methods
Ten simulated maxillary buccal bone defects on five skulls were optically scanned at 40\(\mu\)m resolution (Atos IIe, Gom, Argon Measuring Solutions, Leuven, Belgium). The optical scan volume measurements constituted the gold standard. I-CAT CBCT scans before and after defect creation were taken at 0.25mm resolution. The images were analyzed using Amira software (Visage Imaging GmbH, Germany) by two observers with consensus. The observers assessed the influence of image registration, region of interest (ROI) selection and image segmentation (automatic, semi-automatic and manual) on defects volumes measurements. In total, thirty different combinations of those parameters were included in the evaluation and defect volumes were measured with each approach and compared to the gold standard.

Results
Mean difference between the CBCT measurements and the gold standard was 4,52mm\(^3\) (SD ±1,46mm\(^3\)) for the best method, on a mean volume of 388,58mm\(^3\) and 367,22mm\(^3\) of the ROI before and after defect. Most segmentation and registration parameters had significant influence on the volume measurements. Automatic registration of pre- and post-operative data followed by semi-automatic segmentation using a region growing algorithm, applied within identical 3D ROIs in each image, was the most accurate, reliable and feasible approach to follow-up changes in bone volume.

Conclusions
A novel registration-based approach to follow-up changes in bone volumes with CBCT was established. This could be useful for following up bone grafting procedures.
CBCT scans as a preoperative evaluation in decision making for furcation surgery
Walter C1, Kaner D2, Berndt DC3, Weiger R1, Zitzmann NU1
1Department of Periodontology, Endodontology and Cariology, University of Basel, Switzerland;  
2Institute for Periodontology and Synoptic Dentistry, Charite-University Medicine Berlin, Berlin, Germany;  
3Department of Oral Surgery, Oral Radiology and Oral Medicine, University of Basel, Switzerland

Introduction
Cone beam computed tomography is used in assessing furcation involvement (FI). The aim of this investigation was to show in which extent presurgical CBCT scans influence the decision for furcation surgery.

Materials and methods
Twelve patients with generalized chronic periodontitis were consecutively recruited and CBCT was performed in maxillary molars (n=22) with clinical FI and increased probing pocket depths. CBCT images were analysed and FI root length supported by bone and anatomical features were evaluated. FI and treatment recommendation based on clinical examinations and periapical radiography were compared with data derived from CBCT images.

Results
The clinical estimated degree of FI was confirmed in 27% of the sites, while 29% were overestimated and 44% revealed an underestimation according to CBCT analyses. 25% among degree I FI were underestimated, among degree II and II-III, the underestimation was as high as 75%, while all sites with degree III FI were confirmed in the CBCT. In 52-89% of the teeth, the clinically and the CBCT based therapeutic treatment approaches differed, depending on whether the less invasive or the most invasive treatment recommendation was selected for the comparison.

Conclusions and discussion
Maxillary molars can be visualised in detail using CBCT, which provides a reliable basis for the clinical treatment decision.
<table>
<thead>
<tr>
<th>Wednesday July 1</th>
<th>Room Forum</th>
<th>theme</th>
<th>Room L</th>
<th>theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00 - 10.30</td>
<td>session 1</td>
<td>oral</td>
<td>9.00 - 10.30</td>
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<tr>
<td></td>
<td></td>
<td>Diagnostics 6: bone tissue</td>
<td>Imaging 5: Medical CT and CBCT</td>
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<tr>
<td>11.00 - 11.45</td>
<td>session 2</td>
<td>oral</td>
<td>11.00 - 12.30</td>
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<td>A Taguchi, Japan Diagnosis of osteoporosis on panoramic radiographs</td>
<td>Diagnostics 7: endodontics</td>
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<tr>
<td>11.45 - 12.30</td>
<td></td>
<td>Decision making 1</td>
<td></td>
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<tr>
<td>13.30 - 14.15</td>
<td>session 3</td>
<td>oral</td>
<td>13.30 - 15.00</td>
<td>session 3 oral</td>
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<td></td>
<td></td>
<td>Christina Lindh, Sweden Evidence from studies of diagnostic imaging</td>
<td>Diagnostics 8: orthodontics, others</td>
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<td>14.15 - 15.00</td>
<td></td>
<td>Decision making 2</td>
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<td>break</td>
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<tr>
<td>15.30</td>
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<td>General Assembly</td>
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<tr>
<td>19.00</td>
<td></td>
<td>Dinner and Dance</td>
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</tbody>
</table>
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### W.E.1 - Diagnostics 6: bone tissue

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
<th>Room</th>
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</thead>
<tbody>
<tr>
<td>9.00-9.15</td>
<td>Kim Poon Tan</td>
<td>Evaluation of the accuracy of Cross Sectional Tomographic imaging for Dental Implant Treatment Planning</td>
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<td>9.15-9.30</td>
<td>Amir Daroudi</td>
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<td>9.30-9.45</td>
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<td>Panoramic image—a possible diagnostic indicator of osteoporosis in post menopausal women</td>
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<td>Venia Castro</td>
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<td>Akira Taguchi</td>
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<td>10.15-10.30</td>
<td>Tomasz Kulczyk</td>
<td>A comparison of cortical width and panoramic index measurements performed by experienced radiologists and a computer algorithm</td>
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### W.E.2 - Decision making 1

<table>
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<th>Time</th>
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<tbody>
<tr>
<td>11.00-11.15</td>
<td>Akira Taguchi</td>
<td>Dental CT performance in detecting root fracture</td>
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<td>12.30-13.30</td>
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<td>Phil Mileman, etc.</td>
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<td>13.30-15.00</td>
<td>W.13 - diagnostics 8: orthodontics, others</td>
<td>Reinhilde Jacobs, etc.</td>
<td>The relationship between dental age evaluated using the Demirjian’s method and skeletal maturity determined by cervical vertebral maturation (CVM) method</td>
</tr>
<tr>
<td></td>
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<td>Accuracy of CBCT versus panoramic imaging for detection of simulated canine impaction-induced external root resorption in maxillary lateral incisors</td>
</tr>
<tr>
<td>13.30-13.45</td>
<td>Ingrid Rozylo-Kalinowska</td>
<td>Christina Lindh, Sweden</td>
<td>Evidence from studies of diagnostic imaging</td>
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<tr>
<td>13.45-14.00</td>
<td>Ali Alqerban</td>
<td>Peter Nijkamp</td>
<td>Accuracy of CBCT versus panoramic imaging for detection of simulated canine impaction-induced external root resorption in maxillary lateral incisors</td>
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<tr>
<td>14.00-15.00</td>
<td>Peter Nijkamp</td>
<td>Helena Christell</td>
<td>Economic evaluation in oral health care</td>
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<tr>
<td>14.15-14.30</td>
<td>Ravan Kumar Joshi</td>
<td>Madeleine Rohlin</td>
<td>Cephalometrics in orthodontics: effective?</td>
</tr>
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<td>14.15-14.30</td>
<td>Madeleine Rohlin</td>
<td>Kerstin Knutsson</td>
<td>Dentists vary but are yet confident in their treatment decisions in previously root filled incisors</td>
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<td>14.30-14.45</td>
<td>Anastasia Mitsea</td>
<td>Kerstin Knutsson</td>
<td>Establishing identification of human remains based on anthropological and CBCT findings</td>
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<td>14.45-15.00</td>
<td>Kerstin Knutsson</td>
<td>Kaustubh Sansare</td>
<td>Role of maxillofacial radiologists in gun shot injuries - two case reports</td>
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<td>15.00-15.30</td>
<td>Break</td>
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<td>15.30-17.00</td>
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<td>19.00-23.30</td>
<td>Congress Dinner &amp; Dance</td>
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Evaluation of the accuracy of Cross Sectional Tomographic imaging for Dental Implant Treatment Planning

Tan, Kim Poon
Family Dental Surgery

Introduction
Cross sectional tomographic images are widely used in the measurement of the dimension of bone in implant treatment planning. From many studies, its perpendicular cross sectional slicing and, therefore, accuracy has been assumed to be acceptable and any distortion or magnification, if present, has not been qualified.

Objective and method
Using a simple precision engineered device and a 3-D Narrow Beam Volumetric Tomographic (Instrumentarium Oy, Finland) imaging technique, it is possible to prove that distortion do exists in tomographic images.

Discussion
a) The amount of distortion is dependant on the angle of deviation from the most perpendicular view of the image.
b) The insertion of a device eg a cylinder or ball bearing, in the surgical stent is recommended to calibrate the magnification in the image.
c) This study is limited to the measurement of horizontal magnification or distortion.

Conclusion
Every tomographic image should be carefully rotated in the software until the narrowest section is attained as this represent the most perpendicular cross sectional slice and, therefore, most accurate slice. Alternatively, a calibration device should be incorporated into the images.
**O-62**

Panoramic image-a possible diagnostic indicator of osteoporosis in post menopausal women

Dr. Patil Seema 1, Dr. Iyengar Asha 1, Dr. Chandrashekar 1, 
1Department of Oral Medicine and Radiology, D.A.P.M.R.V. Dental College, Bangalore, India.

Introduction

Osteoporosis, a prevalent metabolic bone disease in post menopausal women is characterized by a loss in bone mineral density resulting in low trauma fractures having dramatic outcomes in terms of morbidity, mortality and cost of health care. Hence, effective preventive strategies should be established for early diagnosis of osteoporosis

Objectives

1. To measure the mandibular cortical width on a panoramic image and compare this with bone mineral density in the assessment of osteoporosis in Indian post menopausal women
2. To calculate Body mass index in the study subjects and correlate it with Bone mineral density.

Materials and methods

The study group comprised of 73 post menopausal women of Bangalore, Indian origin, aged between 45 to 75 years.

Panoramic radiographs were taken; width of the mandibular inferior cortex below the mental foramen was traced and measured. Bone Mineral Density was assessed and Body Mass Index was calculated for all the study subjects.

The Body Mass Index (BMI) and Mandibular Cortical Width (MCW) were compared in all the subjects with Bone Mineral Density (BMD).

Results

Comparison of Mandibular Cortical Width with normal Bone Mineral Density showed a statistical significant difference between normal and osteoporotic group (p<0.01) as well as between osteopenic and osteoporotic group (p<0.05).

Body Mass Index values did not correlate with Bone Mineral Density status.

Conclusion

It can be concluded from our study that the panoramic radiograph may probably be an useful aid in diagnosis of osteoporosis and since these radiographs are frequently made during dental practice, the findings on such radiographs may help identify patients with undetected low Bone Mineral Density and refer them to medical professionals and thus reduce morbidity due to osteoporosis.

**O-63**

An oral predictor of osteoporosis: a cone beam computed tomography (CBCT) and dual x-ray energy absorptiometry (DEXA) imaging modality study


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2UMKC- School of Medicine, Kansas City, MO, USA; 
3Harvard University – The Forsyth Institute, Boston USA

Introduction

In the United States, osteoporosis affects more than 20 million individuals and is responsible for more than 1.5 million fractures. Most commonly the condition affects postmenopausal women and is a major public health issue because of the high skeletal fracture rate, especially given the aging of the American population. This important problem has led to major efforts to develop new diagnostic methods aimed at providing clinically valuable means of predicting which individuals are most likely to develop osteoporosis and fractures.

Objectives

The research project proposed in this investigation is directly focused to establish the correlation between mandibular bone and skeletal bone changes in normal and osteoporotic patients using CBCT and DEXA imaging modalities. This research is pilot data for a larger clinical study. **Aim #1:** To examine the performance of CBCT as a screening tool for osteoporosis and low bone mineral density (BMD) in relation to DEXA imaging.

Materials and methods

The research project proposed in this investigation is directly focused to establish the correlation between mandibular bone and skeletal bone changes in normal and osteoporotic patients using CBCT and DEXA imaging modalities. This research is pilot data for a larger clinical study. **Aim #1:** To examine the performance of CBCT as a screening tool for osteoporosis and low bone mineral density (BMD) in relation to DEXA imaging.

Materials and methods

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Body Mass Index values did not correlate with Bone Mineral Density status.

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It can be concluded from our study that the panoramic radiograph may probably be an useful aid in diagnosis of osteoporosis and since these radiographs are frequently made during dental practice, the findings on such radiographs may help identify patients with undetected low Bone Mineral Density and refer them to medical professionals and thus reduce morbidity due to osteoporosis.

**Conclusion and discussion**

It can be concluded that DEXA and CBCT share a strong sufficient correlation to merit further investigation. Thus, this preliminary proposed study using post menopausal osteoporotic women could be valuable in providing an insight as to how this affects bone changes in the mandible.
**O-64**

Visual assessment of non-eroded thin cortex on panoramic radiographs in identifying women with osteoporosis: Osteoporosis Screening Project in Dentistry (OSPD)

Taguchi A1, Asano A2, Ohtsuka M2, Nakamoto M3, Seki K3, Okano T4, White SC5, Levin M6, Van der Steelt PF7, Jacobs R8, Lindh C8, Rohlin M9, Choi SC10, Hornor K11

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Introduction

The presence of an eroded or thinned cortex of the mandible on panoramic radiographs may be useful in identifying women with osteoporosis. However, little is known as to whether a non-eroded thin cortex predicts osteoporosis.

Objective

To clarify whether visual assessment of non-eroded thin cortex increases the diagnostic efficacy of identifying women with osteoporosis.

Materials and methods

Of 60 observers who participated in OSPD (Taguchi et al., Bone, 2008), 41 observers visually assessed non-eroded thin cortex in addition to Klemetti’s index (KI) for 100 panoramic radiographs on the OSPD website via the Internet twice with approximately a two-week interval. The area under the receiver operating characteristics curves (AUROC) in identifying women with osteoporosis by both KI and non-eroded thin cortex was calculated on two occasions; non-eroded thin cortex was included in "class 1 of KI (decreased probability of osteoporosis)" or "class 3 of KI (increased probability of osteoporosis)". Mean AUROC was compared between these two occasions with paired t-test.

Results

In the first series of observations, the mean AUROC significantly increased when non-eroded thin cortex was considered as a sign of increased probability of osteoporosis (mean +/- SD, 0.68 +/- 0.08 vs. 0.70 +/- 0.07, P=0.011). In the second set of observations, the result was unchanged (0.68 +/- 0.09 vs. 0.71 +/- 0.08, P<0.001).

Conclusions and discussion

Visual identification of a non-eroded thin cortex on panoramic radiographs may increase the diagnostic efficacy of identifying women with osteoporosis.

**O-65**

A comparison of cortical width and panoramic index measurements performed by experienced radiologists and a computer algorithm

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1Poznan University of Medical Sciences, Section of Dental Radiology; 2Poznan University of Technology Chair of Multimedia Telecommunications and Microelectronics

Introduction

Cortical width (CW) and Panoramic Index (PMI) are two measurements which can be performed on a panoramic image for screening of individuals with osteoporosis. In the current method of measurement, a number of linear drawings on the panoramic image must be performed to indentify the lower mandibular cortex and mental foramen. Following identification, manual measurements of distances between points of interest are done by a radiologist. This method is time-consuming due to the precision required in distinguishing details and due to fact that measurements are performed manually by means of a ruler. For these reasons a computer algorithm was developed to perform identification of particular elements on an x-ray image, identification of points of interest, and finally to compute measurements of cortical width and panoramic index.

Objectives

To compare CW and PMI measurements obtained by two experienced radiologists with measurements obtained from a newly developed computer programme designed for automatic recognition of the cortical bone and automatic measurements of distances.

Materials and methods

72 regions of interest (ROI) at the region extending from the mental foramen to below the lower cortical border of mandible were cropped from digital panoramic images of healthy, osteopenic and osteoporotic patients to perform measurements and comparison. Each ROI was presented to two experienced radiologists to perform a recognition of the lower border of the cortical plane of mandible and to manually perform measurements of CW and PMI. The same ROIs were also processed by a newly developed computer programme which was able to detect the mandible's lower and the upper border of cortical plane automatically and to performe a CW and PMI measurements.

Results

Comparison of measurements between the radiologists and the computer algorithm revealed coefficient ratio of 0.78 for CW and 0.91 for PMI respectively. A comparison of repeatability of the two radiologists revealed inter-observer correlation of 0.93 for PMI and 0.84 for CW measurements respectively.

Conclusions and discussion

The computer algorithm is effective in recognition of points of interest in given ROI, as well as in automatic measurements of PMI and CW. Some improvement of the algorithm is necessary to increase the correlation ratio between the radiologists and the programme.
Diagnosis of osteoporosis on panoramic radiographs

Taguchi A
Matsumoto Dental University, Nagano, Japan

Osteoporosis is a skeletal disease characterised by low bone mass and microarchitectural deterioration with a resulting increase in bone fragility and susceptibility to fracture. Increases in the size of the elderly population worldwide will likely cause a marked rise in the incidence of osteoporotic fractures. Several bone mass or bone mineral density (BMD) assessment technologies have been developed and applied worldwide. However, many populations with an increased risk of osteoporotic fractures are still underdiagnosed and undertreated. Several clinical decision-making rules to assist in identifying individuals with low skeletal BMD or osteoporosis have been developed since the mid-1990s. Nevertheless, the clinical application of these rules to determine which patients require BMD assessment is complicated due to a lack of consensus.

Numerous panoramic radiographs are taken annually to examine dental diseases. Using them for triaging individuals with undetected osteoporosis would be economical and beneficial as dentists could refer these patients to medical professionals for further examination. Since the early 1990s, several studies have been performed regarding the utility of panoramic radiographs in triage screening for osteoporosis in dental clinics. Cortical indices of the mandible on panoramic radiographs, such as cortical width and cortical shape, are significantly associated with skeletal BMD, biochemical markers of bone turnover and risk of osteoporotic fractures in postmenopausal women as well as elderly men. In Japanese prospective clinical trials, about 95% of postmenopausal women identified by trained general dental practitioners using cortical shape category on panoramic radiographs had low skeletal BMD or osteoporosis. Panoramic radiography indices may be likely useful triage screening tools for identifying individuals with an increased probability of having low skeletal BMD, osteoporosis and osteoporotic fractures. However, further investigations should be conducted worldwide to determine whether these indices are acceptable for triaging individuals with osteoporosis and referring them to medical professionals.

Akira Taguchi, Nagano, Japan

Diagnosis of osteoporosis on panoramic radiographs

Osteoporosis is the “silent epidemic” and crucial health concerns worldwide. Increases in the elderly population will likely cause a dramatic rise in fractures from osteoporosis. Panoramic radiographic measures may be new triage tests to detect elderly population, especially postmenopausal women, who need bone mineral assessment. In this lecture, I will show you some evidences as to why panoramic radiographs may be useful tools in screening for osteoporosis and present recent actual application of these methods in general dental practice in collaboration with medical professionals in Japan.

Curriculum Vitae

Dr. Taguchi is a graduate of the Hiroshima University and received his D.D.S. in 1988 and Ph.D. in Oral and Maxillofacial Radiology from the Postgraduate School, Hiroshima University, in 1992. He was trained in Oral and Maxillofacial Radiology from the Hiroshima University. He received a scholarship from Japan Ministry of Education and researched osteoporosis in the Department of Oral Medicine, School of Dentistry, at University of Washington from 1996 to 1997. Dr. Taguchi was Clinical Associate Professor of the Department of Oral and Maxillofacial Radiology at the Hiroshima University Hospital up to 2007 and is currently Professor and Chair of the Department of Oral and Maxillofacial Radiology at the Matsumoto Dental University, Nagano, and Visiting Professor of the Department of Oral and Maxillofacial Radiology at the Kanagawa Dental College. He received Certificate of Clinical Dental Research Methods from University of Washington in 2007 and received Certificate of Evidenced Based Diagnostics from Oxford University in 2008. He is also a researcher in the Department of Clinical Studies, Radiation Effects Research Foundation in Hiroshima. Dr. Taguchi is a member of many professional dental organizations as well as medical organizations and has a Diploma from the Japanese Society for Oral and Maxillofacial Radiology. He is an International Editorial Board of Dentomaxillofacial Radiology since 2000 and a member of Japan Nurses’ Health Study, a large prospective cohort study, organized by the Japan Menopause Society since 2005. Research focuses on the screening for osteoporosis by dental panoramic radiographs, the association of skeletal bone density to tooth retention, genetic influences on bone and teeth and the association of oral condition to cardiovascular diseases. Dr. Taguchi has published numerous scientific articles and abstracts on various radiology and osteoporosis topics. He has received awards for his research work at the national levels.
O-66

Will image quality influence diagnostic accuracy efficacy when diagnosing osteoporosis by intraoral radiography?

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1Malmö University, Malmö, Sweden, 2Manchester University, Manchester, UK, 3University of Leuven, Leuven, Belgium, 4University of Athens, Athens, Greece, 5Academic Centre for Dentistry, Amsterdam, The Netherlands

Introduction
In 2003-2005, the OSTEODENT study was performed with the aim of identifying the most valid and effective radiographic index for diagnosis of osteoporosis to be used in oral health care. One of the proposed indices was based on visual assessment of the trabecular pattern in intraoral periapical radiographs. Although strict quality criteria were used, the quality of the intraoral radiographs differed due to film placement and projection errors (Lindh et al 2008).

Objectives
To investigate if the diagnostic accuracy of visual assessment of the trabecular pattern to diagnose osteoporosis in intraoral radiography increased for images with optimal image quality.

Material and methods
One hundred intraoral radiographs of the upper and lower premolar regions with optimal image quality were chosen from the original sample of 600 images. The trabecular pattern was assessed by four observers and classified into one of three groups (i) dense homogenous trabecular pattern, (ii) heterogeneous trabecular pattern, or (iii) sparse homogenous trabecular pattern. The criterion standard was comprised of osteoporosis as measured by DXA. Sensitivity, specificity, odds ratio, and inter- and intra-observer agreement for the assessment of the 100 images with optimal quality were compared to the values obtained from the assessment of the original sample.

Results
Sensitivity of images of optimal quality increased in the upper jaw as compared to that of the original sample. The odds ratios of images with optimal image quality were higher for both the upper and the lower jaw. The median intraobserver agreement (weighted Kappa) was also slightly higher for both jaws whilst the median interobserver agreement was comparable for the two samples.

Conclusions and discussion
Although image quality of intraoral radiography influenced the diagnostic accuracy efficacy in osteoporosis diagnosis to some extent, optimal image quality might not be necessary for the usability of the proposed classification in clinical practice.


O-67

A randomized controlled clinical trial comparing 2D versus 3D diagnostic strategies for the removal of impacted third molars

Maria Eugenia Guerrero1, Olivia Nackaerts1, Sandra Martens1, Jan Vanhove2, Johan Orye3, Xavier Degraeve4, Jeroen Van Hevel1, Joseph Schoenaers5, Keith Horner6, Reinilde Jacobs1 and the SEDENTEXCT, Project Consortium7
1Oral Imaging Center, 2Maxillofacial Surgery Dept, Faculty of Medicine, Katholieke Universiteit Leuven, Belgium, 3School of Dentistry, University of Manchester, UK, 4listing of partners on www.sedentexct.eu

Objectives
To compare the diagnostic accuracy and surgical outcome of Cone beam CT (CBCT) with panoramic radiography in assessing the mandibular canal before removal of impacted lower third molars.

Study design
Twenty-two subjects (18-51 yrs of age, 13 females) referred for surgical removal of impacted mandibular wisdom teeth to the Maxillofacial Surgery Department of the University Hospitals Leuven were recruited. They were randomly allocated to be radiographed using either panoramic radiography (Cranex Tome, Soredex) or CBCT imaging (Scanora 3D, Soredex). A total of 30 impacted mandibular wisdom teeth were thus included with the presurgical planning and the subsequent surgery being either a CBCT-based or a panoramic-based wisdom tooth-extraction. The perioperative observations on the vicinity or relation of the mandibular canal with the wisdom tooth served as gold standard for the diagnostic outcome of the procedures. The post-operative complaints and potential neurosensory disturbances served as gold standard for the diagnostic accuracy.

Results
CBCT images were significantly better than panoramic images to locate the third molar in the 3-dimensional jaw bone, identify potential ankylosis sites and determine its relation to the mandibular canal. CBCT was significantly better in deciding the surgical removal strategy which led to a decreased surgical time and less post-surgical complaints and neurosensory disturbances.

Conclusions
CBCT had a significantly superior diagnostic accuracy than panoramic images for predicting the relation of the mandibular canal with the roots of impacted wisdom teeth roots. This allowed a more efficient surgical procedure with less post-operative complaints.
Prevalence, utilities and treatment decision making by dental students
Mileman PA1, Hout WB van den2
1ACTA, Vrije University of Amsterdam, Amsterdam, the Netherlands; 2UMCL University of Leiden, Leiden, the Netherlands.

Introduction
We have developed a decision aid (DA) to show students how to combine knowledge, values and accuracy of radiographic diagnosis to decide on treatment. How did they arrive at decisions beforehand?

Objectives
To test the hypothesis that before receiving advice from a decision aid dental students’ utilities of treatment outcomes and subjective prevalence of disease would determine their cut-off point for their treatment decisions on the ROC-curve.

Materials and methods
Fourth-year dental students (n=228) using visual analogue scales reported for a patient scenario their perception of the prevalence of caries and their utilities for FP and TP treatment outcomes between TN (optimal health, value 1.0) and FN (worst health state, value 0.0). Their sensitivity and specificity were calculated for their restorative treatment decisions from radiographs of surfaces of teeth with either histologically dentine caries (45) or sound surfaces (60). We used multivariate regression to analyse association between their chosen point on the ROC curve (SE minus SP) and their perceived prevalence and aversion to FN(UTP-UFN) and FP(UTN-UFP) outcomes.

Results
The students on average valued treatment outcomes of FP at 0.36 (SD 0.28) and TP at 0.78 (SD 0.21) (P<0.0001). Mean subjective prevalence was 0.22 (SD 0.17). The chosen point on the ROC -curve significantly depended on perceived prevalence (P=0.05). The coefficients for the utilities of decision outcomes had the expected sign but were not significant (P=0.12 and P=0.52).

Conclusions and discussion
The variation in the students’ restorative behavior was consistent with their perceived prevalence and utilities. The students utilities however seem to reflect their retrospective view of the decision. Reasons for this will be suggested.
EVIDENCE FROM STUDIES OF DIAGNOSTIC IMAGING

Lindh C
Malmö University, Faculty of Odontology, Department of Oral Radiology, Malmö, Sweden

Important healthcare decisions that concern a patient’s health should always proceed from the best available scientific evidence in order to improve quality of care through the identification and promotion of practices that work, and the elimination of those that are ineffective or harmful. Evidence-based medicine (EBM) was originally defined as “the integration of current best evidence with clinical expertise and patient values” (1). EBM is not a cookbook but a useful tool for decision making. There are four steps in incorporating the best available research evidence in decision making: asking answerable questions; accessing the best information; appraising the information for validity and relevance; and applying the information to patient care. This, as well as identification of important knowledge gaps, can be done through systematic literature reviews.

Diagnostic methods differ from therapeutic methods and it is sometimes difficult to establish a connection between results from a diagnostic test with patient outcomes. The benefits associated with the use of a specific diagnostic method depend on performance characteristics such as sensitivity and specificity as well as prevalence of the disease. The fact that diagnostic methods affect short-term outcomes rather than long-term patient outcomes make evaluation of diagnostic tests more complicated than the evaluation of therapeutic methods.

The efficacy of diagnostic imaging methods can be evaluated according to a hierarchical approach as described by Fryback and Thornbury (2). This approach includes six levels of efficacy where efficacy at higher levels is contingent on efficacy at all lower levels. As a tool to assess the quality of studies on diagnostic imaging the QUADAS protocol has been suggested (3). Examples of systematic literature reviews in oral- and maxillofacial imaging, assessed according to the QUADAS protocol, will be given. Few studies deal with the upper levels of the Fryback and Thornbury model and the costs and effects of imaging methods at the patient outcomes and societal levels have rarely been considered.


Curriculum Vitae
Christina Lindh, DDS, Odont Dr, Professor and chair of Department of Oral and Maxillofacial Radiology, Faculty of Odontology, Malmö University, Malmö, Sweden. Consultant radiologist at the Department of Medical Imaging at the University Hospital, Malmö. DDS in 1974, certified specialist in Oral Radiology since 1988, Odont Dr 1996, docent in oral radiology 2004. Current research interest is investigation of accuracy and validity of diagnostic imaging methods with special focus on imaging of jaw bone tissue for osteoporosis diagnosis and related to implant treatment. Has recently been involved in several systematic literature reviews to investigate evidence for diagnostic imaging methods and ongoing studies focus on assessments of the benefits versus costs of newly introduced imaging methods. Has acted as a teacher on different levels of education within oral radiology and been active in the development of a problem-based learning curriculum as well as in the work of harmonizing dental curricula in European dental schools. Peer reviewer in the DentEd/DentEdEvolve international programme of visits to review curricula and professional training in European dental schools. Has acted as chair of the education committee since the foundation of the European Academy of Dental-and Maxillofacial Radiology.

Christina Lindh, Malmo, Sweden
Evidence from studies of diagnostic imaging

The lecture will deal with why it is important to consider evidence-based health care, its connection to the improvement of people’s health and to health care resources. Diagnostic imaging consumes a significant portion of the medical budget. To assess the efficacy of diagnostic imaging methods and their benefits for patients is an important task. One way of assessing the efficacy of diagnostic imaging methods is through systematic literature reviews and examples of such reviews in the field of dental-and maxillofacial radiology will be given.
Systematic reviews - avenues to improved quality in oral health care and research
Rohlin M¹, Knutsson K¹, Lindh C¹, Petersson A¹
¹Malmö University, Malmö, Sweden

Introduction
Systematic reviews comprise a synthesis of scientific evidence that is a key in three approaches to improve the quality of care - evidence-based medicine, health technology assessment, and clinical guidelines. Analysis of the scientific literature also reveals issues that require further research as knowledge gaps will be identified. These can be used to improve the research agenda in health care.

Objectives
To analyse evidence from systematic reviews on imaging methods in oral health care.

Materials and methods
Common features of five systematic reviews, which we performed, were analysed. The reviews elucidated methods used to diagnose chronic periodontitis (one review), jaw bone tissue in dental implant planning (two reviews), and temporomandibular joint disorders (two reviews). Our analysis of original studies included and excluded in the reviews focussed on the study design and outcomes using the Thornbury’s ladder (1).

Results
Overall there is room for improvement. There was a wide heterogeneity in study design and reported outcome variables. Most studies reported outcomes on the level of diagnostic ability. No study presented how any diagnostic method influenced patient care in terms of changed treatment and change in patient outcome. Evidence was limited also on outcomes of combinations of imaging methods with other diagnostic methods as used in clinical care.

Conclusions and discussion
To improve the accuracy and completeness of studies on diagnostic methods, the Standards for Reporting of Diagnostic Accuracy (STARD) statement should be applied. Evidence to support clinical effectiveness of imaging methods is required to improve oral health care.

Dentists vary but are yet confident in their treatment decisions in previously rootfilled incisors
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1Malmö University, Malmö, Sweden; 2Göteborg University, Göteborg, Sweden

Introduction
In a previous study we reported wide variations in dentists’ treatment options in previously rootfilled incisors. We hypothesized that within such a conflicting clinical area decisions are made with a high level of personal uncertainty.

Objectives
To study the dentists’ confidence in their selected treatment option in comparison to other options in previously root-filled incisors.

Material and methods
Twenty endodontists and 20 general dental practitioners (GDPs) were presented to 60 simulated cases of previously rootfilled asymptomatic incisors, which comprised 40 cases of a single incisor and 20 cases where a fixed prosthodontic construction was to be performed that should include the previously rootfilled incisor. The dentists were asked to select one treatment option of five possible. Besides being asked to select the option they considered most optimal, the dentists should also assess their confidence, not only in the selected treatment option, but also in the other four options that could be considered. They assessed their confidence for all five options on a 100 mm visual analogue scale (VAS).

Results
Extensive variations existed between the dentists in which treatment option they selected. However, they were all very confident in the selected option, both in the option per se, and in comparison to other options, despite the same prognosis.

Conclusion
The high confidence in the selected treatment option, related to other options with the same prognosis, might imply that both endodontists and GDPs are less susceptible to modifications of their behavior and that implementation of new evidence into practice could be difficult.

Quantitative analysis of metallic artifacts on multi-detector CT images: the effect of type and position of metal materials at various imaging parameters
Chindasombatjaroen J1,2, Kakimoto N1, Uchiyama Y1, Murakami S1, Furukawa S2
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Introduction
Streak artifact by metal materials is one of the image artifacts associated with CT and is caused by the severe attenuation in the intensity of the X-ray beam as it passes through the metal material, resulting in missing data and unsuitable images for diagnosis.

Objective
The aim of this study was to quantitatively analyze the streak artifacts of metals appeared on CT images in correlation with type and position at various imaging parameters in a phantom study.

Materials and methods
A cube of aluminum, titanium, and cobalt-chromium was placed in a water-filled polypropylene box at various positions (center, left, and upper positions), and then was scanned using MDCT with tube voltage of 80, 100, 120, 140 kVp, and tube current of 100, 150, 200 mA. Artifact areas on axial CT images were analyzed, and compared using ImageJ 1.42 g software by establishing the attenuation value of black and white components.

Results
Cobalt-Chromium caused the largest areas followed by titanium, and aluminum, respectively. Different positions at the same scanning parameters gave comparable amount of artifact areas. Artifact area decreased with the increased tube voltage and tube current.

Conclusions and discussion
Artifact area increased with the increased atomic number of the metal. Scanning with higher kVp resulted in remarkably fewer artifact areas due to increasing of the beam penetration. Metal at various positions gave nearly the same amount of artifact areas. This may be due to the image reconstruction process and algorithm of the CT machine.
O-73

CT-MRI anatomic registration of the maxillo-facial region
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1National University Health System, Singapore; 2National University of Singapore, Singapore.

Introduction
Clinically useful information for surgical treatment planning or diagnosis in the maxillo-facial region is derived either from CT or from MR imaging. Creating a patient-specific digital model where both the skeletal and surrounding muscle information are anatomically related is needed to provide clinicians with an accurate digital model to facilitate diagnosis and planning of treatment.

Objectives
To register the CT and MRI data of the maxillo-facial region using facial bone information derived from MRI.

Materials and methods
One complete set of head CT images (0.6 mm slice, Siemens Somatom) and MR images (1.5T, T1 FLASH, Siemens Magnetom) from the same patient was used in this study. The central idea of the method was to first reconstruct an accurate surface representation of the facial bones from both data sets individually, followed by a surface to surface registration. Subsequently, the entire CT volume was registered with the MRI data. Segmentation of CT was done using a double thresholding technique. Segmentation of MRI craniofacial bone regions was done automatically using an image processing technique called Morphological Hole Filling. The Fast Marching Cubes algorithm was used to reconstruct exact surface representation of the segmented MR and CT images. Surface to surface registration error was determined using the closest distant point function on ten thousand randomly sampled points on the craniofacial bone surface.

Results
The mean error is 0.66 ± 0.64 (SD) mm. Fig 1 and Fig 2 show the overlay of the reconstructed CT facial bone surface with multi-planar reconstructed images from MRI.

Conclusions and discussion
Accurate registration of CT and MR images in the facial regions can be achieved with an acceptable accuracy using MRI-derived facial bone information. The Morphological Hole Filling technique and the Fast Marching Cubes algorithm facilitated the registration process.

O-74

Head movements caused by swallowing in fMRI for taste
Goto TK1, Nakamura Y2, Tokumori K1, Kobayashi K3, Yoshiura T1, Nakamura Y2, Honda H3, Ninomiya Y1, Yoshiura K1
1Kyushu University, Fukuoka, Japan; 2Kyushu University Hospital, Fukuoka, Japan

Introduction
Even after the realignment of MRI images, there is a residual movement-related variance present in the fMRI time-series, causing loss of sensitivity and specificity by a movement-by-inhomogeneity interaction. Therefore, head movement associated with swallowing causes a very critical problem for segregating the taste area of the human brain in a high spatial resolution fMRI.

Objectives
The purpose of this study was to investigate the head movements associated with swallowing solutions in fMRI experiments for taste.

Materials and methods
Two healthy young adult volunteers underwent MRI in a 3T scanner. The Human Experimentation Committee of Kyushu University approved all experimental procedures. Data analysis was performed using the SPM5 software (UCL, London, UK). Sweet (0.5 M sucrose) was used as the tastant and...
An alignment device for cone beam computed tomography examinations
Dawood AJS\textsuperscript{1}, Patel S\textsuperscript{2}, Sauret V\textsuperscript{3}
\textsuperscript{1}Private Practice, London, UK; \textsuperscript{2}King’s College London Dental Institute, London, UK; \textsuperscript{3}Cavendish Imaging London, UK

Introduction
Using the smallest possible Field of View (FOV) for Cone Beam Computed Tomography (CBCT) examinations reduces radiation dose to the patient and the need to report structures which are imaged beyond the Region of Interest (ROI). However, selecting a smaller FOV makes patient positioning within the apparatus more critical.

Objectives
Research was focused upon designing an aid to achieve optimal patient positioning for small FOV CBCT examinations, with a reduced need for “scout” exposures.

Materials and methods
An understanding of the principles of CBCT technology led to the conception of an alignment device for use with small FOV examinations. The device was designed using computer aided design software and fabricated using Selective Laser Sintering. Correct operation of the device was confirmed \textit{ex vivo} before using the device \textit{in vivo} alongside a conventional imaging protocol.

Results
The region of interest was centered within the FOV in both investigations.

Conclusions and discussion
This pilot study showed that the device has the potential to improve results whilst also improving operator understanding of the underlying principles of CBCT technology. With further development, a device of this kind may lead to improved CBCT image acquisition at lower dose, without the need for “scout” projections.

CBCT accuracy for detection and measurement of bone defects – a comparative study with stereomicroscopy as a gold standard
Hedesiu M\textsuperscript{1}, Baçiut M\textsuperscript{1}, Bran S\textsuperscript{1}, Nackaerts O\textsuperscript{2}, Jacobs R\textsuperscript{2}, Horner K\textsuperscript{3}, The SEDENTEXCT Project Consortium\textsuperscript{4}.
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Introduction
Due to its high spatial resolution characteristics, CBCT may prove a useful tool for quantification of the bone structure of the maxillo-facial area.

Objectives
To assess the sensitivity of two different CBCT machines and one MSCT for identification and linear measurement of cortico-trabecular bone defects using stereomicroscopy as the gold standard.

Material and methods
Five pig hemimandibles prepared using formalin fixation and soft tissue simulation were selected to simulate spherical bone defects on the lingual cortex. Another 5 pig hemimandibles were sectioned at the premolar/molar level, obtaining 20 bone blocs, designated for the creation of standardized cortico-trabecular bone defects (diameters 0.5; 0.8; 1; 1.2 and 1.5 mm). CBCT scans and MSCT scans (Bright Speed 8, GE) of all specimens were performed.

Seven examiners evaluated these images independently under controlled viewing conditions to identify the presence, number and dimensions of the bone defects. The results were compared to gold standard measurements obtained by stereomicroscopy and dedicated image analysis software.

Results
The smallest lesion size that could be detected on CBCT images was 0.8 mm in trabecular bone (sensitivity=0.58) in contrast to MSCT images, on which only trabecular bone defects larger than 1.2mm (sensitivity=0.50) could be detected. MSCT tended to overestimate the trabecular hole size, while CBCT tended to underestimate the size compared to stereomicroscopy measurements.

Conclusions
CBCT could detect smaller bone defects than MSCT, although lesion size tended to be underestimated compared with MSCT.
Introduction
The use of 3D imaging is becoming the standard mode of image acquisition for many phases of dentistry. Orthodontics, implant planning, oral surgery and all other sophisticated diagnostic procedures.

Objectives
The highly competitive development of 3D equipment is allowing a selection of type of image acquisition giving latitude of patient exposure vs. image need.

Materials and methods
Several type of 3D equipment was tested in their performance of the specific need of the dental professionals. Specific emphasis was made to the resulting image quality vs. levels of radiation exposure to patients.

Results
The investigation indicates that there are different systems for specific uses and the proper equipment selected will serve the specialist and the patient the best for sophisticated diagnostic image quality.
Value of cone beam computed tomography in the detection of vertical root fractures

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Introduction

Detection of vertical root fractures (VRF) is challenging since the clinical symptoms and the radiographic signs are non-pathognomonic. The radiographic features on peri-apical radiographs (PR) can mimic failed Endodontic treatment or periodontal disease. Therefore, direct visualization of fracture line on radiographs is the only sure way to confirm the presence of VRF. Cone Beam Computed Tomography (CBCT) possesses higher inherent contrast than PR that it could be more beneficial in detecting VRFs.

Objectives

To assess the accuracy of CBCT in detecting VRFs in comparison with PR in endodontically filled and non-filled teeth and to assess the influence of the presence of root canal filling (RCF) on VRF visibility.

Materials and methods

Eighty human teeth were selected and endodontically prepared. The teeth were divided into four groups (A, B, C and D). The teeth in groups A and B were artificially fractured in a systematic method and in groups C and D were not. Groups A and C were root-filled. The teeth were placed in well-fitting sockets in 10 human mandibles and three layers of dental wax were added on both sides to simulate soft tissue. The sample was scanned with i-CAT CBCT and PR. Four observers evaluated the CBCT and the PR images and fracture visibility was scored on a dichotomous scale (Fractured/not-fractured).

Results

The sensitivity and specificity for VRF detection of CBCT were 79.4% and 92.5% and for PR were 37.1% and 95%, respectively. The presence of RCF reduced specificity of CBCT (p = 0.032) but did not influence overall accuracy (p = 0.654) whereas it reduced sensitivity of PR (p = 0.008) and influenced overall accuracy (p = 0.008).

Conclusions

The results showed an overall higher accuracy for CBCT (0.86) than PR (0.66) for detecting VRF and the presence of RCF does not influence overall CBCT accuracy.

Characterization of root canal curvatures by description of the axis based on microCT imaging

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Introduction

Knowledge of the root canal shape helps in selecting the best technique or choosing the most appropriate instrumentation of a given root canal treatment a priori.

Purpose

The purpose of this study was to determine the 3D axis of the root canal using microfocal x-ray source imaging modality.

Materials and methods

Fifty one-rooted teeth were scanned with a microCT (SkyScan 1172) where the voxel size was 10x10x10 micrometer. Approximately 1000 reconstructed slices of each root were used for further analysis. Following the semiautomatic segmentation the axis was determined by the center of gravity calculation method as follows: First a polynomial was fitted to each reconstructed cross-sectional image of the root canal. Than the common center of gravity was calculated from the centroid of triangles plotted into the polyom. Finally centers of gravity were determined at each reconstructed slice and the set of these centers of gravity were considered to represent the 3D root canal axis. Approximating a fourth degree polynomial function to the set of the center of gravity provided a simple space curve. Curvature value and torsion value were calculated from the polynomials characterizing the 3D root canal axis.

Results

The appearance of the root canal axis determined in this way is visualized by software developed by our research group. The reliability of this method was determined by the correlation coefficient value, which was higher than 0.999 for all cases.

Conclusion

This type of mathematical description of a root canal may have a great influence on endodontic practice when it would be successfully embedded in a novel dental imaging modality.
**O-81**

Detection of root fractures using high and low resolution cone beam CT and PSP images with and without enhancement filters

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2University of Aarhus, Aarhus, Denmark.

**Introduction**

Root fracture due to trauma is difficult to diagnose on intraoral radiographs. It has not been evaluated whether CBCT examination can increase the detection rate.

**Objective**

The aim of this study was to compare detection of root fractures on CBCT and PSP images with and without enhancement filters.

**Materials and methods**

Sixty-nine extracted human teeth, 35 with root fractures and 34 without, were radiographically examined using an intraoral PSP system (Digora Optime, Soredex). The images were saved and in a version sharpened with a high-pass filter. The teeth were then examined with CBCT (I-Cat, Imaging Science) in two resolutions: 0.12mm and 0.25mm pixel size. Original images were saved together with images enhanced with a sharpen and an angio-sharpen (5x5 matrix) filter. The volumetric data from the CBCT system was reconstructed and sectioned (1.0 mm) in the mesiodistal plane. Five observers scored the presence/absence of a root fracture in all eight image modalities using the following scoring system: 0=no fracture, 1=fraction in the coronal third, 2=fraction in the middle third, and 3=fraction in the apical third. Sensitivities and specificities were calculated for each modality and each observer.

**Results**

All high-resolution CBCT (pixel size 0.12mm) images had significantly (p<0.02) higher sensitivities (0.87-0.94) than their counterparts in lower resolution (0.74-0.81) and than PSP images (0.74-0.77). Angio-sharpen filtered images for both CBCT resolutions had higher sensitivities than the original images (p<0.03). There were no significant differences between low resolution CBCT and Digora PSP images. Very few false-positive scores were obtained resulting in high mean specificities among all modalities.

**Conclusions**

High resolution CBCT images (0.12mm pixel size) results in an increase in sensitivity without jeopardizing specificity for detection of root fractures compared to lower resolution CBCT images, which are not more accurate than intraoral PSP images. Root fracture detection seems to increase when using specific high-pass enhancement filters.

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**O-82**

Quantitative analysis of longitudinal changes of periapical bone structures in different bucco-lingual slab thicknesses in cone beam computed tomograph

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2School of Engineering, Information and Communications University

**Objective**

The purpose of this presentation is (1) to describe the outline of densitometric and morphologic evaluating methods of periapical lesions for quantitative image analysis and (2) to analyze the bony changes of periapical lesions longitudinally with different bucco-lingual slab thicknesses.

**Methods**

Two Beagle dogs' premolars were exposed for the artificial induction of periapical lesions. Periapical radiographs (Kodak 2200, RVG CCD sensor, Kodak Co.) and cone beam computed tomograph (CBCT) (3D X-ray CT scanner, Alphard Vega, Asahi Co.) of dog's jaws were taken at baseline and every 7 days for 77 days after pulp exposure. We examined the occurrence and areas of periapical bone resorption. Three comparative groups of CBCT were prepared by average projection of thin slabs with different bucco-lingual thicknesses (0.1, 3.0, and 8.0 mm) using a 3D visualization software (Ondemand 3D programme, Cybermed Co. Seoul. Korea). Subsequent densitometric and morphologic analysis of periapical lesions were performed by a customized image analysis programme. Radiographic densities were compensated by image normalization. To normalize an image, tooth dentin area and the background were used as references. In each image, the lesion area was manually selected and segmented by tophat operation. Numerous densitometric and morphological features representing the bony changes were calculated. These features of periapical lesions were compared among three groups of CBCT in different time points using Repeated Measures Analysis of Variance (SPSS version 12.0).

**Results**

In the CBCT group with 0.1mm thickness, radiographic density (p<0.05) and trabecular bone area (p<0.01) were significantly decreased at the fifth week after pulp exposure. However, in the CBCT groups with 3mm and 8mm thickness, none of densitometric and morphological features showed any significant differences throughout time points. Visual inspection revealed the lesions in the CBCT radiographs at the third and fourth week and in periapical radiographs at the fourth and fifth week.

**Conclusion**

We observed the radiographic density difference quantitatively by changing bucco-lingual slab thickness in CBCT. Periapical bony changes could be detected as early as fifth week after pulp exposure and evaluated most sensitively by quantitative image analysis of CBCT with 0.1mm bucco-lingual slab thicknesses.
Incidental peroperative findings during apical dental surgery revealing broken instruments, not visualized by apical dental radiographs nor by cone-beam CT

Politis C1, 2, Sun Y1, Schuermans J1, Vrielinck L1, Schepers S1, 3, Lambrichts 1

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2University of Hasselt, Diepenbeek, Belgium;
3University Gent, Gent, Belgium

Introduction
This study is a continuous of former unpublished research about the Clinical relevance of CBCT of the upper premolar-and molar area in pathology of the maxillary sinus from dental origin. The previous study showed that three-dimensional, volumetric imaging provides a better insight into the specification of the causal relationship in maxillary sinus pathology of dental origin compared to two-dimensional imaging.

Objectives
To establish the value of the cone-beam CT scan for the detection of broken root canal instruments compared to the traditional dental x-ray radiographs (apical radiograph, panoramic radiograph)

Materials and methods
18 patients with maxillary sinus complaints were selected. Clinical exams were set up. An apical dental radiograph, a panoramic radiograph and a cone-beam CT scan (galileo, sirona) were taken for each patient. Apical surgery was applied afterwards. A skull phantom experiment was set up to simulate a broken reamer instrument (n°110) in the endodontic treated root canal which is filled by gutta-percha (n°15). A Cone-beam scan was taken with the maximum radiation (124,5 µSv) and compared with an apical dental radiograph.

Results
In 5 cases out of the total 18 patients, remained reamers were found in the apical region of the root. Five individual experienced oral maxillofacial surgeons had examined the clinical radiographs. In 4 cases, the reamer could not be distinguished from the root canal filling based on all the clinical radiographic exams. Although the presence of the reamer was pre-known by the observer, it was hard to distinguish between the remained reamer and the gutta-percha in the skull phantom experiment.

Conclusions and discussion
Neither cone-beam CT, nor apical x-ray, nor panoramic radiograph was able to detect the broken reamer after lateral condensation by gutta-percha, which was identified during the operation. Marciano J made a study about the chemical composition of gutta-percha. In his report, the average percent of Barium sulphate is about 20% and 60% for zinc oxide. Barium and zinc are metal element and radio-oblique, this may explain the reason why it is so difficult to differentiate between the gutta-percha and the broken reamer.
Cephalometrics in orthodontics: effective?
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Introduction
Cephalometrics is considered to be part of the gold standard at the start of orthodontic treatment planning. However, the effectiveness of this diagnostic record remains questionable.

Objective
To assess whether cephalometrics is of influence on orthodontic treatment planning.

Materials and methods
According to a randomized crossover design, diagnostic records of 48 subjects were assigned to one of two combinations: A. dental casts only and B. dental casts and cephalometrics. The records were presented to 10 orthodontic postgraduates and four orthodontists for formulation of orthodontic treatment plans. Agreement on orthodontic treatment planning using all possible comparisons of diagnostic records (AB, AA and BB) was assessed and overall proportions of agreement (OPA) were calculated.

Results
Median OPA were 0.60 (AB), 0.65 (AA) and 0.60 (BB) for orthodontic postgraduates and 0.50 (AB), 0.75 (AA) and 0.50 (BB) for orthodontists. Irrespective of the level of experience, neither consistency of orthodontic treatment planning between both combinations of diagnostic records showed a statistically significant difference (P>0.05), nor did consistencies and agreement of orthodontic treatment planning after addition of cephalometrics.

Conclusion
Effectiveness of cephalometrics, regarding orthodontic treatment decisions, is not evidenced based.

Accuracy of CBCT versus panoramic imaging for detection of simulated canine impaction-induced external root resorption in maxillary lateral incisors
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2 Oral Imaging Center, School of Dentistry, Oral Pathology and Maxillo-Facial Surgery, Katholieke Universiteit Leuven, Leuven, Belgium
3 Department of Forensic Odontology, Faculty of Medicine, School of Dentistry, Oral Pathology and Maxillo-Facial Surgery, Katholieke Universiteit Leuven.

Introduction
The introduction of cone beam computed tomography (CBCT) in dentomaxillofacial radiology has created new diagnostic challenges, including some potential opportunity for evaluating impacted teeth.

Objectives
The diagnostic accuracy for detection of simulated canine-induced external root resorption lesions in maxillary lateral incisors comparing one 2-dimensional panoramic radiograph system with two 3-dimensional CBCT scanners.

Materials and methods
An infant cadaver skull in the early mixed dentition was obtained from the Department of Anatomy (Hasselt University) with ethical approval. This skull had an impacted maxillary left canine and therefore allowed a reliable simulation. Simulated root resorption cavities were created in eight extracted human maxillary lateral incisors by the sequential use of ISO 0.16 mm diameter round burs in the distolabial root surface. Cavities of varying depths were drilled in the middle or apical thirds of each tooth root according to 3 setups: slight (0.15, 0.20, and 0.25 mm), moderate (0.60 and 1.00 mm), and severe (1.50, 2.00, and 3.00 mm). The lateral incisors, including 2 intact teeth were repositioned individually in the alveolus of the pediatric skull with approximal contacts to the impacted maxillary left canine. Three sets of radiographic images were obtained with panoramic Cranex TOME® (Soredex, Helsinki, Finland), Accuitomo-XYZ Slice View Tomograph, (J. Morita, Kyoto, Japan), and SCANORA® 3D CBCT (Soredex, Tuusula, Finland) for each tooth setup. Eight observers examined the three sets of 10 radiographs for the presence of resorption cavities.

Results
The differences in correct detection of simulated root resorption for all cavity sizes were significantly different (p<0.001) between panoramic and both CBCT systems. CBCT imaging performance was significantly better than that of panoramic radiography for determining the degree of root resorption in the categories of slight and severe resorption.

Conclusions and discussion
The results of this study suggest that the CBCT radiographic method is more sensitive than conventional radiography to detect simulated external root resorption cavities.
Obesity, maxillofacial variance and OSA - A lateral cephalometric study

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2 Prof. & Head, Dept. Of Oral medicine & Radiology, MRADC, Bangalore

Introduction
Obstructive sleep apnea (OSA), a relatively less reported disease in India, has of late gained awareness in the Indian medical fraternity. Eventhough, obesity has been universally linked with OSA as a primary predictive factor; craniofacial abnormalities have also gained acceptability as predictive factors. Most of these evidences are derived from observations carried out on patients in Western, Chinese, or South-East Asian countries. Indian data regarding these anomalies is scarce. Hence there is a need for characterisation of these data in Indian OSA patients.

Objectives
1. To compare the cephalometric anatomy of the maxilla and mandible in patients with Obstructive sleep apnea and normal subjects.
2. To assess for the presence of correlation between OSA and obesity in Indian population.

Materials and methods
Digital lateral cephalograms were recorded in standing position for thirty randomly selected OSA patients and thirty asymptomatic adult individuals, after obtaining an informed consent. These cephalograms were then traced for maxillo-mandibular measurements using standard cephalometric landmarks. The data was compared among the cases and control and statistically analyzed using t-test. The study has a clearance from ethical committee.

Results
It was observed that there was a statistically significant difference between mean SNA (P<0.05) and SNB (P<0.001) values, as they were found to be larger in controls compared to cases. Mean ANB (P<0.01) value was found to be larger in OSA patients. The mean PNS-ANS length was found to be greater in controls compared to cases. No significant difference was observed between in Go-Me, Ar-Go (P>0.05). The mean BMI was found to be 31.8 (considered obese) among the OSA patients when compared to the mean BMI of 21.7 among the control group.

Conclusion
It can be concluded that maxillary micrognathia, maxillary and mandibular retrognathia are significant risk factors for OSA patients. Obesity has a strong association with OSA. These factors may be considered predictive in OSA diagnosis.

Establishing identification of human remains based on anthropological and CBCT findings

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2Department of Oral Diagnosis and Radiology, Forensic Odontology Unit, Dental School, University of Athens, Greece;
3Nafplion Forensic Medical Department, Ministry of Justice, Nafplion, Greece;
4Department of Oral Diagnosis and Radiology, Dental School, University of Athens, Greece

Introduction
Establishing the identification of human remains is one of the most important aspects in the medicolegal investigation of death. The identification process must be considered a multidisciplinary effort especially when the remains are decomposing, skeletonized, or otherwise unrecognizable. In such cases, the biological profile of the remains and the uniqueness of certain skeletal structures may provide the basis for identification. The purpose of this case study is to present the contribution of the anthropological and CT medical records in excluding the identification of a suspected deceased.

Case report
A human cranium was recovered by police in a forested area. The forensic anthropological examination revealed that the cranium belonged to an adult Caucasian male with no evidence of antemortem or perimortem trauma. The above information was not entirely consistent with the biological characteristics, trauma profile, and time since death of an individual who was reported missing in the area 1.5 years ago. Review of medical records of the suspected deceased revealed that a brain CT scan had been performed 2 years prior to his death during a post-surgical evaluation for a shotgun injury. Comparison of the postmortem CBCT findings with the antemortem CT scans confirmed the anthropological analysis.

Discussion
Exclusion of identity can be easily accomplished if the antemortem information is contradicted by the profile of the recovered remains. In this case, anthropological parameters and cone-beam computerized tomography (CBCT) were used to exclude the identity of a missing individual. The potential utility of comparing antemortem and postmortem CT scans for identification purposes is discussed. Antemortem CT scans are useful for comparison with postmortem CBCT images and should be considered as a resource for establishing identification when DNA reference samples are not available.
Role of maxillofacial radiologists in gun shot injuries-two case reports
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1Associate Professor, 2Professor, 3Resident. Oral and Maxillofacial Radiology, Nair Hospital Dental College, Mumbai, India.

Introduction
A sad pandemic of our times is the heinous use of mass attacks on civilians that has now spread to all parts of the world. Clearly we are in the midst of a pandemic that is killing and maiming civilians across the globe. Unfortunately the pandemic is still not over and will be sustained for some time to come. As Oral and Maxillofacial (OMF) Radiologists we cannot influence the surge of this violence, but will be surely called upon to assess and localize the damage. Bullet injuries are grossly divided into high velocity (>2000 ft / s) and low velocity (<2000 ft / s) injuries. A high velocity bullet usually leads to prompt and fatal damage to the deceased. Low velocity, non fatal bullet injuries to the maxillofacial region are therefore of particular interest to the OMF radiologists. Low velocity shotgun injuries differ from those of other missiles because the spectrum of damage is large owing to the fact that the pellets scatter as they travel through the object.

Case report
Two cases of shotgun injuries to the maxillofacial regions are presented with plain radiographs and CT. Recent developments in the understanding of ballistic pathophysiology helped in assessing the damage caused by the bullet and its splinters. Subsequently, a 3D reconstruction of the missile trajectory and its termination was plotted in the sagittal and the coronal plane. This reconstruction helped in better understanding of the damage along the course of the missile. These case reports emphasizes that knowledge of ballistic science will help the radiologist in assessing the damage and localizing its splinters. The path of missile and its termination, close clinical and radiographic observation of the patient helped in assessing and localizing the damage of gunshot injuries to the head and neck region.

Discussion
The OMF radiologists thus have a contribution to make in cases of bullet injuries. This point has only occasionally been mentioned in the literature. Disseminating expertise in our Congresses, journals, fellowships, continuing education and personal communication will be keys to our understanding gunshot injuries. It is time we assess our role as maxillofacial radiologists in cases of bullet injuries.
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### Th.F3 - Imaging 7: CBCT dose 2

**Room Forum**

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#### Presentation Details

**Session Title:** Measuring absorbed dose distributions in a humanoid phantom irradiated with a dental cone beam CT unit

- **Speaker:** Mats Nilsson
- **Chairmen:** William Scarfe, USA and Andres Briner, Chile
- **Time:** 13.30-14.45

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### Th.P6 - Imaging: CT, micro-ct, others, diagnostics: caries, endodentics, periodontology, misc.

**Ruby Lounge**

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**Additional Sessions**

- **15.00-15.15**: Break
- **15.15**: Closing ceremony
- **15.30-17.00**: Farewell Party
O-90

The effects of slice thickness and interslice interval on bone height and contour
Chadwick JW1, Lam EWN1
1Oral & Maxillofacial Radiology, Faculty of Dentistry, the University of Toronto, Canada.

Introduction
Cross-sectional imaging is commonly performed prior to dental implant placement, yet image slice thickness and interslice interval are decided upon almost arbitrarily.

Objectives
The objectives of this study were to systematically evaluate the effects of slice thickness and interslice interval on bone height measurements and contours derived from cross-sectional images reformatted from cone beam CT examinations.

Materials and methods
Imaging and image analysis were performed with the Hitachi CB MercuRay and CB Works software (Tokyo, Japan) on 102 putative implant sites in patients imaged with an imaging stent containing radiopaque markers. Slice thickness and interslice interval were varied from 1 to 5 mm. For each cross-section, bone height was measured, and the data were segmented into short (≤4 contiguous sites) and long (>4 sites) edentulous spans. Statistical differences between bone heights were determined using a one-way ANOVA and post-hoc Tukey tests (SPSS, Chicago, IL). Human research ethics approval was obtained from the University of Toronto Health Sciences Research Ethics Board.

Results
For both short and long edentulous spans, statistically significant differences were found between bone heights using slice thicknesses and interslice intervals of greater than 1 mm and 1 mm, respectively (p<0.005).

Conclusions and discussion
Interslice interval appears to be the more important determinant of bone height and contour than slice thickness. For a clinical tolerance of 1 mm, the use of up to 3 mm slice thicknesses with 3 mm interslice intervals may be acceptable for short edentulous spans. For longer edentulous spans and the same acceptable clinical tolerance, the use of up to 4 mm slice thicknesses with 4 mm interslice interval may be acceptable.

O-91

An up to 14-years split-mouth comparative study of two screw-shaped titanium implant systems
Jacobs R1,2, Pittayapat P1, De Mars G2, Gijbels F2, Van Der Donck A3, Liang X1, Quirynen M1, Van Steenberghe D2, Naert I3
1Oral Imaging Center; 2Department of Periodontology; 3Department of Prosthetic Dentistry; Faculty of Medicine, Katholieke Universiteit Leuven, Kapucijnenvoer 7, 3000 Leuven, Belgium

Introduction
There are many studies dealing with the outcome and radiographic follow-up of implant placement. Yet none applied a split-mouth randomised design for a long-term radiological follow-up to clinically compare 2 very similar implant systems.

Objectives
The aim of the present study was to clinically compare 2 very similar implant systems with different surface characteristics in a split-mouth randomised design and radiologically analyse bone density and bone level around oral osseointegrated titanium implants, tracking changes over an up to 14-years follow-up period.

Materials and methods
The study comprised radiographs of 18 patients, who were rehabilitated by means of both implant types, randomized for the jaw in which each implant system was applied. Ethical approval and informed consent were obtained. Intra-oral radiographs taken at baseline (prosthetic rehabilitation) were compared to radiographs taken during an up to 14-years follow-up period. The images were subjected to bone level and bone density analyses by means of dedicated software.

Results
The up to 14-year radiological results of bone remodelling around oral osseointegrated titanium implants suggest that the design of two different implant systems has no obvious influence on bone level and bone density during function. Bone loss after 12 to 14 years of loading ranged from 0 to 2.7 mm for the Astra implant and 0 to 2.4 mm for the Brånemark implant.

Conclusions
The present digital image analysis demonstrates the stability of bone level and density around oral osseointegrated implants during an up to 14-years follow-up period. Surface characteristics of the tested implant systems do not significantly alter the outcome of the peri-implant bone.
O-92

A cluster analysis of diagnostic methods for bone quality assessment by Brazilian implantodontists
Pereira AC, Oliveira GHC, Barbosa GKS, Silva ET, Freire MCM, Leles CR, Lindh C, Ribeiro-Rotta RF

Introduction
Bone quality (BQ) has been described as an important prognosis indicator for dental implant treatment, but it is still unclear how this variable is evaluated in the routine of dental practice.

Objectives
The objectives of this study were to investigate (a) what Brazilian specialists understand by BQ in implant therapy; (b) if they assess BQ during the therapeutic planning stage and (c) which methods they have used for this purpose.

Materials and methods
A structured questionnaire, previously tested and validated, was sent by mail to specialists in dental implants registered in the National Regulatory Board of Dentistry (Conselho Federal de Odontologia – CFO). The questionnaire included open and closed questions related to knowledge, experiences and attitudes regarded to BQ.

Results
From all respondents (n = 221), 89% practiced clinical activity. Several categories were generated from what is BQ according to the respondents belief. The frequently answers included quantity of cortical bone and marrow (n = 72), density (n = 55), type of bone (n=35), height (n = 30), thickness (n = 27) and primary stability (n = 24). All professionals considered the BQ an important factor, while 88% used the BQ as a criterion for the indication of implants and 98% evaluated the BQ in the planning stage of treatment. The diagnostic imaging methods (conventional and sectional images) and the trans-surgical methods (tactile subjective perception and the peak insertion torque) were identified as those most commonly used to assess BQ.

Conclusions and discussion
The results of the study showed that BQ is a bone characteristic evaluated and used in dental implant treatment by Brazilian specialists. Most of them understand BQ as the proportion of bone mineral content. The professional attitude regard to the importance of the BQ influences the clinical indication and treatment planning.

O-93

Accuracy of implant placement based on the Nobel Procera planning system using three-dimensional cone beam CT images: an in-vivo study
Sun Y, MSc, Vrielinck L, MDD DDS, Schuermans J, MSc, Schepers S, MD DDS, Politis C, MD DDS MHA MM

Introduction
Stereolithographic drill guide was used more and more in the field of dental implant placement. Some studies were performed on the cadaver jaws. However, a large scale in-vivo study is still lack.

Objectives
To evaluate the precision of transfer of Nobel Procera planning for oral implants based on three-dimensional (3D) cone-beam CT images through stereolithographic drill guides in totally edentulous patients.

Materials and methods
20 totally edentulous patients were scanned by a 3D Galileos cone-beam CT scanner. DICOM data was exported into Nobel Procera to make a pre-surgical planning. Stereolithographic drill guide was produced to transfer the pre-surgical planning to the surgery. 90 implants (length: 10-13mm) were placed, within which 23 implants were placed using the technique of Teeth In One Hour (TIOH) and the other 67 implants were placed following normal Nobel Guide procedure. Post-surgery cone-beam CT images were taken immediately after implants placement and matched with the pre-surgery planning to calculate the deviation between the planning and placed implants.

Results
For the TIOH technique, the angular deviation between the planning and the placed implants were 1.99 ± 0.92°, while at the hex point, the lateral deviation is 0.56 ± 0.33 mm and the vertical deviation is 0.38 ± 0.29mm. For the normal Nobel Guide procedure, the angular deviation between the planning and the placed implants were 3.46 ± 2.21°, while at the hex point, the lateral deviation is 1.25 ± 0.72 mm and the vertical deviation is 1.03 ± 1.00 mm.

Conclusions and discussion
Technique of TIOH has a better accuracy than the normal Nobel Guide procedure. 3D cone-beam images has a potential to be used for implant planning, but still a further study should be continued to find out how to minimize all the errors when transferring the planning to the surgery.
O-94

Registration of 3D cone beam and 3D surface image data for virtual implant planning

Ritter L1, Neugebauer J, Dreiseidler T, Karapetian V, Mischkowski RM, Zöller JE
1Dep. for Craniomaxillofacial and Plastic Surgery and Interdisciplinary Outpatient Dep. for Oral Surgery and Implantology University to Cologne, Kerpenerstr. 62, 50937 Köln, Germany

Introduction

3D cone beam imaging is frequently indicated for implant planning. While being scanned patients can wear a scanning template that contains the prosthetic information as a barium sulphate dotted wax-up to provide prosthetic and anatomical information for implant planning software and subsequent guided implant surgery. Integrating virtual models of the patients dentition and the 3D cone-beam data can offer advantages in workflow and precision for dental implant planning.

Objectives

The aim of this study was to evaluate a new method that integrates 3D surface models of the dentition and 3D image data based on cone beam imaging.

Materials and methods

A virtual wax-up based on surface models of the patients dentition acquired with CEREC (Sirona Dental Systems, Germany), was designed using the software. 3D cone beam data (GALILEOS; Sirona Dental Systems, Germany) of 10 patients was registered to the 3D surface models and virtual wax-ups of the patients dentition. Dental surfaces of the cone beam data and the virtual model were compared in axial, sagittal and coronal slice views.

Results

Distinct visualization of the prosthetic proposal alleviated Implant planning and registration showed small or no visible error. Registration was feasible for all tested datasets.

Conclusions and discussion

Integrating complementary digital data provides a well arranged overview for dental implant planning and opens up new possibilities for drill guide and prosthetic manufacturing.

O-95

Accuracy of three-dimensional surface models reconstructions of the occlusal surfaces from cone beam computed tomography

Al-Rawi B1, Hassan B2, Jacobs R1
1Oral Imaging Center Faculty of Medicine Katholieke Universiteit Leuven, Leuven, Belgium
2Department of Oral Radiology, Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands

Introduction

The use of three-dimensional (3D) models of the dentition obtained from computed tomography (CT) scans is a recent trend in dentistry. These models are used for treatment planning and simulation in orthodontics, implant rehabilitation and orthognathic surgery. However, CT has been criticized that it cannot provide accurate 3D reconstructions of the occlusal surfaces due to limited spatial resolution. Therefore, several elaborate and time-consuming impression scanning techniques were used to obtain 3D occlusal surfaces reconstructions for virtual bite registration. Recently Cone Beam Computed Tomography (CBCT) has become available, which has inherently higher spatial resolution compared with conventional CT. The feasibility and accuracy of 3D CBCT occlusal surfaces reconstructions is still unknown though.

Objectives

To investigate the accuracy of 3D CBCT reconstructions of the occlusal surfaces of the upper and lower dentitions.

Materials and methods

A fully dentate dry human skull placed in a plastic box and immersed in water was scanned with CBCT at 0.2mm resolution. The teeth were then extracted and scanned separately using MicroCT at 0.036mm resolution. The data from MicroCT served as the reference gold standard. All datasets were then imported into Amira software and 3D surface models of the occlusal surfaces of the teeth anteriorly and posteriorly were created. The 3D models from CBCT and MicroCT were compared using the iterative closest point (ICP) registration algorithm. Mean root square difference between the two modalities was calculated per tooth and per region.

Results

Mean root square difference between MicroCT and CBCT was 0.126mm (±0.2mm) over the entire surface. The CBCT models were larger than the MicroCT due to the larger voxel size. There was more variation in the maxilla in comparison with the mandible.

Conclusions and discussion

CBCT provides accurate 3D reconstructions of the occlusal surfaces of the teeth that can be used for clinical applications.
Computer aided Surgery in Dentistry – Challenges and State of the Art

W. Birkfellner

1Center for Biomedical Engineering and Physics, Medical University Vienna, Vienna, Austria

Image-guidance in dentistry and cranio- and maxillofacial surgery has been introduced on an academic level more than a decade ago. Since then, a number of techniques were developed which enable precise implant planning by means of modern imaging methods such as tracker-based implant insertion, pre-fabrication of drilling templates, and similar methods. The introduction of these methods in the clinical field poses new challenges and requirements on dento-maxillofacial imaging. By highlighting the technical possibilities and pitfalls of the various image-guidance techniques, and by reviewing the physical properties of various imaging modalities, I hope to contribute to stimulate critical discussion as well as further research into clinical applications of computer-aided dentistry.

Wolfgang Birkfellner was born in 1970 in Steyr/Upper Austria. After school in Austria and Germany, he started studying Physics at the University of Vienna in 1990, and graduated in 1996 in theoretical physics. In 2001, he finished his PhD in Medical Physics. From 2001 to 2003 he was a senior researcher at the University Hospital Basle/Switzerland. He became an associate professor of medical physics at the Center for Biomedical Engineering and Physics of Vienna Medical School in 2004. His research interests include medical image processing, medical physics, image-guided therapy and image-guided radiation oncology. He has authored or co-authored more than 70 peer reviewed journal articles, which were cited over 450 times in the literature. Currently, he is heading the Digital Image Processing Laboratory at the Center for Biomedical Engineering and Physics at the Medical University Vienna. He is also a reviewer for international journals (IEEE TMI, Med Phys) and conferences (MICCAI, SPIE Medical Imaging).
Comparison of radiation exposure of cone beam CT, multi-slice CT and conventional synthesized cephalograms

Th.F2 – Imaging6: CBCT dose 1
THURSDAY 2 JULY 2009 1145-1230
Room Forum
Session Chairs: Ralf Schulze Germany and Chang-Seo Park, South Korea

O-96

Calibration of cone beam CT density readings

Nummikoski P¹, Lee R², Azevedo B³, Sankar V¹, Nourie M¹, Mealey B¹, McDavid D¹
¹University of Texas HSC San Antonio, Texas, USA; ²COR-Imaging, Hawaii, USA; ³Western University College of Dental Medicine, California, USA

Introduction
When measuring the cancellous bone densities in CBCT scans the obtained values often are not correct and reliable for implant treatment planning purposes. This is especially true with small FOV machines that scan only a limited volume for image reconstruction. Conventionally, an intraoral density reference is used to calibrate the density range, but this requires the presence of the calibration device in every scan.

Objectives
Develop and test a clinically useful method of correcting the HU values of tissues in CBCT scans by using patient’s own known tissue densities as reference.

Materials and methods
An intraoral density block was manufactured containing four known simulated tissue materials. While biting on the density block, a 4x4 cm Accuitomo (Morita) scan was taken. In the patient’s scan, two areas of known density (dentin and lingual alveolar soft-tissue) were measured, the values were correlated to the true HU values as determined by medical CT, and a linear regression formula was calculated. The original scan density range in the volume was transformed using the formula, and the densities of the block in the corrected scans were measured and compared to the same block densities in the original scans.

Results
Fifteen 4x4 scans were taken. The patient tissues that were used as density reference were dentin (HU=1880) and lingual alveolar soft-tissue (HU=57). The graph shows the average old density values and new values of three different tissue types following the transformation.

Conclusions and discussion
The soft-tissue equivalent density range (water) and the cancellous bone density range was effectively corrected to closely match the true HU values. However, at the high density range the correction was not adequate. Also, the variation in the measured density values between the patients was large.
O-98

Investigation of scattered radiation and dose distribution in dental CBCT imaging using Monte Carlo simulation
Zhang G1, Pauwels R2, Bosmans H1, Jacobs R1
1Department of Radiology, University Hospitals Leuven, Leuven, Belgium;
2Oral Imaging Center, Faculty of Medicine, KULeuven, Leuven, Belgium

Introduction
Cone Beam Computed Tomography (CBCT) images are significantly degraded due to substantial amount of scattered X-ray contamination on projection data. Monte Carlo (MC) technique has popularized in characterization of scattered radiation as well as in accurate dose calculations. The widespread availability of CBCT for use in diagnostic dentistry entails special concern on this approach for dental applications.

Objectives
This work seeks to quantify the scattered photon contribution, to assess the radiation dose distribution, to investigate and quantify their dependence on various factors as well as to lend insights to post-imaging correction and dosimetric considerations.

Materials and methods
A general purpose CBCT simulator with arbitrary 3D voxelized geometry, precisely synchronized gantry rotation, simplified flat panel detector design, and open interface for device-specific configurations or user interventions was developed using EGSnrc MC code system and was implemented on contrast cylinder phantoms and a revised MIRD-based human head phantom in typical irradiation scenarios.

Results
The scatter and unscattered component were discriminated and visualized by separate profiles. The scatter-to-primary ratio (SPR) ranges from minimal level to more than 1.5 and is largely proportional to the traveling length in phantom and the density of the target. Doses were averaged over all particle histories and were reported in units of pGy for all regions of interest.

Conclusions and discussion
The abovementioned computational framework using MC method offers a possibility for simulating and monitoring every detailed physical and geometrical process involved in dental CBCT imaging. The generated image sets, dose estimates as well as statistical results could assist in preclinical studies or system optimization effort.

O-99

Measuring absorbed dose distributions in a humanoid phantom irradiated with a dental cone beam CT unit
Nilsson M1
1Department of Oral and Maxillofacial Radiology, Faculty of Odontology, Malmö University, Malmö, Sweden

Introduction
The rapidly increasing use of cone beam CT units in dental radiology calls for efforts to accurately map the dose distribution in a situation simulating the clinical setup. These data are needed in order to estimate the effective dose to the patient with reasonable accuracy; the dose values being important when evaluating the risk/benefit ratio for this new modality.

Objectives
The objective is to establish a method for measuring absorbed dose distributions with good accuracy and very high spatial resolution. Undersampling the dose distribution will inevitably underestimate the effective dose to the patient.

Materials and methods
Due to very steep dose gradients resulting from irradiation with a rotating and collimated X-ray source, an integrating detector with a spatial sampling density of less than 1 mm must be used. For this purpose self-developing Gafchromic® film placed inside a humanoid phantom has been tested.

Results
Following careful calibration of the film response, 2D dose distributions can be accurately mapped with a precision far better than traditional methods which rely on point measurements (e.g. TLD measurements).

Conclusions and discussion
The technique used has proven to be very well adapted to its purpose. The accuracy and precision when measuring absorbed dose is sufficient in order to estimate the effective dose with reasonable accuracy. Simultaneous measurement of the 2D dose distributions at different levels in the phantom will give a quite good picture of the 3D dose distribution. The results can also be used for comparison with dose distributions calculated with Monte Carlo methods.
O-100

Comparison of effective doses from CBCT devices
Schulze D1, Fuchs D1, Metzger MC1
1University Freiburg, Department of CMFS, Head and Neck Radiology Section, Freiburg, Germany

Introduction
There is an increasing number of CBCT devices on the market. They show a lot of differences with regard to detector type, size of acquired volume (FOV), exposition parameters, exposure control, voxel size, contrast resolution etc. The resulting effective doses are extremely different and have to be weighted against the aforementioned parameters.

Objectives
Objectives are to measure energy doses and calculate effective doses for ten different CBCT devices and to establish a dose related index which considers other parameters for a better comparison.

Materials and methods
An anthropomorphic phantom equipped with TLD's at typical anatomic landmarks was exposed in ten different CBCT units with standard exposition parameters. Effective doses were derived from the energy dose values using already established calculation factors and weightings according to the ICRP 2007 recommendations.

Results
The calculated effective doses range between 35 and 110 μSv (date of submission). An index out of effective dose, exposition and other technical parameters was calculated later on.

Conclusions and discussion
The sheer notation of effective doses does not represent the whole characteristic of a CBCT unit. Therefore the introduction of a dose-related index seems to be obvious obtaining a better possibility for a comparison of different devices.

O-101

Examination of cone beam CT imaging by radiation dose measurements
Plachtovics M.1, Turák O.2, Osvay, M3
1Kreativ Dental, Budapest, Hungary,
2National Research Institute for Radiobiology and Radiohygiene, Budapest, Hungary
3Institute of Isotopes of the Hungarian Academy of Sciences, Budapest, Hungary

Introduction
There is a possibility to set continuously the size of the direct beam by the collimator and the height of FOV at KaVo Exam 3D Cone Beam CT, in this way the dose of CBCT exposure about patient can be minimized. We did the reconstruction of this 6 cm high (diameter 16 cm) image on PC, that way we opened the collimators posteriorly (virtual imaging). Out of the original image the anatomy of the skull is recognizable in the whole volume of the image. It is reproducible in similar images.

Objectives
Originally, we hypothesized the image to be the result of a direct beam radiation. We aimed at showing that the beamgate blocks radiation, via obtaining air KERMA measures by using KaVo 3D Exam and iCAT Classic Cone Beam CT machines. iCAT Classic Cone Beam CT machine measures were also taken to simulate virtual beam-gate opening to determine the possible cause of the generation of an outside-of-target-volume image.

Materials and methods
We measured air KERMA with radiation measurement equipment (Radical Corporation model 9015). The settings were the next: on the place of patient, in the direct beam and very close to the direct beam without using phantom; on the place of patient very close to the direct beam, at the detection system of X-ray in the field of the picture and in the field of the phenomenon using waterphantom.

Results
In our examinations we proved that there is image out of the original picture and this image is recognizable in aspect of anatomy. On the place of patient in the direct beam we measured 4,98 mGy and very close to it (out of direct beam) 130,63 mikroGy (2,6 %) air KERMA. If we use waterphantom this rate is 14,4 %. When we measured air KERMA at the detector system of the X-ray machine, we observed that rate of the air KERMA dose of the original image and the air KERMA dose of the place where we observed the phenomenon is 51 %. This is the reason why we get a good, but not enough good image about that part of the skull.

Conclusions and discussion
We proved that we get a recognizable image in FOV exposure out of the field of the original image at iCAT Classic and KaVo 3D Exam Cone Beam CT machines. This image is valuless in aspect of anatomy, but it causes more dose for the patient.
Introduction
Dental cone beam CT (CBCT) has been subject to a number of radiation dose evaluations. However, effective dose estimations on anthropomorphic phantoms, or dose quantifications such as the dose-area product, cannot be directly translated to an individual patient.

Objectives
To estimate patient skin dose for CBCT examinations, which can aid in the estimation of effective dose for subsets of patients, and in the determination of dose reference levels (DRLs) for dental CBCT.

Materials and methods
Patient selection was based on age, body mass index (BMI) and craniofacial distances within standard ranges. Ethical approval and informed consent were obtained. Five groups of common radiographic indications were determined, taking ten patients per indication. Eight thermoluminescent dosimeters (TLD-100) were attached on the patient’s face and neck. Two TLDs served to capture the background dose. Patients were scanned on the Scanora® CBCT, using the default scanning protocol for the particular indication. Furthermore, entrance dose was measured on the Alderson RANDO and Alderson Radiation Therapy (ART) phantoms to verify the consistency of the entrance dose measurements in standard conditions.

Results
Average skin absorbed doses per patient varied between 345µGy and 1552µGy with a mean value of 879µGy. The highest radiation doses were received in the area of the mouth (2057µGy) and the salivary glands (1173µGy (parotid glands) and 1051µGy (submandibulary glands)). The lowest mean absorbed dose was perceived in the thyroid area (156µGy) and the eyes (136µGy). Average skin absorbed dose for the RANDO phantom was 759µGy; for the ART phantom it was 846µGy.

Conclusions and discussion
Skin dose values are influenced by a number of factors, which can be device-, operator- and patient-dependent. When coupled with phantom dose measurements, dose simulations or dose-area product values, in vivo dose measurements can aid in the estimation of the effective dose for an individual patient.

Funded by the European Atomic Energy Community’s Seventh Framework Programme FP7/2007-2011 under grant agreement no 212246 (SEDENTEXCT: Safety and Efficacy of a New and Emerging Dental X-ray Modality).
POSTERSESSIONS:

TUESDAY 30 JUNE 2009

POSTER SESSION 1 - DIAGNOSTICS: BONE TISSUE, SALIVARY GLANDS, MISCELL.
09.00-09.45 hours

POSTER SESSION 2 - ANATOMY: INTRAORAL, 3D IMAGING: INTRAORAL, CBCT
09.45-10.30 hours

POSTER SESSION 3 - RADIATION, DECISION MAKING, EDUCATION, IMAGING CBCT/3D
11.45-12.30 hours

THURSDAY 2 JULY 2009

POSTER SESSION 4 - DIAGNOSTICS, ULTRASOUND, OTHERS
09.45-10.30 hours

POSTER SESSION 5 - DIAGNOSTICS: IMPLANTS, PRESURGICAL PLANNING, ORTHODONTICS, TMJ, OTHERS
11.45-12.30 hours

POSTER SESSION 6 - POSTER 6 IMAGING: CT MICRO-CT, OTHERS, DIAGNOSTICS: CARIE, ENDODONTICS, PERIODONTOLOGY, MISCELL.
13.30-14.15 hours
P1-2
Key radiographic features of the cemento-osseous dysplasias
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Introduction
Cemento-osseous dysplasia (COD) is a non-neoplastic process usually confined to the tooth-bearing areas of the jaws that is easily confusable with other entities that arise in the jaws. Radiology plays a valuable role in the diagnosis of COD, and may prevent unnecessary intervention.

Objectives
To identify the pathognomonic radiographic features of COD.

Materials and methods
Two groups of clinicians (3 general dentists [GP] and 3 oral radiologists [RG]) independently reviewed a series of 50 image sets (37 cases of COD and 13 cases of similarly-appearing entities) for specific radiographic features and an interpretation.

Results
Logistic regression analysis demonstrated that bilaterality (odds ratio 10.23, p<0.01), the presence of a well-defined border (6.67, p<0.05), a mixed radiolucent/radiopaque appearance (10.53, p<0.01), an association with anterior and posterior teeth (8.28, p<0.005), absence of cortical expansion (4.43, p<0.05) were the key features that allowed radiologists to make the correct interpretation in 79.3% of cases. In contrast, the absence of root resorption (OR 4.52, p<0.05) was the only key feature that permitted GPs to make the correct interpretation in 38.7% of cases.

Conclusions and discussion
COD is a commonly-occurring entity and may be easily confusable with other entities that include dense bone island, cementoblastoma, cemento-ossifying fibroma, fibrous dysplasia, complex odontoma and sclerosing osteitis. Our work suggests that bilaterality of COD, the involvement of anterior and posterior teeth together, the presence of a well-defined border with an associated radiolucent periphery and the absence of cortical expansion are key features for correctly interpreting COD by oral radiologists. We recommend that these features be emphasized in educational programmes in oral radiology as being important for differentiating COD from other similarly-appearing entities.
Intraosseous schwannoma of the mandible
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Introduction
Intraosseous schwannomas of the mandible are rare, benign tumors with less than 50 cases described in the literature. There is a lack of reports evaluating such tumors with the use of both CT and MRI.

Objectives
The aim of this report is to present 4 cases of schwannomas arising from the nerve within the left inferior alveolar canal diagnosed at our Institution with the use of different imaging modalities.

Materials and methods
Between 1989 and 2008, 3 female and 1 male patients, aging 26 to 42 years, were investigated with conventional radiographic examination and CT imaging. In 3 patients MRI was performed to complete the diagnostic work-up. We evaluated the contribution of each imaging modality in defining the nature of the observed lesion and the spatial extension of the tumor.

Results
In 2 cases panoramic radiography, showing a bulbous, elongated enlargement of the canal, suggested the nature of the lesion with high suspicion. This suspicion was corroborated by the finding at CT and MRI. In the other 2 cases, in which a small radiolucency lesion was observed on panoramic radiograph, CT images permitted to correctly interpret the observed lesion as an enlarged alveolar canal. On the contrary, MRI findings were useful to diagnose the nature of the lesion because of the typical signal intensity. Both CT and especially MRI were particularly useful to detect the extra-canal tumor extension which was relevant in one case. 3 patients underwent complete surgical enucleation while the fourth one has been recently scheduled for resection. Histological examination of the surgical specimen confirmed the diagnosis.

Conclusions and discussion
Although the definitive tumor diagnosis is based on the histopathologic examination of the lesion, radiographic features always suggested the hypotesis of schwannoma especially in patients with large lesions. CT and MRI always permitted a non-invasive correct diagnosis of the nature and extent of the lesion.

Generalized root agenesis in pseudoxanthoma elasticum
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Background and objectives
Pseudoxanthoma elasticum (PXE) is a rare, genetic disorder characterized by progressive calcification and fragmentation of elastic fibers in the skin, the retina, and the cardiovascular system, which is termed as elastorrhexia. The nomenclature was first given in 1896 by Darier, differentiating PXE from xanthoma and linking the pathology to elastic tissue fragmentation. Typically, cutaneous lesions begin in childhood, but, because of their asymptomatic nature, they are not noted until adolescence. In some individuals, skin lesions do not develop until later in life. This disease is important to recognize early to minimize the occurrence of retinal or gastrointestinal hemorrhage and cardiovascular complications. No previous reports in the English literature have mentioned generalized root agenesis in PXE, and the aim of this paper is to present a case of pseudoxanthoma elasticum with generalize root agenesis in a 22-year-old male patient.

Methods
In addition to clinical examination the patient was imaged using medical and panoramic examination.

Conclusion
Radiological examination is important in dental practice and clinicians must be watchfull of the presence of dental abnormalities.
P1-5

Pilot study on fractal dimension evaluation on cone beam computed tomography image of the jaws in patients with bisphosphonate associated osteonecrosis of the jaws
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Introduction
There are no specific radiological signs allowing an early diagnosis of bisphosphonate associated osteonecrosis of the jaws (BP-ONJ). Applying fractal dimension (FD) evaluation on cone beam computed tomography (CBCT) might be a useful diagnostic tool for the diagnosis of BP-ONJ.

Objectives
This retrospective study aimed to detect BP associated bone alterations by FD evaluation of CBCT images, with mathematical morphology operation.

Materials and methods
Sectional images of patients with BP-ONJ who had been examined by CBCT were included in the study. The controls were gender and age matched. The images were selected by a single-blinded investigator. Two regions of interest (ROI) of cancellous bone were selected in mandible: ROI1- close to mental foramen; and ROI2- posterior alveolar bone. Numerical FD evaluations of the ROIs were compared between the groups. High FD was defined as ≥ 1.674 and odds ratios (OR) were obtained. Study was approved by institutional review board and waiver of consent was obtained.

Results
There were 36 patients, 67% females, mean age 60.7. The OR for ROI1 was 1.71 (IC 0.28–1.22); and ROI2 was 6.40 (IC 0.63–156.13). The odds of being a BP-ONJ case versus being a control were higher for individuals with higher FD score.

Conclusions and discussion
The OR evaluation by FD has shown that the odds of being a BP-ONJ case versus being a control were higher for individuals with higher FD score. The ROI closer to alveolar bone could better show differences in bone alterations associated to BP. The results suggest that FD might be a tool in detection of bone alterations caused by BP. Supported by Office of Research, University of Washington School of Dentistry

P1-6

Salivary duct carcinoma in the palate with perineural spread: a case report
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Introduction
Salivary duct carcinoma (SDC) is a rare, extremely aggressive malignancy arising in the ductal epithelium of salivary glands. We present a case of SDC in the palate with perineural invasion and recurring lesions in the maxilla and mandible on the contralateral side.

Case report
A 61-year-old female presented with dull pain in the left maxillary molars. Panoramic radiograph revealed large osteolytic destruction involving the hard palate and alveolar bone, as well as the floor and posterior wall of the left maxillary sinus. On the contrast-enhanced CT image, a large slightly enhancing mass was observed in the left posterior maxilla with infiltration into the maxillary sinus, pterygopalatine fossa, and foramen rotundum. Resection of the mass with subtotal maxillectomy, left supraomohyoid neck dissection, and reconstruction was performed. However, 2 months after the second surgery, the patient complained of dull pain from the right side of her face, contralateral to the primary lesion. Contrast-enhanced CT, MR, and PET images showed several recurred lesions along the right maxillary sinus walls. Resection of mass with total maxillectomy and selective neck dissection, and reconstruction was performed. However, 2 months after the second surgery, follow-up panoramic radiograph demonstrated large permeative bone destruction in the right mandible and the patient was referred for radiation therapy.

Discussion
The present case showed an infiltration into the foramen rotundum via perineural spread and extensive recurrences in the contralateral maxilla and mandible in a short period of time. Close follow-up with contrast-enhanced CT, and MRI, PET is needed to detect the extent of the tumor and recurrence.
Radiographic detection of artificial bone lesions in an in vitro mandible
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Objectives
To assess diagnostic accuracy for diagnosis of bone lesions in vitro with different Cone Beam CT (CBCT) devices and conventional 2D radiographs.

Materials and methods
A dry human mandible was cut in five serial blocks, artificial bone lesions were created with different depths: 150 µm, 175 µm, 200 µm, 250 µm and 300 µm. Lesions were created in the trabecular bone and in the cortico-trabecular area. Periapical radiographs were made using VistaSCAN periio® (Dürr Dental AG, Bietigheim-Bissingen, Germany). CBCT images were made using Scanora 3D® (Soredex, Finland), 3D Accuitomo® (J. Morita, Japan), Galileos® (Sirona, Germany), Kodak 9000 3D® (IMTEC/Kodak dental System, USA), ProMax 3D® (Planmeca, Finland) and Picasso® (Vatech, Korea). Six calibrated observers, evaluated all digital images with at least one week between subsequent sessions. Observers rated the presence or absence of lesions in the trabecular layer and in the cortico-trabecular area on a 5-point probability scale. The observers indicated the locations of the lesions on schematic figures of the bone blocks for both imaging modalities.

Results
CBCT images were significantly better to detect bone lesions in the mandible than periapical images. For the different CBCT systems, minimal detection threshold ranged from 175 µm to 250 µm. More specific, for the Scanora 3D® the threshold was 175 µm. For ProMax 3D® and 3D Accuitomo® it was 250 µm. The detection of bone lesions in the cortico-trabecular area was significantly better than the detection in trabecular bone. Detecting the cortico-trabecular lesions with the Galileos® was more difficult compared to the other CBCT devices.

Conclusions
CBCT images show a significantly better diagnostic accuracy than periapical images. For the different CBCT systems, the threshold for detecting bone lesions ranged from 175 to 250 µm.

Canine width and sexual dimorphism in Indian population: a forensic application
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Introduction
Teeth being the hardest and chemically most stable structures in the body can be easily preserved and fossilized. Thus, they serve as a valuable tool for genetic, forensic and anthropological investigations. As the mandibular canines are less affected by periodontal disease, are last teeth to be extracted and are likely to survive severe trauma, they may serve as a key tooth for personal identification.

Objectives
1. To measure mesiodistal width of mandibular canines and its possible use in sex determination in Indian Population.
2. To determine the efficacy of conventional and digital intraoral periapical radiography in measuring the mesiodistal canine width.
3. To calculate the sexual dimorphism of right and left side.
4. To find out which canine exhibits greater sexual dimorphism.

Materials and methods
A total of thirty subjects of Indian origin were included for the study (15 males and 15 females) in the age group of 19-24 years. The mesiodistal width of mandibular canines was measured on clinical examination, plaster models of the same patients and by conventional and digital intraoral periapical radiographs. Then, sexual dimorphism was calculated for the right and left side based on the formula given by Garn and Lewis.

Results
1. The mesiodistal canine width is greater in males than the mesiodistal canine width in females (more than 7 mm = male, less than 7 mm = female).
2. The difference in the measurements between anatomic mesiodistal canine width and those made by conventional and digital intraoral periapical radiography were found to be statistically insignificant.
3. The left canine shows greater sexual dimorphism.

Conclusions and discussion
From the study we can conclude that the mesiodistal canine width may be used for sex determination in Indian population and left mandibular canine exhibits greater sexual dimorphism. The results are similar to the study conducted by Lew and Keng in ethnic Chinese population. Since the conventional and digital radiography can be used for canine mesiodistal width measurement, records of the same in dental clinics can serve as immense value in the field of forensic odontology.
Radiological evaluation of “sine causa” osteolytic lesions, comparing CT and Dentascan features
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Introduction
Maxillary bone osteolysis are often incidental finding during dental X-Ray exams. This pathology is often asymptomatic thanks to the absence of contact with the nervous branches terminations except of very advanced cases. Radiologic appearance correspond to hudge radiolucent area with irregular edges (pic. 1). In most cases lacune are localized close to the dental root causing inter-radicular bone loss. In rare cases compression of the inferior alveolar nerve can happen with paresthesia as a consequence. Otherwise, very frequently the osteolysis is not related to any dental pathology or at least is not clearly assessed with any associated pathology. Neoplastic and pseudoneoplastic maxillary bone lesions are many and it is necessary to understand their appearance because a complete and correct diagnosis can lead to a correct and quick treatment with a consequent very good prognosis for the patients.

Objectives
To define the differential diagnosis criteria in the radiological evaluation of maxillary bones “sine causa” osteolysis using CT and Dentascan data.

Materials and methods
We considered osteolytic lesions < 1 cm encountered in the course of radiological exams for dental evaluation. We correlated CT (pic 2) and Dentascan data (pic 3, 4). Dentascan Technique was introduced in the last 80’s and is a CT application characterised by a dedicated software which allows electronic reconstruction which gives an optimal visualization of the alveolar bone and adjacent anatomical structures using Panorex and sagittal images (1 mm gap-spaced), orthogonal to the maxillary bone in each site. All data are compared with the histological findings obtained by surgical specimens

Conclusions and discussion
Maxillary osteolytic lesions are detected in a high percentage of patients (> 45 years) undergoing dental X-ray examination. These lesions are often asymptomatic and not related to major pathology but it can be caused by infiltrative asymptomatic tumors. In these cases it is mandatory to look for well known radiological signs in order to suggest subsequent diagnostic and therapeutic procedures. Dentascan is now mandatory to diagnose maxillary anomalies even if in the past it was used only preliminary to implantologic procedures. It can give the best anatomical detail and a higher accuracy in the definition of expansive processes. It is important to consider always this technique complementary to clinical and histopathological data.

A comparative study of the effective radiation doses from plain radiography and cone beam computed tomography sialography
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Introduction
Sialography, which is one of the most effective measures of salivary gland function, is largely dependent on the imaging technique to which it is coupled. Combining sialography with imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) has made possible 3D depictions of gland anatomy, but these modalities have several limitations that may be overcome by the new technology of cone beam CT (cbCT).

Objectives
The objective of these studies was to compare the effective dose ($E$) to the head and neck from cbCT and plain radiography in sialographic examinations. The long term goal of the study is to assess the efficacy of 3D sialography using cbCT in the evaluation of salivary gland function.

Materials and methods
The effective doses were calculated using absorbed doses measured at 25 selected locations in the head and neck of an Alderson Rando phantom, and using tissue weighted factors consistent with the International Commission on Radiological Protection (ICRP) 2007 recommendations.

Results
The calculated $E$ from a plain radiograph sialography series of the parotid gland was 65µSv, and of the submandibular gland it was 156µSv. By comparison, cbCT examinations centered over the salivary glands yielded effective doses that ranged between 60µSv and 683µSv depending on the field-of-view (FOV) and technical settings, kVp and mA.

Conclusions and discussion
The effective doses from cbCT were comparable to the $E$ from plain radiography when smaller fields-of-view were chosen in combination with lower kilovoltage and milliamperage settings (6” FOV, 80kVp, 10mA). Based on these findings a protocol for cbCT sialography is suggested.
Periodic volumetric changes of the cystic lesion in the jaw: evaluation for the effect of decompression treatment

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Objective
The aim of this study is to evaluate the effect of decompression treatment for cystic lesion in the jaw by measuring the periodic volumetric change of the lesion on computed tomographic images.

Materials and methods
Ten patients diagnosed for odontogenic cyst in the jaw were selected for this study. Six of them had the lesion in the mandible and the rest in the maxilla. Computed tomography were taken at the day of the operation and repeated two times at an interval of three month. The volume of lesions was measured by using OnDemand3D® (Cybermed Inc., Seoul, Korea) software and compared by three measurement values.

Results
The decrease of the volume was more prominent in lesions with expansion of the adjacent cortical layer. The volume of the cystic lesions in the maxilla did decrease more than that in mandible.

Conclusion
The decompression treatment for cystic lesions is very effective in expansive lesions but follow up should be done carefully whether the size of it is larger or not.

Differentiation of benign and malignant tumors of salivary glands using MRI and color Doppler sonography

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Introduction
Preoperative prediction of malignancy or benignancy of a salivary gland tumor is clinically very important and strongly influences the surgical plan. Clinically, symptoms are unreliable with regard to predicting the benign or malignant nature of a lesion. Therefore examination by imaging is strongly recommended. MRI and color Doppler sonography are two imaging modalities that currently are used in diagnosing salivary gland tumors. However there are not fully accepted criteria on both techniques to predict the nature of tumors.

Objectives
To evaluate diagnostic criteria of MRI and color Doppler sonography in differentiation of benign and malignant tumors of salivary glands

Materials and methods
35 patients, clinically suspected of having salivary gland tumors, were examined by MRI (1.0 Tesla) and color Doppler sonography. MR images were assessed for the location, borders, tumors signal intensity in T1- and T2-weighted images, and their relation to adjacent structures. Color Doppler sonograms were evaluated for the location, echostructure, borders, degree and pattern of vascularization, values of resistive index(RI) and pulsatility index(PI) of tumors. Finally imaging findings were compared between benign and malignant tumors. Chi square test in qualitative-qualitative variants and independent t- test in qualitative-quantitative variants were used.

Results
There were 22 benign and 13 malignant tumors. Accuracy of MRI and sonography in prediction of tumors location was 100% and 94% respectively. There was statistically significant difference between borders of benign and malignant tumors on both sonography and MRI (p<0.001). Invasion to adjacent structures on MRI was seen only in malignant tumors (PPV=92.3%). Significant difference of the vascularization pattern was found between benign and malignant tumors(p<0.05). There were no statistically significant differences between values of RI and PI of tumors.

Conclusions
Well-defined borders on MRI and sonography were related to benign tumors and tumor invasion to adjacent structures on MRI was an accurate criteria to predict malignancy. The hilar type of vascularity on Doppler sonography suggested malignancy of tumors. Sonography is a useful preliminary technique in evaluation of salivary gland tumors but in case of large tumors or tumors with suspicion of malignancy, MRI examination is recommended.
A case of recurred pleomorphic adenoma of the maxilla
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Introduction
Pleomorphic adenoma is the most common form of benign tumor from the major and minor salivary glands. It is a generally painless and slow growing mass. It can easily recur and change to be malignant when excision is incomplete.

Case report
This is a case of pleomorphic adenoma occurred in the right hard palate with recurrence. At first, it was shown as a 5 X 4 cm sized, well defined, round radiolucency in the right posterior maxilla with the elevation of inferior portion of right maxillary sinus on conventional radiographs. Bony expansion and destruction with internal bony fragments were found on CT scan. Recurred large mass was found with the size of 6.8 X 5 cm involving the whole right maxilla after 4 years of the resection. CT scan showed heterogeneous soft-tissue density mass and MRI scan iso-signal intensity with internal focal high signal intensity (T1W1), and slight high signal intensity mass including cystic portion of foci with multifocal high signal intensity (T2W1). Whole body PET-CT scan showed hypermetabolic tumor from the right maxillary sinus to the nasal cavity.

Discussion
As pleomorphic adenoma is a locally aggressive lesion with the high recurrence rate and frequent malignant change, treatment should be aggressive local surgery. And CT, MRI and PET-CT scans are very useful for the detection of the exact location of the lesion and for the recognition of malignant changes. These diagnostic imaging methods play an important role in the surgical management of the patient.

Undifferentiated carcinoma metastatic to the maxilla
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Introduction
Metastasis to the oral cavity are extremely rare. The most frequent sites of oral metastasis are the jaws, with the premolar and molar areas most frequently involved. This presentation describes a man with a history of undifferentiated carcinoma at the submandibular gland in whom metastases to the multiple site, including the maxilla.

Case report
The patient, a 41-year-old male, was first evaluated with respect to 2X2 cm sized mild hard movable swelling at the right submandibular area. Enhanced CT scans revealed enlarged right submandibular gland with heterogenic characteristic, which subsequently was excised and found, on histologic examination, to be an undifferentiated carcinoma. The patient received radiotherapy and was followed up. After about two years PET CT scans of the whole body revealed two metastatic lesions at 4th and 12th thoracic vertebrae, for which he underwent several courses of radiotherapy and chemotherapy. At that time the patient complained of continuous pain at the right maxillary posterior teeth for several days. Oral examination showed the teeth and supporting structures to be well maintained. Periapical radiographs showed ill-defined periapical radiolucency at the right maxillary first premolar and cone beam CT scans revealed destruction of buccal cortical bone at the right maxillary first and second premolars, which is strongly suspicious for metastasis. The patient is scheduled to undergo an additional workup to determine future management of his disease.

Discussion
Metastatic tumors represent the establishment of new foci of malignant disease from a distant malignant tumor usually by way of the blood vessels. If a metastatic lesion is appeared at the periapex of a tooth, the appearance may be similar to that of a periapical inflammatory lesion. It is essential to differentiate a metastatic lesion from a periapical lesion.
Introduction
Panorama and conventional radiography are useful tools for diagnosing lesions in the jawbone which are evaluated by morphological factors of hard tissue such as the shape and size. However, there is sometimes a difficulty in the diagnosis when a change of the hard tissue is observed. Recently, it became possible to obtain information on the state of a lesion with the appearance of excellent MRI for the observation of the soft tissue.

Objectives
To investigate differential characteristics in MRI images of lesions in the jawbone.

Materials and methods
Patients were initially diagnosed by Panorama or conventional radiography for jawbone lesion, and MRI in the Okayama University hospital between 1995 and 2007. The pathological diagnoses of the lesions found were ameloblastoma, keratocystic odontogenic tumor (KCOT), adenomatoid odontogenic tumor (AOT), dentigerous cyst, and simple bone cyst (SBC). Each case was selected and the best MRI examination was selected among plain MRI, contrast-enhanced MRI, and dynamic contrast-enhanced MRI.

Results
The lesions in the jawbone were able to differentiate a solid lesion or cystic lesion by contrast-enhanced MRI. Ameloblastoma is the representative of solid lesion. The cystic lesions showed markedly high signal intensity on T2 weighted-image (WI). KCOT showed heterogeneous images of moderate signal intensity and high signal intensity on T1 WI. KCOT, dentigerous cyst, and simple bone cyst showed thin rim-enhancement in the margin of the cystic lesion. Ameloblastoma and AOT showed comparatively thick rim-enhancement. Because SBC had shown markedly high signal intensity on T2 WI in all cases, it was suggested that it is filled with liquid internally. Moreover, SBC showed specific features on the dynamic contrast-enhanced MRI; the feature was able to differentiate SBC from other cystic lesions.

Conclusions and discussion
MRI improved the diagnosis of the lesions in the jawbone.

Gardner syndrome confused with florid osseous dysplasia: report of a case and a review of literature

Aim
Gardner syndrome (GS) is an abnormality of familial adenomatous polyposis (FAP) accompanied by characteristic jaw lesions. The radiographic features of GS caused confusion in the differential diagnosis between GS and familial giantiform cementoma (FGC) because the inherited characteristic widespread jaw radiopacities of these 2 abnormalities have similar radiographic features. This report presents a rare case of GS with hereditary widespread osteomatous jaw lesions with a review of the literature.

Methods
A 55-year-old woman visited Wonkwang University Dental Hospital in September 2001 for the treatment of a pulp infection of the right upper second premolar. The incidental findings from a panoramic radiograph included widespread multi-focal radiopaque masses located throughout the upper and lower jaws. The CT Images (May 2004) of the jaws contained sclerotic masses with radiodensities similar to those of teeth. This suggested the production of multiple complex odontomas, intermingled with an osteoma. Furthermore, osteosclerotic masses in the ethmoid sinus were seen that extended into the orbits. Neither cortical expansion nor thinning was observed. Bone scintigraphy demonstrated the presence of multiple foci of increased uptake in the orbit, maxilla, and mandible, consistent with osteomatus lesions. Panoramic images taken of the eldest son (29 years old) and a daughter (26 years old) of the patient. This indicated widespread radiopacities of the jaws, but the image of the second son (24 years old) appeared normal. The masses were interpreted as a variant of cemento-osseous dysplasia and an inherited trait. The tentative diagnosis was FGC of the autosomal dominant type, and further follow-ups of this patient as well as additional examinations of her 3 children were recommended. In 2005, however, multiple polyposis of the ascending colon was detected during an endoscopic examination of this middle-aged woman after lower abdomen symptoms developed. A desmoid tumor of the abdomen was also observed on an abdominal CT scan. The patient stated that her elder sister and elder brother also had histories of lower abdomen tumors.

Result
The present case demonstrated several characteristic features of GS. The widespread osteomatus jaw lesions, osteoma in the ethmoidal sinus and orbit, dental abnormalities such as an odontoma and impacted tooth, a desmoid tumor in the abdomen, and FAP are the characteristic features of this case.

Conclusion
Gardner syndrome intestinal polyps have a 100% risk of undergoing malignant transformation consequently, early identification and surgical intervention of the disease are important to prolong the life of the patient. This case represents several classic features of GS in a late-middle-age woman, presenting similar radiographic features with FGC.
Correlations between panoramic radiomorphometric indices, bone mineral density and osteoporotic fractures in women aged over 60 years old

Leite AF, Figueiredo PTS, Melo NS, Paula AP
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Introduction

As cortical width and cortical shape of the mandible on panoramic radiographs have been considered auxiliary tools for identifying postmenopausal women with low bone mineral density, it is important to verify whether they might predict fracture risk in women.

Objectives

To test for correlation three radiomorphometric indices with skeletal bone mineral density (BMD), and with osteoporotic fractures in women aged over 60 years old. The accuracy of the cortical measurements in predicting osteoporosis, T-Score \( \leq -2.0 \), and osteoporotic fractures was also determined.

Materials and methods

Mandibular cortical index, visual estimation of cortical width and mental index were evaluated in panoramic radiographs of 92 women. BMD of the lumbar spine and hip were determined by dual-energy X-ray absorptiometry. Osteoporosis was defined as a BMD T-Score \( \leq -2.5 \) at either the lumbar spine or the hip. Vertebral fractures were evaluated on lateral spine radiographs using semi-quantitative assessment. For detecting nonvertebral fractures, interviews were obtained. An adjusted stepwise forward logistic regression model was performed. P values of less than 0.05 were considered statistically significant for all statistical analyses.

Results

Fifteen women presented osteoporotic fractures. Significant correlations were demonstrated between all panoramic indices and BMD. No correlations were found between the indices and osteoporotic fractures. Mental index showed accuracy for the identification of women with osteoporosis and T-Score \( \leq -2.0 \). Women classified as C3 presented an odds ratio (OR) of 1.81 for having osteoporosis. In women with very thin cortices, the OR for having T-Score \( \leq -2.0 \) was 2.69. The area under the ROC curve for identifying women with osteoporotic fractures was 0.573 (95% CI, 0.397-0.749) for cortical width.

Conclusions and discussion

Panoramic radiomorphometric indices could predict densitometric diagnosis of osteoporosis and T-Score \( \leq -2.0 \), the threshold to begin treatment. Radiomorphometric indices did not demonstrate accuracy for predicting osteoporotic fractures.
P1-19

Legislative and managerial consideration about execution and interpretation of the odontoiatric and maxillofacial images

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Introduction
Odontoiatric and maxillo-facial imaging has improved consistently in the last decades. The wide diffusion of intraoral and extraoral digital imaging, the spread of CT and cone beam technology with the possibility of data post-processing represent an informatic revolution in the diagnostic workflow of the odontoiatric patient.

Objectives
To identify the correct and proper application of all the complex imaging techniques and to define the appropriate role of each professional expert in the management of the clinical and radiological informations, related to the own specific competence and cultural background.

Materials and methods
We have analyzed the current European law related to control and use of the radiologic sources in order to identify the specialist designed for the management. We have also defined the proper indications and diagnostic possibilities of each radiological procedure related to the oral and maxillo-facial district.

Results
The directive 97/43/EURATOM ratify the norm related to the protection of people exposed to ionizing radiations for medical purposes. The decree 187/2000 identifies the professional figures in charge of the execution and management of the radiological procedures. In the current dental practice, the radiological procedures could be classified in panoramic and non-panoramic based on their explorative capabilities.

Conclusions and discussion
According to the rule in force, any procedure that implies the use of IR must be managed by a technologist and by a radiologist, respecting the principles of justification and optimization and the diagnostic reference levels. The non-panoramic procedures, such as the endoral examinations, could be managed by the dental specialist or by the oral and maxillofacial surgeon as a part of the clinical and instrumental assessment of the odontoiatric patient.

P1-20

Case report of salivary stone removal by minimal intervention in Chile

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Introduction
Sialoliths are calcified structures (stones) that develop within the salivary ductal system. In Chile the available treatment involves the surgical removal of the stone and, in some cases, the affected gland. In other countries, minimally invasive stone removal from the salivary duct system is a procedure being used successfully as an alternative to surgical treatment. This publication reports a successful use of this new type of treatment for Chile.

Case report
A sixty nine year old woman with stones in both parotids had been visiting several practitioners because she refused to be submitted to any kind of surgical treatment for stone removal. The patient had always requested a less invasive procedure since she was keen on having a chance to conserve his gland. History and clinical examination was performed, showing that the stones have been previously investigated by CT and ultrasound. In order to reduce radiation exposure to the patient no further examinations were required. Clinically, the patient presented intermittent mealtime swelling on the right parotid, while the left was asymptomatic. The stone of the right parotid was 1 cm from the parotid duct opening, where it was palpable beneath the mucosa; there was also pain and local inflammation. With a Dormia basket and using a blind technique (without imaging guidance) the stone of the right parotid was successfully retrieved.

Discussion
The successful outcome of the described procedure shows that minimally invasive stone removal from a salivary duct system is a treatment alternative that is susceptible to be applied and incorporated in Chile's practices, in order to avoid submitting patients to surgical procedures that could entail negative sequels during their rest of their life.
Changes in sialograms and decrease of parotid swelling episodes in 23 cases of infantile recurrent parotitis
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Introduction
Recurrent Parotitis (RP) is defined as recurrent parotid inflammation, generally associated with non-obstructive sialectasis of the parotid gland. Infantile Recurrent Parotitis (IRP) is diagnosed on the basis of age at onset, duration of parotid swelling episodes, frequency of attacks and typical sialograms, which may by itself cause a resolution of the symptoms. Treatment is conservative, following an expectant policy.

Objectives
Follow up twenty three cases of IRP, where changes of the typical images of the ailment and a decrease of the symptoms occurred attributed to sialograms.

Materials and methods
In twenty three children IRS was diagnosed. Sialograms revealed acinar and ductal atrophy and severe sialectasis. Infiltrations of oil-based contrast media through the parotid ducts were made, followed by sialograms after one and two years.

Results
The follow-up period was notable for the dramatic decrease in the number and severity of incidents of glandular swelling and, at the same time, for the decrease of the number and size of the sialectasis.

Conclusions and discussion
The improvement in the clinical status of the patients and the notable glandular pattern normalization is attributed to the sialographic procedures.

Dynamic evaluation of benign neoplasms of major salivary glands with multidetector row ct delayed enhancement
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Introduction
Benign neoplasms of the salivary glands are a relatively rare disease of head-neck district and are characterized by a wide variety of histological subtypes. The introduction into clinical practice of more efficient equipment, such as multidetector row CT, allows for the assessment of the differences of enhancement between benign and malignant tumors, through dynamic studies, allowing for typing, but only in the first instance, injuries considered suspicious.

Purpose
To define the role of 4 row MDCT for characterizing benign neoplasms of major salivary glands with dynamic evaluation of the contrast enhancement, also in delayed scans.

Materials and methods
22 patients with salivary glands benign tumors were prospectively evaluated using dynamic MDCT. Helical CT scans were acquired using a standardized three-phases contrast medium protocol. Additional images only of the identified lesion(s) were obtained with delayed acquisition at 9 minutes. Evaluation of net enhancement was achieved by subtracting attenuation values of pre-contrast phase from each post-contrast value. Corrected attenuation values were compared with registration performed in normal salivary gland. CT findings were compared with histopathology.

Results
Pleomorphic adenomas showed a range of net enhancement ranging from 50 to 130 HU, Warthin tumors of 60 to 80 HU, oncocytomas mean of 70 HU. Using morphological characters the following hypothesis were done: pleomorphic adenoma n = 12, Warthin tumors n = 7, focal lesion in chronic inflammatory degeneration of salivary gland n = 3; the evaluation of net impregnations achieved the following diagnostic hypothesis: pleomorphic adenoma n = 12, Warthin tumour n = 9, unknown lesion n = 1. Hystopathology showed 10 pleomorphic adenomas, 10 Warthin tumors and 2 oncocytomas. VPP for diagnosis of pleomorphic adenomas was 45%, while for Warthin tumors was 52.6 %.

Conclusions and discussion
MDCT is an accurate modality for the diagnosis of different salivary glands benign tumors. The evaluation of net enhancement may provide an adjunctive value to achieve the histological type and to differentiate between benign neoplasm and, in doubt cases, benign from malignant lesions. Through thin layer scans and multplanar reconstructions, the district of clinical interest is quickly and with great care taken, allowing to appreciate neoplastic formations reports with the vascular structures of the neck and setting the access to the injury in pre-surgical, to prevent accidental exposure of vascular structures.
Tumorous osseous dysplasia: a report of 6 cases
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Introduction
Osseous dysplasia (OD) occurs in the tooth bearing areas of the jaws and is the most common fibro-osseous lesion encountered in clinical practice. The tumorous subtype (also referred to as familial- or gigantiform OD) is rare and can potentially manifest with considerable jaw expansion.

Objective
The objective of this study was to report 6 cases of tumorous OD diagnosed over a 10-year period in an African population sample.

Materials and methods
The files of 6 cases of tumorous OD diagnosed in the Department of Oral Pathology and Oral Biology at the Oral Health Center, University of Limpopo, were retrieved, data analyzed and compared with recent literature.

Results

Table: Patient data

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Site</th>
<th>Size (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>F</td>
<td>35 -46</td>
<td>10</td>
</tr>
<tr>
<td>29</td>
<td>F</td>
<td>13 – 16</td>
<td>2.5</td>
</tr>
<tr>
<td>34</td>
<td>F</td>
<td>44 – 35</td>
<td>6</td>
</tr>
<tr>
<td>71</td>
<td>F</td>
<td>42 – 34</td>
<td>4</td>
</tr>
<tr>
<td>23</td>
<td>F</td>
<td>Multifocal; gnathial &amp; extra gnathial</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>F</td>
<td>43 – 44</td>
<td>3</td>
</tr>
</tbody>
</table>

During the period covered by this study, 44 ossifying fibromas were diagnosed in the Health Center. Our findings on tumorous OD’s are compatible with those reported in the literature except for the exclusive occurrence in females and higher ages at presentation. Case 5 with multifocal gnathial and extra gnathial tumorous OD’s represents a rare and hereto undescribed presentation of the condition.

Conclusion
Contrary to general belief, tumorous OD’s do occur in African blacks. The growths are probably misinterpreted as ossifying fibromas or osteomas.

Florid osseous dysplasia of the jaw skeleton: CT and MRI observations
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Introduction
Florid osseous dysplasia (FOD) is one of four subtypes of osseous dysplasia (WHO). FOD is characterized by multiple lesions occurring bilaterally in the mandible or even in all jaw quadrants. To our knowledge, there are only four reports on computed tomography (CT) of FOD and no report on magnetic resonance (MR) imaging observations.

Case report
Case 1: 37 year-old female, African, with periodontal pocket and pain region 41. Panoramic examination revealed large osteolytic areas in both jaws, more dominant in the lower jaw.
Case 2: 38 year-old female, African, with abscessed teeth 25 and 26. Panoramic examination revealed large masses of well-defined irregular radiopacities in both jaws.
Case 3: 33 year-old male, Caucasian, with lightly painful swelling in the mandible. Panoramic examination revealed large osteolytic areas in both jaws, predominantly in the mandible.
CT confirmed the panoramic findings and additionally showed areas of thinned, expanded and perforated cortical bone in both the mandible and maxilla (case 1 and 2), and with some central areas of irregular radiopacities not seen with the panoramic examination. MR imaging demonstrated cystic areas in both jaws, i.e., high signal in T2 images and no enhancement after i.v. contrast medium injection in T1 images, except in a thin margin in the periphery (Case 1 and 3).

Discussion
Depending on the relationship between the soft tissue and hard tissue components, the radiologic picture may vary from more or less completely radiolucent to completely radiopaque, as demonstrated in our cases. CT proved superior to the panoramic examination to assess the bone abnormalities. MR imaging gave additionally diagnostic information, revealing cystic areas with radiographic features similar to those reported for simple bone cysts. The lesions have been described to have poor vascular supply, hence a large risk of infection, which was demonstrated in our cases.
Chronic multifocal inflammation of alveolar bone mimicking malignancy: a case report

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Introduction
Chronic inflammation of alveolar bone is a great clinical and radiologic mimic, which merits recognition by the clinician and pathologist. The patient can thus be reassured of correct early treatment and a favorable prognosis. Occasionally it is difficult to differentiate inflammatory lesions from malignant tumors.

Objective
The aim of this report is to present a case with an inflammatory lesion mimicking malignant condition.

Case report
We report a 19-year-old male complaining of rapid onset gingival swelling and looseness of right upper molar teeth since 20 days. Intraorally there was a large, smooth, exophytic mass occupying the entire upper right oral cavity. The molar teeth were mobile in both quadrants. There was no pain, paresthesia, dental calculi or evidence of dental carious lesion. Panoramic radiography revealed two separate bony defects in right side of both jaws. Severe bone destruction with ground glass pattern and "hanging in air" molar teeth with significant displacement of maxillary second molar was seen. However inferior border of maxillary sinus was visible. There was significant bone loss with furcation involvement around mandibular molars. Axial CT scan revealed intact right maxillary lingual plate and buccal cortical destruction around molar teeth without any evidence of sequestrum. Whole body bone scan showed no significant increased uptake in right oral cavity compatible with no active bony pathology. Based on acute onset of gingival hyperplasia and severe looseness of affecting teeth especially in maxilla and patient age, multifocal rapid growing malignant condition was not ruled out. The surgical pathology findings of lesion showed severe chronic inflammation with surface epithelial hyperplasia.

Conclusion
The initial diagnosis of the lesion was malignant condition but was ruled out by bone scan and histological appearance. The report merits attention only because there was no clinical and radiographic sign of infection.

Radiographic bone density assessment of the jaws compared with whole body bone mineral density

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Introduction
Bone mineral density (BMD) assessment by dual energy X-ray absorptiometry (DEXA) is still considered the most effective method for osteoporosis diagnosis. However, this method requires expensive scanners which are available only in a few specialized centers. Therefore, alternative methods for osteoporosis diagnosis with low cost are necessary.

Objectives
This study aimed to analyze the relation between radiographic bone density of the jaws and whole body (BMD) of women aged 40–60 years divided in two groups.

Materials and methods
Sixty women, 30 hysterectomized with bilateral oophorectomy (G1) and 30 non-hysterectomized (G2), were referred to bone densitometry by DEXA of spine and femoral neck. Each radiograph was digitalized using a flatbed scanner and saved as a TIFF format. Intensity of pixels (IP) of regions of interest (ROI) was measured by histogram analysis with the Image Tool software, version 3.0 (UTHSCSA, USA). Thus, BMD values of DXA and IP measures were compared for both groups.

Results
Results showed that median values of DEXA for G1 and G2 were -1.24 and -0.94, respectively, suggesting osteopenia. Median values of IP for G1 and G2 were 101.55 and 104.30 respectively. However, it was not found statistically significant difference between DEXA and IP values for both groups (p>0.05).

Conclusions and discussion
In the present study, no relation was found between radiographic bone density of the jaws and whole body BMD in hysterectomized and non-hysterectomized women.
Comparison of panoramic mandibular index with whole body bone mineral density measures in hysterectomized and non histerectomized women
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Introduction
Bone mineral density (BMD) assessment by dual energy X-ray absorptiometry (DEXA) is still considered the most effective method for osteoporosis diagnosis. However, this method requires expensive scanners which are available only in a few specialized diagnosis centers. Therefore, alternative methods for osteoporosis diagnosis with low cost are necessary.

Objectives
This study aimed to compare the panoramic mandibular index (PMI) with whole body BMD by DEXA of hysterectomized with bilateral oophorectomy and non-hysterectomized women.

Materials and methods
Sixty women, 30 hysterectomized (G1) and 30 non–hysterectomized as a control group (G2), were referred to bone densitometry by DEXA of spine and femoral neck. To assess PMI, linear measures of specific anatomical structures were drawn with a digital pachymeter on a baking paper attached over each panoramic radiography taken previously. Values of PMI and DEXA were analyzed according to a comparative study.

Results
Results showed that median values of DEXA for G1 and G2 were -1.24 and -0.94, respectively, suggesting osteopenia. Median values of PMI for G1 and G2 were 0.4237 and 0.5894 respectively, showing statistically significant difference (p<0.05).

Conclusions and discussion
In this study, hysterectomized and non–hysterectomized groups did not show any relation between DEXA and PMI values. Further studies are necessary to investigate the PMI as a standard method of bone density evaluation.

Craniofacial oncologic imaging: the hidden dimension
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Introduction
PET technology is a multidisciplinary science. The advances in radiotracer chemistry have played a pivotal role in driving the field in new directions in studies of human physiology. Since its synthesis in 1976, 2-fluorine-18-fluorodeoxyglucose (2-[18F]FDG) has been the most widely used radiotracer for PET studies in oncology and neuroscience. The development of radiotracers to monitor the efficiency of gene therapy and organ transplantation has become a new area of research, one in which work will continue in the future.

PET-CT fusion imaging can be a modality of choice as it eliminates false positives and false negatives of PET findings, hence more accurate identification of tumor margins and metastasis is possible. However detection of large tumors in clinically inaccessible areas, spotting recurrent tumors obscured by scar tissue at the site of incipient radiation or post operative necrosis, locating the primary lesion in unknown primary tumors are also important indications of this technique.

Objective
The scope of this modality is discussed in terms of inflammatory and endocrinal lesions wherein the assessment of bone metabolism plays a pivotal role.

Material and methods
The fusion of PET and CT images could optimize the interpretation of a certain category of PET examination and potentially improve the diagnostic accuracy of both modalities. The fusion imaging technique consists of the anatomic detail provided by computed tomography with metabolic information. Pretherapeutic radiological tumor staging includes evaluation of the size, location, and extent of the primary tumor and infiltration into surrounding vascular, visceral and bony structures.

Results
Both detection and differentiation of tumor recurrence and post therapeutic changes are necessary for efficient follow up and for increasing the salvage rate by reducing the delay between treatment of the primary and the recurrences.

Discussion
Listing functional and anatomical data via fusion imaging (PET-CT) provides additional clinical relevant information. This modality is superior in staging of disease, biopsy site selection, radiotherapy and guiding of treatment planning.

Conclusion
This presentation encompasses interesting case reports of variety of lesions. It also discusses the utility and recent applications of this imaging modality.
**P2-1**

**Nuchal ligament ossification in Koreans**

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**Introduction**

The nuchal ligament is a midline structure extending from the external occipital protuberance to the spinous process of the 7th cervical spine. The nuchal ligament ossification is often observed on lateral cephalograph and confirmed by CT.

**Objectives**

To assess the prevalence and radiographic characteristics of the nuchal ligament ossification in Koreans

**Materials and methods**

Lateral cephalographs from 4,558 patients (1,857 males and 2,701 females, age range from 2 to 79 years) were reviewed. The data were analyzed by using chi-squared test with two-tailed and at a 5% significance level.

**Results**

Among those who showed the nuchal ligament ossification, the mean age of the 143 males was 51.1 and that of the 97 females was 48 years. It was not observed completely in teens, and was observed 1% in twenties, 6.1% in thirties, 18.6% in forties, and 27.4% over fifties. It was significantly more prevalent in males than females in the same age group.

**Conclusions and discussion**

The nuchal ligament ossification on lateral cephalographs shows up as a round, rod-like, or segmented shape. The nuchal ligament ossification is often observed after the age of 40 and is observed more frequently in males than females.

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**P2-2**

**Morphological analysis of the anterior maxilla and the incisive canal with cone beam CT images**

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**Introduction**

Knowledge of the shape of the anterior region of the maxilla is critical before tooth restoration because aesthetic demand is high compared to other regions. However, the anatomical structure of the incisive canal and the resorption of alveolar bone after the loss of the teeth make ideal repositioning of teeth difficult.

**Objectives**

In this study, the typical morphology of the anterior region of maxilla and the incisive canal with respect to the presence or absence of the teeth was assessed using cone beam CT (CBCT).

**Materials and methods**

The CBCT images of the anterior region of the maxilla of 122 patients (dentate: 90, edentulous: 32) were acquired. The palatal plane was standardized. With the anterior nasal spine (ANS) as a reference point and the standardized plane, ten points on the sagittal view and four on the coronal view were measured. Changes of positions of these measuring points were analyzed statistically.

**Results**

In the edentulous maxillas, the position of the alveolar ridge in the midline greatly changed in a superior and posterior (nasal and palatal) direction. This resorption influenced the bone surrounding the incisive foramen. The vertical position of the foramen was more superior and the mesio-distal diameter was larger than in the dentate maxillas.

**Conclusions and discussion**

The angle of the anterior alveolar bone changes after the loss of teeth. The CBCT images of the anterior maxillas demonstrated two typical shapes for the presence or absence of the anterior teeth. These results show the importance of image diagnosis before implant treatment or aesthetic restorations.
Guiding the patient to endocrinology after scanning wide osteoporotic fields with dental volumetric tomography in her maxilla and mandible
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Introduction
The advance of computer systems has enhanced and improved the diagnostic examination methods in medicine. This progression in the procedure of diagnosis and the management of treatment has provided to enlarge the vision of dentistry practice.

Objectives
The objective of this case report is to bring up the dental volumetric tomography that is applied as advanced technique and investigation method. It provides more detailed information about the cases than conventional radiographic examination.

Materials and methods
Expansion of maxilla and mandible, maxillofacial deformity was observed in a, 21 years old woman, who applied to Oral Diagnosis and Radiology Department of Istanbul University Dentistry Faculty with esthetic worries. In the detailed anamnesis, the presence of slow expansion of the jaws and chronic pain was determined. The images of wide osteoporotic fields in maxilla and mandible scanned with panoramic and periapical radiography and dental volumetric tomography explained the maxillofacial deformity.

Results
Multiple lesions, age of the patient, biopsy report of materials from maxilla and mandible made us consider the presence of predisposing factors of a systemic illness. The patient was referred to endocrinology for investigating endocrinopathy. General osteomalacia and an advanced osteoporosis were determined. After management of the treatment in endocrinology, dental complaints of the patient with respect to esthetic and functional problems were eliminated.

Conclusion and discussion
In the evaluation of patients who have osteoporosis and osteomalacia, measurement of bone density of femur and vertebra is an important criteria in endocrinologic examination. This fact gives rise to consider scans. Measurements of bone density with NewTom S 9000® can contribute to diagnosis of the illness.

Using of 3D imaging techniques to restore facial defects: a case report
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Introduction
Maxillofacial prosthodontics represents a specialist branch of dentistry that deals with both dental and prosthetic restoration of those patients who are affected by either acquired or congenital defects of the head and neck region. One of the most challenging tasks that a maxillofacial prosthodontist has to deal with is the achievement of acceptable aesthetics of the facial prostheses. Today this restoration requires several appointments, most of which are dedicated to sculpturing the wax manufacture of the missing part, which often presents with a complex anatomy such as ears, eyes and nose.

Objectives
The purpose of this study was to investigate the feasibility to simplify long and complex procedures by elaborating a 3D virtual model of the patient acquired through CT scan.

Materials and methods
Volumetric data of a patient with a missing ear defect were acquired by a Multislice CT scanner (Lightspeed 16Pro, GE, Milwaukee, WI, USA), elaborated with a programme for 3D image processing (Mimics 11.1, Materialise, Leuven, BE) and then reconstructed with an FDM Rapid Prototyping machine (Stratasys Prodigy, Stratasys, Eden Prairie, MN, USA). The obtained model of the missing part was then used to create a perfect duplicate in wax useful to sculpt on the patient the final form. Finally, the wax model was processed in the definitive silicon prosthesis by the traditional technique.

Results
The resultant prosthesis perfectly adapted to the patient and required only 3 sessions with the patient (one for the CT scan and one to sculpt the wax model on the patient and the last to perform the intrinsic coloration of the model), plus a total of 2:30 hours for the operator’s work, versus at least 6 hours and many more sessions with the old technique.

Conclusion and discussion
This methodology results in a significant benefit for the patient in terms of reduction of number of appointments to the prosthodontist and, more important, in a more accurate production of the prosthesis, based on the analysis of the symmetry of the patient himself. The feasibility depends completely on the possibility to correctly analyze symmetrical structures. Patient exposure to x-rays can be justified by the benefits, especially with a correct dose modulation. In case of oncologic diseases, follow-up CT scans can be directly used to obtain the model without any further investigation.
Mandibular canal into lingual cortical plate
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Introduction
Usually the literature describes the mandibular canal located in contact with, very close to or narrowing the lingual cortical plate until it reaches the mental foramen. The mandibular canal occupying the total thickness of the lingual cortical plate, was first described once the use of CBCT became more common. Therefore, this anatomic variation is very important in surgery planning.

Case report
The first patient (male/45yrs) was submitted to a CBCT/i-CAT exam for implant planning. During the cross-sectional image interpretation (iCAT/Vision/0.3mm thickness/monitor Flexscan 20") it was observed that the mandibular canal was occupying the total thickness of the lingual cortical plate bilaterally in the second molar region. The same condition was observed in the second patient (male /63yrs) only in the left distal third molar region. The extreme thinning condition of the cortical plate measured approximately 3mm in length in the first patient and 15mm in the second.

Discussion
The lingual cortical plates were thinning to the point of almost completely losing its total continuity in small part of it. Naturally, this description is according to the interpretation conditions described above. The thickness of the cross-sectional images was 0.3mm for both cases. As CBCT images are becoming more available to surgery planning the professional should take advantage of them. The images should be very carefully analyzed in order to gather the detailed information regarding the mandibular canal position. The mandibular canal seems to be an anatomic variable even in the same patient.

A curious trajectory of inferior alveolar nerve division
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Introduction
The mandibular nerve after passing through the mandibular foramen is called the inferior alveolar nerve (IAN). The IAN contains mainly sensory fibres and only a few motor fibres. The IAN supplies the lower molar and premolar teeth and adjacent parts of the gingiva. Its larger terminal branch emerges from the mental foramen as the mental nerve while the smaller incisive branch supplies the canine and incisor teeth. The IAN suffers anatomic variations such as these included duplication or division of the canal in a small percentage of patients.

Case Report
It was incidentally found in the mandibular ramus of a patient (female/33yrs) submitted to CBCT (i-CAT) for diagnosis purposes, a division of the IAN in the ramus. The division was clearly depicted in the cross-sectional images (0.3mm tickness/monitor Eizo) in the superior portion of the IAN canal. The division was seen in the reformatted panoramic image when using a 0.3/0.6mm thickness. The branch measured 2mmx2mm in diameter and went forward for about 12mm, then exited the mandible moving upward in an ascendent path to the anterior/medial portion of the ramus towards the soft tissues.

Discussion
The advent of CBCT scanners has greatly enhanced the capability of the professional to identify the IAN and its divisions. In this case, it would be speculative to suggest specifically which tissues the IAN branch would be innervating/irrigating after exiting the mandible. Therefore the professional should carefully exam the entire jaw extension in all CBCT images before surgery. Moreover, this case showed a branch that left the mandible which can not be described until examining panoramic images. It is described in literature IAN pattern divisions (branches) but without 3 dimensional imaging it is difficult to identify branch ends.
Introduction
It is important to estimate the relation of the position of the mandibular third molar and the mandibular canal before a surgical procedure.

Objectives
To assess the diagnostic accuracy and value in imaging through comparison of CBCT and panoramic radiography in assessing the topographic relationship between the mandibular canal and impacted third molars.

Materials and methods
Participants consisted of 100 patients referred for CBCT and panoramic radiography. PSR-9000N™ Dental CT as the unit of CBCT, CE-II and Pro Max as the unit of panoramic radiography were used. Panoramic radiographic images were classified into 3 types (I – III) according to the distance between mandibular canal and root. And also they were classified into 4 types (A - D) according to the proximity of radiographic features. CBCT images were classified into 4 types according to the location between the mandibular canal and the root. And they were classified into buccal, inferior, lingual, and between roots, according to the location between mandibular canal and root. The data were statistically analyzed and estimated by \( \chi^2 \)-test.

Results
1. There was no statistical significance between the three types (type I, type II, type III) in CBCT.
2. The results of 4 types (type A, type B, type C, type D) showed a high prevalence of CBCT 1 in type A, CBCT 2 in type B, CBCT 3 in type C, and CBCT 1 in type D; there was a statistical significance (P value=0.03).
3. The results according to location between mandibular canal and root through CBCT recorded respectively 49, 25, 17, 9 as buccal, inferior, lingual, between roots.

Conclusions and discussion
It is required to have an accurate diagnostic approach through CBCT to estimate the relationship between mandibular canal and roots.
Sensitometric evaluation of the periapical radiographic film Dentix E®: effect of the different conditions and processing solutions

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Introduction
Although the use of digital radiographs have grown in recent years, in many countries the use of radiographic films is still a reality in most surgeries. The knowledge of the properties of new radiographic films is of fundamental importance, because of this evaluation it will depend the learning on these films, implicating directly in the radiation dose received by the patient in the execution of radiographic exams.

Objectives
Like this, the objective with this study was to evaluate the sensitometric properties of the new film Dentix E®, comparatively to the films E-speed® and Insight®, processed with different liquids and under different conditions.

Materials and methods
For so much, the films were exposed at pre-certain times and processed manually, for the method temperature/time, with liquids ready use, of Kodak and of Prograd, and automatically with liquids of Kodak. After, the density of these x-rays was measured and built characteristic curves for obtaining of the sensitometric properties of contrast, indicative value of sensibility and latitude. The values of the properties were appraised for the inclination of the curves in the graphs and for descriptive statistics.

Results
It was possible to observe that the film Dentix E® showed characteristic curves and sensitometric properties similar to the film E-speed®, independently of the processing.

Conclusions and discussion
This result indicates that the film Dentix E® presents contrast, sensibility and compatible latitude with films of sensibility of the group E.

Radiopacity of dental tissue

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Introduction
Radiopacities of dental materials and dental tissue (enamel and dentin) are usually compared in studies. However, the radiopacity values of dental hard tissues might be individual.

Objectives
Our aim was to study personal differences in the radiopacity values of enamel and dentin.

Materials and methods
Teeth were obtained from 13 person. One freshly extracted molar tooth from each person was used as samples. 1-mm thick longitudinal sections of enamel and dentin were prepared. Seven radiographs of the sections were taken with an aluminum step wedge. Four measurements of radiographic density were obtained from each image of each item assessed (enamel, dentin, each step) using a densitometer. Radiographic density values were subsequently calculated as equivalents of aluminum thickness. The data were analyzed statistically using Repeated Measures Analysis of Variance and Tukey’s multiple comparisons.

Results
The results showed statistically significant differences in radiographic density values of tissues obtained from different person (P<0.0001).

Conclusions and discussion
According to the results of this study the radiopacity values of enamel and dentin seems to vary among person.
Radiographic evaluation of the mental foramen in a selected Iranian population
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Introduction
This study identified the most common position of the mental foramen in a selected Iranian population. Gender differences were also investigated and the symmetry of location within individuals analyzed.

Objectives
The purpose of this study was to determine the most common location of the mental foramen in Iranian. This information is important because it has not been reported in this group of people. In addition, it is important for local anesthesia and protection during surgical procedures.

Materials and methods
In this study we evaluated 400 panoramic radiographs with regard to the location and symmetry of the mental foramen in both genders. Statistical analysis used: Chi-square test to compare between symmetry and asymmetry groups.

Results
On analyzing the radiographs, it was found that the mental foramen was between the first and second premolars in 47.2% and in line with the second premolar in 46%. In 49.2% of males, the mental foramen was in line with the second premolar and in 50.9% of females it was between the first and second premolars. It was symmetrical in 85.7%.

Conclusions and discussion
Based on our study the most common position of the mental foramen is between the two premolars and in line with the second premolar and this is in concordance with previous studies.

Pre-operative jaw bone quality evaluation of dental implant sites: a cone-beam CT study
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Introduction
Technical developments have made a new type of imaging modality available, cone-beam computed-tomography (CBCT). This technique has a high potential to solve different diagnostic problems among which one is pre-operative planning for dental implants.

Objectives
The aim of this study was to determine variations of bone density in designated endosseous implant site using CBCT and to evaluate the CBCT diagnostic accuracy in assessing implant sites bone quality.

Materials and methods
Eighty-five potential sites for dental implant placement from forty-three patients were used. Bone density was assessed in a standardized implant area superimposed on the CBCT images and its variations were evaluated using the Misch classification. A paired T-test was performed to determine the correlation between the available bone quality and the jaw bone's area designated to be used for implant placement. In addition, the visibility of anatomical landmarks on the CBCT images was also assessed.

Results
CBCT images revealed that bone densities may vary markedly when different areas of a designated implant sites are compared. It has been observed that a difference in the bone density exists for the four regions within the oral area. We obtained statistically significant differences for D1 type of density (p=0.0001 with the prevalence for the anterior mandible) and for D4 density (p=0.003 with the preponderance for the posterior maxilla).

Conclusions and discussions
All bone changes could be identified and accurately diagnosed using CBCT technique and, compared with conventional CT, this volumetric CT alternative emphasizes clearly not only the anatomical bony landmarks, but also the neural structures that could be of interest in surgical procedures. CBCT may be a useful tool in evaluating the bone density of areas of interest before implant placement and this informations about the bone quality and the anatomical landmarks provides dental practitioners with the possibility to do a better treatment planning.
**P2-13**

**Evaluation of ten extra-alveolar TAD insertion sites by cone bean volumetric computer tomography.**
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**Introduction**
Temporary anchorage devices (TAD) are popular in orthodontic treatment. It is important to know the safe anatomical sites for TAD insertion.

**Objectives**
The aim of the present study was to calculate bone thickness of TAD insertion sites and measure its relation with different length of TAD by cone beam volumetric computer tomography (CBVCT).

**Materials and methods**
The hard and soft tissues of the oral cavity were evaluated on 10 patients (5 male and 5 female) by CBVCT. The sample age ranged from 20 to 36 years old. Ten extra-alveolar regions of interest (ROI) were selected and based on anchorage requirements. Data were collected and compared by statistical software.

**Results**
The mean thickness of hard tissue is more than 10 mm, except the infrrazygomatic ridge and midpalatal region. The soft tissue depth of the premaxillary region is thicker than that of the midpalatal region (p<0.05). Huge variation of hard tissue depth was observed at the infrrazygomatic ridge.

**Conclusions and discussion**
TAD insertion could decrease the risk of root injury at the 10 extra-alveolar sites included in this study.

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**P2-14**

**Evaluation of the proximity between mandibular third molar and mandibular canal using panoramic and CT image**
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**Introduction**
Panoramic radiography is especially useful for predicting the physical contact between the mandibular canal and an impacted third molar.

**Objectives**
The purpose of this study was to evaluate the diagnostic accuracy of panoramic radiography in assessing the proximity between the root of mandibular third molars and the mandibular canal.

**Materials and methods**
Panoramic and CT images of 385 impacted mandibular third molars which were obtained from 235 individuals were analyzed. The actual relationship between the two structures was assessed using CT images.

**Results**
In the case of roots being superimposed on the mandibular canal in panoramic radiograph, 49.6% and 13.9% of the samples exhibited narrowing and encroachment of the canals in CT image, respectively. On the other hand, when roots were partially overlapping with the mandibular canal, 23.6% and 22.6% of the samples exhibited narrowing and encroachment of the canals, respectively. Considering the position of the mandibular canal, 35.7% of the samples were buccal, 25.7% lingual and 33.6% inferior.

**Conclusions and discussion**
Since even partial overlaps between the mandibular third molar and the mandibular canal are detected on panoramic radiographs, there may still be more cases of encroachment of the canal. Therefore, CBCT or CT images seem necessary to define more accurately the relationship.
Lingual foramina in the canine/premolar region of the mandible: CBCT and macroscopic evaluations of the cadavers
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Introduction
Dental implant procedures in the inter-foraminal region are considered to be relatively safe. But there are some reports about considerable complications from bleeding while installing implant fixtures or after placement, because of branches of arteries running through the lingual foramina (LF). By preventing vascular damage to these arteries, implant treatment would be safer.

Objective
This study investigated the variations of the lingual foramina in the canine/premolar region of the mandible (LLF: Lateral lingual foramina), using CBCT images. Also, macroscopic observations were performed to identify the arteries.

Materials and methods
25 Japanese cadaver mandibles were used in this study. CBCT (Alioth: Asahi Roentgen Industry, Kyoto, Japan) images were acquired. The frequency, location, and diameter of LLF were evaluated from CBCT images. After obtaining the images, contents of LLFs were evaluated from cadaver dissections.

Results
14 (56.0%) of the 25 mandibles presented at least one LLF, with the total number of LLFs 22. Ten (40.0%) mandibles presented the LLF unilaterally, and four (16.0%) bilaterally. The average location of LLFs was 58.5 mm (SD: 9.81 mm) inferior to the mental foramen. The average diameter of LLFs was 1.08 mm (SD: 0.34 mm). From dissection, the arteries could be identified in 19 LLFs; all of them were submental arteries which had anastomoses with an incisal branch of inferior alveolar arteries.

Conclusions and discussion
Recognition of LLF is necessary to prevent any risk during surgical procedures. The possible complications would be reduced by interpreting the LLF prior to surgical procedure. It is indicated that a thorough interpretation of pre-operative images is required.
P2-17  
Evaluation of the relationship between the impacted mandibular third molar and the inferior alveolar canal on panoramic radiogram 
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Objectives  
To evaluate the diagnostic accuracy of panoramic radiographs in judging the relationship between impacted mandibular third molars (IMTM) and the inferior alveolar canal (IAC) by cone-beam computed tomography (CBCT).  

Patients and methods  
1735 IMTMs on panoramic radiographs were analyzed and classified into three classes according to the relationship between IMTMs and the IAC. 126 IMTMs superimposing on the canal partially or touching the canal in line shown on panoramic radiographs were examined by CBCT. Nine radiographic signs were observed by two oral radiologists respectively and multivariate logistic regression analysis was used.  

Results  
8.7% of IMTMs showed superimposition or a linear touching relationship with the IAC on panoramic radiographs. 52.4% of these IMTMs impinged and broke the IAC on CBCT images. Two radiologic signs on panoramic radiographs including interruption of the radiopaque border of the canal (p=0.007) and interruption of the alveolar lamina dura were statistically significant to predict the impingement of the IAC.  

Conclusion  
Panoramic radiographs can be used to screen for high-risk cases of inferior alveolar nerve injury before IMTM extraction. Those IMTMs superimposing the canal partially or touching the canal in line shown on panoramic radiographs should be examined by CBCT further. Two features on panoramic radiographs, including interruption of the alveolar lamina dura and periodontal space and interruption of the radiopaque border of the canal, were more valuable than other signs to predict impingement and interruption of the IAC wall.  

P2-18  
Assessment of an digital intra-oral radiography reverse contrast option in detection of dentinal occlusal caries  
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Introduction  
As digital intra-oral radiography is having its place in everyday use in dental offices, numerous software options are also offered with these systems. Manufacturers state that these options will enhance the diagnostic accuracy, although documented studies to support this idea are not found widely.  

Objectives  
The purpose of this study was to evaluate the diagnostic precision of the reverse contrast option of the Cygnus Ritter CCD intra-oral digital sensor, compared to original digital radiographs in detection of occlusal dentinal caries.  

Materials and methods  
86 extracted premolars with no clinically apparent caries were selected. The teeth were arranged to make radiographs according to two methods: Digital radiographs using a Cygnus Ritter CCD sensor followed by application of reverse contrast to the original radiographs. Four maxillofacial radiologists observed the original digital and the same radiographs with reverse contrast option to detect occlusal dentinal caries and record it on a 5 grades scale. Microscopic sections were used as gold standard for caries detection, evaluated by a maxillofacial pathologist. The data were analyzed to calculate: sensitivity, specificity, positive predictive value, negative predictive value and accuracy. SPSS 11 was used to analyze data.  

Results  
Statistical analyzes showed a sensitivity of 75% with CI: 95% for the reverse contrast option to detect occlusal dentinal caries which was significantly higher than the original images (p<0.05). The specificity (82.5%), the positive predictive value (72.8%) and negative predictive value (84.1%) and the accuracy (79.7%) for the reverse contrast option were not significantly different from the original images. (p<0.05)  

Conclusions and discussion  
The reverse contrast option of the Cygnus Ritter CCD sensor did not show a significantly higher diagnostic accuracy in detecting dentinal occlusal caries, compared to original digital radiographs made with this digital intra-oral sensor.
An unusual case of a branchial sinus tract treated by sclerotherapy under fluoroscopic control
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Introduction
A 16 year old female presented with a sinus on the skin just medial to the right clavicle which had discharged clear fluid on a daily basis for a number of years. A sinogram was carried out which showed a long sinus tract extending from the region of right clavicle to the lateral pharyngeal wall. Surgical treatment would have required quite an extensive procedure which seemed inappropriate in view of the relatively mild symptoms which the patient was experiencing. An alternative suggestion was to use sclerotherapy.

Objectives
To induce healing of the sinus tract without the need for surgery

Materials and methods
Sclerotherapy was performed using 3% sodium tetradecyl sulphate (STD) foam delivered via a catheter inserted along the full length of the tract, then injecting whilst it was slowly withdrawn.

Results
There were no immediate complications from this procedure and on review at 1 and 6 weeks the patient reported a significant improvement in her symptoms. At 1 year this improvement had been sustained. The patient did report an occasional discharge from the sinus tract orifice at the base of her neck, but she did not feel that this was a significant problem and declined any further treatment.

Conclusions and discussion
This unusual case responded well to sclerotherapy treatment with STD suggesting that this may be a new and less invasive way of treating developmental lesions of this kind.

Subjectivity in radiographic measurements for endodontic treatments
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Aim
To analyze interobserver agreement for linear and angular measurements in intraoral radiographs used in endodontic treatment

Methods
A set of 30 radiographs was used for this study. Two groups of observers examined the radiographs: 10 undergraduated students and 10 dentists specialized in endodontics and dental radiology. Each set of radiographs was evaluated independently by each observer on two separate occasions under controlled conditions.

Results
The results of this research found a substantial interobserver disagreement in measurements usually made for endodontic treatments using periapical radiographs.

Conclusion
Intraobserver reliability was found to increase with the experience of the examiner.
Tusklessness in the African elephant – a radiological study
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Introduction
The tusk plays an important role in the establishment of the social hierarchy in a breeding herd of African elephants (Loxodonta africana). The annual harvesting of tons of illegal ivory is not only threatening the survival of the species, but also impacts on the phenotypical expression of tusklessness in elephant herds. Depending on hunting pressure, the incidence of tusklessness varies between 3 and 80% in elephant sanctuaries.

Objective
The objective of this study was to follow the development and growth of the tush and tusk radiologically and microscopically during embryonal development and in early life.

Materials and methods
Eight embryos with masses between 1g and 240 g, the os incisivum of a 21 month fetus and 8 juvenile elephant calves (2 – 23 months post partum) were radiographed and examined microscopically for the development of the tush and tusk.

Results
The tush develops in a deciduous relationship to the tusk and is pushed aside and resorbed with eruption of the latter. The tush has no function other than providing a primordium for the development of the tusk. Although both tushes and tusks were recorded bilaterally in the majority of embryos and animals studied, both in one embryo-and only the tusks of a second failed to develop. Both these elephant embryos were harvested from tuskless cows.

Conclusion
Two types of bilateral tusklessness were recorded in African elephant. In the first type both tushes and tusks failed to develop, whereas in the second type only the tusks were found to be absent.

Frequency of a mandibular canal anomaly by 2d-imaging: validity, overestimation or underestimation of the results?
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Introduction
Many studies use 2D imaging, and in particular panoramic radiographs, to study the occurrence of anatomical variations. Panoramic radiographs allow a posteriori an easy and quick analysis. However, does it allow for the right analysis?

Objectives
The aim of this study is to show the risk of overestimated or underestimated results due to mistakes in interpretation of conventional radiographs.

Materials and methods
The material consists of a sample of 6000 adult French patients. We focused on multiple mandibular canals that were consistently identified from justified three-dimensional imaging (pre-implant analyses in the mandible area with CT-scans and cone beam CT). Then, we compared these results to frequencies of this feature in 2D-imaging studies.

Results
With 0.05% of real multiple mandibular canals (different from terminally nervous divisions close by mental foramen) in our 3D-imaging study, we show that a possible overestimation of study using panoramic radiographs can occur. Multiple mandibular canals seem to be very rare.

Conclusion
In accordance with Sanchis and al’s study (Sanchis JM, Peñarrocha M, Soler F. Bifid mandibular canal. J Oral Maxillofac Surg 2003; 61: 422-4) and SWEET’s remarks (Sweet APS. A statistical analysis of the incidence of nutrient channels and foramina in five hundred panoramic radiographs. Am J Orthod Oral Surg 1942; 28:427-42), our study underline the necessity to be careful with conventional imaging, and in particular panoramic radiographs. Presence of this anomaly can only be confirmed by volumetric imaging.
Detection of the mandibular canal and the mental foramen in panoramic radiographs: intra-examiner agreement

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Introduction
Radiographic examination plays an important role in implant surgery, for locating anatomical structures and to evaluate bone quality and quantity. Besides, radiographic examinations are indicated for the follow-up.

Objectives
To evaluate the detection of the mandibular canal roof (MCR) and mental foramen (MF) in panoramic radiographs, verifying the intra-examiner agreement.

Materials and methods
Forty panoramic radiographs of edentulous patients were used. Two calibrated examiners (A and B) read the images two times, independently, under blind conditions. The interval between the readings was ten days. For both sides, the criteria for reading the radiographs related to MCR and MF were respectively: 1) full detection of the course of MCR from mandibular foramen to the mental foramen; 2) half detection of MCR; 3) one third detection of MCR; 4) no detection of MCR and 1) continuous; 2) separated; 3) diffuse and 4) unidentified. The intra-examiner agreement in the interpretation of MCR and MF was performed by Kappa statistics with linear weighting (κ).

Results
The intra-examiner agreement for the detection of MCR, in the left side, was good for both examiners (A: κ=0.67; B: κ=0.71). Related to the right side, it was found κ=0.47 and κ = 0.62, respectively to A and B. The intra-examiner agreement for the detection of MF was good for both examiners interpreting the left side (A: κ=0.61; B: κ=0.63), and in relation to the right side, it was moderate (A: κ=0.51) and fair (B: κ=0.38).

Conclusions and discussion
The agreement variation between “good” and “fair” for both examiners detecting RMC and MF might be explained by the poor sharpness of panoramic imaging, by the resorption of the RMC and by the course of inferior alveolar nerve. The intra-examiner agreement in the detection of MCR was good and from good to fair in the detection of MF.

Radiographic and histopathologic evaluation of periapical bone resorption induced in mice

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Introduction
Direct Digital Radiology covers photostimulable phosphor plate detectors and silicon chip based sensors. Advantages are shorter exposure times and direct image capturing saving on the chemical processing to the films.

Objectives
The goals were to verify differences among pixel values from periapical lesions induced in mice obtained with different exposure times using photostimulable phosphor plates (Digora/Soredex) and CCD (Visualix/eHD/Gendex), as well as to compare these data to those obtained from histological analysis of the same lesions.

Materials and methods
A number of 15 female adult Wistar mice were divided equally in three groups according to the sacrifice date (2/15/30 days). The right inferior first molar was submitted to coronary opening with 1/4 high rotation drill, without refrigeration, aiming to induce periapical disease. The left side was used as control. After sacrifice, the mandibles were removed and radiographed. Mean pixel values from experimental areas and from control areas were obtained using ImageJ/NIH.

Results
Visualix showed a significant difference (Paired-T test/p> 0.05) in pixel values between test/control for the groups 2 and 3. When comparing the three experimental times 2/15/30 days, Visualix System showed no statistical significant difference (ANOVA p>0.05). The Digora System results comparing test/control sides showed statistical significant differences between Group 1 vs. Group 2 and Group 1vs. Group 3. Moreover, it showed a statistical difference among the experimental times, for exposure time 0.13s, 2x15days and 2x30days Microscopic analysis showed a number of osteoclasts as well as periapical bone reabsorption in the different experimental times.

Conclusions and discussion
The results showed that the analysis done by pixel values could differentiate test from control side. The same pixel analysis was not able to show differences between all experimental groups. Microscopic analysis proved the periapical disease evolution from pulp necrosis to bone resorption. In conclusion, the pixel value analysis provides different results depending on the disease condition and the digital system used.
Morphologic analyses of the three-rooted mandibular first molar using cone-beam CT imaging
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Introduction
Cone-beam computed tomography (CBCT) provides dentistry with a practical tool for non invasive and three-dimensional (3D) reconstruction imaging for use in morphologic analyses of the root canal anatomy and the true nature of the alveolar bone topography around teeth.

Objectives
To investigate the morphology of three-rooted mandibular first molars using i-Cat CBCT.

Materials and methods
A total of 123 i-Cat CT images were screened to obtain 63 three-rooted mandibular first molars for this study. The angulations from the four canals to the long axis of the tooth in the center, and distances from the extra DL root canal orifice to the DB, MB, and ML canal orifices in 63 three-rooted molars were analyzed by an ImplantMaxTM software system and compared by t-test.

Results
The lingual angulations of the DL canal was more eccentric from the long axis buccolingually than other three canals (MB, ML and DB) (in male: 30° vs. 16.4°, 13°, 22.7°; in female: 32° vs. 16.3°, 13°, 20°). Orifice distances from DL canal to DB canal and to MB canal were 2.7 mm and 4.4 mm respectively.

Conclusions and discussion
Morphological features of the three-rooted mandibular first molar teeth could be observed three-dimensionally using CBCT.

A comparative evaluation of CBCT vs MSCT for jaw bone model accuracy
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Introduction
Both cone beam (CBCT) and multi-slice computed tomography (MSCT) provide three-dimensional data that is used for bone modelling in image-guided surgery. It is however not clear which scanning modality offers the best segmentation quality and whether they behave similar.

Objectives
To compare image segmentation quality for 3D jaw bone models based on CBCT and MSCT having a micro-CT model as a gold standard.

Materials and methods
A formalin-fixed mandible was obtained from the Medical Anatomy Department (KU Leuven) with ethical approval. This mandible was scanned with a high resolution microCT (Skyscan, Kontich, Belgium) and the generated 3D jaw bone model served as a gold standard. Further on, the mandible was scanned with various exposure settings on 6 CBCT scanners (Veraview Epros 3D® and Accuitomo 3D® (Morita), Galileos® (Sirona Dental System), Picasso Duo® (Vatech), Scanora 3D® (Soredex), Kodak 9000  3D® (Kodak)) and one MSCT scanner (16 Somatom Sensation®, Siemens). 3D-bone model surfaces of all acquired CT datasets were segmented in SimPlant Pro® 12 (Materialise Dental). A true volumetric comparison between various exposure protocols of CBCT and MSCT was carried out in 3-matic® (Materialise). This software was also used to determine 3D jaw bone model accuracy for the various scanners, using the microCT model as gold standard.

Results
MSCT versus CBCT models differed on average less than 0.1 mm. The respective accuracy levels (mean deviations) of MSCT and CBCT remained respectively below 0.15 mm for MSCT and 0.5 mm for CBCT, the latter showing a variation between scanner types and exposure protocols.

Conclusions
This study indicates a clinically acceptable model accuracy for both MSCT and CBCT, with the former having a slightly better segmentation accuracy. It should be considered that scanner type and exposure protocols may influence segmentation quality, with higher resolution protocols not necessarily yielding better 3D jaw bone models.
P2-28
Morphological observation of the midline using CBCT images
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Introduction
Implant treatment is becoming a general procedure for edentulous patients as well as for other prosthodontic restorations. The anterior mandibular region requires a high esthetic standard though this region has the smallest antero-posterior bone width and severe bone resorption can occur after the loss of teeth. It is important to confirm the bone morphology of this region prior to restorative treatment.

Objectives
The purpose of this study was to investigate morphology on the midline of the mandible with respect to the presence or absence of the lower incisors, and to reflect the results to restorative planning for edentulous mandibles.

Materials and methods
CBCT images of the anterior region of 62 Japanese dry mandibles (dentate: 40, edentulous: 22) were acquired. The mandibular plane was standardized. On the sagittal images of the mandibular midline, four measurement points (anterior ridge, alveolar crest, most inferior point, and lingual foramen: just superior to mental spine,) were defined to compare overall bone morphology on the midline with respect to the presence or absence of incisors.

Results
The location of the alveolar ridge was significantly moved in inferior and lingual direction in edentulous mandibles. Although vertical bone resorptions was observed in most edentulous mandibles, the alveolar crests were located above the mental spine.

Conclusions and discussion
Vertical and horizontal bone resorption occurred above the mental spine. In edentulous mandibles, vertical bone angulation (from alveolar crest to most inferior point) revealed significant change. These results are important when installing implants near the midline.

P2-29
Quality assessment of bone depiction around implants in Volumetric Tomography (VT)
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Introduction
Metal artifacts from implants in medical CT-imaging can cause severe disturbances making it impossible to assess the conditions in the bone surrounding dental implants.

Objective
The aim of this study is to evaluate a new technique for the production of cross sectional images of the jaws (Volumetric Tomography, VT, using the OP-200D X-ray machine) with respect to its abilities to visualize the bone surrounding dental implants.

Material and methods
In 12 dry human mandibular specimens (7 molars and 5 incisors) titanium implants were inserted and a soft tissue equivalent material was placed around the specimens. Five observers independently scored the cross-sectional images of the implants as to their ability to display the buccal and lingual alveolar bone (BAB and LAB) and the implant to bone relation on either side (BIB, LIB). A 4-point scale was used (4: excellent, 3: good; 2; fair, 1: unacceptable). The results were statistically analyzed using Sheffe’s test as between each observers, and chi-square test was used for analyze visible rate of place in each section.

Results
There was no statistical difference between the observers’ scores (P>0.05). When dichotomizing the scores into visible (scores 4+3+2) and nonvisible (score 1) 100% of the bone surfaces in the incisor region were deemed visible. In the molar regions 94% (BAC, BIC), 91.4% (LAB) 88.5% (LIB) of the surfaces were scored as visible. This resulted in the percentages of visible bone surfaces, irrespective of regions, of 96.9% (BAC, BIC), 95% (LAB), 93.3%(LIB). No statistically significant difference was found between regions or surfaces.

Discussion
The technique seems to make it possible to evaluate the bone at the buccal and lingual aspects of implants with the best results obtained for the buccal surfaces.
P2-30

A limited cone-beam volumetric imaging system in assessing proximal caries of primary molar
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Introduction
The proximal caries can be detected by intraoral radiography with some limitation. The limited cone-beam volumetric imaging (CBVI) systems can be expected to be higher in accuracy not only in detection but also in estimation of the lesion depth.

Objectives
In the study, the visibility of caries lesion in both conventional intraoral radiography and CBVI was compared using extracted human primary teeth.

Materials and methods
Twenty-four extracted primary molars (32 surfaces) with proximal caries were used. The depth of the lesions was verified using a Micro CT (Micro Focus X-ray System, Shimadzu Corp., Kyoto, Japan) and classified into 3 categories, limited in enamel (C1), penetrated into dentine (C2) and reached to the pulp (C3). A CBVI system used was a 3D Accuitomo (J. Morita Mfg. Corp., Kyoto, Japan) operated at 80kV and 4mA. An intraoral X-ray machine was also used. The images obtained were examined to determine the depth by an author.

<table>
<thead>
<tr>
<th>No. Caries (nm)</th>
<th>Dental</th>
<th>CBVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 (25)</td>
<td>560.7%</td>
<td>562.5%</td>
</tr>
<tr>
<td>C2 (30)</td>
<td>450.0%</td>
<td>452.3%</td>
</tr>
<tr>
<td>C3 (40)</td>
<td>675.3%</td>
<td>675.0%</td>
</tr>
</tbody>
</table>

Results
The CBVI images were more accurate in the estimation of the depth for any lesions than the intraoral radiographic images.

Conclusions and discussion
The results suggested that limited CBVI could be used for assessment of the primary teeth

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P3-1

Reliability of the sagittal planes for evaluating facial asymmetry on 3-dimensional cone-beam CT images
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Introduction
Accuracy and reproducibility of CBCT data is reported to be sufficient in linear measurement between two landmarks for clinical use. However, the reliability (or reproducibility) of distance between an objective landmark and a reference plane has not been evaluated. It could depend on the setting up reliability (reproducibility) of the reference plane as well as the landmark itself. For evaluating the facial asymmetry, an alternative is to measure the distance of objective landmarks from the sagittal reference plane.

Objectives
The aim of the present study was to evaluate the reproducibility of three different sagittal planes that were determined to assess the skeletal facial asymmetry using CBCT data.

Materials and methods
On the 3D image of a head phantom obtained with a CBCT, three sagittal planes were set twice by 6 dentists. The reproducibility of some objective landmarks was assessed by means of the 95% confidence ellipse method. Three reference planes were set based on S, N and Ba (procedure 1), S, ANS and Ba (procedure 2), and N, ANS and Ba (procedure 3).

Results
When the Me was used as the objective landmarks, procedures 2 and 3 showed a high reproducibility in comparison with procedure 1.

Conclusions and discussion
A significant factor of the reproducibility was the distance between landmarks that created the referent sagittal plane. Before proposing a measurement method and emphasizing its utility based on the results of actual measurements, the reproducibility of such a method should be verified. Without the verification of reproducibility, efforts may not be trusted.
Osteoclasts in Japanese medaka (Oryzias latipes) after irradiation of carbon ion or gamma ray.
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Introduction
In accordance with recent biological analyses, medaka has attracted much attention as a model animal of human diseases whereby the genetic background of human diseases may be deduced. We investigated radiological effect on medaka with carbon ion and gamma ray irradiation.

Objectives
To establish the medaka as an animal model for irradiated bone response to evaluate the tolerance for and effectiveness of carbon ion radiation dose with bone metabolism.

Material and method
We irradiated the whole body of medaka with carbon ions and gamma rays. Bone resorption in the pharyngeal bone was investigated by histological analysis. Histochemical localization of enzymatic activity of tartrate-resistant acid phosphatase (TRAP), the main marker of osteoclasts, was performed on sections of pharyngeal bone.

Results
The carbon ion irradiated medaka showed reduced size and number of osteoclast compared with the gamma ray. The TRAP activities of carbon ion irradiated osteoclasts were more suppressed than gamma ray irradiated medaka.

Conclusions and discussion
Carbon ion irradiation had a more marked effect on osteoclast activity, and suppressed their maturation to a greater extent than gamma irradiation. These observations suggest that carbon ion irradiation induces differential modulation of osteoclast growth factor expression. Medaka share many cellular and morphological aspects with mammals that will allow exceptional experimental approaches to identify novel factors in bone biology under normal and pathological conditions.
**P3-4**

**Evaluation of the relationship between panoramic examination and incidental lesions of paediatric patients: a pilot study**

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**Objectives**

To investigate the relationship between panoramic examinations and incidental lesions for paediatric patients.

**Material and methods**

Subjects for this retrospective study consist of all 500 paediatric patients who visited the department of Oral Diagnosis and Radiology at Dentistry Faculty and had a panoramic radiograph taken between 2008 and 2009. The following information was obtained from the patients’ medical and dental history and panoramic radiographs were evaluated by four dental radiologists.

**Results**

The mean ages of this study patients were 8.01 (age ranged from 2 to 14) and of the 500 patients, 238 (47.6%) were girl and 262 (52.4%) were boy. The lesions were observed in 72 (14.4%) of the 500 panoramic radiographs. Among the 72 radiographs with lesions, there were 3 mesiodens, 9 missing teeth, 12 impacted, 3 supernumerary teeth, 7 dentigerous cyst, 2 taurodontism.

**Conclusions**

Panoramic radiographs gave important clues to incidental lesions, and may be useful for children.

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**P3-5**

**Investigation of bond strength of dental adhesive systems irradiated with ionizing radiations**

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1 Piracicaba Dental School

**Objective**

The aim of the present paper was to determine the effect of different ionizing radiations on bond strength of three different dentin adhesive systems.

**Material and methods**

120 specimens of 60 human teeth (protocol number: 032/2007) sectioned mesio-distally were divided into 3 groups according to the adhesives systems used: SB (Adper™ Single Bond Plus), CB (Clearfil™ SE Bond) and AP (Adper™ Prompt™ Self-Etch). The adhesives were applied on dentin and photo-activated using LED (Lec 1000, MMoptics, 1000mW/cm2). Onto the bonding areas were placed customized elastomer molds (0.5 mm-thickness) with three orifices of 1.2mm which were filled with composite resin (Filtre™ Z-250) photo-activated during 20s. Each group was subdivided into 4 subgroups for application of the different ionizing radiations: Ultraviolet radiation (UV), diagnostic X-radiation (DX), therapeutic X-radiation (TX) and without irradiation (Control group – CG). The microshear tests were carried out (Instron Inc., model 4411), and afterwards the modes of failure were evaluated by optical and scanning electron microscope and classified using 5 scores: adhesive failure, mixed failures with 3 significance levels and cohesive failure. The results were submitted to ANOVA by Tukey test, Dunnett test and Kruskal-Wallis test (p=0.05).

**Results**

No change on bond strength of CB and AP was observed after application of the different radiations, only SB showed increase on bond strength after UV (p=0.0267) irradiation. The UV also changed the failure patterns on SB (p=0.0000).

**Conclusions**

The radio-induced changes did not cause degradation in restoration which means that they can be exposed to these ionizing radiations without weakening the bond strength.
P3-6

Evaluation of carotid artery calcification in coronary artery disease patients by panoramic view
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Introduction
Approximately 65 percent of cerebrovascular accidents [CVA] are ischemic in nature and are caused by atherosclerotic disease in the internal carotid artery (ICA). A strong association between the extent of carotid artery calcifications (CAC) and coronary artery disease (CAD) has been demonstrated. Patients with coexistent narrowing of carotid and coronary arteries represent a particularly high-risk group and to date there has been no consensus with regard to their management.

Objective
We advocate evaluating patients with diagnosed CAD for carotid atherosclerosis.

Method and material
62 Patients who underwent coronary angiography for any reason were recruited for this study. B mode Carotid Doppler (DS) were obtained by an experienced general radiologist. Panoramic radiographs were obtained in radiology department of Shiraz dental school and interpreted by an oral and maxillofacial radiologist. A radiopaque mass or masses adjacent to the cervical vertebrae at or below the intervertebral space between C3 and C4 were diagnosed as Carotid artery calcifications.

Results
Utility of panoramic radiography to detect any CAC in patients with CAD

\[
\begin{array}{|c|c|c|}
\hline
 & \text{Calcification} & \text{No calcification} & \text{Total} \\
\hline \text{ULTRASONOGRAPHY} & 18 & 22 & 40 \\
\hline \text{PANORAMIC RADIOGRAPH} & 9 & 75 & 84 \\
\hline \text{Total} & 27 & 97 & 124 \\
\hline
\end{array}
\]

Sensitivity=66.6%, specificity=77.3%, PPV=45%, NPV=89.3%

Measurements of agreement between Panoramic radiographs and DS results were assessed by kappa statistics ($k=0.27$, $p=0.000$). Our study indicated that a significant limitation of using panoramic radiographs to detect calcified carotid atheromas is the number of false positive findings due to overlying anatomical and pathological structures.

Conclusion
When compared to Doppler sonography, the panoramic radiograph is not an accurate or reliable test to detect carotid artery calcification. We are in agreement with the studies that reported unreliability of panoramic radiography to detect carotid artery calcifications.

P3-7

The impact of digital image processing artefacts mimicking pathological features associated with restorations
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Introduction
All image processing algorithms produce features into the image that are not genuinely there in the original, which by definition makes them artefactual. There is an opportunity for induced artefacts to be misdiagnosed as pathology, potentially altering treatment decisions.

Objectives
The aim of this study is to highlight the potential for image processing to mimic pathology.

Materials and methods
An interactive study was conducted at a UK dental radiology conference in order to illustrate the potential for image processing algorithms to mimic pathological features. There were 42 participants in the study and they were shown randomly 16 unprocessed digital x-rays of single teeth containing restorations. They were also shown the same images after they had been processed with a common image processing algorithm. They were asked to score each image on a scale from 1 – 5, where 1 was definitely no pathology and 5 was definitely pathology.

Results
The results show that 59% of 1 responses (definitely no pathology) for the raw images changed to 4 or 5 responses with the processing. This is considered to mark the potential for a significant change in the management of the patient from doing nothing to a possible intervention.

Conclusions and discussion
This study carried out in a group involved in imaging, demonstrates that there is a risk that imaging induced artefacts can be misdiagnosed as pathology. For the patient, this could mean the difference between conservative management and a restoration being placed. It is hoped that this study has highlighted the potential for image processing to mimic pathology and hopefully inform practice in the use of digital imaging.
**P3-8**

Study of threshold and opacity in three-dimensional CT volume rendering of oral and maxillofacial area  
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**Introduction**  
Three-dimensional reconstructed images could be distorted by threshold and opacity settings. Threshold and opacity can be easily controlled by an operator and the selection of proper values depends on the practical experience of an operator.

**Objectives**  
This study was designed to determine the proper threshold value and opacity in three-dimensional CT volume rendering of the oral and maxillofacial area.

**Materials and methods**  
Three-dimensional CT data obtained from 50 persons who underwent orthognathic surgery, retrospectively. 12 volume rendering post-processing protocols which are combinations of threshold (100HU, 150HU, 221HU, 270HU) and opacity (58%, 80%, 90%) were applied. Five observers independently evaluated the quality of images by using a five-point range scale. The results were analyzed by receiver operating characteristic curves, ANOVA and Kappa value. And three oral and maxillofacial surgeons chose the images which are clinically acceptable for them.

**Results**  
The highest diagnostic accuracy appeared at 100HU and 58% opacity, and the lowest diagnostic accuracy appeared at 221HU and 58% opacity in a protocol used in the department of oral and maxillofacial radiology of Seoul National University. No statistically significant difference was noted between any of the protocols. The number of proper images clinically chosen by three oral and maxillofacial surgeons was the largest in the cases of protocol 8(221HU, opacity 80%) and protocol 11(270HU, opacity 80%).

**Conclusions and discussion**  
Threshold and opacity in volume rendering can be controlled easily and modifying these can cause a change of a diagnostic accuracy. So we need to select proper values of these factors.

**P3-9**

CBCT – the dilemma of data volumes and server space  
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**Introduction**  
The Accuitomo 3DX provides 4cm & 6cm cylindrical 3D volumes of the maxillofacial skeleton. The manufacturer advocates the use of one patient head position for scanning and if necessary recommends that the resulting volume data is re-constructed to orientate the images in true cross-section using I-dixel® software. However, each time the data is re-sliced another data volume is created that needs to be archived and stored. If patient positioning protocols are used, optimum image data is captured that does not require re-slicing. The aim of this project is to determine how much server space may be saved by avoiding the need to re-slice data.

**Method**  
A 4cm scout and scan of a lower 3rd molar and a 6 cm scout and scan of the maxillary incisor region were performed on a human skull phantom. The resulting data volume in megabyte (MB) for each was recorded. Each data volume was re-sliced to the default I-dixel® slice interval and slice thickness and the new data volume was recorded. The total number of clinical scans performed over one year was reviewed. Using the data collected from the skull phantom scans and the total number of clinical scans performed in 1 year it was possible to determine how many MB of data may be saved by not re-slicing the data volumes and the cost implications.

**Results**  
One 4 cm scout plus scan produces 47.4 MB of data; a scout plus scan plus re-sliced volume produces 94.1 MB, therefore each re-slicing produces 46.7 MB additional data to be stored on the server. For each 6cm scan the additional data produced by each re-slicing is 82.6 MB. 404 clinical scans were performed in a year, 356 of 4cm and 48 of 6cm volumes. The additional data produced by re-slicing each of these would be 20.60 GB. The amount of additional data produced over a 5 year period would be in the region of 105 GB.

**Conclusion**  
Using patient positioning protocols to minimise the need to re-slice data volumes has the potential to save server space and therefore costs.
Habit of prescribing panoramic radiographs in Hungarian Dental Schools

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Hungarian dentists sometimes prescribe panoramic and intraoral radiographs parallelly. One possible explanation for that might be the quality of panoramic images.

Aims

Aims of this study were to assess the habit of academic staffs from all the Hungarian Dental Schools in prescribing panoramic radiographs; and to estimate the excess effective dose of different x-ray modalities due to parallel requests.

Materials and method

One week with the usual admission of patients was chosen as a basis of the planned assessment. The object of analysis included: the amount of intraoral radiographs prescribed parallelly with panoramic; amount of intraorals due to full-mouth survey (FMS); amount of intraorals additionally requested within a week. The additionally taken intraorals were grouped according to the regions of the dental arch. These radiographs were compared with the dependent panoramic for there consideration.

Results

During the examined period 528 panoramic radiographs were taken. A total of 79 intraorals were requested parallelly. FMS was requested in 26 cases involving 269 intraorals. The distribution of additionally requested intraorals was 66, 38, and 49 representing the incisive, premolar and molar regions respectively. Approximately half of these radiographs (70) was based on a real request, while the request of the rest was causeless, since the examined area was clearly visible on the original panoramic radiograph.

Discussion

The present study revealed that the 528 panoramic radiograph attracted 153 intraorals of which approximately half is superfluous. If this amount is multiplied to a yearly quantity it takes approximately 7500 useless intraoral exposition which is around 30 mSv.

Conclusion

It would be of high importance to emphasize quitting this bad habit during the different levels of the training.
Designing educational software for radiology course in dentistry
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Introduction
The third part of the radiology course in the Dentistry curriculum involves oral and maxillofacial bone lesions. An educational software was designed to teach this course to dentistry students.

Objectives
To compare computer-based learning with traditional education.

Materials and methods
In this study 32 students were chosen and the radiology course was divided in 2 parts for them. The first half of the course was thought by traditional method (control) and the second part by using software (case). The students’ opinion about the course and final examination was assessed by using a standard questionnaire.

Results
Most of the students (90.6%) believe that the software is useful in education. In addition 84.4% of students think it can evaluate the clinical skills of the students in detecting the radiological defects. The final mark in the case group was significantly higher than in the control group. The satisfaction rate of the students was 59.4%.

Conclusions
This study shows the effectiveness of using the computer for educational purposes. Computer science can help students in memorizing different signs and symptoms of many disorders. In addition, it can help the teachers to evaluate the students at the end of the course.

Collimator’s size and shape effects on the dosis to the crystalline and thyroid gland
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Introduction
X-ray examinations are the main source of population’s exposure to artificial ionizing radiation. Radiation dose in such examinations should be as low as possible but still ensuring a good image quality. Rectangular collimators have been proposed to substitute the circular ones in order to minimize the radiation exposure to nearby critical organs.

Objective
To compare the radiation doses in the lens of the eyes (right and left) and thyroid gland obtained using different collimators, in a full mouth examination (14 radiographic exposures).

Materials and methods
The study was approved by the Ethical and Research Committee (UFRGS). Thirty patients who provided informed consent were randomly allocated to three groups, according to the collimator used: 1 – circular, 60 mm diameter; 2 – rectangular, 24 x 32 mm; and 3 – rectangular 30 x 40 mm. The doses were measured by LiF:Mg,Cu,P thermoluminescent dosimeters (TLD-100H) positioned over both right and left eyelids and under the lead thyroid protector, in the gland position. The results were submitted to Kruskal-Wallis and Friedman non-parametric statistics analysis, complemented by multiple comparison tests (α=5%).

Results
Group 2 presented a significant dose reduction in the eye region compared to groups 1 and 3. Groups 2 and 3 showed a significant dose reduction in the thyroid gland region compared to group 1.

Conclusion and discussion
The rectangular 30 x 40 mm collimator only affected significantly the dosis to the thyroid gland whereas the smaller rectangular collimator (24 x 32 mm) also reduced the dosis to the crystalline. So it is important to employ the smaller rectangular collimator when taking periapical radiographs in order to minimize radiation dosis to the crystalline and thyroid gland.
**P3-14**

**Relation between the jaw bone height and the bone density for implant recipient sites: a cone beam computed tomography study**

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**Introduction**

Pre-surgical assessment of proposed implant sites requires very specific and accurate data. Imaging has always been used to assist in the implant site assessment. CBCT scanners prove to be an extremely useful imaging tool for pre-surgical assessment of dental implant sites.

**Objectives**

The aim of this study was to compare bone height and bone density determination of designated endosseous implant sites using CBCT.

**Materials and methods**

Eighty-five potential recipient sites for dental implant placement of forty-three patients were used. Bone density was assessed in a standardized implant area superimposed on the CBCT images and its variations were evaluated using the Misch classification for bone density. The imaging examinations were made using a NewTom3G unit.

The bone height was measured as the vertical distance from the alveolar ridge to the closest anatomical landmark. The acquired data were evaluated using paired T-test and $\chi^2$ test.

**Results**

The analysis of the data obtained from this study revealed a statistically significant correlation ($p=0.003$ with T-test and $p=0.009$ with $\chi^2$ test) between the superior bone densities (D1/D2) and the proper height of the alveolar bone process in the jaw area designated for implant placement.

**Conclusion and discussion**

Bone structures of various degrees of quality are encountered for every anatomic area selected to be used for dental implant placement. Determination of the density of these structures is essential for the preoperative evaluation of the edentulous area selected to be restored by means of osseointegrated implants.

The complete and precise qualitative-quantitative evaluation of the jaw bone structures helps the surgeon to consider the proper therapeutic approach for each patient, contributing also to the success of the implantology treatment.

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**P3-15**

**Comparison of CT and CBCT for fabrication of physical models via rapid prototyping technologies applied to dentistry**

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**Introduction**

In this paper CT and CBCT are compared in fabrication of medical models using rapid prototyping technology (RP), and results and data are acquired from CBCT cannot be used for construction of medical models using rapid prototyping technology (RP).

**Objectives**

This paper compares quality, resolutions and the number of data that is acquired via CT and CBCT for construction of physical models using rapid prototyping (RP) technologies.

**Materials and methods**

Medical imaging technologies involve a range of techniques: from plain X-ray radiology to more advanced and refined medical imaging modalities such as CT, CBCT, MRI and laser digitizing. However, the display of 3D volume on a 2D screen does not provide surgeons with a complete understanding of patient’s anatomy. Surgeons must learn to interpret the visual information in order to reconstruct mentally the 3D geometry. Unfortunately, there is still no physical feel of the area of interest, like the infection area or fracture size, until an operation is performed. The construction of physical models is often necessary. Physical models provide for surgeons a direct, intuitive understanding of complex anatomic details which otherwise cannot be obtained from imaging on screen. Physical models are constructing using rapid prototyping (RP) technologies. In this method we need medical imaging technologies. The fabrication of physical models via RP has the following procedure:

1 data acquisition, 2 data processing, and 3 model fabrication.

So the first is to acquire the data for the existing structure of interest. Thus quality and resolution of the images and the number of data that is acquired is very important. When part of the image is invisible and an inadequate number of data is acquired, problems may arise, and this consequently influences data processing and model fabrication.

**Results**

Because an inadequate number of data is acquired from CBCT compared with CT, it cannot be used for fabrication of medical models using Rapid Prototyping (RP) technology.

**Conclusion and discussion**

Therefore the most important factor in fabrication of physical models is data acquisition. When low quality and an inadequate number of data is acquired, problems are introduced in the next steps of model fabrication.
P3-16

Effects of 2-deoxy-D-glucose and quercetin on the expression of osteonectin and osteopontin during the differentiation of irradiated MC3T3-E1 osteoblastic cells

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Introduction
Ionizing radiation has an influence on the production of cytokines during the differentiation of MC3T3-E1 cells and changes the extracellular matrix. However, the effects of 2-deoxy-D-glucose (2-DG) or Quercetin (QCT) on gene expression on gene expression of bone formation-related factors in irradiated osteoblastic cells are poorly understood.

Objectives
To characterize the effects of 2-DG and QCT on gene expression of osteonectin (ON) and osteopontin (OP) in irradiated MC3T3-E1 cells.

Materials and methods
When MC3T3-E1 osteoblastic cells had reached 70-80% confluence, cultures were transferred to a differentiating medium supplemented with 5 mM 2-DG or 10 uM QCT and then irradiated with 2, 4, 6, and 8 Gy. At various times after irradiation, the cells were analyzed for the expression of bone mineralization genes such as ON and OP.

Results
Irradiation adding 2-DG showed a significant peak value on the expression pattern of ON at 4 Gy 7 days after irradiation. Irradiation adding QCT increased the mRNA expression of ON and OP in a dose-dependent manner, but irradiation adding 2-DG did not show any differences between the control and experiments 14 days after irradiation. Irradiation adding QCT increased significantly the expression patterns of ON 21 days after irradiation.

Conclusions and discussion
The results showed that QCT acted as a radiosensitizer in the gene expression of ON and OP during differentiation of the late stage of irradiated MC3T3-E1 osteoblastic cells.

P3-17

Comparison of the dose in Maxillo-Facial region during Simulation with conventional CT, large bore CT and MVCT

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Introduction
In recent improvement of technology and computer science were widely applied in medical science, and it significantly cause good result in cancer treatment. Because of the widely use of adaptive planning and image guided technology in radiotherapy, the treatment applied to the patients become more precise, however, in the mean time the patients also receive more radiation doses. This study was designed to estimate the doses of head and neck in simulation, when three different CT scanner were used, those were: Tomotherapy Hi-Art system, Philips AcQSim CT-Simulator, and Picker PQ5000.

Materials and methods
The head and neck part of anthropomorphic phantom (RANDO, The phantom Laboratory, Salem, NY) was used to simulate as a patient. Lithium fluoride (LiF:Mg,Ti, TLD-100) chips were placed in different anatomic sites, ex. lens, eye ball, optic nerves, chiasma, nose tip, lip and thyroid glands in this experiment.
Three different types of CT scan of head and neck were performed to the Rando phantom. 85 cm large bore size single-slice Philips AcQSim CT and 70 cm conventional bore size single-slice Picker PQ5000 CT were set at 120 KV, 250 mA to perform the scanning with slice thickness of 4 mm. The Tomotherapy Hi-Art system which equipped with megavoltage CT (MVCT) function to do the image guided radiotherapy was performed under the condition of 2 MV with the slice thickness of 4 mm. Than the reading of Lithium Fluoride chips at varies sites was measured by Harshaw TLD reader 5500.

Results
The different sites of the head and neck phantom received about 3 to 6 cGy per KVCT scan, about 1 to 2 cGy per MVCT scan. From the results of this study, clinicians need to care about the exposure dose when manipulate the procedure of simulation. Explain and interpret results in light of the objectives. Address how your findings compare to those of others. Highlight advances in the field. Identify major conclusions and implications of your research.
FDG-PET and ultrasound (US) image findings on VX2-induced rabbit oral maxillofacial and hind limb squamous cell carcinoma (SCC) and metastases

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Introduction and objectives
The purpose of this study is to evaluate the advantages and disadvantages of FDG-PET and US examination on VX2-induced rabbit SCC in oral maxillofacial region and hind limb.

Materials and methods
Nine adult, male, New Zealand white rabbits (weighting 2.5-3.5 kg) received s.c. injection of VX2 suspension and solid pieces implantation into hind limbs and oral maxillofacial regions. FDG-PET and US examination were performed every two weeks. Six weeks after inoculation, autopsy was conducted and the size of the primary tumors and lymph node, lung and other possible metastases were assessed.

Results
Both FDG-PET and US could detect the lesions of the hind limb as early as 2 weeks after tumor induction (not visible grossly). At 4 weeks, the tumors were palpable and visible grossly. At 6 weeks, the cervical lymph node could be detected by US but not apparently by FDG-PET. The findings of FDG-PET for tumors were lobulated and circumferential with central hollow appearance. For US examination, the size, location, depth, and blood circulation of tumor were more easily detectable. On the other hand, both-FDG PET and US could not detect lung metastasis. US examination of the oral cavity was not feasible, except for tumor implantation through extraoral (cheek and submandible) approach, which produced images that were easier to obtain like the tumor produced in hind limb. Most of the experimental rabbits showed cervical lymphadenopathy at head & neck approach, the lung metastasis only can be detected at hind limb approach. Microscopic examination revealed poorly differentiated squamous cell carcinoma at primary implanted site as well as found in the pulmonary alveolar space and cervical lymph nodes of metastasis site.

Conclusions and discussion
Compared with FDG-PET imaging, US examination was easier to detect tumor size, shape, content, and depth in hind limb tumor, and extraoral (cheek and submandible) approach. However, the size of US sensor has not been tiny enough to assess the oral cavity, thereby causing difficulty for intraoral examination. Both FDG-PET and US examination to detect lymph nodes involving the human head and neck tumor are important and should be emphasized. US examination should be considered as a valuable supplemental diagnostic imaging tool to FDG-PET examination.

Detection of dental root fracture with cone-beam computed tomography for 398 teeth

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Introduction
The presence of a dental root fracture often means a poor prognosis, and in many cases extraction is the only possible treatment option. Conventional radiographs can be helpful for the diagnosis when the x-ray beam is parallel to the plane of the fracture. Cone-beam computed tomography provides high-resolution images in three-planes and is now commonly used for dental practice.

Objectives
The purpose of this article is to evaluate the usefulness of cone-beam computed tomography (CBCT) for detection of dental root fracture.

Materials and methods
The study group comprised 375 patients with a total of 398 teeth who were examined by CBCT (3DX multi-image micro CT, Morita, Japan) for evaluation of probable root fracture. Patient characteristics were recorded, and the location, fractured roots, type of fracture, and three-dimensional images of the involved teeth were analyzed. Two experienced oral radiologists independently analyzed each case and reached a consensus, and the diagnosis was graded in one of the following 3 categories: fracture definitely present (FDP), fracture probably present (FPP), and no visible fracture (NVF).

Results
Among these teeth, 39.0% were diagnosed as FDP, 3.5% were diagnosed as FPP, and 57.5% were diagnosed as NVF in consensus reading. In FDP cases, 60.0% aged from 50 to 69 years. 107 teeth were primarily fractured, and the remaining were endodontically treated with (n=32) or without (n=16) crown placement. The maxillary and mandible molars were mostly affected (81.9%). The fracture roots were mostly palatal (62.3%) in maxillary molars and mesial (75.9%) in mandible molars. The fractures varied as vertical (n=84), horizontal (n=34), oblique (n=5), and complicated (n=32) fractures. In NVF cases, the CT images exhibited mainly periodontal lesions (n=62), periodontal-endodontic combined lesions (n=31), and nearly normal appearance (n=45).

Conclusions and discussion
The application of CBCT is valuable for the diagnosis of root fracture.
P3-20
True panoramic images from CBCT data sets
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Introduction
The reconstruction of panoramic images from volume data has been a challenging task to show a better visual appearance of patient's entire jaw. A new breakthrough panoramic image reconstruction technology has been developed in Imaging Sciences International. The new created panoramic image represents the true anatomic dentition of the jaw region.

Objectives
The aim of this presentation is to evaluate the benefits and advantages of this new panoramic image technology.

Materials and methods
More than 500 data sets from i-CAT scanners (i-CAT, ISI, Hatfield, PA) were employed for verification and validation of the new true panoramic image technology. The new true panoramic images were compared with the existing panoramic images reconstructed from 3D volumes.

Results
Through comparison and validation procedures, the new true panoramic images were shown to have superior quality compared to the existing panoramic images or radiographs in almost all aspects and almost all individual studies.

Conclusions and discussion
The true panoramic images show superior visual appearance of the jaw and local information and provide more accurate spatial information and more valuable benefits in diagnosis, surgical planning, and tooth implantation.

P3-21
Treatment results of radiotherapy in patients with head and neck cancer: a 20-year experience
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Introduction
In our hospital, 517 patients with head and neck cancer have been treated by radiotherapy (RT) for about twenty years.

Objectives
The aim of this study was to review and assess retrospectively treatment outcomes of patients with head and neck cancer who had undergone RT in our hospital.

Materials and methods
Of 449 data of patients who underwent RT with head and neck cancer by January 2006, we identified 371 patients which were not lost to follow-up within 6 months, consisting of 217 of primary and 154 of secondary cases. Data were analyzed by Kaplan-Meier method and log-rank test to calculate survival rate (SR) and statistical significance, with the various parameters such as gender, age, site, Cancer staging, modality, dose and histopathological classification of squamous cell carcinoma (SCC).

Results
Statistically significant differences were observed in SR for different cancer staging of primary and secondary cases, for histopathological classification of secondary cases and for dose.

Conclusions and discussion
Not only in primary cases but also in secondary cases, the cancer staging have great effect on SR. And concerning histopathological subtype of SCC, the poorly differentiated type had a significantly low SR. These results may give us room for reconsidering the adequate dose for secondary cases when histopathological subtypes are proven.
TMJ radiographic changes in asymptomatic patients examined with CBCT

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Introduction
Because of their complex etiologies and pathogenesis, temporomandibular disorders (TMDs) are difficult to diagnose and manage. Imaging is a valuable instrument in adding important information and helping to determine a correct diagnosis, it plays also a major role in the detecting of occult changes that might float to the surface after occlusal restoration of orthodontic treatment.

Objectives
To detect the presence of radiographic changes in the TMJs of asymptomatic patients referred for diagnosis and treatment planning of conditions that are not related to the temporomandibular complex.

Materials and methods
A randomly selected sample of patients referred for CBCT evaluation is included in the study. Bilateral TMJ evaluation for patients referred by practitioners from different specialties was conducted by experimented radiologists. All findings were recorded. TMJ radiographic changes were categorized between absent, mild, moderate and severe, other conditions are mentioned if they existed.

Results
Percentage of different findings will be presented.

Conclusions and discussion
Many asymptomatic patients present with different degrees of bony changes; many symptomatic patient present with normal or very close to normal TMJs. This will raise the question of the threshold and the adaptation of the patient as well as the possible development of symptoms after treatment.

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An Optically-Stimulated Luminescence Dosimeter to Measure an Organ Dose in Diagnostic Radiology

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Introduction
Measurement of organ dose in Gy is indispensable to estimate the relative risk induced by diagnostic radiation. An optically-stimulated luminescent dosimeter (OSLD) used for personal monitoring could be applied with modifications for this purpose. Such a dosimeter should be evaluated in terms of the energy used and projection angle of the X-ray to the dosimeter to measure the organ dose.

Objectives
Clarify the applicability of the OSLD in measuring the dose of diagnostic radiology and estimate such doses of several modalities in dentistry.

Materials and methods
An OSL phosphor (Al₂O₃) coated on a thin plastic strip (3×20×0.35mm) was used. The OSL phosphor was then sandwiched by a poly-methyl methacrylate (PMMA) cylinder and wrapped in a black heat shrinkable vinyl tube to protect the exposure from white light. X-rays generated at 50, 90, and 120 kV were measured in air kerma with a radiation monitor (model 9015 Radcal Corp). The projection angle to the dosimeter ranged from 0 to 90 degrees. In measuring the organ doses the dosimeters were inserted in cavities of a human equivalent anthropomorphic phantom (Rando phantom) using three types of panoramic machines. More than two dosimeters were used for the determination of organ doses.

Results
The response in energy was ranged between 3 and 4 for X-rays used. The angular dependency was minimal. The organ doses were comparable to previous reports where different types of dosimeters were used.

Conclusions and discussion
An optically-stimulated luminescent dosimeter can be used to measure organ doses in diagnostic radiology.
P3-24

Comparison of conventional and reconstructed panoramic images from stitched small and large field of view cone beam computed tomography

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Introduction
Cone beam computed tomography (CBCT) units with small fields of view (SFOV) can make relating adjacent anatomic structures problematic. Third party software is now available to mosaic and "stitch" SFOV CBCT data volumes to create a larger volumetric dataset.

Objectives
To compare the reliability and accuracy of horizontal measurements made on reformatted panoramic images from "stitched" SFOV and large FOV (LFOV) CBCT datasets and conventional digital panoramic (DP) images to direct measurement (DM).

Materials and methods
Multiple SFOV CBCT scans at 3 resolutions (SFOV1, 0.076mm; SFOV2, 0.1mm, SFOV3, 0.2mm), a single LFOV CBCT scans and DP images were made for 3 skulls. Adjacent SFOV volumes were stitched and panoramic images reconstructed from CBCT datasets. Horizontal dimensions were measured for each quadrant by one observer on three independent occasions and compared to DM. The intraclass correlation coefficient (ICC), mean of the absolute difference (MAD) and mean measurements were calculated.

Univariate analysis of variance (with Levene tests) and post hoc tests (Least Significant Difference or Tamhane T2 test) were used to determine differences in ICC, MAD and mean measurements between modalities (p ≤ .05).

Results
No significant differences (F=1.46, p=.25) were found between modality ICCs (range; .99 - .4); MAD for SFOV1 [range; .16 - .22] were significantly smaller than LFOV (1.4 ± .8mm), DP (1.2 ± .7mm) and DM (.88 ± .4mm). Overall DP mean measurements (47.5 ± 3.1mm) were less than for all other modalities (DM [52.8 ± 2.6mm], LFOV [53.4 ± 2.4mm], SFOV1 [53.9 ± 1.9mm], SFOV2 [53.5 ± 2.1mm] and SFOV3 [53.4 ± 2.1mm]). No differences between DM and CBCT were found.

Conclusions and discussion
Horizontal measurements on panoramics reconstructed from stitched SFOV images are reliable and accurate compared with DM and LFOV CBCT formats.

P3-25

Development of the CBCT-based stereolithographic surgical guide aiding autotransplantation of teeth: in vitro validation

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Introduction
Autotransplantation of tooth is a technique-sensitive procedure. Careful pre-operative planning and surgical guidance are essential to make autotransplantation a more efficient therapy with a decreased risk for post-transplantation complications and an improved long-term prognosis.

Objectives
The aim of this study was to develop a CBCT-based surgical planning technique including stereolithographic surgical guide fabrication in order to diminish extensive and time-consuming manipulation of the donor tooth and preparation of the receptor site.

Material and methods
A stereolithographic surgical guide including a tooth replica was produced with SimPlant Pro 12.1 software (Materialise Dental). To validate this process, a dry dentate mandible was first scanned using the Scanora 3D CBCT (Soredex), then tooth segmentation and replica design were prepared for comparison to an optical scan of the corresponding tooth.

Result
Accuracy levels of tooth segmentation and replica design were found satisfactory (accumulated error ≤ 0.25 mm) allowing optimisation of the stereolithographic procedure for in vivo planning of CBCT-based autotransplantation.

Conclusions and discussion
Autotransplantation may become a more reliable treatment method for tooth replacement by using 3D CBCT-based planning and stereolithographic surgical guidance.
P3-26
A survey of organ and effective doses for seven dental cone beam computed tomography (CBCT) units
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Introduction
Dental CBCT has been associated with higher radiation risk compared to conventional dental imaging and lower radiation risk compared to multi-slice CT (MSCT). Several studies have reported on radiation doses but the number of TLDs and the range of CBCT units used were rather too limited to provide an accurate estimation of the radiation risk.

Objectives
The objectives of this study is to measure the organ (OD) and effective doses (ED) for seven dental CBCT units.

Materials and methods
Radiation absorbed doses were measured using two adult ART head and neck phantoms using a large number of thermoluminescent dosimeters (TLD-100 and TLD-100H) positioned at the most radiosensitive organs for seven CBCT. Correction factors were applied to the skin and red bone marrow absorbed doses for each phantom slice to account for the fraction of the total mass of the specified organ in the phantom. The EDs were calculated using the ICRP 103 tissue equivalent factors.

Results
The average ODs for brain, salivary glands, thyroid, red bone marrow and skin were 0.13 mGy, 1.52 mGy, 0.48 mGy, 0.02 mGy and 0.02 mGy respectively. The salivary glands and the skin received the highest and lowest absorbed doses respectively. Planmeca ProMax 3D and Scanora 3D exhibited the highest and lowest effective dose respectively. The wide range in the EDs for the same clinical examination can be attributed to the different exposure conditions set by the different manufacturers.

Conclusions and discussion
This study reported and compared organ and effective doses for seven dental CBCT units. In addition, this study confirmed that CBCT radiation doses are one-twentieth of published MSCT radiation doses but four times higher than the average panoramic dose published by the Health Protection Agency (UK).

P3-27
A method for metal artifact reduction from cone beam CT using dual energy method
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Introduction
Hounsfield unit is only a normalized index of X-ray attenuation. By using an analysis method of X-ray spectra in any way, new modalities of CT imaging technique can be developed. The images of new modalities may be different from ordinary CT images.

Objectives
The purpose of this work is to make a metal artifact reduction algorithm for cone beam CT using dual energy X-ray absorptiometry.

Materials and methods
Materials: CBCT PSR9000N(Asahi roentgen Ind.Co.,Ltd) , X-ray filters(Kyokko), FORTRAN Builder(NAG), Dental models with metal crowns.
Methods: Two scans of CT with different energy were performed to make bone mineral density(BMD) images. One scan was 90kV with Cu filter, another scan was 60kV with CdS filter.

Results
BMD images can be obtained. Metal was imaged in black areas in BMD CT images, and metal artifacts were reduced.

Conclusions and discussion
Dual energy CBCT has the advantage of making BMD images and of reducing metal artifacts. Dual Energy CBCT may become a helpful method for dental diagnosis.
Osteoradionecrosis of head and neck patients: a review of 31 cases

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Introduction

Radiotherapy is one of the main treatment modalities for head and neck (H&N) cancer patients. However, the spectrum of subsequent complications severely affects the quality of life of surviving patients, particularly the complication of osteoradionecrosis of jaws, present long-term challenges to both dentists and oncologists.

Objectives

The aim of the present study was to retrospectively review the characteristics and risk factors of osteoradionecrosis (ORN) of H&N cancer patients during the past 12 years in our institution.

Materials and methods

A total of 31 H&N cancer patients (18 oral, 9 nasopharyngeal (NPC) and 4 tonsil) with radiation treatment history (4600 to 7380 cGy) were collected from our pathologic file with diagnosis of ORN between 1997 and 2008. They were 29 males and 2 females, with mean age 56 year-old (range 33-80 years). Panoramic radiographies, histological findings and medical charts were reviewed.

Results

The most common affected site was the mandible (24 cases, 77.4 %), followed by the maxilla (8 cases, 25.8 %). One case involved both jaws, and 3 cases were bilateral. Five of the maxillary cases were NPC patients. All of the affected sites were within the radiation field. The time of ORN onset was between 2 and 225 months (mean=43.7 months). Only 10 cases (32.3%) occurred within the first year, 8 cases (25.8%) occurred more than 3 years after radiotherapy. Eight cases (25.8%) were initiated by extraction, 8 cases (25.8%) by periodontitis, 4 cases (12.9%) by apical lesions, and 5 cases (16.1%) were spontaneous. Twenty-three (74.2%) patients lacked regular dental care after radiotherapy.

Conclusions and discussion

Long-term periodic dental care and evaluation both clinically and radiologically before and after radiotherapy are necessary since most of our ORN cases are symptomless. Avoidance of dental infections and mucosal dehiscence should be the key points in prevention of ORN of the jaws.

Analysis of Hounsfield units and gray level measurements with conventional and cone beam computed tomography

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Introduction

Hounsfield units (HU) are standard numbers originating from conventional computed tomography (CT). On the other hand, cone beam computed tomography (CBCT) is a recent technology for which the image data seem not to conform to typical HU.

Objectives

This study aimed to compare the variability of HU and gray levels in conventional CT and CBCT scanners and to assess the scan stability of CBCT.

Material and methods

A commercially available QCT-Bone Mineral™ Phantom (Image Analysis, Inc., Kentucky, USA) was scanned with one conventional CT and five CBCT scanners. In a second experiment, the phantom was scanned several times in different set-up positions with the same Scanora 3D® (Soredex, Tuusula, Finland) CBCT. The HU and gray level values were measured with custom-made software based on MevisLab® (MeVis Research GmbH, Bremen, Germany) within specific regions of interest (ROI) in the phantom images.

Results

Results showed that the variability of HU in conventional CT images was proportional to the phantom densities analyzed. The variability of gray levels in CBCT images differed amongst CBCT scanners and was influenced by CBCT protocols and phantom positioning. Gray level variability was not significantly related to phantom densities for any of the CBCT scanners analyzed. For the conventional CT the average of HU values (SD) of one ROI was 1142.15 (18.26). For the same ROI, the averages (SD) were 629.66 (8.33), 651.52 (19.44), 1896.15 (156.26), 1791.40 (29.78) and 129.24 (5.62) for different CBCT scanners respectively.

Conclusions and discussion

CBCT image data do not seem to produce reproducible gray scale values. The use of a bone mineral phantom for calibration does not seem to produce a reliable and standardized density output.
Cleidocranial dysplasia: a case report
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Introduction
Cleidocranial dysplasia is a developmental anomaly of the skeleton and the teeth. This condition may be inherited, be transmitted as dominant characteristics in either sex, or even may appear spontaneously. It presents with skeletal defects of several bones, like partial or complete absence of clavicles, late closure of the fontanels, presence of open skull sutures and multiple wormian bones.

Objectives
In this research, we showed that radiological imaging can be a very powerful diagnosis tool for Cleidocranial dysplasia patients. During research the genetic basis of the disease could also be verified.

Materials and methods
In this case report, we describe a healthy 31 year-old male patient who was admitted with a complaint of missing anterior maxillary and mandibular teeth. The subject had twenty four erupted teeth and thirty-two total or partial unerupted teeth. He also had left periorbital edema, lymphadenopathy and dental pain. He had malocclusion. He had also hypoplasia of clavicles, the late closure of cranial sutures and fontanelles, hyperhidrosis. Same sufferings were observed with his daughter. A panoramic, lateral cephalogram, chest, pelvis x-ray and dental CT were evaluated.

Results
The evaluation of the dental CT, panoramic, anteroposterior lateral cephalogram and chest x-ray were confirmed as Cleidocranial dysplasia.

Conclusions and discussion
In this case report, the clinical and genetic features of this disorder are discussed and the literature is reviewed.

POSTER SESSION 4 - DIAGNOSTICS, ULTRASOUND, OTHERS
THURSDAY 2 JULY 2009

P4-1
Masseter muscle sonographic features as indices for evaluating the efficacy of massage treatment
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Introduction
We have clarified the sonographic characteristics of internal echogenic bands in the masseter muscles of TMD patients with myofascial pain in our previous studies. These features would be helpful for evaluating the efficacy of massage treatment.

Objectives
To clarify the sonographic features as indices for judging the therapeutic efficacy of muscle massage.

Materials and methods
Using an oral rehabilitation robot, massage was performed alternately for the masseter and temporal muscles in 13 patients with myofascial pain. Nine had pain in the unilateral masseter muscle and 4 in the bilateral. The massage pressure was at 6-12 N. The total treatment period was ranging from 6 to 21 weeks. All patients were asked to record subjective evaluations regarding muscle pain (VAS). The thickness and intramuscular appearances of the masseter muscles were also evaluated using sonography.

Results
Asymmetric index of the right and left thickness was larger in patients with unilateral masseter pain than that in the bilateral group (p=0.045, Mann-Whitney rank sum test). Asymmetric indices of the unilateral group reduced significantly after treatment (p=0.044, Wilcoxon signed-rank test). Change in the thickness after treatment related to VAS value of pain. The intramuscular echogenic bands decreased or disappeared, which was shown as an anechoic area, in 18 muscles (69%) in 11 patients. The anechoic area reduced after treatment in 16 muscles (89%). The presence of anechoic area related to massage pressure, treatment period and VAS value of pain.

Conclusions and discussion
Asymmetry index of the right and left thickness and the presence of anechoic area might be related to the therapeutic efficacy.
P4-2

Comparison between radiological and intraoperative evaluation of space and dimensional relationship in impacted third molars extraction
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Introduction
Even though there is an increasing use of CT for surgical planning of lower wisdom teeth removal, the classic semeiology, which still surgeon and literature refer to, is based upon panoramic radiography (PR) findings.

Objectives
Aim of this study was to compare radiological and surgical data in order to investigate the reliability of the radiological findings and their usefulness in facilitating surgical procedure.

Materials and methods
40 impacted lower third molars and their nearest structures were studied with particular regard to: the distance between the ramus and second molar, the third molar impaction depth and angulation, the discontinuity of the superior aspect of the mandibular canal and roots morphology. Both digital PR and CT findings and measures were compared with the intraoperative ones.

Results
Discrepancies between radiological and surgical findings were three times more in PR than in CT when measuring the distance between the second molar and the ramus, while they were two times when impaction depth was evaluated. Reliable evaluation of the roots morphology PR and CT was found in 30% and 100% of examined teeth respectively.

Conclusions and discussion
CT, more than panoramic radiography, allows to find out measurements superimposable to those obtained clinically. Detailed knowledge of measures, morphology, position and relationship of third impacted molar with contiguous structures make it possible to foresee extraction difficulty and plan surgical acts, such as osteotomy and odontotomy in order to reduce operative length and complications.

P4-3

Isolated extreme congenital hypoglossia: a case report.
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Introduction
Hypoglossia and aglossia are among the most rare congenital malformations. The vast majority of the cases reported in the literature refer to conditions associated with several other congenital abnormalities.

Materials and methods
We were called to perform the excision of decayed dental root stumps on a patient which showed congenitally missing teeth (hypodontia), with the residual ones clearly appearing irregularly deployed. Treatment was successfully performed, yet another aspect of the oral cavity of the patient grabbed our attention, the almost complete absence of the tongue. The patient referred not to be affected by any other upset, either congenital or else; none of her relatives had ever been affected by any similar condition nor by any other congenital malformation. The only evident clinical sign was that her tongue was replaced by a very small and uneven mucosal bud placed at the right side of the oral cavity floor, associated to a moderately hypertrophic uvula. Hypoglossia neither was associated with any other conditions described in literature to possibly co-occur with this abnormality, nor any different upset could be identified, apart from a slightly slowed speech, yet surprisingly good, which in fact should be interpreted as a most normal consequence of such extreme lingual atrophy.

Conclusions and discussion
We may affirm that the one case we are reporting here is a highly rare case of isolated extreme hypoglossia.
Prevalence of incidental paranasal sinus opacification in a dental adult population.
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Objectives
The purpose of this study was to determine the prevalence of sinus opacification among dental adult patients.

Materials and methods
Five hundred-twenty nine Cone Beam Computed Tomography (CBCT) scans of dental patients over the age of 18 were reviewed for sinus opacification. Patients with any sinus-related signs or symptoms were excluded.

Results
The overall prevalence of sinus opacification was 63.1%. The ethmoid (41.4 %) and maxillary (38.6 %) sinuses were most frequently affected.

Conclusions
The high prevalence of sinus opacification in asymptomatic adults emphasizes the necessity of clinical correlation.

Diagnostic Imaging Analysis of the Impacted Mesiodens
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Introduction
Panoramic radiograph is primarily used to locate the impacted mesiodens.

Objectives
The goal was to predict the three dimensional relationship of the impacted mesiodentes, with the anatomic structures by comparing their panoramic images with the CT images.

Materials and methods
The panoramic and CT images of 154 impacted mesiodentes obtained from 120 patients were analyzed. The number, shape, orientation and positional relationship of mesiodentes with adjacent anatomic structures were investigated.

Results
The mean number of mesiodentes per patient was 1.28. There were more cases of anatomical structure encroachment (especially on the nasal floor and nasopalatine duct) when mesiodentes were not superimposed on the central incisors than when they were. Delayed eruption (55.6%), crown rotation (66.7%) and crown resorption (100%) were observed when the mesiodens was superimposed with the crown of the central incisor.

Conclusions and discussion
It seems possible to predict the three dimensional relationship between the impacted mesiodentes and the adjacent anatomical structures in the panoramic images, but more details should be confirmed by CT images when necessary.
The usefulness of panoramic radiographs in assessing the inflammatory changes of antral floors according to the degree of mucosal thickening and observer’s experiences

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Introduction
Panoramic radiographs are routinely used for evaluating the status of the inferior border of maxillary sinuses when setting up treatment plans for dental implants.

Objectives
The aim of this study was to evaluate the usefulness of panoramic radiographs in assessing the inflammatory changes of antral floors according to the degree of mucosal thickening and observer’s experiences.

Materials and methods
156 maxillary sinuses were evaluated from panoramic radiographs of 78 patients, whose CT images were available. The presence or absence of antral mucosal thickening was scored by a 5-point scale system.

Results
Diagnostic ability of the oral and maxillofacial radiologist group was significantly superior, compared to those of other observer groups. Diagnostic ability of the specialist group and the general practitioner group improved as the degree of mucosal thickening increased. But that of the student group didn’t show improvement.

Conclusions and discussion
As the panoramic radiograph alone is not enough for non-specialist groups to diagnose inflammatory changes of the maxillary sinus properly, it is recommended to take further examinations when inflammatory changes are suspected from the panoramic radiograph.

Clinical and imaging aspects encountered in intraorbitary extensions of periorbital lesions

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Objectives
Presentation of the symptomatology and intraorbitary extension pathways of different periorbital lesions.

Material and method
A retrospective study was conducted using the clinical and imaging records of 34 patients with periorbital lesions explored with CT (n=31) and MRI (n=4) between January 2004 – January 2009.

Results
The studied cases presented: unilateral exophthalmia (n=24), reduction of visual acuity (n=17). From the histological point of view the 19 lesions were classified as: periorbital abscess (n=1), mucocel (n=2), fibrosarcoma SM (n=1), rhabdiosarcoma (n=1), accessory salivary gland pleomorphic adenoma (n=1), inflammatory pseudotumor (n=2), meningioma of the sphenoid great wing (n=3), ethmoidal and maxillary sinus carcinoma (n=10), ethmoidal adenocarcinoma (n=5), intraorbital extended lymphoma (n=1), subacute subperiostal hematoma (n=1), meningioma of the optical nerve sheath (n=1), neurofibroma (n=1), fibrous displasia (n=3). The CT and MRI exams have shown the site of lesions and the extension pathways inside the orbit.

Conclusions
The periorbital lesions with intraorbitary extensions have benefitted from the quality of the analysis provided by the CT-MRI association which helped in establishing a precise diagnosis and which at the same time offered the possibility of the evaluation of the intraorbitary extensions of the lesions and the therapeutic conduct.
Correlation of imaging and pathological stage with the quantitatively and qualitatively CD44s expression in maxillofacial squamous cell carcinoma

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Introduction
CD44 is a cellular adhesive molecule having the role to bind and connect the hyaluronic acid (HA), the extra-cell proteins and the growth factors all together. These molecules are involved in the invasion processes of the tumors and also in the metastases.

Objectives
The aim of the study was to establish if there is any significant correlation between the quantitative and qualitative expression of CD44 in the cancer cells of squamous cell maxillofacial carcinoma and the histopathological and imaging stage of the tumor extension (T) and lymphatic invasion (N).

Materials and methods
A number of 43 maxillofacial carcinomas were assessed by CT, and 2 specialized radiologists on head and neck imaging examined the images to establish the tumoral and nodal stage (rT, rN) of tumour invasion in conformity with the TMN standard system. After tumor removal surgery, the histopathological stage (pT, pN) was assessed after a macro- and microscopically analysis of the surgically removed pieces and by studying the tumor expansion, the infiltration of the incision edges as well as considering the lymphatic invasion. For the immunohistochemical analysis tissue sections where used preserved in paraffin blocks. The CD44 molecules contained in the tumor cells were assessed both quantitatively (calculating the percentage of the positive malignant cells) and qualitatively by the intensity of the immunopositive reaction to the CD44 antibodies. Based on the first criterion there were four distinct categories: group 1 with 0-24% positive cells, group 2: 25-49%; group 3: 50-74%; group 4 > 75%. The intensity of the reaction was appreciated on a three-level scale: weak, moderate and intense. The testing proved conclusive for the presence of the CD44 molecule in the tumoral tissue, consistent with the diagnosis based on the CT scan (rT, rN) and on the histopathological assessment of the malignant expansion (pT, pN).

Results
The CD44 molecule was present in the cancer tissues in 74.41% of the cases and as such, it could be considered a molecular marker in the diagnosis of the scaly carcinoma in the maxillofacial region. The percentage of the cells that tested positive for CD44 and the intensity of the immunohistochemical reaction is significantly correlated with the pT and pN histopathological stage (p < 0.05) but there is no relevant correspondence between these and the imaging assessed T and L stages.

Conclusions
Due to the direct correlation with the real histopathological stage of the tumour extension, the CD44 molecule can be considered as a reliable prognosis factor. The results of the study might settle a number of different controversies from the publications in the domain, related to the presence of the CD44 molecule and the clinical-pathological factors of the scaly carcinoma in the maxillofacial area.
Conclusion

Of 346 cases with malignant tumor of jaws, 18 (5%) were PIOC. Male patients were significantly more frequent in PIOC in comparison with gingival SCC. Majority of the patients with PIOC had initial symptoms related to teeth. Most of PIOC showed irregular radiolucency without sclerotic rim on panoramic radiography. Epicenter of the lesion on the panoramic radiographs were in the center of the bone or in the periphery (alveolar bone).

Introduction:

Primary intraosseous carcinoma of jaws (PIOC) is relatively rare disease. Because the number of the reported cases is so small that the clinical characteristics of the disease is not well realized. Here we report 18 PIOC cases found in our pathological list of recent 10 years.

Objectives

To investigate the clinical and radiological characteristics of the primary intraosseous carcinoma (PIOC)

Materials and Methods

The clinical records and pathological reports of all the patients who were pathologically diagnosed as having malignant tumor in the maxilla or the mandible in Tokyo Medical and Dental University Dental Hospital from January 1998 to December 2007 were retrospectively reviewed. PIOC were diagnosed based on the histopathological criteria or when the pathological findings strongly suggested the possibility and the clinical record definitely showed that there was no mucosal involvement at the first visit.

Results

The patients who had a primary site in the maxillary sinus or soft tissues other than gingiva were excluded and 346 patients were diagnosed as having a malignant tumor in the maxilla or mandible. Male to female ratio was 54:46 (187 males and 159 females); 96 (28%) in the maxilla and 250 (72%) in the mandible. Of 346 cases, 301 (87%) were gingival squamous cell carcinoma (SCC), 18 (5%) were PIOC, 7 were metastatic carcinoma, 5 were mucoepidermoid carcinoma, 5 were SCC originated in the area of the osteoradionecrosis, 2 were adenocarcinoma, 2 were malignant melanoma and 6 were sarcomas. Of 18 PIOC, 14 were male and 4 were female. Male patients were significantly more frequent in PIOC in comparison with gingival SCC. Fifteen were in the mandible and 3 were in the maxilla. Thirteen cases (68%) of PIOC were found in the mandibular body distal to the molar area, and 6 cases have clinical symptoms related to an impacted third molar. Twelve PIOC had tooth ache or swelling of the alveolus as an initial symptom of the disease. Two other patients were diagnosed as having tooth related cysts. Panoramic radiographic findings of PIOC were 1 cystic radiolucency with sclerotic rim, 16 irregular radiolucency without sclerotic rim, 1 showed no recognizable radiolucency on the panoramic radiography. Epicenter of the lesions on the panoramic radiographs were 7 in the center of the bone, 10 in the periphery (alveolar bone) and 1 was not recognized.

Discussion

Five percent of the malignant tumor occurred from jaws were diagnosed as PIOC. When the tumor developed in the central part of the bone grows to destroy the cortex and merges with the surface mucosa, it may be difficult to distinguish between a PIOC and a gingival SCC. Therefore the present value of the frequency of PIOC may have been the lower estimation. Twelve PIOC had tooth ache or swelling of the alveolus as an initial symptom of the disease. Two other patients were diagnosed as having tooth related cysts. Panoramic radiographic epicenter of the tumor were not always in the central part of the bone. Therefore, careful radiographic interpretation is important to find PIOC.
Salivary gland in health and disease - an ultrasonographic study
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Introduction
Diseases of the salivary glands can be evaluated using various imaging modalities which include Conventional Radiography, Sialography, Scinitigraphy, Magnetic Resonance Imaging and Ultrasound. Each technique has its own advantages and limitations. Ultrasound can be used to evaluate various disease processes affecting the salivary gland such as inflammatory swellings, tumours, cysts as well as non inflammatory, non neoplastic swellings.

Objectives
This study evaluates the use of ultrasound as an imaging modality in salivary gland diseases and highlights the ultrasonographic appearance of salivary glands in health and disease.

Materials and methods
The ultrasonographic examination of salivary glands was carried out using a high-frequency transducer with frequency ranging from 7.5-10MHz. The major salivary glands and all lesions were evaluated in at least two perpendicular planes during the ultrasound examination. The whole neck was scanned to assess lymph nodes and to search for concomitant or related disease.

Results
The normal echogenicity of major salivary glands, including the parotid gland, was homogeneous and varied from very bright and markedly hypechoic to only slightly hypechoic in comparison to adjacent muscles. In salivary gland cysts, the ultrasonographic picture showed a well defined anechoic aseptate swelling. In Pleomorphic adenoma ultrasound showed hypoechoic, well-defined, lobulated lesions with posterior acoustic enhancement that contained calcifications.

Discussion
The ultrasonographic picture of normal Salivary glands, some disease processes affecting the salivary glands and a literature review will be discussed.

Conclusion
Ultrasound has the advantage of not using ionizing radiation and it is a non invasive technique. It serves as a useful tool in the assessment of salivary gland diseases.

Kinetic analysis of the laryngeal movement and laryngeal closure in swallowing
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Introduction
Age related changes of swallowing have been reported. It is generally considered that videofluoroscopic examination of swallowing is the most common and reliable examination for swallowing. The results are usually reported qualitatively and quantitatively.

Objectives
The aim of this study is to analyze the age-related changes of the laryngeal closure and movement in healthy volunteers.

Materials and methods
16 volunteers aged from 24 to 89 years, 10 males and 6 females, were examined. The subjects were divided into two groups of young (20s, 4 males, 2 females) and elderly (80s, 6 males, 4 females). A lateral fluoroscopic examination of 3ml and 10ml barium swallowing was done using a DSA system in the sitting upright position, with 30 frames /second recording. The recorded images were retrieved into the personal computer and analyzed frame by frame with software Videopoint™. The movement of elevation of assigned point of the larynx was traced and the velocity was analyzed by the software.

Results
Almost all had one-peak type velocity of the laryngeal elevation during 3ml swallowing. The peak was closely related to the start of the laryngeal closure. One volunteer had two peaks, the earlier is related to the start of the laryngeal closure, the later one to the end of the laryngeal closure. In 10 ml swallow, 3 cases of the younger group and 4 cases of the elderly group had two peaks.

Conclusions and discussion
There were 2 types of laryngeal elevation during swallowing. One is a one peak-type and another is a 2 peak-type. The 2 peak-type was mainly observed during 10 ml swallowing and the swallow process was divided into 2 parts. The distribution of the 2 peak-type was not related to age, but the quantity. Duration of swallowing was longer in the elderly, but the peak velocity of the laryngeal elevation of swallowing was almost the same. It is suggested that the swallowing duration takes longer in the elderly, but the speed of the elevation did not change with aging.
P4-13

Effects of bleaching– a quantitative radiographic study
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Aim
The objective of the study is to evaluate the effect of Tooth Whitening on the tooth structure by comparing the changes in radiographic densities of natural teeth before and after bleaching using three different intra-oral imaging modalities.

Introduction
Bleaching or “teeth whitening” has become a very common cosmetic procedure that is available to the patients in the field of cosmetic dentistry. Most will contend that there is nothing harmful about many teeth bleaching procedures, as long as they are dentist-supervised. Our literature search indicated that no major study was performed to device a unique and practical way of quantitatively evaluating the structural changes of teeth due to the difficulty in establishing the gold standard.

Materials and methods
Six Extracted Teeth (3 incisors, 2 premolars and 1 molar) were bleached with Opalescence Xtra Boost bleaching material. The active ingredient in Opalescence Xtra Boost is 38% hydrogen peroxide. The teeth were bleached for 15 minutes and washed thoroughly.
All teeth were imaged before and after bleaching using D and F speed film and phosphor plates. All the exposures were standardized. All exposures were made using the same intra oral X-ray unit. All the films were developed immediately and the phosphor plates were scanned within half hour of exposure. D and E speed films were digitized and stored in JPEG format. All the images were exported into the Image J software (rsb.info.nih.gov/ij/) and the mean grey values and integrated density of each tooth before and after bleaching was calculated from six random enamel areas of each image and averaged. The mean grey value and integrated density in the crown part of each tooth before and after bleaching were compared. All statistical analysis was performed at 95% confidence intervals.

Results
Changes were observed in the mean grey values and integrated densities of the same teeth pre and post bleaching.

Conclusions and discussion
Though the bleaches are considered to be safe the changes may be direct result of the alteration in tooth structure. Significant changes could lead to permanent damage and detrimental effect on integrity of the tooth structure. More clinical studies have to be performed to substantiate the claim made in effect to the above study.

P4-14

Unusual appearance on dental radiograph resulting from a dermatologic procedure
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Introduction
This paper describes the appearance of foreign bodies present on dental intraoral and extraoral radiographs of a patient who had undergone implantation of gold threads in the neck for cosmetic reasons.

Objectives
A 48 year old female patient attended dental practice for the placement of dental implants in the region of the first and second left mandibular molars. On a panoramic image taken for evaluation purposes radio-opaque structures in the form of fine tangled threads were observed bilaterally in the molars region extending from above to below the lower border of the mandible. As this appearance on the panoramic image was confusing it was mistakenly identified as artifacts. Two dental implants were placed in the region of interest and the patient was sent home for the osteointegration period. At the second appointment 3, 5 months after implant insertion, intraoral x-rays were taken for evaluation of the bone around the implants before the prosthetic treatment. On intraoral x-rays a radio-opaque elongated element could be seen superimposed upon the lower border of the mandible just below mandibular canal (Fig 1). Patient admitted that a few years previously she had undergone a procedure to insert gold threads in her neck as a dermatologic procedure designed to rejuvenate the skin. In this procedure 24-carat gold threads of 0.1mm thickness are inserted into the dermis layer of the skin under local anesthesia. The threads induce a granulomatous reaction with abundant elastic fibers around the threads followed by new vascularization. The formation of new collagen and fibres is completed within a few months and gives the appearance of a rejuvenated skin. The indications for this procedure include: incipient aging, elimination of wrinkles and elimination of flabbiness. In this particular case a number of threads was inserted on both sides of the neck in this patient to form a kind of mesh. The radio-opaque elements seen on both the intra and extraoral images are located on the inner aspect of the body of mandible

Conclusions and discussion
This case demonstrates the necessity to take all the steps necessary to identify unusual or suspicious radiological appearances before undertaking complex dental procedures.
A case of impacted bilateral first premolars of maxilla erupted into nasal cavity

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Introduction
A tooth eruption into the nasal cavity is rare. In Japan, there have been more than 200 reports since the first report in 1901. Inverted teeth are usually seen as supernumerary teeth in the midline of maxilla. Here, a rare case of bilateral first premolars erupted into the nasal cavity is reported.

Case report
A 14-year-old Japanese girl was referred to our hospital. Her chief complaint was the treatment of impacted teeth. She had been treated of her irregular dentition and occlusion by an orthodontic clinic. Congenital missing permanent teeth of 12, 25 were recognized, and the teeth 54, 55, 64, 65 were still remained.

In panoramic radiography, two impacted inverted teeth were observed in the maxilla; the right first premolar was observed to have a contact with the inferior nasal cavity; the left first premolar had a well-circumscribed thickened dental follicle around the crown, eventually the sinus floor seemed to elevate. In occlusal radiography, both first premolars were overlapped with the inferior nasal cavity. In cone beam CT (CBCT), the parts of the crowns of the inverted first premolars were observed to erupt through the inferior nasal floor. The lesion around the crown of left first premolar was not detected by CBCT images although.

As the treatment, the surgical extraction of the premolars was adopted, and no discomfort was observed after treatment.

Discussion
The stimulations of the nasal cavity mucosa by an unerupted inverted tooth, and erupted tooth in the nasal cavity have the possibility of causing nasal symptoms. For the treatment planning, especially for a complexed case like this, three-dimensional imaging seemed to be critical. CBCT imaging is useful for pre-surgical diagnosis.

Quantitative ultrasonographic differentiation between cervical metastatic and nonmetastatic lymph nodes in patients with oral carcinoma

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Introduction
Tissue echogeneity is an important dimension of ultrasonography. It has been established that density perception by the human eye is far from being reliable in assessing echogeneity. Ultrasonograms must be quantified to exclude the effects of these subjective factors. So, we have used the modified complexity value (MCV) to obtain quantitatively objective ultrasonographic internal architecture.

Objectives
To evaluate the ultrasonographic internal architecture of enlarged cervical lymph nodes from oral carcinoma using the MCV, and to determine if the MCV is a valid diagnostic parameter for differentiating between metastatic and nonmetastatic lymph nodes.

Materials and methods
An ellipsoid ultrasonographic phantom and 50 enlarged cervical lymph nodes (metastasis, 27; nonmetastasis, 23) were examined with a linear ultrasound scanner. Two hundred fifty-six grayscale images were reconstructed from the 16 grayscale images. MCV was calculated by dividing the square of the total length pixels by the total area of the images at the same density level in the region of interest. Definite diagnosis of the nodes was obtained by histologic examination after neck dissection.

Results
MCV under different conditions of the phantom did not differ from one another. The sum of the MCV of the metastatic lymph nodes was higher than that of the nonmetastatic lymph nodes.

Conclusions and discussion
The MCV of the lymph node ultrasonogram is a useful parameter for differentiating between metastatic and nonmetastatic enlargement in cervical lymphadenopathy in the oral carcinoma.
**P4-17**

**Computed tomographic analyses of anatomies of the mandibular first and second molars and their surrounding structures for spread of odontogenic infection**

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**Introduction**

Mandibular molars are regarded as frequent causes of odontogenic infection. It is therefore important to understand the pathways of odontogenic infection originating from the mandibular molars. However, the pathway without the influence of surgical intervention has not been investigated, moreover, differences related to the causal tooth are not taken into account.

**Objectives**

This study aimed to analyze the CT anatomy of mandibular molars in uninfected subjects, and to clarify the pathway of odontogenic infection originating from the mandibular molars.

**Materials and methods**

CT anatomy, especially with respect to buccolingual aspects and the surrounding soft tissues, were investigated in 100 uninfected subjects, and 18 infected patients to clarify the pathways.

**Results**

Differences were found in bony width between the buccal and lingual cortices for both 1st and 2nd molars (p < 0.001), however, the wider side was observed conversely between the two molars. For cortical thickness, no difference was found between buccal and lingual sides in the 1st molar, while the buccal cortex was thicker in the 2nd molar (p < 0.001). All medial pterygoid and 88% of masseter muscles were situated posteriorly without horizontal overlapping with the 2nd molar. The mylohyoid muscle was vertically positioned superior to the root apices in 10% and 39% of 1st and 2nd molars, respectively. In infected 1st molars, all patients showed involvement of buccal structures. Infection originating from the 2nd molar was more likely to spread on the lingual side.

**Conclusions and discussion**

CT anatomy surrounding the causal teeth supported spread pathways of mandibular 1st and 2nd molar infection.

**P4-18**

**MRI findings in vascular malformations of the tongue**

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**Introduction**

Vascular malformations are common lesions accounting for approximately 7% of all benign tumours, the majority of which develop in the head and neck region. Generally, vascular malformations such as lymphangiomas, haemangiomas, and arteriovenous communications in the head and neck represent only an aesthetic problem. However, when localized in the tongue, these lesions can create clinical problems consisting, in the majority of cases, in spontaneous haemorrhage from the mouth. Although uncommon, progressive asymmetric growth of the tongue (macroglossia) can also be observed.

**Materials and methods**

Few cases of vascular abnormalities of the tongue are described in the literature, and several of these are characterized with Diagnostic Imaging techniques. In 2003, Lo Casto et al., retrospectively analyzed the MR findings in eight patients with lingual venous malformations. The authors conclude that knowledge of MRI findings of lingual venous malformations is useful for differential diagnosis with other focal lingual lesions that also show high intensity on T2 weighted images. This discrimination is achievable using i.v. paramagnetic contrast medium on dynamic T1 weighted images, which allows visualization of the typical slow and homogeneous filling.

Recently, our group describes three cases of vascular malformations of the tongue, studied with Magnetic Resonance Imaging. Neither contrast medium administration, nor angio-MR technique was used.

**Conclusions and discussion**

In our experience, MR appears to be the ideal technique to define the site, extension and the origin of vascular malformation, due to its ability to depict the typical signal flow voids in the lesions and to differentiate slow flow lesions from high flow ones. Moreover, the use of an adequate imaging protocol allows the simultaneous examination of the brain, permitting the identification of associated intracranial vascular malformations.
Accidental sinus findings in asymptomatic CBCT patients
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Introduction
Cone-beam CT machines of large field of view offer a possibility of radiological evaluation of the sinuses. In some patients sinonasal pathologies remain occult and produce no evident signs and patients therefore may be asymptomatic.

Objectives
To evaluate the sinus findings in asymptomatic CBCT patients.

Materials and methods
The material consisted of 100 consecutive CBCT examinations obtained in adult patients reporting no signs and symptoms suggestive of sinonasal pathologies who were referred for an examination for dental reasons (implantology, orthodontics, surgery). The examinations were performed using the Galileos (Sirona, Germany) CBCT unit with a field of view 15x15x15 cm.

Results
Large field of view allowed a good visualization of maxillary, ethmoid and sphenoidal sinuses. In most of the patients also the lower portion of the frontal sinus was well visible. Only 9 patients presented normal air-filled sinuses. In the majority mainly maxillary findings were observed such as thickening of maxillary mucosa, especially in alveolar recesses (80 patients), mucosal polyps (24 patients), air-fluid level (2 patients). In 11 patients dental filling material was present in maxillary lumen or in proximity of maxillary wall, while in 21 patients periapical pathology of upper molars was detected. Sphenoidal sinuses are rarely affected by sinusitis, but in the own material lesions were found in 5 patients (polype, mucosal thickening and in one case radioopacity of the whole sinus). Ethmoids were affected more often than the sphenoids. Visible portions of frontal sinuses were radiolucent in all patients. It was also possible to evaluate nasal septum (deviation, presence of spines, pneumatized conchae).

Conclusions
It was found that CBCT examinations performed because of dental indications is helpful in revealing asymptomatic sinonasal pathologies thus influencing decisions on consulting a specialist.

Interpretation of SUV of FDG-PET in oral malignant tumors
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Introduction
Recently FDG-PET has been introduced for the diagnosis of oral malignant tumors.

Objectives
The purpose of this study is to investigate the usefulness of SUV (standardized uptake value) of FDG-PET for the diagnosis of oral malignant tumors.

Materials and methods
Seventy-four cases with oral malignant tumors underwent FDG-PET. The uptake of FDG and SUV of the early and delayed scans were estimated. Uptake grades were classified into three groups (hot, warm and cold). The early-SUV, delayed-SUV and the ratio of the delayed-SUV to early-SUV (SUV-ratio) were calculated. The uptake grade, SUV and SUV-ratio were evaluated in relation with T-classification (T1~T4) and the lymph node metastasis. Furthermore, the transporter proteins of FDG in the tumor were estimated immunohistochemically in relation with the SUV.

Results
82% of T1 group showed the cold uptake, but 70%, 89% and 86% of T2, T3 and T4 groups showed the hot uptake. Concerning the SUV, 73% of T1 group showed the small SUV, but 100% and 86% of T3 and T4 groups showed the large SUV. Moreover, 87% of the cold uptake group showed the small SUV, but 79% of the hot uptake group showed the large SUV. In relation with the lymph node metastasis, 86% of the small SUV group showed the negative, but 72% of the large SUV group showed the positive. Moreover, 67% of the small SUV-ratio group showed the negative, but 59% of the large SUV-ratio group showed the positive. The transporter proteins were expressed markedly in tumors of the hot uptake group.

Conclusions and discussion
Most of patients with oral malignant tumors showed a distinct uptake of FDG. The SUV was helpful to evaluate the lymph node metastasis because most of large SUV group showed the positive.
T2 values and ADC of masseter muscle increase during clenching
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Objectives
Our purpose of this study was to evaluate the change of T2 values and apparent diffusion coefficients (ADC) in masseter muscle (MM) by clenching.

Materials and methods
25 healthy volunteers were examined. All the examinations were performed on a 1.5T scanner (Intera Achieva; Philips Medical systems, Best, the Netherlands) utilizing a sensitivity encoding SENSE-NV-16 coil. To calculate T2, we used a turbo spin-echo sequence with various echo times from 10 to 80ms in 10-ms interval. To calculate ADC, a single-shot, spin-echo, echo planner sequence were used. The motion-probing gradients (MPG) were applied separately along the orthogonal three directions (PA, RL, SI) with b values of 0, 300, and 600s/mm2. All examinations have been performed before, during and after clenching. The study protocol was accepted by the Ethics Committee of our university.

Results
T2 value showed significant difference before and during clenching. The ADC-SI was greater than either the ADC-RL or the ADC-PA, and it showed the anisotropic diffusion in the MM. ADC-PA, ADC-RL, ADC –SI and ADC-iso were significantly increased by clenching, and decreased after rest.

Conclusions and discussion
This research demonstrated the anisotropic diffusion in of MM and the increase of both T2 value and ADC by clenching. These ADC changes might be attributed in the changes of the perfusion and those of muscle microstructure and so on. We thought that both T2 values and ADC were effective for evaluation for bruxism.

Cell cycle dependency of 18F-Choline uptake during proliferation of cultured human cancer cells
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Introduction
Recently [18F] labeled choline ([18F] Choline) has been developed as a promising tracer for cancer detection; including ones found in the lung, prostate gland, head and neck regions. The experimental study demonstrated [18F] Choline uptake was higher in faster-growing rather than in slower-growing tumors. However, the precise mechanism remains to be elucidated.

Objectives
In this study, the relationship between [18F] Choline uptake and the cell cycle phase in cultured human cancer cells (HeLa S3), as well as how they compare to the conventional tracer [18F] FDG with PET was assessed.

Materials and methods
Synchronization of HeLa S3 cells was accomplished via a double thymidine block. Flow cytometry (FCM) was used to determine the relative DNA contents of cells to check the degree of cell synchronization. The uptake of [18F] Choline and [18F] FDG was determined after cell cycle synchronization.

Results
FCM findings confirmed that the cells were well synchronized. [18F] Choline uptake was 77% of the peak level in the early S-phase immediately after release, gradually increased, and peaked in the early G2/M phase. Subsequently, [18F] Choline uptake steeply declined over the late G2/M phase to 55% in the G1 phase. However, [18F] FDG was significantly higher in the early S phase compared to the G1 phase.

Conclusions and discussion
The results suggest that the uptake of [18F] Choline and [18F] FDG are cell cycle dependent, are associated with the proliferative activity of the tumor seen during PET imaging.
P4-24

The use of cone beam CT as an aid in dental treatment planning for a patient with cleidocranial dysplasia

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Introduction
Cleidocranial dysplasia (CCD) is a rare congenital disorder transmitted as a dominantly inherited skeletal dysplasia.

Case report
We reported a 19-year-old, well-developed, well-nourished, Thai woman who presented with intermittent dull pain in the lower left jaw for about a week. On intraoral examination, the edentulous ridge on the lower left premolar area can be seen and delayed eruption of teeth was then suspected. CCD was diagnosed based on a large amount of supernumerary germs, a parallel-sided ascending ramus, hypoplasia of the zygomatic bone, discontinuity of the zygomatic arch and 32 unerupted teeth found on the panoramic radiograph. Chest and skull radiograph were performed to evaluate the clavicles and skull bone formation to confirm the diagnosis of CCD. Family members including parents and siblings were radiographically investigated and showed no abnormalities. Five supernumerary teeth at the lower left premolar area, deciduous canine and permanent third molar were removed and artificial eruption was surgically performed on the lower left permanent canine, first and second premolar under general anesthesia.

Discussion
Three-dimensional imaging by cone beam CT was suggested as an aid in dental treatment planning for further dental surgery and orthodontic treatment. Positions and inclinations of the other unerupted teeth were described and evaluated.

P4-25

Gorlin-Goltz syndrome: report of 8 cases and criteria for diagnosis evaluation

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Introduction
The Gorlin-Goltz syndrome is an autosomal dominant condition transmitted with complete penetrance and variable expressivity that has been linked to germline mutations in patched gene (PTCH). It is a rare syndrome whose estimated incidence is at one per 50,000 to one per 150,000. It causes an ecto-mesodermal dysplasia with manifestations in any organs.

Case report and discussion
In this study, the clinical and radiographic features from 8 patients were evaluated. After clinical and radiographic extra-oral evaluation, 100% of patients presented falx cerebri calcification, 75% hypertelorism, 75% increase of the circumference of the head, 62.5% frontal bossin, 50% multiple basal cell carcinomas of the skin, 25% strabismus, 25% hydrocefaalia and 25% moderate mental retardation. None presented dyskeratosis palmo-plantar neither bifid ribs. On clinical and radiologic bucal examination, 62.5% presented impacted teeth, 62.5% crossbite, 25% dental crowding, 37.5% transverse maxillary deficiency, and 100% odontogenic keratocysts. The number of keratocysts found was, in average 3.4, in a way that the highest number of cysts was 5 and the lower was 2. The predilection of localization of the keratocysts was in the jaw, with 75% of cases. Recurrence of keratocysts in 50% of the analyzed patients was detected. It was more frequent in female patients. Of the analyzed patients, 3 belonged to the same family and 5 were isolated cases. The age of identification of the syndrome varied from 12 to 47 years, with average age of 22 years. The follow-up period ranged from 6 months to 6 years.
P4-26
Dynamic contrast-enhanced magnetic resonance imaging for estimating tumor proliferation and microvessel density of oral squamous cell carcinomas
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Introduction
Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI), which produces functional images, not only aid diagnosis but also provide measures that relate to histological assessments of vascular density, providing a noninvasive method for measuring angiogenesis and tumor proliferation.

Objectives
In the present study, we evaluated the relationship between histopathological prognostic factors, tumor proliferation, microvessel density (MVD), and enhancement parameters in dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) in oral squamous cell carcinoma (SCC).

Materials and methods
Twenty-eight T2 and T3 patients with primary oral SCC underwent DCE-MRI using three-dimensional fast imaging with a steady-state precession sequence. Tumor cell proliferation and MVD of all surgical specimens were evaluated using immunohistochemical staining with CD34 and the antibody for proliferating cell nuclear antigen (PCNA). Regression analysis was used to statistically analyze the relationship between the PCNA labeling index or MVD and each of three DCE-MRI parameters: CI-max, CI-gain and the CI-gain / CI-max ratio.

Results
The PCNA labeling index and MVD showed significant correlations with the CI-gain/CI-max ratio (P = 0.0012, r = 0.581 and P = 0.0014, r = 0.574, respectively).

Conclusions and discussion
The assessment of DCE-MRI parameters may prove to be a valuable non-invasive method for assessing tumor cell proliferation and MVD of patients with oral cancer.

P4-27
Prognostic factor of the late neck metastasis in the oral squamous cell carcinoma by the CT images
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Introduction
The neck lymph node (LN) metastasis is one of the risk factors for oral squamous cell carcinoma (SCC) patients. Therefore, early detection of neck LN metastasis in oral SCC patients would be very useful for an increase of the survival rate.

Objectives
To suggest effective diagnostic features of metastatic LN and to analyze the prognostic factor of late neck metastasis in oral SCC patients by evaluating CT images longitudinally.

Materials and methods
Between 2000 and 2007, 69 patients with regional LN metastasis of oral SCC treated with a neck dissection (ND) were enrolled in this study. All patients underwent contrast enhanced CT imagings at the initial examination and before ND. The long axis, short axis, short axis to long axis (S/L) ratio, pre-contrast CT value and contrast-enhanced (CE) ratio were measured in all lymph nodes.

Results
Ninety-seven metastatic LNs and 253 non-metastatic LNs were identified on CT images. The long axis, short axis and S/L ratio of metastatic LN were significantly larger than those of non-metastatic LN. However there were no significant differences on the long axis, short axis, S/L ratio, pre-contrast CT value and CE ratio of metastatic LN between the first and second CT images.

Conclusions and discussion
The measurement of the long axis, short axis and S/L ratio was useful for the diagnosis of the metastatic LN. However, it was impossible to predict the late neck metastasis on the first CT image.
P4-28

**Radiological evaluation of odontomas in children**

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**Introduction**

Odontomas are odontogenic tumors, considered to be developmental anomalies resulting from the growth of differentiated epithelial and mesenchymal cells. Most odontomas do not produce clinical symptoms and are discovered during routine radiographic examination or failed eruption of permanent teeth. They show calcified structures resembling teeth in the centre of a well-defined radiolucent lesion. Panoramic radiographs are often the first screening tool used for discovery of these lesions. Computerized tomography (CT) is used for detailed evaluation of bony involvement and associated anatomic structures.

**Aim**

The aim of this study is to present 15 cases of odontomas their radiological examinations and investigate the necessity of the CT evaluation in surgical treatment.

**Material**

The present study used clinical records, radiographs and oral photographs of odontomas of the jaws in young patients aged 2-15 years treated during a ten years period (1999-2008).

**Conclusions**

Combining plain radiography with advanced imaging techniques, including CT can improve the accuracy of diagnosing and benefits surgical treatment.

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P4-29

**Dental age assessment in a group of Turkish children: a pilot study**

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**Objectives**

The aim of this study was to investigate the timing of individual tooth formation stages in a group of Turkish children.

**Materials and methods**

Dental age was assessed from panoramic radiographs of healthy children attending the Marmara University Dental School, Istanbul, Turkey. The sample was 320, aged 3-12 years. Seven mandibular teeth were evaluated according to Demirjian’s eight grade-dental maturity scale by one examiner. Dental age was compared to chronologic age by using a paired t-test.

**Results**

It was found that the mean dental age was significantly higher (p<0.05) than chronological age in the entire studied group; therefore dental development was considerably accelerated. No statistically significant differences between dental ages of girls and boys were observed in particular age groups.

**Conclusions and discussion**

Preliminary research data showed that the means of dental ages of the studied group of Turkish children in Istanbul evaluated by Demirjian’s standards are significantly higher than the chronological ages. One of the limits of this study was the number of the children. This retrospective analysis is continued to establish the definite results in Turkish children.
Supernumerary teeth "mesiodens". Case report

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Introduction
The supernumerary tooth is a dental eruption anomaly that is not rare to find in clinical practice. Among the supernumerary teeth the "mesiodens" is the most frequent. The mesiodens is found in the region of the superior central incisors.

Objectives
In this case report, we describe a 37 year-old female with three mesiodentes.

Materials and methods
The three mesiodentes are detected by periapical dental radiographs. Occlusal and panoramic radiographs made subsequently also showed the three mesiodentes.

Results
There are three mesiodentes and one of them is in an inverted position.

Conclusions and discussion
Early diagnosis and appropriate management can minimize the potential complications caused by supernumerary teeth.

Focal cemento-osseous dysplasia: report of a case

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Introduction
Cemento-osseous dysplasia (COD) is a cementum and/or bone-producing non-neoplastic condition of the jaws. Although the etiology and pathogenesis of focal cemento-osseous dysplasia are unknown, these lesions are thought to occur in response to reactive or dysplastic changes in the periodontal ligament and/or medullary bone. Trauma, infection or hormonal imbalance could be triggering factors. COD is separated into three subtypes based on clinical and radiographic features: periapical, focal, and florid. The focal type exhibits a single site involvement in any tooth bearing or edentulous area of the jaws. Because of its progressive mineralization, the radiographic appearance depends on the stage of development.

Case report
In the presented case a 24-year-old female patient was referred to our clinic complaining of swelling in the left edentulous mandibular premolar-molar region without pain, tenderness and paresthesia. Clinical examination demonstrated swelling in the posterior mandible which was firm, non-fluctuant and covered by normal mucosa. On panoramic radiography and CT, a mixed density lesion was observed, approximately 1.5 cm in diameter and well defined. There was cortical expansion and the lingual surface of the cortical bone was thinned but remained intact.

Because of the swelling was slightly increasing in two years and the difficulty of using prosthetics, the lesion was totally excised under local anesthesia and the surgical specimens were submitted for histopathological examination. The histopathologic diagnosis established that it was focal cemento-osseous dysplasia.

Discussion
Focal cemento-osseous dysplasia occurs with greater frequency in women, with the greatest prevalence in the fourth and fifth decades of life. The posterior mandible is the predominant site. These lesions are usually asymptomatic, therefore they are frequently diagnosed incidentally during routine radiographic examinations. Lesions are usually benign, show limited growth and further surgical intervention is not necessary, but periodic follow-up is recommended, because occasional cases were observed to progress into florid osseous dysplasia and simple bone cysts may develop within an area of cemento-osseous dysplasia. In the study presented here, the monitored expansion which has prevented the use of prosthetics, the young age of the case, and the localization of the lesion, in the initial examination cemento-ossifying fibroma was suspected and the lesion was excised surgically. Because of the cemento-ossifying fibroma is a real neoplastic entity, making a differential diagnosis is essential.
Radiographic prescription in dental implant assessment: a survey
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Introduction
The use of dental implants for the replacement of edentulous spaces is now gaining popularity in India. Radiographic evaluation of the implant site is necessary for adequate assessment of bone condition, determining the number and size of the implants required and designing of the implant. The choice of the apt radiographic technique depends on the clinician and the clinical situation. Due to the lack of information on the various radiographic techniques employed by implantologists for assessment of the implant site this survey was conducted to assess the present trend of radiographic prescription for implant site assessment.

Objectives
To assess the current prescriptions of radiographic assessment for dental implants among dentists in India

Materials and methods
Ninety nine dentists attending the National Conference of Implantology were interviewed by the investigator. A pre tested and modified questionnaire was the instrument used. The data was entered into Microsoft Excel 2007 and analysed using SPSS version 11.5.

Results
The mean age of the sample was 36.8. The sample consisted of 87.8% males. The average number of years in practice as an implantologist was 2.45 years and the average number of patients per month was 4. 27.3% used a combination of panoramic and periapical radiography while 10.1% used only panoramic radiography and 2% used only periapical radiography. 3% used only computed tomography while 2% used a combination of periapical, panoramic and computed tomography. The main reasons for the choice of imaging modality were cost and measurement precision.

Conclusion
This study showed that periapical radiography was used by most dentists based on the cost and measurement precision. This study shows that implantologists need to be further educated on the recent advances in imaging technology and there needs to be standardization of imaging criteria for implant placement in India.

The comparison between radiographic findings of mandibular asymmetric and symmetric patients
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Introduction
The etiological factors of mandibular asymmetry are not completely known. Clinical exam, conventional radiographies and isotope scanning are several steps in the diagnosis of mandibular asymmetry.

Objectives
To compare the radiographic findings of patients with mandibular asymmetry and normal subjects, and to define the asymmetry index in this group of patients

Materials and methods
In this case-control study, PA ceph, panoramic and tomographic views of twenty patients including 10 asymmetric patients with the mean age of 17.8 years (6 female, 4 male) and 10 symmetric subjects with the mean age of 17.6 years (6 female, 4 male) were evaluated. The case and control groups were matched by CVMS (cervical vertebrae maturation stages) index and nearly chronological age. In PA cephalometry radiographs, 8 indices were evaluated in two categories of horizontal and vertical indices. After measuring condylar and ramal heights in panoramic views, condylar and ramal indices were determined. On frontal tomograms of Rt and Ll Condyles, the average of maximum medio lateral dimensions of posterior, middle and anterior cuts were calculated and used for calculation of tomographic index and ratio.

Results
Paired sample test analysis revealed no significant difference between case and control groups on all of the mentioned radiographic indices and measurements.

Conclusions and discussion
No significant differences between the condylar asymmetry index in patients with temporomandibular joint disorder and normal patients was reported by Saglam et al. Moreover, selected mandibular reference points in our study were confirmed by Trpkova et al. Overall, Tomography, PA cephalometry, panoramic views are helpful in the diagnosis of asymmetry but they can't introduce a definitive borderline in the form of asymmetry indices.
Clinical, histopathological and imaging findings in pleomorphic adenoma of the pterygopalatine fossa

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Objectives
Pleomorphic adenoma is the most common tumor of the major salivary glands. Also it can occur in the minor salivary glands in the oral cavity, paranasal sinus and other sites in the head and neck regions. We report a very rare case of Pleomorphic adenoma of the pterygopalatine fossa in a 59 year old Romanian housewife.

Material and methods
A 59 year old female patient was referred to the Department of General and Dental Radiology, Faculty of Dental Medicine, Gr. T. Popa Iasi, Romania, with left exophthalmia and swelling in the left buccal area. Physical examination was unremarkable except for a slight swelling of the left buccal area and posterior alveolar bone. A computer tomography was made.

Results
CT revealed a homogenous mass in the left pterygopalatine fossa, with extension into the cavernous sinus and involvement of the temporal bone. The lesion presented a little contrast enhancement and a small intracranial extension with compression to the lateral cavernous sinus. Surgical intervention was performed with partial resection of the tumor.

Histopathological examination revealed a Pleomorphic adenoma with no evidence of malignancy. Three and seven years after surgery the CT and IRM imaging proved the stability of the lesion which remains with no bone involvement or size change.

Conclusion
This presentation describes a very rare case of Pleomorphic adenoma of the pterygopalatine fossa. Histopathological and CT and IRM imaging provided valuable information.

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Evaluation of the usefulness of the MRI in the assessment of the thickness of the roof of the glenoid fossa of the TMJ

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Introduction
Progressive remodeling of the temporomandibular joint (TMJ) following diskectomy and disk perforation is shown to increase the thickness of the roof of the glenoid fossa (RGF).

Objectives
The purpose of this clinical study was to evaluate the usefulness of the MRI in measuring the RGF of the TMJ.

Materials and methods
The study was performed on 55 patients who visited the Nihon University Dental Hospital, Japan with suspected TMJ disorders. The patients underwent MRI and Cone Beam Computed Tomography (CBCT). A Digital caliper and a 3D image tool were used to measure the minimum thickness of the RGF.

Results
The average MRI measurement was 1.43 mm (range: 0.83–3.01 mm). The average CBCT image measurement was 0.91 mm (range: 0.43–2.98 mm).

Conclusion
The value of MRI was higher than CBCT with a distinctly thicker measurement. The correlation was good. The results suggest that the bone thickness measurements of the RGF using MRI are effective.
Pre-evaluation of implant sites by dentascans
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Introduction
Dentascans form a three dimensional imaging modality, and it is the third eye gifted to implantologist. It surpasses the various shortcomings of two dimensional imaging with regard to accuracy and simplicity.

Objectives
To study the efficacy of pre-evaluation of implant sites by Dentascans.

Material and methods
25 patients in the age group between 10 and 80 years requiring implant placement were selected for this study. The CT scan machine used for this study was a Siemens Somatom Sensation 64. Axial, paraxial and panoramic images obtained were evaluated for available ridge height and width at implant sites, proximity to maxillary sinus and inferior alveolar canal, easy of identification of inferior alveolar canal, radiographic presence of bony concavities and density at implant sites.

Results
Dentascans was an effective software in pre-evaluation of available height and width at the implant sites. There was a correlation between the available bone at the implant sites and region of jaw, sex, and age of the patients. The inferior alveolar canal was identified in 85.71% of the cases. Bony concavities were identified in 22.95% of the cases. Dentascans provide subjective evaluation of bone density in Hounsfield Units (H.U)

Conclusion and discussion
Dentascans are a rapid, time saving, effective, safe and indispensable procedure in dental implantology. Dentascans determined the available bone at the implant sites accurately without any magnification or distortion as is present in panoramic radiography.

Comparison of the buccolingual inclination in alveolar bone and tooth using Dental CBCT
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Introduction
It is important to determine the bucco-lingual inclination of implants on radiographs before implant surgery.

Objectives
To compare the buccolingual inclination of alveolar bone and the teeth using CBCT and to prepare a standard for the buccolingual inclination of implant.

Materials and methods
Axial, panoramic, and buccolingually sectioned images of 80 implant cases with stent including straight markers using CB Mercuray™(Hitachi, Japan) were evaluated. The comparison of the buccolingual inclination of remaining alveolar bone with that of the teeth and the markers was performed statistically.

Results
The buccolingual inclination of remaining alveolar bone and teeth was on average 82.8±4.6° and 85.8±4.7°(p<0.05, r=0.96) at the 1st molar area and 76.4±1.7° and 82.7±1.7° (p>0.05) at the 2nd premolar area in the upper jaw, 81.3±8.3° and 87.5±6.3° (p>0.05, r=0.85) at the 2nd premolar area and 94.3±6.6° and 93.3±7.2° (p<0.05, r=0.91) at the 1st molar area in the lower jaw respectively. The inclinations of markers were very different from those of remaining bone at most of the areas except the upper 2nd premolar area(r=0.79).

Conclusions and discussion
It is recommended to do a dental CBCT analysis for patients, in order to determine the buccolingual inclination of the dental implant, because there is a difference between the buccolingual inclination of remaining alveolar bone and teeth on average.
P5-9

Comparative evaluation of computed tomography for dental implants on the mandibular edentulous area
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Objectives
The purpose of this study was to evaluate the clinical usefulness of multi-detector computed tomography (MDCT) and cone beam computed tomography (CBCT) in pre-operative implant evaluation, by comparing them with single detector computed tomography (SDCT), already confirmed for accuracy in this area.

Materials and methods
Five partially edentulous dry human mandibles with 1×1 mm gutta percha cones, placed at 5 mm intervals posterior to the mental foramen on each side of the buccal part of the mandible were used in this study. They were scanned as follows: 1) SDCT: slice thickness 1 mm, 200 mA, 120 kV 2) MDCT: slice thickness 0.75 mm, 250 mA, 120 kV 3) CBCT: 15 mAs, 120 kV Axial images acquired from three computed tomography data sets were transferred to a personal computer, and then reformatted cross-sectional images were generated using VImplant 2.0® (CyberMed Inc., Seoul, Korea) software. Among the cross-sectional images, those that showed the gutta percha cone definitely were selected as the measuring point and the distance from the most superior border of the mandibular canal to the alveolar crest was measured and analyzed 10 times by a dentist.

Results
There were no significant intraobserver differences in the distance from the most superior border of the mandibular canal to the alveolar crest (p>0.05). There were no significant differences among SDCT, MDCT and CBCT in the distance from the most superior border of the mandibular canal to the alveolar crest (p>0.05).

Conclusions and discussion
MDCT and CBCT are clinically useful in the evaluation of pre-operative site for mandibular dental implants, with consideration for radiation exposure dose and scanning time.

P5-10

A case of synovial chondromatosis in which an arthrographic study of the temporomandibular joint was used to identify the pathologic joint cavity
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Introduction
Synovial chondromatosis (SC) in the temporomandibular joint (TMJ) is exceedingly rare. While a majority of these cases occur in the superior joint cavity, exceptionally they may occur in the inferior joint cavity or both joint cavities. We present a case of SC pathology that was effectively identified by arthrography of the TMJ.

Case report
The patient was a 34-year-old woman. The panoramic and plain X-ray images showed the universal findings of SC in TMJ. However, the magnetic resonance imaging (MRI) showed two enlarged joint cavities containing loose bodies both anterior to the condyle and posterior to the condylar process. It was impossible to identify whether SC had occurred in the superior or inferior cavity. Cone beam computed tomography (CBCT) showed that loose bodies were detected around the condyle. A large loose body was seen adjacent to the inner lower surface of the condyle. Limitations in imaging techniques prevented identifying the pathology of the joint cavity. Thus, CBCT arthrography of the superior joint cavity was performed. This showed that all the loose bodies were contained in the superior joint cavity, including the loose body at the inner lower surface of the condyle. The enlarged joint cavity posterior to the condylar process was also imaged. Features of loose bodies were seen in the superior joint cavity through the contrast medium. According to the above observations, the affected cavity was the superior joint cavity.

Conclusions
MRI is extremely useful in diagnosing SC. TMJ arthrography is helpful to diagnose cases where difficulty exists in determining whether the suspected lesion has spread to the superior or inferior joint cavity.
Evaluation of the lateral pterygoid muscle and its relationship with temporomandibular disorders in patients with migraine: 3D, clinical, and magnetic resonance image study.

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Introduction

The headache symptoms described by Temporomandibular disorders (TMD) patients are similar to those reported by patients diagnosed as having migraine headaches according to the International Headache Society. The relationship between migraine and myalgia of the mastigatory muscles has been demonstrated in many patients, few studies show a significant association between vascular headache or migraine and TMD.

Objectives

Compare the LPM volumes, in subjects with migraine and without migraine, using segmentation of these muscles in TMJ magnetic resonance images (MRI), relating these findings to signs and symptoms of TMD.

Materials and methods

The study involved 20 migraine patients and 20 volunteers without migraine. TMJ-MRI was performed with a 1.5 Tesla MR imager with bilateral circular-polarized 8.0 cm coil. Those images were selected for analysis of the disk-condyle relationship. All the images were used in ITK/SNAP® 1.4.1 software that focus on active contour segmentation and calculates the volume of segmented structures.

Results

DTM variables in the control and migraine groups were the Chi-squared and Fisher’s Exact Test (p<0.05). Regarding to the LPM volume in the control and migraine patients groups, the t-test was used in order to compare the values, with different variances P (t=1) unicaudal 0.000001%. There were statistic differences between the two groups for all of the analyzed variables. This could be confirmed with the Chi-squared and Fisher’s Exact Test (p<0.05%). There was a relation between migraine and: disc displacement (p<0.0001), condyle motion position (p<0.0001), joint noise (p=0.0282), articular and/or muscle pain (p<0.0001) and jaw motion (p<0.0001). In the LPM volume, the t-test showed a relation between migraine patients and increase of their volume. The Logistic Binary Regression Test was applied, and the relevant factors, that could lead to infer the presence of migraine headache were: limited jaw motion (61.24%), LPM volume increased (58.67 %) and disc displacement (50.25%).

Conclusions and discussion

The three most important variables are related to migraine: abnormal mandibular motion, hypertrophic LPM and TMJ disc displacement. It is relevant as a method to evaluate the lateral pterygoid muscle, DTM in Migraine patients.

Metric analysis for the disc position of temporomandibular joint of asymptomatic volunteers by magnetic resonance imaging

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Objective

To investigate the disc position of temporomandibular joint (TMJ) of asymptomatic volunteers by magnetic resonance imaging (MRI).

Materials and methods

One hundred asymptomatic volunteers were divided into 5 groups (11-20 years; 21-30 years; 31-40 years; 41-50 years; 51-60 years. 10 male subjects and 10 female subjects were included in each group. 200 TM joints were scanned sagittally by using a Siemens Trio a Tim 3.0T MRI system in closed-mouth position. Visual inspection for TM joints was performed on 3 slices for each subject (lateral, central, medial), and the disc position was ascertained according to the classification as follows: I: normal (N); II: partial insidious disc displacement(PIDD), III: total insidious disc displacement (TIDD), IV: partial anterior disc displacement (PADD), and V: total anterior disc displacement(TADD). Metric analysis was performed based on the image of the central slice to assess the disc position.

Results

The proportion of 5 types of the disc position was N-73%, PIDD-7.5%, TIDD-11.5%, PADD-2% and TADD-6% respectively. No significant differences were found among different groups of age and between genders (P>0.05). The disc position relative to the fossa and the condyle, and the disc angle in relation to the condyle were proved significantly different among the N I, IDD II + III, and ADD IV+V (P<0.05). The disc angle in relation to the condyle of the group N, IDD and ADD was 1.14 º±10.31º, 21.45 º±11.54º and 67.25 º±35.68 º respectively.

Conclusions

The disc position varies and 27% are not in the normal position in asymptomatic volunteers. There is no association between the disc position and age or gender. The disc position and angle changed with the occurrence of IDD and ADD.
Injection of sodium hyaluronate compared with a corticosteroid in the treatment of patients with temporomandibular joint osteoarthritis: clinical effects and computed tomography evaluation of osseous changes
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Introduction
Osteoarthritis (OA) is the most common disorder in the temporomandibular joint (TMJ) and treatment is still debatable. TMJ injection with sodium hyaluronate has been found more effective in decreasing pain than corticosteroids in patients with OA.

Objectives
The aim of the present study was to compare the osseous changes in the TMJ, assessed on CT examinations, before and after two intra-articular TMJ injections of sodium hyaluronate or corticosteroid, in patients with OA of the TMJ and relate these to the clinical findings of pain, function and complications.

Materials and methods
Forty patients were randomly allocated into two groups for two intra-articular injections with the two drugs. The effect of treatment was evaluated before and 6 months after the injections. Bilateral TMJ examinations with high resolution CT were obtained in 36 patients before and 6 months after treatment. Treated and contralateral TMJs were evaluated for the presence of osteoarthritic osseous abnormalities by two reviewers independently.

Results
Injection with sodium hyaluronate was significantly more effective in decreasing pain intensity than corticosteroid. Progression, regression and no change of osseous abnormalities were demonstrated in 14, 10 and 12 TMJs, respectively, 6 months after treatment. Decreased pain intensity and increased vertical mandibular opening were observed in the majority of patients where progression of osseous changes was observed on CT.

Conclusions
Injections in the TMJ with sodium hyaluronate or corticosteroid may reduce pain and improve function in patients with OA. Progression, regression and no changes were observed in treated as well as untreated TMJs. Radiological evaluation of progression of osteoarthritis does not always reflect the clinical signs and symptoms.

Comparison between panoramic and CBCT images for measuring the pre-implant site
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Introduction
There is some dispute regarding the expected distance for implantation according to the imaging modes.

Objectives
The aim of this study is to visualize and measure the distance for implantation on mandibular partial edentulous area.

Materials and methods
The subjects were 13 patients who had 25 mandibular partial edentulous sites. The average number of missing teeth was 1.9 and the average age of the patients was 45 years. An estimation of the distance for implantation on a partially edentulous mandible was done using conventional panoramic radiography (Orthopantomograph OP 100®) and CBCT radiography (I-CAT®). In the panoramic radiography, the expected possible distance was measured from the alveolar crest to the superior border of a mandibular canal. In the CBCT radiography, the DICOM images were imported into the Accurex®(Cybermed Inc., Seoul, Korea) software programme to obtain multiplanar reconstructions.

The expected path for placement in the preimplant site had contained the corresponding angulation of the adjacent mandibular and opposite maxillary teeth. The distance on that path of placement was measured from the upper most edentulous ridge to the superior cortical layers of the mandibular canal.

Results
The largest mean difference between 2 imaging modes was 1.7±1.11 mm. There were significant differences between panoramic and CBCT methods (P<0.05) for the prediction of the path for implantation.

Conclusions and discussion
The expected possible distance for implantation was different between two imaging modes. Injury to the mandibular canal could happen according to the selected imaging modes.
Chondrosarcoma of temporomandibular joint: a case report in a child
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Introduction
Chondrosarcoma is a malignant cartilaginous neoplasm that resembles synovial chondromatosis. In the head and neck region, chondrosarcoma is uncommon, corresponding to 6.4% to 12% of all reported cases. The majority of patients with chondrosarcoma are in the third to fourth decades of life. A PubMed search showed that 20 cases had been reported up to 2008.

Case report
Herein we report the case of an 11 year-old girl referred to an Oral Disease Center presenting a preauricular swelling on the right side and normal ENT evaluation. The patient was healthy. Discrete pain and mild limitation of mouth opening were observed. Panoramic radiography, computed tomography (CT), ultrasound, magnetic resonance imaging (MRI) revealed an osteolytic lesion in the right TMJ. The skull base and adjacent spaces were preserved but adjacent anatomic structures were displaced. After an incisional biopsy, the patient underwent high condilectomy. Microscopic findings showed a tumor exhibiting cartilaginous tissue proliferation with cellular pleomorphism, nuclear hyperchromasia and mixoid changes in the matrix. The immunohistochemical analysis of the expression of Ki-67 and Cyclin B1 proteins (cellular proliferation markers) revealed a very low cell index. The six years of clinical and imaging follow-up have shown no evidence of recurrence or metastasis, but signs of myofascial disorders could be observed.

Discussion
Cartilaginous lesions in the jaws must be regarded with suspicion, since benign and malignant lesions may show similar clinical features. To minimize misdiagnosis, we point out the importance of interdisciplinary treatment.

Dental age in patients with retained maxillary canines regarding position of the impacted teeth
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Introduction
In patients with retention of permanent canines moderate to severe tendency of retardation of dental development is observed.

Objective
To investigate the differences between dental age evaluated using the Demirjian’s method, in patients with retained maxillary canines impacted palatally and buccally, in comparison with controls without dental retention.

Materials and methods
The material consisted of clinical files and panoramic X-rays and of 122 children aged from 10 to 16, with retained maxillary canines in palatal position (group 1) and in buccal position (group 2) treated or followed-up in the Department of Orthodontics at Warsaw Regional Dental Centre in the years 1994-2004. Two control groups (group 3 and 4 including 122 children) were selected from the same database. Chronological ages of the patients were established, and their panoramic radiographs were examined, and tooth development of 7 left permanent mandibular teeth was assessed according to the Demirjian’s system on an eight-grade scale. The relationships between dental ages as well as calculated differences between dental and chronological ages between the 4 groups were analyzed.

Results
Mean dental age was lower in patients with retained maxillary canines (group 1+2) than in healthy controls (groups 3+4) (p=0.00002). When localization of impacted canines was taken into account, the mean ages were lower in both groups than in two control groups (group 1 < group 3, p=0.0002 and group 2 < group 4, p=0.0126). No differences in mean dental age was found between the two groups of patients with impacted canines (group 1 vs. 2, p=0.0711). Similar relationships were confirmed for the calculated differences between dental and chronological ages.

Conclusions and discussion
It was confirmed that mean dental age was lower in patients with retained maxillary canines than in healthy controls. No differences in mean dental age was found for patients with canines impacted in palatal or buccal position.
P5-17
The effects of premolar extraction on prediction factors of mandibular third molar eruption in orthodontically treated adolescents
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Introduction
Some authors believe that extraction of premolars in orthodontic treatment would ease eruption of mandibular third molars and reduce their impaction probability; as some others disagree with the presence of any relationship between the two. Lots of studies are published in literature but rarely different types of premolar extraction have been compared. That is why this research was designed to assess the effects of extraction type on the impaction patterns of developing lower third molar teeth.

Objectives
The main aim is to investigate changes in factors which may predict lower third molar eruption after orthodontic treatment with 1st/2nd premolar extractions in adolescents.

Materials and methods
162 lower third molars were selected randomly from ex-orthodontic patients. Four factors were measured on pre- and post-treatment panoramic views: third molars angle, mesial drift of lower molars, eruption space and eruption index. Magnification amounts were calculated and factored on each data, except for the angle. Data were analysed using SPSS software. Different statistical tests were used. P-values were calculated based on 95% confidence interval. Ethical committee approval was gained.

Results
Statistically significant differences occurred for all factors during treatment (P-values<0.001). The changes were slightly greater in the second premolar extraction group, among which only third molar angulation approached significance.

Conclusions and discussion
This shows that following orthodontic treatment with premolar extraction in adolescents with Angle Class I malocclusion, mandibular molars moved markedly forward, eruption space significantly increased, eruption index approached one and finally the angle of lower third molars improved into a more upright position. Although differences between the two groups were not statistically significant, a greater upright third molar which occurred in the 2nd premolar group might clinically be considerable.

P5-18
Validation of trabecular bone density profile at potential implant sites as a simple and accurate predictor of bone quality
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Introduction
Different studies have measured HU bone density using different methodological approaches, with use of different software based on axial DICOM or reformatted images to assess bone density. A density scale, rather than absolute values, would be more flexible and accurate to categorize bone quality, as a diagnostic predictor as it would accommodate the “gray zones” between the bone groups, which exist due to standard deviations. The study aims to validate a simple, accurate and easily accessible interactive CT software tool for bone density analysis in potential implant sites.

Objectives
1. To assess the trabecular bone density measurements of potential implant sites made on axial DICOM images and reformatted cross-sectional images.
2. To correlate mean HU density profile with bone densities in HU measured on axial & cross-sectional images in the same sites & with bone quality classifications made according to the classification of Lekholm and Zarb.

Materials and methods
Computed tomographic (CT) examinations of 80 patients with 150 potential implant sites in the maxillae and mandible were selected. Trabecular bone density was evaluated using rectangular ROI with Dental CT (Syngo Dental, Siemens Ltd, Erlangen, Germany) on axial DICOM images, and with OnDemand3D software (Cybermed inc, Korea) on reformatted cross-sectional images. HU Bone density profile measurements were made at three different sites in each potential implant site. 2 examiners subjectively evaluated bone quality. Descriptive statistics, between- and within-group comparison, correlation analysis were used for data analysis.

Results and discussion
The results and discussion will be presented at the IADMFR Congress 09.
Comparison of panoramic and conventional cross-sectional tomography for preoperative selection of implant size
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Introduction
No consensus exists on which type of radiographs should be included in the treatment planning procedure for dental implants. The goal is to choose a radiographic method providing sufficient diagnostic basis for the evaluation with the least possible radiation dose and costs for the patient.

Objectives
To compare panoramic and conventional cross-sectional tomography for preoperative selection of implant size for three implant systems.

Materials and methods
Presurgical panoramic (Pan) and conventional cross-sectional tomograms (Tomo) of 124 implant sites in 121 patients scheduled for single-tooth implant treatment in the maxilla or mandible were evaluated by three observers with the intent to select the appropriate implant size. Seventy implant sites were recorded with a metal ball placed in the edentulous area. By means of computer software, an implant with subjectively determined proper dimensions for the respective site was outlined by manually placing four reference marks on the digital image. Additionally, four reference marks corresponding to the margins of the metal ball (when present) were manually placed.

The length and width of the implant were calculated after calibration to the reference ball (true magnification) in 70 of the Pans and according to a “standard” calibration method (magnification factor 1.25 in Pans and 1.7 in Tomos) in all images. Based on the adjusted dimensions, implants with relevant size were selected among those available in a given system.

Results
When comparing Pans with Tomos, implant size differed in 89% of the cases on average for the implant systems and calibration methods. The length differed in 69% and the width in 66%. For all regions, 30% of the implants were narrower in the tomograms, but in the posterior regions it was less than 10%. One implant system differed significantly from the other two systems when using “standard” calibration and for this system only, a significant difference was found between the calibration methods.

Conclusions and discussion
Implant size differed considerably between Pan and Tomo in this study; however, future studies are needed to verify whether preoperative cross-sectional tomography has an impact on the success of implant treatment.
The difference of the movement of the mandibular condyle between transcranial and panoramic TMJ radiographs

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Introduction
The transcranial radiograph provides the lateral aspects of the mandibular condyle and temporal component, and panoramic radiograph does the mesial aspects. Some panoramic machines provide an improved image of the TMJ, such as condylar movement.

Objectives
To evaluate the difference of the movement of the mandibular condyles between transcranial and panoramic TMJ radiographs.

Materials and methods
Thirty-four paired transcranial and panoramic TMJ radiographs were used. On both radiographs, the distances from the most superior point of the mandibular condyle to the most inferior point of the articular eminence of both sides at closed and maximum opening state were measured. Differences between matched pairs were analyzed by paired t-test, with significance established at P<0.05.

Results
At closing state, the mean distance measured on panoramic TMJ radiographs was longer than transcranial radiographs (0.85 mm at right side, 1.20 mm at left side). But at maximum opening state, the mean distance on transcranial radiographs was longer (1.00 mm at right side, 0.62 mm at left side) than panoramic TMJ radiographs.

Conclusions and discussion
Although there is a weakness that can’t show the exact distance of condylar movement, panoramic TMJ radiographs may be used to assess the movement of the mandibular condyles similar to transcranial radiographs.

Diagnostic accuracy of cone beam computed tomography and conventional spiral tomography in sheep mandibular condyle fractures

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Introduction
Management of mandibular condylar fractures which account for 21% to 52% of all mandibular fractures still pose a real challenge in maxillofacial traumatology.

Objectives
The objective of this study was to compare diagnostic reliability and validity of cone beam computed tomography (CBCT) and conventional spiral tomography (CT) in artificially created fractures of sheep mandibular condyle.

Materials and methods
49 complete dead sheep head were used in this study. Two surgeons created unilateral or bilateral fractures on the mandibular condyle. CBCT images were acquired by a NewTom 3G CBCT scanner (Verona, Italy) and CT imaging was done using Toshiba Aquillon Multislice CT scanner (Tokyo, Japan). Two pre-calibrated observers who were blind to the experiment were asked to determine the following criteria on tomographic images: presence or absence of fracture, type of fracture, anatomic location, type of displacement and angle of displacement. Inter and intra observer agreements were calculated with kappa statistics. Sensitivity, specificity and accuracy measurements were done using Mc Nemar test.

Results
The animal model used in this study has proven to be reliable as kappa coefficients of intra- and inter-observer agreement varied between 0.61-1.00 which was classified as substantial and almost perfect. There was no significant differences between imaging modalities which were both sensitive and specific for the diagnosis of condylar fractures. Reconstructed 3D images allowed better visualization of fracture sites.

Conclusions and discussion
Our study confirms that CBCT is comparable to conventional CT in the diagnosis of condylar fractures. Furthermore, CBCT is significantly cheaper and it uses a considerably lower radiation dose when compared to conventional CT. However, since the usage of this system is currently limited to the maxillofacial region, the practical versatility of a high-end conventional CT seems to be a major advantage over CBCT which should not be underestimated.
Significance of calibration of radiographs with a reference metal ball in preoperative selection of implant size
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Introduction
Use of a metal marker of known dimensions as a reference to calculate the "true" size distortion in a certain area of a radiograph has been suggested. However, no previous study has evaluated the significance of using such a reference marker in implant size selection during treatment planning.

Objectives
To evaluate the impact of a reference metal ball for calibration of periapical and panoramic radiographs on the preoperative selection of implant size for three implant systems.

Materials and methods
Presurgical digital radiographs (70 panoramic, 43 periapical) of 70 patients scheduled for single-tooth implant treatment in the maxilla or mandible, recorded with a metal ball placed in the edentulous area, were evaluated by three observers with the intent to select the appropriate implant size. Four reference marks corresponding to the margins of the metal ball were manually placed on the digital image by means of computer software. An implant with subjectively determined proper dimensions for the respective site was also outlined by manually placing four reference marks. The diameter of the metal ball and the unadjusted length and width of the implant were then calculated. Implant size was adjusted according to a "standard" calibration method (SCM; magnification factor 1.25 in panoramic images and 1.05 in periapical images) and according to a reference ball calibration method (RCM; true magnification). Based on the unadjusted as well as the adjusted implant dimensions, implants with a relevant size were selected among those available in a given implant system.

Results
On average for the 3 systems, when comparing SCM and RCM with unadjusted implant dimensions in periapical radiographs, implant size changed in 42% and 58%, respectively. When comparing SCM and RCM, implant size changed in 24%. For panoramic radiographs, comparing SCM and RCM changed implant size in 48%.

Conclusions and discussion
The use of a reference metal ball for calibration of periapical and panoramic radiographs when selecting implant size during treatment planning might be advantageous.

Orthopantomogram can find asymptomatic carotid artery calcium: verification of the detection rate and correlation with the severity confirmed by dental CT imaging
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Objectives
The purpose of this study was to elucidate the frequency of calcification in carotid artery wall on CT images and to assess the correlation between results of CT imaging and orthopantomography.

Materials and methods
Valid plain CT images were obtained from 1619 adult persons who received some dental treatments in our dental hospital. We defined a region around the carotid artery with a density more than 90 HU as a calcification. We calculated the total area and volume of the calcification. We classified the calcifications into three groups according to the calcium score. In addition, we evaluated every orthopantomogram in 478 patients with calcification confirmed by CT imaging.

Results
Of all 1916 subjects 559 (34.5%) had the carotid calcification. Median calcium volume was 63.2 mm³. Number of persons with high, moderate, and slight calcification were 71, 101, and 286, respectively. Of 218 valid orthopantomograms comparable with calcification confirmed by CT image, 107 (49.0%) had carotid calcifications. The detection rate of high calcification by orthopantomogram was 100%, and calcification >100 mm³ calcium was 93.0%.

Conclusions and discussion
This study suggests the usefulness of orthopantomogram as a screening tool to detect carotid calcifications. The fact that orthopantomography could find more than 50% of the persons with <100 mm³ calcified lesions indicates the potential to have early diagnosis of asymptomatic carotid stenosis with carotid calcification, and to bridge dental practice to the treatment of cerebral stroke.
P5-25

CBCT for diagnosis of the unerupted teeth
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Introduction
CBCT is a new diagnostic method for precise imaging of anatomical relationships in the dento-alveolar region. Therefore we decided to apply it for diagnosis of unerupted teeth instead of commonly used periapical, occlusal radiographs and DPT.

Objectives
To present our experience with CBCT imaging in treatment planning of unerupted teeth.

Material and methods
CBCT imaging was used for diagnosis of 5 patients, with unerupted teeth in the front region of the maxilla. Scans with NewTom 3G were performed prior to surgery and orthodontic treatment.

Results
We were able to assess localization, position, morphology of the enerrated teeth and adjacent dentition.

Conclusion
CBCT is useful diagnostic tool in treatment planning of the unerupted teeth.

P5-26

Evaluation of masseter muscle metabolism by 31P-MR spectroscopy and Doppler ultrasonography

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Introduction
Phosphorus-31 magnetic resonance spectroscopy (31P-MR spectroscopy) is used to assess muscle metabolism. On the other hand, Doppler ultrasonography (Doppler US) provides non-invasive information about blood flow and internal architecture in the muscle. Therefore, Doppler US also is likely to be a useful imaging method for evaluating muscle metabolism.

Objectives
To assess whether Doppler US is useful for evaluating the masseter muscle metabolism as well as 31P-MR spectroscopy.

Materials and methods
Five subjects were examined by both 31P-MR spectroscopy and Doppler US before, during and after clenching. Ratio of Pi / PCr in 31P-MR spectroscopy is measured. Alteration of Pi / PCr ration before, during and after clenching was analyzed. Blood flow area on Doppler US images during and after clenching were measured. Echoes distribution in the masseter muscle was analyzed on B-mode US.

Results
Ratio of Pi / PCr decreased during clenching and was recovered after clenching. Recovering of Pi / PCr ration was associated with blood flow area on Doppler US images.

Conclusions and discussion
It was considered that Doppler US findings mirror masseter muscle metabolism.
Clinical significance of oral conditions in progressive systemic sclerosis
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Introduction
Progressive systemic sclerosis (PSS) is a relatively rare condition characterized by the excessive production and deposition of collagen within tissue. This condition is thought to be immunologically mediated and, in addition to its cutaneous manifestations, often involves multiple organs. Oral and maxillofacial commitment has been described, but its diagnosis/prognosis meaning has not yet been established.

Objectives
The aim of this observational case-control study was to evaluate the degree of mouth opening, salivary flow, periodontal ligament space, jaw bone resorptions (angle, ramus, coronoid process and head of the mandible), and to investigate possible associations between these changes and systemic commitment of PSS patients.

Materials and methods
Twenty nine adults with PSS, diagnosed according to the criteria of the American College of Rheumatology and 29 assymptomatic adults matched by gender and age range (1:1) with PSS group were evaluated. Clinical and radiographic (panoramic and periapical) examinations were performed. Interexaminers agreement for subjective radiographic interpretation was evaluated.

Results
The PSS group showed mouth opening and salivary flow significantly reduced compared to the control group (p <0.01) and the periodontal ligament space was wider in patients with PSS (p = 0.012). It was not possible to identify differences between the two groups regarding bone resorption. Interexaminer agreement was high for subjective radiographic interpretation except for the widening of the periodontal ligament space. There was no association between widening of the periodontal ligament space and severity of the disease, but it was found between widening of periodontal space and capillaroscopy.

Conclusions and discussion
Despite the fact that differences between oral and systemic changes were found, more specific studies must be performed to confirm the diagnosis and prognostic value of these changes.

POSTER SESSION 6 - POSTER 6 IMAGING: CT MICRO-CT, OTHERS, DIAGNOSTICS: CARIE, ENDODONTICS, PERIODONTOLOGY, MISCELL.
THURSDAY 2 JULY 2009

P6-1
Tooth loss and reason of tooth extractions in the elderly patients
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Objectives
The aim of this study was to evaluate the level of edentulousness and the pattern of reasons of tooth extraction in a group of elderly patients attending a Dental School in the North of Turkey.

Material and methods
The study group of this study were 498 patients (243 men and 255 women), aged 60 years and over, who have attended the University of Ondokuz Mays, Dental School between 2003-2005 for routine dental treatment. Personal information, clinical details and extracted teeth were obtained from patients records. The number of teeth per person were evaluated from first diagnostic panoramic radiographs. The results were evaluated with Mann-Whitney U test and the number of tooth for each subject was compared in the manner of lower and upper jaw and gender difference was evaluated by chi-square test.

Results
109 (21.9%) patients were totally edentulous. The mean number of the teeth in dentate patients (78.1%) was 15.51 for per patient (15.41 for men and 15.61 for women). The total number of teeth extracted was 463 with a mean of 1.19 teeth per patient. Periodontal disease was given as the reason for 36.28 per cent. Analysis by tooth type showed that incisors were the most common tooth type extracted.

Conclusions
Both caries and periodontal diseases were the main reasons for tooth extraction in the North of Turkey. Although in many studies regarding edentulous subjects some information may be obtained, as far as we are concerned secure reports may only be obtained from studies done in Finland, Sweden, England, and USA. These countries have the medical records about the past 40 years. The identified aim by WHO in 1992 was that 80 years old will still have 20 teeth. This study was undertaken to evaluate how far this part of our country is in reaching this aim. Although the number of teeth in the elderly subjects may be acceptable more or less, the ratio of edentulous subjects was found to be high in comparison to above named countries.
P6-2

3-D in vitro imaging of root canal system
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Introduction
Medical imaging has progressed greatly since the last 30 years. In endodontic in vitro studies, new technologies and modalities were explored to assess root canal geometry and anatomical changes after canal preparation. X-ray microtomography constitutes one of these modalities which allows to obtain three-dimensional images of canal geometry before and after an endodontic treatment.

Objectives
The aim of this study was to develop a 3-D reconstruction method applicable to hard and soft dental tissues. This paper provides in vitro study to illustrate the usefulness of 3-D reconstruction for evaluation of complex dental (endodontic) anatomy and to assess root canal geometry and changes after endodontic preparation.

Materials and methods
Two steps have been used to obtain root canal images: image acquisition and three-dimensional (3-D) reconstruction.

Acquisition: The specimens (freshly extracted human maxillary and mandibular molars) have been scanned, before and after root canal shaping. Acquisitions have been realized using a high resolution microtomography scanner, Skyscan1072 (Micro Photonics Inc, Allentown, PA, USA).

3-D Reconstruction: Three major steps have been involved by this generic task: 1) data filtering; 2) delineation and registration of the 3-d shape of the ROI (regions of interest); and 3) mapping measurements over these shapes. The second step, i.e., 3-d image segmentation and registration, has been performed using commercial software, AMIRA (Indeed Visual Concepts, Berlin, Germany).

Results
Three-dimensional images of the root canal have been obtained, and the assessment of the anatomical changes (volumes, surfaces,...) done. Volumes and surface areas and canal axis for each canal before and after preparation have also been calculated. Changes after endodontic preparation were calculated for each canal before and after canal shaping.

Conclusions and discussion
This methodology seems to be a very adequate in vitro endodontic methodology to explore root canal geometry and to assess anatomical changes.

P6-4

Predictors for marginal bone loss on tooth level – a radiographic study
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Introduction
Longitudinal information on marginal bone loss in Denmark is scarce. The prediction of marginal bone loss of a tooth, and identification of risk factors for marginal bone loss is of great importance.

Objectives
To predict marginal bone loss on tooth level in Danish adults during a five-year period.

Materials and methods
In 1997, 616 randomly selected individuals (mean age: 42 years, range: 21-63 years) underwent a full-mouth radiographic survey consisting of 14 periapicals and two bitewings. In 2003, the survey was repeated in 473 of the same individuals (239 females and 234 males). The radiographs were used to measure marginal bone level of each tooth in mm from the cemento-enamel junction to the marginal bone. The periapical status was assessed by the Periapical Index (PAI). Coronal restorations (crowns, fillings) and endodontic treatment were also recorded on the radiographs. Smoking status was registered through a questionnaire.

Linear mixed model regression analysis with both inter- and intra-individual variation was used to determine the predictors for the marginal bone level in 2003. Potential predictors included both person-specific variables and tooth-specific information from the registrations in 1997. The regional Committee of Ethics had approved the study.

Results
Individual variables (number of teeth <21, smoking and mean marginal bone level in 1997) and tooth-related variables (presence of crowns, apical periodontitis and the marginal bone level of the tooth in 1997) were all identified as predictors for marginal bone loss in the period between examinations. Moreover, it was shown that second molars in the upper jaw had the highest risk of bone loss and canines in the upper and lower jaw the lowest risk of bone loss. The analysis also showed that men had a slightly higher risk of bone loss than women, but this tendency was not statistically significant (p=0.06). Fillings and endodontic treatment were not predictors for marginal bone loss.

Conclusions and discussion
Both individual as well as tooth-related factors were predictors for marginal bone loss in a five year period. The prediction of marginal bone loss for teeth through identification of risk factors may be an important clinical tool for dental practitioners.
Detection method of proximal dental caries using line profile from radiograph image
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Introduction
Dental caries is known as a decay process on the tooth surface where acid was formed from food and attached by streptococcus mutans. The images from dental caries are available in digital format and it makes computer-based analysis possible.

Objectives
The purpose of this study is to investigate how to detect proximal caries using a line profile and validate linear measurements of proximal caries lesions by basic digital manipulation of radiographic images.

Materials and methods
Radiographs of the control group (15) and carious teeth (15) from patients are used. For each image, the line profile at the proximal caries-susceptible zone is calculated.

Results
To evaluate the contrast as a function of line profile to detect proximal caries, a difference coefficient (D) that measures the relative difference between caries and sound dentin or intact enamel was defined. Mean values of D is non-caries to 0.0354 (SD: 0.0153) and D of caries to 0.2632 (SD: 0.0982) (p<0.001).

Conclusions and discussion
It is demonstrated that the mean value of D from caries group was higher than that of control group. From the result, values of D possess great potentiality as a new detection parameter for proximal dental caries.

Effect of explaining the radiographic information to the patient before third molar surgery
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Introduction
Before removal of a lower third molar the patient must be informed about the course of the operation, the risks and benefits of the surgery and what to expect postoperatively. This information can be supplemented with explaining the radiograph to the patient. The effect of explaining the radiographic information on patient satisfaction has not previously been evaluated.

Objectives
1) To compare patient satisfaction with the preoperative information before and after explaining the radiograph; 2) to compare patient satisfaction with the radiographic information when based on a digital image or a conventional image as well as an extraoral or intraoral image.

Materials and methods
301 patients were given preoperative information by one of two trained scholar students before removal of a lower third molar. The patient was explained the course of the surgery and possible postoperative complications and risks. The patients rated their satisfaction with the information on a 100-mm visual analogue scale (VAS). Thereafter, the patient was explained the radiographic information concerning the third molar, and any additional risk factors were pointed out. After this additional information the patients rated their satisfaction on a new VAS. Paired t-test was used to compare patient satisfaction before and after the radiograph information was given. Grouped t-tests were used to compare satisfaction with the radiographic information when this was based on digital or conventional images and intraoral or extraoral images.

Results
There was no significant difference in patient satisfaction scored before (mean VAS=92.0 mm) and after (mean VAS=91.5 mm) the radiographic information was explained (p=0.43). No difference in satisfaction was found between patients who were shown digital (N=236) compared to conventional (N=56) images or between patients who were shown extraoral (N=196) compared to intraoral (N=105) images (p>0.5).

Conclusions and discussion
This study showed that no additional patient satisfaction was obtained by showing and explaining the radiograph to the patient before lower third molar surgery. If the dentist still wishes to show the patient the radiograph, the type of the image is not important.
Quantitative assessment of radioisotope uptake in mandibular condyles by Single-photon emission computed tomography (SPECT)
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Introduction
Unilateral condylar hyperplasia may lead to marked changes in face and occlusion. Therefore, the method of determining side-to-side differences in condylar activity is an important step in management of this condition.

Objectives
To determine the growth activity in mandibular condyles, and to devise an index of side-to-side differences in condylar activity in different individuals.

Material and methods
Thirty eight patients ranging from 13 to 34 years who were undergoing skeletal scintigraphy for a variety of conditions agreed to participate in this study. No subjects were found to have clinical or radiographic signs of mandibular hyperplasia. After injection of 25 mci TC-99 the uptake by the right and left mandibular condyles was measured and the side-to-side differences were used to calculate an index.

Results
The maximum side-to-side difference was 6.2 per cent (Left side versus Right side: 53.1 per cent and 46.9 per cent, respectively) in the male patients and 5.7 per cent in the female patients (Right side versus Left side: 52.85 per cent and 47.15 per cent, respectively).

Conclusions and discussion
The variation in the growth activity of normal right and left condyles was less than 6.2 per cent. This index serves to be a superior guideline to determine mandibular asymmetry. Our finding which was a maximum side-to-side difference of 6 percent in the uptake of isotope is comparable with the 6 and 12 per cent differences reported by others. For example, Pogrel and coworkers reported that the side-to-side variations in uptake were always less than 10 per cent and Hodder and coworkers reported a difference of 6 per cent between two normal condyles.

Radiological evaluation of the effects of mandibular wisdom teeth removal to the periodontium of the adjacent second molar
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Introduction
The presence of wisdom teeth is a common radiological finding in adults. In most cases the extraction is due to therapeutic or preventive reasons. The post-extraction effect on the periodontium of the adjacent second molars is a controversial topic in the current literature.

Objectives
The aim of this study is to fully present clinical cases through a series of intraoral radiographs that depict the effect of wisdom teeth extraction to the periodontium of the adjacent second molars.

Materials and methods
25 patients with 29 mandibular wisdom teeth extractions were selected. The teeth were either impacted or semi-impacted and were surgically extracted. The patients had a clear medical history and no postoperative complications. Radiographic evaluation was performed with parallel technique, prior to the extraction, immediately postoperatively and at a 3 and 6 months recall time.

Results
In 27 of the 29 cases there was bone regeneration distal to the second molar. In 2 cases there was no bone regeneration 6 months after the surgery. The authors believe that the difference in these two cases was due to poor oral hygiene or local factors that could effect the periodontal condition of the patient (eg fillings).

Conclusions and discussion
Overall there seems to be a bone regeneration tendency in patients with good oral hygiene though there is a big controversy in the literature. The requirements from our radiological findings to achieve adequate bone regeneration are good oral hygiene in the distal surface of the second molar and the elimination of all predisposing local factors.
Comparison of micro-CT and histology as gold standards in caries diagnosis
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Introduction
In research histological sections of extracted teeth are used as a gold standard for radiographic caries diagnosis. However, fewer teeth are being extracted and the preparation of histological sections is very time consuming. This comprises the use of histology as a gold standard. Micro-CT scans seem a promising alternative to histological sections, especially because the teeth are not cut down in slices.

Objectives
The aim of the study is to compare histology and micro-CT as gold standards for radiographic caries diagnosis. This study was performed to clarify the accuracy of micro-CT and to determine whether micro-CT could replace histological sections as gold standard in radiographic caries diagnosis.

Materials and methods
In this study 32 teeth were used. A micro-CT scan was made from every tooth and afterwards the teeth were sectioned for histological evaluation. The histological sections were photographed using a microscope. The photographs and the micro-CT images were presented to six observers. The observers digitally measured caries depth in millimetres.

Results
The results show high numbers of correlation and low absolute differences between measurements from observers for the two methods under investigation. A small difference between measurements on histological sections and micro-CT scans can be related to the fact that discolouration does not necessarily reflect the degree of demineralization.

Conclusions
Micro-CT scans can replace histological sectioning of teeth for assessment of lesion depth as a gold standard in 'caries studies'.

Comparative study on Romanian and Polish dentists attitude towards digital radiology and CBCT
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Objectives
To investigate the dentists' attitude towards digital radiology and CBCT in the biggest two Eastern European countries, Poland and Romania and to determine dentists' reasons, willingness and problems occurred in using digital radiology.

Materials and methods
A questionnaire was distributed among 300 dentists from Poland and Romania in 2008 and 2009. The replies were evaluated to determine dentists' knowledge on digital sensors and their opinion on the current and future status of digital intra-oral radiology. Dentists knowledge on CBCT and the proportion of dentists currently using CBCT images in both countries was also analyzed in this study.

Results
The results of the present study indicated that the number of dentists using digital imaging systems increased in 2009 in both countries comparing to our last study on this topic ( 2007) even the proportion of dentists with minimum knowledge on digital sensors is still big. Cost of equipment and lack of knowledge on IT equipment were indicated as significant obstacles by a substantial proportion of responding dentists.

Conclusions and discussion
Digital X-rays systems are considered more efficient then conventional film because they are time saving, give better image quality, low radiation dose and increase patient satisfaction.
Orbital fractures associated with skull, facial massive and brain lesions

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Purpose
To evaluate CT correlations between anatomical forms of orbital fractures and the gravity of the concurrent facial, skull and cerebral traumatic lesions and to underline the benefits of spiral CT followed by bi- and three dimensional reconstruction, in marking the bone loss and used for therapy guidance.

Material and method
352 patients were analysed retrospectively, with complex trauma of the facial massive, explored by CT between January 2005 and December 2008, in the Radiology Department from the Emergency Hospital "Prof. Dr. Nicolae Oblo" Iaşi. All exams were made with a Philips Aura CT, using spiral protocols including 1mm slices with 1,5 mm pitch, followed by 2D (MPR, MIP) and 3D reconstructions of the images.

Results
Axial spiral sections followed by 2D and 3D reconstructions of the images allowed us to specify the orbit fracture type and the concurrent facial, skull and brain lesions. Most frequent associations were met between inferior orbit rebord (n=76), ceiling orbit fractures (n=68), internal orbit wall (n=68), external orbit wall (n=100) and other facial massive fractures. Superior orbit border fractures were associated with frontal intracranial traumatic lesions, and the orbit apex fractures were accompanied by a large variety of traumatic brain lesions: 35 patients with brain contusions, 29 cases with brain lacerations, 28 patients with brain hematoma, 30 cases with extradural hematoma, 26 cases with subdural hematoma, 29 patients with arachnoidian haemorrhage and 12 cases with intracranian air collections.

Concluions
The quick and precise evaluation of traumatic lesions involving orbit, skull and brain CT spiral examinations, followed by 2D and 3D reconstructions of the images, turned out to be the best technique in all crano-facial traumatic emergencies examinations. All patients with orbit fractures have to be explored using spiral CT because the majority has associated lesions involving the skull, the brain, intraorbital tissues and the optical nerve which has to be treated.
**P6-15**

**Cemental tear: report of cases**

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**Introduction**

Cemental tear means detachment of a cemental fragment from the root surface. Aetiologic factors that lead to tearing of cementum are not known, but most frequently suggested causes are excessive occlusal force, previous trauma, and aging. Cemental tear has been considered to be one of the potential factors in localized rapid periodontal breakdown because there are greater losses of attachment on the site of the tear as compared with intact root surface. The exact incidence is not known yet, but it is thought there were many cases remaining undiagnosed.

**Case Report**

We report cemental tears on cervical areas and lateral root surfaces that have a pricklylike structure with suspicion of detachment of cementum from the root surface. They showed a tendency to happen on a tooth with a single root and related to relatively severe alveolar bone loss.

**Discussion**

We could suggest that cemental tear can be one of the causes of localized rapid alveolar bone loss.

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**P6-16**

**Flow phantom study on visualization of arteries in maxillofacial region by phase contrast MR angiography**


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2 Faculty of Dentistry, Tokyo Dental College, Chiba, Japan;
3 Oral and Maxillofacial Radiology, Tokyo Dental College, Chiba, Japan;

**Introduction**

MR angiography is commonly applied to evaluate intra-cranial vascular and cervical carotid arterial disease. Phase contrast MR angiography (PC-MRA) is an MR angiography technique.

**Objectives**

The purpose of this flow phantom study was to obtain primary data on visualization of arteries in the maxillofacial region by PC-MRA.

**Materials and methods**

A 1.5T MR unit and a maxillofacial surface coil developed by our department were used to obtain all MR images. Two-dimensional PC-MRA images of the flow phantom were obtained at a VENC of 10, 8, 6, 4, 2, and 1 cm/sec. The flow phantom consisted of silicon tubes with an internal diameter of 4, 2, and 1 mm, and a pump system. Each tube was flowed with 6 mol/L CuSO₄ solution at a flow rate of 10, 8, 6, 4, 2, or 1 cm/sec. Contrast-to-noise ratios (CNR) were calculated for all magnitude images and analyzed. Moreover, two observers evaluated the clarity of the tube in each image.

**Results**

The CNR for the 4 mm tube was the highest at all VENCs. The CNR decreased with decrease in the internal diameter of the tube. The minimum tube size and flow rate at which detection was possible were 1 mm and 1 cm/sec, respectively.

**Discussions and conclusion**

The direction of blood flow in many arteries in the maxillofacial region is parallel to the axial plane of the body, and the flow rate may be low. PC-MRA offers the advantage of strong sensitivity to flow parallel to the slice plane. In this study, the minimum tube size and flow rate detected on the PC-MRA images were 1 mm and 1 cm/sec, respectively. This indicates that PC-MRA is very capable of depicting narrow arteries with low flow rates. However, this technique still requires many clinical trials and modification. In conclusion, PC-MRA is a useful technique in visualization of the arteries in the maxillofacial region.
**P6-17**

**Hinge axis in a teleostean depressible tooth revealed by MCT**

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**Introduction**

Micro CT designed for small-sized experimental animals is now an indispensable tool in studies of comparative anatomy, but its significance or potential usefulness is not yet sufficiently documented.

**Objectives**

A hinged depressible tooth was examined in both its ordinary upright and fully tilted positions to identify hinge axis and to dissect microanatomy of the tooth and pedestal bone involved specifically in rotation around the axis.

**Materials and methods**

An unfixed, fresh mandible with teeth and mucosa of a teleost, angler fish (*Lophius litulon*), was scanned by a micro X-ray CT system (R_mCT; Rigaku, Tokyo, Japan) with the exposure of 90 kV, 150 µA and slice intervals at 0.16 mm. Tomograms and their 3D rendering images were examined closely using I-View software (J.Morita, Kyoto, Japan).

**Results**

A tooth depressed posteriorly was tilted onto the lingual mucosa at an angle of about 44° from its original upright position. The axis for rotation was not in the lingual fibrous ligament but found at the posterolateral shoulders of the pedestal bone. The shoulders articulated bilaterally with the tooth base at about one third from its flattened posterior border, which protruded backward away from the hinge axis and provided an attachment site for lingual ligament.

**Conclusions and discussion**

By utilizing micro CT technology, a hinge axis for the depressible tooth was confidently identified at the location slightly anterior to the previously predicted (Fink, 1981). The anatomy of the posterior border of the tooth base appeared specialized to accept a wider fibrous ligament which would exert springiness for the recovery of tooth position.

**P6-18**

**Establishment of TMJ puncture technique in rats using in vivo micro CT (R_mCT)**

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**Introduction**

Drug-induced temporomandibular joint (TMJ) osteoarthritis animal models are extensively used in physiological, biochemical and histological studies. However, to the best of our knowledge, there are no reports on an intra-articular puncture technique for the TMJ in rats.

**Objectives**

The objective of this study is to establish a puncture technique for the TMJ cavity in rats.

**Materials and methods**

Experimental samples comprised 16 male Sprague-Dawley rats (age, 8 - 9 weeks; body weight, 250 - 350 g). Under the general anesthesia, the upper joint cavity of the rat was punctured either laterally (lateral puncture technique (LPT), n = 11) or anteriorly (anterior puncture technique (APT), n = 4) using a 27-gauge needle. After the tip of the needle was confirmed by micro computed tomography (micro-CT) (R_mCT, Rigaku, Tokyo, Japan) as located on the mandibular fossa, 0.05 ml of contrast media was injected under micro-CT fluoroscopic guidance. Upon confirmation that the joint cavity was filled with contrast media, CT imaging was carried out.

**Results**

Accurate injection of the contrast media into the joint cavity was achieved in 5 of the 11 rats for LPT and in 4 of the 4 rats for APT. An average of 20 minutes was needed to complete puncturing in the LPT compared to approximately 2 minutes for the APT. Furthermore, the APT demonstrated improved preservation of the needle; it was harder to detach the needle which led to greater stability.

**Conclusion**

The results suggest that the APT assisted by micro-CT is vital for research involving drug injection into the TMJ cavity of rats.
Video fluoroscopic assessment of residual food bolus in the pharynx—an in-vitro study using an artificial oropharynx-
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Introduction
In the clinical dynamic video fluoroscopic swallow study (VFSS) of patients with swallowing disorder (dysphagia), it was frequently seen that the residue of food to the valley which is formed by the base of the tongue and the epiglottis. The residue on the epiglottic vallecula occurs followed by an involuntary food bolus slid down on the base of the tongue before starting the swallowing reflex. It has been thought that this creates the risk of aspiration. Therefore we designed an in-vitro VFSS simulation system.

Objectives
A simulation VFSS to observe the movement of test foods and liquids in the oral-pharyngeal cavity was performed.

Materials and methods
Based on CT image data, an artificial oropharyngeal model was made using 3D modeling (rapid processing) technique. We prepared four test foods for VFSS simulation. Then we poured them and analyzed the ratio of the residue, the time distance of the test food slipping down, the area of residual foods in the lateral and the frontal images, and the gray value density of the image.

Results
The higher viscosity food flowed slowly down the base of the tongue, and more residues occurred because it flowed as a mass. On the other hand, as liquids flowed rapidly and diffusely less of it remained. Barium with food thickener, custard pudding and rice porridge slid down the slope as a bolus of food. On the other hand, as liquid barium flowed down speedy and makes a splash, the residue was small.

Conclusions and discussion
Results from the present study revealed that thickened boluses have a tendency to create a residue in the epiglottic vallecula. As liquid creates fewer residues, the risk of penetration to the larynx and aspiration is increased. This study shows that not only the lateral image but also the frontal image is important to evaluate the residual foods.
P6-22

The distribution of C-shaped root canal system in Korean population with CT image
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Introduction
C-shaped canals are known to present a complex canal anatomy, thus requiring supplementary effort to accomplish root canal treatment. Their prevalence is different for ethnic groups and especially high in Asian races.

Objectives
To investigate the incidence and prevalence of C-shaped root canals using CT images of head and neck in the Korean population.

Materials and methods
268 examinations consisting of serial axial CT images with 8 normal molars from the maxilla and from the mandible were selected and investigated. We defined the C-shaped root canal and we could get 82 proper image examples according to this definition. These were investigated with regard to the incidence and prevalence of C-shaped root canal.

Results
C-shaped root canals were found in 82 examples among 268(30.6%) and 147 teeth. The highest incidence was 37.41% of #37 tooth, and the lowest was 2.04% of #17 tooth. The prevalence related to tooth position was the highest in the mandibular 2nd molar, 65% of C-shaped root canals, and the lowest in the maxillary 2nd molar, 6%.

Conclusions and discussion
C-shaped root canals on randomly selected CT images made up 31%. The C-shaped root canal of the mandibular second molar was found most frequently and of the second molar of the maxilla most infrequently. In the Korean population, a C-shaped root canal is one of the conditions that need concern during dental treatment because it appears to have a relatively high prevalence.

P6-24

The role of contrast-enhanced magnetic resonance imaging in the diagnosis and characterization of maxillofacial fibrous dysplasia
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Introduction
Fibrous dysplasia is the more frequent polyostotic lesion of the facial bones. Differential diagnosis with other similar lesions can be particularly difficult when imaging doesn’t show highly specific patterns, such as ground-glass.

Objectives
Our purpose is to evaluate if contrast-enhanced (c.e.) Magnetic Resonance Imaging (MRI) may help in differentiating benign from malignant lesions.

Materials and methods
We performed c.e. MRI in 19 patients with a suspected maxillo-facial fibrous dysplasia observed on a previous CT/MR examination without contrast injection. All patients underwent percutaneous or surgical biopsy within two weeks after MRI to have a definitive histopathological diagnosis.

Results
In nine cases, lesions showed limited or no enhancement: histological diagnosis was a fibrous dysplasia with a pagetoid pattern in seven cases and a sclerotic pattern in the other two. In six cases with a moderate and homogeneous c.e. at imaging a pagetoid fibrous dysplasia was diagnosed. Four cases with irregular and/or inhomogeneous c.e. revealed to be aggressive or malignant lesions (aggressive fibrous dysplasia, multiple myeloma, mixed low-grade fibrosarcoma).

Conclusions and discussion
The evidence of an irregular and/or inhomogeneous c.e. at MRI in maxillo-facial fibrous dysplasia indicates wider vascularization and biological activity, and may suggest the presence of a malignancy or malignant changes within the dysplastic lesion. In these cases biopsy is necessary for a correct diagnosis, with the possibility of targeting samplings to areas with greater enhancement.
The influence of image filters of digital radiography on the results of measurements of root canal widths
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Introduction
Digital radiography is widely used in dental practice therefore application of available image postprocessing tools should be studied and optimised.

Objectives
To evaluate the influence of digital radiographic image filters on the results of measurements of root canal widths.

Materials and methods
The material consisted of 36 digitized periapical radiographs of teeth with a single root canal. After calibration root canal widths were measured using Digora (Soredex) software with precision up to 0.1 mm at 5 levels: in proximity of the pulp chamber, in the middle of root canal, as well as 3 mm, 2 mm and 1 mm from root apex. There were used the digital image filters of the Dürr Dental software (S, P1, P2, P3, O and R – Noise Reduction) and of Archimed Suite CNS Imaging software (3D Effect, Detail, Enhance 2, Contour detection, Implant). The results of measurements using image filters were compared with those obtained in the Digora software that served as a golden standard. Statistical analysis was carried out using Statistica 6.0 for Windows software and the following tests: Shapiro-Wilk test, t-Student’s test, U Mann-Whitney test and Cochran-Cox test (α=0.05).

Results
Application of the majority of image filters did not influence the results of the measurements at the level of pulp chamber; while in case of filters P2, P3, O, R the results were significantly lower. Measurements in the middle of root canal length resulted in agreement between results obtained with filters and without filtering for filters S, P1, Enhance 2 and Contour detection, Implant. For the measurements at the distance of 3 mm from tooth apex the agreement was obtained for 2 filters only - Detail and Enhance 2. At 2mm and 1mm from the dental apex application of the filters Detail, Enhance 2, Contour detection and Implant impeded measurements in most of the cases while the other filters caused significant underestimation of root canal widths.

Conclusions
It was found that digital radiographic image filters had considerable influence on the results of evaluation of root canal widths, in many cases even hampered the measurements.

Visualization of inferior alveolar artery by phase contrast MR angiography
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Introduction
The inferior artery runs along the mandibular canal together with the inferior alveolar nerve. Ascertaining the location of the mandibular canal within the mandible is important not only in diagnosis, but also in surgical planning. However, poor depiction on radiographic images can make this difficult.

Objectives
The purpose of this study was to visualize the inferior alveolar artery using phase contrast MR Angiography (PC-MRA).

Materials and methods
A 1.5T MR unit and a maxillofacial surface coil developed by our department were used to obtain all MR images. Two-dimensional PC-MRA images of 5 healthy volunteers were obtained at a VENC of 10, 8, 6, 4, 2, and 1 cm/sec. Contrast-to-noise ratios (CNR) were calculated for all magnitude images and analyzed. The study protocol was approved by our institutional review board, and informed consent was obtained from all volunteers.

Results
The highest CNR was obtained at a VENC of 2 cm/sec in the mandibular ramus region, 1 cm/sec in the molar region, and 1 cm/sec in the premolar region.

Discussions and conclusion
A number of studies have investigated depiction of the mandibular canal by conventional MRI. However, to the author’s knowledge, none of these studies have used PC-MRA. In this study, the inferior alveolar artery was identified on 2-D PC-MRA images. This technique may be useful in surgical planning such as for tooth extraction or implantation. It may also be useful in diagnosing mass lesions within the mandibular canal and determining infiltration by malignant tumors. However, this technique has some limitations such as the long scan time required, and the difficulty of obtaining an appropriate slice position. In conclusion, 2-D PC-MRA is a useful technique in the visualization of the inferior alveolar artery.
Metallic artifact of orthodontic appliances on magnetic resonance images
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2Department of Orthodontics, Osaka Dental University

Introduction
In Neurosurgery Magnetic resonance imaging (MRI) became the regular examination for
the brain tumors. Orthodontic patients in their childhood could not be examined with
MRI, because of metal artifacts.

Object
We examined the metallic artifact of orthodontic appliances in MRI in this experimental
study. We tried to investigate the cause of the metallic artifact of the orthodontic
appliances.

Materials and methods
Materials were steel brackets, steel orthodontic wires and steel ligature wires, adapted to
study models. The MR images were taken with a 1.5 tesla super-conductive MR machine
using several sequences.

Results
The largest metallic artifact occurred in the images with adapted steel brackets, steel
wire and steel ligature. With only steel brackets, we found large metallic artifact. The
ceramic brackets and Ti materials did not create the large metallic artifacts.

Conclusion
We concluded that patients, with head and neck region being examined with MRI, should
not use steel orthodontic appliances.

Analysis of apical root resorption by means of digital subtraction
radiography and conventional radiography
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Introduction
Apical root resorption refers to the loss of cementum and dentin from the apical part of
the root that sometimes extend to the pulp. This resorptions appear in conventional
radiography when mineral loss reaches 40%; in digital subtraction radiography is capable
of localizing a lesion with 1-5% mineral loss.

Objectives
The aim of this study was to compare the accuracy of conventional radiography and
digital subtraction radiography to diagnose apical root resorption.

Material and methods
In this study 20 extracted human anterior teeth with intact roots were collected. The
teeth were fixed between the X ray tube and CCD sensor and radiographic films. Direct
digital image and conventional images were obtained before and after each lesion was
created by ½, 1.2, 4 round dental bur on the apical part of the roots. Then digital
subtraction images and conventional images were obtained and observers evaluated all
of images. Sensitivity and specificity and accuracy were analysis.

Results
The results showed that the sensitivity of digital subtraction was 97.24% and the
sensitivity of direct digital images was 92.65% and for conventional images was 89%.

Conclusion and discussion
Digital subtraction radiography was superior to direct digital radiography and
conventional radiography in detecting apical root resorption.
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