ICDMFR 2021

The 23rd International Congress of DentoMaxilloFacial Radiology

in conjunction with

The 53rd Annual Scientific Meeting of KAOMFR

April 28 Wed - May 1 Sat, 2021

Kimdaejung Convention Center, Gwangju, Korea

Abstract Book

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DENTISTRY

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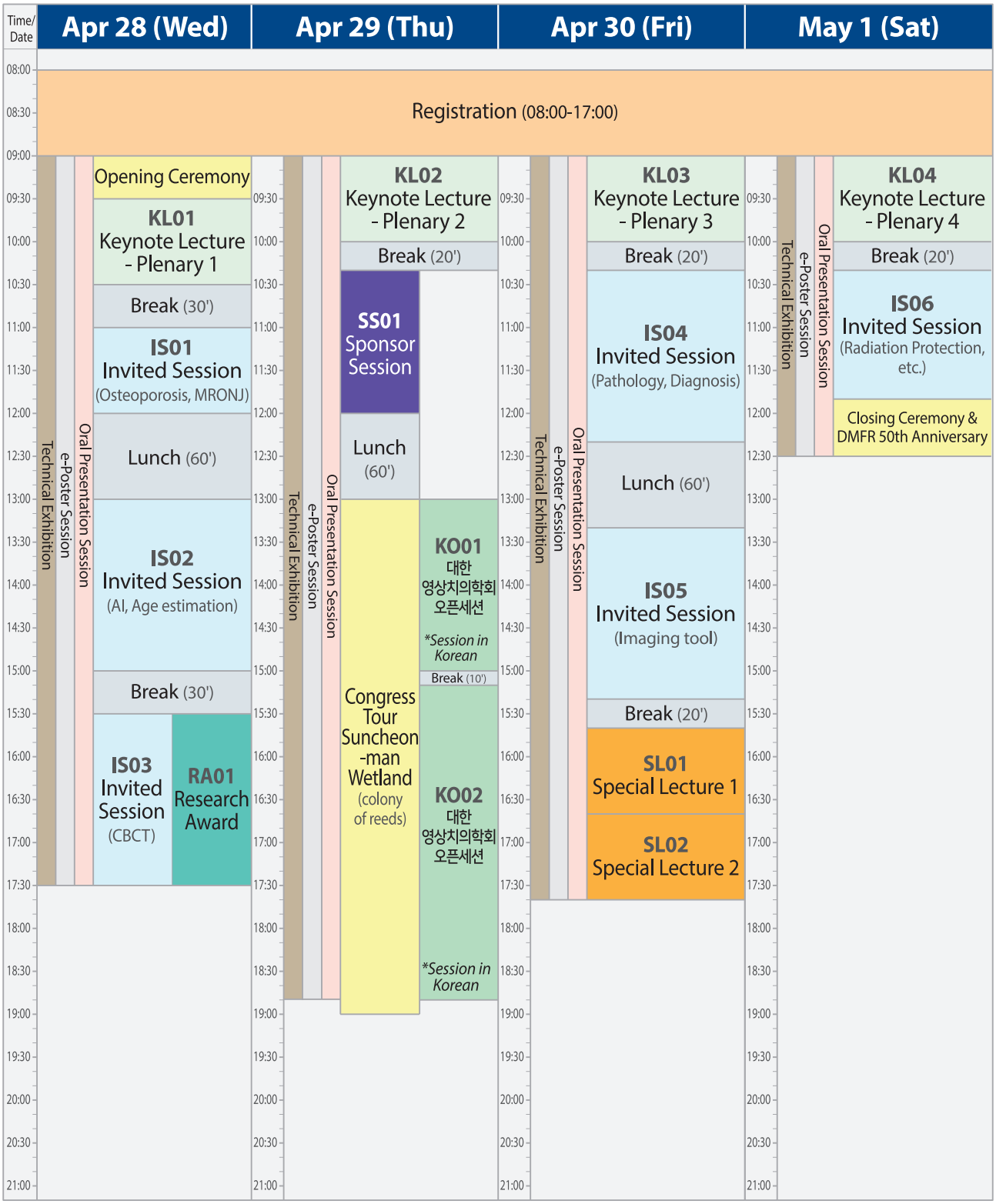
Program at a Glance



***Board Meeting : April 27(Tue) 20:00-24:00 (KST) / 13:00-17:00 (CET)*
***General Assembly : April 30(Fri) 20:00~(KST) / 13:00~(CET)*

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CONTENTS

2021
Gwangju
KOREA
2021.04.28 - 05.01

ICDMFR 2021 The 23rd International Congress of DentoMaxilloFacial Radiology
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Keynote Lecture

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Keynote Lecture

KL 01

Oral and maxillofacial malignancy with various faces

Kyung-Hoe Huh[1*]
[1] *Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea*

Abstract
Many malignancies arise in the oral and maxillofacial region and they present various phenotypes. Early detection and correct diagnosis of them are very important for patients' prognosis and their quality of life. However, we often face lesions with indeterminate imaging features which are somewhere between benign and malignant tumors. Cases of malignant tumors that were mistaken for infection or benign tumors will be presented and key imaging features regarding influence on the surrounding anatomic structures, including perineural spread and denervation atrophy, will be discussed.

Imaging features of hematopoietic malignancy will also be discussed. As leukemias and Burkitt's lymphomas can manifest first in the oral and maxillofacial region, oral and maxillofacial radiologists should not overlook the need to carefully recognize changes in bone marrow space other than changes in bony crypt of the tooth follicles and lamina dura.

In clinical setting, we sometimes experience discrepancies between imaging features and histopathology. Various diseases that caused such a situation in our institute will be introduced along with several cases, where the wrong surgery or treatment was performed due to a misdiagnosis at the initial presentation.

The anatomy of the head and neck is very complex and knowledge of anatomy is imperative for oral and maxillofacial radiologists in order to accurately localize the tumor and its relationship to adjacent structures and to make the correct diagnosis. Next to the development of metastases, infiltration and resultant spread of cancer into the adjacent structures are the most reliable features that differentiate malignant from benign tumors. The lecture will give an overview of the various patterns of spread in head and neck malignancies with special emphasis on imaging anatomy.

KL 02

"You'll learn" - words from a mentor

Sharon L Brooks[1*]
[1] *Department of Periodontics and Oral Medicine, University of Michigan, USA*

Abstract
I have worked as a Dentomaxillofacial Radiologist for a long time, starting with teaching my first radiology course in 1978, continuing through a long career in academia until I retired from the University of Michigan in 2010, moving on to a private practice opportunity with BeamReaders since then - and I'm not finished yet! Along the way I have had opportunities to be a student, a teacher, a lecturer, a researcher, a clinician, a committee person, an author, a manuscript reviewer, a journal editor, an officer in a professional organization, a mentee, a mentor, a world traveler, a speaker of a second language, a studier of other languages to a lesser degree, a guest, a host - and, I hope, a friend to many. Outside of my professional life I have been a daughter, a wife (I still am, after 55 years of marriage), a sister, an aunt, a volunteer in ecological research projects, a hiker, a cross-country skier, a scuba-diver, a marathon-walker, a bird and animal watcher, a cat lover - and, I hope, a friend to many. In this keynote address I want to talk about how I got where I am today and share what I've learned along the way with the members of this wonderful organization, especially the young people who are in the early stages of their careers. I also want to recognize my first mentor, Professor H. Dean Millard, my first department chairman at the University of Michigan, and the words of wisdom he gave me one day when I felt that I did not know enough to teach the class he assigned to me: "You'll learn." Those words are simple but had a profound effect on my career. I hope they will on yours too.

Keynote Lecture

KL 03

The artificial wonders of planning and printing

Reinhilde Jacobs[1*]
[1] *Department of Imaging & Pathology, KULeuven, Belgium*

Abstract
Digital dentistry goes hand in hand with dental imaging. During the last decade, imaging has started to play a more dominant role in daily practice, not only in relation to radiologic diagnosis, yet and surely also in relation to surgical and treatment planning. These changes may create a need to redefine the role of dentomaxillofacial radiologists within the dental team. This digital evolution may also require to reconsider education and training. Digital imaging may even revolutionize oral healthcare by the introduction of artificial intelligence and its potential for education, diagnosis and treatment planning.
We need to wonder how AI can help to reshape dentistry of the future.

KL 04

Importance of dentomaxillofacial radiographic examinations for patients with systemic diseases.

Masahiro Iikubo[1, 2*]

[1] *Division of Dental Informatics and Radiology, Tohoku University Graduate School of Dentistry, Japan*

[2] *Perioperative Oral Care Support Center, Tohoku University Hospital, Japan*

Abstract

The links between oral and general health have been increasingly recognized over the past two decades. There is mounting evidence that oral condition contributes to infectious complications following surgery, such as postoperative pneumonia or surgical site infection. In Tohoku University Hospital, the Perioperative Oral Care Support Center was established to provide oral care for hospitalized patients in 2015. Currently, I am the director of both the Perioperative Oral Care Support Center and the Division of Oral and Maxillofacial Radiology. I examine the oral condition and radiographic images of patients who are hospitalized to receive medical treatment, such as surgery, chemotherapy, and radiation therapy. I would like to explain the role of our center in the hospital and present some cases where I strongly felt the importance of taking radiographic reading by the dentomaxillofacial radiologist before medical treatment.

It is well known that some systemic diseases are caused by oral diseases. On the other hand, partial symptoms of systemic disease often appear in the mouth. Dentomaxillofacial radiologists should acquire knowledge regarding the relationship between oral diseases and systemic diseases due to the susceptibility of jaw bones to genetic and hormonal influences. Hence, I would like to present these cases that indicate an interactive relationship between systemic diseases and oral diseases, and introduce my basic research developed from such cases.

I am looking forward to discussing with everyone about the importance of the dentomaxillofacial radiographic examinations for patients with systemic diseases.

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Special Lecture

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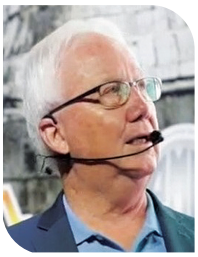
Special Lecture

SL 01



Detection of undiagnosed type II diabetes on cone beam CT images

Dale Allan Miles[1*]
[1] *Private Practice, Fountain Hills, Arizona, USA*

Abstract
In 2017, the Centers for Disease Control (CDC) reported that there were more than 120 million U.S. adults had Type II Diabetes Mellitus (T2D) or were pre-diabetic. Worldwide diabetes is a public health epidemic with 463 million living with the disease (International Diabetes Foundation). Dentists have many patients with this disorder visit their practices. In addition to carotid plaques seen on panoramic radiographs, there is now way of detecting these more serious calcifications called MAC (medial arterial calcifications) on CBCT images; that is, if you know where to look and what you're looking for.

Early detection of T2D helps the patient's primary care physician diagnosis and could, in some cases, save the patient's life. Early detection will also enhance the quality of the patient's life and possibly prevent many below the knee amputations. Dr. Miles will review some of the key radiographic features of T2D we should look for in our images and give you the tools to enhance their detection.

Objectives
At the completion of this program dentists will understand:

- Where to look for calcifications in the various segments of the internal carotid and other arteries
- How to separate intimal plaques and MAC on both panoramic and CBCT images
- The importance of an appropriate referral of patients with these detected calcifications

SL 02

Cone beam CT: How did it all start?

Yoshinori Arai[1*]
[1] *Department of Oral and Maxillofacial Radiology, Nihon University School of Dentistry, Japan*

Abstract
The mathematical theory of Computed Tomography came from J. Radon in 1917. It was declared that whole projection data sets were needed to reconstruct Computed Tomography images. Therefor Limited Cone Beam Computed Tomography (CBCT) was impossible under the theory of J. Radon.

In this paper I discover how to reconstruct Limited CBCT images under a new theory. This theory was shown that Limited CBCT images can be reconstructed, if the objects were high contrast such as teeth and bone, and the images did not require CT values. At the Same time, it was shown that Limited CBCT cannot reconstruct low contrast object such as soft tissue.

However, Limited CBCT is now very popular in dental practice. Because everyone knows that Limited CBCT had low radiation dose and high resolution.

I would like to introduce this mathematical theory and some episodes when I developed the Limited CBCT in 1990s.

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Invited Session

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Invited Session

IS 01-1

Recommendations and perspectives about osteoporosis screening in general dental practice

A. Taguchi[1*]
[1] *Department of Oral and Maxillofacial Radiology, School of Dentistry, Matsumoto Dental University*

Abstract
Fragility fracture associated with osteoporosis is an immense burden worldwide. Those are associated with an increased risk of subsequent fractures, a higher rate of mortality, and incremental medical costs. Incidental findings, which include some measurements related to the mandibular inferior cortex and the alveolar trabecular bone pattern of the mandible determined on panoramic radiographs, are considered to be a useful tool for identifying asymptomatic individuals at risk of having osteoporosis and/or fragility fractures.

Based on a worldwide literature survey, I present the following clinical recommendations. Postmenopausal female dental patients with a mandibular inferior cortical width (MCW) of less than 3 mm on panoramic radiographs may be at risk of having low skeletal bone mineral density (BMD) or osteoporosis, but not fragility fractures. Additionally, those with a severely eroded mandibular inferior cortex may have an increased risk of having low skeletal BMD, osteoporosis, and fragility fractures. The alveolar trabecular bone pattern of the mandible might be useful for identifying female dental patients at risk of having fragility fractures, although further investigation is necessary to confirm this possibility.

If incidental findings determined on panoramic radiographs are used for identifying individuals, especially postmenopausal females, at risk of having low skeletal BMD, osteoporosis, and fragility fractures, these may be useful tools to reduce the incidence of the first fracture, resulting in a reduction in the secondary fractures, medical costs, mortality, and morbidity associated with osteoporotic fractures, without incurring additional costs. Several recent studies also show that the diagnostic efficacy of computer assisted diagnosis (CAD) and/or artificial intelligence (AI) in identifying asymptomatic individuals with osteoporosis was acceptable. Since panoramic radiography is rapidly shifting to a digital system, the application of CAD and/or AI to digital panoramic radiographs in osteoporosis screening may proceed in the near future.

IS 01-2

MRONJ: The biology of the disease and imaging the biology

Sanjay M. Mallya[1*]
[1] *Section of Oral and Maxillofacial Radiology, University of California Los Angeles, USA*

Abstract
Medication-related osteonecrosis of the jaws (MRONJ) is necrosis of bone that develops associated with anti-resorptive or anti-angiogenic therapy. This presentation will discuss the pathogenesis of this disease and currently accepted diagnostic criteria. It will review the current state of application of imaging in diagnosis and treatment planning of MRONJ, including radiologic appearances and their practical implications. Finally, it will highlight knowledge gaps that could potentially benefit from the study of the imaging appearances of this disease.

Invited Session

IS 02-1

Artificial intelligence: What does it mean for maxillofacial radiology and dentistry?

D. Tyndall[1*], M.Hamdan[1], F. Huang[2], L Huang[1]
[1] Division of Diagnostic Sciences, University of North Carolina Adams School of Dentistry, USA
[2] Graduate Endodontic Program, University of North Carolina Adams School of Dentistry, USA

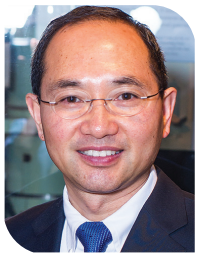
Abstract
This presentation is designed to provide information, stimulate discussion, and generate research ideas, on the developing technology of artificial intelligence, specifically deep learning, as applied to maxillofacial radiology and dentistry. The presentation will assess the current state of deep learning research and its usefulness in the interpretation of 2D and 3D images and other tasks related to radiological information. The focus will not be on the technical details of deep learning and its constituent components. Instead, the discussion will center on deep learning as applied to radiological interpretation and image dependent tasks such as treatment planning and procedure risk assessment.

For radiologic interpretation, research on dentoalveolar disease assessment and jaw lesion detection in 2D images and 3D volumes will be considered. Identification of potential lesions on 3D volumes is of considerable importance as CBCT usage is rising in many areas of the world. For this reason, deep learning is imperative, as most clinicians using 3D imaging are not sufficiently trained in interpretation. In addition, research in identification of potential lesions in MDCT, MRI and ultrasound will be considered as a component of maxillofacial radiology practice now and in the future.

Deep learning research as applied to treatment planning, improved workflow and risk assessment will be presented and assessed. Benefits or threats because of deep learning applications to the practice of maxillofacial radiology and dentistry will also be weighed.

Research based on ground truth is scarce as most standards consist of consensus panels, some with experts and some without. Most experts agree that optimum deep learning research will be based on studies employing ground truth, were practical, multiple imaging systems and collaborative institutions producing the most broadly generalizable results. Finally, consideration will be given to the best approach for facilitating such research amongst maxillofacial radiologists around the world.

IS 02-2



Machine learning and artificial intelligence in oral and maxillofacial imaging analysis

Jie Yang[1*]
[1] *Division of Oral and Maxillofacial Radiology, Temple University Kornberg School of Dentistry, USA*

Abstract
Nowadays artificial intelligence (AI) and the ability of machines to learn from experience and perform tasks once only done by humans have become a reality. Facial recognition, autopilot, imaging analysis and other AI technology have all possibilities to enrich and improve human lives.

Osteoporosis is a major health problem in the United States and afflicts more than half of American population aged 50 and above. Unfortunately, the current gold standard measured by the dual energy X-ray absorptiometry, is not convenient and suitable for routine patient care due to the cost effect. Previous studies have shown that trabecular microarchitecture and bone quality change affect jawbone image appearances both in vitro and in vivo.

To investigate the potential of AI machine learning models for prescreen of this disease, we have designed both traditional learning models based on support vector machines and deep learning models with multi-task architecture. The proposed models have been evaluated on data sets containing both normal and osteoporosis patients. In the leave-one-out cross-validation evaluation, our method can reach an overall accuracy of 92% for osteoporosis prescreening, showing the potential of learning-based methods for imaging analysis of osteoporosis.

Invited Session

IS 02-3

Age estimation and the role of dental imaging

Apirum Janhom[1*]
[1] *Division of Oral and Maxillofacial Radiology, Faculty of Dentistry, Chiang Mai University, THAILAND*

Abstract
Age estimation can help establish the age of an individual, narrow down the search for a missing person, and identify deceased persons. Age estimation is also important in jurisdictional and legal cases. Teeth are used in the age estimation process because of their uniqueness and their durability. Many methods have been developed for age estimation in both living and deceased individuals. Age estimation using radiographic tooth development is found to be a more accurate method because it is mainly genetically influenced and less affected by nutritional and environmental factors in comparison with physical and skeletal maturity indicators. Dental imaging can be used to gather information regarding the developmental stages of teeth, information that has been shown to have a correlation with chronological age. The aim of this presentation is to present the role of dental imaging in dental age estimation methods that have been specifically developed for the Thai population and may be applicable to other ethnic populations. These methods can be easily achieved using panoramic or pariapical radiographs. A review of some methods used in age estimation using dental radiographs will be presented, including age estimation from seven mandibular teeth from panoramic radiographs, age estimation from mandibular third molars, and how an artificial intelligence program can help in a semi-automated method to facilitate age estimation in young adults.

IS 02-4

Artificial intelligence and deep learning in dentomaxillofacial radiology

Kaan Orhan[1,2*]
[1] *Department of Dentomaxillofacial Radiology, Ankara University, Turkey*
[2] *Medical Design Application and Research Center (MEDITAM), Ankara University, Turkey*

Abstract
Artificial intelligence (AI) in healthcare is the use of algorithms and software to approximate human cognition in the analysis of complex medical data. Specifically, AI is the ability for computer algorithms to approximate conclusions without direct human input. What distinguishes AI technology from traditional technologies in health care is the ability to gain information, process it and give a well-defined output to the end-user. AI does this through machine learning algorithms, which can recognize patterns in behavior and create its own logic. This lecture explains the basic principles of deep learning and its application in radiology, discusses technical requirements, and presents examples of successful application of deep learning techniques in dentomaxillofacial radiology.

Keywords
Artificial intelligence, deep learning, machine Learning, CBCT, MRI

Invited Session

IS 03-1

How CBCT can enhance diagnosis

David Stanislaw MacDonald[1*]
[1] *Department of Oral Biological and Medical Sciences, University of British Columbia, USA*

Abstract
CBCT has been used in dentistry for just over two decades. Initially it was applied to pre-implant planning, but since then it has become an indispensable tool in the assessment of patients for endodontic and orthodontic treatment. Although a voluminous literature has developed over that time, much of it simply outlines its use rather than evaluating its clinical value, namely its efficacy with regards to diagnosis and treatment, particularly in endodontics. The use of CBCT in the assessment of impacted maxillary canines by using different reconstructions is reviewed. The invaluable contribution of CBCT to the diagnosis and/or further assessment of lesions arising in the face and jaws will be addressed in the presentation.

IS 03-2

The role of CBCT in endodontics-bridging basic research and clinical application

Ming-Gene Tu[1,2*]
[1] *School of Dentistry, China Medical University, Taichung, Taiwan*
[2] *Department of Dentistry, China Medical University Hospital, Taichung, Taiwan*

Abstract
Radiological examination is an essential part of the diagnosis and management of endodontic disease. Radiological examination is usually limited to two-dimensional periapical images. CBCT images could provide essential information of the three-dimensional anatomy of the tooth/teeth and adjacent anatomy. CBCT scans reveal extra anatomy, relationships of structures, traumatic fractures, missed canals, resorptions, instrumentation-related issues such as perforations and help during treatment complications. Accurate measurements can replace certain working images and thus make up for the higher radiation patients receive during a CBCT scan. In this presentation, we will share some root morphology studies in Taiwanese population by using CBCT images. Furthermore, some endodontic retreated, calcified, internal or external root resorption cases which were accomplished in good results by CBCT for its relevant sagittal, coronal and axial slices of the area's information. CBCT may become standard of care for some therapies, but it is not necessary for every root canal treatment.

Invited Session

IS 03-3

Patient motion as a challenge in CBCT-quality: what do we know in 2021 and which solutions are foreseeable?

RKW Schulze[1*], S Niebler[2], E Schoemer[2], U Schwanecke[3]
[1] Department of Oral and Maxillofacial Surgery, Section of Oral Radiology, University Medical Center of the Johannes Gutenberg-University Mainz, Germany
[2] Institute of Computer Science, Johannes-Gutenberg University, Germany
[3] Computer Vision & Mixed Reality Group, RheinMain University of Applied Sciences, Germany

Abstract
A CBCT-volume is generated by a process termed „backprojection" which is a simplified inversion of the projection process for the multitude of 2D-projection radiographs that are acquired for the reconstruction process. Backprojection relies on accurate knowledge of the imaging geometry for each and every projection radiograph. Under the assumption that the patient does not move at all this imaging geometry is known from machine specifications. However, research over the last decade has demonstrated I) that more or less all patients move to some extent over the scanning time of several seconds an ii) that this motion induces motion blur (unsharpness) or even typical artefacts. Both effects significantly reduce quality of the reconstructed CBCT-volume. Measures to reduce patient motion include head and chin rests as well as other devices to fixate the patients' head during image acquisition. In addition, head motion can be tracked by external (e.g. optical) markers fixed to the patients' head. From the tracking the true image geometry can be inferred and this knowledge can be used for a motion-corrected backprojection process. Other measures to a posteriori correct the volume include implementation of general sharpness criteria in the sense of an optimization process which eventually produces a "best-fit"-volume.
The lecture summarizes the current knowledge on patient motion during CBCT-scans and on measures to i) reduce such motion and ii) to a posteriori correct for its' effects on image quality.

IS 03-4

The current issue of CBCT utilization in Indonesia.

Menik Priaminiarti[1*], Inka Saraswati[1]
[1] Department of Dental and Maxillofacial Radiology Faculty of Dentistry Universitas Indonesia, Jakarta, Indonesia.

Abstract
Since its introduction in Indonesia in 2008, CBCT has gained an important role in the Dento-Maxillofacial Radiology community as well as in Dentistry as general.

The lack of DMFR experts as a radiologist to interpret CBCT data and utilize it to its optimum functionality has been one of the problems in Indonesia nowadays. During the last few years, we gained professional recognition among other fields in dentistry, not only by always trying to put forward professionalism as a DMF radiologist but also emphasizing our specialty in CBCT.

This also, in turn, has led our professional association to be formally acknowledged by the Nuclear Energy Regulatory Agency of Indonesia as one of the key institutions in regulation development. This lecture will seek how CBCT gave remarkable change and explain the potential that it can offer to the future of DMFR professional community in Indonesia, as one of the largest developing countries in Asia.

Invited Session

IS 04-1

MRI protocols based on the clinical manifestations of the patien with TMJ dysfunction

Adalsa Hernandez[1*]
[1] *Department of Dentomaxillofacial Radiology, Hospital Clinica Felix Boada, University of Zulia, Venezuela*

Abstract
Craniofacial pain reflected in the TMJ frequently makes it difficult to determine the exact etiology site, since hemifacial pain and limited mouth opening might be common manifestations of temporomandibular dysfunction. Knowledge of clinical manifestations referred by our patient is our guide for the selection of suitable protocol for obtaining magnetic resonance images, allowing us to obtain accurate and reliable information.

IS 04-2

MRI characteristics of odontogenic tumors and cysts

Tohru Kurabayashi[1*]
[1] *Department of Oral and Maxillofacial Radiology,*
Graduate School, Tokyo Medical and Dental University, Tokyo, JAPAN

Abstract
A variety of tumors and cysts of odontogenic origin occur in the mandible and maxilla. The differential diagnosis of those is essential for treatment planning, and imaging plays an important role in this process. In recent years, CT has been widely used to image odontogenic tumors and cysts of the jaw, and has proved effective not only in evaluating their extent but also in establishing the differential diagnosis. On the other hand, MRI has not been routinely applied to those lesions. However, MRI can clearly show the contents of the lesion because of its excellent soft tissue resolution. Further, in addition to conventional MRI, diffusion-weighted MRI (DWI) and dynamic contrast-enhanced MRI (DCE-MRI) can be used as functional imaging techniques for assessing tissue biology. In particular, DWI, which quantifies the random motion of water molecules in tissues as the apparent diffusion coefficient (ADC), is reported to be useful in characterizing cystic masses of the jaw. For example, odontogenic keratocysts have been reported to show significantly lower ADC than unicystic ameloblastoma, reflecting the high viscosity of the fluid containing the keratinized material.

In my presentation, I would like to present representative MR images of several types of odontogenic tumors and cysts including ameloblastoma, odontogenic keratocyst, myxoma, fibroma and primary intraosseous carcinoma, and discuss MR imaging characteristics useful for the differential diagnosis.

Invited Session

IS 04-3

Image diagnosis and radiation therapy for tongue cancer

Shumei Murakami[1*]
[1] *Department of Oral and Maxillofacial Radiology, Osaka University Graduate School of Dentistry, JAPAN*

Abstract
For the radical treatment of tongue cancer, interstitial brachytherapy (ISBT) is often applied, because its result (local control rate) is high and it preserve functions and configuration of the tongue.

In our institute patients with tongue cancer have been treated by the high dose rate (HDR) ISBT with a remote after-loading system (RALS). Advantages of this method are 1) highly concentration of radiation dose, 2) adequate dose distribution by 3D plan using CT, and 3) no need for shielded ward.
The local control rates for tongue cancer by this method are 92% in T1 (< 2 cm) cases and 84% in T2 (< 4 cm) cases. And, we can prevent the osteoradionecrosis in the mandible as a late complication by using a newly invented protection device.

It is very important, however, to know the tumor location before the ISBT. We have now concluded that T2-weighted MRI with fat suppression is the best for detection of the tongue cancer.

In this lecture, the adequate imaging modality for tongue cancer and the technique and the treatment result of the RALS-HDR-ISBT and the radiation protection device of tongue cancer will be presented.

IS 04-4

Diagnosis of peri-implant bone disease- 2D or 3D?

Michael M. Bornstein[1*]

[1] *Department of Oral Health & Medicine, University Center of Dental Medicine Basel UZB, University of Basel, Switzerland*

Abstract

Current guidelines advocate intraoral radiographs to be taken when clinical examination is indicative of disease. However, conventional two dimensional (2D) intraoral radiographs lack buccal/lingual bone visualization, parallel projection might be difficult in some situations, and they frequently underestimate proximal peri-implant bone loss. Three dimensional (3D) imaging using cone beam computed tomography (CBCT) has become widely popular in dental mediciene over the last two decades. CBCT image quality varies with the device and technical parameters like field of view (FOV), voxel size, x-ray beam quality, image reconstruction parameters, and can frequently be compromised by artifacts. In implant dentistry, CBCT has mainly been used in the assessment of surgical sites prior to implant insertion or evaluation of post-surgical complications. Its performance in the diagnostic imaging of peri-implant bone loss is unclear. The objective this lecture is to provide an overview on the current use and available evidence regarding the diagnostic performance of CBCT in peri-implant bone loss diagnosis in comparison to 2D radiographs.

Invited Session

IS 05-1

The role of 3D imaging methods in digital dentistry

Arthur Rodriguez Gonzalez Cortes[1*]
[1] *Department of Dental Surgery, University of Malta, Malta*

Abstract
Digital workflow using computer-aided design and manufacturing (CAD-CAM) is spreading in Dentistry. Among the procedures involved are: digital impression with intraoral scanners, superimposition of DICOM and STL files for treatment planning, digital design of prostheses and their manufacture with milling machines and 3D-printers. Nevertheless, some details on the potential of CAD-CAM technology for diagnosis and treatment planning are still to be clarified. The aim of this lecture is to overview and discuss the applications of 3D-imaging methods (e.g. CBCT, intraoral and facial scanners) and their roles in the digital workflows related to the different specialties of dentistry.

IS 05-2

The diagnostic use of ultrasound in dentistry

Jo-Eun Kim[1*]
[1] *Department of Oral and Maxillofacial Radiology, Seoul National University Dental*

Abstract
Ultrasound imaging is non-invasive, has no risk of radiation exposure, and can be acquired in real time, making it relatively easy to use. However, the use of ultrasonography in the area of dentistry, where teeth and jaws are the main areas of interest, is not universal except in some countries. Ultrasound is most often used in the diagnosis of salivary glands and soft tissue in the cervical region. Ultrasound-guided interventional procedures have various restrictions, such as health insurance system, equipment, and the experience of the clinician, so their use is limited. In this session, this speaker intends to present the diagnostic use of ultrasound imaging in the maxillofacial area and the use of interventional procedures by sharing experiences through various cases. In addition, I would like to briefly introduce the newly applicable ultrasonic imaging technology and discuss about its potential.

Invited Session

IS 05-3

Videofluoroscopic assessment of function within DMFR

Eva Levring Jäghagen[1*]
[1] *Oral and Maxillofacial Radiology, Department of Odontology, Faculty of Medicine, Umeå University, Sweden*

Abstract
Several functions in the dentomaxillofacial (DMFR) region are crucial for life support and wellbeing e.g., breathing, chewing, swallowing and speech. For that, adequate function in the oral cavity, pharynx and the temporomandibular joint (TMJ) is necessary.

TMJ disorders can be examined with arthrography if there are contraindications for MRI or requests for assessment of e.g., real-time dynamic function or perforations in the disc or posterior disc attachment. Further, fluoroscopy can be used for precise administration of steroid injection in the TMJ.

Videofluoroscopy is also valuable for assessment of oral and pharyngeal function during speech and swallowing. Many patients suffer from dysphagia e.g., due to a stroke, head and neck cancer treatment, neurogenic diseases and, less well known, due to snoring. Aspiration with coughing and choking can be life-threatening and have a negative effect on quality of life, since eating, in addition to nutrition, is important for meals when people are socialising. An unintelligible speech can be a social problem since it makes it difficult to communicate. Velopharyngeal insufficiency during speech is commonly found among e.g., patients with cleft lip and palate.

Videofluoroscopy as method and some examples of assessments of function will be presented.

IS 05-4

Dental maxillofacial, head and neck Ultrasound – a beginner's guides, tips and pitfalls

Rose Ngu[1*]
[1] *Department of Dental Radiological Imaging, Dental Institute, King's College London, Guy's and St Thomas' Hospitals, United Kingdom*

Abstract
Ultrasound (US) is a non-invasive imaging technique that uses high frequency sound waves to visualise soft tissue, internal organs of the body and it is widely used in different part of the body. It is radiation free and safe.

The learning objectives of this lecture are:
1. Anatomy of the head and neck as seen on US.
2. Understanding how anatomy may aid diagnosis.
3. Commonest pathology in different level of the neck.
4. Differential diagnosis of lumps in different level of the neck.
5. Tips to aid diagnosis.
6. How to perform a US guided fine needle aspiration.
7. How to perform a core biopsy safely.
8. Pitfalls and limitation of US.
9. What do you need to set up your US department?

Invited Session

IS 06-1

Does accumulated radiation dose from dental X-ray examinations increase potential cancer risk?

Gang Li[1*]
[1] *Department of Oral and Maxillofacial Radiology, Peking University School and Hospital of Stomatology, China*

Abstract
It is well-known that radiation dose is accumulated. However, in clinics patient is usually asked to take a series of radiographs including panoramic, lateral and posteroanterior cephalometric radiographs, sometimes even a CBCT or CT scan in a very short period for orthodontic or orthognathic treatment planning and/or prognosis evaluation. Thus, whether the radiation dose accumulated in such a short time increases potential cancer risk becomes concern. The lecture aims to present a series of studies investigating the potential biological damage on such patients and provide a theoretical basis for the optimization of treatment process and radiation protection.

IS 06-2

Aspects of radiation protection in dentistry

Hidalgo A[1*]
[1] *Department of Stomatology, University of Talca, Chile*

Abstract
This lecture will provide information on the principles of radiation protection applied to dentistry, mainly focused in cone-beam computed tomography, along with recent research carried out in this field. Also, some aspects of practical application of the principles of radiation protection in Latin America, from an expectation vs reality perspective, will be discussed.

Invited Session

IS 06-3

Cephalometric assessment of eustachian tube parameters and their association with hearing status

Sunali Khanna[1*]
[1] *Associate Professor, Dept of Oral Medicine & Radiology, Nair Hospital Dental College,India*

Objective:
The assessment of middle ear function by radiological landmarks of the Eustachian tube (ET) region in Down's syndrome (DS), Otitis Media (OM) and control groups. The Eustachian tube length (ET length), Posterior Upper Facial Height (PUFH), Maxillary Depth (MD), Total Cranial Base (TCB), and S-Ba to ET length and S-Ba to Palatal line were compared in DS, Otitis Media and control groups.The hearing status was classified as Normal, Slight Hearing Loss (HL),Mild HL, Moderate HL, Moderately Severe HL and Severe HL.

Methods:
The study comprised of 75 subjects of both sexes in the age range of 7 to 20 years. Digital Lateral Cephalometry was performed for Trisomy 21, OM and controls (n=25). The Eustachian tube function was determined using the Pure Tone Audiometry and Immittance Audiometry.

Results:
ET length, PUFH, MD and TCB were found to be significantly reduced in the DS, OM and controls. S-Ba to ET length and S-Ba to Palatal line showed a marked reduction in patients with DS, OM and S-Ba to ET and S-Ba to PL and was significantly reduced in patients with B and C tympanograms.

There was a strong association between middle ear function and radiological landmarks in the study groups.
The acute angle of entry into the nasopharynx and the diminished tube size predispose to risk of Otitis Media. The Distribution of subjects with various hearing status in the three groups was statistically significant in the left as well as the right ears.

Conclusion:
Aberration in the dimension of the region of the ET can be considered as a predisposing factor for OM in Down's syndrome. Assessment of ET related parameters in OM and Down's syndrome is vital in analyzing the alteration in function and implementing preventive measures for decreasing the disability. Early identification and intervention coupled with regular re-evaluation of the audiological parameters before the onset of COM can help reduce the severity of the disability in the vulnerable groups. This is a pioneering study in the multidisciplinary field of radiology and audiology.

Key words:
Eustachian tube, Digital Lateral Cephalometry, Down's Syndrome, Chronic Otitis Media.

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Oral Presentation

READING AND LEADING DENTISTRY

Oral Presentation

O-003

Optimization of automated segmentation of neck lymph nodes on CT images of oral cancer patients using deep convolutional neural network

Atsutoshi Nakatani[1*], Iori Sumida[2,1], Hiroaki Shimamoto[1], Tomomi Tsujimoto[1], Ryoko Okahata[1], Minami Majima[1], Wiranut Kitisriworapan[1], Yuka Uchimoto[1], Seiki Tomita[1], Shumei Murakami[1,2]
[1] Department of Oral and Maxillofacial Radiology, Osaka University Graduate School of Dentistry, Japan
[2] Department of Radiation Oncology, Osaka University Graduate School of Medicine, Japan

Introduction
For the oral cancer patients the occurrence of the regional lymph node (LN) metastasis decreases a survival rate. The contrast-enhanced CT (CECT) plays an important role in a detection of the LNs, but it takes a long time and effort to scrutinize nearly 350 CT images per patient. Therefore, we aimed to perform the automated segmentation of neck LNs on CECT in oral cancer patients using convolutional neural network (CNN).

Materials and Methods
The subject were total 7,150 enhanced CT images that consist of axial images, reformatted coronal and sagittal images from 10 oral cancer patients with prominent LN swelling. To perform supervised learning, we created training data set with manual segmentation in organs (used as the ground truth) and trained it to increase accuracy. We adopted CNN based on U-net architecture and compared predicted images against the corresponding ground truth images. At the first trial, targeted organs were neck LNs only, secondly vessels were included and finally fat tissue were added on axial images.
At the next stage, the same processes were repeated on reformatted images.

Results
Predicted images showed a tendency to include adjacent structures such as vessels and fat tissue. After training with fat tissue and vessels, the predicted images showed marked improvement but not enough to separate LNs individually. Finally, the training with reformatted images achieved good results showing tendency to designating LNs more individually.

Conclusions
For precise segmentation of LNs, designating surrounding structures, especially fat tissue, is essential. And the reformatted images have advantages to identify neck LNs compared with axial images. And for further precise segmentation, voting method using multiple cross-sectional images to achieve higher availability and reliability seems promising.

O-004 *Research Award

A fused deep learning architecture for the detection of the relationship between the mandibular third molar and the mandibular canal

Cansu Buyuk[1*], Nurullah Akkaya[2], Belde Arsan[3], Gurkan Unsal[4,5], Secil Aksoy[4], Kaan Orhan[6,7]
[1] Dentomaxillofacial Radiology, Istanbul Okan University, Turkey
[2] Computer Engineering, Near East University, Cyprus
[3] Dentomaxillofacial Radiology, Istanbul Medeniyet University, Turkey
[4] Dentomaxillofacial Radiology, Near East University, Cyprus
[5] Research Center of Experimental Health Science, Near East University, Cyprus
[6] Dentomaxillofacial Radiology, Ankara University, Turkey
[7] Medical Design Application and Research Center, Ankara University, Turkey

Introduction
The present study aimed to generate a fused deep learning algorithm that detects and classifies the relationship between the mandibular third molars (M3) and the mandibular canal (MC) automatically on orthopantomographs (OPGs).

Materials and Methods
1880 OPGs that meet the inclusion criteria were selected. Two independent observers were annotated the MCs and M3s. Each labeled region was classified for the extent of the root tip of M3- MC overlap. The data were split into a training group (80%) and a testing group (20%). The proposed architecture is composed of the following steps: Each OPG is split into 256 by 256 patches. Each patch is segmented using a U-Net like architecture. Patches are combined to recreate the segmented OPG. From the segmented OPG left and right molars are isolated. A 256 by 256 image is cropped centered on each molar, left and right. Image augmentation is applied to further increase the number of samples for classification. Each patch is flipped on the horizontal axis. This segmented image from the above step is to run through a classification network based on AlexNet which results in the classification of inferior alveolar canal overlap. Accuracy, the weighted intersection over union score, and average dice score were used to calculate the performance of the model in comparison to the manual segmentation and the classification.

Results
Our segmentation network based on U-Net achieved a global accuracy of 0.99 and a weighted intersection over union score of 0.98, average dice score overall images was 0.91. Our classification network based on AlexNet achieved an accuracy of 0.78 across all images.

Conclusions
This study aimed to achieve a better segmentation and classification network by combining various AI models for the mandibular canal and the third molar detection on OPGs which can be used for preoperative surgical examination.

O-005 *Research Award

Performance of a convolutional neural network algorithm for teeth detection and numbering on periapical radiographs

Cansu Görürgöz[1*], Kaan Orhan[2], İbrahim Şevki Bayrakdar[3], Özer Çelik[4], Elif Bilgir[3], Alper Odabaş[4], Ahmet Faruk Aslan[4]
[1] Department of Dentomaxillofacial Radiology, Bursa Uludağ University, Faculty of Dentistry, Turkey
[2] Department of Dentomaxillofacial Radiology, Ankara University, Faculty of Dentistry, Turkey
[3] Department of Dentomaxillofacial Radiology, Eskişehir Osmangazi University, Faculty of Dentistry, Turkey
[4] Department of Mathematics and Computer Science, Eskişehir Osmangazi University, Faculty of Science, Turkey

Introduction
The present study aimed to evaluate the performance of a faster Region-based Convolutional Neural Network (R-CNN) algorithm for tooth detection and numbering on periapical images.

Materials and Methods
The data set of 1686 randomly selected periapical radiographs of patients were collected in the study. GoogLeNet Inception v3 faster R-CNN network implemented with TensorFlow library was used model development. Initially, upper jaw-lower jaw image classification model was developed. Then, 16-class object detection model for upper and lower jaws was developed. The upper-lower jaw and right-left-anterior region of the jaws were trained with 6 different models. From the estimation results of the trained models, the row of teeth with the highest probability of accuracy was determined and the remaining teeth were enumerated to reach the most accurate results.

Results
CranioCatch (Eskisehir, Turkey) was used as a deep CNN system for both detection and numbering of teeth on periapical images. Of 764 teeth in 156 periapical radiographs, 668 were correctly numbered in the test dataset. The F1 score, precision, and sensitivity were 0.8720, 0.7812, and 0.9867, respectively.

Conclusions
The study demonstrated the potential accuracy and efficiency of CNN algorithm for the detection and numbering of teeth. The deep learning-based methods can help clinicians in reducing workload and improve dental records. This architecture might also contribute to the forensic field.

O-006 **Research Award*

Preliminary evaluation of envisaged points to be used with artificial intelligence models – a pilot study

Hakan Amasya[1*], Turgay Aydogan[2], Emre Cesur[3], Nazan Kemaloglu[4], Mehmet Ugurlu[5], Ibrahim Sevki Bayrakdar[6], Kaan Orhan[7,8]
[1] Department of Oral and Maxillofacial Radiology, Istanbul University-Cerrahpasa, Faculty of Dentistry, Turkey
[2] Department of Computer Engineering, Suleyman Demirel University, Faculty of Dentistry, Turkey
[3] Department of Orthodontics, Medipol Mega University, Faculty of Dentistry, Turkey
[4] Information Technology Research and Application Center, Burdur Mehmet Akif Ersoy University, Turkey
[5] Department of Orthodontics, Eskisehir Osmangazi University, Faculty of Dentistry, Turkey
[6] Department of Oral and Maxillofacial Radiology, Eskisehir Osmangazi University, Faculty of Dentistry, Turkey
[7] Department of Oral and Maxillofacial Radiology, Ankara University, Faculty of Dentistry, Turkey
[8] Medical Design Application and Research Center (MEDITAM), Ankara University, Turkey

Introduction
This study aims to test the potential of the anatomical landmarks designated for a research related to hand-wrist maturation and machine learning, by preparing subset of sample with the envisaged points to develop temporary models and evaluate the results of the classification. Thus, the potential of the envisaged anatomical landmarks is evaluated with a pilot study to prevent any possible loss of time.

Materials and Methods
This study was conducted with 136 hand-wrist radiographs taken at the Medipol Mega University Hospital, Faculty of Dentistry, Department of Orthodontics. The relationship of the epiphysis and diaphysis were categorized as 'narrow', 'equal', 'capping' or 'fusion'. A total of 22 anatomical points is designated to be used in extracting the features of the DP3, MP3, PP3 and MP5 regions. A web-based system is developed for labeling of the data set. The samples are uploaded and labeled by three observers. 18 ratios and 15 angles were extracted and used to develop two different neural networks, NN-1 and NN-2. The percentage of agreement, Cohen's Kappa (cκ) and Weighted Kappa (wκ) coefficients are calculated to evaluate the results of the models.

Results
The cκ coefficients for the method error were in between 0.7 and 1. The compliance of the classification results and the data labels were changed between 82.14% and 89.29%. On average, NN-1 and NN-2 models were shown 85.71% and 85.52% performance in classifying the relationship of the epiphysis and the diaphysis. The cκ and wκ coefficients of the NN-1 model for each phalanx region changed between -0.01 and 0.91.

Conclusions
The anatomical points envisaged to be used in determining the phalanx morphology are found to be promising.

O-007

Very deep super resolution for efficient cone-beam computed tomographic image restoration

Jae Joon Hwang[1*]
[1] Oral and Maxillofacial Radiology, Pusan National University, South Korea

Introduction
As cone-beam computed tomography (CBCT) has become the most widely used 3-dimensional (3D) imaging modality in dental field, storage space and cost for large-capacity data became important issue. Therefore, if 3D data can be stored at a clinically acceptable compression rate, the burden on storage space and cost can be reduced and data can be managed more efficiently. In this study, a deep learning network for super-resolution was tested to restore compressed virtual CBCT images.

Materials and Methods
Virtual CBCT image data was created with publicly available online dataset (CQ500) of multidetector computed tomography images using CBCT reconstruction software (TIGRE). The very deep super resolution (VDSR) network was trained to restore high resolution virtual CBCT image from the low-resolution virtual CBCT image.

Results
The images by VDSR shows better image quality than bicubic interpolation in restored images at various scale ratio. The highest scale ratio with clinically acceptable reconstruction accuracy is 2.1 using VDSR.

Conclusions
VDSR showed a promising restoration accuracy in the study. In the future, it would be necessary to experiment with new deep learning algorithms and large-scale data for clinical application of this technology.

Oral Presentation

O-008

A comparative study on the subjective visual quality of periapical radiographs treated with deep-learning resolution improvement methods

Marcelo Daniel Brito Faria[1,2*], Luciana Freitas Bastos[1], Maira Beatriz Hernandez Moran[1,3], Larissa Aparecida Vaz Oliveira[1], Gilson Giraldi[4], Aura Conci[3]
[1] Dental Radiology Center, Policlinica Piquet Carneiro, Universidade do Estado do Rio de Janeiro, Brazil
[2] Faculdade de Odontologia, Universidade Federal do Rio de Janeiro, Brazil
[3] Instituto de Computação, Universidade Federal Fluminense, Brazil
[4] SVVR Laboratory, Laboratório Nacional de Computação Científica, Brazil

Introduction
This study evaluates the visual quality of periapical radiographs treated with three resolution improvement methods: Bicubic interpolation (widely used in commercial software), super-resolution convolutional neural network (SRCNN), and super-resolution generative adversarial network (SRGAN).

Materials and Methods
Five periapical radiographs were treated with each of the considered methods. The 15 treated images were evaluated by two observers, experienced dentists, considering the Mean Opinion Score (MOS). To compare the methods, we used the Visual Grading Characteristics (VGC) curve based on the MOS values. The area under the VGC curve, AUCVGC, for methods MA and MB measures the quality of images treated with them. The higher it is, the better is MB compared to MA. We considered these MA-MB pairs: Bicubic-SRCNN (P1), Bicubic-SRGAN (P2) and SRCNN-SRGAN (P3). We calculated the general AUC, considering the VGG from both observers' MOS scores; and the AUC from VGG for MOS from each observer separately. Finally, the Wilcoxon paired test, with a 99% confidence interval, analyzed the alternative hypotheses: MOS scores of MB are higher than MOS scores of MA.

Results
The general AUC was 0.80 for P1, 0.94 for P2 and 0.76 for P3. For observer 1, the AUC was 0.78 for P1, 0.92 for P2 and 0.68 for P3. For observer 2, it was 0.84, 1.00 and 0.88 for these respective pairs. These results denote the superiority of the deep-learning methods, especially SRGAN, compared with the interpolation method. The Wilcoxon p-values (0.0023 for P1, 0.0009 for P2 and 0.0023 for P3) also prove these hypotheses.

Conclusions
The results demonstrate that the evaluated deep-learning methods improved the image quality. The SRGAN performance suggests its feasibility as a resolution improvement tool.

O-009 **Research Award*

Development and validation of a novel artificial intelligence driven tool for accurate mandibular canal segmentation on CBCT

Pierre Lahoud[1*], Siebe Diels[2], Liselot Niclaes[1], Stijn Van Aelst[1], Holger Willems[2], Adriaan Van Gerven[2], Reinhilde Jacobs[1,3]
[1] OMFS-IMPATH Research Group, KU Leuven, Belgium
[2] Relu, R&D, 3000 Leuven, Belgium
[3] Department of Dental Medicine, Karolinska Institute, Sweden

Introduction
The increasing use of implant placement, bone harvesting and adapted endodontic treatment strategies, has led to rising rates of inferior alveolar nerve (IAN) injury. Visualisation of the mandibular canal, housing the IAN, is crucial for preoperative planning of oral and maxillofacial surgery procedures as such to prevent nerve injury.

The aim of the present study is the development and validation of an AI-driven tool for automated, fast and accurate nerve segmentation of the mandibular canal.

Materials and Methods
For initial training, a total of 40 CBCT scans from dentate subjects needing oral surgery (M3BE database; www.m3mka.be) were fed into Romexis software (Planmeca, Helsinki, Finland) to perform nerve tracing of the mandibular canal (MC). The generated segmentations allowed for training of a deep learning algorithm, core of a novel AI-driven nerve segmentation tool (www.relu.be). The initial set of 40 MC tracings allowed for MC path prediction on a second set of 76 CBCTs, where diameter and direction of the MC were adjusted using a voxel-wise approach.

Testing was then performed on a new set of 25 CBCTs, where voxel-level annotations and intersection-over-union (IoU) of each MC were assessed

Results
Primary results show successful implementation of the AI algorithm for segmentation of the MC with a mean IoU of 0.614 (¬± 0.07), a median IoU of 0.626, a mean Dice Similarity Coefficient of 0.758 (±0.06), a mean Hausdorff Distance of 0.686mm (± 0.334); while Precision, Recall and Accuracy had mean values of 0.79(±0.10), 0.75 (±0.13) and 0.99 (±7.64x10-05) respectively.

Conclusions
This study demonstrates a novel and accurate AI-driven module for MC segmentation on CBCT.

O-010

A deep learning hybrid framework for detection of radiographic bone loss and classification of periodontitis stage on dental panoramic radiographs: a multi-center study

Sangjeong Lee[1*], Hyuk-Joon Chang[2], Won-Jin Yi[2]
[1] Department of Biomedical Radiation Sciences, Seoul National University, South Korea
[2] Department of Oral and Maxillofacial Radiology, Department of Oral and Maxillofacial Radiology, South Korea

Introduction
The American Academy the European Federation of Periodontology proposed a new definition and classification criteria for periodontitis based on a staging system in 2017. In a previous study, a deep learning hybrid framework was developed to automatically stage periodontitis on dental panoramic radiographs according to the criteria proposed at the 2017 workshop. In this study, the previously developed framework was modified to classify periodontitis into four stages by detecting the missing teeth using CNN.

Materials and Methods
We used a total of 530 panoramic radiographs from three centers excluding the images of patients with primary or mixed dentition. Deep learning was used to detect the periodontal bone level (or the CEJ level) and teeth and to quantify the missing teeth on the panoramic

radiographs. Next, the percentage rate analysis of the radiographic bone loss combined the tooth long-axis with the periodontal bone and CEJ levels. Using the percentage rate and the number of missing teeth, we could automatically classify periodontitis into four stages according to the criteria proposed at the 2017 workshop. A multi-center analysis was performed to evaluate the generality of the developed method.

Results
The mean absolute difference (MAD) between the stages classified by the automatic method and diagnosed by the professor, fellow, and resident's diagnoses values were 0.26, 0.31, and 0.35, respectively, for the teeth of the whole jaw. For the multi-center analysis, the MAD values were 0.25, 0.34, and 0.35 for the vendor1, 2, and 3 images, respectively. The correlation coefficients (PCC and ICC) between the automatic method and the professor's diagnosis showed the highest values.

Conclusions
The developed method can help dental professionals to diagnose and monitor periodontitis precisely on panoramic radiographs. Therefore, it may improve dental professionals' performance with regard to the treatment of periodontitis.

O-012

An artificial intelligence approach to apical lesion detection on panoramic radiographs

Sinem Atay Görür[1*]
[1] *Dentomaxillofacial Radiology Department, Ankara University, Turkey*

Introduction
Periapical and panoramic radiography are the most frequently used techniques in the diagnosis and treatment of apical lesions (2). One of the many technological advances to have occurred recently is artificial intelligence (AI) (12).

We assessed the performance of an artificial intelligence (AI) system based on a deep convolutional neural network (CNN) model for the segmentation of periapical lesions on panoramic radiographs.

Materials and Methods
The panoramic radiographs were from the panoramic radiology archive of the Faculty of Dentistry of Eskisehir Osmangazi University; 473 anonymized panoramic radiographs were used.

The Planmeca Promax 2D (Planmeca, Helsinki, Finland) panoramic imaging system was used to obtain panoramic radiographs with the following parameters: 68 kVp, 16 mA, and 13 s.

3 dental radiologists (I.S.B. and E. B. with 10 years of experience and F.A.K. with 3 years of experience) annotated ground truth images with common decision on all images using Colabeler Annotation software (MacGenius, Blaze Software, CA, USA).

Results
The AI model segmented 252 apical lesions on 234 radiographs in the test data set (True-positives). 24 apical lesions were not detected (False-negatives). In 10 cases without apical lesions, lesions were nevertheless segmented by the AI model (False-positives). The sensitivity, precision, and F1-score values at 50 % IoU value were 0.9618, 0.9130, and 0.9368, respectively.

Conclusions
Deep-learning AI models enable evaluation of periapical pathology based on panoramic radiographs. The application of AI for apical lesion detection and segmentation can reduce the burden on clinicians.

O-013

The use of "MASK R-CNN" deep learning algorithm with a small training database for fast teeth detection in CBCT

Talia Yeshua[2*], **Asher Alexander**[2], **David Salem**[2], **Ragda Abdalla-Aslan**[3,1], **Isaac Leichter**[2], **Chen Nadler**[1]
[1] *Maxillofacial Imaging, Oral Medicine Department, Hebrew University Hadassah School of Dental Medicine, Israel*
[2] *Computer Science and Engineering Department, The Jerusalem Collage of Technology, Israel*
[3] *Department of Oral and Maxillofacial Surgery, Rambam Health Care Campus, Israel*

Introduction
Most convolutional neural network (CNN) algorithms for detecting objects in images require manual marking on a large training database, extreme computational power and time-consuming training process. This study evaluates the ability to use a transfer learning algorithm, called "Mask R-CNN", which requires a small training database and low computational power, in order to detect teeth contour in Cone Beam Computerized Tomography (CBCT).

Materials and Methods
"Mask R-CNN" transfer learning algorithm was applied on an existing neural network, for teeth detection in CBCT slices. This algorithm produces a bounding box around the detected teeth and simultaneously generates an instant high-quality contour of each tooth. The algorithm was trained on less than 10 various slices, using the CPU of an Intel Core i7 laptop. The performance of the trained neural network was tested on 383 CBCT slices of several cases with images of various protocols and fields of view.

Results
Each training epoch, with standard computational power, lasted less than 1 hour. Using only one epoch, the trained "Mask R-CNN" neural network detected the teeth on the CBCT slices, with a sensitivity of 90.7% and a specificity of 98.3%. The training process with 16 epochs improved the detection sensitivity to 95.1% and the specificity to 99.1%.

Conclusions
The use of the "Mask R-CNN" algorithm with a very small training database, standard computational power and reasonable duration produced high-quality teeth detection in CBCT. This algorithm can be further trained on a small database in order to detect pathologies in CBCT images

Oral Presentation

O-014

The application of deep learning system on mandibular fracture in panoramic radiographs

Yeong-Ah Yoon[1*], Karp-Shik Choi[1], Seo-Young An[1], Dong-Min Son[2], Sung-Hak Lee[2], Chang-Hyeon An[1]
[1] Oral and Maxillofacial Radiology, Kyungpook National University, South Korea
[2] Electronic and Electrical Engineering, Kyungpook National University, South Korea

Introduction
Deep learning systems are built based on convolutional neural networks (CNN) algorithms. You Only Look Once (YOLO), which is called the break-through in CNN family, innovated the way that object detection is programmed using the simplest and the most efficient methods. This study attempts is applying the deep learning system in mandibular fracture diagnosis on panoramic radiographs, and analyzing its accuracy compared to the diagnoses done by the a resident with 2 years of clinical experience.

Materials and Methods
Panoramic radiographs were selected from 2014 to 2020 at Kyungpook National University Dental Hospital. After applying the 360 images to train the YOLO v4, we tested its diagnostic ability using a different set of 60 images. The deep learning system augmented the set of 360 to 1080 images in order to enhance its fracture detection accuracy. In the testing process, the system identified the fractures in one or more regions out of 6 different regions of the mandible (ie. condyle, coronoid, ramus, angle, body and (para)symphysis). The diagnoses made by the system were compared to that of a resident to analyze its accuracy.

Results
The deep learning system had a diagnostic precision of 85% and recall of 71%. Its diagnosis was the most reliable when identifying the fractures in the body of the mandible, and less accurate in the (para) symphysis, coronoid and ramus area. Resident showed a precision of 98% and sensitivity of 92%, respectively.

Conclusions
We should also note that deep learning system only had panoramic radiographs for its diagnosis, which surely could limit its performance. It has potential to improve its diagnostic abilities upon additional training using more samples and CBCT data. Further development of deep learning system seems promising in the field of dentistry, especially for dentists with less experience in emergency response.

O-015

Automated clustering of the three-dimensional mandibular canal course using unsupervised machine learning method

YoungHyun Kim[1*], Kug-Jin Jeon[1], Chena Lee[1], Yoon Joo Choi[1], Hoi-In Jung[2], Sang-Sun Han[1]
[1] Department of Oral and Maxillofacial Radiology, Yonsei University, South Korea
[2] Department of Preventive Dentistry & Public Oral Health, Brain Korea 21 Plus Project, Yonsei University, South Korea

Introduction
The aim of this study was to analyze the three dimensional (3D) course of the mandibular canal (MC) using cluster analysis, an unsupervised machine learning method, and to visualize the standard courses for each classified type in Korean population.

Materials and Methods
A total of 429 cone-beam computed tomography images acquired at Yonsei University Dental Hospital were used. The MC course was measured with four parameters, upper height, lower height, lingual width, and buccal width, in four sites of the MC. Cluster analysis, one of the unsupervised machine learning methods, was carried out as follows: normalization of selected parameters, evaluation of cluster tendency, determination of the optimal number of clusters, and k-means cluster analysis.

Results
Three types of the 3D MC course were derived as cluster 1, 2 and 3 by cluster analysis, and statistically significant mean differences were shown among clusters. Cluster 1 had a steep vertical slope and steadily traveled to the lingual direction. Cluster 2 was the type that ran in an almost straight line closest to the low border and lingual border of mandible. Cluster 3 was traveled with increased vertical slope and buccal bend in the posterior area. Cluster 1 type was the least distributed with 26.3%, and in this type, female was 59.7%. On the other hand, cluster 2 showed the most distribution of driving courses at 41.7%, and males were more distributed at 57.3% compared to female. Cluster 3 accounted for 31.9% of the total and showed a similar sex ratio. There was no statistically significant difference in proportion for the right and left.

Conclusions
3D MC courses were automatically classified as three types through cluster analysis. Cluster analysis can be used to objectively classify anatomical structures and can provide standard information for each classified group without observer variability

O-016

An extensive ameloblastic fibroma involving bilateral side of the mandible in a teenager

Ahmad Badruddin Ghazali[1*], Raweewan Arayasantiparb[1], Rachai Juengsomjit[2]
[1] Department of Oral and Maxillofacial Radiology, Mahidol University, Thailand
[2] Department of Oral and Maxillofacial Pathology, Mahidol University, Thailand

Introduction
Ameloblastic fibroma is a rare benign odontogenic tumor comprising of both epithelial and mesenchymal cells. It is commonly diagnosed in the first two decades of life and has slight male predilection.

Case
We report a case of ameloblastic fibroma in a 15-year-old girl with complaint of extensive swelling of mandibular region for three years. Large field of view cone beam computed tomography revealed large multilocular radiolucency in both sides of the jaw from 37 to 47 area causing impaction, displacement, transposition and root resorption. A presumptive preoperative diagnosis of ameloblastoma was made. Incisional biopsy showed odontogenic epithelial islands and mesenchymal connective tissue cells leading to diagnosis of ameloblastic fibroma. The treatment done was partial mandibulectomy and reconstruction with iliac crest bone graft under general anesthesia. The 14-month postoperative follow-up showed no recurrence for this patient.

Discussion
The case is interesting because the patient is a young female teenager but presented with large tumor crossing the midline of the mandible, requiring aggressive treatment. Long term follow up is highly recommended to detect any recurrence and possible transformation into malignancy.

O-018 *Research Award

Are optimised CBCT protocols suitable to detect vertical root fracture in the presence of metal outside and/or inside the FOV?

Amanda Candemil[1*], Francesca Mangione[2], Karla Vasconcelos[3], Anne Oenning[4], Reinhilde Jacobs[3], Deborah Queiroz[1], Francisco Haiter-Neto[1], Benjamin Salmon[2], Matheus Oliveira[1]
[1] Oral Radiology, Piracicaba Dental School Unicamp, Brazil
[2] Orofacial Pathologies, Imaging and Biotherapies Lab, Université de Paris, France
[3] OMFS-IMPATH Research Group, Department of Imaging and Pathology, Catholic University of Leuven, Belgium
[4] Oral Radiology, Faculdade São Leopoldo Mandic, Brazil

Introduction
Dose optimisation has been revisited in the literature due to the great use of cone-beam CT scans (CBCT) and, the reduction of the FOV size has shown to be an effective strategy. However, small FOV scans are more susceptible to the negative effect from the exomass. Therefore, the aim of this study was to evaluate the diagnostic accuracy of an optimised CBCT protocol for the detection of vertical root fracture (VRF) in the presence of metallic artefacts arising from the exomass and/or endomass.

Materials and Methods
Twenty extracted human teeth were endodontically instrumented and VRF was induced in half of them. A fiberglass post was inserted in each tooth root, which were individually placed in an empty socket of a human mandible embedded with Mix-D. Titanium implants and cobalt-chromium posts were alternatively placed at different regions in relation to the FOV: outside but still between the X-ray source and the image receptor (exomass) and/or inside (endomass). For each metallic material disposition, CBCT scans were obtained at two protocols: standard (100mAs and 90kVp) and optimised (24mAs and 70kVp). Three radiologists evaluated the CBCT images and indicated the presence of VRF using a 5-point scale. Sensitivity, specificity, and area under the ROC curve (AUC) were obtained and compared using analysis of variance (α=0.05).

Results
Overall, sensitivity (standard, 0.87-0.97; optimised, 0.63-0.93), specificity (standard, 0.77-0.97; optimised, 0.60-0.91) and AUC (standard, 0.91-0.97; optimised, 0.81-0.94) did not differ significantly ($p>0.05$) between the dose protocols.

Conclusions
In conclusion, optimised CBCT protocols should be considered in the detection of VRF of dental roots filled with fiberglass posts irrespective of the occurrence of artefacts from metallic materials in the exomass and/or endomass.

O-019

Diagnostic application of fractal dimension analysis of bone invasion in oral malignancy- a retrospective study

Archana M[1*]
[1] Oral Medicine and Radiology, Tamil Nadu Government Dental College and Hospital, India

Introduction
Fractal geometry was introduced by the French American mathematician Benoit B. Mandelbrot in 1977.Fractal dimension analysis gives a numerical measure of the degree of boundary irregularity or surface roughness of an object and is based on quantitative analysis of features in an image. It quantifies the trabecular pattern of bone by analyzing the trabecular bone and bone marrow detecting the early changes in alveolar bone mineral content. The study aimed to assess the alveolar bone density by fractal dimension analysis in digital orthopantomograms showing bony erosion.

Materials and Methods
The digital orthopantomograms of 100 patients from the archives of Department of Oral Medicine and Radiology were included in this retrospective radiographic study. The radiographs were selected based on set inclusion and exclusion criteria. Fractal dimension (FD) analysis through box counting (using ImageJ software) was applied to the digital radiographs to establish a non-invasive evaluation of bone structure. The FD values obtained were recorded. The fractal dimension values were recorded and the data will be analyzed using SPSS version 22.

Results
The fractal dimension values on the affected and the normal side will be analysed and compared using the t test.The level of significance will also be ascertained.This is an ongoing study and the results are yet to be elucidated.The final results and outcome will be presented at the conference.

Conclusions
We are expecting that fractal dimension analysis will show a correlation with the alveolar bone density and potentially be an innovative method which can be used for early diagnosis of bony invasion in oral cancer.

O-020

The relationship between periodontal status and bone mineral density in renal transplant patients

Ayse Gulsahi[1*], Bahar Fusun Oduncuoglu[2], Neslihan Arhun[3], Turan Colak[4]
[1] Department of Dentomaxillofacial Radiology, Baskent University Faculty of Dentistry, Turkey
[2] Department of Periodontology, Baskent University Faculty of Dentistry, Turkey
[3] Department of Restorative Dentistry, Baskent University Faculty of Dentistry, Turkey
[4] Department of Nephrology, Baskent University Faculty of Medicine, Turkey

Introduction
This study aimed to investigate the possible association of bone mineral density (BMD) with periodontal, dental parameters in renal transplant patients.

Oral Presentation

Materials and Methods
76 renal transplant patients who had periodontal, dental parameters, panoramic radiographs and BMD measurements at least 1 year after transplantation were categorized with respect to femoral-neck/lumbar-spine BMD, panoramic indices, age, renal transplant age, dental/periodontal status and medical parameters. Statistical analysis was performed with one-way analysis of variance, chi-square and Pearson's correlation coefficient. The significance level was $p<0.05$.

Results
In lumbar-spine BMD group, osteoporotic patients were significantly older than osteopenic patients ($p<0.05$). The Plaque Index(PI) scores were significantly higher in osteopenic patient compared to osteoporotic patients in femoral neck BMD group($p<0.05$). For femoral-neck BMD and periodontal parameters, there were negative correlations between osteoporosis and Gingival Index($p<0.05$) and; osteoporosis and PI($p<0.01$). There was also a negative correlation between osteopenia and PI($p<0.05$). There was a negative correlation between Decay scores and osteoporosis, and a positive correlation between Decay scores and normal BMD scores($p<0.05$). The higher mandibular cortical index and trabecular bone pattern scores and increased ratio of these scores in both osteopenic and osteoporotic patients indicated the effect of osteoporotic changes of renal transplant patients on mandible. However, the relation of periodontal parameters and the mandibular cortical index and trabecular bone pattern scores did not clearly reveal the effect of osteoporosis on periodontal destruction.

Conclusions
Although this study revealed that femoral-neck and lumbar-spine osteoporosis seem to have some associations with periodontal parameters of renal transplant patients, sound conclusions may be driven by prospective studies with larger number of subjects.

O-021

Assessment of odontogenic infections in pediatric patients by utilizing cone beam computed tomography

Busra Yilmaz[1*], Efsun Somay[2], Ayse Gulsahi[1]
[1] Department of Dentomaxillofacial Radiology, Baskent University, Turkey
[2] Department of Oral and Maxillofacial Surgery, Baskent University, Turkey

Introduction
In pediatric patients, odontogenic infections are usually caused by caries, periodontal problems or trauma. They can be localised or spread to head and neck regions. Cone Beam Computed Tomography (CBCT) images are very useful for the diagnosis and treatment planning of odontogenic infections, Therefore, the aim of this study was to determine the clinical and radiographic features of odontogenic infections in pediatric patients by utilizing CBCT.

Materials and Methods
The CBCT images of pediatric patients (under the age of 18 years) who referred to the Dentomaxillofacial Radiology Clinic between 2016-2020 with odontogenic infections were retrospectively analyzed. Age, gender, the sources of odontogenic infections, teeth site involved and the signs and symptoms such as pain, swelling were recorded. In addition, lesion size, shape, borders, presence of tooth displacement and root resorption were evaluated on CBCT images.

Results
A total of 50 patients (20 boys, 30 girls, age range 7-17) were assessed in the study. It was determined that unerupted tooth/teeth were the most common source of odontogenic infections. Maxillary anterior teeth were the most commonly involved teeth. Furthermore, there was a significant correlation between the sources of odontogenic infections and lesion size, scalloped borders, lesion shape, presence of unerupted tooth/teeth.

Conclusions
The radiographic features obtained from the CBCT images provided significant information about the odontogenic infection source, lesion size and shape. With these data, diagnosis and control of infections and avoiding the complication are provided in the pediatric patient population.

O-022

Role of radiography in the management of craniomaxillofacial gunshot wounds: a case report

Catherine Olajumoke Enahoro[1*], Ibiyinka Olushola Amole[2], Akinwaleola Akinlade[2]
[1] Oral Diagnostic Sciences, Bayero University, Kano, Nigeria
[2] Oral and Maxillofacial Surgery, Bayero University, Kano, Nigeria

Introduction
Radiological investigations are standard protocol in the diagnosis and management of craniomaxillofacial gunshot wounds (CGSW) and involve the use of conventional radiography, computed tomography (CT), and more advanced imaging techniques. Radiography is used in determining the extent of injury, proximity to the vital structures of the face, as well as in treatment planning. We report the case of a CGSW patient with extensive midfacial destruction.

Case
A 55-year-old man was rushed to the hospital following an armed robbery attack which resulted in CGSW to the face. The patient was in obvious respiratory distress and was bleeding from the injury site. An emergency tracheostomy and initial debridement were done under general anaesthesia, and the patient placed on IV medication. CT scans revealed total destruction of the infra-orbital region on the left-hand side, with comminuted fractures involving the whole left midfacial region. There was complete destruction of the nasal and lacrimal bones on the right-hand side with some involvement of the medial portion of the maxilla. Shrapnel left behind during the 1st surgery was removed with CT guidance during the 2nd stage surgical debridement

Discussion
Ballistics is the science of the motion and effects of projectiles from within the firearm to the penetration of tissues. With many maxillofacial injuries, the projectile will cause comminution of bones and often fracture of teeth, causing fragments to explode outwards in all directions on initial impact. Resultant secondary missiles often produce a large exit wound, as observed in this patient. The extensive destruction of composite tissue suggested a distant position of a high-velocity firearm. The patient may also have been shot with a shotgun at close range, associated frequently with armed robbery attacks. Radiography played a dominant role in the diagnosis and management of this patient.

O-023

Quantitative analysis of metal artefacts of dental implant in CBCT image by correlation analysis to micro-CT: a microstructural study

Chang-Ki Min[1*], Kyoung-A Kim[1]
[1] Oral and Maxillofacial Radiology, School of Dentistry, Jeonbuk National University, South Korea

Introduction
The objectives of this study were 1) quantification of dental implant metal artefacts in CBCT images using correlation analysis of trabecular microstructural parameters from CBCT and micro-CT and 2) analysis of the effect of varying the angular position of the subject.

Materials and Methods
Polyurethane synthetic bone blocks were first scanned without implants by micro-CT and CBCT. Two dental implants were then placed parallel in the bone blocks and these specimens were scanned by CBCT with different alpha angles. Three volumes of interest (VOI) were set for further analysis. Six microstructural parameters were measured: trabecular thickness (TbTh), trabecular spacing (ThSp), bone volume per total volume (BV/TV), bone surface per total volume (BS/TV), connectivity density (CD) and fractal dimension (FD). Micro-CT measurements were used as a gold standard for CBCT. Spearman correlation coefficients for each microstructural parameter from CBCT and micro-CT were calculated and compared using Steiger's Z test.

Results
Without the implants, in VOI1, the Spearman correlation coefficients of TbTh, TbSp, BV/TV, BS/TV, CD and FD were 0.599, 0.76, 0.552, 0.566, 0.664 and 0.607, respectively. With the implants, the correlation coefficients decreased sharply in VOI1. As the alpha angle increased from zero to 90°, the correlation coefficients increased and became significant. Similar results appeared in VOI2. In contrast, in VOI3, the correlation coefficient decreased as the alpha angle increased.

Conclusions
Metal artefacts were successfully quantified using microstructural parameters in terms of the image quality of the CBCT. Changes in alpha angle affected the quality of the CBCT image.

O-024

Decrease in panoramic technical errors by visual and verbal pre-imaging communication

Chen Nadler[1*], Andra Rettman[1], Tevel Amiel[1], Evyatar Yeffet[1], Ragda Abdalla-Aslan[2]
[1] Maxillofacial Imaging, Oral Medicine Department, Hebrew University Hadassah School of Dental Medicine, Israel
[2] Department of Oral and Maxillofacial Surgery, Rambam Health Care Campus, Israel

Introduction
Panoramic imaging is used for detection and diagnosis of oro-maxillofacial pathologies. Technical errors are mostly made by incorrect patient's positioning. The most common technical error is the demonstration of the palatoglossal air space (PAS) which may cause misdiagnosis and may be reduced by patient's correct instruction, prior to imaging. The aim of this research was to retrospectively review the effect of adding verbal and visual instructions, prior to imaging, on PAS demonstration, in panoramic imaging.

Materials and Methods
We reviewed the PAS demonstration in panoramic images of adult dentate patients preformed in three different periods of time, during 2016-2019: (1) Period with no uniform instructions (2) Period with uniform verbal instructions (3) Period with both verbal and visual uniform instructions. Demographic data of the patients imaged were retrieved from our database. Then, three calibrated observers were asked to evaluate, for each image, in each group, the existence and the radiographic characteristic features of PAS. Then, we statistical analyzed and compared these features, in each and between all groups

Results
We included in our research 444 panoramic images, 148 preformed following verbal instruction, 143 preformed following verbal and visual instruction and 154 preformed without a uniform instruction. Most of the PAS demonstration in the panoramic image were bilaterally, spread over several teeth (>9 teeth), and with a vertical dimension equivalent to a third of the root. PAS demonstration was not affected by age, but was significantly reduced by addition of the verbal instructions. Furthermore, though not statistically significant, the addition of the visual instructions also decreased the PAS occurrence.

Conclusions
Obtaining a diagnostic image, decreases the need for re-takes, thus decreasing patient's radiation dose. This study strengthen the need for improved patient-operator communication by using uniform visual-verbal operator's instructions.

O-025

Influence of the tube current and artefact reduction tool on the CBCT-based diagnosis of peri-implant dehiscence

Danieli Moura Brasil[1*], Eduarda Helena Leandro Nascimento[2], Rocharles Cavalcante Fontenele[1], Ana Catarina Imbelloni[3], Hugo Gaêta-Araujo[1], Flávia Maria Moraes Ramos-Perez[3], Gustavo Machado Santaella[4], Deborah Queiroz Freitas[1]
[1] Department of Oral Diagnosis, University of Campinas, Brazil
[2] N/A, Neuroimagem Arcoverde, Brazil
[3] Department of Clinic and Preventive Dentistry, Federal University of Pernambuco, Brazil
[4] Department of Diagnosis and Oral Health, University of Louisville, United States of America

Introduction
The expression of the cone-beam CT (CBCT) artefacts varies according to the implant's composition. Increasing the CBCT exposure parameters and using an artefact reduction (AR) tool are alternatives to reduce the artefacts expression. This study aimed to evaluate the influence of the tube current and the AR tool on the diagnosis of buccal and lingual peri-implant dehiscence related to titanium-zirconia (Ti-Zr) and zirconia (Zr) implants using CBCT images.

Materials and Methods
Ti-Zr and Zr implants were inserted alternately at 20 sites in the posterior region of three human mandibles, which presented intact cortical (control) or simulated buccal and/or lingual peri-implant dehiscences. CBCT images were acquired with the OP300 Maxio unit, varying both the tube current (5 mA and 8 mA) and the use of the AR tool. Three oral radiologists assessed the presence of dehiscence using a 5-point scale. The area under the ROC curve (Az), sensitivity, and specificity of each group were obtained and compared using multi-way ANOVA ($\alpha = 0.05$).

Results
The tube current and the use of the AR tool did not influence the diagnostic values for buccal or lingual dehiscence, and there were no differences between the cortical plates ($p>0.05$). However, Zr implants were related to higher sensitivity (0.67-0.89) and lower

Oral Presentation

specificity (0.26-0.44) than Ti-Zr implants (0.19-0.44; 0.93-1.00, respectively) ($p<0.05$). Az values did not differ between the implant types ($p>0.05$).

Conclusions
Dehiscences were more detectable when related to Zr implants, while the absence of dehiscence was more correctly visualized when adjacent to Ti-Zr implants. The tube current and AR tool did not affect the diagnosis of peri-implant dehiscence, regardless of the involved cortical (buccal or lingual).

O-026

The value of mental index (MI) and gonial index (GI) in hypertension patients on its correlation with serum calcium and cortisol level

Dwi Putri Wulansari[1*], Lusi Epsilawati[1], Farina Pramanik[1], Suhardjo Sitam[1]
[1] Oral and Maxillofacial Radiology, Padjadjaran University, Indonesia

Introduction
The altered of serum calcium and cortisol levels possibly play a role in the pathogenesis of hypertension and might be associated with the reduced skeletal bone mineral density. This study aimed to analyze the mandible cortical width based on a mental index (MI) and gonial Index (GI) in hypertension patients correlated with serum calcium and cortisol levels.

Materials and Methods
This study was an analytic-observational study with 33 hypertension patients aged 41-79. All of the patients have checked their serum calcium and cortisol level. The panoramic radiograph was taken and analyzed using Image-J Fiji software. The mandible cortical width was then measured with Mental Index (MI) and Gonial Index (GI) and correlated with the serum calcium and cortisol level.

Results
Based on the data obtained from the examination of serum calcium and cortisol level and the measurement of Mental Index (MI) and Gonial Index (GI), it showed varying results but tends towards normal values with serum calcium level in the range of 8.4-10.2 ml/l, cortisol calcium level 3.7-19.4 ml/l, MI > 3.1 and GI > 1.2.

Conclusions
There was no correlation between serum calcium and cortisol level in the value of MI and GI in hypertension patients.

O-027

Odontogenic maxillary sinusitis caused by chronic periodontitis: incidental case in CBCT

Fahri Reza Ramadhan[1*], Suhardjo Sitam[2], Lusi Epsilawati[2]
[1] Dentomaxillofacial Radiology Resident, Universitas Padjadjaran, Indonesia
[2] Dentomaxillofacial Radiology, Universitas Padjadjaran, Indonesia

Introduction
Odontogenic sinusitis is one type of sinusitis in maxillary sinus which represents about 20% off all the paranasal sinusitis cases. Periapical or periodontal infection and iatrogenic injury are among the most frequent cause of this lesion. Although the radiographic feature of all type sinusitis could be similar, but somehow it differs by a specific characteristic. Cone-Beam Computed Tomography (CBCT) is an imaging modality that often used in dentistry. This modality offers good detail and resolution that allows readers could understand the cause of the case including to assess maxillary sinus.

Case
A 56-year-old female was referred to the Oral Maxillofacial Radiology Department for a 3D CBCT with a suspect of impacted teeth in posterior upper left jaw. The radiographic examination showed a distinct condition in left maxillary sinus in which a hyperdense area was seen on the sinus floor. While there are no other abnormal findings, a suggestive of sinusitis that caused from the impacted third molar was suspected. However, it turns out that the case does not lead that way.

Discussion
Sinusitis caused by chronic periodontitis is a rare condition due to relationship between periodontal tissue and the sinus which anatomically not directly-related unless there is a widespread infection. In this case, the diagnosis of maxillary sinusitis that caused by a chronic periodontitis could be revealed from the radiographic feature and characteristic, especially in CBCT. A good detail CBCT result could present a good visualization of the case.

O-028

Evaluation CBCT of lymphoblastic lymphoma on mandibular child : case report

Farina Pramanik[1*]
[1] Dentomaxillofacial Radiology, Universitas Padjadjaran, Indonesia

Introduction
Lymphoma is a malignancy lesion affected lymph nodes and lymphoid tissue. Lymphoblastic lymphoma is a variant of non-Hodkin lymphoma (NHL) group. NHL along with Hodgkin's lymphoma and leukemia were ranked 6th is the most frequent cases of malignancies. Non-Hodgkin's lymphoma (NHL) rarely occurs in the oral cavity. Radiograph assessment is useful to evaluate bony involvement. Panoramic and cone-beam computed tomography (CBCT) are able to describe the characteristics of the lesion and the involvement on surrounding anatomies This report aim to provide a comprehensive description of radiographic features of lymphoblastic lymphoma in mandibular child using panoramic and cone-beam computed tomography (CBCT).

Case
We reported a case of lymphoblastic lymphoma of the mandible child. The patient was a male, aged 13 years old. The initial complaint was a painful swelling in the right lower jaw since 1 year ago. The lump got bigger and worse over the time. The specialist in oral surgery referred him for a radiological examination. The results of panoramic radiographs and CBCT showed a malignant lesion in the right mandible with expansive, invasive and destructive appearance. A biopsy examination was performed along with histomorphology and immunohistochemistry examination as well. The patients were later suggested to get chemotherapy treatment.

Discussion
Radiographic examinations such as panoramic and CBCT are able to provide information about the characteristics of the lesion, bone involvement and the extension, including the presence of malignancy. However, for cases with non-specific clinical-radiological features, histological examination is required, and if there is difficulty in histological interpretation, immunohistochemistry examination is heavily recommended.

O-029

CBCT evaluation of radiographic features of the periosteal reactions in the jawbones

Gürkan Ünsal[1,2,3*], Merva Soluk-Tekkeşin[4], Kıvanç Bektaş-Kayhan[5], İlknur Özcan[3]
[1] Department of Dentomaxillofacial Radiology, Near East University, Cyprus
[2] Research Center of Experimental Health Science, Near East University, Cyprus
[3] Department of Dentomaxillofacial Radiology, Istanbul University, Turkey
[4] Institute of Oncology, Department of Tumour Pathology, Istanbul University, Turkey
[5] Department of Oral and Maxillofacial Surgery, Istanbul University, Turkey

Introduction
Periosteal reactions (PR) are a new bone structure that occurs under the periosteum. The PR pattern is thought to be useful in differentiating aggressive lesions from relatively less aggressive lesions and distinguishing malignancy from benign lesions. However, there are only few reports on the structural pattern of PRs in the jaws. In this study, CBCT images obtained from the Department of Dentomaxillofacial Radiology of Istanbul University Faculty of Dentistry between 25 December 2015 – 31 May 2018 were examined. PR (+) and PR (-) cases were listed and histopathological examinations of these groups were determined by evaluating the report system and the microscope slides. We investigated whether there is any relationship between the presence of PR and histopathological diagnosis.

Materials and Methods
4988 CBCT images were evaluated and they were classified according to their radiological diagnosis. Images with pathologies were listed according to their histopathological examinations as cystic lesions, benign tumours, malignant tumours, fibro-osseous lesions and osteonecrosis while images without pathologies were listed as traumas and others. All groups were reclassified as those with and without PR within themselves. Chi-square test was used between the groups.

Results
Pathologies and traumas were detected in 1801 of 4605 patients. There were 3 PR in 1140 cystic lesions, 4 PR in 102 benign tumours, 16 PR in 43 malignant tumours, 67 PR in 156 osteonecrosis/osteomyelitis cases and 3 PR in 262 trauma cases. As a result of the chi-square test between groups, there was a significant relationship between histopathologic diagnoses and periosteal reaction pattern (p=0,000).

Conclusions
Although there is a significant overlap between the patterns of PRs; PRs can be used to narrow the possibilities in the differential diagnosis. However, PRs alone are not sufficient variables for differential diagnosis in the absence of cortical bone destruction, localization, clinical and systemic findings.

O-030

18F-FBPA PET after high-dose-rate interstitial brachytherapy for tongue cancer: comparison to inflammation-related uptake on 18F-FDG PET

Hiroaki Shimamoto[1*], Tadashi Watabe[2], Sadahiro Naka[3], Takashi Kamiya[3], Yuka Uchimoto[1], Ami Takeshita[1], Takuya Cho[1], Keisuke Marutani[1], Tomomi Tsujimoto[1], Seiki Tomita[1], Atsutoshi Nakatani[1], Shumei Murakami[1]
[1] Oral and Maxillofacial Radiology, Osaka University Graduate School of Dentistry, Japan
[2] Nuclear Medicine and Tracer Kinetics, Osaka University Graduate School of Medicine, Japan
[3] Radiology, Osaka University Hospital, Japan

Introduction
^{18}F-fluorodeoxyglucose (FDG) is a major PET tracer used worldwide for the evaluation of cancer patients. However, the glucose transporter is upregulated not only in cancer cells, but also in inflammatory cells, which may lead to false-positive findings.
The aim of this study was to introduce the usefulness of 18F-fluoroboronophenylalanine (FBPA) as a tumor-specific tracer, compared to FDG in the presence of active inflammation after high-dose-rate interstitial brachytherapy (HDR-ISBT) for tongue cancer.

Case
A-77-year-old man with left tongue cancer underwent HDR-ISBT to the primary lesion (54 Gy/9 fr/5 days). Ten days later, FDG-PET revealed increased FDG uptakes (SUVmax: 6.8) in the primary region, suggesting radiation-induced inflammation compared to those in the pretreatment FDG-PET (SUVmax: 5.0). FBPA-PET revealed low FBPA uptakes (SUVmax: 3.2).
A 68-year-old man with right tongue cancer underwent HDR-ISBT. Ten days later, FDG-PET revealed increased FDG uptakes (SUVmax: 7.1) in the primary region, suggesting radiation-induced inflammation compared to those in the pretreatment FDG-PET (SUVmax: 2.8). FDG-PET also revealed high FDG uptakes (SUVmax: 9.1) in the pathway of the applicator implantation from the tongue to the submandibular region, which was not observed in the pretreatment FDG-PET. FBPA-PET revealed no significant FBPA uptake.
No recurrence and metastasis have not seen at this time in both cases.

Discussion
Recent study showed the utility of FBPA as a tumor-specific probe of L-type amino acid transporter 1 (LAT1). LAT1 is a cancer-type amino acid transporter that shows minimal expression in inflammatory lesions or normal tissues.
In conclusion, FBPA-PET can be used for early therapy evaluation in the presence of active inflammation after HDR-ISBT for tongue cancer.

O-031

Case report: chronic recurrent multifocal osteomyelitis of the mandible

Hyeran Choi[1*], Suhwoo Yoo[1], Juhee Kang[1], Joeun Kim[2], Kyunghoe Huh[1], Wonjin Yi[1], Minsuk Heo[1], Samsun Lee[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, South Korea
[2] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
Chronic recurrent multifocal osteomyelitis (CRMO) is an autoimmune disease that has symptoms similar to osteomyelitis. CRMO commonly affects the metaphysis of long bones in children and adolescents. This report aimed to reveal an uncommon case of CRMO involving mandible.

Oral Presentation

Case
An 11-year-old female patient who had symptoms of intermittent swelling and discomfort in unilateral side of the mandible visited the Department of Oral and Maxillofacial Surgery. There was no evidence of trauma or inflammation due to odontogenic origin in the right mandible. However, the panoramic and CT images showed multiple sclerosis, periosteal new bone formation, and irregular osteolysis extended from the mandibular symphysis to the right mandibular condyle. Besides the mandibular lesion, bone scan images revealed multiple active bone lesions in the left clavicle, right proximal tibia, lumbar spine (L1), left iliac bone, and right distal femur. The patient was finally diagnosed with CRMO based on the bone biopsy, bone scan, and blood tests. The patient underwent partial bone resection including decortication of the right mandible and she was on long-term medication with indomethacin and steroids. Nevertheless, she still complains of recurrent pain and swelling not only on the right mandible but also on her legs.

Discussion
The CRMO etiology is not yet fully understood and remains a diagnosis of exclusion due to the lack of widely accepted criteria or disease biomarkers. The consensus treatment protocols are also under way. Timely diagnosis and treatment after careful work-up based on full understanding of oral radiology can be key success factors to prevent unnecessary multiple biopsies and antibiotic treatment. Although CRMO rarely involves the jaw bone, the prospect should not be overlooked in case of osteomyelitis that occurs without apparent origins in children or adolescents.

O-032

Correlation between height and length of mandibular in radiographs and calcium levels in elderly patients

Ichda Nabiela Amiria Asykarie[1*], Lusi Epsilawati[2], Ria Noerianingsih Firman[2], Farina Pramanik[2]
[1] Dentomaxillofacial Radiology Resident, Faculty of Dentistry, Padjajdjaran University, Indonesia
[2] Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Padjajdjaran University, Indonesia

Introduction
There are many changes in systemic and physical in elderly patients. These changes are related to one another. The mandible is one of the active bones, whose quality is also seen by many factors including systemic. Abnormalities in levels of calcium can change bone structure. This study aimed to look at the correlation between mandibular height and length from radiographs and calcium levels in elderly patients.

Materials and Methods
This study is a cross-sectional observational study, using 15 panoramic radiographs of patients aged 60-80 years. The radiograph is then analyzed by measuring the patient's length and height mandible and calcium levels.

Results
The means values for mandibular length are ± 10 centimetres (cm), and for mandibular height are ± 7 centimetres (cm), while the calcium values indicated a mean value of ± 8.7-10 mg/ dl. Pearson correlation test showed that there were no significant correlations between length and height of mandibular and calciums levels in elderly patients. A recent analysis of the results is less significantly correlated.

Conclusions
Based on this research, it can be concluded that there was no correlation between height and length of mandibular and calcium levels in elderly patients.

O-033 **Research Award*

MRI compared with CBCT for dental implant planning: a pilot, ex-vivo study on alveolar bone measurements

Joao Marcus Fuglsig[1*], Brian Hansen[2], Lars Schropp[1], Donald R Nixdorf[3,4], Ann Wenzel[1], Rubens Spin-Neto[1]
[1] Department of Dentistry and Oral Health, Aarhus University, Denmark
[2] Center of Functionally Integrative Neuroscience, Aarhus University, Denmark
[3] Division of TMD & Orofacial Pain, School of Dentistry, University of Minnesota, United States of America
[4] Department of Radiology, Medical School, University of Minnesota, United States of America

Introduction
At present, implant-planning-related 3D image assessment is X-ray-based (i.e. cone beam CT - CBCT). The objective of this study was to compare zero-echo-time magnetic resonance imaging (ZTE-MRI) and CBCT providing bone height and width measurements in images obtained for dental implant planning.

Materials and Methods
Twenty edentulous sites in human cadaver specimens were imaged with CBCT and ZTE-MRI. Bone height and width at 1, 3, 5, 7, and 9 mm from the alveolar ridge top was measured (one trained observer) in coronal plane images, generated based on the long-axis of the site where the implant was to be placed. Twenty percent of the sample was measured in duplicate to assess intra-observer reproducibility (ICC) and the method error (defined as the range of the differences between the measurement rounds). The differences between CBCT and ZTE-MRI measurements were calculated and compared (paired t-tests).

Results
Observer reproducibility was >0.90. The average method error for bone height was 0.42 mm and 0.41 mm, and for bone width was 0.74 mm and 1.10 mm (CBCT and ZTE-MRI, respectively). Mean bone height the difference was -0.06±1.36 mm. For bone width, the mean differences were: at 1 mm, -0.29±0.76 mm; 3 mm, -0.22±0.55 mm; 5 mm -0.40±0.50 mm; 7 mm -0.24±0.56 mm; and 9 mm, -0.11±0.63. The majority of the bone measurement differences between CBCT and ZTE-MRI were statistically insignificant (except bone width measurements at 5 mm, P=0.003), and not larger than the method error.

Conclusions
ZTE-MRI is not significantly different from CBCT, when comparing measurements of bone height and width for dental implant planning.

O-034

Immunoglobulin g4-related disease and sjogren's syndrome: a case report

Liu Liu[1*]
[1] Oral Maxillofaical Radiology Department, Affiliated Hospital of Stomatology, Nanjing Medical University, China

Introduction
Immunoglobulin G4-related disease(IgG4-RD) is a newly recognized immune-mediated disease which could affect virtually any organ. IgG4-RD of head and neck region showed multiple bilateral enlargement of major salivary glands and lacrimal glands, which may be confused with Sjögren syndrome due to the similar clinicoradiological features.

Case
a 47-year-old female presented with 6 months history of bilaterlal enlarged submandibular glands and lacrimal glands. Immunohistological examination showed marked IgG-positive and IgG4 positive plasma cell infiltration (serum IgG4 11.500g/L, serum IgG 16.70g/L), IgG4 / IgG ratio >40%. MR image demonstrates bilateral swelling of the submandibular glands and lacrimal gland. Sonographic examination showed hypoechoic areas with hyperechoic at submandibular gland.

Discussion
Both IgG4-RD and Sjögren syndrome affect major salivary gland and lacrimal gland, the differential diagnosis is not always easy. Radiological findings of IgG4-related disease are usually nonspecific. The immunohistological examination is usefull that serum levels of IgG4 were elevated in almost all the cases. Because involvement of multiple sites is common in IgG4-related disease, dentists should familiar with the clinical and radiological feature to avoid a delay in diagnosis or unnecessary invasive interventions.

O-035

When to extract mesiodens? identification of the optimal time and condition for safe removal of mesiodens

Majd Barham[1*], Shunsuke Okada[2], Miki Hisatomi[2], Abdullah Khasawneh[1], Nouha Tekiki[1], Yohei Takeshita[1], Toshiyuki Kawazu[1], Yoshinobu Yanagi[3,4], Junichi Asaumi[1,2,4]
[1] Department of Oral and Maxillofacial Radiology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Japan
[2] Department of Oral Diagnosis and Dentomaxillofacial Radiology, Okayama University Hospital, Japan
[3] Department of Dental Informatics, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Japan
[4] Oral Examination and Diagnosis Center, Okayama University Hospital, Japan

Introduction
Mesiodens is the most common type of supernumerary teeth located in the premaxilla. Several mesiodens-related complications have been reported; delayed eruption or root resorption of adjacent teeth, as well as cyst formation. Because of the controversy regarding when to remove mesiodens, our study focuses on this matter by using cone-beam computed tomography (CBCT) to identify the 3D position of mesiodens to reach an exact diagnosis and identify the optimal time and conditions for safe removal of mesiodens.

Materials and Methods
This is a three-year retrospective study in which CBCT, taken in Okayama University Hospital from 2016 to 2018, were thoroughly examined for detection of mesiodens and identification of its 3D position. Mesiodens-related data were recorded including number; age of the patient at the time of discovery; associated abnormalities (especially for patients aged < 10) and relationship with adjacent teeth (direct contact) and other neighboring structures. Depending on the contact point with adjacent teeth and their maturity status, the risk of developing complications due to early extraction of mesiodens was divided into low, medium and high risk.

Results
For this study, 5,958 CBCT exams were obtained, and 460 patients (age 3-85) were diagnosed with a total of 568 mesiodentes from which 382 (67.25%) cases discovered at young age (age < 10), from which 333 (87.17%) mesiodentes associated with abnormalities were discovered. Moreover, out of 82 mesiodentes, which were found to have direct contact with adjacent teeth, 66 (80.49%), 5 (6.10%) and 11 (13.41%) mesiodentes were considered as low, medium and high risk, respectively.

Conclusions
Mesiodens should be extracted at the early stage which is most preferable immediately after discovery considering the risk factor due to extraction, the high possibility of developing complications at young age, patient's medical status and cooperation and other factors.

O-036

Prevalence and characteristics of osteoarthritis in the temporomandibular joint in norwegian 65-year olds: a CBCT study

Margareth Kristensen Ottersen[1*], Tore A. Larheim[1], Lene Hystad Hove[2], Linda Z. Arvidsson[1]
[1] Maxillofacial radiology, Institute of clinical dentistry, Faculty of Dentistry, University of Oslo, Norway
[2] Cariology and Gerodontology, Institute of Clinical Dentistry, Faculty of Dentistry, University of Oslo, Norway

Introduction
The prevalence and severity of radiographic osteoarthritis in the temporomandibular joint (TMJ-OA) in the aging population is largely unknown. The aim of the present study was to determine the prevalence and characteristics of radiological findings of TMJ-OA by cone beam computed tomography (CBCT) in a population-based sample of 65-year-olds.

Materials and Methods
159 participants (86 females, 73 males) were randomly recruited from the epidemiological study "Oral health of 65-year-old Oslo citizens" (OM65), consisting of 460 individuals.The TMJs of the participants were examined with CBCT. Images were analyzed for bone change characteristics and each joint was diagnosed with either OA, no OA or as indeterminate for OA. Image analysis criteria developed for the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were used. Frequencies of bone changes, joint diagnoses and severity grades were calculated, as well as kappa values for observer agreement.

Results
CBCT-defined TMJ-OA was present in 56 of 159 participants (35 %). Forty participants with OA (71 %) were females and 35 had grade 2 OA in at least one joint (24 women, 11 men). Of the 318 joints 76 (24 %) were diagnosed with TMJ OA, 172 joints (54 %) with no OA, and 70 joints (22%) were indeterminate for OA. Frequent condylar bone changes in TMJs diagnosed with OA were flattening (92 %), osteophyte (79 %) and subcortical sclerosis (64 %). Frequent fossa/eminence changes were flattening (46 %), subcortical sclerosis (41%) and erosion (34 %). Inter- and intra-observer agreement showed mean κ values of 0.80 and 0.78 respectively.

Oral Presentation

Conclusions
One third of the investigated 65-year-old Oslo citizens had radiological TMJ-OA. Radiological characteristics of TMJ-OA were predominantly remodeling and bone-productive changes. A significantly greater proportion of TMJ-OA were found among females.

O-037

Central giant cell granuloma: a pattern-based approach to diagnosis using cone beam computed tomography

Mehrnaz Tahmasbi Arashlow[1*], Paras B Patel[1], Madhu K Nair[1], Hui Liang[1], Yi-Shing Lisa Cheng[1]
[1] Diagnostic Sciences, Texas A & M University, College of Dentistry, United States of America

Introduction
Central giant cell granuloma (CGCG) is a benign intraosseous lesion of the jaws with variably aggressive nature. The etiology is unknown, however, thought to be a reactive process of bone due to trauma or inflammation. The aim of this study was to characterize cone beam computed tomography (CBCT) image features of CGCG in the maxillofacial region.

Materials and Methods
Three radiologists retrospectively reviewed 26 CBCT studies of histologically proven CGCG. The intuitional IRB was approved. Chi-square and t-test were used for statistical analysis. Descriptive statistics were performed for variables of gender, age, location, border, internal structure, locularity, expansion, cortical perforation, and effects on surrounding tissues.

Results
Out of 26 cases, mandible was the most affected at 65.4%, followed by maxilla at 34.6%. 66.5% of maxillary lesions and 53% of mandibular lesions involved both anterior and posterior regions. A localized posterior involvement was more common in mandible (35.5%) than maxilla (22.5%). A localized anterior jaw involvement was relatively the same in the mandible compared to the maxilla (11.5% versus 11.1%). Five of the mandibular lesions and two of the maxillary lesions crossed the midline. Of 26 cases, 65.5% of lesions were unilocular and 34.5% were multilocular ($p > .05$). 65.5 % of lesions were hypodense with no evidence of internal structures, whereas 34.5 % of cases showed internal granular trabeculae. Cortical perforation was seen in 73% of cases. Two hybrid lesions comprising CGCG and central ossifying fibroma and one hybrid lesion comprising CGCG and central odontogenic fibroma were identified.

Conclusions
CGCG has a wide range of radiographic appearance. It varies from well-defined expansile lesions to an ill-defined destructive appearance with no apparent expansion. CBCT imaging is highly effective in demonstrating the radiographic range of appearance and extent of CGCGs in the maxillofacial region.

O-038

Usefulness of hard palate measurements in predicting airway dimensions in patients referred for cone beam CT.

Mustafa Alkhader[1*]
[1] Department of Oral Medicine and Oral Surgery, Jordan University of Science and Technology, Jordan

Introduction
the aim of the study was to evaluate the usefulness of hard palate measurements in predicting airway dimensions in patients referred for cone beam CT (CBCT).

Materials and Methods
643 patients (239 males and 404 females) were examined by CBCT. Using dedicated CBCT software (Kodak CS 3D imaging version 3.8.6, Carestream, Rochester, NY, USA); different hard palate (palatal interalveolar length (PIL), palatal arch depth (PAD), the ratio of PAD/PIL, maxillopalatal arch angle (MPAA) and alveolar width (AW) and airway measurements (airway volume (AV), minimum cross sectional area (MCA), minimum anteroposterior distance (MAD), minimum right to left distance (MRD) and airway length (AL) were obtained and correlated using Pearson's correlation coefficients and regression analysis.

Results
although the correlation between hard palate and airway measurements was weak (Pearson coefficient (r) < 0.40), There were significant ($P < 0.05$) additive effects for the PAD in predicting airway dimensions, except for AL. Similarly, there were significant associations in the following analyses: PIL in predicting MAD, AW in predicting MRD, and the ratio of PAD/PIL in predicting MAD and AL. MPAA was the only hard palate measurement that had no effect in predicting airway dimensions.

Conclusions
with exception of MPAA, all hard palate measurements are considered useful in predicting airway dimensions in patients referred for CBCT.

O-040

A review of odontogenic keratocyst and case series

Nejlan Eratam[1*], Ercin Samunahmetoglu[1], Irem Alan[2], Raha Akbarihamed[2], Kivanc Kamburoglu[1], Hakan Alpay Karasu[2]
[1] Oral and Maxillofacial Radiology, Ankara University, Turkey
[2] Oral and Maxillofacial Surgery, Ankara University, Turkey

Introduction
Preoperative assessment is important for management of Odontogenic Keratocysts (OKCs). Radiological imaging, mainly Cone Beam Computed Tomography (CBCT) plays an important role in the diagnosis and management of OKCs.The knowledge about typical and atypical radiological features of OKCs is essential for their diagnosis however, histopathological examinations are required for definitive diagnosis.

Case
#1 A-15 year-old male patient referred our clinics sought for orthodontic treatment. Intra oral examination revealed absence of 33th, 47th, 12nd and 22nd teeth. Migration of the lower left premolar-molar teeth was observed. For detailed radiographic examination a CBCT imaging was performed. Histopathological examinations of biopsy specimen revealed a cystic lesion with a parakeratinized basal layer and keratin lamellae in its lumen.

#2 A-51-year old female patient referred our clinics with a complaint of pus discharge and a swelling in the right maxillary alveolar region. CBCT image analyses showed oroantral communication with severe bone resorptions. Histopathological examination had showed the characteristic lining of parakeratotic epithelial cells and satellite cysts in the cystic wall.

#3 A-57-year old, male, completely edentulous patient presented our clinics for a new total prosthesis. A well defined corticated radiolucency was detected in the panoramic radiograpy incidentally. CBCT examinations revealed minimal expansion of lingual alveolar bone. Aspiration and inciosonal biopsy was performed. As a result of histopathological examination the cystic lesion was diagnosed as OKC.

Discussion
OKCs occur twice as often in the mandible as in the maxilla-congurent with the present cases. Large size lesions are particularly common at the ramus of the mandible as we described in case #1. Conversely, the anterior sextant are the most common sites of origin in the maxilla.OKCs originating from the alveolar bone subjacent to the maxillary sinus, its floor is lifted and lumen is reduced as we described in case #2.

O-041

Calcified carotid artery atheromas on panoramic radiographs indicate increased risk of cardiovascular events

Nils Gustafsson[1*]
[1] *Odontology, Umeå University, Sweden*

Introduction
Calcified carotid artery atheromas (CCAAs) detected on Panoramic Radiographs (PRs) indicate cardiovascular disease that might increase the risk of future cardiovascular events.Calcified carotid artery atheromas (CCAAs) detected on Panoramic Radiographs (PRs) indicate cardiovascular disease that might increase the risk of future cardiovascular events.

The aim was to study whether CCAAs on PRs among men and women are associated with high estimated risk of future cardiovascular events and death, and with established or unknown diabetes.

Materials and Methods
738 cases (138 women) with a first myocardial infarction and 744 controls (144 women) examined with PR in the PAROKRANK study were included. The risk of cardiovascular events and death was estimated according to the Framingham Risk Score (FRS) and Systematic COronary Risk Evaluation (SCORE). Established and previously unknown diabetes was determined. Associations were analysed using logistic regression

Results
CCAA was detected on PR in almost 30% of the controls and in one third of the cases. High FRS was associated with CCAA among controls (P<0.05) and cases. High SCORE was associated with CCAA among controls (P<0.05), but not cases. Among men, FRS and SCORE were associated with CCAA in both groups, but not among women. Diabetes was 50% more common among controls with than without CCAA. However, the subgroups were small and the result was not significant after adjustments.

Conclusions
CCAA on PRs was associated to a high estimated cardiovascular risk among controls. Dentists should be encouraged to refer patients with CCAA on PR for medical examination of cardiovascular risk factors. Diabetes was not independently associated with CCAA.

O-042

Dynamic contrast-enhanced MRI assessment of the therapeutic effect of immune checkpoint inhibitors in oral squamous cell carcinoma

Nouha Tekiki[1*], Mariko Fujita[1], Tatsuo Okui[2], Hotaka Kawai[3], Toshiyuki Kawazu[1], Miki Hisatomi[4], Shunsuke Okada[4], Yohei Takeshita[1], Yoshinobu Yanagi[5], Jun-ichi Asaumi[1,4]
[1] *Department of Oral and Maxillofacial Radiology, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan*
[2] *Department of Oral and Maxillofacial Surgery, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan*
[3] *Department of Oral Pathology and Medicine, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan*
[4] *Department of Oral Diagnosis and Dentomaxillofacial Radiology, Okayama University Hospital, Japan*
[5] *Department of Dental Informatics, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan*

Introduction
For patients with recurrent/metastatic head and neck squamous cell carcinoma (HNSCC), recent years witnessed the approvals of the immune checkpoint inhibitors (ICIs), nivolumab and pembrolizumab. PD-L1 expression is commonly used as a biomarker to predict the therapeutic effect and response rates to immunotherapy treatments. However, resorting to biopsies to assess the PD-L1 expression is accompanied by surgical invasion and a physical burden on the patient. Considering that dynamic contrast-enhanced MRI (DCE-MRI) is a non-invasive method, performed as a preoperative examination for patients with HNSCC, our study aimed to identify DCE-MRI parameters that might assess the expression of PD-L1 and subsequently predict the therapeutic effect of ICIs.

Materials and Methods
From 2012 to 2017, images of 21 patients diagnosed with primary oral squamous cell carcinoma (OSCC) who underwent DCE-MRI at Okayama University Hospital have been collected. Using DCE-MRI, contrast index (CI) curves and parameters (CI-max, T-max, CI-gain, CI-gain/CI-max ratio and CI-peak) have been acquired. The respective surgical resection specimens were used for immunohistochemistry and analysis of the PD-L1 expression was performed. PD-L1 expression was scored using the tumor proportion score. Samples were sorted into; negative (less than 1%), low-positive (1-49%) and high-positive (50-100%).

Results
PD-L1 expression showed strong positive and statistically significant correlations with CI-max, CI-gain and CI-peak ($p < 0.01$). The means of CI-max, CI-gain and CI-peak were the highest in the high-positive PD-L1 expression tumors with statistically significant differences ($p < 0.05$), particularly between the negative and high-positive PD-L1 expression tumors.

Conclusions
DCE-MRI might be a valuable non-invasive method for assessing PD-L1 expression and thus the therapeutic effect of ICIs for patients with OSCC.

Oral Presentation

O-043

Evaluation of the articular eminence morphology and upper head of the lateral pterygoid muscle in disc displacement patients: an MRI study

Nuran Bayramov[1*], Busra Dilara Karaca[1], Sebmen Ercalik Yalcinkaya[1]
[1] Oral and Maxillofacial Radiology, Marmara University Faculty of Dentistry, Turkey

Introduction
This study aimed to evaluate the associations between articular eminence inclination/height (AEI/AEH) and morphology(AEM), upper head of the lateral pterygoid muscle (LPM) length and pathology, and attachment type of lateral pterygoid muscle on the magnetic resonance imaging (MRI).

Materials and Methods
MRI (1.5-T, Siemens, Germany) images of 100 TMJs in 50 patients (8 males, 42 females, mean age=31 years) were grouped according to disc status "normal, with/without reduction (DDwR/DDwoR)" and the measurements were made on both oblique sagittal and coronal slices. LPM attachments to the condyle-disc complex were categorized into three different types. AEMs and upper head of LPM pathologies were classified into four different groups. The AEI, AEH, AEM, upper head of LPM length and pathology, and attachment type of LPM were analyzed and possible associations with disc status were assessed. One Way Anova test was used for the comparison of parameters showing normal distribution in the case of three or more groups, and the Kruskal Wallis H test was used for intergroup comparisons of parameters that did not show normal distribution. Results were accepted at 95% confidence interval and significance level of $p<0.05$.

Results
Of the TMJs, 40% and 37% showed DDwR and DDwoR respectively. Upper head of LPM length was statistically significant with DD and LPM pathologies ($p<0.001$). AEM showed statistically significant differences with AEI($p<0.001$) and AEH($p=0.03$). The most frequent LPM attachment type was Type II(41 %). No statistically significant differences were shown between muscle attachment types, DD, upper head of LPM length, AEI and AEH.

Conclusions
It may be concluded that AEH/AEI indicated the morphology of AE and the upper head of LPM length was more contract in DD patients with upper head of LPM pathologies.

O-044

Simulated patient head movements have impact on sella turcica area and location of point sella in cephalograms

Olesya Svystun[1*], Lars Schropp[1], Ann Wenzel[1], Rubens Spin-Neto[1]
[1] Dentistry and Oral Health, Aarhus University, Denmark

Introduction
The literature suggests that artefacts may influence cephalograms image interpretability and cephalometric analysis. The aim of the present study was to assess changes in sella turcica area ("STA") and location of the cephalometric point "sella" ("S") on lateral cephalograms acquired by CCD-based image sensors with and without simulated patient head movements.

Materials and Methods
A human skull was mounted on a robot simulating four head movements (antero-posterior translation/lifting/nodding/lateral rotation) at three distances (0.75/1.50 / 3 mm) and two patterns. Two ProMax-2D units (Dimax-3, D-3 or Dimax-4, D-4), and a Orthophos-SL unit (ORT) acquired cephalograms during the predetermined movements ("cases", 48 images/unit) and without movement ("controls", 24 images/unit). The study design provided sets of two cases followed by one control. Three observers manually traced the contour os sella turcica and marked "sella". STA was calculated in pixels2 based on the tracing. S was defined by its x,y-coordinates, recorded by the same software in pixels. Ten percent of images were assessed in duplicate. The difference between cases and controls (case minus control) for the STA and S (namely Diff-STA and Diff-S) was calculated and assessed through descriptive statistics (%).

Results
Inter- and intra-observer agreement were substantial for STA and S. Diff-STA ranged from -42.5% to 12.9% (D-3), -15.3% to 9.6% (D-4), and -25.3% to 39.9% (ORT). Diff-S represented up to 50% (D-3), 134% (D-4), and 103% (ORT) of the mean diameter of sella turcica in control images.

Conclusions
Simulated patient head movements caused significant distortion in lateral cephalograms acquired by CCD-based image sensors, as seen from alterations in sella turcica area and location of cephalometric point sella.

O-045

Dense bone islands: prevalence and anatomical pattern in a london population

Phillip Gerard Seenan[1*], Suk Yee Ng[1]
[1] Dental Radiology, Guy's and St Thomas, United Kingdom

Introduction
Dense Bone Islands (DBI) are localised benign masses of compact bone of unknown cause. They are asymptomatic lesions of variable shape and size, commonly found incidentally on imaging. Despite their benign nature, according to Dave and Horner (2017) these lesions make up 9% of all referrals to Dental and Maxillofacial Radiologists for second opinion. On review of the literature, the prevalence and definition of DBI varies amongst authors.

The primary aim of this project was to identify the prevalence of DBI in the London population. The second aim was to identify the range of shapes, sizes and locations of DBI in the jaws.

Materials and Methods
After agreeing the selection criteria, observer 1 (PS) reviewed 1450 sequential dental panoramic tomographs (DPT) taken at a London based teaching hospital between 1st January and 4th February 2018. The presence or absence of DBI was recorded, along with their shape, size and location if present. By way of control, observer 2 (SN) independently reviewed every 10th DPT taken in this time frame. Observer 1 and observer 2 together reviewed all DPT radiographs where dense bone islands were identified by observer 1, to ensure agreement of diagnosis. Only lesions where both observers agreed were DBI were included in the final analysis.

Results
Of the 1450 radiographs reviewed, 6.9% had a DBI. The majority of these were within the mandible in the premolar and molar regions near the apices. The size of DBI ranged from 2x1mm to 16x12mm. 22.9% were round in the shape and the remainder were ovoid or irregular in shape.

Conclusions
This study shows the prevalence of DBI in the jaws for the London population is approximately 7 in 100 patients. The study also provides examples of the common sites of DBI and the variability in their size and shape.

O-046

Assessment of mesio-distal space requirements for a third molar auto-transplantation to replace missing premolar.

Piotr A. Regulski[1,2*], Stanislaw Jalowski[1], Pawel Plakwicz[3], Kazimierz Szopinski[1]
[1] Department of Dental and Maxillofacial Radiology, Medical University of Warsaw, Poland
[2] Center of Digital Science and Technology, Cardinal Stefan Wyszynski University in Warsaw, Poland
[3] Department of the Periodontology and Oral Diseases, Medical University of Warsaw, Poland

Introduction
The aim of the study was to assess the possibility of auto-transplantation of a third molar (TM) into a missing premolar space (MPS) by measuring the difference between widths of TM and MPS on cone-beam computed tomography (CBCT).

Materials and Methods
Seventeen individual CBCT cases (Scanora, Soredex, Tuusula, Finland) of patients (11 females and 6 males, mean age 15.6±3.6 years) with at least one premolar missing and at least one third molar present (11 upper, 6 lower) were analyzed retrospectively.

The inclusion criteria were: premolar absence (congenital, posttraumatic, caries), absence of radiologic signs of inflammation, third molar in development stage from Ri to Rc according to Moorrees, neither caries nor periodontal inflammation. The widest mesio-distal dimension of the TM and the narrowest mesio-distal dimension in the MPS were measured with OnDemand3dMed software (CyberMed, Daejeon, Korea). The average difference between TM and MPS dimensions was calculated. Statistical analysis was performed with Statistica software (Tibco, Palo Alto, USA) using the Student's t-test for paired, dependent samples (STT) and Shapiro-Wilk normality test (SWNT).

Results
The average TM, MPS widths, and difference between them (MPS-TM) were 9.3±1.0mm, 6.7±2.4mm, and -2.7±2.2mm respectively. Recipient space deficiency was observed in 82.1% cases and was statistically significant (STT, $p<0.001$). The differences between RMPS and DTM were normally distributed (SWNT, $p=0.014$).

Conclusions
In the majority of evaluated cases, auto-transplantation of TM would not be possible without prior orthodontic space opening due to space limitation at the site of missing premolar. The space deficiency between TM width and MPS width was -2.7 mm on average.

O-047

Treatment-based indications of cone beam computed tomography in children with impacted maxillary canines

Randi Lynds[1,2*], Christina Giovanos[3], Haihong Liao[4], Ingrid Ring[5], Olle Malmgren[4], Daniel Benchimol[5], Georgios Tsilingaridis[5], Xie Qi Shi1[6]
[1] Department of Clinical Dentistry, University of Bergen, Norway
[2] Folktandvården, Region Dalarna, Sweden
[3] Orthodontics, Private Practice, Sweden
[4] Orthodontics, Huddinge Specialist Clinic, Sweden
[5] Department of Dental Medicine, Karolinska Institutet, Sweden
[6] Faculty of Odontology, Malmö University, Sweden

Introduction
Cone beam computed tomography (CBCT) provides additional diagnostic information for clinicians aiming to treat patients with impacted canines, though little is known about how this information affects clinicians at the therapeutic thinking level. Patient subgroups should be identified where information obtained from CBCT is key for the choice of continued treatment. Our goal is to derive useful guidelines clarifying clinical situations where CBCT is beneficial for clinicians at the therapeutic thinking level for management of impacted maxillary canines.

Materials and Methods
91 cases have been collected from three specialist clinics in Stockholm, Sweden. The inclusion criteria are youths with impacted maxillary canines who each have CBCT scans, intraoral, and extraoral radiographs taken within a nine-month period, and clinical photos or models. The CBCT units involved are NewTom and ProMax3D. A multidisciplinary scientific advisory board consisting of six international experts in pedodontics, orthodontics, and oral radiology chose their preferred treatment alternative for each patient, first without and then with CBCT images.

Results
Preliminary results show that 51% of the cases had no indication for CBCT for therapy decision-making. The therapy changed in 10% of the cases with additional information from CBCT. Of these, the therapy changed from non-extractions to extraction therapy in five cases. Additionally, five cases changed from extracting premolars to extracting lateral incisors or the impacted canine. In one case, the therapy changed from extracting the impacted canine to extracting the central incisor.

Conclusions
CBCT is indicated for therapy decision-making when extraction strategy is involved, especially regarding impacted canine or incisor extraction. CBCT doesn't seem to affect the treatment choice for patients without crowding. In patients with crowding, CBCT is indicated if the presence and extension of root resorption is essential for treatment choice and the resorbed tooth has a good prognosis based on 2D images.

Oral Presentation

O-048

Accuracy of MRI evaluation of tongue carcinoma in the assessment of depth of invasion and tumour thickness with histopathological correlation: a retrospective study.

Rupsa Das[1*], Satya Ranjan Misra[1]
[1] Oral Medicine and Radiology, Institute of Dental Sciences, India

Introduction
Magnetic resonance imaging (MRI) is considered the gold standard of imaging to evaluate tongue carcinoma, providing accurate information about the extent of the lesion (tumour thickness) and the depth of invasion, aiding in treatment planning. The aim of the study was to correlate MRI and histopathological findings to assess the tumour thickness, depth of invasion of tongue carcinoma and to evaluate the role of MRI in loco-regional tumour node metastasis (TNM) staging.

Materials and Methods
This study was undertaken on 30 patients with clinical diagnosis of tongue carcinoma referred for MR imaging at a hospital over the 1.5-year period between January 2019 and June 2020. MRI was performed with GE 1.5 Tesla scanner, neurovascular (NV) array coil. Post-surgery, histopathological TNM staging was done and correlated with MRI TNM staging. The correlation between the radiologic and histologic tumour thickness as well as depth of invasion was calculated using Pearson correlation coefficient and p values of <0.05 were considered significant.

Results
30 patients diagnosed with tongue carcinoma, evaluation done by independent observers showed Fair agreement was noted for T staging and N staging between MRI and histopathology staging assessments. Good agreement was noted between radiological and pathological tumour depth. For the T1WGd MRI depth with a cut-off value of 5 mm, the nodal metastasis rate in the group with values >5 mm was 54%, and for those <5 mm was 25%, both of which were significantly different (P = 0.042). Pearson's correlation coefficient of HP depth and T1WGd MRI depth was 0.847 (P < 0.001) suggesting that HP depth shows strong correlation with T1WGd MRI depth.

Conclusions
The study shows high correlation between MRI and histopathological findings regarding tumour thickness and depth of invasion which can be used in planning surgical treatment strategies.

O-049

Evaluation of sagittal root position (SRP) and labial bone thickness (LBT) in anterior maxilla for immediate implant placement: a CBCT based study

Saqib Habib[1*], Momina Anis Motiwala[1], Farhan Raza Khan[1]
[1] Section of dentistry, Department of Surgery, Agha Khan University, Stadium Road, Karachi, Pakistan, Pakistan

Introduction
Immediate implant placement in the maxillary esthetic zone is a highly challenging and technically demanding task. To achieve favorable esthetic results, proper case selection and treatment planning is necessary. Variables like SRP and LBT of maxillary anterior teeth are of paramount importance for predictable outcomes. The objective of this study was to evaluate the SRP and LBT of maxillary anterior teeth for immediate implant placement using cone beam computed tomography (CBCT).

Materials and Methods
A cross sectional study was done to include CBCT scans of patients fulfilling the inclusion criteria. The SRP of each tooth (maxillary canine to canine) was evaluated in a sagittal section of a CBCT scan. The LBT of each tooth was measured perpendicularly to the long axis of tooth at three sites i.e. P1, P2 and P3. Descriptive statistics were reported for both SRP and LBT. Chi square test was employed to assess any association of SRP with tooth type, age and gender.

Results
Class I SRP was the most prevalent n=196/240(81.6%). Class III was the least frequent SRP n=1/240 (0.4%). The association between tooth type and SRP was statistically non-significant (p=0.51). The mean LBT for central incisor, lateral incisor and canine ranged from 0.5mm-0.8mm.

Conclusions
The most frequent type of SRP of maxillary anterior teeth in a sample of Pakistani population is Class I which is most favorable for immediate implant placement. Furthermore, LBT of maxillary esthetic zone is mostly thin i.e. within the range of 0.5-0.8 mm.

O-050 **Research Award*

Three-dimensional quantification of the relationship between upper first molar and maxillary sinus

Tobias Regnstrand[1*], Mostafa Ezeldeen[2], Sohaib Shujaat[2], Khalid Alqahtani[2], Daniel Bencimol[1], Reinhilde Jacobs[1,2]
[1] Dental Medicine, Karolinska Institutet, Sweden
[2] Department of Imaging and Pathology, OMFS-IMPATH, Belgium

Introduction
The present study aims to describe the relationship between first upper molar roots and maxillary sinus, for the first time with a truly three-dimensional approach. Knowledge of the anatomical relationship between upper teeth and maxillary sinus is valuable in diagnostics and for clinicians performing treatments in this area.

Materials and Methods
From a retrospective CBCT sample of the upper jaw, a total of 105 upper first molars in contact with maxillary sinus from 74 patients (male: 24, female: 50, mean age 42) were included in the present study. Segmentation of the upper 1st molar and maxillary sinus in CBCT were performed utilizing a semiautomatic livewire segmentation tool in MeVisLab v.3.1. The segmentations were analyzed in 3-matic Medical 20.0 for root volume and contact area between upper first molar roots and maxillary sinus. ANOVA test was applied to detect statistically significant differences between the roots.

Results
The palatal root had the largest contact area 27.8±21.4 mm2 (20% of the root area) followed by the mesiobuccal 20.5±17.9 mm2 (17% of the root area) and distobuccal root 13.7 ±12 mm2 (14% of the root area). A significant difference in contact area of the different roots of the upper first molar were seen.

Conclusions
This study showed 70% of the upper first molars in contact with the maxillary sinus. The palatal root having the largest contact area was followed by the mesiobuccal and distobuccal roots. The true 3D relationship could help to better understand maxillary and dentoalveolar anatomy and occurring pathologies in the area.

O-052

Amyloid variant of odontogenic fibroma: clinicopathological and radiographic study of 5 cases

Xiao-Long Guo[1,3*], Ming Zeng[3], Bo Li[1,3], Xin-Ming Chen[2,3], Shao-Dong Yang[2,3]
[1] Department of Oral Radiology, School and Hospital of Stomatology, Wuhan University, China
[2] Department of Pathology, School and Hospital of Stomatology, Wuhan University, China
[3] The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST), School and Hospital of Stomatology, Wuhan University, China

Introduction
The amyloid variant of odontogenic fibroma (AOF) has been described recently, and most of the putative examples of non-calcifying Langerhans cell-rich variant of calcifying epithelial odontogenic tumor may represent AOF (Ide F, et al. What Is the Non-calcifying Langerhans Cell-Rich Variant of Calcifying Epithelial Odontogenic Tumor? Head and Neck Pathology, 2019, 13:489-491.). This is clinically relevant, but remains controversial. The aim of this study is to investigate the clinicopathologic features of AOF.

Materials and Methods
Five cases of AOF were retrospectively studied.

Results
Of five cases, two cases were male and three female, aged 26-55 years (mean, 35 years); all occurred in the maxilla, anterior to the first molar. Palatal depression was found in 4 cases, followed by loose teeth and swelling.
Radiographically, all appeared as well-defined, irregular, unilocular and homogeneous radiolucencies, perforating the cortical plates, and were not associated with impacted teeth; root resorption, perforation of nasopalatine canal wall and/or nasal floor were noted in 3 cases. Microscopically, the tumors consisted of fibrous connective tissue with scattered epithelial nests and cords and abundant amyloid deposits. Of the 4 cases treated with local curettage and 1 with partial maxillectomy, none recurred after 3-113 months' follow-up.

Conclusions
AOF occurs primarily in the anterior maxilla of adults with a female predilection, and behaves non-aggressively with low rates of recurrence after conservative treatment. Radiographically, AOF shows a unilocular or multilocular radiolucency with frequent root resorption and perforation of cortical plates.

O-054 **Research Award*

Diagnostic efficacy of CBCT, MRI and CBCT-MRI fused images in determining anterior disc displacement and bone changes of temporomandibular joint

Ying-hui Wang[1*], Ruo-han Ma[1], Chuang-chuang Mu[1], Yan-ping Zhao[1,2], Juan-hong Meng[2], Hao Zhang[2], Gang Li[1]
[1] Department of Oral and Maxillofacial Radiology, Peking University School and Hospital of Stomatology, China
[2] Center for Temporomandibular Disorders and Orofacial Pain, Peking University School and Hospital of Stomatology, China

Introduction
Due to the respective limitations of CBCT and MRI images, the temporomandibular joint (TMJ) disc and surrounding bone tissues cannot be displayed simultaneously. Therefore, a method used to fuse CBCT and MRI images was established. The purpose of this study was to evaluate the diagnostic efficacy of CBCT-MRI fused image for anterior disc displacement and bone changes of TMJ, which are the main imaging manifestations of temporomandibular disorders (TMD).

Materials and Methods
One hundred and twenty patients (231 TMJs) who were diagnosed as TMD were included in this study. The anterior disc displacement, bone erosion and bone hyperplasia evaluated by three experts were used as a reference standard. Three residents individually evaluated all the three sets of images (CBCT, MRI, and CBCT-MRI images) in a random order for the above mentioned three image features with a five-point scale. Each set of images was observed at least one week apart. A second evaluation was performed after 4 weeks. ICCs were calculated to assess the intra- and inter-observer agreement. The areas under the ROC (AUCs) were compared between the three image sets using Z test.

Results
Eighty-four cases were determined as bone erosion, 40 as bone hyperplasia, and 145 as anterior disc displacement. The intra and inter-observer agreements in the CBCT-MRI images (0.76-0.91) were good to excellent. The AUC-index for the CBCT-MRI images (0.92) was higher than the MRI set in the diagnosis of anterior disc displacement ($p>0.05$), and significant higher than the MRI images in bone changes ($p<0.05$).

Conclusions
CBCT-MRI images can significantly improve the observers' reliability in determining anterior disc displacement and bone changes of TMJ. It can also be utilized especially for inexperienced residents to shorten evaluation time and improve diagnostic efficacy.

O-056

Ultrasonographic findings in patients with painful salivary gland swellings.

Antigoni Delantoni[1*], Apostolos Sarafopoulos[2], Dimitrios Andreadis[1], Athanasios Poulopoulod[1]
[1] School of Dentistry, Aristotle University of Thessaloniki, Greece
[2] Radiology Department, AHEPA General Hospital, Greece

Introduction
The aim of the present study is to show and analyze the ultrasonographic findings in patients with acute clinical symptoms, and pain in the regions of the salivary glands.

Materials and Methods
The patients included were adults that presented in the Emergency Dept of the AHEPA General Hospital with acute pain and/or swelling of the salivary glands area within the academic year of 2018-2019. A total of 42 cases involving salivary gland pathoses were included in the study. The pathological conditions identified from the findings from the ultrasonogaphic examination were the following:
Salivary Gland lithiasis in both cases of Wharton and Stensen ducts. Lithiasis affects 1,2% of the population in the literature and involves mostly the submandibular glands. It is the most common cause of sudden swelling of the area.
Non Typical sialadenitis, mostly of imflammatory origin with mild symptoms and slight anechoic echostructure. No presence of caculi is seen, and the symptoms subside after the use of antibiotics.
Acute inflammatory swelling of both parotid and submandibular

Oral Presentation

glands in the initial diagnosis of Sjogren syndrome. Reduced echostructure of the glandular parenchyma with increase in vascularity upon triplex study.
Abscesses in patient with recurrent inflammations of the salivary glands due to infected 1stbranchial arch cyst verified by FNAB or a known history of HIV (lymphoepithelial cysts)

Results
The 42 cases that were studied and included in the study will be analyzed and the most important cases of them will be presented and their ultrasonographic features will be analyzed

Conclusions
In conclusion we must underline the important of Ultrasonography in the identification and detailed evaluation of the pathology of the salivary glands. The ultrasonographic examination is a first line exam in the study of the glands and their underlying pathology providing direct and trustworthy results in their study.

O-058

Effect of orthophos XG 3D CBCT system FOV size, position within the FOV and scanning modes on artifact intensity

José Cordeiro Lima Neto[1*], Martina Gerlane De Oliveira Pinto[1], Saulo Leonardo Sousa Melo[1], Larissa Rangel Peixoto[1], Fernanda Clotilde Mariz Suassuna[1], José Bruno Da Silva Leite[1], Ana Priscila Lira de Farias Freitas[1], Patrícia Meira Bento[1], Daniela Pita De Melo[1]
[1] Dentistry, State University of Paraíba, Brazil
[2] Dentistry, Faculdades Integradas de Patos, Brazil

Introduction
The aim of this research is to assess the effect of ORTHOPHOS XG 3D field of view (FOV) sizes, scanning positions within the FOV and scanning modes on artifact intensity.

Materials and Methods
Twenty single-rooted premolars divided into two groups (NiCr and AgPd posts), each containing ten teeth were scanned using four sets of CBCT scanning protocols varying FOV sizes (80 mm x 55 mm and 50 mm x 55mm) and scanning acquisition modes (Standard Mode-SM and High Definition-HD). Two different methods of positioning the object within the FOV were assessed: 1- pre-established by the CBCT scanner (central and lateral) and, 2- established by the operator (four quadrants). Hyperdense and hypodense artifacts were assessed quantitatively using ImageJ software. Data was assessed using Two-way analysis of variance (ANOVA), Tukey honest significant difference (HSD) test and Tukey independent test. The significance level was set at 5% ($p<0.05$).

Results
Hyperdense and hypodense artifact intensity differed statistically between FOV sizes for central and lateral positions within the FOV for NiCr and AgPd posts ($p<0.05$). Hyperdense and hypodense artifact intensity differed statistically between larger FOV size scanning modes for NiCr posts positioned in all studied quadrants ($p<0.05$).

Conclusions
Orthophos XG 3D scanning modes do not interfere on artifact intensity; however, larger FOV size scans present higher artifact intensity values. Lower dose scanning modes and smaller FOVs should be chose whenever possible.

O-059

Radiographic imaging in relation to the mandibular third molar. a survey among oral surgeons in sweden

Josefine Cederhag[1*], Anna Truedsson[2], Per Alstergren[3], Xie-Qi Shi[1,4], Kristina Hellén-Halme[1]
[1] Oral and Maxillofacial Radiology, Malmö University, Sweden
[2] Oral & Maxillofacial Surgery and Oral medicine, Malmö University, Sweden
[3] Orofacial Pain and Jaw Function, Malmö University, Sweden
[4] Oral and Maxillofacial Radiology, University of Bergen, Norway

Introduction
The aim was to evaluate subjective experiences on the choice of radiological modalities for preoperative assessment of mandibular third molar among dentists.

Materials and Methods
A web questionnaire based on four radiographic patient cases were sent to 280 oral surgeons and dentists. The participants were requested to report which radiographic method needed based on radiographic information obtained for each case and to assess their level of confidence. Furthermore, opinions and experience of different radiographic methods and the use of them in relation to pre-surgical analysis were investigated.

Results
The response rate was 64%. Preliminary results showed that most respondents (86%) often/always used panoramic radiograph prior removal. Many considered that panoramic radiographs and CBCT often/always facilitated the removal, 87% and 72%, respectively. About 50% of the respondents believed that CBCT often/always reduced surgical complications. None of the radiographic modalities seemed to affect treatment strategy or to refrain the removal in any great extent. There were some variations between age, gender and practising experience and which radiographic method preferred

Conclusions
The use of CBCT seems to be preferred in pre-surgical evaluations even if it from a radiological point of view, intraoral images or/and panoramic radiograph were enough.

O-060

MRI image artefacts caused by orthodontic appliances and/or implant-supported dental prosthesis: a systematic review

Katrine Mølgaard Johannsen[1*], João Marcus Fuglsig[1], Brian Hansen[2], Torben Ellegaard Lund[2], Ann Wenzel[1], Rubens Spin-Neto[1]
[1] Dentistry and Oral Health, Aarhus University, Denmark
[2] Center of Functionally Integrative Neuroscience, Aarhus University, Denmark

Introduction
Dental materials (i.e., orthodontic braces and titanium implants) are commonly questioned as a possible source of artefacts in magnetic resonance imaging (MRI). The aim of the present study was to conduct a systematic review of the literature on MRI image artefacts due to dental materials, limited to orthodontic appliances and implant-supported dental prosthesis, on both technical and diagnostic levels.

Materials and Methods
The MEDLINE bibliographic database was searched up to April 2020. The search was limited to studies published in English, using the search string: (MRI or magnetic resonance) and (artefact or artefact) and (dental or ortho or implant or restoration or restorative). The studies were assessed independently by three reviewers, focusing on the following parameters: MRI sequences, tested materials, assessed parameters, and outcome.

Results
The search strategy yielded 31 studies, which were included in this systematic review. These studies showed that metallic dental materials, commonly present in orthodontic appliances and implant-supported dental prosthesis led, to diverse types/severities of artefacts in MRI images. Thirteen studies were in vivo, based on human subjects. The studies differed substantially in terms of tested materials, assessed parameters, and outcome measurements. No studies defined the diagnostic relevance of the investigated artefacts for the diverse MRI applications.

Conclusions
Metallic dental materials cause artefacts of diverse types and severities in MRI images of the head and neck region. However, the diagnostic relevance of these artefacts is yet to be studied.

O-061

Effect of spatial position in the field of view on dimensional changes in cone beam computed tomography

Mehrdad Panjnoush[1*], Yasaman Kheirandish[1], Negar Zeini[2]
[1] Oral & Maxillofacial Radiology, Tehran University of Medical Sciences, Iran
[2] Oral & Maxillofacial Radiology, Rafsanjan University of Medical Sciences, Iran

Introduction
This study aimed to assess the relation between dimensional changes and object location in the field of view (FOV) using cone beam computed tomography (CBCT).

Materials and Methods
A custom-made phantom was fabricated from base plate wax. To analyze the accuracy of measurements in horizontal and longitudinal dimensions, aluminum squares (0.5 mm thickness, 10×10 mm dimensions) were constructed and placed in three levels (upper, middle, and lower) and five positions (central, right, left, anterior and posterior). This phantom was scanned using Asahi, Planmeca and NewTom CBCT systems. CBCT scans were measured three times by use of their corresponding software. Statistical analysis was performed using one-way ANOVA, post-hoc test and two-way ANOVA ($P<0.05$).

Results
The differences between the mean horizontal dimensions of different systems were not significant ($P=0.296$). However, the differences between the mean longitudinal dimensions of different systems were significant ($P=0.039$). The differences between the different positions and the mean horizontal and longitudinal dimensions were significant ($P<0.001$, and $P<0.001$, respectively). The differences between the mean horizontal dimensions and different levels were not significant ($P=0.51$), but the differences between the mean longitudinal dimensions and different levels were significant ($P<0.001$). The interaction effect of level and position on the accuracy of horizontal and longitudinal measurements was significant ($P<0.0001$).

Conclusions
We found statistically significant differences in most of our comparisons; however, these differences were not clinically significant. Therefore, CBCT could be an accurate device for measurement of dimensions of objects placed in different positions in the FOV.

O-062

Development evidence-based guidelines of radiographic examination for implant installation

Min-Ji Kim[1*], Sam-Sun Lee[1], Min-Suk Heo[1], Kyung-Hoe Huh[1], Won-Jin Yi[1], Jo-Eun Kim[1], Ju-Hee Kang[1]
[1] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
This study aimed to develop evidence-based clinical imaging guidelines before and after dental implant surgery to assess the proper implant location to prevent complications and identify potential complications during follow-up.

Materials and Methods
The guideline development process employed an adaptation methodology in accordance with the Korean clinical imaging guidelines (K-CIG). A committee was developed for the development of guidelines and key questions were set. After that, domestic and international databases were used to search for guidance corresponding to the key question. The searched guidelines were selected according to established criteria, and the quality of the studys was evaluated by searching the latest documents that are the basis of the recommendations. Through this, recommendations and evidences for each key question are prepared . The recommendations were decided through the expert's consensus process (Delphi method), and the final recommendation was made.

Results
To derive recommendations for implant planning, identified articles were searched. And our online search identified articles for the development of the guidelines regarding the appropriate imaging modalities that should be used following implant placement. After that, several articles were selected according to the selection criteria for guildelines of radiographic examination for implant installation.

Conclusions
Cone beam computed tomography (CBCT) scanning is recommended for individual patients judged to require a cross-sectional image after reading of a panoramic X-ray image and a conventional intraoral radiological image for implant planning. Also, conventional imaging should be the first choice for assessing the implant following its placement and osseointegration. The metal artifacts in Cone Beam Computed Tomography (CBCT) should be considered. However, CBCT is recommended for patients with sensory abnormalities following dental implant surgery to evaluate and identify the underlying cause of implant complications and to determine the appropriate treatment.

Oral Presentation

O-063

Scatter-to-primary ratio in dental cone-beam computed tomography: effect of field of view and beam energy

Ruben Pauwels[1,2*], Pisha Pittayapat[2], Phonkit Sinpitaksakul[2], Soontra Panmekiate[2]
[1] Aarhus Institute of Advanced Studies, Aarhus University, Denmark
[2] Department of Radiology, Faculty of Dentistry, Chulalongkorn University, Thailand

Introduction
The aim of this study was to evaluate the effect of field of view (FOV) and kilovoltage on the scatter-to-primary ratio (SPR) in dental CBCT.

Materials and Methods
An anthropomorphic phantom representing an adult male (ATOM Max 711-HN) was scanned using the 3D Accuitomo 170 CBCT (J. Morita, Kyoto, Japan) using 11 FOVs. During each scan, half of the X-ray beam was blocked. Each scan was performed at three exposure settings with varying beam energy and equal radiation dose: 90 kV, 5 mA, 77 kV 7.5 mA and at 69 kV 10 mA. The SPR was estimated by measuring the grey values in the blocked and non-blocked regions of the RAW data. The effect of FOV on SPR was evaluated using Dunn's Multiple Comparison test, and the effect of the exposure settings was compared using a paired t-test.

Results
Larger FOVs showed increased scatter. Most intercomparisons between FOVs were statistically significant. The largest difference was found between 17x12 cm and 6x6 cm (lower jaw), with the former showing a 2.9-fold higher SPR. For FOVs positioned in the dental region, a consistent linear relation could be seen between the FOV size and SPR (R^2 = 0.96). There was no significant difference in SPR between the three beam energies.

Conclusions
Whereas the choice of FOV size and position is determined by the diagnostic region of interest, the image quality deterioration for large FOVs due to scatter provides another incentive to limit the FOV size as much as possible.

O-065

Knowledge, awareness, and attitude of dentist for cone beam computed tomography (CBCT) prescriptions

Sunil Surendraprasad Mishra[1*], Anita D Munde[1], Asmita S Mishra[1], Poonam S Mishra[1]
[1] Oral Medicine and Radiology, Pravara Institute of Medical Sciences (Deemed to be University), Loni, India

Introduction
With increasing number of CBCT manufacturer in market, availability of CBCT machines in dental practice and as exclusive centers are at constant rise. But with increasing number of CBCT machines and it's usage by dentist, there is also a need to assess the quality of the prescriptions which are made for CBCT evaluation. There have been multiple short term courses and lectures for the dental practitioners regarding interpretation of CBCT images and the use of the CBCT software for planning and assessment but hardly any focus been given to highlight the conditions for which such investigations be advised. This thought was the surge for our research.

Materials and Methods
The study was designed as an online survey with a set of questionnaires using Google Forms platform. The sample included private dental practitioners, faculty members in academic jobs and postgraduate students. The survey got 360 response in the fixed duration of the survey.

Results
Most common cases for which CBCT was advised was diagnosis of jaw lesions (72%) and pre-implant planning (71%). 52% of participants were advising CBCT for pre- and post-operative implant assessment. Only 23% of participants were aware of European commission guidelines. Only 37% of the participants had read about the prescribing guidelines regarding CBCT. Only 56.9% of the participants believed that reducing FOV can reduce the patient exposure to the patient. 28% of the participants believed that CBCT should completely replace conventional radiography and 15.8% of them felt that all patient must undergo CBCT examination prior any dental procedures. The detailed findings will be presented in the presentations.

Conclusions
CBCT provides us with the third dimension and can be beneficial in all jaw conditions but the principal of ALARA still applies to CBCT and the dentist should have a detail knowledge regarding the prescribing guidelines for CBCT.

O-066

Ultrasonographic evaluation of the platelet-rich fibrin effect in free gingival graft procedures

Revan Birke Koca-Ünsal[1*], Gürkan Ünsal[2,3], Yiğit Fıratlı[4], Gökhan Kasnak[5], İlknur Özcan[6], Kaan Orhan[7,8], Erhan Fıratlı[4]
[1] Department of Periodontology, University of Kyrenia, Cyprus
[2] Department of Dentomaxillofacial Radiology, Near East University, Cyprus
[3] Research Center of Experimental Health Science, Near East University, Cyprus
[4] Department of Periodontology, Istanbul University, Turkey
[5] Department of Periodontology, Istanbul University-Cerrahpaşa, Turkey
[6] Department of Dentomaxillofacial Radiology, Istanbul University, Turkey
[7] Department of Dentomaxillofacial Radiology, Ankara University, Turkey
[8] Medical Design Application and Research Center (MEDITAM), Ankara University, Turkey

Introduction
Tissue transplantation procedures might be difficult to tolerate by many patients due to the second wound site. Platelet-rich fibrin (PRF) has been used in dental practice for many years to reduce postoperative pain and stimulate wound healing. There are many studies in which PRF application as palatal dressing after gingival graft harvesting; however, those studies only evaluated clinically. Ultrasonographic (US) evaluation plays an essential role due to avoid hemorrhagic complications, follow the tissue thickness, revascularization and tissue healing in soft tissue grafting. In this study, we aim to evaluate the PRF efficiency in donor site with US examination.

Materials and Methods
Ten individuals assigned to two groups as PRF applied or not applied. The PRF membrane was stabilized in the donor site in the PRF group, whereas a gelatin sponge was placed in the second group. All the individuals underwent US examination before graft harvesting

and 2nd, 4th, 7th and 14th days after the operation. Donor sites were evaluated by means of tissue thickness and vascularity. The results were evaluated statistically at the p <0.05 significance level.

Results
The PRF (+) donor sites showed increased vascularity which can be interpreted to improve healing in soft tissue. There was no statistically significant difference between the groups and tissue thickness (p>0,05). However, a statistically significant, positively very high correlation was observed between the right and left tissue thicknesses (p=0,00; r=+0,902).

Conclusions
In this study, we evaluate the PRF effect in donor site both clinically and radiologically for the first time. Especially for soft tissue augmentations, evaluation of tissue thickness and vascularization of both recipient and donor sites not only increases clinical success but also reduces the postoperative pain and complication risk. We aim to contribute to the literature in terms of emphasizing the importance of US imaging in periodontal operations.

O-067

The cleft collection for research on optimized imaging of cleft lip and palate treatment

Artur Kesztyüs[1,2*], Agota Buzár[3], Flavia Preda[2], Eman Shaheen[2,4], Karla Faria Vasconcelos[2], André Ferreira Leite[2,5], Catalina Moreno-Rabie[2], Krisztian Nagy[1,2], Reinhilde Jacobs[2,4,6]
[1] First Department of Pediatrics, Semmelweis University Budapest, Hungary
[2] OMFS-IMPATH Research Group, Department of Imaging and Pathology, KU Leuven, Belgium
[3] Department of Anthropology, Hungarian Natural History Museum, Hungary
[4] Department of Oral and Maxillofacial Surgery, University Hospitals Leuven, Belgium
[5] Department of Dentistry, University of Brasília, Brazil
[6] Department of Dental Medicine, Karolinska Institutet, Sweden

Introduction
There is a lack of international guidelines regarding the optimized three-dimensional (3D) imaging protocol for patients with cleft palate. The aim of this study was to describe the development of six age-specific phantoms that will be used for pediatric imaging research. The phantoms have been primarily developed to establish a standardized approach for justification and optimization of Cone Beam Computed Tomography (CBCT) scans for patients with orofacial clefts, balancing dose-image quality for treatment and follow-up of this specific group of patients..

Materials and Methods
Material and Method: Six human skulls (aged 6-10 years) derived from the collection of the Hungarian Natural Museum have been selected. The cleft palate collection was scanned using a cone-beam CT device. Initial scans were performed for age estimation. Subsequently artificial clefts have been prepared using virtual 3D planning softwares to design and 3D printing technology to manufacture the custom-made cutting guides. After artificial cleft creation, the skulls were covered, layer-by-layer, with Mix-D soft tissue equivalent material. Mandibles were immersed separately, and a Mix-D tongue model was also created. For this we have followed the methodology of the DIMITRA (Dentomaxillofacial paediatric imaging: an investigation towards low dose radiation induced risks) study. The images deriving from all anthropomorphic phantoms were evaluated by two Dentomaxillofacial Radiologists, investigating the presence of air bubbles, artifacts and inhomogeneities of the Mix-D material and a potential effect on the visualization of the bone defect and other relevant anatomical landmarks.

Results
Phantoms, which showed human-like characteristics allowing the planning of further research on the imaging protocol for treatment and follow-up of patients with orofacial cleft, were selected.

Conclusions
The present study allowed the development of a pediatric orofacial cleft phantom collection which can be used for future imaging research on dose optimization and justification.

O-068

Development of evaluation method and standard for the image layer of panoramic radiography

Han-gyeol Yeom[1,2*], Sam-Sun Lee[1], Soon-Chul Choi[1], Min-Suk Heo[1], Won-Jin Yi[1], Kyung-Hoe Huh[1], Jo-Eun Kim[1]
[1] Oral and Maxillofacial Radiology, Seoul National University, South Korea
[2] Oral and Maxillofacial Radiology, Wonkwang University, South Korea

Introduction
The purpose of this study was to analyze the correlation between spatial resolution and ball distortion rate of panoramic radiography and to elucidate the minimum criterion for ball distortion rate. And we aimed to evaluate the potential for utilization of software using C# language.

Materials and Methods
Horizontal and vertical spatial resolution and ball distortion rates were calculated in the same position with various object depths corresponding to 48 mm. A region showing spatial resolution above the reference standard was selected and the mean and standard deviation of the obtained ball distortion rates were calculated.

And we produced two analysis programs for panoramic radiographs of the phantom using Matlab and C# programming language and compared analysis results of three devices.

Results
In all devices, the horizontal line pair phantom was readable in all areas measured at the line pair value of at least 1.88 lp/mm. The line pair value tended to be higher toward the center and lower toward the outside. The ball distortion rate tended to decrease closer to the center and increased further away. The ball distortion rates for the same site that satisfy the reference line pair value when using the horizontal or vertical resolution phantom were extracted and the mean ball distortion rate that met any of the criteria was proposed. The MTF values evaluated by Matlab and C# were not significantly different between the two software.

Conclusions
Image layer of panoramic radiography could be evaluated by the spatial resolution using line pair phantoms and by assessing ball distortion rates through a ball-type panorama phantom. A ball distortion rate could be used as a threshold to evaluate the image layer of panoramic radiography. The analyzing program for panoramic radiographs using C# programming language could be easily used in many dental hospitals.

Oral Presentation

O-069

Effective dose estimation in cone-beam computed tomography for dental use by monte carlo simulation employing a step and shoot method

Hiroshi Watanabe[1*], Yoshihiro Ozaki[1], Tohru Kurabayashi[1]
[1] Oral and Maxillofacial Radiology, Tokyo Medical and Dental Univerisity, Japan

Introduction
Cone-beam computed tomography for dental use (CBCT) is widely used in dental practice and it is important to know their effective dose given to patients in advance.
It is usually estimated using thermo-luminescence dosimeters (TLDs) located in a Rando phantom, but recently a Monte Carlo simulation (MC) method has been introduced that can simulate photon behaviors interacting with matters in silico. However, MC takes much times for calculating the dose and it would be essentially difficult to simulate a moving X-ray source continuously emitting X-rays. In this study, we employed a step and shoot method in MC simulation and clarified how the dose was influenced when the calculation degrees were thinned out.

Materials and Methods
We simulated 3DX Accuitomo FPD8 (Morita Corp., Kyoto, Japan) as a CBCT model and two types of field of views (FOVs) of 8 x 8 cm and of 4 x 4 cm. The scanning parameters were the tube voltage of 80 kV, the tube current of 7 mA, the acquisition time of 17.5 seconds (360-degrees rotation).

We employed a Particle and Heavy Ion Transport code System (PHITS) as a MC method and simulated the X-ray source behaviors employing the step and shoot method, that was executed in one degree step against the voxel Rando phantom. The results were compared with those estimated by TLD measurement in the original Rando phantom.

Results
The results from every one degree MC simulation were almost same with those from TLD measurements for each of FOVs. We considered that the simulation with every 5 and 30 degrees would be acceptable for the 8x8 and 4x4 FOVs, respectively.

Conclusions
In this study, we could seek the optimized numbers of step and shoot procedures in MC for CBCT examinations.

O-070

First and second branchial cleftcysts: ultrasonographic features of a multicenter study

Antigoni Delantoni[1*], Apostolos Sarafopoulos[2], Denis Ahsen[3], Orhan Kaan[3]
[1] School of Dentistry, Aristotle University of Thessaloniki, Greece
[2] Radiology Department, AHEPA General Hospital, Greece
[3] Dentomaxillofacial radiology, Ankara University, Turkey

Introduction
Cervical swelling at a young age is rarely due to congenital malformations such as branchial cysts and vasculopathy, thyroid pore cysts and teratomas.They are often combined with the presence of inflamed salivary glands. When involving 1st cleft they mainly affect young women with recurrent, painful swelling of the parotid gland, while 2nd cleft most commonly occurs in young children with inflammatory hypoglossal salivary gland inflammation.The aim of this study is to present the key ultrasonographic features of Branchial Cleft Cyst through a case series presentation where ultrasonography was selected as the initial examination of imaging.

Materials and Methods
During the past year, patients with painful or asymptomatic swelling of the upper neck area and buccal region were examined by ultrasound in the AHEPA hospital emergency department and Ankara University department of Dentomaxillofacial Radiology. These cases showed abnormal lesions with morphological features of complex cleft cysts 1 and 2. The diagnosis was based on patient history, clinical picture and ultrasound findings.

Results
The specific locations of the cysts are intraparotid for the 1st cleft cysts and submandibular region for the 2nd cleft cysts

Conclusions
In combination to the swellings, the young age of the patients, and thecharacteristic features of the ultrasonographic examination it is easy to establish the diagnosis of the embryonic residues of the branchial arches.

O-071

Assessement of bone loss six months after cystectomies using cone beam computed tomography

Cristina Antohi[1*], Roxana Mihaela Popescu[2], Radu Eduard Cernei[2], Mihaela Salceanu[1], Doriana Forna Agop[2], Danisia Haba[2]
[1] Endodontology, UMF "Gr.T.Popa", Iasi, Romania
[2] Surgery, UMF "Gr.T.Popa", Iasi, Romania

Introduction
Odontogenic cysts have developmental or inflammatory origins. Cystic conditions of the jaw cause bony destruction and may cause resorption or displacement of adjacent teeth. Our purpose was to evaluate the bone loss at six months after cystectomies by using cone beam computed tomography reconstructions to perform the implants.

Case
We selected a case of a 37 years-old female who came for an abscess between central left incisor maxillary and the canine. After a clinical examination she was given an orthopantomography to be able to complete the entire treatment plan. Orthopantomography revealed seven cysts at the level of the entire maxillary, which is why cone beam computed tomography was performed. The cone beam computed tomography cross-section revealed: large cysts in the premolar-molar area at the level of the right and left maxillary and an infected cyst was discovered between central left incisor maxillary and the canine. Following an interdisciplinary consultation between the surgeon and the endodontist they decided on a more conservative treatment plan: the teeth in contact with the cysts were removed with them-Caldwell Luc procedure and the rest of it were preserved. After six months we do a cone beam computed tomography to measure bone loss to use implants.

Discussion
Cone beam computed tomography reconstructions after six months allowed us to assess in 3D plan bone loss in the premolar-molar area at the level of the right and left maxillary which is an important one;

in the frontal region of maxillary it can also be observed that bone regeneration is not complete and does not allow the use of implants. Implants cannot be used without bone addition and sinus lift.

O-072

Informed consent in dentomaxillofacial radiology: a cross-sectional study

Melih Ozdede[1*], Gulsun Akay[2], Ozge Karadag[3]
[1] Department of Dentomaxillofacial Radiology, Pamukkale University, Turkey
[2] Department of Dentomaxillofacial Radiology, Gazi University, Turkey
[3] Department of Statistics, Gazi University, Turkey

Introduction
Informed consent is the provision of sufficient information to a patient and the patient's consent or rejection of the medical intervention. This study aims to evaluate the perceptions and attitudes of dentomaxillofacial radiology (DMFR) physicians worldwide about informed consent in terms of oral radiology applications.

Materials and Methods
Research assistants, specialists, and lecturers working in dentomaxillofacial radiology departments in various countries were invited to the study via e-mail. The participants answered their demographic information (country, age, gender, professional experience, title, and institution), and questions about informed consent. The Pearson chi-square and Fisher's exact tests were used for statistical analysis.

Results
Forty-six male (51.7%) and 43 female (48.3%) dentists from 22 countries have completed the survey. Most of the participants were aged between 31 and 45 (46.1%). Most of the surveyors' (53.9%) institutions were university hospitals. Twenty-nine (32.6%) of the participants were from Europe while 30.3% of them were from South America. The surveyors who have experienced 1-8 years and 9-20 years had similar opinions about the evolution of their knowledge about informed consent while most of the DMFR specialists who have experienced 21 years and more (86%) said that their knowledge was sufficient in this topic ($p<0.05$). Most of the participants aged between 30 and 45 (43.9%) said that patients should not be informed about the risk of cancer while most of DMFR specialists aged 45 and above (67.5%) stated that patients should be informed about cancer risk ($p<0.05$).

Conclusions
This study showed that most of the DMFR physicians stated that they have responsibility for getting informed consent. However, it was found that only one-third of the surveyors inform patients about the risks of radiation.

O-073

Structured report for cone beam computed tomography of oral and maxillofacial region: in perspective of radiologist and clinician

Hak-Sun Kim[1,2*], Chena Lee[2], Jinwoo Choi[1], Eun-Kyung Kim[1], Won-Jeong Han[1]
[1] Oral and Maxillofacial Radiology, Dankook University, South Korea
[2] Oral and Maxillofacial Radiology, Yonsei University, South Korea

Introduction
Radiographic image interpretation plays a crucial role in diagnosis and radiology report is a means of communication between radiologists and clinicians. Thus, effects of structure in radiology reporting has been extensively studied in diagnostic radiology. The purpose of this study was to evaluate structured report for interpretation of cone beam computed tomography (CBCT) in oral and maxillofacial region in perspective of radiologists and clinicians.

Materials and Methods
Thirty-six CBCT cases acquired to assess various jaw diseases in oral and maxillofacial region were selected, and the template for structured report was fabricated. Two board-certified oral and maxillofacial radiologists interpreted the images in free-text reports, then in structured reports a few weeks later. Along the interpretations, convenience and organization were evaluated by 5-point Likert scale for each type.
The reports of both types were delivered to clinicians in two different fields; oral and maxillofacial surgery and general dentistry. Clinicians evaluated productivity, consistency, and organization with the same scale for each type. Student's t-test was used to statistically compare scores of structured reports and free-text reports.

Results
Convenience and organization scores of structured reports evaluated by radiologists and productivity, consistency and organization scores of structured reports evaluated by general dentists were significantly higher than those of free-text reports. In contrast, productivity and organization scores of free-text reports evaluated by oral and maxillofacial surgeons were significantly higher than those of structured reports.

Conclusions
In diagnosing jaw diseases by CBCT, structured reports are more convenient and organizing to write for radiologists and more productive, consistent and organized to read for general dentists. However, free-text reports were found more productive and organized to read for oral and maxillofacial surgeons. Preferred structure of radiology reports in oral and maxillofacial region may differ by their roles in diagnosis and treatment.

O-074

The use of post-exam feedback in oral radiology. a survey study among dental and dental hygienist educations in europe.

Jan Ahlqvist[1*], Eva Levring Jäghagen[1], Thomas De Lange[2], Gerald Torgersen[3], Anne Møystad3[3]
[1] Department of Odontology, Umeå University Medical Faculty, Sweden
[2] Department of Education, University of Oslo, Norway
[3] Institute of Clinical Dentistry, Faculty of Dentistry, University of Oslo, Norway

Introduction
A combination of summative assessment followed by active post-exam feedback can create a formative assessment environment supporting students learning. One way is to give the students feedback in an in-plenum discussion on answers to questions after a written final exam in order to identify knowledge gaps and misconceptions. The extent to which such sessions are used in oral radiology education for dental and dental hygienist students in Europe is not known. The aim of this survey study was to explore whether post-exam feedback sessions are conducted in Europe, and if so, in what format.

Oral Presentation

Materials and Methods
A questionnaire, including two reminders, was distributed to 118 dental schools in 29 countries and to 52 dental hygienist schools in 16 countries in Europe. The questions addressed use of feedback after final exams, and if feedback was given, whether the sessions were formalized/mandatory or performed for other reasons.

Results
Answers were received from 33 (28%) dental schools (18 countries; 62%) and 25 (48%) dental hygienist schools (11 countries; 68%). In total, 52% of the dental schools and 52% of the dental hygienist schools reported that there were guidelines for formalized post-exam feedback at their school. In schools without such guidelines, informal feedback was given at 38% of the dental schools and at 42% of the dental hygienist schools. These informal sessions were in the majority of cases initiated by individual students who wanted feedback to their result.

Conclusions
Half of the responding dental and dental hygienist educations in Europe have guidelines for and conduct post-exam feedback sessions after final exams in oral radiology. To support the students learning, there seems to be a large potential for development of post-exam feedback after summative assessments within Europe.

O-075

Building an online education system for undergraduate clinical training utilizing dicom viewer with cloud-based pacs

Ken-ichiro Ejima[1,2*], Ryutaro Kohashi[1], Yusuke Hayashi[1], Ko Dezawa[1,2], Toshihiko Amemiya[1,2], Yuka Sato[1], Kunihito Matsumoto[1,2], Kunihiko Sawada[1,2], Yoshinori Arai[1,2], Kazuya Honda[1,2]
[1] Department of Oral and Maxillofacial Radiololgy, Nihon University School of Dentistry, Japan
[2] Division of Advanced Dental Treatment, Dental Research Center, Nihon University School of Dentistry, Japan

Introduction
Due to the spread of COVID-19, our lecture was changed from face-to-face to online. Accordingly, undergraduate students could not take clinical practice in our dental hospital. In the context of these circumstances, we built an online education system using an external reference viewing system for clinical practice.

Materials and Methods
The online education system consists of a portal site, viewer system and video conference system. Normal anatomy documents on CT and MRI were uploaded in PDF files onto the site. The viewer system was introduced the external reference viewing system (TSUNAGU, NOBORI Ltd.) This system will anonymize DICOM image data and transmitted the data to a dedicated cloud-based PACS. Students connected to PACS using their own device (tablet PC, note PC, smartphone) and they can check the cross-sectional images on CT and MRI via DICOM viewer. Video conference system was used for communication bi-directionally.

Results
There was no system failure and the students were able to practice smoothly. This system was received well about viewing the cross-sectional images on CT and MRI from students.

Conclusions
In COVID-19 environment, we were able to train our undergraduate students for clinical practice using this online education system. In the future, we plan to customize this system so that it can be used in other grades.

O-077

Imaging findings of extra-nodal rosai-dorfman disease of the orbit in elderly patient: a case report

Nisha G Manila[1*], Sinan A Bana[2], Brian Johnston[3], Amin F Saad[2], Madhu K Nair[1]
[1] Diagnostic Sciences, Oral and Maxillofacial Radiology, Texas A&M College of Dentistry, Dallas, TX, United States of America
[2] Diagnostic Radiology, Baylor Scott and White Medical Center, Dallas, TX, United States of America
[3] Department of Pathology, Baylor Scott and White Medical Center, Dallas, TX, United States of America

Introduction
Rosai-Dorfman Disease (RDD), also known as sinus histiocytosis with massive lymphadenopathy is a benign idiopathic histiocytic proliferative disease. RDD was described by Juan Rosai and RF Dorfman in 1969, with children and young adults (mean age: 21 years) affected the most. Although etiology is unknown, disordered immune regulation and viral infections such as EBV and HHV are thought to be involved. RDD can affect several organ systems including nodal and extra-nodal tissues, with 75% of the extranodal variety affecting the head and neck.

Case
A 71-year-old male, with a family history of malignancy or hematologic disorders, and past history of myocardial infarction, presented with poor vision.
Magnetic resonance imaging with and without contrast demonstrated infiltrative, enhancing, soft tissue mass centered within the right orbit directly involving the infraorbital canal, inferior orbital fissure, right maxillary sinus and pterygopalatine fossa. Chest CT did not reveal other significant findings. A differential diagnosis of benign neoplasm of the orbit versus RDD was made.
The histopathologic specimens portrayed the presence of S100-positive, CD1a-negetive histiocytes with emperipolesis and background inflammatory cells, suggestive of RDD.

Discussion
With more severe fibrosis and fewer histiocytes in lesions, the diagnosis of extranodal RDD is challenging. Furthermore, most patients may manifest no significant signs and symptoms. Painless cervical lymphadenopathy and histopathologic evaluation are significant for diagnosis. Increased awareness of RDD among oral and maxillofacial radiologists can help better delineate RDD from the more common diseases in the head and neck region. Mid-face is the most common site, while oral manifestations and bone involvement being relatively rare.

O-078

Development of virtual radiology clinical competency evaluation amidst covid-19 at rutgers school of dental medicine

Steven R. Singer[1*], Mel Mupparapu[2,1]
[1] Diagnostic Sciences, Rutgers School of Dental Medicine, United States of America
[2] Oral Medicine, The University of Pennsylvania School of Dental Medicine, United States of America

Introduction
Third year (D3) dental school clinical competency evaluations (CCEs) are a component of our Oral Radiology Clinic course and have been used as evaluation instruments. Competency evaluations were underway in March 2020 when the COVID-19 pandemic-related school closure began and the entire Radiology CCE evaluation process was halted. There was an urgent need to develop and implement the virtual CCEs (VCCEs) to ensure this requirement would be completed by D3 students for an on-time promotion to senior year.

Materials and Methods
Paper-based CCEs were converted to VCCEs. All examination full mouth series (FMS) and panoramic radiographs were de-identified. Upon completion of their clinical session pre-requisites, D3 students were permitted to schedule online competency exams via the Microsoft Bookings App. (Microsoft, Renton, USA). Faculty scheduled WebEx (Cisco Systems, Milpitas, USA) meetings at the pre-selected time for each examination. Each examination was scheduled for one hour. Assessment, following the grading rubric for each competency, was entered after each examination via Axium (Exan, Coquitlam, Canada) software. Three different VCCEs were administered: FMS Technique, FMS Interpretation, and Panoramic technique, anatomy, and interpretation.

Results
Four faculty members of the Division of Oral & Maxillofacial Radiology administered approximately 200 VCCEs over a period of approximately ten weeks. The VCCEs were accomplished concurrently with scheduled group virtual clinic sessions. Students were overwhelmingly successful in earning passing scores in the VCCEs and generally were pleased with the individual sessions with faculty. All students successfully completed all three VCCEs prior to the end of the course. The first-time pass rate for the VCCEs was 100%.

Conclusions
VCCEs allowed D3 students to maintain existing knowledge of radiographic assessment and interpretation and add new knowledge, reducing the pandemic-induced hiatus in their education. Faculty gained experience in distance learning techniques, which may have future application.

O-079

Novel method to create 3D printed tooth models using open source software and low-cost 3D printers

Suvendra Vijayan[1*], Nyla Balakrishnan[2], Anitha Potluri[1], Veeratrishul Allareddy[3]
[1] Diagnostic Sciences, University of Pittsburgh School of Dental Medicine, United States of America
[2] Dental Public Health, University of Pittsburgh School of Dental Medicine, United States of America
[3] Oral Pathology, Radiology and Medicine, The University of Iowa College of Dentistry and Dental Clinics, United States of America

Introduction
Dental anatomy, which has been taught using extracted human teeth, is one of the linchpins of dental education. There are inherent issues associated with using extracted human teeth, from limited quantity to ensuring sterilization of teeth. The current project explores the possibility of segmenting a DICOM file of a natural tooth using open source segmenting software and 3D printing the model using a low-cost DLP 3D printer.

Materials and Methods
Extracted premolar teeth were scanned using a microCT machine. The DICOM files were imported into an open source software, 3D Slicer, for segmentation. Using the threshold and paint tools the pulp, enamel and dentin were segmented. After checking for accuracy, a 3D model was created and exported as a .stl file. The files were sliced, and 3D printed in a DLP 3D-printer using vat photopolymerization technique which comprises of a laser which cures a vat of resin in the required areas layer by layer, creating the 3D model of the tooth.

Results
The 3D printed model retained the anatomic accuracy of the scanned model to a high degree.

Conclusions
With the advent of 3D printing and high-resolution imaging, creating low cost alternates to natural teeth is possible. This creates a more affordable, personalized, and hygienic approach to dental education. Using scans of teeth from cone-beam CT (CBCT) is a realistic approach to create these models. Virtual files, of patient teeth whether normal or with pathology, are easily scannable, shareable and can be printed anywhere. Accuracy and affordability of 3D printers are also on the rise. A combination of these factors will contribute to enhancement of student learning using virtualization and 3D modelling. Extending these advances to other areas including using advanced materials for practice of tooth preparation for caries treatment or for endodontic purposes in dental education is also possible.

O-080

Students' perceptions of post-exam feedback in oral radiology—a comparative study from two dental hygienist educational settings

Thomas De Lange[1*], Jan Ahlqvist[2], Eva Levring Jäghagen[2], Gerald Torgersen[3], Anne Møystad[3]
[1] Department of Education, University of Oslo, Norway
[2] Oral and Maxillofacial Radiology, Department of Odontology, Umeå University, Sweden
[3] Institute of Clinical Dentistry, University of Oslo, Norway

Introduction
Post-exam feedback aims to provide students with insight into their performances and enable them to identify knowledge gaps to guide further learning. According to a survey, giving post-exam feedback is mandatory in half of the responding universities in Europe. The aim of this study was to assess dental hygienist students' perceptions of their learning gains from post-exam sessions in a university with (Umeå) and without (Oslo) mandatory post-exam feedback and to compare differences in arrangements with the purpose of improving the quality of post-exam feedback.

Materials and Methods
The sessions were carried out among dental hygienist students from Umeå University, Sweden and from University of Oslo, Norway. The post-exam feedback in Umeå was given simultaneously with the exam results, while the session in Oslo was held after the students had received their results.
The study was based on a qualitative approach, with two student focus group interviews conducted in each study context (Umeå, n=13/Oslo, n=5). All the interviews were led by an unbiased external researcher. The interviews were transcribed verbatim, and a content analysis was performed to identify patterns in participant experiences and perceptions.

Oral Presentation

Results
(Preliminary) Students from both contexts, with and without previous experience, appreciated the post-exam feedback, citing the learning benefits by clearing up uncertainties and revealing knowledge gaps and misconceptions. Students from Umeå reported a somewhat stressful experience having simultaneously received their grades and during the feedback session, a tension that was not reported in Oslo. Most students suggested that the post-exam feedback sessions should always be carried out and last longer.

Conclusions
Post-exam feedback appears to support student learning. The reported learning outcomes depend on how the session is organized and this requires further investigation.

O-081

Carcinoma of mandibular gingiva case given brachytherapy in an out-patient treatment

Tomomi Tsujimoto[1*], Ami Takeshita[1], Yuka Uchimoto[1], Makihito Hamamoto[1], Yuri Iwamoto[1], Ryoko Okahata[1], Hiroaki Shimamoto[1], Atsutoshi Nakatani[1], Yuka Uchiyama[1], Tetsuro Miyamoto[2], Shumei Murakami[1]
[1] Oral and Maxillofacial Radiology, Osaka University Graduate School of Dentistry, Japan
[2] Dental Laboratory, Osaka University Dental Hospital, Japan

Introduction
High-dose-rate brachytherapy (HDR-BT) is one of the most effective treatment methods for oral cancers because of the good local control rate and preservation of oral functions. Though the application of HDR-BT has expanded to many sites in oral cavity, the most cases was tongue cancer with the use of HDR-interstitial BT, having been used in treatment of the other site. If the primary is too thin to implant catheter applicators, an intraoral mold technique is optional. Some reports have described oral cancer treatments that use the mold HDR-BT, which can be performed as an in-patient treatment.
This case report presents a clinical experience of HDR-BT for the mandibular gingival carcinoma by customized intraoral mold technique in an out-patient treatment.

Case
71-year-old man with left mandibular gingival carcinoma, who had not been treated previously and had refused surgical treatment, selected HDR-BT with customized intraoral mold technique conclusively. The mold was divided into two pieces, one set up three catheter applicators and the other put lead for the purpose of avoiding the radiation exposure to normal tissue. HDR-BT using an Ir-192 small source to the primary lesion in an out-patient treatment was performed (54 Gy/9 fr/5 days).
No local recurrence and metastasis have not seen at this time in this case.

Discussion
This case report showed HDR-BT for mandibular gingival carcinoma by customized intraoral mold technique in an out-patient treatment was safely completed. Though no local recurrence and metastasis have not seen at this time, careful follow-up is needed to prevent osteonecrosis caused by the radiation exposure.

HDR-BT for mandibular gingival carcinoma by customized intraoral mold technique in an out-patient treatment may be effective and useful treatment method.

O-082

A case of suspected radiation-induced tumor after high-dose-rate interstitial brachytherapy (HDR-ISBT) for tongue cancer

Yuka Uchimoto[1*], Hiroaki Shimamoto[1], Masako Tsuzawa[1], Yuri Iwamoto[1], Keisuke Marutani[1], Tomomi Tsujimoto[1], Atsutoshi Nakatani[1], Tadashi Sasai[1], Kaori Oya[2], Yasuo Fukuda[2], Shumei Murakami[1]
[1] Department of Oral and Maxillofacial Radiology, Osaka University Graduate School of Dentistry, Japan
[2] Clinical Laboratory, Osaka University Dental Hospital, Japan

Introduction
High-dose-rate interstitial brachytherapy (HDR-ISBT) is one of the most effective treatments for the oral cancers. The radiation therapy including the HDR-ISBT, however, can cause serious complications, and the radiation-induced malignant tumor has become the worst complication among long-term survivors. The diagnosis of radiation-induced malignant tumor has difficulties because there is no specific signs nor symptoms, so it defined by latency period, histopathological type, and occurrence site.

We report a case of suspected radiation-induced malignant tumor after HDR-ISBT for the tongue cancer.

Case
A 39-year-old woman with right tongue cancer had received the HDR-ISBT (60 Gy/ 10 fr/ 8 days). Five years after the HDR-ISBT, a tumor formed at the primary site. Total glossectomy, rectus abdominis muscle flap reconstruction, partial mandibulectomy, scapular reconstruction, and bilateral radical neck dissection were performed. The tumor was diagnosed as a spindle cell sarcoma histopathologically.

Discussion
According to the recent criteria of radiation-induced sarcoma, this case classified as a radiation-induced sarcoma. Our search of the literature revealed no report of radiation-induced tumor after HDR-ISBT.

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e-Poster Presentation

READING
AND
LEADING
DENTISTRY

e-Poster Presentation

E-001

Mandibular canal segmentation in 3D CBCT using Multi-LSTM 3D unet

Bo-Soung Jeoun[1*], Sang-Jeong Lee[2], Min-Hyuk Choi[2], Ji-Yong Yoo[2], Tae-Hoon Yong[2], Si-Eun Choi[2], So-Young Chun[1], Su Yang[2], Jin Kim[1], Won-jin Yi[2,3]
[1] The Interdisciplinary Program in Bioengineering, Graduate School of Engineering, Seoul National University, South Korea
[2] Department of Biomedical Radiation Sciences, Graduate School of Convergence Science and Technolog, Seoul National University, South Korea
[3] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
The accurate localization of mandibular canal is considered to be crucial to avoid its physical damage during dental implant surgery or third molar removal operation. However, due to the complexity of three-dimensional data such as 3D CBCT, it has been challenging for skillful radiologists to accomplish an abundant amount of annotated data by hand which leads to a need for automatic segmentation of mandibular canal to ease the labor intensity. Here, we present a deep learning technique for mandibular canal segmentation in 3D CBCT by using a modified 3D Unet with Long Short-Term Memory, Multi-LSTM 3D Unet.

Materials and Methods
3D Unet is an extended version of 2D Unet that keeps more spatial information, consisted of encoder-decoder structure. Long Short-Term Memory(LSTM), one of the representatives of Recurrent Neural Network(RNN), is an efficient method for maintaining useful contextual information from the previous stage. Therefore, in the perspective of preserving the continuity of mandibular canal, we applied multiple LSTMs to 3D Unet to strengthen the information obtained from the network itself during training. The CBCT data were acquired from 50 subjects who have visited Seoul National University Hospital and split into 30 for train, 10 for validation, and 10 for test. Resizing, cropping and zero-padding were done as preprocessing to adjust the input volume size as 128 x 128 x 200.

Results
The Dice Coefficient (DSC) Score was used to digitize the performance of the proposed method for quantitative evaluation, which achieved 0.76±0.18 and 0.73±0.14 respectively for each left and right side of mandibular canal.

Conclusions
Though there are some limitations of the heavy computational cost and memory efficiency issue of 3D Network, our proposed method achieved high performance based on 3D reconstruction with a few false positives and disconnectivity.

E-002

TMD detection using infrared thermography and machine learning

Elisa Diniz De Lima[1*], José Alberto Souza Paulino[1], José Eraldo Viana Ferreira[1], Jussara Da Silva Barbosa[1], Ana Priscila Lira de Farias Freitas[1], Daniela Pita De Melo[1]
[1] Dentistry, Paraiba Estadual University, Brazil

Introduction
Machine learning may be a useful tool to improve diagnosis; therefore, this study aimed to improve Temporomandibular disorder (TMD) detection using infrared thermographic and machine learning.

Materials and Methods
78 patients were selected by applying the Fonseca questionnaire to detect the control patients and RDC/TMD to confirm the presence TMD (41 patients with TMD and 37 patients without TMD). Two images (lateral projections) of each patient were acquired totalizing 156 images. For each lateral projection, four ROIs were selected, three of the masseter muscles and 1 of the temporal muscle. Two methods of extracting attributes were used. The first was a radiomic method where texture attributes were used, and to increase the database and to amplify the ability to generalize the models, four co-occurrence matrices were obtained for each image, at the following angles: 0º, 45º, 90 e 135º. Ten texture attributes were assessed (entropy, homogeneity, variance, contrast, correlation, energy, trimmed mean, kurtosis, asymmetry, standard deviation). The second method was the semantic method, which used the ROI mean temperatures using FLIR Tools software and pain intensity data obtained during palpation. For data classification in both studied methods, the following machine learning techniques were used: KNN, SVM and deep DMLP.

Results
The accuracy of KNN, SVM and deep DMLP classifiers for texture attributes for the masseter muscles were 70.25%, 66.22%, 81.01% and 77.49%, 64, 42%, 78.49% for the temporal muscle. The mean temperature of the ROIs and pain intensity data assessment for KNM, SVM and RNM were 93.33%, 92.33% and 54.16%.

Conclusions
Infrared thermography images combined with machine learning can be effective on TMD diagnosing using classical techniques as KNN e SVM. Infrared thermography semantics attributes merging temperature and pain intensity data are more accurate than infrared thermography attributes alone.

E-003

Fully automated human identification based on deep learning algorithm using dental panoramic radiograph

Eun-gyu Ha[1*], Young Hyun Kim[1], Sang-Sun Han[1]
[1] Oral and Maxillofacial Radiology, Yonsei University, South Korea

Introduction
Human identification using dental panoramic radiographs (DPRs) is necessary task to verify a person's identity in unexpected accidents. The several automated identification process have been tried to overcome the shortcomings of the manual DPR comparison process such as labor-intensive and time-consuming, but there is no fully automatic model for identification using deep learning. In this study, we proposed fully automated human identification method based on convolutional neural network (CNN).

Materials and Methods
In total, 2,765 DPRs from 746 anonymized patients were included and divided into training (1,221 images) and test (1,544 images) datasets. After augmentation by combining various methods, the number of training dataset was increased from 1,221 to 13,431 DPRs. The proposed CNN model was developed based on the VGG algorithm.

Results
The model identified human with a Rank-1 accuracy of 75.2% on test dataset. The objective performance evaluation metrics of precision, recall, accuracy and F1 score were 97.6%, 74.4%, 79.3% and 84.4%, respectively. In visual evaluation using gradient-weighted class activation mapping image, the most interested areas of the model had identifiable dental information that deserve focus when manually compares DPRs.

Conclusions
The proposed fully automatic human identification model provided acceptable results for a wide range of database at a faster rate than manual methods, so they have the potential to be applied to forensic human identification.

E-004

Sanity checks for deep learning to estimate the location of dental X-ray images

Hideyoshi Nishiyama[1*], Taichi Kobayashi[1], Makiko Ike[1], Masaki Takamura[1], Yutaka Nikkuni[1], Marie Soga[1], Sachiko Hayashi Sakai[1], Takafumi Hayashi[1]
[1] Division of Oral and Maxillofacial Radiology, Niigata University Graduate School of Medical and Dental Sciences, Japan

Introduction
The development and use of image recognition system with deep learning is rapid and widespread.
However, since the basis for system decision-making lies within the black box, accountability is required.
This time, we conducted an experiment with the aim of clarifying whether the human side can understand the basics of a system that estimates the image position of dental X-rays with a diagnostic accuracy of 100%.

Materials and Methods
We use 900 images extracted from 150 sets of full-mouse (10 blocks), excluding implants or mistakes. With the anterior blocks duplicated, we flipped one side to create 6 blocks and rotated them 90 degrees three times to create 4452 images. All images were expanded and shaped into a 128x128 pixel square.
We used a windows 10 system with NVIDIA GeForce GTX 1060 6GB. The software used was a neural network console (Sony, 1.4.6983.42039, offline). The residual_learning (a kind of ResNet) model was used. The accuracy, average precision, average recall, and average F-measures were all 100%.
The cognitive abilities of this system were evaluated using a human-recognizable textbook schema (15 images) and a schema used for student education (6 images). In addition, we created a heatmap and analyzed which parts were used as the basis for recognition.

Results
The maximum cognitive ability of this system when reading a human-recognizable schema is about 33%, and it may not be judged based on the anatomical structure recognized by the human side. Heatmaps suggested that cognition may depend on something other than anatomy.

Conclusions
Deep learning systems might make decisions based on parts unrelated to the anatomical structure that is the basis for logical thinking on the human side.
When educating students who will become AI users in the future, we think that this point should be fully taken into consideration.

E-005

A development of deep learning hybrid method for automatic evaluation of periodontal bone loss

Hyuk-Joon Chang[1*], Sang-Jeong Lee[2], Tae-Hoon Yong[2], Nan-Young Shin[1], Bong-Geun Jang[1], Jo-Eun Kim[1], Kyung-Hoe Huh[1], Sam-Sun Lee[1], Min-Suk Heo[1], Soon-Chul Choi[1], Tae-Il Kim[3], Won-Jin Yi1[2]
[1] Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea
[2] Biomedical Radiation Sciences, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[3] Periodontology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea
[4] Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
The purpose of this study was to develop an automatic method to diagnose periodontal bone loss (of individual teeth) for staging the periodontitis on dental panoramic radiographs using the deep learning hybrid method. A novel hybrid framework of deep learning architecture and the conventional CAD approach was proposed to detect and classify periodontal bone loss according to the 2017 World Workshop criteria.

Materials and Methods
Deep learning was used to detect the radiographic bone level (or the CEJ level) as a simple structure for the whole jaw on panoramic radiographs. Then, the percentage rate analysis of the radiographic bone loss was conducted with the tooth long-axis with the periodontal bone and CEJ levels. The periodontal bone loss could be classified using the percentage rate automatically. This classification was used for periodontitis staging according to the new criteria proposed at the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions.

Results
The Pearson correlation coefficient of the automatic method with the diagnoses by radiologists and the intraclass correlation value were measured.

Conclusions
The hybrid framework of combined deep learning architecture and the conventional CAD approach showed high accuracy and excellent reliability in the automatic diagnosis of periodontal bone loss and staging of periodontitis.

E-006

Deep learning-based detection of apical lesions in panoramic radiography

Il-Seok Song[1*], Ju-Hee Kang[1], Jo-Eun Kim[1], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Heo[1], Sam-Sun Lee[1]
[1] Oral and Maxillofacial Radiology and Dental Research Institute, Seoul National University School of Dentistry, South Korea

Introduction
The field of deep learning encompasses a group of artificial intelligence methods which employ a large amount of simple interconnected units to perform complicated tasks. We evaluated the performance of deep learning in detecting apical lesions on panoramic radiography.

e-Poster Presentation

Materials and Methods
A total of 713 panoramic radiographic images were divided into a training and validation dataset (n=641 [90%]) and a test dataset (n=72 [10%]). A pre-trained YOLO v3 CNN was used for preprocessing and transfer learning. The diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were calculated for detection and diagnostic performance of the deep CNN algorithm.

Results
The diagnostic accuracy were 97.08% for incisor, 97.96% for premolar, 94.94% for molar, respectively. The deep CNN algorithm showed the sensitivity of 0.36 for incisor, a sensitivity of 0.74 for premolar, and a sensitivity of 0.73 for molar, and the specificity of 0.99 for incisor, 0.99 for premolar, and 0.98 for molar models. The premolar model provided the best sensitivity.

Conclusions
This study showed the potential utility of deep learning for the detection and diagnosis of apical lesions. A deep CNN algorithm provided considerably good performance in detecting apical lesions in panoramic radiography.

E-007

Automatic teeth detection and numbering in panoramic radiographs using deep learning coupled with domain knowledge

Yu-Cheng Kuo[1], Ju-Hui Wu[2], Jhih-Yuan Huang[1*], Wei-Po Lee[1]
[1] Department of Information Management, National Sun Yat-sen University, Chinese Taipei
[2] Department of Oral Hygiene, Kaohsiung Medical University, Chinese Taipei

Introduction
Our purpose is to develop a machine learning-based approach for automatic teeth detection and numbering in panoramic radiographs, which are important but tedious steps before detailed analyses and diagnoses can be performed by dentists. For clinical applications, our study can help the dentists efficiently identify the patients' teeth conditions. They can thus focus on more important tasks, such as patient diagnoses and surgery operations. Our approach adopts deep learning methods coupled with domain knowledge to achieve better performance.

Materials and Methods
We design four processing steps to improve the performance of teeth detection and numbering. Firstly, we apply an object detection algorithm to localize each tooth and classify its number, in which the overlapping boxes are removed by an IOU threshold. Secondly, we calculate boundaries of the teeth and utilize these boundaries to filter the outliers. Next, we build a model to predict the numbers of missing teeth and insert their bounding boxes. Finally, we optimize the inserted boxes by analyzing the shapes of the inserted and the special type teeth.

Results
We evaluated the proposed approach with the dataset collected and labeled by the department of Oral Hygiene, Kaohsiung Medical University, Taiwan. Two object detection algorithms, Faster RCNN and RetinaNet, were tested and consistent results were obtained. The former can improve the performance from 77.83% to 82.43% in mAP, and the latter, from 80.42% to 80.72%. The final precision and recall are 0.9654 and 0.9999, respectively. These results confirm that our method can effectively enhance the overall performance.

Conclusions
Teeth detection and numbering are critical in the teeth diagnosing system. We proposed a deep learning-based approach to improve the system performance and evaluated our approach with two popular object detection algorithms. The enhanced and consistent results verify the effectiveness and generalization of our approach.

E-008

Supervised machine learning for alveolar bone segmentation in intraoral ultrasonographs

Kim Cuong Nguyen[1,2*], Dat Q Duong[3], Fabiana T Almeida[4], Paul W Major[4], Neelambar R Kaipatur[4], Thanh-Tu Pham[1,2], Edmond H M Lou[2,5], Michelle Noga[1], Kumaradevan Punithakumar[1], Lawrence H Le[1,2,4]
[1] Radiology and Diagnostic Imaging, University of Alberta, Canada
[2] Biomedical Engineering, University of Alberta, Canada
[3] Computer Sciences, University of Science, Vietnam
[4] Dentistry, University of Alberta, Canada
[5] Electrical and Computer Engineering, University of Alberta, Canada

Introduction
Alveolar bone process is an important anatomical structure which provides support for the teeth embedding in the alveolar bone proper. Accurate measurement of alveolar bone level is essential for orthodontic treatment planning and periodontal diagnosis. Recently, ionizing radiation-free ultrasound has been demonstrated to image dental structures clearly, especially alveolar bones. Interpretation of ultrasonographs is challenging because the images do not have good contrast-to-noise ratio and the tissue boundaries are fuzzy. Manual delineation of bone boundaries is also sensitive to rater's expertise. The objective of this study is to apply machine learning to segment alveolar bone in ultrasound images.

Materials and Methods
A total of 1100 images was acquired from the central incisors of adolescent patients and divided into training, validation, and testing sets with data augmentation. The manual labeling of the alveolar bone contour by the biomedical engineer was used to train and validate the convolutional neural network, U-net with ResNet34 encoder to delineate the bone automatically. The images of the test set were labeled by three raters and the manual labeling by the oral maxillofacial radiologist was considered the gold standard for comparison.

Results
The Dice coefficient varied from 83% to 86% for intra-rater, 79% to 85% for inter-rater, and 82% to 87% for machine learning-rater respectively. The proposed machine learning approach showed an agreement of 85% in Dice coefficient and 0.28 mm in Hausdorff distance in comparison with the gold standard and took less than 0.5 sec to produce a prediction.

Conclusions
This study demonstrated that machine learning could assist dental clinicians to identify alveolar bone in ultrasonographs, thus improving workflow efficiency and accuracy for diagnosis. Future work will involve a larger study involving different types of teeth for a more comprehensive validation of this machine learning approach.

E-009

Convolutional neural network models as an assistive tool in the evaluation of approximal caries severity

Marcelo Daniel Brito Faria[1,2*], Luciana Freitas Bastos[1], Maira Beatriz Hernandez Moran[1,3], Gilson Giraldi4, Aura Conci[3]
[1] Dental Radiology Center, Policlinica Piquet Carneiro, Universidade do Estado do Rio de Janeiro, Brazil
[2] Faculdade de Odontologia, Universidade Federal do Rio de Janeiro, Brazil
[3] Instituto de Computação, Universidade Federal Fluminense, Brazil
[4] SVVR Laboratory, Laboratório Nacional de Computação Científica, Brazil

Introduction
The high incidence of approximal caries suggests the importance of decision support systems to aid their evaluation. This work uses convolutional neural networks (Inception models) for classifying teeth in bitewing radiographs according to their approximal caries severity, considering three stages: normal (no lesion), incipient (superficial lesion affecting the enamel), and advanced (lesion expanding into the dentin and the pulp).

Materials and Methods
We extracted 480 different tooth images from 112 bitewing radiographs applying these steps: image enhancement using the adaptative histogram equalization, noise and background removal using Otsu's thresholding and morphological operations, and definition of each tooth region using bounding boxes. Two experienced dentists associated each detected tooth to one of the considered classes/stages (no differences between their annotations). Fifteen cases of each class compose the test set (total: 45 images). The remaining 435 images underwent a data augmentation process, resulting in 1160, 1176 and 1128 images for normal, incipient and advanced classes, respectively. The training and validation sets are composed by 80% and 20% of such images. The CNNs' training used learning rates of 0.1, 0.01 and 0.001, and the ImageNet dataset for transfer learning.

Results
The 0.001 learning rate model achieved the best results. For normal class it obtained 0.818 for precision, 0.600 for recall, 0.933 for specificity, 0.823 for negative predictive value; for incipient class: 0.722, 0.866, 0.833, 0.926, and 0.861 for the same respective metrics; and for advanced class: 0.687, 0.733, 0.833, and 0.862. The area under the curve for the receiver operating characteristic was 0.643 for normal class, 0.861 for incipient and 0.810 for advanced.

Conclusions
Such promising results suggest this method's feasibility for aiding the severity analysis of approximal caries in bitewing images.

E-010

A sparse-view reconstruction of panoramic radiography for dose reduction using generative adversarial network

MinHyuk Choi[1*], Sangjeong Lee[1], Jiyong Yoo[1], Taehoon Yong[1], Sieun Choi[1], Bosoung Jeoun[2], Su Yang[1], Soyoung Chun[2], Jin Kim[2], Wonjin Yi[3]
[1] Department of Applied Bioengineering, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[2] Interdisciplinary Program of Bioengineering, Seoul National University, South Korea
3 Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
Oral Panoramic Radiography(OPR) is fundamental imaging modality for diagnosing patient's oral condition[1]. Although Dose of OPR is lower than Computed Tomography(CT), It is 3.5times and 10times higher than intra-oral and cephalometric radiography, respectively [2]. However, the research about dose reduction of OPR has not been much studied since the recognition that OPR has a lower dose of radiography than CT has prevailed. In this study, we introduce generative adversarial network(GAN) based low dose panoramic radiography using a sparse-view reconstruction widely used in low dose CT.

Materials and Methods
We used patch-GAN to acquire synthesis OPR from a sparse-view. The 283, 94 and 96 OPR was used to train, validate and test the model, respectively. The sparse-view OPR was acquired by applying zero-padding with 8 pixels' stride. There was the training with ADAM optimizer and 300 and 0.0002 of learning rate and 300 of epochs. We evaluate the proposed method with normalized root mean square error(NRMSE), peak signal noise ratio(PSNR) and structural similarity index(SSIM) in comparison with the real low dose OPR.

Results
The NRMSE, PSNR and SSIM of our method were 5.43, 0.85 and 10.83dB. On the other hand, those of lose dose OPR were 8.35, 0.69 and 10.76dB, respectively. Our model showed outstanding performance to the low dose OPR.

Conclusions
We propose the method of generative adversarial network(GAN) based low dose panoramic radiography using a sparse-view reconstruction widely used in low dose CT. It could fill the data on missing part of sparse-view and acquire whole synthesized OPR. The image quality was higher than real lose dose OPR. Although we only measured quantitative analysis of images, clinical acceptance will be evaluated with dental disease in the future.

E-011

Automatic segmentation of maxillary sinus

Nermin Morgan[1*], Holger Willems[2], Adriaan Van Gerven[2], Nick Vandenbroeck[2], Eman Shaheen[1], Reinhilde Jacobs[1,3]
[1] OMFS-IMPATH Research Group, Department of Imaging and Pathology, Faculty of Medicine, KU Leuven, Belgium
[2] Relu, Innovatie-en Incubatiecentrum, KU Leuven, Belgium
[3] Department of Dental Medicine, Karolinska Institutet, Stockholm, Sweden

Introduction
The maxillary sinus is the largest of the four paranasal sinuses, and of paramount importance for maxillofacial surgeons, periodontologists, head and neck as well as dentomaxillofacial radiologists.

Segmentation of sinus radiographic images allows for comparison between right and left sides in the context of development evaluation, forensic identification, diagnosis of diseases, symmetry assessment, volumetric measurement, and surgical planning as sinus augmentation and implant placement.

Nowadays, artificial intelligence (AI) has started to play a growing role in oral healthcare. If such segmentation could be automated via AI while keeping anatomical accuracy, clinicians would surely gain in time, consistency and accuracy. The aim of the present study was to develop and validate an AI-based tool for sinus segmentation.

e-Poster Presentation

Materials and Methods
This study was ethically approved (S57587) by the Ethics Commission UZKULeuven. A set of 50 CBCT scans (NewTom VGI Evo, Cefla, Imola, Italy) were selected from a retrospective dataset, including cases with a pathology-free maxillary sinus. Images were manually segmented and labelled by a dentomaxillofacial radiologist using Materialise Mimics Medical 22 software (Materialise, Belgium). Then, STL files of right and left sinuses were separately exported. This allowed for development of an AI driven algorithm based on deep convolutional neural networks (Relu, Leuven, Belgium). Afterwards, another 20 CBCT cases were used for validation of the automatic segmentation tool in terms of system accuracy, time analysis and consistency.

Results
Automatic segmentation is significantly faster (< 1 min) and consistent while reaching the same accuracy in comparison to manual segmentation as performed by the dento-maxillofacial radiologist.

Conclusions
The developed automatic segmentation tool proofs to be highly accurate, consistent and fast for segmentation of the normal sinuses. This finding may allow its enrollment in multiple applications in oral healthcare and maxillofacial surgery.

E-012

Evaluation of knowledge, attitudes, and perceptions of dentists towards artificial intelligence (AI) in dentistry: a national survey

Rohan Jagtap[1*], Hakan Amasya[2], Aniket Jadhav[3], Eugene Shumilov[5], Kaan Orhan[4]
[1] Oral and Maxillofacial Radiology, University of Mississippi Medical Center School of Dentistry, United States of America
[2] Oral & Maxillofacial Radiology, Faculty of Dentistry, Istanbul University-Cerrahpasa, Turkey
[3] Oral & Maxillofacial Radiology, Virginia Commonwealth University School of Dentistry, United States of America
[4] Oral & Maxillofacial Radiology, Faculty of Dentistry, Ankara University, Turkey
[5] Dentistry and Medicine, Diagnocat, Inc, United States of America

Introduction
Over the years, new technologies in healthcare industries have influenced human life. Significant developments in technologies related to artificial intelligence have taken place in many areas. They acted as an aid for screening, diagnosis, therapeutics, treatment planning, and many other aspects of patient care. Our study investigated dentists knowledge, attitudes, and perceptions regarding AI in dentistry.

Materials and Methods
An anonymous online survey consist of twenty-three questions was distributed to USA dentists through Qualtrics. The survey included questions regarding the dentist's knowledge, attitudes, and perceptions about the development and application of AI in dentistry.

Results
In total, 300 responses were included in our study, with around 85% participation rate. The age range of the participants varied between 29 to 80 years (mean 54.6 yr.) old. The male/female ratio was found to be 5:4. There was at least 70% consensus on responses to the questions at the intro, which measured participants' general knowledge of the AI concept by true or false options. More than half of the participants declared they neither agree nor disagree with the questions regarding their satisfaction in the developments of the AI field and if they are ready to trust the decisions of the AI in the future. More than half of the participants agreed that AI systems should not manage the entire treatment but provide assistance. While the majority of the survey participants deemed it appropriate to reduce the daily working hours with the contribution of AI, it was found that in case of malpractice, the responsibility should belong to the person using the system.

Conclusions
The study concluded, even though there is insufficient knowledge of AI among dentists, but they are interested in the development and application of AI in dentistry. Dentists attitudes and perceptions are very positive towards the use of AI dentistry.

E-013

Attitude of brazilian dentists and dental students regarding artificial intelligence in oral radiology: a multi-center survey

Ruben Pauwels[1*], Yumi Chokyu Del Rey[2]
[1] Aarhus Institute of Advanced Studies, Aarhus University, Denmark
[2] Department of Dental Materials and Prosthodontics, Ribeirão Preto Dental School, University of São Paulo, Brazil

Introduction
The aim of this study was to assess the attitude of dentists and dental students in Brazil regarding the impact of artificial intelligence (AI) in oral radiology, and to evaluate the effect of an introductory AI lecture on their attitude.

Materials and Methods
A questionnaire was prepared, comprising statements regarding the future role of AI in oral radiology and dentistry. A lecture of approx. 1 h was prepared, comprising the basic principles of AI and a non-exhaustive overview of AI research in medicine and dentistry. Participants filled in the questionnaire prior to the lecture. After the lecture, the questionnaire was repeated.

Results
Throughout seven sessions at six locations, 293 questionnaires were collected. The majority of participants were undergraduate dental students (57%). Prior to the lecture, there was a strong agreement regarding the various future roles and expected impact of AI in oral radiology. Approximately one third of participants was concerned about AI. After the lecture, agreement regarding the different roles of AI in oral radiology increased, overall excitement regarding AI increased, and concerns regarding the potential replacement of oral radiologists decreased.

Conclusions
A generally positive attitude towards AI was found; an introductory lecture was beneficial towards this attitude and alleviated concerns regarding the effect of AI on the oral radiology profession. Given the unprecedented, on-going revolution of AI-augmented radiology, it is pivotal to incorporate AI topics in dental training curricula.

E-014

Automatic 3D localization of anatomical landmarks in MDCT images using multi-planar U-net

Soomin Kim[1*], Minhyuk Choi[3], Ju-hee Kang[2], Jo-eun KIM[2], Kyung-hoe Huh[1], Won-jin Yi[1], Min-suk Heo[1], Sam-sun Lee[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, Seoul National University School of Dentistry, South Korea
[2] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea
[3] Department of Applied Bioengineering, Seoul National University Graduate School of Convergence Science and Technology, South Korea

Introduction
Three-dimensional(3D) landmarks have been applied in various medical fields including craniofacial dysmorphosis and comparative anatomy. However, manual annotation of the landmark is difficult in 3D due to the complexity of the anatomical structure. In this paper, we proposed the automatic 3D localization of anatomical landmarks with the neural network using multi planar Computed tomography(CT) images.

Materials and Methods
Forty patients' CT data was acquired and divided into 27, 6 and 7 for training, validation and test, respectively. We selected the 13 landmarks which were the important role in 3D cephalometry including Nasion, ANS, Orbitale, Porion, Menton, Sella, PointA, Gonion(right, left), and Pogonion. The 3D coordinates of landmarks in each CT data were obtained by an Orthodontist.

The proposed system consisted of 2 parts. First, the probability maps of landmark location in multi-planar images was acquired with a conventional U-net. Second, the 3D coordinates of the landmark were localized by intersecting the probability maps.
In order to evaluate the proposed method, we measured the Euclidean distance between the ground truth and the predicted points.

Results
The mean distance differences with standard deviation were 0.62±0.50mm, 0.52±0.28mm, 0.67±0.50mm and 1.27±0.56mm for all landmarks in x-, y-, z-axis and 3D distance, respectively.

Conclusions
The results of the proposed method showed the 1.27±0.56mm in 3D distance, which means that the method can be used for clinical practice, since it is lower than clinical requirement (2mm). Additionally, although the false positive of the landmark was occurred on a specific plane image, it may be removes by intersecting the multi planar result. In further studies, it is necessary to study the difference in cephalometric annotation between clinicians and transfer learning with CBCT.

E-015

Multi-center study of segmentation using deep learning in CBCT images

Soyoung Chun[1*], Sangjeong Lee[2], Jiyong Yoo[2], MinHyuk Choi[2], Taehoon Yong[2], Sieun Choi[2], Bosoung Jeoun[1], Su Yang[2], Jin Kim[1], Wonjin Yi[3]
[1] Interdisciplinary Program in Bioengineering, Seoul National University College of Engineering, Seoul, South Korea
[2] Department of Applied Bioengineering, Graduate School of Convergence Science and Technology, Seoul National University, Seoul, Korea, South Korea
[3] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
The performance of deep learning varies depending on the CNN structure, but the composition of the data set is also an important factor in deep learning because training is performed with a specified data set. Therefore, in this paper, we would like to discuss which training data in deep learning segmentation using 3D medical images yields more effective results.

Materials and Methods
We use a Dense U-Net to segmentation the third molars in CBCT images from two institutes with different image quality characteristics. (The data of both institutes are CBCT data taken from the bottom of the ANS to the mandibular end.) The data of institute S is fine then institute W and has many slices in the z-axis direction. Therefore, the number of axial slices of 13 patients in institute S and 50 patients in institute W are almost the same. The data set composition is 13 patients of S institute, 26 of S institute, 13 of S institute with 50 of W institute, and we analyzed the deep learning results of them.

Results
Based on the Dice coefficient, the result for 13 S institute was 0.88, the result for 26 patients was 0.89, and the result was 0.93 based on the data of the two institutes. It can be seen that the result of using data on various patients from different institutes together is better than the result of doubling the image of the same institute.

Conclusions
Therefore, in the case of segmenting structures with various angles and aspects in medical images using deep learning, it can be confirmed through experiments that patient data of various aspects are required rather than fine images of each patient.

E-016

Development and validation of a visually explainable deep learning CNN model for detection of c-shaped canals of the mandibular second molars in dental radiographs.

Sujin Yang[1*]
[1] Advanced General Dentistry, Yonsei University, South Korea

Introduction
Convolution Neural Networks (CNNs) have shown exceling performances in computer vision, yielding promising results in terms of detection and classification of medical diseases in the radiological and pathological field. Additionally, CNN models have become interpretable, and has overcome its un-explainability to a certain level through the application of GRAD-CAM, which visualizes class activation maps. Accordingly, the purpose of this study was to develop and validate of a visually explainable deep learning model for detection of C-shaped canals of the mandibular second molars in dental radiographs.

Materials and Methods
The periapical, panoramic, and CBCT images of 1000 mandibular second molars were collected from 372 patients. The diagnostic performance of the deep learning system using periapical and panoramic radiographs was investigated in respect to its ability to determine whether the second mandibular molar showed a C shaped canal configuration.

e-Poster Presentation

The results of the canal configuration on CBCT were used as a gold standard. A learning model was created, then tested with an internal test set and an external test set prepared from another clinic for external validation. The class activation maps were achieved to evaluate on which portion the model focused on to achieve results.

Results
Mandibular second molars having C-shaped canals showed a high prevalance of 47%. The overall diagnostic accuracy was 83%. Heat maps attained from GRAD-CAM showed highlights in areas in the mid 1/3 to the apical 1/3, which coincide with the areas where clinicians focus on for diagnosis.

Conclusions
The deep CNN algorithm model showed high accuracy in predicting the C-shaped canal variation among mandibular second molars. With further optimization of the test data using a larger dataset and improvements made in the model, a deep learning system can be expected to effectively diagnose C-shaped canals and aid clinicians in everyday practice.

E-017

Deep implant thread shape classification and comparison of accuracy by placement site from dental panoramic image using deep neural networks

Sujin Yang[1*], Youngjin Choi[2]
[1] Advanced General Dentistry, Yonsei University, South Korea
[2] College of Dentistry, Yonsei University, South Korea

Introduction
The thread shape is a characteristic most implants have and can be distinguished on a radiographic image to some extent even through the naked eye. The aim was to classify the implant system by comparing the types of implant thread shapes shown in radiographs using various CNNs; especially, Xception, InceptionV3, ResNet50V2, and ResNet101V2. In addition, the accuracy of CNN depending on the implant site (maxillary incisors/maxillary molars/mandibular incisors/mandibular molars) was compared.

Materials and Methods
A total of 980 radiographic images consisting of 8 types of implants (Dentium Implantium, Dentium NR line, Osstem TS III, Straumann BL, Straumann BLT, Straumann Standard, Straumann Standard Plus, Straumann Tapered Effect) were used. The images were preprocessed by resizing and filtering(CLAHE filter was applied), augmented, and put into CNN models for implant thread shape prediction. Grad-CAM was applied to show visualized class activation map (CAM)s upon the implant threads shown within the radiographic image.

Results
Each model achieved an AUC of over 0.9, AUC of 0.9205 (95% CI 0.9068-0.9342) with Xeption, AUC of 0.9276 (95% CI 0.9145-0.9407) with InceptionV3, AUC of 0.9435 (95% CI 0.9318-0.9552) with ResNet50V2, AUC of 0.9538 (95% CI 0.9432-0.9644) respectively. The accuracy was higher in the posterior portion than in the anterior area in all 4 models. ResNet50V2 demonstrated an accuracy of over 85% in all areas. Most CAMs highlighted the implant surface where the threads are present, yet some showed response in the healing abutment or the connection between the healing abutment and the fixture rather the threaded portion of the implant.

Conclusions
Combining CNNs noticing certain features and a pre-made database of possible implant systems, prediction of the most eligible candidate among various implants is an achievable task.

E-018

Comparison among bone age assessment methods and development of a fishman-based skeletal maturity determination system using deep learning

Tae-Hoon Yong[1*], Nan-Young Shin[2], Ju-Hee Kang[3], Jo-Eun Kim[3], Kyung-Hoe Huh[4], Won-Jin Yi[4], Sam-Sun Lee[4], Min-Suk Heo[4]
[1] Department of Applied Bio-Engineering, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[2] Department of Oral and Maxillofacial Radiology, School of Dentistry, Seoul National University, South Korea
[3] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea
[4] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, BK21, Seoul National University, South Korea

Introduction
Fishman method is one of bone age assessment (BAA) methods that are commonly used. BAA is an ideal task of object detection and image classification using artificial neural networks. This study aimed to investigate the reliability of Fishman's skeletal maturity indicators(SMIs) and develop a new fully-automated SMI-based skeletal maturity determination system using deep learning.

Materials and Methods
The left hand-wrist radiographs of 1,617 subjects were selected. Bone ages were calculated using the GP, TW3, and Fishman methods, and compared with chronological ages. For developing a fully-automated deep learning system for skeletal maturity determination using the Fishman method, Two SMI-based systems were developed; a system trained with an SMI-labeled dataset, and another one trained with a dataset not only labeled with SMIs but also labeled considering region of interests (ROI) extraction and skeletal maturity for each ROI. Two radiologists established a reference standard.

Results
The BAs generally showed significant differences with the CAs, however, a high degree of correlation was observed between the CAs and the BAs for all the methods. For the system trained with an SMI-based set, the mean absolute error (MAE) was 0.88 and the within-1 concordance rate was 73.1%. The system including ROI-based labeling showed much better outcomes; the MAE was 0.34 and the within-1 concordance rate was 93.7%.

Conclusions
In this study, Fishman's SMI was confirmed as a reliable index for the determination of skeletal maturity from hand-wrist radiographs. A developed deep learning system automated the entire process consisting of ROI extraction, skeletal maturity determination for each ROI, and final SMI prediction. The system's accuracy in predicting skeletal maturity was outstanding. Thus, the system presented in this study can be applied effectively to determine the skeletal maturity.

E-019

A double 3D U-nets based teeth landmarks localization for virtual surgical planning in orthognathic surgery

Su Yang[1*], Sang-Jeong Lee[2], Tae-Hoon Yong[1], Jin Kim[3], Won-Jin Yi[4]
[1] Department of Applied Bioengineering, Graduate School of Convergence Science and Technology, Seoul National University, South Korea

[2] Department of Biomedical Radiation Science, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[3] Interdisciplinary Program of Bioengineering, Seoul National University College of Engineering, Seoul National University, South Korea
[4] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
One critical step in preoperative routine orthognathic surgery is to annotate teeth landmarks in an intraoral scanning model for 3D virtual surgical planning. However, this data annotation of teeth landmarks is time-consuming, labor-intensive, and sometimes involves expert knowledge. To date, there are still no effective solutions to establish an automated teeth landmark localization for computer-aided surgical simulation due to morphological variations, registration error, and metal artifact. In this paper, we propose a deep learning-based framework to automatically localize teeth landmarks for 3D virtual surgical planning in CT images.

Materials and Methods
The ground truth of six teeth landmarks was annotated by an expert in the 3D maxillary model combined with the intraoral scanning model from 46 patients. The proposed framework is based on double 3D U-Nets, which combines global and local feature responses via coarse-to-fine learning with the attention mechanism and regressing the multi-channel heatmaps for teeth landmarks localization. In the first 3D U-Net, which guides the anatomical context features by training the coarse heatmaps of teeth landmarks, and the second 3D U-Net trains fine heatmaps of teeth landmarks more elaborately based on the guided anatomical context.

Results
The accuracy of the proposed deep network was evaluated on CT images from 6 patients. The proposed deep network achieved average distance errors of 1.04±0.45mm in coarse learning and 0.91±0.43mm in fine learning on CT images containing metal artifacts and morphological variations. At test time, the proposed deep network inferred six teeth landmarks within a second.

Conclusions
We demonstrated that the proposed network with coarse-to-fine learning improves the performance of teeth landmarks localization and reduces false positives. We expect that the proposed method could be applied to automatic 3D virtual surgical planning in orthognathic surgery.

E-022

The unusual co-existence of ethmoid sinolith and chronic maxillary sinusitis that developed into mucous retention pseudocyst: a rare finding on CBCT imaging

Aga Satria Nurrachman[1*], Norlaila Sarifah[1], Lusi Epsilawati[2], Ria Noerianingsih Firman[2]
[1] Dentomaxillofacial Radiology Residency Program, Faculty of Dentistry Padjadjaran University, Indonesia
[2] Dentomaxillofacial Radiology, Faculty of Dentistry Padjadjaran University, Indonesia

Introduction
Sinolith is a calcified mass presents in paranasal sinuses, mainly in maxillary sinus which is also known as an antrolith or antral stone. Literature findings of sinolith in other sinuses are still limited thus it is consequently becoming an uncommon entity. CBCT is a diagnostic imaging modality that shows 3D images of dentomaxillofacial region. CBCT has been more widely used in clinical dentistry as it offers a simple, faster and cheaper of examination than CT. The available ethmoid sinolith cases that have been reported worldwide in recent years were generally diagnosed using CT. This study is aimed to present a rare case of a sinolith in ethmoid sinus with maxillary sinusitis that subsequently developed into a pseudocyst and to emphasize the advantage of CBCT imaging for the diagnosis of any paranasal sinus diseases.

Case
A 28-year-old female patient complained of her impacted mandibular third molar and wanted to check the condition of a previously treated molar. A following panoramic radiography was done and showed a mucosal thickening of the maxillary sinus inferior wall.
It was found out later that the patient also had a nasal obstruction and regular headache. The patient has been referred for CBCT examination to cover all parts of dentomaxillofacial region in which the biggest field of view (FOV) 13x15 was used. CBCT was re-done after her last following medication with the otorhinolaryngologist.

Discussion
The CBCT showed a homogenous radiointermediate mass in the left maxillary sinus which later changed into a typically dome-shaped lesion suggested as a pseudocyst, and also a small, oval-shaped, stone-like appearance, radiopaque mass in the ethmoid sinus. CBCT 3D may be an adequate diagnostic imaging approach in assessing any paranasal sinus diseases, which in this case of sinolith, sinusitis and pseudocyst, the abnormalities were all clearly visible and interpretable.

E-023

Estimation of chronological age by the demirjian method adapted to the brazilian population

Andrezza Ramos Dos Santos[1*], Julyana De Araujo Oliveira[1], Ana Sofia Vieira Dos santos[1], Danyel Elias Ramos Perez[1], Andrea Dos Anjos Pontual[1], Flávia Maria Moraes Ramos-Perez[1], Maria Luiza Dos Anjos Pontual[1]
[1] Department of Clinical and Preventive Dentistry, Federal University of Pernambuco, Brazil

Introduction
Estimating the chronological age of individuals is necessary for the identification of decomposing bodies and in the adoption process. The teeth, because they have characteristics inherent to each degree of development, are useful tools to estimate chronological age. There are several classifications of the stages of dental development, including the Demirjian method adapted by Soares. This study aimed to analyze the applicability of the method proposed by Soares.

Materials and Methods
The data regarding the sex, age and stage of development of the third molars present in the digital panoramic radiographs of the evaluated patients will be tabulated in an Excel spreadsheet and then exported to the SPSS® statistical software. All calculations will be performed taking into account a confidence index of 5% (0.05).

Results
The model by Soares et al.(2015) underestimates the average chronological age at each Demirjian stage. underestimation ranges from 1.1 years (= 10.9 - 9.8) to 2.9 years (= 21.1 - 18.2). In general, without taking into account the dental stage, the differences in mean age ranged from 2.0 years (upper right third molar and lower right third molar) to 2.1 years (upper left third molar and lower left

e-Poster Presentation

third molar). On the other hand, Pearson's correlation coefficients between the model estimates by Soares and the chronological ages associated with each third molar were: 0.88 (upper right third molar); 0.87 (upper left third molar); 0.89 (lower left third molar) and 0.89 (lower right third molar).

Conclusions
Soares's method demonstrated good discriminatory capacity, and even underestimating age, with no significant difference between genders, it is a promising formula and a simple method of determining age, since, when analyzing the third molar, it allows estimating the age of people between 9.8 and 22 years.

E-025

Cortisol secretion level and its relationship to mandibular bone quality in women with type 2 diabetes mellitus

Annisa Putri[1*], Azhari Azhari[1], Lusi Epsilawati[1], Farina Pramanik[1], Erna Herawati[2]
[1] Oral and Maxillofacial Radiology, Universitas Padjadjaran, Indonesia
[2] Oral Medicine, Universitas Padjadjaran, Indonesia

Introduction
Individuals with type 2 diabetes mellitus (T2DM) have an increased risk of bone fragility. The pathophysiological pathway is complicated, one of mechanisms suggested the relation to increasing level of cortisol secretion. The negative effect of cortisol hypothesized leading to a shift in the balance of osteoblastogenesis and adipogenesis of mesenchymal cells in bone. Women tend to have higher level of cortisol due to vicious circle of estrogen. The aim of the study was to evaluate cortisol secretion level and its relationship to mandibular bone quality in women with T2DM.

Materials and Methods
This was a case-control study in an outpatient setting, comprised of 21 female subjects (mean age 57.25 years old, range 38–68) with T2DM diagnosis validated through medical record. Digital panoramic radiographs of all patients were evaluated by radio-morphometric indices; mandibular cortical width (MCW) and fractal dimension (FD). All patients were also referred to get random serum cortisol level measured.

Results
The average cortisol level in women with T2DM (7.6 mcg/dl ± 0.3) was significantly increased although still within normal values (3.7-19.4 mcg/dl). The mean value of MCW was 0.48 cm ± 0.2 and FD was 1.3 ± 0.2. Subjects with higher cortisol level had significantly showing degenerative change in radiograph with evident of lower MCW and FD values. In multiple regression analyses, the following significant inverse correlations were found; cortisol level and MCW ($p < 0.05$) or FD ($p<0.05$).

Conclusions
Lower MCW and FD values were associated with increased cortisol level in women with T2DM. The trabecular microstructure presented bone alteration and cortical thinning. The results suggest screening using these radiograph markers is useful to evaluate mandibular bone quality particularly in women with T2DM for early detection and management risk of osseus change.

E-026

Comparative analysis of interclinoid ligament and sella turcica dimensions in cone-beam CT images versus reconstructed lateral cephalograms – a pilot study

Anusha Vaddi[1*], Kevin Hathorne[1], Kandasamy Rengasamy[1], Pooja Bysani[2], Aditya Tadinada[1]
[1] Department of Oral & Maxillofacial Radiology, UConn health, United States of America
[2] Department of General Dentistry, UConn health, United States of America

Introduction
The anterior & posterior clinoid processes of the hypophyseal fossa are connected by a fold of dura matter called interclinoid ligament. Ossification of the ligament is known as Sella-Bridge (SB), it is an important consideration while performing surgery in this area. While muscles and ligaments are not visualized on CBCT imaging, they can be seen when calcified. Visualization of the bridge in imaging could be due to true bony union of the clinoid process or can be a projection artifact. The majority of studies regarding SB are based on two-Dimensional (2D) imaging like lateral cephalograms where both sides are superimposed. In this study, Multi-planar Cone-Beam CT (CBCT) sections and reconstructed lateral cephalograms were used to assess and distinguish true ossification of SB from projection artifacts. Also, this study compared the dimensions of Sella turcica in sagittal CBCT sections to reconstructed lateral cephalograms.

Materials and Methods
50 CBCT scans were retrospectively evaluated using a CBCT program Invivo- 6. The presence of SB was assessed in all three orthogonal planes and morphometric measurements were performed at standardized locations in sagittal plane. The presence of SB was also assessed in reconstructed 2D lateral cephalograms of right and left sides and similar measurements were performed.

Results
Out of the 50 scans studied, incomplete SB was found in 1 scan. Ten cases showed an appearance similar to the bridge in reconstructed cephalograms. Further observation of those 10 scans in the true right & left lateral cephalograms showed close approximation of dorsum and tuberculum Sella. The dimensions of Sella Turcica were almost comparable in sagittal sections & reconstructed lateral cephalograms.

Conclusions
The majority of Sella bridging reported in literature, based on 2D imaging might be due to superimposition of closely approximated dorsum & tuberculum Sella. However, larger sample size is required for further validation.

E-027

Root proximity to nerve and bone in posterior mandible

Aysha Arif[1*], Momina Anis Motiwala[1], Farhan Raza Khan[1]
[1] Surgery, The Aga Khan University Hospital, Pakistan

Introduction
The aim of this study was to assess the proximity of the root apices of mandibular posterior teeth to the IAN and the cortical bone on CBCT (Cone Beam Computed Tomography), in Pakistani population.

Materials and Methods
A total of 106 scans were included using convenience sampling. ORTHOPHOSXG 3Dready/CEPH, SIRONA CBCT machine was employed for scans. Shortest linear distances from root apices of the mandibular posterior teeth, to the superior border of the IAN canal, and to the buccal cortex of the mandible, were measured on the GALAXIS Galileos Implant software. Descriptive statistics were computed using SPSS 23.0.

Results
The shortest distance from the root apex to the IAN canal was observed among the right second premolar in males and left second premolars in females. The shortest mean distance from the root apex to the buccal cortex was recorded in right first premolar in males and right second premolar in females. The distances measured among females were shorter than males for all mandibular posterior teeth. Independent sample t-test revealed that the distance of root to IAN canal were different between the genders, on the left side ($p \leq 0.05$), but were not significant for the distance between root apices and the buccal cortex ($p \geq 0.05$). Paired sample t-test revealed that the readings of right side were not different from left side ($p \geq 0.05$). A weak positive correlation was found between the age and tooth to nerve distance ($r \leq 0.30$) and from root to buccal cortex ($r \leq 0.28$).

Conclusions
Second premolar is the tooth closest to the mandibular nerve and buccal cortex. Dental procedures in the second premolar can put the nerve at risk of injury. Females and individuals < 41 years are most prone to such injuries.

E-028

Optimization of cone beam CT for the evaluation of the maxillary sinuses

Barbara Cristina Anrain[1*], Ademir Franco[1], Danieli Moura Brasil[2], José Luiz Cintra Junqueira[1], Luciana Butini Oliveira[1], Anne Caroline Oenning[1]
[1] Division of Oral Radiology, Faculdade São Leopoldo Mandic, Instituto de Pesquisas São Leopoldo Mandic, Brazil
[2] Department of Oral Diagnosis, Piracicaba Dental School, University of Campinas, Brazil

Introduction
Cone beam computed tomography (CBCT) is an optimal tool for the assessment of maxillary sinus conditions. The use of CBCT, however, raises concern when it comes to justification and optimization. The purpose of this study was to test the default protocols of a CBCT unit in order to find lower-dose alternatives with diagnostically acceptable image quality for the maxillary sinuses visualization.

Materials and Methods
Two dry skulls with well-preserved maxillae were used. The four maxillary sinuses were prepared to simulate the imaging sings of membrane thickening, mucous retention pseudocyst, bone graft and normal sinus. CBCT scans were obtained in the i-CAT classic (Imaging Sciences International, Hatfield, PA, USA) using ten default protocols with different energy parameters, field of view and voxel sizes. Multiplanar reconstructions were demonstrated to three Oral Radiologists; these observers judged general image quality, sharpness, contrast, noise and artifacts using a progressive four-level scale. Data underwent Fisher's exact test ($\alpha=0.05$) for inferential outcomes.

Results
Protocols with higher energy parameters had significant association with higher scores for general image quality, sharpness and contrast ($p<0.05$). Protocols with intermediate level of radiation dose had also significant association with good and excellent image quality, while for the level of noise and artifacts the images were rated as acceptable.

Conclusions
In conclusion, default i-CAT protocols with lower radiation dose provided acceptable image quality for the visualization of the maxillary sinuses.

E-029

Scoring system for differentiation of synovial chondromatosis from chondrosarcoma of the temporomandibular joint using CT and MRI

Bong-Geun Jang[1*], Ju-Hee Kang[1], Jo-Eun Kim[1], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Huh[1], Sam-Sun Lee[1]
[1] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
The aim of this study is to identify CT and MR features to differentiate chondrosarcoma from synovial chondromatosis (SC) of the temporomandibular joint (TMJ).

Materials and Methods
CT and MRI scans of twelve and thirty-five patients with histopathologically confirmed chondrosarcoma and primary SC of the TMJ were retrospectively reviewed. Imaging features including the lesion epicentre, destruction/sclerosis of surrounding bones, infiltration into the tendon of the lateral pterygoid muscle (LPM), calcification, periosteal reaction, osteophyte, enhancement, and lesion size were assessed. A comparison between chondrosarcoma and SC was performed with Student's t-test for quantitative variables and with Fisher's exact test or linear-by-linear association test for qualitative variables. For statistically significant variables, a point of 1 or 0 was assigned to each based on the cut-off value. A point of "1" indicates a high-risk feature for chondrosarcoma, while "0" indicates a favorable feature for SC. A composite score for differentiating chondrosarcoma from SC was created by summing the points of all variables. ROC analysis was performed to evaluate the best cut-off value of the composite score to differentiate chondrosarcoma from SC.

Results
High-risk imaging features for chondrosarcoma were epicentre of the mandibular condyle, destruction of the mandibular condyle, no destruction/sclerosis of the articular eminence/glenoid fossa, infiltration into the tendon of the LPM, calcification (absence or stippled), periosteal reaction, internal enhancement, and size ≥30.5 mm. The best cut-off value to discriminate chondrosarcoma from SC was presence of four imaging features, with area under the curve of 0.986 and an accuracy of 95.8%.

Conclusions
We developed a scoring system using CT and MRI characteristics, which may contribute to distinguishing chondrosarcoma from SC of the TMJ.

e-Poster Presentation

E-030

A case report of central odontogenic fibroma of maxilla

Bonghae Cho[1*]
[1] *Oral & Maxillofacial Radiology, Pusan National University, South Korea*

Introduction
A central odontogenic fibroma (COF) is a rare benign tumor of mature fibrous connective tissue, with variable amounts of odontogenic epithelium. It usually appears in the anterior region of maxilla, whereas in the premolar and molar area of mandible. Clinically the most prevalent complaint is non-tender swelling. Radiographically, the COF commonly presents multilocular or unilocular with distinct borders. It also might show cortical thinning or perforation, tooth displacement or resorption and bone expansion. Rarely it shows a mixed radiolucent and radiopaque appearance. Microscopically, mature collagen fibers and numerous fibroblasts along with odontogenic epithelial islands are characteristically found. The best choice of treatment for COF is conservative surgical enucleation and the recurrence is not common.

Case
A 54-year-old male patient presented with facial swelling in the right maxilla since 4 months. Intraorally, irregular soft tissue mass involving right posterior maxilla. Past dental history revealed that he had undergone two surgical operations in the region 36 years ago and 26 years ago. Panoramic radiography revealed severe bone resorption involving whole right maxilla with soft-tissue-mass shadow and right maxilla was in edentulous state. Computed tomography showed the heterogenous occupying right maxilla completely and right nasal cavity partially. There were residual bone remnants were observed along the rather clear border. Incisional biopsy was revealed that it was COF and excisional biopsy followed by surgical enucleation was confirmed it simple COF.

Discussion
This case showed no typical clinical and radiographic characteristics of COF. It might be attributed to the two previous operations. The odd thing for this case was that it recurred twice. It is known that the recurrence rate of COF is very low. Without the past clinical data, in-depth inference was not available, but we need to know COF can recur and be aggressive.

E-031

Recurrent intravascular papillary endothelial hyperplasia of the maxilla.

Brandon Owen[1*], **Kirstyn Donaldson**[2]
[1] *Department of Oral Surgery, Glasgow Dental Hospital, United Kingdom*
[2] *Department of Radiology, Glasgow Dental Hospital, United Kingdom*

Introduction
Intravascular papillary endothelial hyperplasia (IPEH), often referred to as a Masson's Tumour, is a reactive proliferative lesion of endothelial cells in blood vessels commonly associated with vascular injury. IPEH typically affects soft tissues with lesions involving bone less common. A handful of cases exist of IPEH affecting the mandible and the maxillary sinus, but to the best of our knowledge there are no reports in the English language of IPEH within the maxilla. We present a case of recurrent maxillary IPEH.

Case
A 59-year-old female was referred to the oral surgery department and complained of a tender persistent post-operative swelling for ten months following extraction of the upper left second premolar. Medically, she had hypertension, angina, anxiety and depression. A periapical radiograph revealed a suspected residual cyst, and subsequently the site was explored and the lesion excised. Histopathological examination revealed an IPEH. The patient presented 24-months later with new-onset paraesthesia affecting her left upper lip. An orthopantomogram taken at the time revealed a radiolucency within the left posterior maxilla. Cranial nerve examination revealed some discrepancy affecting the left maxillary division of the trigeminal nerve. Magnetic resonance imaging demonstrated a well-circumscribed lesion in the left maxillary alveolus pushing into the maxillary sinus. Cone beam computed tomography demonstrated a well-defined corticated unilocular radiolucency within the left posterior maxillary alveolus. A subsequent incisional biopsy confirmed recurrence of the IPEH and the patient is awaiting surgical excision.

Discussion
IPEH commonly presents as an asymptomatic slowly growing soft tissue mass. This case demonstrates that IPEH can arise within the maxilla and resemble odontogenic pathology. IPEH may recur highlighting the importance of reviewing patients who present with atypical lesions. The imaging, pathology and literature surrounding this case will be explored further.

E-032

Characteristic features of a fungus ball in the maxillary sinus and location of intralesional calcifications on computed tomographic image: a report of two cases

Jae Hoon Lee[1], **Wan Lee**[2], **Byung Do Lee**[2*]
[1] *Department of Otolaryngology, Institute of Wonkwang Medical Science, Wonkwang University, South Korea*
[2] *Department of Oral and Maxillofacial Radiology and Research, Institute of Dental Education, Wonkwang University, South Korea*

Introduction
Sinus fungul ball (FB) is the most common form of fungal sinusitis. Fungal sinusitis was once considered a rare disorder but is now reported with increasing frequency throughout the world. The purpose of this study is report two cases of fungus ball (FB) with characteristic radiographic features of maxillary sinus.

Case
Two female patients, aged 62 and 40 years, sought consult at the dental hospital for the treatment of dental implants and tooth pain, respectively. Panoramic radiography and small field-of-view (FOV) cone-beam computed tomography (CBCT) did not provide a detailed information regarding the radiographic diagnosis of fungus ball due to the limited images of the maxillary sinus. Additional paranasal sinus computed tomographic images showed the characteristic features of fungus ball, such as heterogeneous opacification and intralesional calcification of the maxillary sinus. The fungus ball calcified materials were located in the middle and superior regions of the maxillary sinus.

Discussion
CBCT is often first sectional imaging technique used for workup of maxillary sinus disease because it is now widely available in dental field due to relatively low radiation dose and high spatial resolution. Identification of an area of increased attenuation in maxillary sinus on CBCT can direct the dentist to focused calcified materials. This allows confirmation of fungus ball that would be otherwise be diagnosed as mucosal thickening or maxillary sinusitis. It is necessary to optimize the scan size of CBCT for detection of upper sinus calcification.

E-033

Forensic clues in craniomaxillofacial gunshot wounds: a case report

Catherine Olajumoke Enahoro[1*], Ibiyinka Olushola Amole[2], Akinwaleola Akinlade[2]
[1] Oral Diagnostic Sciences, Bayero University, Kano, Nigeria
[2] Oral and Maxillofacial Surgery, Bayero University, Kano, Nigeria

Introduction
Increasing socio-economic, religious, political and ethnic tensions have resulted in a steep rise in the use of firearms globally. Several factors including the type of firearm/propellent used and tissue factors, determine the nature, pattern and severity of resultant craniomaxillofacial gunshot wounds (CGSW). We report the case of a CGSW patient with radiopaque structures seen in the floor of the mouth and the right shoulder. These findings presented an interesting wounding pattern and posed important forensic questions.

Case
A 25-year-old man caught in a dangerous crossfire presented at the clinic. On examination, a crater-like injury on the right side of his neck, dentoalveolar fracture, avulsion of teeth, occlusal disharmony, and a gaping wound on the right shoulder were noted. Radiologically, an opaque object was discovered in the right sublingual region and a spring coil lodged within the substance of the right rotator cuff muscles. Skeletal stabilization, occlusal adjustments, serial debridement and soft tissue repair were done under general anaesthesia.

Discussion
Often, weapon/projectile combinations have predictable wounding patterns and this patient was likely shot with a low-velocity shotgun at a medium or long range. The cylindrical, hollow metallic object retrieved from the sublingual area resembled the case of a bullet or a cartridge. This would typically not be expelled along with the bullet or would be expelled to the ground. This casing had no identification marking, typically found around the rim. The coil spring in the shoulder further raised suspicions that a homemade firearm had been used, popular with local terrorist organizations. These locally made projectiles possibly have unpredictable wounding presentations, which might be an emerging trend. Such can be recorded on a forensic database, invaluable in law enforcement.

E-034

CT angiography in the investigation of a bullet lodged in the neck: a case report

Catherine Olajumoke Enahoro[1*], Ibiyinka Olushola Amole[2], Akinwaleola Akinlade[2]
[1] Oral Diagnostic Sciences, Bayero University, Kano, Nigeria
[2] Oral and Maxillofacial Surgery, Bayero University, Kano, Nigeria

Introduction
The effects of a bullet as it traverses its target are varied at different layers of the body. Mechanisms of injury include crushing, shearing and stretching of tissues. Following a loss of velocity and, depending on the cohesiveness and elasticity of the tissues, the projectile may perforate the body, or may become embedded within the soft tissues or muscles. Subcutaneous tissues tend to provide a path of least resistance for bullets to pass through. Vital structures such as blood vessels and nerves may be encountered, presenting a risk of haemorrhage, haematoma formation, embolism, tissue infarction and nerve damage.

Case
A 26-year-old man shot at close range by armed robbers presented at the hospital in a stable condition, 12 hours after the incident. Clinical examination revealed a bleeding puncture wound of the left cheek and a swollen nuchal region. A sagittal computed tomography (CT) view revealed a 'travelling' radiopaque cylindrical object posterior to the 2nd and 3rd cervical spine. Progressive neck expansion and trajectory of the bullet through the neck raised suspicions of a vascular injury. CT angiography, however, ruled this out. The bullet was subsequently removed under general anaesthesia.

Discussion
Conventional, and multidetector CT angiography (MDCTA) are valuable in suspected vascular lesions. MDCTA is a fast, non-invasive technique, useful in the assessment of penetrating neck injuries. It provides detail about the integrity of the vasculature, airway, base of the skull, bones, viscera and fascial planes of the neck. An interactive viewer is useful for determining wound trajectories. MDCTA, however, has a few shortcomings, as foreign bodies may create beam-hardening artefacts which could confuse the picture. Magnetic resonance angiography has not been found to be useful in penetrating neck injuries, and in fact, should be avoided, due to the presence of potentially ferromagnetic foreign objects.

E-035

Full-thickness avulsion facial wounds: a case report of a firearm injury

Catherine Olajumoke Enahoro[1*], Ibiyinka Olushola Amole[2], Akinwaleola Akinlade[2]
[1] Oral Diagnostic Sciences, Bayero University, Kano, Nigeria
[2] Oral and Maxillofacial Surgery, Bayero University, Kano, Nigeria

Introduction
A significant proportion of casualties of firearm assaults sustain craniomaxillofacial injuries. Victims may present with severe haemorrhage and/or respiratory distress, necessitating emergency management to prevent shock, sepsis, and mortality. Facial fractures of varying severity, soft tissue injury and tooth loss are common. Transient or permanent nerve damage, orbital or brain involvement may occur. Victims may sustain permanent disfigurations or develop anxiety disorders. The use of appropriate imaging modalities is important in the management of cases.

Case
A 40-year-old man reported to the hospital with gunshot injuries to the face and left thigh, sustained in a communal clash. There was a full thickness avulsion injury of the left labio-buccal soft tissue with associated comminuted mandibular fractures and multiple missing teeth. Conventional posteroanterior and left/right oblique lateral jaw views showed total destruction of part of the left side of the mandible extending from the midline to halfway up the ramus. The orthopaedic and plastic surgery teams were invited for review and management of the thigh injury. Skeletal stabilization by intermaxillary fixation and wound exploration using wound acquired bone as autograft were done. He is currently awaiting soft tissue reconstruction.

Discussion
The extensive destruction of composite tissue bordered by clean margins and lack of gun powder tattooing suggests a distant position of a high-velocity firearm used. Deformation on impact caused by bullets, usually reflected on radiographs as an obvious stream of metal fragments in soft tissues, is evidenced in this patient as minimal opacities, likely caused by hollow-point bullets.

e-Poster Presentation

The management goal of patients with maxillofacial gunshot injuries follows the principles of skeletal stabilization, serial debridement and soft tissue repair. A multidisciplinary management approach is essential. Orthopaedic and plastic surgery teams were involved in this management, and depression and sullenness observed necessitated psychiatric referral.

E-036

Penetrating gunshot injuries: an interesting case involving the infratemporal and orbital regions

Catherine Olajumoke Enahoro[1*], Ibiyinka Olushola Amole[2], Akinwaleola Akinlade[2]
[1] Oral Diagnostic Sciences, Bayero University, Kano, Nigeria
[2] Oral and Maxillofacial Surgery, Bayero University, Kano, Nigeria

Introduction
Several cases of firearm injuries to the craniomaxillofacial region have been reported in literature. In some cases, the fired projectiles have become embedded in the soft tissues, within muscles, and in the numerous fascial spaces in the head and neck, potentially resulting in serious temporary or permanent morbidity. Thorough clinical and radiological assessments of all patients is thus, of utmost importance.

Case
A 32-year-old man shot by armed robbers was brought to the hospital in a stable condition. Clinical examination revealed a penetrating wound of the infraorbital region, gross trismus and nil perception of light in the right eye. Before he was referred to the ophthalmology unit, plain occipitomental views of the skull and jaws showed antral opacification on the right side and a radiopaque object within the infratemporal fossa on the same side. Under general anaesthesia, a multidisciplinary surgical team performed bullet extraction and globe enucleation. The patient subsequently could open the mouth and has since been fitted with an ocular prosthesis.

Discussion
Computed tomography is the radiological technique of choice in the management of penetrating firearm injuries and has been found to have a high sensitivity and specificity. Orbital involvement may also be better visualized, though conventional radiographs were sufficient in this case. In more extensive injuries, 3-dimensional facial reconstruction may be performed to clearly visualize the extent of the injury. The foreign object discovered to be a bullet was responsible for preventing translational movement of the jaws. Proper diagnosis and planning are therefore necessary to reduce patient morbidity and to achieve favourable treatment outcomes, such as in this patient.

E-037

Cavernous sinus thrombosis caused by dental infection

Chang-Ki Min[1*], Kyoung-A Kim[1]
[1] Oral and Maxillofacial Radiology, Jeonbuk National University, South Korea

Introduction
The cavernous sinus is a venous sinus located lateral to sphenoid sinuses. Many anatomical structures, such as internal carotid arteries and cranial nerves (CN III~VI), pass through the cavernous sinus. The cavernous sinus has numerous venous connections and some of which are passageways between the intra- and extracranial structures. Due to the various venous connections and the absence of venous valve, extracranial inflammatory by-products can travel into intracranial vein via the cavernous sinus. Blood clots formation as inflammatory by-products in the cavernous sinus is called cavernous sinus thrombosis (CST). CST can cause serious brain damage due to subdural empyema or brain abscess. Although most CST occurs from infection of the sphenoid sinus, it can also occur through dental infection. CST can occur if the pterygoid vein plexus, which is closely connected to the cavernous sinus, is affected by dental infection.

Case
A 38-year-old male patient visited the emergency room of Jeonbuk National University Hospital, complaining of drowsiness and peri-orbital swelling. After the extraction of a maxillary molar tooth two days ago, fever, headache and peri-orbital swelling developed. One day ago, he showed disorder of consciousness. He was diagnosed as CST through CT and MR imaging.

Discussion
CT with contrast enhancement is useful in imaging diagnosis of CST. In CST patients, cavernous sinus shows heterogeneous enhancement and lateral bulging of cavernous sinus. In MRI, cavernous sinus usually shows T2 hyperintensity. Thrombus in cavernous sinus could appear as filling defects.

E-038

Outcomes of oral squamous cell carcinoma correlated with imaging feature: perineural encasement and bone destruction pattern

Chena Lee[1*], Yoon Joo Choi[1], Kug Jin Jeon[1], Sang-Sun Han[1]
[1] Department of Oral and Maxillofacial Radiology, Yonsei University College of Dentistry, South Korea

Introduction
With the substantial development in imaging technology, it is necessary to provide imaging feature as supplementary information for expecting prognosis of SCC patient. The primary aim of this study was to identify diagnostic imaging findings associated with poor outcomes in oral squamous cell carcinoma of mandible.

Materials and Methods
All mandibular SCC cases (n=66) diagnosed in Dental Hospital, Yonsei University College of Dentistry from 2006 to 2016 were retrospectively reviewed. Cases were excluded if they had not undergone surgery or had pre-operative images with poor quality for evaluation. Pre-operative CT and MRI were evaluated to classify lesions into 3 grades according to the bone involvement pattern. Also, inferior alveolar nerve (IAN) encasement was evaluated. All imaging features were reached consensus under the agreement of two oral and maxillofacial radiologists. The prognosis, locoregional recurrence, and death or hospice were correlated with imaging findings. Also, histopathologic assessment was correlated with imaging bone involvement pattern and IAN encasement.

Results
Total 52 cases (31 males, 21 females) were reviewed. According to imaging evaluation system, 29, 20 and 3 cases were grouped into grade1, 2 and 3 respectively. Imaging grade 1 cases presented lower locoregional recurrence rate compared to well differentiated cases. Imaging grade 3 cases presented higher hospice/death rate compared to the poorly differentiated cases. There were 22 cases showing IAN encasement in image while 13 cases confirmed as perineural invasion in histopathologically.

Conclusions
Therefore, analysis of imaging features provided more specific results for survival prognosis in mandibular SCC. Imaging advances can potentially provide detailed gross views of tumor masses to facilitate development of prognostic criteria for SCC.

E-039

Use of cone-beam computed tomography in endodontic treatment of a mandibular first premolar with complex canal system and perforations

Cheng-Mei Yang[1*], Chiung-I Yang[1], Yi-Chu Sung[1]
[1] Department of Stomatology, Kaohsiung Veterans General Hospital, Chinese Taipei

Introduction
Endodontic failure is caused by the inability to treat all canals of the root canal system effectively. Mandibular premolars were probably the most difficult teeth to treat due to its frequent variations in root canal morphology. The lingual canal orifice in the Vertucci type V mandibular first premolar were mostly located at the middle-apical third of the teeth with severe angle. Lack of knowledge about this anatomy may lead to the consequent risks of endodontic treatment. This case report highlights the importance of applying 3-D cone beam computed tomography (CBCT) imaging evaluation in the management of mandibular first premolar with abnormal anatomic variation and perforations.

Case
A 37-year-old female complaining of intra-oral fistula was referred for endodontic treatment of mandibular left first premolar. The preoperative periapical radiograph showed an inadequate root canal filling, apical radiolucency, and a root canal that had not yet been treated. A diagnosis of chronic apical abscess was established. However, the abscess persisted after endodontic retreatment. A CBCT based 3-D analysis revealed C-shaped root anatomy, a perforation at mid-D aspect and an untreated lingual root. So periapical surgery was arranged after root canal filling. 7 days after surgery, the intra-oral swelling had disappeared, and the tooth was asymptomatic. At a 2-year recall, the region appeared normal and the periapical radiograph showed complete healing of the periapical lesion.

Discussion
Lingual canal orifice of type V mandibular first premolar located at the middle-apical third of the teeth with severe angle indicates great challenge in endodontic therapy. Furthermore, attempts to negotiate such canals with calcification often result in iatrogenic perforations. CBCT is an effective imaging modality that help to detect the perforation and determine the location and curvature of the lingual canal by reconstructing 3-dimensional (3D) models.

E-040

The condylar morphological characteristic on temporomandibular joint quadruple radiography of patients diagnosed as disc displacement with reduction or without reduction

Dai-Chian Chen[1,2*]
[1] Department of Stomatology, Kaohsiung Veterans General Hospital, Chinese Taipei
[2] Department of Dentistry, National Yang-Ming University, Chinese Taipei

Introduction
Magnetic resonance imaging is the gold standard for diagnosis of disc displacement with reduction (DDR) or without reduction (DDwoR). Although the limitation of plain radiography, it is feasible in most of dental offices for evaluation of TMJ. The purpose of this study was to compare the difference of condylar morphology including condylar angle calculated on temporomandibular joint quadruple radiography (TMJQR) with respect to the status of DDR or DDwoR.

Materials and Methods
This was a retrospective study. The included subjects were female diagnosed as DDR or DDwoR from 2019 to 2020 at our department. Men were excluded in this study to prevent possible morphological differences related to gender. The TMJQR were obtained with Orthophos XG 3D Ready (Sirona) by a technician according to the operating instructions. TMJQR were retrieved from a computer database and analyzed by a TMD specialist. Right and left TMJs at close position were analyzed. The most superior point of condylar head or the middle of flat surface of condylar head was marked. Outmost point of condyle in ramus tangent was marked. The line between outmost point of condyle and the point on the condylar head was connected. The angle between ramus tangent and the line connecting two points were calculated.

Results
The youngest patient was 16 years old and the oldest one was 78 years old. The mean age was 44.5±16.7 (mean±S.D) years old. The group of DDwoR revealed more flat surfaces over condylar head compared to the group of DDR. The DDwoR demonstrated with larger angle compared to the DDR. The angle calculated in this study showed prominent changes from DDR to DDwoR.

Conclusions
TMJQR provides not only about the functional relationship between the condyle and the fossa but also certain information of condylar morphological characteristics between DDR and DDwoR.

E-041

Diagnostic accuracy of CBCT versus intraoral imaging for the assessment of peri-implant bone defects

Dandan Song[1*], Sohaib Shujaat[1], Karla De Faria Vasconcelos[1], Yan Huang[1,2], Constantinus Politis[1], Ivo Lambrichts[3], Reinhilde Jacobs[1,4]
[1] Imaging & Pathology, KU Leuven, Belgium
[2] West China College of Stomatology, Sichuan University, China
[3] Morphology, Hasselt University, Belgium
[4] Dental Medicine, Karolinska Institute, Sweden

Introduction
Early detection of marginal bone loss is vital for treatment planning and prognosis of teeth and implant. The objective of the present study was to assess the diagnostic accuracy of CBCT compared to intra-oral radiography for detection, classification and measurement of peri-implant bone defects in an animal model.

Materials and Methods
Sixteen samples were selected from 54 bone blocks with bone defect surrounding the implant from 9 beagle dogs (Ethical approval no: WCCSIRB-D-2014-010). For all bone blocks, we acquired intraoral digital radiographs, CBCT and 3D μCT, meanwhile using CT-analyzer for advanced image processing. Detection of the bone defects as well as differential diagnosis of specific bone defects were examined by two trained and calibrated observers.

e-Poster Presentation

Bone defect size was also determined. Test-retest reliability of the observers as well as diagnostic accuracy of the radiographs were analyzed.

Results
Three different bone defects (dehiscence, infrabony and crater-like) were observed and reconstructed in three dimensions. High agreement (Kappa: 0.92; 95% CI: 0.88-0.96) and high reliability (ICC: 0.97; 95% CI: 0.96-0.97) were found between and within observers. Perfect sensitivity (100%) was found for detection of bone defects using 3D imaging. For diagnosis of the specific defects, 3D imaging allowed for perfect sensitivity to identify dehisences, and over 90% for both infrabony defects and crater-like defects. For 2D radiographs detection of bone defects remained low for 2D (50%), lacking the possibility to further identify defect shape. Bone defect size was significantly better assessed on 3-D radiographs.

Conclusions
Detection, shape-specific diagnosis as well as bone defect size assessment of peri-implant bone defects were significantly better when using 3D imaging. Application of CBCT adds substantial information related to diagnosis of peri-implant bone defects and may therefore aid decision-making.

E-042

Comparison of the presence of inflammatory and structural damage in the temporomandibular joint in patients with juvenile idiopathic arthritis using the omeract and eurotmjoint classifications

Danielly de Fatima Castro Leite[1*], André Luiz Ferreira Costa[2], Mariana Quirino Silveira Soares[1], Paulo Sérgio Flores Campos[3], Jaqueline Serra Martins[4], Gabriela Dias Prado[3], Simone Appenzeller[4], Francine Kühl Panzarella[1]
[1] Oral Radiology, São Leopoldo Mandic Research Institute, Brazil
[2] Department of Postgraduate Program in Dentistry, Cruzeiro do Sul University, Brazil
[3] Oral Radiology, Federal University of Bahia, Brazil
[4] Medicine, Faculty of Medical Science, UNICAMP (State University of Campinas), Brazil

Introduction
Different classifications have been developed for the assessment of inflammatory and structural damage of the temporomandibular joint (TMJ) in patients with juvenile idiopathic arthritis (JIA) using magnetic resonance imaging (MRI). This study compared the presence of inflammatory and structural damage in the TMJ in patients with JIA, and its the subtypes, and controls, using the OMERACT and EuroTMjoint classifications.

Materials and Methods
MRI scans of 29 JIA patients, the JIA subtypes included polyarticular (16 patients) and oligoarticular (13 patients), diagnosed with the criteria established by the International League of Associations for Rheumatology (ILAR) and 48 controls were evaluated. The TMJs on both sides of each patient were considered individually. Hence, 58 images in the JIA group and 96 in the control group were blindly evaluated by a radiologist. TMJ involvement was graded with a progressive scoring system EuroTMjoint, inflammatory signs (bone marrow edema, joint effusion, synovial thickening), bone deformity of the temporal bone and jaw head were graded on 4-grade scales (absent, mild, moderate and severe). The items of the OMERACT were bone marrow edema (grades 0-1), joint effusion (grades 0-2), synovial thickening (grades 0-2), condylar flattening (grades 0-2), erosions (grades 0-2) and disk abnormalities (grades 0-1), the result of each item was summed to create a total score and individual scores for the inflammatory changes and structural deformities of each TMJ. For statistical analysis, the significance level of α=0.05 was admitted.

Results
The JIA group showed a higher frequency and more severe signs of inflammatory and structural changes ($p<0.05$) assessed both by EuroTMjoint and OMERACT. The polyarticular subtype showed greater intensity of inflammatory changes and deformities than the oligoarticular subtype ($p<0.05$).

Conclusions
JIA was associated with increased inflammation and TMJ degenerative changes.

E-043

Juvenile fibrous dysplasia of posterior mandible: a rare case report

Ebtihal Habeeb Zain-Alabdeen[1,2*]
[1] Oral Clinical and Basic sciences, Taibah University, Almadinah Almonawarrah, Saudi Arabia
[2] Department of Oral and Maxillofacial Surgery, King Fahad Hospital, Almadinah Almonawarrah, Saudi Arabia

Introduction
Fibro-osseous lesions of the jaws is normal bone is replaced by fibrous connective tissue with slow growth. These types of lesions includes fibrous dysplasia, cystic fibrosis, and osteoporosis. In most cases, the juvenile type involves paranasal sinuses, ethmoid, eyes, and the upper jaw and rarely in the long bones of the body and in the mandible with equal proportions in male and female.

In diagnosing of fibro-osseous lesions, pathology, CT SCAN, and clinical findings are helpful. The purpose of the case report is to present clinical examination, radiography, pathology, and the challenge in diagnosis due to lymph nodes involvement.

Case
A 4-year old female patient was refered to maxillofacial surgeon due to swelling over the left angle of the mandible, the refering physician suspected abcess or tumor.History given by the parents that the whole family were recovering from flu-like symptoms likely to be covid-19, and that the swelling started after she got the infection, however, it could be that the parent only realized the swelling at that time, while infact it has been there before.

The cheif complain was swelling, no pain or dysplasia. However, lymph node examination revealed movable tender submandibular lymph node. This case report was challenging due to the lymph node involvement and biopsy has been done to confirm diagnosis, the purpose of this case report is to document and report the CT appearance of fibrous dysplasia with an attempt to a better diagnosis. The paper highlights the importance of computed tomography in diagnosis as well as assessing the extent of the disease, the lesion has been examined histologically with confirmed diagnosis.

Discussion
Discussing similar cases and the radiographic interpretations, emphasizing the radiographic appearance of fibrous dysplasia in advanced imaging modalities like CT for delivering diagnosis.

E-044

Apparent diffusion coefficient of masticatory muscles in magnetic resonance imaging

Eri Sawada[1*], Kotaro Ito[1], Naohisa Hirahara[1], Hirotaka Muraoka[1], Satoshi Tokunaga[1], Shunya Okada[1], Tomohiro Komatsu[1], Shungo Ichiki[1], Go Itakura[1], Takumi Kondo[1], Kohei Otsuka[1], Shoya Hirohata[1], Takashi Kaneda[1]
[1] Department of Radiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
To evaluate the apparent diffusion coefficient (ADC) values in normal masticatory muscles with magnetic resonance (MR) imaging.

Materials and Methods
This study was approved by the ethics committee at the authors' university (EC19-011). Twenty-eight healthy volunteers (10 men and 18 women; age range, 21–77 years mean age, 53.7 years) who underwent MRI examination of the TMJ at the authors' hospital from November 2015 to January 2017 were included in this study. Diffusion-weighted MR images were acquired using a 1.5 T unit with a b factor of 0 and 1000 s/mm2, and ADC maps were generated. The ADC values were measured for healthy masticatory muscles. Regions of interest (ROIs) were drawn to completely include the right and left lateral pterygoid, medial pterygoid, and masseter muscles on a slice demonstrating the largest area of each muscle on the ADC maps.

Results
The mean ADC values of the lateral pterygoid muscles, medial pterygoid muscles, and masseter muscles were $1.21 \pm 0.31 \times 10^{-3}$ mm2/s, $1.10 \pm 0.25 \times 10^{-3}$ mm2/s, and $1.09 \pm 0.23 \times 10^{-3}$ mm2/s, respectively. The ADC values of the lateral pterygoid muscles were significantly higher than those of the medial pterygoid muscles and masseter muscles (*$p<0.05$).

Conclusions
The results of this study present the ADC values of the masticatory muscles of healthy subjects in vivo. Data regarding the ADC values for normal masticatory muscles will help facilitate quantitative evaluations of temporomandibular disorders.

E-045

Correlation of radiological features of fracture healing with increased activity of FGF-2 in rats: Preliminary study

Fadhlil Ulum Abdul Rahman[1*], Lusi Epsilawati[1], Azhari Azhari[1], Mieke Hermiawati Satari[2]
[1] Dentomaxillofacial Radiology, Padjadjaran University, Indonesia
[2] Oral Biology, Padjadjaran University, Indonesia

Introduction
The fracture healing process involves the interaction of various cell types, anatomical structure, extracellular matrix, and growth factors. Fibroblast growth factor-2 (FGF-2) is one of the growth factors with the most extensive activity in this process because it can induce osteoblast proliferation for new bone formation post-fracture. Radiograph examination is essential in monitoring the changes that occur during the fracture healing process and can detect new bone formation accurately. This preliminary study aims to find the appropriate fracture model and the radiographic analysis used in correlating radiographic images and increased FGF-2 activity on bone healing observed a few days after fracture.

Materials and Methods
This study was preliminary research using 12 male Wistar rats with a fracture model in the right femur. FGF-2 activity and digital radiographic examination were carried out on days 5,10, 17, and 25 after fracture and used FGF-2 activity data from literature reviews.

Results
The results showed that the fracture length and depth in this fracture model were significantly decreased continuously evaluated from day 5 to day 25 after a fracture. On the other hand, the fracture healing area density value seems to have increased. A decrease in the value of the fracture gap's length and depth and an increase in the fracture healing area density were seen progressively, especially between day 5 and day 17. This shows a radiographic pattern of bone healing in line with the increase in FGF-2 activity starting from day 5 until it peaked on day 14 after a fracture.

Conclusions
The incomplete fracture model of the rat femur and the radiographic analysis results to determine the correlation with the increased FGF-2 activity proposed in this study is in line with the literature review and previous studies to reliably be used in further studies.

E-046

Non-hodgkin lymphoma of the mandible with CBCT, USG, MRI and histopathological findings

Gürkan Ünsal[1,2,3*], Sabri Cemil İşler[4], Merva Soluk-Tekkeşin[5], İlknur Özcan[3]
[1] Department of Dentomaxillofacial Radiology, Near East University, Cyprus
[2] Research Center of Experimental Health Science, Near East University, Cyprus
[3] Department of Dentomaxillofacial Radiology, Istanbul University, Turkey
[4] Department of Oral and Maxillofacial Surgery, Istanbul University, Turkey
[5] Institute of Oncology, Department of Tumour Pathology, Istanbul University, Turkey

Introduction
Non-Hodgkin's lymphoma is a rare lesion with 24% extranodal localization. The probability of occurrence in the jaws is reported to be only 0.6%, which is often misidentified. This condition, which cannot be differentiated from chronic osteomyelitis or odontogenic neoplasms as a result of radiological evaluations, is diagnosed by histopathological evaluations. The aim of this case report is to evaluate the rare case of non-Hodgkin's lymphoma located in the mandible from the histopathological and radiological point of view.

Case
A 38-year-old female patient was referred to our clinic with pain that persisted after tooth extraction and unhealed extraction socket. When preoperative orthopantomographic (OPG) and cone beam computed tomography (CBCT) images were examined, enlargement of the periodontal space at the mesial root and bifurcation of lower left first molar tooth with destruction at lamina dura were observed. Magnetic resonance imaging (MRI) scans showed a lesion with a 47mm wide, medullary infiltration extending from the left mandible to the ramus with extraosseous soft tissue component. Antigenic examinations were CD20 (+), CD3 (-), Bcl-6 (+), CD10 (-), MUM-1 (-), Bcl-2 (-), Ki-67 proliferation index was 90% and c-Myc protein index was 5%. These findings were consistent with high grade B cell lymphoma and the clinical manifestation was consistent with high grade non-Hodgkin's lymphoma.

Discussion
Non-Hodgkin lymphomas observed in the jaws do not have specific

e-Poster Presentation

images on CBCT and OPG images, however; unexplained enlargements in the periodontal space and destruction of the lamina dura may cause suspicion. Dentists should carefully evaluate these two structures in all images of their patients and be able to conduct appropriate consultations.

E-047

Case series of cleidocranial dysplasia: radiographic follow-up study of delayed eruption of impacted permanent teeth

Han Gyeol Yeom[1*], Wan Lee[1], Byung Do Lee[1]
[1] Department of Oral and Maxillofacial Radiology and Research, Institute of Dental Education, Wonkwang University, South Korea

Introduction
Cleidocranial dysplasia (CCD) is a rare congenital bone disease characterized by abnormalities of the clavicles, skull, and jaw, as well as occasional stunting of long bones. This report describes 3 cases of cleidocranial dysplasia (CCD) and presents relevant findings on long-term followup radiographic images of impacted permanent teeth with delayed eruption.

Case
Radiographic images of 3 CCD patients were reviewed retrospectively. These images were mainly composed of panoramic and skull radiographs, and the follow-up periods were 3, 13, and 13 years, respectively. The distinct features revealed by the images were described, and the eruption state of impacted permanent teeth was evaluated. The features common to the 3 cases were multiple supernumerary teeth, the presence of Wormian bone, underdevelopment of the maxilla and the maxillary sinus, and clavicular hypoplasia. The eruption of impacted permanent teeth was not observed without proper dental treatment in adult CCD cases, even after long time periods had elapsed

Discussion
Further studies are needed to better understand the cause of delayed eruption in CCD. According to this report, the causes of delayed permanent eruption were similar, yet certain aspects were different. For example, only case 2 showed characteristic dense alveolar bone. Some potential factors, such as the incomplete cementum layer of the unerupted teeth or the reduced ability of the periodontal ligament to induce osteoclastogenesis, may have contributed to delayed eruption in all 3 cases.

E-048

Why does this fibrous dysplasia case show normal radiopacity?

Hang Moon Choi[1,2*], Jin-Woo Han[1,2], In-Woo Park[1,2]
[1] Department of Oral and Maxillofacial Radiology, Gangneung-Wonju National University, South Korea
[2] Research Institute of Oral Science, Gangneung-Wonju National University, South Korea

Introduction
Fibrous dysplasia (FD) is a developmental tumor-like disease having characteristics of replacement of normal bone by fibrous connective tissue intermixed with irregularly shaped immature bone. FD has three radiographic patterns - cystic (radiolucent), sclerotic, and mixed (radiolucent/radiopaque). In most cases, FD is diagnosed incidentally as a result of radiological images.

Case
A 14-year-old male patient visited Gangneung-Wonju National University Dental Hospital for third molar extraction before orthodontic treatment. In the panoramic image, the posterior region and ramus of the left mandible were almost similar to the right side, except that the bony crypt of the third molar and lower border of the mandible were slightly thin and the mandibular canal was not clear. Both posterior regions of the mandible showed very similar radiopacity. In the cone beam CT images (CBCT), buccolingual expansion and ground-glass appearance were additionally confirmed. The area with ground glass appearance showed higher radiopacity than the normal cancellous area. In addition, it was confirmed that the upper boundary of the lesion was below the mandibular notch. It was diagnosed as FD based on panoramic and CBCT images.

Discussion
Even though The area with ground glass appearance is thicker and more radiopaque than the left normal area, why is the radiopacity of the lesion so similar to the left normal symmetrical area on the panoramic image?
In this case the main factor in reducing radiopacity is cortical bone thinning. Since thinning of the cortical bone offsets the radiopacity produced by the ground glass appearance, the diagnosis of FD requires careful attention. CBCT is a good diagnostic method for identifying the characteristics and extent of the lesion because it can be observed separately in the cortical bone and the cancellous bone region.

E-049

Concomitant cemento-osseous dysplasia and aneurysmal bone cyst of the mandible: a rare case report with literature review

Han-Gyeol Yeom[1*], Wan Lee[1], Byung-Do Lee[1]
[1] Oral and Maxillofacial Radiology, Wonkwang University, South Korea

Introduction
Concomitant cemento osseous dysplasia (COD) and aneurysmal bone cyst (ABC) are rare in the head and neck region. In our search of the English language literature, we found only one case report describing the simultaneous occurrence of COD and ABC in the head and neck region. Here, we report a case of COD associated with ABC.

Case
The patient was a 32-year-old Korean woman referred because of a cystic lesion below the mandibular right first molar at a local dental clinic. She had no pain or significant systemic disease. Panoramic radiography revealed a round, mixed lesion below the mandibular right first molar (Figure 1). The border of the lesion was clear and the effects on the adjacent teeth and inferior alveolar canal were unclear. The lesion was generally radiolucent, but a mixed radiopaque portion was seen adjacent to the anterior boundary of the lesion.

Histopathologically, stromal tissue was composed of spindle-shaped fibroblasts with small blood vessels (Figure 2). The anterior part of the lesion showed a sclerotic mass of cemento-osseous material (Figure 3). Considering both histopathological and radiographic properties, the final diagnosis was concomitant COD and ABC.

Discussion
Our literature search demonstrated only one case report of concomitant COD and ABC. Both patients were women, and the ages were 32 and 41 years, respectively. Compared to one previously reported concomitant COD and ABC case, our patient showed the anterior part of the mixed lesion and the posterior cystic portion. Buccolingual expansion was unclear in the cystic portion. We are expecting to better understand and diagnose nonepithelial cystic lesions associated with COD by reporting this case.

E-050

The role of ultrasonography and CT angiography in diganosis and surgical management of a superficial temporal artery pseudoaneurysm

Hannah Muir[1*], Kirsty Cowan[1], Peter Steele[1], John Jeff Downie[1]
[1] Oral and Maxillofacial Surgery, NHS Forth Valley, United Kingdom

Introduction
We present the case of a patient referred to the Oral and Maxillofacial Department (OMFS) by his General Medical Practitioner (GMP) with a left sided forehead mass which arose following trauma. Clinical examination and ultrasound imaging of the mass confirmed a Pseudoaneurysm of the Superficial Temporal Artery. Following a CT Angiogram to facilitate planning, surgical excision of the lesion was carried out. We would like to highlight this case to raise awareness of a Pseudoaneurysm as an uncommon but important differential diagnosis for masses in the head and neck region and the meaningful role that Ultrasonography and CT Angiography can play in aiding confirming diagnosis and guiding surgical management.

Case
An 81 year old male attended the OMFS department following a referral from his GMP regarding a facial swelling present for three weeks following blunt trauma. A provisional diagnosis of a haematoma was made. However, Ultrasonography identified an ovoid mass consisting primarily of a haemoatoma with a 12mm focus of pulsatile flow at the superior aspect consistent with a pseudoaneurysm. Following on from this a CT Angiogram was requested to guide surgical management of the pseudoaneurysm. The Pseudoaneurysm was surgically excised in theatre. An incision was made to expose the mass; the left superficial temporal artery was identified and ligated along with two further minor feeding vessels.

Discussion
Although an uncommon diagnosis, it is important to be aware of a Pseudoaneurysm as differential diagnosis of masses of the head and neck region. Particularly in relation to excluding a pseudoaneurysm prior to diagnosing a simple post traumatic haematoma. The treatment strategies for the two pathologies differ considerably and early, accurate diagnosis is essential for positive treatment outcomes. Ultrasonography and CT Angiography can have a meaningful role in accurately diagnosing these lesions and guiding surgical management as demonstrated in this case.

E-051

Case report: an unusual case of multiple skeletal muscles and skin metastases of tongue squamous cell carcinoma

Han-Sol Lee[1*], Sam-Sun Lee[1], Min-Suk Heo[1], Won-Jin Yi[1], Kyung-Hoe Huh[1], Jo-Eun Kim[1], Ju-Hee Kang[1]
[1] Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
Non-lymphatic spread of Head and neck squamous cell carcinoma(HNSCC) is reported in only 10% of the cases, the most frequent regions are as follows: lung(66%), bone(22%) and liver(10%). Skeletal muscle metastases from primary HNSCC is very rare that only 18cases were reported up to Dec. 2019(rate: 0.03-0.16%). Here, we report an even rarer case of distant metastases of HNSCC to multiple skeletal muscles and skin.

Case
A 49-year-old male was referred to department of oral and maxillofacial surgery diagnosed with Tongue SCC(tSCC). Pre-operative(op.) contrast enhanced CT(CECT) and MR images showed a huge heterogeneously enhancing lesion in left tongue and sublingual space with metastatic lymph nodes(mLN) in left level Ib, IIa. PET/CT reported consistently, with no evidence of distant metastasis. The patient underwent induction chemotherapy, surgery and post-op. radiation therapy. Pathologic results confirmed tSCC and mLNs with extracapsular extension in left level I, II. During follow-up clinical sessions, the patient constantly complained of pain in extremities but 1month follow-up CECT and PET images, showed no sign of recurrence.

On post-op. 4month session, the patient complained of scalp lesion and left shoulder pain. CECT taken only 1month after the last showed multiple rim-enhancing lesions in op.-site, paraspinal muscles, left scapular region, subcutaneous layer of occipital area indicating loco-regional and distant metastases. Punch biopsy on scalp lesion revealed metastatic SCC. The patient expired during palliative treatment work up, only 6months after initial operation.

Discussion
Due to it's rarity, precise mechanism of non-lymphatic metastasis of HNSCC is very poorly understood. Therefore, a much intensive inspection of surrounding musculature on follow-up images is recommended in cases where regional lymph node involvement with extracapsular extension is present.

E-053

Assessment of age-related changes in the mandibular bone marrow

Hirotaka Muraoka[1*], Kotaro Ito[1], Naohisa Hirahara[1], Satoshi Tokunaga[1], Takumi Kondou[1], Eri Sawada[1], Shungo Ichiki[1], Shunya Okada[1], Tomohiro Komatsu[1], Go Itakura[1], Takashi Kaneda[1]
[1] Radiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
The apparent diffusion coefficient (ADC) values of bone marrow in musculoskeletal lesions have been extensively researched. However, there are few studies assessing the normal ADC values of bone marrow in the mandible and their variations with age. The purpose of this study was to investigate the age-related changes of ADC values in the normal mandibular bone marrow using diffusion-weighted imaging (DWI).

Materials and Methods
We designed and implemented a retrospective cohort study, which was approved by our university ethics committee (EC19-011). The study population (49 men and 215 women, 5-89 years, mean age - 44.95 years) was composed of all patients who had an MRI between April 2018 and March 2019. Based on age, they were divided into two groups: 30-64 years and 65-89 years. The mean ADC values of mandibular bone marrow were assessed on the ADC map and the groups were compared using the Mann–Whitney U-test. Spearman's correlation coefficients were calculated using age groups as the criterion variable and the ADC values as explanatory variables. $P < 0.05$ was considered to indicate statistical significance.

Results
A total of 264 participants (49 men, 215 women), aged 5–89 years (mean age 44.95 years), were included in the study. There was significant difference in the ADC values of the mandibular bone marrow between the two groups ($P < 0.001$). There was significant correlation between the age groups and the ADC values ($P < 0.001$). The ADC values were found to decrease with age.

e-Poster Presentation

Conclusions
This study demonstrates that the normal apparent diffusion coefficient values of the mandibular bone marrow show significant negative correlation with increasing age. These findings will be useful in the diagnosis of bone marrow diseases.

E-054

Imaging characteristics of extracranial invasive menigioma with mouth opening limitation.

Hongyul Moon[1*], Dong-Hun Han[2], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Heo[1], Sam-Sun Lee[1]
[1] Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea
[2] Preventive & Public Health Dentistry, Seoul National University, South Korea

Introduction
Meningioma is a common benign tumor of the central nervous system (CNS). The incidence of an extracranial extension to other sites is rare. In rare instances (<2%), they appear as an extracranial tumor, most often in the head and neck region, and specifically in the sinonasal tract, ear and temporal bone, and scalp. Meningioma involving masticator space and causing mouth opening limitation has not been reported yet.

Case
A 50 year-old-male patient was referred to our dental hospital due to difficulty in mouth opening. He had been supposed to undertake a resection surgery for a large temporal mass in the department of neurosurgery. Plain radiographs revealed no evidence of pathological bony change on both temporomandibular joints, but increased radiopacity with an irregular bony surface in the left calvarium was observed on Waters' image. CT images demonstrated a large soft tissue mass adjacent to the left calvarium. A prominent hair-on-end appearance was observed in the left calvarium, especially in the internal surface of the calvarium. MR images revealed a multi-spatial, hyperintense T2 signal lesion, mainly occupying the temporal region with extension into the masticator and buccal space. The left temporal and lateral pterygoid muscles were infiltrated by the lesion, which was suspected of the cause of mouth opening limitation.

Discussion
Extracranial invasive meningioma involving the lateral pterygoid muscle is extremely rare. The characteristic hair-on-end appearance on the calvarium and adjacent infiltrative soft tissue mass might be its important imaging features.

E-055

Radiographic evaluation of underlying dental diseases, adjacent structures, and the occurrence of MRONJ in oncologic patients

Hugo Gaêta-Araujo[1,2*], André Ferreira Leite[2,3], Karla Faria Vasconcelos[2], Reinhilde Jacobs[2,4], Christiano Oliveira-Santos[5]
[1] Oral Diagnosis, Division of Oral Radiology, Piracicaba Dental School, University of Campinas, Brazil
[2] OMFS IMPATH Research Group, Department of Imaging and Pathology, Faculty of Medicine, University of Leuven, Belgium
[3] Department of Dentistry, Faculty of Health Sciences, University of Brasilia, Brazil
[4] Department of Dental Medicine, Karolinska Institutet, Sweden
[5] Department of Stomatology, Public Oral Health, Forensic Dentistry, Division of Oral Radiology, School of Dentistry of Ribeirao Preto, University of Sao Paulo, Brazil

Introduction
The aim of the present study was to verify the association of radiographic characteristics of adjacent structures, underlying dental diseases in extraction sites of oncologic patients under antiresorptive therapy and the occurrence of medication-related osteonecrosis of the jaws (MRONJ).

Materials and Methods
Patients under antiresorptive therapy for oncologic purposes, indicated for tooth extraction and presenting panoramic radiograph before the surgical procedure were retrospectively included. Clinical reports were used to confirm the diagnosis of MRONJ development or uneventful recovery of the extraction site. Panoramic radiographs were evaluated by 2 observers considering radiographic aspects of 3 structures: periodontal ligament space, lamina dura, and alveolar bone pattern. Each extraction site was grouped according to the radiographic diagnosis of underlying dental condition as: none, periodontal, endodontic, or endo+perio; and categorized according to the development of MRONJ. Chi-square test was used to compare the distribution of MRONJ sites among groups according to the adjacent structures' assessment (α=0.05).

Results
A total of 158 extraction sites were evaluated from 41 patients, of which 77 of those sites developed MRONJ. Overall, MRONJ was more frequent in locations with combined endo+perio problems (p=0.019) and in the presence of dental diseases with periodontal ligament space widening (p=0.023), normal lamina dura (p=0.025), and normal alveolar bone pattern (p=0.045). All extraction sites with surrounding mixed alveolar bone pattern further developed MRONJ.

Conclusions
The presence of underlying dental diseases are highly associated with the development of MRONJ following tooth extraction. A higher risk is observed in the combination of dental disease and periodontal ligament space widening.

E-056

Langerhans cell histiocytosis with proliferative periostitis

Hui Liang[1*], Paras B Patel[1], Mazen Duraini[2], Yi-Shing Lisa Cheng[1]
[1] Department of Diagnostic Sciences, Texas A&M College of Dentistry, United States of America
[2] Texas Maxillofacial Surgery, Keller, Texas, United States of America

Introduction
Langerhans cell histiocytosis (LCH) is a rare disease that typically affects children, with more than 60% of cases occurring in children younger than age 16. In the pediatric population LCH typically affects the long bones and often presents as an isolated radiolucent lesion. If LCH involves the jaw, children may present with swelling, pain, loose teeth, and gingival recession. Radiographically, differentiating LCH in the jaw from osteomyelitis is difficult in the presence of a periosteal reaction.

Case
A 12-year-old Caucasian boy presented with pain and swelling involving his left posterior mandible for more than two weeks. The patient was seen by his pediatric dentist, who provided a provisional diagnosis of pericoronitis, prescribed a course of antibiotics, and

scheduled a follow-up visit for removal of the operculum. At the follow-up visit the swelling had increased, and the patient was subsequently referred to an oral surgeon.

Upon examination, the second molar appeared vital. An MDCT scan demonstrated a hypodense area apical to the second molar with significant buccal periosteal reaction. An incisional biopsy was performed and diagnosed as proliferative periostitis. Due to persistent pain and progressive swelling, an excisional biopsy was performed and a diagnosis of LCH was rendered. The patient was referred to an oncologist for further evaluation, which revealed this to be an isolated lesion with no extragnathic involvement.

Discussion
Proliferative periostitis in the jaws mainly affects children and young adults; and is most often the result of odontogenic infection. Our case showed the typical clinical and radiographic findings for proliferative periostitis. However, in the absence of any infection/inflammatory source, further investigation is warranted. A recent study showed that 12 of 14 LCH cases presented with periosteal new bone formation in CT and/or MRI images. Increasing awareness of LCH associated with periosteal reaction is therefore emphasized.

E-057

Osteolytic masses in the left maxilla including inflammatory myofibroblastic tumor: report of 3 cases

Hyo-Sik Park[1*], Ju-Hee Kang[2], Jo-Eun Kim[2], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Heo[1], Sam-Sun Lee[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, Seoul National University School of Dentistry, South Korea
[2] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
Various types of disease could cause bone destruction in head and neck area. This report showed 3 patients with large osteolytic soft tissue masses in the left maxilla and differentiated from other diseases.

Case
The first patient was a 65-year-old male. He had undergone impacted tooth removal and cyst enucleation with bone graft about 2 years ago at outside hospital. He was referred to our hospital because of the increased soft tissue mass in the left maxilla. Radiologically, the patient showed an enhancing soft tissue lesion, which showed destruction of the left maxillary sinus wall and suspicious for involvement of buccinator muscle. There was an enlarged lymph node in the left level Ib and sequestrum. To rule out malignancy, he received biopsy, and the final diagnosis was inflammatory myofibroblastic tumor (IMT). The second patient was a 46-year-old male. The radiologic findings showed a mild enhancing mass with an enhancing nodule with large bone destruction in the left maxillary sinus, pterygoid plate, and zygoma. There were enlarged lymph nodes in the left level Ib, and IIa. He was diagnosed with an undifferentiated pleomorphic sarcoma which called malignant fibrous histiocytoma previously. The third patient was a 41-year-old female. The radiologic findings showed an enhancing soft tissue mass with progressive osteolytic and osteoblastic foci in the left maxilla. Following evaluation revealed increasing mass size and involvement of orbit floor, sphenoid sinus, and zygomatic bone. This mass confirmed as osteosarcoma after biopsy.

Discussion
Three cases shared extensive bone destruction in the left maxilla in radiologic evaluation. IMT is a rare tumor mainly found in children and young adults. It could be occurred in any site of the body, but rarely occurred in head and neck region. Although IMT is a benign tumor, it shares clinical and radiological features with malignancy.

E-059

Correlation of calcium levels with mandibular cortical quality in patients with type-2 diabetes mellitus based on panoramik radiograph

Ika Rachmawati[1*]
[1] Dental Maxillofacial Radiology, Radiologis, Indonesia

Introduction
Type 2 diabetes mellitus (T2DM) is a major metabolic disorder characterized by hyperglycaemia, is associated with an increased risk of multiple chronic conditions. This condition is often accompanied by decreased calcium levels and decreased bone quality. The purpose of this study was to evaluate the corellation of calsium level with mandibular cortical quality in patients with T2DM based on panoramic radiograph.

Materials and Methods
The method of this research was the analytical study. The sample collected of 22 female patients (mean age 56.47 years old, range 43-68 with DM type-2 from two clinic in Bandung City. Blood samples were taken to evaluate calcium level. Panoramic radiographs of all the study subjects were recorded for evaluation of 2 radiomorphometric indices mental index (MI) and antegonion index (AI).

Results
The results of this study found that the average calcium level in woman with DM type-2 was (9.3 ml/l ±0.5) still within normal value (8.4-10.2 ml/l). The mean value of MI was 4.1mm ±0.8 and AI was 2.9 mm ± 0.6. There was significant corellation between calcium level and cortical mandibular cortical values ($p<0.05$).

Conclusions
There founded a positive correlation between mandibular cortical values and calcium levels, even though the calcium levels still within normal value. MI and AI can be effectively measured on a panoramic radiograph, hence could be used as a screening tool for evaluate mandibular cortical quality in woman with T2DM.

E-060

Bilateral osteochondritis dissecans of the temporomandibular joint: a case report

In-Woo Park[1*], Jin-Woo Han[1], Hang-Moon Choi[1]
[1] College of Dentistry, Gangneung-Wonju National University (GWNU), South Korea

Introduction
Osteochondritis dissecans (OCD) is a joint disorder in which cracks form in the articular cartilage and the underlying subchondral bone. Loose bodies are characteristic features of OCD which usually occurs on large joints, including the knee, elbow, and ankle. This report shows a rare case of bilateral osteochondritis dissecans on temporomandibular joint (TMJ).

Case
The patient, a 17-year old female, was evaluated with respect to

e-Poster Presentation

anterior open bite and facial asymmetry by cone-beam computed tomography (CBCT). CBCT showed loose bodies on both TMJs, in different stages for each other. Bilateral OCD of the TMJ was diagnosed by radiographic examination.

Discussion
The patient had mouth locking history and tongue sticking habit. We supposed that the mechanical and traumatic factor was possible etiologic factor. Because of her young age, just reducing the temporomandibular joint load and correcting her sticking habit will improve her prognosis. Cone-beam computed tomography is a great tool for the evaluation of OCD after all.

E-061

Quantitative evaluation for jawbone fracture by thickness of mandibular cortical bone using computed tomography

Itakura Go[1*], Kotaro Ito[1], Naohisa Hirahara[1], Hirotaka Muraoka[1], Eri Sawada[1], Satoshi Tokunaga[1], Shungo Ichiki[1], Shunya Okada[1], Tomohiro Komatsu[1], Takumi Kondo[1], Kohei Otsuka[1], Shoya Hirohata[1], Takashi Kaneda[1]
[1] Radiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
The purpose of this study was to evaluate the thickness of mandibular cortical bone using CT and to clarify the risk assessment of jawbone fracture.

Materials and Methods
This retrospective study was approved by the Institutional Review Board (EC19-009). This study included 321 patients (151 women and 170 men, mean age: 50.5 years [range 20-90]) with suspected jawbone fractures who underwent CT at matsudo, Chiba, Japan, from April 2008 to March 2015. Thickness of mandibular cortical bone was measured by coronal CT images on both sides of the mandible, distal to the mental foramen by two oral radiologists. All images were independently evaluated by two oral radiologists, and any differences were resolved by forced consensus. Each two groups were compared with and without fracture about average of thickness of mandibular. The exclusion criteria were under 20 years old and osteoporosis.

Results
Of the 321 patients, jawbone fractures were seen in 207 patients (64.5%). The average thickness of the lower mandibular cortical bone in patients with jawbone fractures was 2.44±0.64 mm. In contrast, the average thickness of the lower mandibular cortical bone in patients without jawbone fracture was 2.89±0.62 mm ($p < 0.01$).

Conclusions
Our results suggested that the thickness of the mandibular cortical bone on CT may provide a quantitative of jawbone fractures.

E-062

Evaluation of ten cone-beam computed tomography devices for endodontic assessment of fine anatomical structures

Jáder Camilo Pinto[1,2*], Victor Aquino Wanderley[1,3], Karla De Faria Vasconcelos[1], André Ferreira Leite[1,4], Ruben Pauwels[5,6], Mansour Nadjmi[1], Matheus Lima Oliveira[3], Mario Tanomaru-Filho[2], Reinhilde Jacobs[1,7]
[1] OMFS IMPATH Research Group, Department of Imaging and Pathology, Faculty of Medicine, Catholic University of Leuven, Belgium
[2] Department of Restorative Dentistry, School of Dentistry, Araraquara., São Paulo State University (UNESP), Brazil
[3] Department of Oral Diagnosis, Division of Oral Radiology, Piracicaba Dental School., University of Campinas, Brazil
[4] Department of Dentistry, Faculty of Health Sciences, University of Brasilia, Brazil
[5] Aarhus Institute of Advanced Studies, Aarhus University, Denmark
[6] Department of Mechanical Engineering, Catholic University of Leuven, Belgium
[7] Department of Dental Medicine, Karolinska Institutet, Stockholm, Sweden

Introduction
Cone-beam computed tomography (CBCT) contributes to the assessment of endodontic complexity, directly impacting clinical decision making. However, accurate detection of minute endodontic structures remains a challenge. In a clinically realistic scenario, image quality provided by CBCT devices may differ significantly, especially in the presence of artifacts generated by high-dense objects. Therefore, the present study aimed to assess the performance of ten CBCT devices for detection of selected fine endodontic structures.

Materials and Methods
A dedicated anthropomorphic fully dentate skull phantom was scanned two times using ten CBCT devices: without any metal and with an endodontically treated tooth containing a metallic pin. The CBCT devices were coded with letters, as follows: 3D Accuitomo 170 (A), Veraview X800 (B), X1 (C), NewTom VGi evo (D), OP 3D Pro (E), OP 3D (F), CS 9300 (G), ProMax 3D Max (H), Orthophos SL 3D (I), and Spectral Dental UEG (J). A reference image obtained with an industrial CT device was used to register all images. Three experienced observers assessed all registered CBCT images for their ability to detect narrow canal, isthmus, and apical delta ramification following a categorical rank from 1 (best) to 10 (worst). Fleiss Kappa statistics were used to calculate intra- and interobserver agreements for each CBCT device separately. Based on the observers` scores, general linear mixed models were applied to compare image quality among different CBCT devices in the detection of fine endodontic structures ($\alpha = 0.05$).

Results
The ten CBCT devices performed differently for the evaluated endodontic tasks ($p < 0.05$), with devices A, B, and C performing better than the others. Yet, in the presence of metal, devices A and D had better image quality for detecting fine endodontic structures.

Conclusions
The CBCT-based detection of fine endodontic structures is device-dependent and negatively influenced by the presence of metal.

E-063

Retrospective study of postoperative maxillary cyst

Jaeseo Lee[1*], Hyoung Cheol Kim[2], Suk-Ja Yoon[1], Byoung-Cheol Kang[1]
[1] Oral and Maxillofacial Radiology, School of Dentistry, Chonnam National University, South Korea
[2] School of Dentistry, Chonnam National University, South Korea

Introduction
The postoperative maxillary cyst (POMC) is a complication that occurs 10 to 30 years after the maxillary sinus radical surgery. Clinical symptoms may not appear, but various clinical symptoms such as buccal swelling, facial pain, toothache, nasal obstruction can occur.

Postoperative maxillary cyst may mimic odontogenic lesion, when patient complains of toothache. Misinterpretation of POMC may lead to delayed management.

The purpose of this study is to evaluate the clinical and radiologic findings of the POMC and to investigate the relationship between size of the lesion and clinical symptoms depending on the time (years) passed after the maxillary sinus surgery.

Materials and Methods
29 patients who were diagnosed with POMC at Chonnam National University Dental Hospital from 2009 to 2017 were selected. The clinical findings and radiologic findings were evaluated using their electronic medical records and radiographic images. Patients were divided into two groups: one who had maxillary sinus surgery under 30 years ago and the other with over 30 years ago. Then the relationship between two groups and clinical findings and radiologic findings were investigated. IBM SPSS Statistics for Windows, version 23(IBM Corp, N.Y., USA) were used for chi-square test.

Results
Clinical symptoms related to the POMC were as follows: buccal pain and swelling, dull pain, toothache, abscess, sensory abnormality, and no symptom. There were no significant difference in clinical symptoms, the development of the secondary cyst and mesiodistal length of the cyst on CBCT images between the two groups of patients (p >0 .05). However, there were significant difference in buccolingual length of the cyst on CBCT images between the two groups (p <0 .05).

Conclusions
The size of POMC in axial view showed greater difference in BL length than MD length, when compared based on the period (30 years) after the maxillary sinus surgery,

E-064

Radiological and clinical features of medication-related osteomyelitis of the jaw (MROMJ): comparison between osteoporosis and oncology patients

Jeong Won Shin[1*], Jo-Eun Kim[2], Kyung-Hoe Huh[3], Won-Jin Yi[3], Min-Suk Heo[3], Sam-Sun Lee[3], Soon-Chul Choi[3]
[1] Institute of Oral Health Science, Ajou University Medical Center, South Korea
[2] Department of Oral and Maxillofacial Radiology and Dental Research Institute, Seoul National University Dental Hospital, South Korea
[3] Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, South Korea

Introduction
This study aimed to assist with diagnosis and treatment for reducing the associated risk of MROMJ by analyzing and comparing the clinical, panoramic radiographic imaging, and CT imaging features of MROMJ between low-dose medications administered osteoporosis and high-dose medications administered oncology patients.

Materials and Methods
The records of 161 patients with MROMJ patients (18 men, 143 women, average age: 72.0 years) administered antiresorptive medications for the management of osteoporosis or bone malignancy were retrospectively reviewed. The clinical and radiological data of 120 osteoporosis patients and 41 oncology patients who developed MROMJ after using antiresorptives were analyzed and compared.

Results
The mean age was significantly higher in the osteoporosis group than in the oncology group (75.8 vs. 60.7 years, p<0.001). The average medication duration was significantly longer in the osteoporosis group (59 vs. 28 months, p<0.001). Pus discharge was significantly more frequent in the osteoporosis group (p<0.001), whereas bone exposure was significantly more frequent in the oncology group (p=0.030).

The mean sequestra size was significantly larger in the oncology group than in the osteoporosis group (15.6 vs. 10.6 mm, p=0.002). On panoramic radiographs, the MCI values were significantly higher in the osteoporosis group (p<0.001).

The cure rate was significantly higher in the osteoporosis group than in the oncology group (66.3% vs. 42.9%, p<0.001). Moreover, the cured patients were significantly younger in the osteoporosis group (p= 0.049).

Conclusions
Osteoporosis and oncology patients with MROMJ exhibited significant differences in terms of clinical age, medication duration, signs and symptoms, and prognosis.
In the future, these findings might serve as a useful aid in the diagnosis, treatment planning, and prognostication of MROMJ in osteoporosis and oncology patients.

E-065

Bone resorption under chin implant: a case report

Jin-Woo Han[1,2*], Hang-Moon Choi[1,2], In-Woo Park[1,2]
[1] Department of Oral and Maxillofacial Radiology, Gangneung-Wonju National University, South Korea
[2] Research Institute of Oral Science, Gangneung-Wonju National University, South Korea

Introduction
Alloplastic chin implants are frequently used in cosmetic surgery as a valuable treatment modality to enhance a harmonic face. There have been reports of a series of possible complications related to the use of implants such as bone resorption under chin implant. This complication occurs because the chin is a very dynamic region, and it is exposed continually to the movements of the lips and mouth.

Case
A 43-year-old female visited Gangneung-Wonju National University Dental Hospital with a chief complaint of crowding on anterior teeth. The patient did not manifest any symptoms on the mandible. The mandible and chin area were also unremarkable, as observed in a panoramic image. However, a lateral cephalometric image showed chin implant and adjacent concavity on the buccal surface of the mandible. Cone beam computed tomography images revealed an implant causing an erosive defect on the cortical bone of the mandible. Based on the radiographic features, we could diagnose this case as a bone resorption under chin implant.

Discussion
There have been reports of a series of possible complications related to the use of implants such as infections, oral incompetence, displacement of the implant, damage of the mental nerve, bone resorption, and so on. Bone resorption is the most disturbing complication that could occur. This complication occurs because the chin is a very dynamic region, and it is exposed continually to the movements of the lips and mouth. Cone beam computed tomography would allow us to determine and quantify the magnitude of the erosion, in a periodical follow-up more precisely.

e-Poster Presentation

E-066

Bilateral masticatory muscles atrophy caused by trigeminal motor neuropathy : report of 2 cases

Jin-Young Chang[1*], Ju-Hee Kang[2], Jo-Eun Kim[2], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Heo[1], Sam-Sun Lee[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, South Korea
[2] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, Seoul, South Korea

Introduction
Pure trigeminal motor neuropathy is a rare condition, characterized by atrophy of masticatory muscles which are innervated by trigeminal nerve. Especially bilateral masticatory muscles atrophy is very unusual. We present 2 cases of bilateral masticatory muscles atrophy caused by trigeminal motor neuropathy.

Case
The first patient was 24-year-old female who presented with malocclusion, restricted mouth opening without pain and facial asymmetry.
The patient claimed to have these symptoms since she was 4-year-old. The CT showed atrophy and fatty degeneration of masticatory muscles for both sides. Only part of medial pterygoid muscles was shown. The second patient was a 53-year-old female who presented same symptoms as first patient. The patient claimed to have these symptoms since she could remember. The CT showed atrophy of masticatory muscles and platysma muscles for both sides.

Discussion
The etiology of pure trigeminal motor neuropathy is unclear. Suggested causes include neurofibromatosis, viral infection, multiple sclerosis, trauma, or unknown factors. In both cases, no causative findings were found in clinical and radiographic examination. The consequence of the fatty atrophy of masticatory muscles is a progressive limitation of mouth opening, caused by the loss of muscle fiber. Weakness of the masticatory muscles and limitation of mouth opening are mimic symptom of temporomandibular joint disorder. Both two cases, patients complained of limitation of mouth opening and were diagnosed using CT image. Patients with suspected trigeminal motor neuropathy should undergo CT or MRI to evaluate the sequelae of denervation and to rule out an intracranial or extracranial lesion.

E-067

Evaluation of imaging segmentation technique for 3-dimensional analysis of the mandible: a comparative study between manual and semi automatic segmentation technique

K.S.Sethna MuthLakshmi[1*]
[1] Oral Medicine and Radiology, Srm Dental College, India

Introduction
3D imaging is a recent trend in Radiomics. In medical imaging, it makes use of software and algorithms to extract data from CBCT (Cone Beam Computed Tomography). A Preliminary simulation model of anatomic structures is necessary for therapeutic purposes. The accuracy of 3D imaging in precisely reconstructing key anatomic structures will play a vital role in treatment strategies.

Materials and Methods
A dry skull with a mandible is used for the study to reconstruct a 3D mandible. The landmarks are marked in the mandible to obtain the physical volume using the water displacement method. The dry skull with mandible is subjected to CBCT. 3D reconstruction of the mandible will be obtained using manual segmentation and a semi-automatic approach. The assessment will be evaluated by two oral and maxillofacial radiologists for three times.

Results
The measurements obtained from the mandible and reconstructed models were compared with Analysis of variance (ANOVA) to determine the accuracy. The Inter and intra examiner reliability will also be assessed.

Conclusions
The present study results reveal the essence of 3D reconstruction and the reliability of the segmentation technique in 3D printing and reconstruction.

E-068

Three dimensional radiographic features of craniometaphyseal dysplasia

Kavya Shankar Muttanahally[1*]
[1] Oral and Diagnostic Science, University of Connecticut, United States of America

Introduction
Craniometaphyseal dysplasia (CMD) is a rare skeletal disorder characterized by progressive thickening and increased bone density of craniofacial bones and abnormally developed metaphyses in long bones.
Objective: To evaluate the three-dimensional radiographic features of craniometaphyseal dysplasia.

Case
Materials and Methods
CBCT scans of 7 patients diagnosed with Craniometaphyseal dysplasia were evaluated for this study. Radiographic features like patency and size of the paranasal sinuses, size of temporal, frontal, parietal, and occipital bones were evaluated. The skull base foramina, external auditory meatus, Sella turcica were also evaluated. Along with these, dental abnormalities were also assessed. Age and gender-matched control samples were used for comparison. Bone quality of the normal and syndromic patients was done by measuring Pixel intensity (PIV) values generated by the CBCT scans.

Discussion
Results
Cranial bones in patients with CMD were hyperostotic, the most prominent bone deposition was in the inner table of the frontal and occipital bones. All CMD patients had narrowed skull base foramina and smaller maxillary, ethmoid, sphenoid, and frontal sinuses. Bucco-lingual dimensions of jawbones were increased, with expansion in mandible more pronounced than in the maxilla. PIVs of cortical bone were 100-1000 and –258 to –60 for trabecular bone in CMD patients while in normal patients were >900 in cortical bone and 150-250 for trabecular bone.

Conclusion
CMD patients have significantly smaller sinuses, larger bone widths but the poorer bone quality compared to the control group.

E-069

CT texture analysis of stage 0 bisphosphonate-related osteonecrosis of the jaw

Kotaro Ito[1*]
[1] *Radiology, Nihon University School of Dentistry at Matsudo, Japan*

Introduction
Bisphosphonate-related osteoradionecrosis of the jaw (BRONJ) is one of the serious complications in patients who taking history of bisphosphonates. BRONJ has four stages (0-3), however, it is difficult to detect stage 0 (at risk category) BRONJ from CT. The purpose of this study was to quantitatively evaluate of normal mandibular bone marrow and mandibular bone marrow of the stage 0 BRONJ using CT texture analysis.

Materials and Methods
This IRB-approved retrospective study included 25 BRONJ patients (3 men, 22 women; age mean, 75.4, range 48-88) who underwent head and neck CT and MRI. The mandibular bone marrow with abnormal signals (T1WI: low, T2WI: low or high, STIR: high) on MRI in patients with a prior history of taking bisphosphonate and no qualitative characteristic CT and oral findings for osteoradionecrosis (exposed bone, sequestrum, periosteal reaction and osteolysis) were identified as stage 0 BRONJ. The mandibular bone with bilateral BRONJ, tumor or cyst, prior history of radiotherapy, and sever artifacts on CT images were excluded. The radiomics features of mandibular bone marrow of the BRONJ and normal (opposite side) mandibular bone marrow were analyzed using an open-access software LIFEx. The volume of interest (VOI) was manually placed by tracing contours of bilateral mandibular bone marrow, excluding teeth, mandibular canal and cortical bone on CT images. Thirty-seven texture features were extracted from each VOI. The results were tested with Wilcoxon rank sum test.

Results
Six GLRLM feature (LGRE, HGRE, SRLGE, SRHGE and LRHGE) and 4 GLZLM features (LGZE, HGZE, SZLGE and SZHGE) showed significant differences between normal and BRONJ mandibular bone marrow ($p<.05$).

Conclusions
CT was able to quantitatively evaluate of normal and BRONJ mandibular bone marrow. CT texture analysis may have the potential to detect of stage 0 BRONJ.

E-070

Dentinogenic ghost cell tumor in the maxilla : CT and MRI imaging finding

Kouhei Otsuka[1*]
[1] *Radiology, Nihon University School of Dentistry at Matsudo, Japan*

Introduction
Dentinogenic ghost cell tumor (DGCT) is classified as a benign mixed epithelial and mesenchymal odontogenic tumor. Past literature reported that DGCT often transform to odontogenic ghost cell carcinoma. Therefore, it is very important to diagnose the DGCT from images. However, to our knowledge, there are few reports for MR imaging findings of DGCT. In this time, we report our experience of DGCT, along with CT and MR imaging findings.

Case
A 71-year-old man was referred to our hospital because of a maxillary swelling in January 2020. Panoramic radiograph and CT showed multilocular radiolucent lesions with marked bone expansion in the maxilla. This lesion contained several punctiform calcification and impacted canine. MRI showed a heterogeneous region with low signal intensity on T1WI, intermediate signal intensity on T2WI and high signal intensity on STIR, and with several void signal in lesions. The mean apparent diffusion coefficient values of lesion were $2.32 \pm 0.16 \times 10^{-3}$ mm^2. The tumor subsequently underwent a biopsy for detailed, and dyskeratosis of ghost cells and the formation of atypical dentin were showed. Finally, the tumor was identified to DGCT.

Discussion
DGCT is an odontogenic tumor that shows a wide variety of histopathological features. Therefore, DGCT shows a wide variety of CT and MRI findings, however, generally, keratinized ghost cells show calcified findings in images. DGCT shows also a characteristic finding that it contains impacted tooth.
Calcifying epthelial odontogenic tumor, adenomatoid odontogenic tumor, ameloblastic fibro-odontoma, etc., which show similar those imaging findings, can be distinguished from DGCT, but it is difficult to distinguish them by image examination. This DGCT case also showed CT and MRI findings similar to those mixed lesions.

In conclusion, DGCT should be included to differential diagnosis if mixed lesions including impacted teeth are found in the jawbone.

E-071

Quantification of bone marrow fat fractions in temporomandibular joint using iterative decomposition of water and fat with echo asymmetry and least-squares estimation method (IDEAL-IQ)

Kug Jin Jeon[1*], **Chena Lee**[1], **Yoon Joo Choi**[1], **Sang-Sun Han**[1]
[1] *Oral and Maxillofacial Radiology, Yonsei University, South Korea*

Introduction
The prevalence of temporomandibular joint disorder (TMD) is gradually increasing, and magnetic resonance imaging (MRI) are becoming increasingly common as modalities used to diagnose TMD. Edema and osteonecrosis in the bone marrow of the mandibular condyle were considered to be a precursor to osteoarthritis, but these changes were not evaluated accurately and quantitatively on routine MRI. This study aimed to analyze the quantitative fat fraction (FF) in temporomandibular joint (TMJ) using Iterative Decomposition of water and fat with Echo Asymmetry and Least-squares estimation method (IDEAL-IQ).

Materials and Methods
Seventy-nine people who underwent MRI using IDEAL-IQ were investigated and divided into two groups as normal group (34 people) without temporomandibular joint disorder (TMD) symptoms and TMD group (45 people) with unilateral TMJ pain. In both groups, the FF of the condyle head in the TMJ was analyzed on 3D coronal IDEAL-IQ sequence by two oral and maxillofacial radiologists. In the TMD group, 29 people underwent cone-beam computed tomography (CBCT) and the presence or absence of bony changes in the condylar head was evaluated. The t-test was used to analyze the FF values of the normal and TMD groups and, within the TMD group, the FF according to the presence or absence of pain and bony changes.

e-Poster Presentation

Results
The FF measurements of the condyle head using IDEAL-IQ showed excellent inter-observer and intra-observer agreement. The average FF of the TMD group was significantly lower than that of the normal group ($p < 0.05$). In the TMD group, the average FF values of joints with pain and joints with bony changes were significantly lower than those of joints without pain or bony changes, respectively ($p < 0.05$).

Conclusions
The FF using IDEAL-IQ in the TMJ can be helpful for the quantitative diagnosis of TMD.

E-072

Radiographic evaluation in thickness of the roof of the glenoid fossa of the temporomandibular joint in patients with progressive condylar resorption

Kunihito Matsumoto[1*], Ko Dezawa[1], Ryutaro Kohashi[1], Toshihiko Amemiya[1], Yoshinori Arai[1], Kazuya Honda[1]
[1] Department of Oral and Maxillofacial Radiology, Nihon University School of Dentistry, Japan

Introduction
Progressive condylar resorption (PCR) of the temporomandibular joint (TMJ) presents decrease of mandibular height, and an anterior open bite as a result of the loss of condylar bone mass. Staging diagnosis of PCR using imaging modalities for therapeutic decision is still controversial. The authors hypothesizes that the mandibular fossa has reactive changes in patients with PCR because of the reactive thickening of the roof of the glenoid fossa (RGF), which is an indicator of overload to the TMJ in patients with osteoarthritis of the TMJ according to our prior studies. Therefore, the present study compares the thickness of the RGF in PCR patients with other subjects.

Materials and Methods
The study subjects comprised 16 patients with PCR (PCR-group), 22 patients with both retrognathia and anterior open bite (retrognathia-group), and 21 controls without any dentofacial deformities. Sagittal sectional images of computed tomography were used for measuring the minimum thickness of the RGF. In addition, Sella-Nasion-B point angle (SNB) and Frankfort-mandibular plane angle (FMA) were measured in the PCR- and retrognathia-groups.

Results
The minimum thickness of the RGF in the PCR-group was significantly higher than those in the retrognathia- and control-groups (Median, PCR-group: 1.83 mm, retrognathia-group: 1.35 mm, control-group: 1.23 mm). No statistical significance was found in the thickness of the RGF difference between the retrognathia- and control-groups. SNB in the retrognathia-group was higher than that of the PCR-group. FMA in the PCR-group was higher than that of the retrognathia-group.

Conclusions
The present study revealed bone augmentation in the RGF of the TMJ during the progress of PCR. Future studies, which compare progress of the disease with image findings of RGF in patients with PCR, will clarify whether RGF is an indicator of PCR progression.

E-073

Continuous report on MRI images in TMJD of patients with disk disorders.

Limin Lin[1*]
[1] Oral Pathology and Radiology, Kaohsiung Medical University, Chinese Taipei

Introduction
The prevalence of temporomandibular joint and muscle disorder (TMJD) in Taiwan is about 20% but among those TMJD patients who are seeking for treatment is less than 10%.It has been reported that about 5% to 12% of the United States population is affected by TMJD.
Plesh et al.documented that US National Health Interview Survey (NHIS) reported a total of 189,977 people, 4.6% (n = 8964) had experienced TMJD from 2000 to 2005.The purpose of this study is to evaluate the MRI images on TMJD on patients with disk and other TMD related disorders. A retrospective review for TMD MRIs was done for disc and bone changes in the TMD clinic of Kaohsiung medical university hospital from 2018 to 2019.

Case
Total number received the MRI examination were 125 patients divided into the elderly group (over 55 years old,18 patients, mean age 63.27,M:F=1:4.7) and control group (below 54 years old, 107 patients, mean age 34.85,M:F=1:5.036).

Discussion
The results were the incidence of disc displacement and osteoarthritis were significantly different between elderly group and control group. conclusion: Anterior disc displacement was the most common finding in the control group(younger).Bone changes were more prevalent in the elderly group.

E-074

Dental cementum assessment by optical coherence tomography

Luiz Eduardo Marinho Vieira[1*], Lígia Natália Sobreira Duarte Bezerra[2], Fernanda Clotilde Mariz Suassuna[3], Jéssica Gomes Alcoforado de Melo[4], Anderson Stevens Leônidas Gomes[5], Daniela Pita de Melo[2], Ana Marly Araújo Maia Amorim[2]
[1] Department Oral Diagnosis, University of Campinas, Brazil
[2] Department of Dentistry, State University of Paraíba, Brazil
[3] Department of Dentistry, Nova Esperança Faculty, Brazil
[4] Department of Dentistry, Sertão Integration Faculty, Brazil
[5] Department of Physics, Federal University of Pernambuco, Brazil

Introduction
The dental cementum presents high clinical and laboratorial relevance and has been assessed by various imaging modalities. However, these methods can present some disadvantages when compared with OCT. The aim of this study was to quantify and qualify the structure of the cementum using OCT.

Materials and Methods
53 teeth were divided into three groups according to the dental group (anterior, posterior and third molars) and into three groups according to age (18 to 30, 31 to 50 and above 50 years-old). All teeth were scanned using the Callisto OCT model (ThorlabsInc, New Jersey, USA) with a superluminescent diode (930 nm) bandwidth of 100 nm and maximum output power of 3 mW. The image analysis was performed using the ImageJ software. Kruskal Wallis test was performed to compare qualitative variables between unrelated groups ($p<0.05$); Friedman's test ($p<0.05$) was performed to assess paired groups. Spearman Correlation Test ($p<0.01$) was performed to assess possible correlations between cementum thickness and age.

Results
The apical root third presented greater cementum thickness than the middle and cervical thirds ($p<0.05$). All studied dental groups differed in cementum thickness for the middle and apical thirds ($p<0.05$). The anterior teeth group presented a strong correlation between cementum thickness and age for the middle ($r=0.712$; $p<0.01$) and apical thirds ($r=0.527$; $p<0.01$). There is a predominance of cementum translucency alterations in the middle and apical thirds. Stain spots were observed in the apical third regardless of age group and dental groups.

Conclusions
OCT permits the measurement of the thickness of the cementum. Qualitative differences are observed between the root thirds and the studied dental groups. Cementum thickness and age present a positive correlation for anterior teeth.

E-076

Multiple agenesis associated with bilateral subcondyle teeth ectopy discovered on orthopantomogram: case report

Mamadou Lamine Ndiaye[1*], Mamadou Diatta[1], Papa Abdou Lecor[1], Babacar Toure[1]
[1] Department of Dento-Maxillofacial Radiology, Faculty of Medicine, Pharmacy and Odontology,, Cheikh Anta Diop University of Dakar, Senegal

Introduction
Multiple agenesis associated with multiple dental inclusion remains a rare case. This article describes a case of multiple dental agenesis associated with bilateral ectopy of the third molar and the second left mandibular premolar. Multiple agenesis associated with multiple dental inclusion remains a rare case.

Case
Methodology. A 30-year-old patient was referred by her gastroenterologist for dental care. The patient describes never having had dental avulsion and was not suffering from any pain or discomfort at the orofacial level. Clinical exploration followed by radiological examinations were performed. The clinical examination reveals the absence of several teeth. Panoramic radiographs confirmed the diagnosis of multiple agenesis of eight teeth. The CBCT examination shows a dehiscence of the cortices of the inner and outer surfaces of the ramus by looking at the crowns of the third molars.

Discussion
Oligodontia in a non-syndromic subject associated with multiple dental ectopias is quite rare. Radiological examinations play a major role in the discovery, anatomical study of the teeth included in ectopic position as well as in therapeutic decision-making. In the absence of clinical and radiological symptoms, it is advisable to abstain from an avulsion of the ectopic impacted tooth and to monitor.

E-077

Automatic maxillary sinuses 3D segmentation in cone beam computerized tomography

Marcelo Daniel Brito Faria[1,2*], Luciana Freitas Bastos[1], Maira Beatriz Hernandez Moran[1,3], Gilson Giraldi[4], Aura Conci[3]
[1] Dental Radiology Center, Policlinica Piquet Carneiro, Universidade do Estado do Rio de Janeiro, Brazil
[2] Faculdade de Odontologia, Universidade Federal do Rio de Janeiro, Brazil
[3] Instituto de Computação, Universidade Federal Fluminense, Niterói, Brazil
[4] SVVR Laboratory, Laboratório Nacional de Computação Científica, Brazil

Introduction
Maxillary sinuses evaluation aid the diagnosis of several endonasal injuries, and is mostly based on cone-beam computerized tomographs (CBCT), in which sinuses can be identified by their radiopacity. This work presents an automatic method to segment and create 3D models of maxillary sinuses from CBCT.

Materials and Methods
The thresholding process, applied for all CBCT axial slices, selects points with Hounsfield values in the air range, since sinuses are air-containing cavities. Then, we select the i-th slice, which is likely to be in the sinuses area, being $i=5\times(n/6)$, where n is the number of axial slices of the considered CBCT. For each thresholded slice, the interception region between this slice and the i-th slice is used as seed for a region growing process. To remove possible noise, morphological operations were applied to the obtained regions. Finally, a 3D Tringle Mesh is generated from the slices points using the Screened Poisson Surface Reconstruction algorithm. To obtain the actual volume values (in cm3), the number of voxels are multiplied by the CBCT machine resolution.

Results
This method's evaluation included 7 exams of six women and one man with ages from 30 to 60.
These exams were acquired in three CBCT machines with resolutions: 0.20, 0.25 and 0.30 mm3. The obtained volumes were 36.764, 39.665, 29.424, 43.235, 44.615, 33.287 and 63.943 (in cm3), which is close to the average value denoted by previous works (29.28cm3, considering both sinuses, for patients with ages from 20 to 60). A visual assessment comparing the CBCT data and the volume shape also demonstrated our results' precision.

Conclusions
The results (volume values and visual assessment) pointed out that our method is promising.

E-078

A comparative study between CT, MRI, and intraoral us for the evaluation of the depth of invasion in early stage (T1/T2) tongue squamous cell carcinoma

Masaki Takamura[1*], Taichi Kobayashi[1], Yutaka Nikkuni[1], Kouji Katsura[1], Manabu Yamazaki[2], Satoshi Maruyama[3], Jun-ichi Tanuma[2], Takafumi Hayashi[1]
[1] Division of Oral and Maxillofacial Radiology, Niigata University Graduate School of Medical and Dental Sciences, Japan
[2] Division of Oral Pathology,, Niigata University Graduate School of Medical and Dental Sciences, Japan
[3] Oral Pathology Section, Department of Surgical Pathology, Niigata University Medical & Dental Hospital, Japan

Introduction
This study aimed to clarify the accuracy of intraoral ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI) in preoperative image depth of invasion (DOI) measurement of T1/T2 tongue cancer through comparison with histopathological measurements.

e-Poster Presentation

Materials and Methods
Imaging of the primary lesions was performed at Niigata University Medical and Dental Hospital; the lesions were classed into T1 and T2 based on the 8th edition of the AJCC/UICC, and surgery performed. There was histopathological confirmation of lesions as squamous cell carcinoma in 48 patients with tongue cancer. T3 and T4 cases, cases in which preoperative chemotherapy and radiation therapy were performed, and cases where biopsy was performed before imaging were excluded. The radiological DOI in US, CT, and MRI and the histopathological DOI as base were comparatively investigated and statistical analyses were performed by Bland-Altman analysis and Spearman's rank correlation coefficient.

Results
Bland-Altman analysis showed that the US radiological DOI was overestimated by an average of 0.2 mm compared to the histopathological DOI, while CT and MRI radiological DOI were overestimated by an average of 2-3 mm. The comparison of CT and MRI revealed that the difference between the MRI and histopathological DOI, as well as the 95% limit of agreement, were smaller than those of the CT radiological DOI.

Conclusions
US is the most accurate preoperative diagnostic tool for T1 and T2 squamous cell carcinoma; CT and MRI tend to have an overestimation of about 2 to 3 mm and so caution is required.

E-079

External cervical resorption — prevalence and characteristics

Matheus Diniz Ferreira[1*], Matheus Barros Costa[1], Felipe Ferreira Costa[2], Deborah Queiroz Freitas[1]
[1] Department of Oral Diagnosis, FOP - Unicamp, Brazil
[2] Department of Stomatology, FOUSP - University of São Paulo, Brazil

Introduction
Dental resorption is a challenge in diagnosis and treatment planning for dentists due to the complexity of the process. External root resorption can be subclassified into many categories, being one of them external cervical resorption (ECR). The aim of this study was to assess the prevalence and characteristics of ECR regarding tooth, sex, age, and portal of entry, and degree according to the Heithersay classification using cone-beam computed tomography (CBCT) exams.

Materials and Methods
CBCT exams of 1313 patients acquired using PreXion 3D CBCT unit were evaluated to diagnose ECR. All teeth in the exams were evaluated and demographic data were registered. After, the cases of ECR were assessed simultaneously by 2 oral radiologists to evaluate the portal of entry and perform the Heithersay classification. After 15 days, 20% of the sample were reevaluated. The association between the presence of the ECR and the factors studied was assessed using chi-square and Fisher's exact test. The intra-observer agreement was analyzed by Kappa test. The significant level was set at 5%.

Results
A total of 6244 teeth were analyzed and 84 teeth (1.35%) were affected by ECR. A significant association was found between the presence of ECR and sex, with higher prevalence in males ($p = 0.002$). There was no significant association between the presence of ECR and the age ($p=0.147$). The most commonly affected teeth were mandibular and maxillary central incisors. The highest degrees of ECR (classification 3 and 4) were associated to the maxillary canines, and mandibular lateral and central incisors ($p = 0.015$) and with lingual and proximal entries ($p=0.020$).

Conclusions
In the population studied, the prevalence of ECR was 1.35%, with higher prevalence for males and wide age distribution. Mandibular and maxillary central incisors were the most commonly affected teeth.

E-080

Morphological and topographic evaluation of the mandibular canal and its relationship with the facial profile, skeletal class, and sex

Matheus L Oliveira[1*], Gustavo M Prado[1], Rocharles C Fontenele[1], Eliana D Costa[1], Deborah Q Freitas[1]
[1] Oral Diagnosis, University of Campinas, Piracicaba Dental School, Brazil

Introduction
Disharmonic development of the maxillofacial complex can compromise maxillary and/or mandibular growth and result in skeletal and dental changes in individuals with different facial types. Considering that patients eligible for orthognathic surgery or other surgical procedures typically present abnormal craniofacial development, it is relevant to assess the anatomical features of the mandibular canal in different groups of patients. Thus, the aim of this study was to evaluate the morphology and topography of the mandibular canal in patients with different facial profiles, skeletal classes, and sexes

Materials and Methods
Cone-beam computed tomography volumes of 103 patients were classified according to facial profile and skeletal class. Two examiners classified the mandibular canal into a linear, spoon-shaped, elliptical arc, or turning curvature and measured four related linear distances. Mode of the mandibular canal curvatures was calculated and multiway ANOVA with Tukey's test compared the linear measurements between facial types, skeletal class, and sexes ($\alpha = 0.05$). Kappa and intraclass correlation coefficients were used to assess the reproducibility of qualitative and quantitative variables, respectively.

Results
The examiners showed excellent reproducibility. The mandibular canal presented different curvatures, being the spoon-shaped and elliptical arch the most frequent. No significant differences were observed for most of the linear measurements between the different facial profiles, skeletal classes, and sexes ($p>0.05$).

Conclusions
Spoon-shaped and elliptical arch are the most frequent curvatures of the mandibular canal; furthermore, its morphology and topography seem to be little influenced by the facial profile, skeletal class, and sex.

E-081

Iatrogenic subcutaneous facial emphysema following dental procedures: a report of two cases and review of the literature

Mehrnaz Tahmasbi Arashlow[1*], Poorya Jalali[2]
[1] Diagnostic Sciences, Texas A & M University, College of Dentistry, United States of America
[2] Endodontics, Texas A & M University, College of Dentistry, United States of America

Introduction
Subcutaneous facial emphysema (SFE) is a clinical condition when air infiltrates in the subcutaneous layer of skin, causing distention of the facial plane. SFE is associated with trauma, infection with gas-forming bacteria, dental or surgical procedures. SFE is usually a self-limiting condition; however, it can become a life-threatening, complication. Subcutaneous emphysema can spread to the deep spaces of the head and neck, compressing the airway, which leads to dyspnea. It can spread to the mediastinum and affects respiratory or cardiac function.

Case
A 57-year-old female and a 69-year-old male with an unremarkable medical history presented for implant evaluation. Cone-beam computed tomography (CBCT) was performed for treatment planning purposes. A first case had a history of recent extraction of the maxillary right first premolar. A second case had a history of recent implant surgery at the site of the maxillary right second premolar. The CBCT images of both cases showed remarkable air accumulation in the buccal space anterior to the right maxillary sinus. There was no evidence of fracture in the maxillofacial region.

Discussion
In dentistry, SFE is an uncommon complication and it has been rarely reported. Therefore, it is necessary to be aware of this complication and be able to differentiate SFE from other conditions that have similar radiographic features and clinical presentations. Swelling and crepitus over the involved site are the main signs of SEF. Imaging plays a significant role in the diagnosis and evaluation of the extent of the SFE and its complications. Radiographically, SFE appears as air accumulation or often striated radiolucencies in the soft tissues. In this presentation, two cases of SFE following dental procedures will be presented with a review of the literature. The CBCT imaging features, signs and symptoms, and the management of the condition will be discussed.

E-082

Application of texture analysis to odontogenic lesions

Miharu Taguchi[1*], Junichiro Sakamoto[1], Hiroshi Watanabe[1], Tohru Kurabayashi[1]
[1] Oral and Maxillofacial Radiology, Graduate School, Tokyo Medical and Dental University, Tokyo, Japan, Japan

Introduction
Odontogenic keratocysts (OKCs), ameloblastomas (AMs), and dentigerous cysts (DCs) are common types of odontogenic lesions of the jaw. Computed tomography (CT) is generally performed for diagnosis; however, the CT findings of these lesions are similar and differential diagnosis is sometimes difficult. Recently, texture analysis has been applied to medical imaging and its efficacy has been reported. Texture analysis includes several methods such as the grey level co-occurrence matrix (GLCM) which gives measurements by calculating how often pairs of pixels with specific values and in a specified spatial relationship occur in an image, and the grey-level run length matrix (GLRLM) which gives the size of homogeneous runs for each grey levels. The purpose of this study was to perform texture analysis of soft tissue on CT images of OKCs, AMs, and DCs and to investigate its efficacy for differential diagnosis.

Materials and Methods
This retrospective study protocol was approved by our institutional review board, and 127 cases (36 OKCs, 28 AMs, and 63 DCs) that had undergone CT and had a confirmed histological final diagnosis of OKC, AM, or DC were included. Texture analysis (histogram analysis, GLCM, and GLRLM) was performed on all cases. For each case, a region of interest (ROI) was manually established and twenty-four features within the ROI were texturally analyzed.

Results
For 13 features, significant differences were detected using the Kruskal-Wallis test. A post-hoc test (Steel-Dwass test) revealed six features showing significant differences between OKCs and DCs, three features showing significant differences between AMs and DCs, three features showing significant differences between OKCs and DCs, AMs and DCs, and one textural feature common to all three lesions.

Conclusions
Texture analysis of soft tissues on CT images may provide quantitative information to differentiate between common odontogenic lesions.

E-083

Exceptional association of two maxillary bones pathologies with the very different natural histories

Mladen Milicevic[1*]
[1] Radiology, University Hospital of Liège, Belgium

Introduction
We present association between non familial cherubism and giant cell central granuloma (GCCG). Cherubism is rare, approximately 300 cases published, but non familial form is exceptional. Association mentioned above will be one of the first described, at our best knowledge, with histologic and genetic confirmation.
Orthopantomograms, Computed Tomography (CT) and mostly Cone Beam CT (CBCT) images, served for 9 years follow up of a patient with a non familial cherubism discovered at age of 6 and with GCGG discovered 5 years later. Diagnoses were done in function of clinical and radiological appearances and confirmed by genetic and histopathologic analyses.

Case
An orthopantomogram and a CT exam were performed on a 6 years old girl for swelling of mandibular angles. Expansive, multilocular cystic lesion with scalloping and well defined septa is found at mandibular angles and maxillary tuberosities. After lesion curettage, histopathologic and genetic analyses confirmed cherubism. There wasn't family history of cherubism. At CBCT lesion became sclerotic with involution at puberty.
CBCT at age of 11 presented a huge, expansive, multilocular symphyseal and parasymphyseal mandibular lesion, with teeth displacement and some teeth agenesis. Partial surgery was performed to allow teeth eruption. Histology confirmed GCCG. Currently, rhizalysis of canine 43 is observed.

Discussion
Association of cherubism and GCCG was described previously in 7 or 8 cases but only one with a non familial cherubism. Our case has histologic and genetic confirmation. We must keep in mind that cherubism is a self limited, involutive pathology, at puberty, and GCCG is of later appearance and progresses after puberty. Both pathologies have histological similarity, giant cells, seen also in Brown tumor and aneurysmal cyst. Thus differential diagnosis must take in consideration natural history, age, location, histological, biological and genetic analyses of these four pathologies.

e-Poster Presentation

E-084

Radiographic evaluation of bone and mucosa using low-dose CBCT with radiopaque X-resin stent versus CT and ridge mapping: a validity study

Nader Nabil Rezallah[1*]
[1] *Oral Radiology, Tijan International Dental Clinic, Kuwait*

Introduction
To compare the abilities of computed tomography (CT), cone beam computed tomography (CBCT) with X-resin and ridge mapping and to measure the thickness of bone and soft tissue during implant planning, which allows increasing the success criteria of implant placement.

Materials and Methods
This validity study included a total of 96 samples chosen from 20 patients undergoing implant surgeries (mandible and maxilla) aged between 25 and 50 years. Measurements of bone and mucosa were done by using three techniques, which are the CT, CBCT with X-resin, and finally ridge mapping at 4 points that are 3, 4, 5, and 6 mm from the alveolar crest. The analysis of variance test was used for statistical analysis, establishing a level of significance at $P \leq 0.05$.

Results
A comparison between the different techniques was done using Freidman's test with the Wilcoxon signed-rank test for paired (matched) samples as multiple 2-group comparisons. Two-sided $P < 0.05$ were considered statistically significant. For bone measurements, results showed that there was a statistically significant difference between CBCT and CT and between CBCT and ridge mapping, whereas for soft tissue measurements; results showed that there was no statistically significant difference between ridge mapping and CBCT using the X-resin stent and there was a slight statistically significant difference between the ridge mapping and the CT.

Conclusions
The study reveals the ability of CBCT with the X-resin to give accurate measurements not only to the bone but also for the soft tissue in different cases with the least radiation dose and low cost.

E-085

Rheumatoid arthritis: quantitative assessment of the mandibular condyle using diffusion-weighted imaging

Naohisa Hirahara[1*], **Hirotaka Muraoka**[1], **Kotaro Ito**[1], **Satoshi Tokunaga**[1], **Eri Sawada**[1], **Takumi Kondo**[1], **Takashi Kaneda**[1]
[1] *Radiology, Nihon University School of Dentistry at Matsudo, Japan*

Introduction
Bone destruction in the joints of patients with Rheumatoid arthritis (RA) occurs within 2 to 3 years after the onset of the disease and rapidly progresses. Therefore, early detection of RA is important for these patients. The purpose of this study was to quantitatively assess the mandibular condyle in patients with rheumatoid arthritis using the apparent diffusion coefficient (ADC) on diffusion-weighted imaging (DWI).

Materials and Methods
This study was approved by the Ethics Committee at our university (EC19-011) and all patients signed an informed consent agreement for magnetic resonance imaging (MRI) examinations. Thirty-four patients with RA and temporomandibular joints (TMJs) pain who underwent MRI examination of the TMJs at our hospital between August 2006 and March 2020 were included in this study. Thirty-six patients with normal TMJs who underwent MRI examination at our hospital between August 2006 and March 2020 were included as controls. The MRI findings were compared between the two groups.

Results
The mean ADC values of the mandibular condyle in patients with RA were $1.20 \pm 0.17 \times 10{-}3$ mm2/s. The mean ADC values of the mandibular condyle in patients with RA were significantly greater than the controls ($P < 0.01$). Receiver operating characteristic (ROC) curve analysis revealed a cutoff of 0.89 for the ADC values of the mandibular condyle in patients with RA. The ROC curve analysis revealed areas under the curve for maximum ADC values of 0.98.

Conclusions
This study found that the ADC on DWI could be used for the quantitative assessment of the mandibular condyle in patients with RA, which indicated that the ADC on DWI could be useful for predicting RA.

E-086

A case report: breast carcinoma with multiple metastasis to calvarium, cervical vertebrae and mandible

Nejlan Eratam[1*], **M. Feyzi Kucukkalem**[1], **Ercin Samunahmetoglu**[1], **Kivanc Kamburoglu1**
[1] *Oral and Maxillofacial Radiology, Ankara University, Turkey*

Introduction
Breast cancer is the cancer with the highest incidence and mortality rate in women among all cancers worldwide. Metastases in the oral regions, including soft tissues and jaw bones, account for only %1 to %8 of all oral malignancies. The most common location, in jaw bones, is the molar region of mandible. Metastatic tumors are clinically significant as their appearance may be the first indication of an undiscovered malignancy. Sometimes metastatic lesions to jaws may show vague pain and misdiagnosed as pathologic entities of dental origin. The prognosis of metastatic lesions to the oral cavity is very poor. Careful examination of oral symptoms and further radiographic examination of lesions is crucial for the possible presence of jaw metastases.

Case
A 49-year-old female patient was referred to the Department of Oral and Maxillofacial Radiology, Ankara University for further examination of lesions suggesting bone metastasis in the right mandibular ramus. Patient's medical history revealed that ten cycles of chemotherapy and radiotherapy was performed for the treatment of breast carcinoma.In the molar and ramus regions of the right mandible and on the left mandibular ramus increased osteoblastic activity with radiopaque margins extending towards the left temporomandibular joint, proc. condylaris and coronoid was noted on Cone Beam Computed Tomography images. In addition, similar lesions were observed in the calvaria, cervical vertebrae, and temporal bones.

Discussion
In the present case the primary tumor was already diagnosed and clinical symptoms were not obvious.Wolujewicz and Irani stated that metastasis to TMJ is rare and mostly occurs in the final stage of a malignancy. In our case metastasis to TMJ were including in the calvarial bones, vertebrae and temporal bones and radiographic appearance of metastatic lesions were consistent with present literature.

E-087

Association of panoramic radiographic measure with prognosis of HA implant placement

Noriyuki Sugino[1*], Yutaka Kitamura[2], Akihiro Kuroiwa[3], Hiroko Kuroiwa[1], Kozue Mori[1], Hizuru Osanai[1], Akira Taguchi[1]
[1] Department of Oral and Maxillofacial Radiology, Matsumoto Dental University, Japan
[2] Department of Oral and Maxillofacial Surgery and Dental Implant, Center of Oral and Maxillofacial Surgery and Dental Implant in Shinshu, Japan
[3] Department of Prosthodontics, Matsumoto Dental University, Japan

Introduction
To clarify the association of panoramic radiographic measure with prognosis of HA implant placement.

Materials and Methods
Of the patients who had HA implant placement, 202 Japanese men and women aged 26 to 83 years participated in this study. Association between panoramic radiographic measure and prognosis of HA implant placement was assessed in a total of 667 implants. One certificated oral surgery operated HA implant placement. One certificated oral and maxillofacial radiologists classified cortical shape of the mandible into three categories on panoramic radiographs; normal (type 1), mildly to moderately eroded (type 2) and severely eroded (type 3). Logistic regression analysis adjusted for age, gender, region, CT number, number of residual teeth, diabetes and hypertension was performed to clarify the association between cortical shape and prognostic of HA implant placement. Since there were 27 unsuccessful implant (maxilla: 26, mandible: 1), mandibular case was excluded from the analysis.

Results
The number of subjects were 69 in type 1, 42 in type 2, and 14 in type 3. The odds ratios of having unsuccessful implant in subjects with type 2 or type 3 were 13.5 (95% Confidence Interval [CI], 1.32-138.00) compared to subjects with type 1. In subjects with type 1, the odds ratios of having unsuccessful implant were 1.5 (95% CI 1.15-1.95) with increase of CT number by 100.

Conclusions
Our results suggested that cortical shape of the mandible may be useful marker for predicting the prognosis of HA implant placement.

E-088

MRI evaluation of the articular eminence morphology and condyle shape in TMD Patients

Nuran Bayramov[1*], Berceste Polat Akmansoy[1], Sebmen Ercalik Yalcinkaya[1]
[1] Oral and Maxillofacial Radiology, Marmara University Faculty of Dentistry, Turkey

Introduction
The aim of this study was to evaluate the associations between articular eminence inclination/height (AEI / AEH) and the shape of condylar head on the magnetic resonance imaging (MRI) in disc displacement (DD) patients.

Materials and Methods
MRI (1.5-T, Siemens Magnetom Espree, Siemens AG Medical Solutions, Germany) images of 124 TMJs of 62 patients (8 male and 54 female; mean age=31 years) were grouped according to disc status "normal, with/without reduction (DDwR / DDwoR)" and the measurements were made on both sagittal and coronal slices. The AEI, AEH, and condyle shape were evaluated and possible associations with disc status were assessed.

Results
Of the TMJs, 19% were evaluated as normal, 41% had DDwR and 40% had DDwoR. The most frequently observed condyle shape was flattening in sagittal (38.7 %) and coronal planes (46%). Flattened condyle shape was seen more frequently in TMJs with DDwoR (63% sagittally and 57% coronally). Oval and round condyle shapes were seen more often in TMJs with normal disc status. Statistically significant correlations were recorded between AEI and the shape of condylar head ($p<0.05$) and within the disc status groups ($p<0.05$).

Conclusions
Within the limits of this MRI study, AEI was decreased in DD patients and the frequently observed condyle shape was flattened.

E-089

Infrared thermography on the diagnosis of actinic cheilitis and lower lip squamous cells carcinoma using machine learning

Raelly Katharinne Lima De Meneses[1*], Ingrid Morgana Fernandes Gonçalves[1], José Alberto Souza Paulino[2], Alanne Vandreia Da Silva Alves[2], Robson Pequeno De Sousa[3], Daniela Pita De Melo[1], Cassiano Francisco Weege Nonaka[1], Pollianna Muniz Alves[1]
[1] Dentistry, Universidade Estadual da Paraiba, Brazil
[2] Computer Science, Universidade Federal de Campina Grande, Brazil
[3] Computer Science, Universidade Estadual da Paraiba, Brazil

Introduction
To evaluate the use of the infrared thermography (IT) for diagnosis of actinic cheilitis (AC) and lower lip squamous cell carcinoma (LLSCC) through machine learning..

Materials and Methods
All sample consisted of 65 patients, divided in 2 groups: test group (with AC and LLSCC) and control group (without AC and LLSCC). Thermographic images were obtained using the FLIR T650sc® camera. Using a co-occurrence matrix, final sample corresponded to 312 thermographic images. Python language was used to development of algorithm. For machine learning, three classifiers were used (K-Nearest Neighbors-KNN, Support Vector Machine-SVM and Dense Neural Networks-DNN). Panda library was used for data analysis, and Scikit learn for machine learning. Confusion matrix was used to assess accuracy, sensitivity and precision.

Results
Among classifiers evaluated, DNN classifier showed major accuracy between test and control group (97.33%), and between AC and LLSCC (95.55%). DNN classifier exhibited only 6.4% false negatives to test group and none to control group. Between AC and LLSCC, DNN classifier exhibited non false negative to AC and only 2.5% false negatives to LLSCC.

Conclusions
Through machine learning, using the DNN classifier, it is suggested that IT can be used as a health technology for diagnosis of AC and LLSCC, thus bringing numerous benefits, such as the early diagnosis of lip cancer and, thus, reducing costs of public health used for the treatment of this malignant neoplasm.

e-Poster Presentation

E-090

Cone beam CT features of arrested pneumatization of the sphenoid sinus

Noura AlSufyani[1,2], Nouf Alsuayri[1], Raghad AlRasheed[1*]
[1] Department of Oral Medicine and Diagnostic Sciences, KSU, Saudi Arabia
[2] School of Dentistry, Department of Medicine and Dentistry, University of Alberta, Canada

Introduction
Arrested pneumatization of the sphenoid sinus (APSS) is a developmental variation usually incidentally discovered due to its asymptomatic nature. It results when the sinus fails to become aerated and fully pneumatized. Arrested pneumatization is more commonly reported with the sphenoid sinus and its sites of accessory pneumatization compared to other paranasal sinuses.
APSS represents a challenge mainly because it is difficult to diagnose and to differentiate from other pathological lesions related to skull base. Only scarce reports exist on demographic and cone beam CT (CBCT) features of APSS.

Materials and Methods
Retrospective analysis of radiographic reports of CBCT images of dental patients scanned for maxillofacial purposes at two dental imaging centers. The radiographic and demographic data were retrieved for the qualifying reports and radiographic features were secondarily analyzed by a maxillofacial radiologist.

Variables collected: demographic (age/gender) and radiographic features: location, extent, periphery, internal structure, and effect on surrounding.

Results
There were 29 reports with APSS: mean age was 29.9±19 years and 17 (58.6%) were females. APSS mostly presented unilaterally, 16 (55.5%) and 27 (93.1%) involved the body of sphenoid. The most common accessory site involved was the pterygoid process or plates, 21 (72.4%). Involvement of the vidian canal was noted in 27 (93.1%) and 18 (62.9%) involved foramen rotundum. Majority of the cases, 28 (96.5%) were well defined, corticated, and with mixed attenuation. Only one case (3.4%) caused narrowing of the vidian canal.

Conclusions
Understanding the sphenoid bone anatomy is crucial to analyze the involvement of accessory sites of APSS. Pterygoid plate, vidian canal, and foramen rotundum were common accessory sites. The lack of displacement or expansion of the surrounding structures is key to differentiate from skull base tumors.

E-091

Oroantral communication

Rama Shahrour[1*], Ali Syed[1]
[1] Radiology, Case Western Reserve University, United States of America

Introduction
This pictorial review aims to explain the basic radiographic features of oroantral communication (OAC) using 2D and 3D imaging modalities as well as provide the ideal imaging modality for its identification and diagnosis. It also aims to clarify the causes, complications and treatments of OAC.

Materials and Methods
The study compares the radiographic features of OAC using 2D imaging modalities including Periapical (PA), Orthopantomogram (OPG) and Water's view to 3D imaging modalities including Computed Tomography (CT) and Cone-beam Computed Tomography (CBCT).

Results
The study shows that 2D imaging modalities are the modality of choice to identify discontinuity in the maxillary sinus floor and the size of the bony defect. On the other hand, 3D imaging modalities are essential for determining the status of soft tissue in the maxillary sinus and nasal cavity as well as any sinus pathology. The most common locations of OAC is as follows: maxillary second molars (45%), third molars (30%), first molars (27.2%), and first premolars (5.3%). There is a slight male predilection of OAC with a female-to-male ratio of 1:1.52.

Conclusions
This study has concluded that the integration of both 2D and 3D imaging modalities is essential for the correct and comprehensive diagnosis and treatment of OAC. This will ultimately prevent unnecessary mental and financial burdens. Characteristic features of OAC are the loss of continuity of the floor of the maxillary sinus and thickening of the soft tissue of the maxillary sinus mucosa, or a combination of both. However, diagnosis of OAC must be confirmed clinically.

E-092

Radiology and inca culture: appearance depending on the environment

Raúl Herrera Mujica[1*]
[1] Bucomaxillofacial Medicine and Surgery, Universidad Peruana Cayetano Heredia, Peru

Introduction
Interpretation of the images is a process of information collection contained in the different imaging techniques; but interpretation requires proper description, detailing characteristics of the image leading to a final conclusion. In these characteristics are different appearances of some pathological or non-pathological entities.

Case
These cases show the similarity between some entities and images of every day in Peru. Radiologist must consider that sometimes the similarity depends on the environment in which it was established.

Discussion
Since a long time, in radiographic description of the pathologies of maxillofacial region, radiologists have made similarities between the appearance of the lesions and different images of everyday life; in order to facilitate understanding of the description of the entity and nominate differential diagnosis based on the appearance. For example: windblown snow, eggshell, mottled appearance, pagetoid appearance, ground glass, pencil lines, cutting brush and others. Some appearances fulfill the purpose for which they are mentioned; but not others, leading to confusion because depending on the environment some images are everyday, casual or unknown.

Radiologists internalize the knowledge through visual learning and perceive things as images, because represent things as images or graphics helps them remember and learn. Therefore, this poster will present radiographic and tomographic images resembling photographs of different landscapes and archaeological remains of the Inca culture, it was a great pre-columbian civilization was located in present territories of Peru, Argentina, Bolivia, Chile, Colombia and

Ecuador; capital of this empire was Cusco "the sacred city". The aim is to suggest that radiologists mention the radiographic appearance according to their environment.

E-093

Evaluation of the neck lump clinic and the effectiveness of diagnostic tools used to reach diagnosis

Ria Radia[1*], Ashana Gupta[1], Bhagyalakshmi Batchu[2]
[1] Oral and Maxillofacial Surgery, King's College Hospital NHS Trust, United Kingdom
[2] Dental and Maxillofacial Radiology, King's College Hospital NHS Trust, United Kingdom

Introduction
Many patients present with head and neck lumps with wide-ranging aetiologies, from reactive lymph nodes to malignant conditions. At King's College Hospital, such patients are referred to a dedicated one-stop clinic in which the Oral and Maxillofacial Surgery Department work alongside Dental and Maxillofacial Radiology and Haematology, designed to streamline the patient pathway from referral to diagnosis. Diagnostic tools used in the clinic include ultrasound, ultrasound-guided fine-needle aspiration, core biopsy and surgical biopsy.

Materials and Methods
We evaluated the Neck Lump Clinic in an Oral and Maxillofacial Surgery Department, over a one-year period, looking at average time periods from referral to assessment to discharge, and analysed the efficacy of diagnostic tools used. We compared the initial clinical diagnosis on assessment to the final diagnosis and analysed which diagnostic tools were most effective in reaching the diagnoses for a variety of conditions.

Results
216 patients were seen from March 2018-2019. Of these, 166 patients presented with a head or neck lump. The average time between referral and first appointment was 17.3 days and 10.6 days for 2 week wait urgent referrals. 25 malignant cases underwent further investigation including ultrasound scanning, fine-needle aspiration and biopsy. Core biopsies were the key diagnostic tool in most cases. The cancer pick-up rate of the clinic is therefore 11.6%, which falls within the UK standards.

Conclusions
The clinic forms an effective pathway for cancer patients to receive care from head and neck radiologists and surgeons in a timely manner. Whilst the cancer pick-up rate is good, 87% of cases seen did not require specialist intervention. The clinic would benefit from a more stringent referral pathway to reduce the number of benign cases being investigated. This will benefit a reduced waiting time for urgent 2 week wait referrals.

E-094

Dilemma with implant placement in patient with florid cemento-osseous dysplasia: a literature review

Rohan Jagtap[1*], Mythili Bhat[2], Neeta Mehta[2], Swati Gupta[3]
[1] Division of Oral & Maxillofacial Radiology, Department of Care Planning & Restorative Sciences, University of Mississippi Medical Center School of Dentistry, United States of America
[2] Advanced General Dentistry, University of Mississippi Medical Center School of Dentistry, United States of America
[3] Periodontist, Gainesville, Florida, United States of America

Introduction
Florid Cemento-osseous dysplasias (FCOD) are rare benign fibro-osseous lesions predominately seen in African American women, with most common location in the mandible. The pathogenesis underlying these non-reactive lesions involves the replacement of normal bone with fibroblasts, collagen fibers, and immature bone. Implant placement has been a challenge in patients with FCOD due to changes in the bone like poor vascularization, higher mineralization, and susceptibility to bone cavity formation. The objective of the present review was to conduct a thorough comparative review of articles on placement of implants in Florid cemento-osseous dysplastic patients and determine a position with the present data.

Materials and Methods
An electronic and hand search was performed for the screening of articles. A total of 11 case reports were included for the review. The primary variables included were age, sex, site of implant placement, post peri-implant complications, post-operative clinical and radiographic changes, and the duration of follow-up.

Results
The initial search suggested successful placement of implant placement in six articles and failures in the other five. Complications of buccal swelling and loose implants have been reported, which have been argued by certain studies, proposing strict infection control and minimally invasive submerged two-stage surgery.

Conclusions
Within the limitations of the review, it can be concluded that with precautions and with a strict inclusion criterion, implants can be placed in patients with FCOD. However, case-control and prospective long-term studies are warranted.

E-095

Ectopic eruption of mandibular second molar in the coronoid process: a case report and review of literature

Rohan Jagtap[1*], Pia Kirk[1], Tracy Dellinger[1]
[1] Division of Oral & Maxillofacial Radiology, Department of Care Planning & Restorative Sciences, University of Mississippi Medical Center School of Dentistry, United States of America

Introduction
The ectopic eruption has been defined as a condition in which the permanent teeth, because of deficiency of growth in the jaw or segment of the jaw, assume a path of eruption that intercepts a primary tooth, causes its premature loss and produces a consequent malposition of the permanent tooth. Prevalence of ectopic eruption of the lower permanent second molar is reported between 0.06 and 0.3%. The present case report discusses the ectopic eruption of the second mandibular molar in the right coronoid process.

Case
A 50-year-old female with a non-contributory medical history visited the University of Mississippi Medical Center School of Dentistry for a routine check-up. She was referred to the division of oral and maxillofacial radiology for the radiographic analysis. A pantomograph was made as part of the diagnostic workup which revealed an impacted mandibular right second molar in the coronoid process. Based on clinical and radiographic findings, a cone-beam CT (CBCT) volume was made. Both panoramic and CBCT affirmed ectopic eruption of mandibular right second molar in the coronoid process with bilateral coronoid hyperplasia.

e-Poster Presentation

Discussion
Ectopic eruption of mandibular second molar in the coronoid process is a rare phenomenon. There is a high incidence (85%) of dentigerous cyst associating with ectopically erupted molars. Treatment of ectopic eruption of molars varies from the conservative approach such as follow-up to requiring emergency surgical intervention. Surgical approaches to the coronoid process region include both intraoral and extraoral techniques. The introduction of endoscopically assisted intraoral approaches for the removal of teeth from this region provides a less invasive treatment option with reduced operative morbidity.

E-096

Root migration following mandibular third molar coronectomy

Sandeep Acharya[1*], Anne Donnelly[1]
[1] Oral & Maxillofacial Surgery, Arrowe Park Hospital, United Kingdom

Introduction
Coronectomy is a procedure done in many Oral & Maxillofacial Surgery (OMFS) units, Specialist Practices and Community Oral Surgery settings. This surgical technique is performed to reduce the risk of damage to the inferior alveolar nerve, which could occur when surgically removing mandibular third molars that have apices located in close relation to the nerve. Instead, the tooth is decoronated and the roots are left in situ. Root migration is a known sequelae of coronectomy. This study aims to assess the incidence of root migration following mandibular third molar coronectomy in patients treated at an OMFS unit at a District General Hospital.

Materials and Methods
This study was a retrospective case note review of all patients who underwent coronectomies from March 2017 to March 2020 at the OMFS unit. Data was recorded on the date of surgery, the date of review appointment, any post-operative problems, whether radiographs were taken on review, and any radiographic evidence of root migration.

Results
From March 2017 to March 2020, twenty patients underwent coronectomies at the OMFS unit. The majority of these patients were reviewed at 6-weeks and 6-months post-operatively. Ten percent of patients had radiographic evidence of root migration. No patients experienced any long-term symptoms, and no patients required procedures to remove the migrated roots.

Conclusions
Coronectomy can be considered as a viable alternative to mandibular third molar removal, when the apices of the tooth radiographically appear to lie in close relation to the inferior alveolar nerve. Review of patients following coronectomy is important to assess symptoms. Migration of retained roots can lead to pain and infection. It should be noted that in this sample, the incidence of root migration was low and that no patients required procedures to remove the remaining roots.

E-099

CT and MRI findings of childhood cherubism in nonfamilial case

Shoya Hirohata[1*]
[1] Radiology, Nihon University School of Dentistry at Matudo, Japan

Introduction
Cherubism is rare hereditary condition characterized by bilateral and symmetric giant cell lesions that occur the jawbone. Hence, an understanding of imaging findings of this lesion is important for radiologist. In this time, we report our experience of cherubism in 8-year-old child without family history of genetic disorders, along with CT and MR imaging findings.

Case
An 8-year-old girl was referred to our hospital because of a cyst-like radiolucent lesion in the left lower molar region. She had no family history. Panoramic radiograph showed the bilateral multilocular radiolucent lesions in the lower molar regions. CT showed the bilateral multilocular low density lesions with marked bone expansion in the mandibular molar regions. The lesions showed low signal intensity on T1-weighted MR image, intermediate signal intensity on T2-weighted image, and high signal intensity on STIR image. The mean apparent diffusion coefficient values of left and right lesions were 1.24±0.16 and 1.29±0.20×$10^{-3}$$mm^2$/second, respectively.

Discussion
Cherubism can be substantially differentiated from fibrous dysplasia, ameloblastoma, central giant cell granuloma, and odontogenic myxoma by the bilateralism of the cystic bone defect. To distinguish between basal cell nevus syndrome and cherubism, it is important to evaluate the bone expansion three-dimensionally using CT. Furthermore, ADC values 1.2-1.3×$10^{-3}$$mm^2$/second on MRI may be useful for quantitative evaluation of cherubism. In past reports, the ADC value of odontogenic keratocysts was about 0.9×$10^{-3}$$mm^2$/second, and it suggest that the ADC value is able to differentiate odontogenic keratocyst from cherubism.

In conclusion, it was suggested that the three-dimensional evaluation of bone expansion by CT and the ADC value by MRI are useful for the diagnosis of cherubism.

E-100

Age-related changes in alveolar bone height and width using computed tomography for dental implant treatment

Shungo Ichiki[1*], Naohisa Hirahara[1], Hirotaka Muraoka[1], Kotaro Ito[1], Eri Sawada[1], Yoshinobu Hara[1], Satoshi Tokunaga[1], Go Itakura[1], Shunya Okada[1], Tomohiro Komatsu[1], Takumi Kondo[1], Kohei Otsuka[1], Shoya Hirotaka[1], Takashi Kaneda[1]
[1] Ragiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
In aging society, dental implant will contribute to tooth loss and health and quality of life. Accurate diagnosis of the jaw is significant important in implant treatment. There have been many reports on assessment of the diagnostic imaging of jaw morphology, although there are few reports of the evaluation of age-related changes in alveolar bone height and width in the jaw using computed tomography (CT).

The purpose of this study was to assess the age-related changes in alveolar bone height and width using computed tomography (CT) for dental implant treatment.

Materials and Methods
We analyzed the CT studies of 1800 sites in 600 cases (200 men,400 women, 20-85 years of age, mean age 58.96 years) performed from August 2016 to December 2018. This study investigated to mean of height and width of the alveolar bone in the jaw.

All cases divided into two main group by age 20-64years and 65-85 years. Alveolar bone height and width were classified into six groups by site and were then analyzed about average of thickness of Alveolar bone height and width by age. We performed analyses of data using the Mann-Whitney U test and spearman's correlation coefficients. $P < 0.05$ was considered to indicate significance.

Results
The upper anterior height, upper premolar height, upper molar height, lower anterior height, lower premolar height, lower molar height, upper anterior width, upper premolar width and upper molar width in alveolar bone were significantly associated with age, respectively ($P<0.05$).

Conclusions
This study found that decline upper alveolar bone height and width in most site due to aging. These results suggest that older people may not be able to receive implant treatment without bone graft.

E-101

Assessment of the mandibular bone marrow of diabetes mellitus patients using diffusion-weighted magnetic resonance imaging

Shunya Okada[1*], Kotaro Itou[1], Hirotaka Muraoka[1], Naohisa Hirahara[1], Eri Sawada[1], Satoshi Tokunaga[1], Shungo Ichiki[1], Go Itakura[1], Tomohiro Komatsu[1], Takumi Kondo[1], Kohei Otsuka[1], Shoya Hirohata[1], Takashi Kaneda[1]
[1] Radiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
Only a few studies on mandibular bone marrow in diabetes mellitus (DM) patients using diffusion-weighted imaging (DWI) have been done.The purpose of this study was to assess quantitatively the mandibular bone marrow of patients with and without DM using the apparent diffusion coefficient (ADC) values on DWI.

Materials and Methods
This study was approved by the Institutional Review Board (EC19-011). We analyzed the MRI studies on the cranio-maxillofacial region of 50 DM patients (30 men, 20 women, 35-80 years of age, mean age 55.4 ± 15.8 years) and their age, sex, and periodontitis stage compared to those of 50 patients without DM in the Nihon University School of Dentistry Dental Hospital, Matsudo, Chiba, Japan. Patients evaluated from April 2006 to March 2018 were included in this study. The ADC values of bone marrow (patients with and without DM) were independently measured and recorded by two oral radiologists. Each of the two groups was analyzed using the Mann-Whitney U-test and receiver operating characteristic (ROC) curve analysis. P-values <0.05 were considered statistically significant.

Results
The mean ADC values of the mandibular bone marrow of patients with and without DM were $1.20\pm0.31\times10{-}3$ mm^2/s and $0.79\pm0.15\times10{-}3$ mm^2/s, respectively. Based on the ROC curve, the ADC values of DM patients were significantly higher than those of patients without DM. The interobserver agreement for the ADC values of the mandibular bone marrow of patients with and without DM was good (ICC = 0.73).

Conclusions
The apparent diffusion coefficient values allowed the quantitative evaluation of the mandibular bone marrow of DM patients. DWI might serve as a new and noninvasive method to assess the presence of DM in patients.

E-102

Clinical application of ultrasound for diagnosing salivary gland diseases in chonnam national university dental hospital

Suk-Ja Yoon[1*], Jae-Seo Lee[1], Byung-Cheol Kang[1]
[1] Oral and Maxillofacial Radiology, Chonnam National University, South Korea

Introduction
Salivary gland diseases are occasionally encountered in dental clinics. Ultrasound provides high-resolution image of parenchyma of salivary glands and the information of vascularity, without using ionizing radiation. The objective of this study was to share clinical experience of utilizing ultrasound for diagnosing salivary gland diseases in Chonnam National University Dental Hospital.

Materials and Methods
Forty-four patients (23 males, 21 females; mean age 46.09 yrs, SD 18.24 yrs)on whom ultrasound scanning was performed in addition to clinical and radiographic examination for salivary gland diseases from 2011 to 2016 were reviewed. Ultrasound scanning was performed utilizing 12 MHz transducer. The medical charts, radiographic and ultrasound findings were reviewed for the impression of the diseases.

Results
Ultrasound scanning in addition to clinical and radiographic examination provided impression for salivary gland diseases. Normal salivary gland was in 8 patients (18.18 %), acute sialadenitis 11 (25 %), chronic sialadenitis 2 (4.55 %), sialolithiasis 9 (20.45%), sialodochitis 6 (13.64 %), Sjögren's syndrome 2 (4.55 %), benign tumor 1 (2.27 %), and malignant tumor 1 (2.27 %). The disease was detected on submandibular gland in 27 patients (61.36 %), sublingual gland 3 (6.82 %), parotid gland 12 (27.27 %), and all salivary glands 2 (4.54 %).

Conclusions
Ultrasound is a helpful imaging modality in dental clinics for diagnosing inflammation, stone, autoimmune disease and tumor of salivary gland disease, providing high-resolution image of parenchyma and information of vascularity.

E-103

Classification paradox - a unique case of hereditary dentin abnormality

Suvendra Vijayan[1*], Elizabeth Ann Bilodeau[1], Anitha Potluri[1]
[1] Diagnostic Science, University of Pittsburgh School of Dental Medicine, United States of America

Introduction
Inherited dentin defects include dentinogenesis imperfecta (DI) and dentin dysplasia (DD) both which are due to defects in DSPP (dentin sialophosphoprotein) gene. These are rare entities with incidence of 1/8000 and 1/100000, respectively. We herein present a case of a unique instance of a hereditary dentin abnormality in which classification based on clinical/radiographic phenotype and histology is inconclusive, with overlapping features of DI and DD.

Case
A 14 year-old female patient presented with complaint of "my back teeth up here hurt". Patient has a history of an oral cyst removal a year prior interpreted as inflamed odontogenic cyst.

e-Poster Presentation

There was diffuse swelling in left maxilla and a draining sinus tract buccal to #12. On radiographic examination, multiple periapical radiolucencies were seen with loss of lamina dura and PDL space. No obvious caries were seen in these teeth. Pulp canals were wider than normal across shovelshaped anterior teeth. Pulp stones were present in multiple teeth. Genetic testing was negative for Gorlin syndrome (No PTCH1, PTCH2, or SUFU mutation detected). Patient's father reported a family history of suspected dental abnormalities.

Discussion
Radiographic examination favors DD as the gross tooth morphology is relatively normal even with the presence of multiple periapical radiolucencies. Histologically, haphazard and disorganized dentin was seen, reminiscent of DI. There is also a suspected family history of osteogenesis imperfecta. However, the current patient has no evidence of syndromic involvement (bone alteration).

These conflicting findings present a challenge in formulating a definitive diagnosis for this patient based on clinical phenotype, discordant radiographic and histologic findings, and questionable family history. A newer classification schema, where DI and DD are viewed as a spectrum of heritable dentin diseases based on the driver mutation and severity, might be a possible solution when clinicians are confronted with such cases.

E-104

Characteristic CT and MR findings of sclerosing osteomyelitis in the mandible

Takumi Kondo[1*], Hirotaka Muraoka[1], Kotaro Ito[1], Naohisa Hirahara[1], Eri Sawada[1], Satoshi Tokunaga[1], Shunya Okada[1], Shungo Ichiki[1], Tomohiro Komatsu[1], Go Itakura[1], Hiroyuki Okada[2], Takashi Kaneda[1]
[1] Radiology, Nihon University School of Dentistry at Matsudo, Japan
[2] Histology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
The purpose of this study was to assess the characteristics CT and MR findings of sclerosing osteomyelitis in the mandible.

Materials and Methods
Patients consisted of eleven patients (3 men, 8 women: 14-71 years, mean age 48.5±18.5 years) with sclerosing osteomyelitis who underwent CT and MRI performed between April 2006 and March 2020 at our university hospital. The present study assessed the characteristic CT and MR finding such as osteolytic or sclerotic changes, sequestrum, periosteal reaction, swelling soft tissue, deformation and MR signal intensities. This study was approved by the ethics committee at the our university (EC19-011).

Results
Characteristic CT and MR findings of sclerosing osteomyelitis showed osteolytic (64.0%), sclerotic changes (100.0%), osteolytic and sclerotic changes (64.0%), sequestrum (18.2%), periosteal reaction (45.0%), swelling of soft tissue (55.0%), and deformation (45.0%). Furthermore, MR signal intensity showed a low signal intensity on T1WI (100.0%), and intermediate to high signal intensities on T2WI and STIR images (64.0%).

Conclusions
Characteristic CT and MR findings of sclerosing osteomyelitis are useful for differential diagnosis of the mandibular lesions.

E-105

Lobodontia in the primary and permanent dentition: a condition requiring individualized care

Teodora-Iunia Gheorghe[1*], Wendy Male[2], Anthea Senior[3]
[1] Musculoskeletal Laboratory, Department of Surgery, Division of Anatomy, Faculty of Medicine, University of Toronto, Canada
[2] School of Health Sciences, College of New Caledonia, Canada
[3] School of Dentistry, University of Alberta, Canada

Introduction
Lobodontia is a rarely-documented dental condition associated with conical cusps on premolars and canines, multitubercular occlusal surfaces on molars, and irregularly-shaped incisors. Information on this condition is scarce, particularly regarding manifestations in the primary dentition. Six cases that are part of two families are described here. These cases demonstrate a diverse spectrum of clinical and radiographic features, and suggest that an individualized approach to treatment is necessary.

Case
Family #1 consisted of a 52-year-old mother and a 15-year-old son. Both exhibited shovel-shaped incisors, conical canine crowns, and multituberculate molars with single roots. Traits seen in only one family member included: taurodontism in mandibular molars, premolars with large buccal cusps, congenitally absent teeth, and interdental spacing. Previous treatment of the mother included endodontic and extensive restorative treatment. The son had undergone orthodontics and aesthetic restorative treatment.

Family #2 consisted of a 39-year-old mother and three children: ages 8 years (male), 6 years (male), and 3 years (female). Multitubercular and single-rooted, permanent or deciduous molars were seen in all family members. Only some of the family exhibited shovel-shaped primary incisors, conical deciduous or permanent canines, conical buccal premolar cusps, taurodontism in primary and permanent molars, and congenitally absent teeth. The mother had a history of orthodontics and minimal restorative treatment.

A diagnosis of Lobodontia was made for the members of both families.

Discussion
These cases reveal a spectrum of presentation associated with Lobodontia. To the best of our knowledge, this is the first report of an association of Lobodontia with conical canines and taurodontism in deciduous teeth. The limited transmission observed suggests an autosomal dominant pattern. The diverse treatment these patients have undergone suggests that aesthetic and functional needs vary considerably and an individualized approach to treatment planning is recommended.

E-106

A pictorial review of soft tissue calcifications in the head and neck region

Thimanthi Withana[1*], Nisha Maheshwari[1], Annaliese Ng[1], Ali Syed[1]
[1] Oral and Maxillofacial Radiology, Case Western Reserve University, United States of America

Introduction
Soft tissue calcifications (STC) occur when calcium salts accumulate and deposit into various areas of the body. STCs of the head and neck region are a relatively common occurrence which are normally found incidentally on routine radiographic examinations. While some calcifications may be pathogenic and require treatment, many calcifications are asymptomatic and do not require any additional treatment. The purpose of this pictorial review is to guide clinicians on which STCs of the head and neck need additional testing, referrals, and treatments.

Materials and Methods
STCs were organized by vascular and non-vascular lesions. For each calcification an ideal image that fit the radiographic appearance was chosen from the Case Western Reserve University Oral and Maxillofacial Radiology Clinic.

Results
For each calcification the Imaging appearance was outlined with particular emphasis placed on discussing the differences between two-dimensional and three-dimensional imaging. Finally, clinical implications were discussed for each calcification.

Conclusions
Not all soft tissue calcifications are pathologic and therefore only some may need further treatment. By using the appropriate radiographic modality clinicians can be informed and familiarized on recognizing STCs of the head and neck region, which can reduce anxiety and excess financial burden for patients.

E-107

Metal artifacts of titanium-zirconium alloy dental implants on magnetic resonance imaging

Tomohiro Komatsu[1*], Kotaro Ito[1], Hirotaka Muraoka[1], Naohisa Hirahara[1], Eri Sawada[1], Satoshi Tokunaga[1], Taiga Fukuda[1], Shunya Okada[1], Shungo Ichiki[1], Go Itakura[1], Takumi Kondo[1], Kohei Otsuka[1], Shoya Hirohata[1], Takashi Kaneda[1]
[1] Radiology, Nihon University School of Dentistry at Matsudo, Japan

Introduction
In recent years, a titanium-zirconium alloy showing improved mechanical properties as compared to commercially pure titanium has been introduced. On magnetic resonance imaging (MRI), metal artifacts of the dental implant often make diagnosis difficult in clinical situation. The purpose of this study was to investigate and to compare the metal artifacts of titanium and titanium-zirconium alloy dental implants.

Materials and Methods
The phantom used in this study was composed of a hollow cylinder with an outer diameter of 20.0 cm.
Titanium and titanium-zirconium alloy implants were placed at the tip of a removable rod with a diameter of 1.0 cm, which was placed along the central axis of the phantom. The all subjects had undergone imaging with a 1.5 T MR scanner (Intera Achieva® 1.5 T: Philips Medical Systems, Best, the Netherlands) with a SENSE head 8-channel coil. The imaging sequences included turbo spin echo (TSE) T1-weighted imaging (T1WI), TSE T2-weighted imaging (T2WI), short tau inversion recovery (STIR), single shot echo planar imaging diffusion-weighted imaging (DWI). Each phase-encoding direction and frequency-encoding of the full width at half maximum (FWHM) was measured on Image J. The Mann-Whitney U test was used to compare the FWHM between the titanium implant and titanium-zirconium alloy implant. P-values less than 0.05 were considered to indicate statistical significance.

Results
Phase-encoding direction and frequency-encoding of FWHM was significantly different between the titanium implant and the titanium-zirconium alloy implant in the T2WI ($P < 0.01$) and DWI ($P < 0.05$). There was no significant difference between each material in T1WI and STIR imaging ($P > 0.05$).

Conclusions
This study suggested that titanium-zirconium alloy implant is affected by metal artifacts less than titanium implant on MRI.

E-108

Molecules, morphogenesis and malformations: radiological manifestations of deregulated FGF signaling

Vidhya Venkateswaran[1*], Sanjay M. Mallya[1]
[1] Department of Oral and Maxillofacial Radiology, UCLA, United States of America

Introduction
The fibroblast growth factor (FGF) signaling pathway plays critical roles in early embryogenesis, epithelial-mesenchymal interactions, neural induction, and skeletal development. In humans, the FGF family includes 18 ligands and 4 receptors encoded by separate genes. This presentation will focus on the functions of FGFR2 and FGFR3 receptors in endochondral ossification and cranial suture development, and the diseases caused by mutations in these genes.

Case
Through illustrative cases, we will discuss the typical radiographic features of craniosynostosis syndromes such as Apert syndrome and Crouzon syndrome, both caused by FGFR family gene mutations. Clinical manifestations include bicoronal craniosynostosis, acrocephaly, maxillary hypoplasia, and orbital proptosis. In addition to the distinct craniofacial presentations, FGFR mutations also result in anomalies such as syndactyly, noted in Apert Syndrome. We will discuss the molecular mechanisms underlying the various clinical findings using these phenotypes. Specifically, we will discuss the effect of FGFR family gene mutations on osteoblastic function which results in the premature fusion of sutures and associated craniofacial anomalies. We will also discuss how differences in gene mutations can yield discrete diseases with overlapping clinical manifestations—information of value in differential diagnosis.

Discussion
This presentation will review the biology of FGF signaling in regulating craniofacial and skeletal development. Familiarity with the physiological functions of these proteins and receptors will help understand the spectrum of overlapping manifestations of craniofacial diseases caused by mutations in the FGFR gene family. This knowledge will facilitate the radiographic approach to evaluating these craniofacial syndromes.

e-Poster Presentation

E-109

Anterior stafne bone defect- a case report and literature review

Wen-Chen Wang[1*], Ching-Yi Chen[1,2,3], Chih-Huang Tseng[1], Yuk-Kwan Chen[1,2,3], Li-Min Lin[1,2,3]

[1] Division of Oral Pathology & Maxillofacial Radiology, Kaohsiung Medical University Hospital, Chinese Taipei
[2] Oral & Maxillofacial Imaging Center, Kaohsiung Medical University, Chinese Taipei
[3] College of Dental Medicine, Kaohsiung Medical University, Chinese Taipei

Introduction
Stafne bone defect(SBD) is often an accidental finding in the panoramic radiography. The most common location is in the molar area of mandible, a lingual depression between the mandibular canal and the lower cortical border of the mandible. The anterior SBD is extremely rare. The incidence is about 0.009%.

Case
A 53 year-old healthy male referred from a local dental clinic because an asymptomatic apical radiolucency of tooth 43 was found on the panoramic radiography in his implant treatment procedures with unknown duration. Oral examination revealed that right lower canine is vital, no caries, no palpation pain, no local gum swelling or erythema, no palpable local lesion clinically. The differential diagnosis includes Stafne bone defect, odontogenic cysts or tumors, benign salivary gland tumors, early fibro-osseous lesions, central giant cell lesions, hemangioma of the bone, and benign neurogenic tumors. In the CBCT examination, a well-defined lingual depression with corticated border connected with lingual apical area of 43 was noted, measuring 12.2x7.5x7.4mm in dimension. The clinical diagnosis is Stafne bone defect, regular radiographic follow up is recommended without surgical intervention.

Discussion
To our best knowledge, there are only 71 patients with 72 anterior SBD case at lingual side of mandible published in English literature, including one case of bilateral. A little male predilection and elder in male, 17 female cases with an average age of 36.23, and 48 males had an average age of 47.60. 46 cases in the 71 had been biopsied, only 3 were not salivary gland tissue(sublingual). In fact, there have been very few cases confirmed by biopsy since 2010(7/21). It is now believed that as long as the image and clinical evidences are sufficient, SBD should be conservatively followed up rather than aggressively surgical exploration.

E-110

CBCT evaluation of the inferior part of the maxillary sinus

Won-Jeong Han[1*], Jong-Tae Park[2], Jeong-Hyun Lee[2]
[1] Dentomaxillofacial Radiology, Dankook University, South Korea
[2] Oral Anatomy, Dankook University, South Korea

Introduction
Accurate measurements of the maxillary sinus are important for implant treatment. Cone-beam computed tomography (CBCT) allows to measure the height of the residual bone ridge, the thickness of the lateral wall of maxillary sinus.
The purpose of this study was to evaluate the difference by comparing the inferior part of the maxillary sinus based on the NCF (nasal cavity floor) according to the sex of the patient.

Materials and Methods
CBCT (Alphard 3030, Asahi, Kyoto, Japan) data were obtained from 60 (male 30, female 30) adults in their 20s without missing teeth, facial asymmetry, systemic disease.
The coronal and sagittal view of the lower maxillary sinus were analyzed using the Mimics 3-D imaging program. After comparing the averages, statistical analysis was conducted.

Results
The heights of the inferior part from the floor to the NCF were 15.06 mm and 13.30 mm on the left and right sides respectively in males, and 10.59 mm and 11.19 mm in females.
The widths of the inferior part from the coronal view were 24.49 mm and 24.26 mm on the left and right sides respectively in males, and 20.65 mm and 20.31 mm in females. The widths of the inferior part from the sagittal view (SW values) were 33.64 mm and 31.34 mm on the left and right sides respectively in males, and 26.19 mm and 26.10 mm in females.
The volumes between the maxillary sinus floor and the NCF were 27.05 mm3 and 22.55 mm3 on the left and right sides respectively in males, and 17.84 mm3 and 15.04 mm3 in females.

Conclusions
CBCT data showed that the inferior part of the maxillary sinus was larger in male than in female.

E-111

Comparison of the diagnostic value of indices localizing mandibular third molar roots relative to inferior alveolar canal in panoramic view and CBCT

Yasaman Kheirandish[1*], Mehrdad Panjnoush[1], Hoorieh Bashizadeh[1], Mahdi Niknami[1], Mehdi Soltani[2]
[1] Oral & Maxillofacial Radiology, Tehran University of Medical Sciences, Iran
[2] Prosthodontics, Islamic Azad University Isfahan (Khorasgan) Branch, Iran

Introduction
Although evaluation of mandibular impacted third molars and their vicinity to IAC could be achieved using panoramic view, this modality has some limitations including two dimensional nature and uneven magnification which emphasize the necessity of CBCT technique for more accurate results.

Materials and Methods
In this descriptive analytic study, 103 radiographs of mandibular impacted third molars were assessed using both panoramic and CBCT techniques. Roots' position in relation to IAC was evaluated by three oral& maxillofacial radiologists and was repeated two weeks later one more time. The results were compared to CBCT images afterwards. According to signs observed in panoramic view, the position of third molar roots in relation to IAC was designated as buccal, lingual or middle position. A chi- square test was used for data analysis and comparison between the observers. The significance level was determined as 0.05.

Results
Among 103 teeth, 56 were lingually positioned in relation to IAC (54.4%), 25 had middle position (24.3%) and 22 were buccally positioned in relation to IAC (21.3%) (P-value< 0.002).

Root deviation, mandibular canal deviation, narrowing of roots, borders discontinuity and narrowing of mandibular canal were more frequent in buccal positions of roots in relation to IAC. However the sign of roots darkening was more frequent in lingual positions of roots in relation to IAC. Observers' agreement in assessing the signs and indices was in an acceptable level.

Conclusions
Although there are some indices in panoramic view to determine the relationship of third molar and IAC, this modality does not provide high diagnostic accuracy in this regard. On the other hand, CBCT is a valuable tool in evaluating the relationship of third molar and canal; therefore the risk of nerve damage during surgeries in third molar region could be reduced using this technique.

E-112

Mandibular ectopic ciliated cyst that developed after orthognathic surgery : a case report

Yeon-Sun Yoo[1*], Sam-Sun Lee[1], Min-Suk Heo[1], Won-Jin Yi[1], Kyung-Hoe Huh[1], Jo-Eun Kim[1], Ju-Hee Kang[1]
[1] Department of Oral and Maxillofacial Radiology, Seoul National University School of Dentistry, South Korea

Introduction
The ectopic ciliated cyst has been observed in very rare cases following orthognathic surgery. This cyst is known to develop primarily in the maxilla after sinus surgery. But in very rare cases, it may occur in the mandible. The exact etiology is unknown in the mandible. The widely accepted theory is that the pathogenesis of this cyst is related to implantation of sinus epithelium during the surgical procedure.

Case
We report on two surgical ciliated cysts arising within the mandible. One is a 42-year-old male presented with a painless lesion in the mandible. The panoramic radiograph revealed a lobulated radiolucent cystic lesion with a well-defined corticated margin observed below the anterior teeth in mandible. These radiolucent areas did not appear to be in contact with the apex of the respective teeth. The patient had undergone simultaneous orthognathic surgery of the maxilla and the mandible 24 years ago. Those that require differential diagnosis included simple bone cyst and odontogenic keratocyst. With regards to histopathology, this lesion was diagnosed as an ectopic ciliated cyst. The other is a 26-year-old female presented with a dull pain when pressed the posterior part of the left mandible. The panoramic radiograph revealed a round, corticated osteolytic lesion observed in area of tooth number 37. No direct continuity between the lesion and the lamina dura of the tooth was observed. Two years prior, the patient had undergone Le Fort 1 osteotomy, BSSRO and genioplasty. With regards to histopathology, it was diagnosed as a ciliary cyst.

Discussion
Rarely, when a cyst occurs in the mandible, if a cyst of odontogenic origin can be excluded, the clinicians should be aware of the ectopic ciliated cyst as a potential complication in patients who have undergone orthognathic surgery.

E-113

Ultrasonography diagnosis of mass-like lesions of the oral region

Yohei Takeshita[1*], Toshiyuki Kawazu[1], Miki Hisatomi[2], Shunsuke Okada[2], Mamiko Fujikura[2], Saori Yoshida[3], Yuri Namba[2], Yudai Shimizu[1], Yoshinobu Yanagi[3,4,5], Junichi Asaumi[1,2,3]
[1] Department of Oral and Maxillofacial Radiology, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan
[2] Department of Oral Diagnosis and Dentomaxillofacial Radiology, Okayama University Hospital, Japan
[3] Preliminary Examination Room, Okayama University Hospital, Japan
[4] Department of Dental Informatics, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Japan
[5] Oral Examination and Diagnosis Center, Okayama University Hospital, Japan

Introduction
Ultrasonography (US) is often chosen as the first option of image examination for patients developing mass-like lesions in the oral region. Most of times, additional CT or MRI are required depending on the results of US. The purpose of this study is to examine the diagnostic usefulness and procedures of US for mass-like lesions in the oral region.

Materials and Methods
The study subjects were 45 cases of mass-like lesions in the oral region (33 cases of tumorous lesions and 12 cases of cysts). These were gone through by the US and histopathological examinations at Okayama University Hospital from January 2017 to December 2019. The following points were evaluated by observers using evaluation scale: vascularity; echo intensity level; boundary; margin; distribution of internal echoes; capsule. Usefulness of each point for differential diagnosis of tumorous lesions and cysts was analyzed statistically.

Results
There were significant differences between tumorous lesions and cysts at 4 evaluation points (vascularity, echo intensity level, boundary and margin). Cysts were almost completely excluded especially when vascularity was observed. There were also significant differences between non-vascularity tumorous lesions and cysts at 2 evaluation points (echo intensity level and boundary), it could be considered that anechoic level or clear boundary increase the possibility of cysts.

Conclusions
In US examination for mass-like lesions in the oral region, in cases where vascularity was observed, it was possible to diagnose tumorous lesions and exclude cysts. Whereas, in cases where vascularity was not observed, it was valid to identify tumorous lesions and cysts by the use of evaluation points; echo intensity level and boundary. When tumorous lesion is suspected in the end, additional contrast-enhanced CT and MRI are highly recommended for differential diagnosis of benign or malignant. US could be concluded as a very important and beneficial method affecting diagnosis and treatments.

e-Poster Presentation

E-114

The prevalence of incidental findings on temporomandibular joint magnetic resonance imaging

Yoon Joo Choi[1*], Chena Lee[1], Kug Jin Jeon[1], Sang-Sun Han[1]
[1] Department of Oral and Maxillofacial Radiology, College of Dentistry, Yonsei University, South Korea

Introduction
Clinicians usually need magnetic resonance images (MRI) evaluation for precise diagnosis of suspected temporomandibular disorder (TMD) patients and may encounter unexpected radiologic findings in and out of the temporomandibular joint (TMJ) region. The goal of this study was to categorize the types and analyze the frequency of the various incidental findings(IFs) on MRI performed in the patients with TMD symptoms.

Materials and Methods
TMJ MRI of 1013 patients with TMD symptoms was retrospectively examined. Incidental findings were defined as imaging features found accidentally or unexpectedly, but as degenerative bone changes or disc abnormalities in the TMJ complex. It was categorized into two groups: TMJ site-specific findings and unexpected findings at any other regions. We analyzed the prevalence of each group.

Results
Of a total of 26 cases (2.57%), 13 were classified as TMJ site-specific findings, and 13 were unexpected findings in other fields. TMJ site-specific findings included 6 cases of synovial chondromatosis, 6 cases of synovial cyst and one case of osteochondroma. Also unexpected findings included 3 cases of salivary gland tumor, 3 cases of developmental cyst, 2 cases of vascular malformation, 4 cases of mastoiditis and one case of sialadenitis on parotid gland.

Conclusions
When diagnosing TMD using TMJ MRI, it is essential to carefully read the image to account for the possibility of incidental findings, as it can visualize the pathology of the TMJ site and other oral and maxillofacial areas.

E-115

Atypical ghost-like image on panoramic radiograph

Yo-seob Seo[1*], Munjeong Lee[2], Shin-Kuk Lee[2], Seongwook Sin[2]
[1] Oral and Maxillofacial Radiology, Chosun University, South Korea
[2] Department of Dentistry, Chosun University, South Korea

Introduction
In general, panoramic radiograph with earring on shows one real image and one ghost image. But we experienced atypical ghost-like image other than the typical real image and ghost image on panoramic radiograph. We would like to discuss the cause of atypical ghost-like images and present explanatory diagrams.

Case
Case 1. A 4-year-old female patient took a panoramic radiograph (ProMax, Planmeca, Helsinki, Finland) without removing her both side earrings. There are atypical ghost-like images other than the typical real images and ghost images on her panoramic radiograph. Case 2. A panoramic radiograph of 27-year-old female patient shows ghost image of the opposite mandibular angle, unilaterally. But The shape of ghost image is different from the typical ghost image and is similar to mandibular ramus.

Discussion
Theoretically, the atypical ghost-like image is a real image, and consequently double image, because the center of rotation of panoramic machine was outward than the earring. The actual location of earring was far from the image layer of panoramic radiography, So the image is blurred and magnified, making it look similar to the ghost image.

When interpreting panoramic images, dentists should be familiar with the geometric principles of imaging devices. Through analysis of real and ghost images, dentists will be able to better understand panoramic radiography and interpret panoramic radiographs.

E-116

Comparison of panoramic radiography and cone-beam computed tomography for assessing radiographic signs indicating root protrusion into the maxillary sinus

Yun Hoa Jung[1*], Bong-Hae Cho[1], Ja-Joon Hwang[1]
[1] Department of Oral and Maxillofacial Radiology, School of Dentistry, Pusan National University, South Korea

Introduction
This study investigated correlations between findings on panoramic radiographs and cone-beam computed tomography (CBCT) to assess the relationship between the maxillary sinus floor and the roots of maxillary posterior teeth. In addition, radiographic signs indicating actual root protrusion into the maxillary sinus were evaluated on panoramic radiographs.

Materials and Methods
Paired panoramic radiographs and CBCT images from 305 subjects were analyzed. This analysis classified 2,440 maxillary premolars and molars according to their relationship with the maxillary sinus floor on panoramic radiographs and CBCT images. In addition, interruption of the sinus floor was examined on panoramic radiographs.

Results
Root protrusion into the maxillary sinus occurred most frequently in the mesiobuccal roots of the second molars. The classification according to panoramic radiographs and CBCT images was the same in more than 90% of cases when there was no contact between the root apex and the sinus floor. When the panoramic radiograph showed root protrusion into the sinus, the CBCT images showed the same classification in 67.5% of second molars, 48.8% of first molars, and 53.3% of second premolars. There was a statistically significant relationship between interruption of the sinus floor on panoramic radiographs and root protrusion into the sinus on CBCT images.

Conclusions
The presence of root protrusion into the sinus on panoramic radiographs demonstrated a moderate ability to predict root protrusion into the maxillary sinus. Interruption of the maxillary sinus floor could be considered an indicator of actual root protrusion into the maxillary sinus.

E-117

The rare cases of malformed mesiodens elongated along nasopalatine canal

Yun-Hui Kang[1*], Sam-Sun Lee[1], Min-Suk Heo[1], Won-Jin Yi[1], Kyung-Hoe Heo[1], Jo-Eun Kim[1], Ju-Hee Kang[1]
[1] Oral and Maxillofacial Radiology, School of Dentistry, Seoul National University, South Korea

Introduction
Mesiodens, a supernumerary tooth that occurs between the central incisor in anterior maxilla, is usually asymptomatic and often found accidentally during radiographic examination. Early detection and follow-up is required because mesiodens can cause various clinical problems such as eruption disorder, midline deviation, diastema, rotation, cystic change, and absorption of adjacent roots. In this study, we retrospectively reviewed 6 cases of the impacted mesiodens which showed root elongation in the nasopalatine canal.

Case
All patients had no symptoms related to mesiodens and it was found by chance in a panoramic examination. The average age of 6 patients was 9.5 years old and they were consisted of 5 males and 1 female. In the intraoral and panoramic images, the elongated root of mesiodens was observed. In CT images taken for surgery planning, the root of all mesiodens was elongated within the nasopalatine canal, and the root length was averaged 7.5mm. Three of them were inverted. In the other 3 cases, two crowns of mesiodens were located respectively in the palate and nasal cavity and connected by elongated roots. 5 patients underwent surgical extraction without any complications. In 2 cases of them, only the part of mesiodens were removed by palatal approach.

Discussion
Several theories have been proposed for the etiology of mesiodens, in terms of genetics and environmental factors. The theory of hyperactivity of dental lamina is generally acceptable etiology. When the dental epithelium is excessively proliferated into the incisor due to various causes, blood vessels and neural formation occur actively in that area, and thus, it may affect the formation of mesiodens within the nasopalatine canal. In addition, the relationship between mesiodens and the canal is difficult to observe in plain radiography. (CB)CT can help identify the relationship of mesiodens and adjacent structure.

E-118

Efficacy of cone-beam computed tomography with gray scale change versus digital periapical radiography for assessment of gap at the bone-implant interface

Zahra Dalili Kajan[1*]
[1] *Maxillofacial Radiology, Guian University of Medical Sciences, Iran*

Introduction
Changing the gray scale range may enhance the quality of CBCT images. An example is the use of gray scale change in CBCT images for detection of screw access holes in implant-supported cement-retained restorations. Thus, this study was designed to compare the efficacy of CBCT with gray scale change versus digital PA radiography for detection of gap at the bone-implant interface.

Materials and Methods
Titanium implants were placed in 52 fresh bovine rib bone blocks such that 42 blocks that had no gap at the interface first served as the control group. Afterwards, the implants were placed in the same blocks with 0.25 mm increase in the osteotomy size to serve as the test group. The remaining 10 bone blocks were used for random arrangement of the test and control blocks within a fabricated wax arch. CBCT scans with change in the gray scale range and digital PA radiographs were obtained and evaluated by two observers for presence/absence of gap at the interface. The ROC analysis, Kappa and McNemar tests ($\alpha = 0.05$) are used for analysis.

Results
Digital PA radiography and CBCT had moderate agreement for gap detection (k=0.60). There is no significant differences between AUC of CBCT (0.88) and digital PA radiograph (0.92) in assessment of bone-implant interface (P=0.45). The frequency of correct diagnoses on PA radiographs was significantly higher in the test group (P=0.016), but this difference was not significant for CBCT (P=0.344). PA radiography had higher sensitivity (100%) than CBCT (83.33%). The specificity of CBCT was 92.86 compared with 83.33 for PA radiography.

Conclusions
Gray level change in CBCT enhances the assessment of bone-implant interface and makes it closer to digital PA radiography as the modality of choice for this purpose.

E-120

Hounsfield units derived of TCFC: equivalence with values of multislice computed tomography

Ana Sofia Vieira dos Santos[1*], **Eduarda da Silva Vieira Barros**[1], **Andrezza Ramos dos Santos**[1], **Danyel Elias da Cruz Perez**[1], **Andrea dos Anjos Pontual**[1], **Flavia Maria Moraes Ramos-Perez**[1], **Maria Luiza dos Anjos Pontual**[1]
[1] *Department of Clinical and Preventive Dentistry, UFPE, Brazil*

Introduction
The aim of this research was to validate the formulas developed for acquisition of images for implants of iCAT Next Generation®, PreXion 3D® and CS9000 3D® CT scanners, by comparing them with the values of Hounsfield Units, obtained in CT. Also, to compare the gray values and the HU values provided by the OnDemand 3D® program.

Materials and Methods
A dry human mandible was selected after previous acquisition on the iCAT Next Generation® tomography scanner, using the implant protocol. The images were exported in DICOM format for evaluation using the On Demand3D® software. In each parasagital section, 2 (two) ROI´s with 3X3mm were marked in the medullary and cortical bone tissue. The average gray values of each site were converted to gray values in HU with the formulas of previous studies obtained by the NIST XCOM interpolation method. Subsequently, The Mann-Whitney test was applied to two related samples by selecting Willcox ($p \leq 0.05$).

Results
Regarding the numbers of multislice CT, there was no difference in relation to the values of the transformed Prexion ($p = 0.062$), Hu iCat ($p = 0.14$), gray iCat ($p = 0.168$), Hu CS ($p = 0.638$) and gray CS ($p = 0.935$). In the devices, the gray values were similar to the HU values of the onDemand® program in iCat ($p = 0.291$), Prexion ($p = 0.884$) and CS ($p = 0.123$). The other comparisons showed relevant differences ($p \leq 0.05$).

Conclusions
TCFC devices differ from each other, the application of the formula for converting the gray values to HU, is feasible only on the PreXion 3D device. The absolute gray values of the iCat and CS9000 3D devices are equivalent to the HUs, as well as the HUs measured with the OnDemand 3D program.

e-Poster Presentation

E-121

Radiographic diagnosis of proximal caries: effect of the automatic exposure compensation of digital systems under different exposure protocols

Andrea Anjos Pontual[1*], Íris Rafaela Leão Gomes[1], Eduarda Helena Leandro Nascimento[2], Hugo Gaêta-Araujo[3], Maria Luiza Anjos Pontual[1], Flavia Maria Moraes Ramos-Perez[1]
[1] Clinical and Preventive Dentistry Department, Universidade Federal de Pernambuco, Brazil
[2] Department of Dentistry, Universidade Federal de Sergipe, Brazil
[3] Oral Diagnosis Department, Universidade Estadual de Campinas, Brazil

Introduction
The aim was to investigate the performance of two radiographic systems with automatic exposure compensation (AEC) on the diagnosis of proximal caries on images acquired with different exposure parameters (exposure time and kilovoltage) and in the presence of high-density materials. Also, the subjective quality of the images was assessed.

Materials and Methods
Forty posterior teeth (80 proximal surfaces) were radiographed using a phosphor plate (Express, Instrumentarium, Finland) and a CMOS system (RVG 6100, Carestream, USA). All images were acquired with different exposure times (0.06, 0.10 and 0.16 s) and kilovoltages (60 and 70 kV), in the absence or presence of high-density material in the X-rayed region (control and high-density groups). Three oral radiologists assessed the presence of proximal caries using a 5-point scale and the subjective image quality. The diagnosis of caries was validated by scanning the teeth in the Skyscan 1174 microcomputed tomography device (Bruker Corp., Kontich, Belgium). Diagnostic test values were obtained for each protocol and compared using two-way ANOVA ($p<0.05$).

Results
For both radiographic systems, there were no significant differences in the area under the ROC curve (ranged from 0.60 to 0.73), sensitivity (ranged from 0.79 to 0.87) and specificity (ranged from 0.29 to 0.48) between the control and high-density groups, exposure times or kilovoltages tested ($p>0.05$). Image quality, scores assigned to the control and high-density groups were similar in each exposure protocol in both radiographic systems.

Conclusions
The presence of the high-density material, the exposure time and the kilovoltage did not affect the diagnosis of proximal caries in any of the systems used. It is recommended to use protocols with lower doses to reduce the patient's exposure.

E-122

CBCT of impacted maxillary canine teeth: patient radiation dose using minimum field-of-view

Anne-Mari Ilo[1*], Janna Waltimo-Sirén[2,3], Elmira Pakbaznejad Esmaeili[4], Marja Ekholm[1,5], Mika Kortesniemi[6]
[1] Department of Oral Pathology and Oral Radiology, Institute of Dentistry, University of Turku, Finland
[2] Department of Pediatric Dentistry and Orthodontics, Institute of Dentistry, University of Turku, Finland
[3] City of Turku, Division of Welfare, Turku, Finland
[4] Department of Oral and Maxillofacial Diseases, University of Helsinki, Finland
[5] South West Finland Imaging Centre, Turku University Hospital, Finland
[6] HUS Medical Imaging Center, Helsinki University Central Hospital, Finland

Introduction
Minimum indication-specific field-of-view (FOV) of 40 x 35 mm has been assessed for CBCT-scans of impacted maxillary canines (Pakbaznejad Esmaeili et al., Clin Oral Investig., 2020). The aim of the study was to calculate and compare the effective dose attained from CBCT-scans using the minimum FOV size versus commonly used FOV sizes, to estimate its effectiveness on dose reduction.

Materials and Methods
An adult female phantom (ATOM Dosimetry Phantoms, CIRS ATOM 702-D) was scanned using Planmeca Viso G7 CBCT-device (Planmeca, Helsinki, Finland) at HUS Surgical Hospital, Helsinki, Finland. Dose-area product (DAP) values and anatomical FOV locations from CBCT-scans were used for Monte Carlo PCXMC-simulation (Radiation and Nuclear Safety Authority, Helsinki, Finland). Radiation output of the CBCT-device was ensured by measuring air kerma value with Raysafe X2 R/F dosimeter.

Results
Imaging fields of 40 x 35 mm, 50 x 50 mm, 80 x 50 mm, 70 x 80 mm and 100 x 100 mm were selected and the respective effective doses were determined as 42 µSv, 63 µSv, 96 µSv, 113 µSv, and 164 µSv. Effective dose reduction between the minimum FOV and 50 x 50 mm FOV was 33%.

Conclusions
Using indication-specific minimum FOV for CBCT-imaging of impacted maxillary canines, instead of commonly used small FOV sizes, the effective dose received by the patient would decrease.

E-124

The influence of focal trough pattern on panoramic radiography imaging error: a pilot study

Ari Lee[1*], Chena Lee[1], Yoon Joo Choi[1], kug Jin Jeon[1], Sang-Sun Han[1]
[1] Department of Oral and Maxillofacial Radiology, Yonsei University, South Korea

Introduction
The panoramic radiography of the same patient can be obtained differently depending on the devices. It can be expected that the imaging error may related with the focal trough pattern. This study analyzed the width and the shape of the focal trough in 2 different panoramic units and investigated their influence on the clinical imaging error.

Materials and Methods
Panoramic image of TOPAN phantom (Leeds Test Objects, North Yorkshire, UK) was obtained with adult male exposure condition in Pax-I-plus (A) and Alapha-plus (B). In the image, the horizontal and vertical magnification of the sphere object in the phantom was measured the ratio was calculated. The width and the shape of the focal trough were analyzed at incisor, right and left second / third molar region.

Twenty patient panoramic images from the 2 devices were randomly selected. The imaging error was evaluated according to the 10

criteria by 2 radiologists. The evaluation criteria were followed the previous study.

Results
There was no significant difference in width of the incisor to the second molar region between the 2 devices. From the second to third molar region, the width of A was wider than B. The more flared shape of the focal trough was shown in the second to the third molar region of A compared to that of B. Of the total error items, 18% for A and 27% for B showed imaging errors. The most abundant error in imaging was "Cervical vertebra overlapped the ramus" in A (4 out of 10) and "Head tilting" in B (6 out of 10).

Conclusions
The imaging error tendency in panoramic radiography may related with the focal trough pattern. Since the current study is a pilot, further evaluation with varied panoramic unit and large samples of clinical image is necessary.

E-125

Effect of tube current and metal artifact reduction on artifacts at different distances from titanium and zirconia implants in cone-beam computed tomography

Christiano Oliveira-Santos[1*], Arthur Xavier Maseti Mancini[2], Matheus Urias Cruz Santos[1], Hugo Gaêta-Araujo[3], Camila Tirapelli[2], Ruben Pauwels[4,5]
[1] Stomatology, Public Oral Health and Forensic Dentistry, University of Sao Paulo - Ribeirao Preto School of Dentistry, Brazil
[2] Dental Materials and Prosthodontics, University of Sao Paulo - Ribeirao Preto School of Dentistry, Brazil
[3] Oral Diagnosis, University of Campinas - Piracicaba Dental School, Brazil
[4] Imaging and Pathology, Catholic University of Leuven, Belgium
[5] Aarhus Institute of Advanced Studies, Aarhus University, Denmark

Introduction
Artifact-generating implants are common in the field of view of CBCT examinations. Optimal exposure parameters, such as tube current, ensure high image quality with lowest possible radiation exposure. The objective of this study was to evaluate the effect of cone-beam computed tomography (CBCT) tube current (mA) on the magnitude of artifacts at different distances from titanium or zirconia implants, with and without activation of metal artifact reduction (MAR).

Materials and Methods
Human mandibles were scanned before and after the installation of dental implants, with four different tube currents (4 mA, 6.3 mA, 8 mA and 10 mA), with and without activation of MAR. The effect of mA on the standard deviation (SD) of gray values and contrast to noise ratio (CNR) were assessed in regions of interest located at 1.5 cm, 2.5 cm, and 3.5 cm from implants.

Results
In the presence of titanium implants, a significant decrease in SD was found by increasing tube current from 4mA to 6.3mA or 8mA. For zirconia implants, 8 mA yielded better results for all distances. MAR improved CNR in the presence of zirconia implants at all distances, whereas no differences were observed with the use of MAR for titanium implants.

Conclusions
Increased tube current can improve overall image quality in the presence of implants, at all the distances tested. When a zirconia implant is present, such increase in mA should be higher in comparison to that for examinations with titanium implants. Activation of MAR improved image quality only among examinations with zirconia implants.

E-126

Effects of energy level, reconstruction kernel, and tube rotation time on hounsfield units of hydroxyapatite in virtual monochromatic images obtained with dual-energy CT

Dae-Kyo Jeong[1*], Sam-Sun Lee[1], Jo-Eun Kim[2], Kyung-Hoe Huh[1], Won-Jin Yi[1], Min-Suk Heo[1], Soon-Chul Choi[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, South Korea
[2] Department of Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
This study was performed to investigate the effects of energy level, reconstruction kernel, and tube rotation time on Hounsfield unit (HU) values of hydroxyapatite (HA) in virtual monochromatic images (VMIs) obtained with dual-energy computed tomography (DECT) (Siemens Healthineers, Forchheim, Germany).

Materials and Methods
A bone density calibration phantom with 3 HA inserts of different densities (CTWATERR; 0, 100, and 200 mg of HA/cm3) was scanned using a DECT scanner at 120 kVp with tube rotation times of 0.5 and 1.0 seconds. The VMIs were reconstructed by changing the energy level (with options of 40 keV, 70 keV, and 140 keV). In order to investigate the impact of the reconstruction kernel, 3 virtual monochromatic images were reconstructed after changing the kernel from body regular (Br40) to head regular 40 (Hr40) in the reconstruction phase. The mean HU value was measured by manually rounding the regions of interest in the middle of each insert obtained from the virtual monochromatic images. The HU values were compared with regard to energy level, reconstruction kernel, and tube rotation time.

Results
For the HA 100 and 200 inserts, HU decreased significantly at increased energy levels (correlation coefficient=−0.538, $P<0.05$) but increased by 70 HU when using Hr40 rather than Br40 (correlation coefficient=0.158, $P<0.05$). The tube rotation time did not significantly affect the HU ($P>0.05$).

Conclusions
The HU values of HA were negatively correlated with the energy level in VMIs obtained with dual-energy CT. When comparing HU between CT images, exposure parameters should be considered.

e-Poster Presentation

E-127

Thermal and volumetric assessment of endodontic filling techniques- a infrared thermography and µCT study

Daniela Pita Pita De Melo[1*], Fernanda Clotilde Mariz Suassuna[1], Débora Ketley Martins de Araújo[1], Ana Marly Araújo Maia Amorim[1], Saulo Leonardo Sousa Melo[2]
[1] Dentistry, Division of Oral Radiology, State University of Paraíba, Brazil
[2] Department of Integrative Biomedical & Diagnostic Sciences School of Dentistry, Oregon Health & Science University, United States of America

Introduction
There is a lack of studies assessing endodontic filling techniques considered cold. This study aimed to assess root temperature variation during different filling technique and to quantify the volume and voids of endodontic filling materials. using infrared thermography and µCT.

Materials and Methods
The sample consisted of 90 premolars equally divided into 3 groups according to the filling techniques assessed: 1) Lateral condensation (LC), single cone (SC) and thermomechanical compaction (TMC) techniques. Half of the sample was submitted to the three studied filling techniques while monitored by a FLIR T650sc thermal camera and the other half was scanned on a NIKON µCT scanner. Thermal analysis was conducted on the teeth's three thirds and its long axis. The volumetric analysis was conducted to assess gutta-percha, cement, and the void volumes. Descriptive and inferential statistical analysis were done (non-parametric Mann-Whitney, Kruskal-Wallis, and Friedman tests with Tukey's bidirectional analysis of variance). The level of significance was set at 5%, considering $p < 0.05$.

Results
The highest median temperature increase was of 7.5 ° C for TM at 15 seconds after endodontic filling was done 60 seconds after obturation, the temperature decrease was statistically significant in the three studied groups. The cervical third showed the highest temperature increase compared to the other thirds (18.6 ° C). In the volumetric assessment, TMC presented the largest volume of gutta-percha ($p < 0.05$) with an average of 67.27 ± 25.61 mm3. Among the three techniques, LC presented a higher void volume (29.91 ± 15.37 mm3).

Conclusions
The temperature increase generated by the studied gutta-percha endodontic filling techniques is within the acceptable limits. A greater volume of endodontic cement was observed in the single cone and lateral condensation filling techniques.

E-128

Ultrasonography as a complementary examination in the diagnosis of periapical abscess: case report

Danieli Moura Brasil[1*], Rodrigo Enrique Brito Roa Sarmiento[2], Rafael Brito Roa Sarmiento[3], Gabriel Gomes Alencar[4], Gustavo Machado Santaella[5], Francisco Haiter-Neto[1], Eduarda Helena Leandro Nascimento[6]
[1] Department of Oral Diagnosis, University of Campinas, Brazil
[2] N/A, Institute of Integral Medicine Fernando Figueira, Brazil
[3] N/A, Uninassau- Pernambuco - University Center, Brazil
[4] N/A, G.A. Estética Arcoverde, Brazil
[5] Department of Diagnosis and Oral Health, University of Louisville, Brazil
[6] N/A, Neuroimagem Arcoverde, Brazil

Introduction
Periodontitis is a chronic multifactorial inflammatory disease characterized by progressive destruction of the teeth-supporting structures, resulting in a significant tissue breakdown. Its initial diagnosis is clinical and radiographic. Extraoral sinus tracts of odontogenic-origin suppurative lesions present a diagnostic challenge because of their distant location from the underlying infection source and the absence of dental symptoms. Even with the increased use of new technologies in dentistry, ultrasonography is still an underused diagnostic tool. However, it is considered a safe examination and has no harmful effects on the patient.
This study aimed to present a case initially investigated as a skin lesion; however, it was later diagnosed as a lesion of odontogenic origin (periapical abscess) by ultrasonography exam.

Case
A 22-year-old female patient attended a medical clinic to treat a lesion on her face's right side. When performing an ultrasound exam, a fistulous path to the maxilla was found. Then, the patient was referred for a panoramic radiograph. An apical radiolucent image of diffuse limits associated with the root of tooth 14 was identified. CBCT was performed for a more detailed assessment, and the diagnosis of a periapical abscess was achieved. The patient was referred for dental treatment and removal of the source of infection.

Discussion
When a suppurative lesion is seen on the face's skin, an endodontic origin should be considered in the differential diagnosis, even if dental symptoms are absent. The lesion's chronicity has often been worsened by the misdiagnosis, which could significantly affect facial aesthetics due to undesirable treatment such as frequent biopsies resulting in the skin's scarring. Ultrasonography can be used as an important diagnostic tool, as it has high specificity for soft tissues, capable of detecting, delimiting, and evaluating the internal content in dental-maxillo-facial structures.

E-129

Assessment of the diagnostic effectiveness of terahertz radiation in comparison to ultrasonography in oral soft tissue lesions

Esra Ece Cakmak[1*], Nejlan Eratam[1], Gul Sonmez[2], Melis Gelgec[3], Ataberk Atalar[3], Emre Baris[4], Hakan Altan[3], Kivanc Kamburoglu[1]
[1] Dentomaxillofacial Radiology, Ankara University Faculty of Dentistry, Turkey
[2] Dentomaxillofacial Radiology, Dentistomo Private Diagnostic Imaging Center, Turkey
[3] Physics, Middle East Technical University, Turkey
[4] Oral Pathology, Gazi University Faculty of Dentistry, Turkey

Introduction
There has been great interest in the development of non-invasive and non-ionizing Terahertz (THz) applications. THz photons are known to be of low energy and they can be safely used in medical applications when used at low densities.
Another non-ionized imaging method is ultrasonography (US) which is based on the basic principle that sound waves (echo) are reflected within frequency range that the human ear cannot hear and the tissues have different acoustic properties.
In this pilot study, our aim was to utilize THz resources and measure-

ment tools developed by our team to investigate soft tissue lesions and evaluate the diagnostic capability of this technology in comparison to ultrasonography.

Materials and Methods
With ethical approval, we evaluated 8 oral tissue lesions (pyogenic granuloma, peripheral giant cell granuloma, peripheral ossified fibroma, fibroma) using ultrasonography (Siemens Acuson S 2000) in the Dentomaxillofacial Radiology Department of Ankara University Faculty of Dentistry and the THz system in the Middle East Technical University Terahertz Research Laboratory. In addition, the gold standard histopathological evaluation was performed at the Oral Pathology Laboratory, Gazi Faculty of Dentistry. Ultrasound, Terahertz and histopathology were compared by using regression analysis.

Results
Characteristic and differential diagnostic imaging findings were obtained by THz and US for oral lesions tested. According to the regression analysis; acceptable relationship was found between ultrasound, THz and histopathology in terms of lesion width, height, circumference and volume.

Conclusions
Within the limitations of the present study we obtained promising results for THz and US assessment.

E-130

Assessment of cone beam computed tomography retake rates

Maria Luiza Anjos Pontual[1*], Lia Pontes Arruda Porto[1], Vinícios Saito Medeiros Barros[2], Ana Sofia Vieira Santos[1], Danyel Elias Cruz Perez[1], Andrea Anjos Pontual[1], Flávia Maria Moraes Ramos-Perez[1]
[1] Clinical and Preventive Dentistry, Universidade Federal de Pernambuco, Brazil
[2] Nuclear Energy, Universidade Federal de Pernambuco, Brazil

Introduction
The aim of this study was to assess three private dental radiology practices cone beam computed tomography (CBCT) exam retake rates.

Materials and Methods
i-CAT Next Generation, i-CAT Classic and PreXion 3D CBCT units' databases and images were retrospectively assessed for a period of 25 months. Data were submitted to descriptive statistical analysis and Pearson's chi-square test or Fisher's exact test ($p \leq 0.05$). A total of 2696 CBCT exams were included in the survey (1241 from i-CAT scanners and 1455 from the PreXion 3D unit).

Results
The percentage of scan retakes was 19.8%, with a maximum of eleven retakes per person. The most frequent reason for repetition was patient movement (65%), followed by an "unjustified" reason (16%) and area of interest out of the FOV (11%). There was greater repetition in the cases of requests for exams in the indications "indication not informed", Dolphin, Pain / paresthesia, Maxillary sinus, TMJ, Surgery, Orthodontics and General assessment, for the i-CAT scanner ($p \leq 0.05$), and in the Endodontics and Implantology groups, most of which were performed in PreXion ($p \leq 0.05$). Patients under the age of 10 years-old, and patients with an indication for Endodontics, Implant or third molar surgery, who underwent the CBCT scan on the PreXion CT scanner had a higher percentage of repetitions ($p < 0.05$).

Conclusions
The prevalence of repetitions for CBCT scans is high, and patient movement is the most common cause of image retake. Retakes are more frequent in patients under the age of 10 and patients with indication for endodontic treatment, placement of implants and third molar assessment using the PreXion CT scanner.

E-131

Applications of cone-beam computed tomography in a faculty of dentistry from turkey

Melek Tassoker[1*]
[1] Oral and Maxillofacial Radiology, Necmettin Erbakan University, Turkey

Introduction
It was aimed to determine the distribution of cone-beam computed tomography (CBCT) imaging indications of individuals who applied to Necmettin Erbakan University Faculty of Dentistry for diagnosis and treatment.

Materials and Methods
Archival records of 691 individuals who underwent CBCT imagingin the Department of Dentomaxillofacial Radiology were retrospectively analyzed.
The patients were grouped according to age, gender and reasons of CBCT imaging requests. The data were evaluated using descriptive statistics.

Results
In this study group, there were 310 (44.9%) men and 381 (55.1%) women. 222 (32.1%) CBCT records consisted of small field of view (FOV) and 469 CBCT records (67.9%) consisted of large volume scans including the entire lower-upper jaw. The most common reasons for CBCT imaging requests were preoperative implant planning (52.7%), evaluation of impacted teeth (16.4%), examination of pathologies (14.9%), respectively. Oral Surgery was the department that most frequently requested CBCT imaging (66.7%).

Conclusions
CBCT is widely used in implant dentistry, impacted tooth surgery and for examining pathologies. Especially in cases where two-dimensional imaging such as panoramic, occlusal and periapical radiographs is insufficient, the application of CBCT procedure minimizes the complications.

E-132

Analysis of osteoblast, osteoclast levels and radiographic patterns in the healing process of bone fractures (preliminary research)

Norlaila Sarifah[1*], Lusi Epsilawati[2], Azhari Azhari[2], Mieke H Satari[3], Priosoeryanto Bambang P[4]
[1] Dentomaxillofacial Radiology, Faculty of Dentistry, Lambung Mangkurat University, Indonesia
[2] Dentomaxillofacial Radiology, Faculty of Dentistry, Padjadjaran University, Indonesia
[3] Biologi Oral, Faculty of Dentistry, Padjadjaran University, Indonesia
[4] Pathology of Veterinary Division, Faculty of Veterinary Medicine, Institut Pertanian Bogor, Indonesia

e-Poster Presentation

Introduction
The healing process of a bone fracture goes through many phases. The hard callus phase was an important phase, where the original structure was conduct. The hard callus growth depends on osteoblasts and osteoclasts active, and this condition can be analyzed on the radiograph. This study aimed to examine the analysis between osteoblasts and osteoclast's numbers and radiographic patterns in the bone fracture healing process.

Materials and Methods
The study using 12 male Wistar rats with an incomplete fracture in the right femur made by a dental tapered bur with 0.3 mm in length and 0.2 mm in depth. Digital radiographic examinations were carried out on days 0, 5, 10, 17, and 25 after fracturing in lateral position. Furthermore, a radiographic analysis was performed using Image-J to obtain changes in the value of length, depth, and density in the healing area. The analysis was performed to find the radiopaque and radiolucent patterns and the number of osteoblasts and osteoclasts.

Results
This study resulted in changes in the radiograph pattern. The ra diopaque continued to increase while the radiolucent decreased;
the osteoclast pattern tended to be stable while the osteoblasts in creased. The correlation of all the factors is very closely related.

Conclusions
The conclusions were obtained there is changes in the radiograph pattern. The radiopaque continued to increase while the radiolucent decreased; the osteoclast pattern tended to be stable and decreased while the osteoblasts increased during the fracture healing process. The correlation of all the factors is very closely related.

E-134

Subjective assessment of image quality of 13 CBCT devices in the presence of metal artefact

Victor Aquino Wanderley[1,2*], André Ferreira Leite[1,3], Karla De Faria Vasconcelos[1], Ruben Pauwels[4,5], Francisca Müller García[1], Kathrin Becker[6], Matheus Lima Oliveira[2], Reinhilde Jacobs[1,7]
[1] Department of Imaging and Pathology, KU Leuven, Belgium
[2] Oral Diagnosis, University of Campinas, Brazil
[3] Department of Dentistry, University of Brasilia, Brazil
[4] Aarhus Institute of Advanced Studies, Aarhus University, Denmark
[5] Department of Mechanical Engineering, KU Leuven, Belgium
[6] Department of Orthodontics, Universitätsklinikum Düsseldorf, Germany
[7] Department of Dental Medicine, Karolinska Institutet, Sweden

Introduction
The purpose of this study was to subjectively assess image quality of 13 CBCT devices and the influence of field-of-view (full-mandible and half-mandible) in the presence and absence of metal artefacts.

Materials and Methods
CBCT images were acquired of a dry human skull phantom in three conditions: 1) without any metal, 2) with a metal post, and 3) with a titanium implant. Four observers evaluated, in total, 204 representative image slices from 13 CBCT devices and ranked them from best to worst. Additionally, within each device, the observers compared images acquired on full and half-mandible protocols. General linear mixed models were used to assess subjective assessment on overall image quality in the presence and absence of metal artefacts ($\alpha<0.05$). A multiple comparison with the best and worst ranked device was performed.

Results
Subjective assessment of image quality significantly differed amongst CBCT devices, irrespective of the presence of metal and the field-of-view. Some specific devices performed better than others. In the presence of metal, the image quality of a greater number of CBCT devices was ranked as worst. Full-mandible scanning protocol was better evaluated in the presence of metal while, in the absence of metal, half-mandible yielded the highest performance.

Conclusions
Subjective assessment of image quality differed significantly amongst CBCT devices, with the majority of CBCT devices being severely impacted by the presence of metal and the field-of-view.

E-135

A novel surface registration method for reducing radiation dose using bite tray

Jiyong Yoo[1*], Wonjin Yi[2]
[1] Department of Biomedical Radiation Sciences, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[2] Department of Oral and Maxillofacial Radiology, School of Dentistry, Seoul National University, South Korea

Introduction
If an existing patient has taken CT for diagnosis, it is not necessary to take a CT scan again for surgical navigation. The patient made an occlusal state using the bite tray, then took a CT of this bite tray separately. Then the bite tray CT image in which occlusal state were stored and patient CT were matched using surface registration of the teeth area. This is how the bite tray that stores the occlusal state on the CT image of the previous patient is positioned according to the teeth shape.

Materials and Methods

Mandible Segmentation
First, the patient's CT data used for surgical navigation was separated from the skull and the mandible using 3D Slicer (https://slicer.org).

Bite Tray
A bite tray capable of storing the patient's initial occlusal state was manufactured using a CAD program (Rhinoceros 5, Robert McNeel & Associates).

Teeth and Bite Tray Surface Registration
The teeth shape of the patient's CT image taken without the bite tray and the teeth model created using 'Boolean operation' on the bite tray were matched by surface registration, and the bite tray model was placed on the CT image taken without the bite tray.

Registration for Surgical Navigation
In order to use surgical navigation system, 3D coordinate space of the patient's CT data and the coordinate space of the tracking device must be matched, which is called CT-Tracker registration. We used point-to-point registration with the feature points in the CT space and the feature points in the actual tracking device space.

Results
As a result of the final surface registration, the error was 0.02 mm. The error was 0.35mm as a result of the point registration for navigation.

Conclusions
Results were within the range of clinically usable error.

E-137

Marker-less registration algorithm using deep learning for augmented reality surgical navigation

Sieun Choi[1*], Sangjeong Lee[1], Jiyong Yoo[1], Minhyuk Choi[1], Taehoon Yong[1], Bosoung Jeoun[2], Soyoung Chun[2], Su Yang[1], Jin Kim[2], Wonjin Yi[3]

[1] Department of Applied Bioengineering, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[2] Interdisciplinary Program of Bioengineering, Seoul National University, Seoul National University, South Korea
[3] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
Augmented Reality based surgical navigation system is used to improve surgeon's skill in minimally invasive surgery. Marker is usually used to register the virtual orgnas and real organs. However, it is too bulky to use in limited space, e.g. dental surgery. In this study, we provide marker-less registration method using deep learning for augmented reality navigation system.

Materials and Methods
We trained U-net using images of human face to segment maxillary teeth in RGB image. The segmentation result, which is 2D pixel, transformed to 3D coordinate using depth map. We also segment corresponding site manually in 3D CT model. ICP algorithm is used to registration between camera coordinate and CT coordinate.
We attached four 1mm ceramic balls to the bilateral upper central incisor and bilateral upper lateral incisor of the phantom. The ceramic balls which represent target points is used to measure the target registration error. The measurements performed 6 times in different directions and the distance between the camera and the phantom is 350~500mm.

Results
The results measured six times were confirmed by taking the average for each target point, and RMS was also measured. The average of registration error in x, y, and z-axis was also measured.
The registration error in the x-axis is 0.54mm, in the y axis is 1.29mm, in the z axis is 1.09mm, and the average of RMS is 1.78mm.

Conclusions
The result shows our marker-less registration method's accuracy is 1.78mm. The error of the y-axis is higher than other axis, and it was expected limitation of the depth resolution which is associated with hardware problem. In the future, 3D CT model should be segment automatically, and the error of y-axis should be improved.

E-138

Ultrasound-guided sialo-irrigation for the treatment of chronic sialodochitis with sialolithiasis

Song hee Oh[1*], Eun Mi Kim[1], Gyu-Tae Kim[1], Yong-Suk Choi[1], Eui-Hwan Hwang[1]

[1] Oral and Maxillofacial Radiology, Kyung Hee University, South Korea

Introduction
Sialolithiasis is one of the most common causes of salivary duct obstruction. In the last 20 years, minimally invasive procedures like sialendoscopy, extracorporeal lithotripsy, and basket snaring are increasingly being used for the treatment of salivary gland duct stones. Sialo-irrigation of the salivary gland is an effective procedure for treating inflammation and providing symptomatic relief. This procedure can be employed for the treatment of sialolithiasis by using the back pressure of instilled saline. Sialo-irrigation under ultrasound (US) guidance allows for dynamic studies showing real-time images during diagnostic or surgical procedure and can be used for the removal of sialoliths. In addition, it can also be used to remove primitive sialoliths and microliths by washing out the ductal system, which prevents the recurrence of sialoliths. The aim of this study was to propose a minimally invasive technique for sialolithiasis using US-guided sialo-irrigation.

Case
A 40-year-old man was referred for the treatment of pain, swelling in the left sublingual region and dry mouth, which began 1 year ago. Sialography of the left submandibular gland (SMG) shows multiple calcified masses in Wharton's main and accessary ductal systems. He was diagnosed as having sialodochitis with sialoliths and then underwent US-guided saline irrigation of the left SMG. During the irrigation, the back pressure of the injected saline pushed the stone to the mesial region of the duct, which was removed by simple papillectomy.

Discussion
US-guided sialo-irrigation appears to be a simple and conservative treatment option for patients with chronic sialadenitis accompanied by sialolithiasis. This minimally invasive intervention, which causes less tissue damage compared to surgical procedures of the salivary gland and is less expensive than sialendoscopy, can be performed at the Department of Oral and Maxillofacial Radiology.

E-139

An audit on radiographic requesting and reporting in an oral and maxillofacial department

Angela Boscarino[1*]

[1] OMFS, Alder Hey Hospital, United Kingdom

Introduction
Patients with complex medical histories and difficult clinical needs are routinely referred to the local maxillofacial department for dental extractions. A new radiograph is requested when the patient attends the consultation clinic. Radiographs are ordered before the patient has been seen by the clinician, so the requested radiograph may not always be the most appropriate. This means that the patient may have had an unnecessary increased radiographic exposure. In addition, not all radiographs are reported upon. Therefore, pathology or disease may be missed, which can lead to long term problems such as pain or infection for the patient.
The aim of this audit is to ensure that the clinician requests the appropriate radiograph that will allow the treatment to be completed, but also keep the dose as low as reasonably practical. In addition, each radiograph should be reported, and any incidental findings should be acted upon to allow the patient's overall oral health to be addressed.

Case
A retrospective audit of 50 patients demonstrated that 54% of patients did not have a radiographic report. A total of 26% of patients had incidental findings on their radiographs that were not acted upon, which included missed caries and periapical pathology. 46% of patients had an inappropriate radiograph prescribed for the necessary clinical treatment.

e-Poster Presentation

Discussion
Radiographs are a necessary part of an examination prior to dental extractions. It is important that the clinician assesses the patient prior to requesting a radiograph, so that each exposure is justified, and the dose is kept as low as reasonably practical. A radiographic report ensures that all disease is noted. Missed caries or pathology can cause a detrimental effect to the patient's well-being. A re-audit was conducted following an implementation of change. The second cycle showed an overall improvement in results

E-140

Investigate the frequency of dental radiography for assessing the exposure dose of patients

Changho Song[1*]
[1] Oral and Maxillofacial Radiology, Seoul National University, Democratic People's Republic of Korea

Introduction
The necessity for radiographic imaging in the field of diagnosis and treatment is increasing everyday. However, there are also reports of harmful effects of radiation exposure such as carcinogenesis.
Due to this dualistic nature of Radiation, the United Nation Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) collects data on the exposure status of citizens of various countries, including medical exposure, occupational exposure, and exposure to the general public from countries around the world. They periodically provide these data to the health care policy organizations in each country so that the data on radiation exposure are managed and reported around the world.
However, the exposure collection system of each country including Korea uses a retrospective approach based on insurance claims which causes for concern of under evaluating the amount of actual exposure.

Materials and Methods
Therefore, this paper conducted a questionnaire survey to determine the number of actual radiographic exposure and compare them with the insurance claims to demonstrate dental radiation exposure in Korea.
A preliminary survey was conducted on 112 dental medical institutions based on a metropolitan area with a population of over 1 million, and based on the results of the preliminary survey, a survey was conducted on 1284 dental medical institutions nationwide.

Results
The results showed a statistical significance between the actual number of radiographs taken and the number of reported insurance claims for the four radiographic imaging method: panoramic radiograph, periapical radiograph, cephalometric radiograph, CBCT. Also, data confirmed that cephalometric and CBCT radiograph were taken twice the amount of reported insurance claims.

Conclusions
In conclusion, it is necessary to change the existing method for establishing information on dental radiation exposure.

E-141

The accuracy of the indicated dose area product for panoramic X-ray equipment

Eun-Kyung Kim[1*], Won-Jeong Han[1], Min-Suk Heo[2], Sam-Sun Lee[2], Kyoung-A Kim[3], Wan Lee[4], Jin-Soo Kim[5], Suk-Ja Yoon[6], Yun-Hoa Jung[7], Gyu-Tae Kim[8], Kug Jin Jeon[9], Jin-Woo Han[10], Seo-Young An[11]
[1] Dept. of Oral and Maxillofacial Radiology, Dankook University, South Korea
[2] Dept. of Oral and Maxillofacial Radiology, Seoul National University, South Korea
[3] Dept. of Oral and Maxillofacial Radiology, Jeonbuk National University, South Korea
[4] Dept. of Oral and Maxillofacial Radiology, Won-Kwang University, South Korea
[5] Dept. of Oral and Maxillofacial Radiology, Chosun University, South Korea
[6] Dept. of Oral and Maxillofacial Radiology, Chonnam National University, South Korea
[7] Dept. of Oral and Maxillofacial Radiology, Pusan National University, South Korea
[8] Dept. of Oral and Maxillofacial Radiology, Kyung Hee University, South Korea
[9] Dept. of Oral and Maxillofacial Radiology, Yon-Sei University, South Korea
[10] Dept. of Oral and Maxillofacial Radiology, Gangneung-Wonju National University, South Korea
[11] Dept. of Oral and Maxillofacial Radiology, Kyungpook National University, South Korea

Introduction
According to IEC 60601-2-63, dental extra-oral X-ray equipment shall be provided with an indication of the dose area product (DAP). And the information about the overall uncertainty of the indicated DAP values shall be provided and shall not exceed 50%. This study was performed to assess the accuracy of the indicated DAP values of panoramic X-ray equipment.

Materials and Methods
One hundred twenty-five panoramic X-ray equipments were randomly selected from all regions of South Korea for the study. Among 125 equipments, 66 equipments were provided with an indication of the DAP. At these equipments, the indicated value of DAP at the clinical exposure setting, the age of radiographic equipment, the manufacturing company, the type of radiographic system were documented. And DAP values were measured by a DAP meter with its ionization chamber at the first collimator side of the X-ray tube side. They were measured three times at the clinical exposure setting and averaged. In order to evaluate the accuracy of indicated DAP values, the ratio of the indicated DAP value to measured one was calculated.

Results
The number of the manufacturing company of 66 equipments providing the indicated DAP value was 6. The ratio of the indicated DAP value to measured one was from 21% to 208%. The median ratio was 85% and the mean ratio 90%. The number of equipments showing the uncertainty exceeding 30% (less than 70% or more than 130%) was 19 (29% of all equipments) and the number of equipments exceeding 50% (less than 50% or more than 150%) was 4 (6% of all equipments).

Conclusions
The considerable number of panoramic radiographic equipments displayed the inaccurate DAP value. It is necessary to confirm the accuracy of an indicated reading of DAP at the acceptance and routine tests of panoramic radiographic equipment.

E-143

Aggressive central giant cell granuloma: report of 3 cases

Anwesha Samanta[1*]
[1] *Oral Medicine Diagnosis and Radiology, Pravara Medical Sciences (Deemed to Be University), India*

Introduction
Central giant cell granuloma (CGCG) is a benign, non odontogenic lesion accounting for fewer than 7% of all benign tumors of the jaws. It is defined as "an intraosseous lesion consisting of more or less fibrous tissue containing multiple foci of hemorrhage, aggregates of multinucleated giant cells, some amount of trabeculae of woven bone forming within the septa of more mature fibrous tissue that may traverse the lesion". It commonly occurs in young adults showing a female predilection. Multifocal CGCGs in maxillofacial region are very rare and suggestive of systemic diseases such as hyperparathyroidism, an inherited syndrome such as Noonan-like multiple giant cell lesion syndrome or other disorders.

Case
Here we are presenting three cases of CGCG. All cases were females with age range from nine years to thirty years. The first case of CGCG was in the right posterior mandible, second one with two lesions (multifocal) involving the left posterior mandible and maxilla and third one in the mandibular body crossing the midline and all were multilocular and aggressive variants. No recurrences were found on follow-up.

Discussion
CGCG occurs more commonly in the mandible, anterior to the first molar and often crosses the midline. Occasionally, they may occur in the facial bones, maxillary sinus, ethmoidal sinus, temporal bone, cranial vault and small bones of hands and feet. CGCG has a rare aggressive variant based on clinico-radiographic features which are large and rapidly growing, may cause local bone destruction, loose and displaced teeth, root resorption, cortical expansion or perforation, sensory impairment and have high recurrence rate. The nonaggressive form may present with asymptomatic swelling or may be discovered accidentally during routine radiographic examination. Most widely used intervention for CGCG is curettage. It ranges from simple curettage to resection in addition to cryosurgery and peripheral ostectomy.

E-144

Evaluation of accuracy around dental implants placed with flapless and open-flap guided surgery

Pedro Henrique Nascimento Dourado[1], **Arthur Rodriguez Gonzalez Cortes**[2*], **Otavio Henrique Pinhata-Baptista**[1], **Leticia Cristina Cidreira Boaro**[3], **Heloisa Fonseca Marão**[3]
[1] *Department of Implantology, Hospital Militar de Área de São Paulo, Brazil*
[2] *Department of Dental Surgery, Faculty of Dental Surgery, University of Malta, Malta*
[3] *Department of Implantology, University of Santo Amaro, UNISA, Brazil*

Introduction
Implant guided surgery has shown satisfactory clinical applicability because the technique is minimally invasive and easy to perform. However, discrepancy of angulation can occur between the virtual plan to the placed position of the implants. Therefore, the aim of this prospective study with one-year follow-up was to evaluate the deviation between the planned and placed position of the implants and compare the flapless guided surgery with the open-flap guided surgery.

Materials and Methods
Thirteen patients were selected with the absence of one of the premolars. Flapless guided surgery was perform in 6 patients whereas open-flap surgery was perform in the other 7 patients. All cases were planned with the coDiagnostiX software and with StraumannÒ BLT 3.3 implants with lengths ranging between 8.0 and 12 mm. After surgery, a cone beam computed tomography was performed to compare the final position of the implants with the planned positions virtually. The images were overlaid using the Treatment Evaluation tool in the coDiagnostiX software. Differences in positioning between implants placed with flapless and non-flapless surgery were evaluated related to: angulation, 3D deviation (implant platform), distal and vestibular deviation from the implant platform, apical deviation, 3D apical deviation, distal and vestibular deviation of the implant apex, 3D deviation (implant apex). The data were tabulated and submitted to the Mann-Whitney test (platform deviation) and ANOVA + Tukey (other deviations).

Results
The 3D deviation was greater for the flapless guided surgery and there was statistically significant difference relation to the implant platform (P= 0,032) and the apex of the implant (P=0,048).

Conclusions
According to the results of the present study, implant guided surgery is a feasible and predictable alternative to rehabilitation. There are still some variations of the positions but is not clinically relevant.

E-145

Cone beam computed tomography utility in diagnosis of asymptomatic periodontitis: case raport

Cristina Antohi[1*], **Danisia Haba**[2], **Yllka Decolli**[1], **Radu Eduard Cernei**[2], **Tudor Hamburda**[1], **Mihaela Salceanu**[1]
[1] *Endodontology, UMF "Gr.T.Popa", Iasi, Romania*
[2] *Surgery, UMF "Gr.T.Popa", Iasi, Romania*

Introduction
We set out to demonstrate the necessity of achieving a cone beam computed tomography in the complex cases which we have every day in endodontics.

Case
We selected a 26 years old woman who had pain in the second maxillary premolar and had come to the Departament of Endodontology for treatment. Vitality tests were negative which means we have a pulp necrosis. We also performed a periapical radiograph that revealed the existence of a radiolucency at the apex of the premolar. We decided to measure it in the three plans in order to evaluate the sale after the treatment so that it was necessary to make a cone beam computed tomography. The cone beam computed tomography reconstructions allowed us to measure the existing lesion at the level of premolar but what was most surprising is that it revealed the first maxillary molar demage that did not appear on periapical radiograph.

e-Poster Presentation

Discussion
The axial, sagittal, coronal and 3D reconstructions reveals a radiolucency affecting the first maxillary molar both at the periapical and interadicular levels so here it was a asymptomatic periodontitis. Because the molar had a metallic pivot and crown and the patient mentioned that it had been retreated in the past, the lesion was very extensive we extracted it and treated only the premolar. Following the radiological examination, cone beam computed tomography the diagnosis and the treatment plan for an apparently healthy tooth was changed.

E-146

The diagnostic role of cone beam computed tomography in endodontology: case raport

Cristina Antohi[1*], Roxana Mihaela Popescu[2], Bogdan Ionut Dobrovat[2], Anca Melian[1], Liana Aminov[1], Radu Eduard Cernei[2]
[1] Endodontology, UMF "Gr.T.Popa,Iasi, Romania
[2] Surgery, UMF "Gr.T.Popa", Iasi, Romania

Introduction
We wanted to highlight the importance of cone beam computed tomography in diagnosing teeth that can be endodontically retreated versus extraction and implant.

Case
We report the case of a 20 years old woman who came with an abscess at the first mandibular molar at the Departament of Endodontology. At the clinical examination we found: swelling, tooth mobility, pain in percussion. The pacient also mentioned that in the past the tooth was treated endodontically and she would like to retreated it now if it is possible. We indicated the achievement of a cone beam computed tomography as well as the interdisciplinary consultation between a endodontist , a surgeon and a dento maxillo facial radiogist before establishing the treatment plan.

Discussion
The cone beam computed tomography reconstructions revealed a perforation of the distal root, an incomplete endodontic treatment and by perforation the extrusion of the filling material between the two roots. On the sagittal and coronal cross-sections we could see the presence of the radiolucency in the apical part of both roots called granulomas. The three doctors decided that extraction and implant in this case would be much more indicated than retreated it. Respecting the principle ALARA cone beam computed tomography must be indicated when we have a case that requires an interdisciplinary approach. As we well know the cone beam computed tomography is useful in both surgery and endodontology.

E-147

A fast robot arm TCP calibration method using OTS

Jin Kim[1*], Sangyoon Woo[2], Soyoung Chun[1], Sangjeong Lee[2], Jiyong Yoo[2], MinHyuk Choi[2], Taehoon Yong[2], Sieun Choi[2], Bosoung Jeoun[1], Su Yang[2], Wonjin Yi[3]
[1] Interdisciplinary Program in Bioengineering, Seoul National University College of Engineering, South Korea
[2] Department of Applied Bioengineering, Graduate School of Convergence Science and Technology, Seoul National University, South Korea
[3] Department of Oral and Maxillofacial Radiology, School of Dentistry and Dental Research Institute, Seoul National University, South Korea

Introduction
The rapid development of technology has brought various options to physicians, such as Robot-Assisted Surgery with wider application. At the same time, there still are a lot of limitations when technology is applied in practice. To overcome the difficulties especially in maxillofacial surgeries, researchers adopt assisting devices with high accuracy and precision including Optical Tracking System (OTS) and robot arms. In the present study, we propose a modern and easy Tool Center Point (TCP) calibration method of a robot arm using OTS.

Materials and Methods
The tool is attached to the robot flange, and the tool has an end-effector marker for tracking. OTS tracks the marker to constantly acquire the position data. To determine the TCP by using the OTS, firstly, the tooltip of the OTS needs to be calibrated to yield more precise results. After that, the vector from the robot end-effector marker to the TCP from the OTS coordinate can be acquired by pointing the TCP with the tooltip. To calculate the TCP, the robot flange frame and the robot end-effector marker need to be obtained. With the simultaneous target data from corresponding points, point-to-point matching can be conducted and TCP can be acquired.

Results
Several tests have been conducted and the result has a tendency that varies depending on the distance between the OTS and the marker. Though the robot contains inherent non-linear errors, the measured data contains a more complex relationship including the accuracy of the OTS, the temperatures.

Conclusions
The results have shown it contains non-linear errors especially for precise surgeries that need to be compensated in terms of its accuracy. Although the OTS cannot competitively track the marker with laser trackers, there still are possibilities where it can be reduced by adopting other compensation methods such as neural network systems.

E-148

Recording status of radiologic report items in South Korea

Jinwoo Choi[1*]
[1] Oral and Maxillofacial Radiology, Dankook University, South Korea

Introduction
Imaging is essential in dental clinics. Interpretation and recording of image information have a direct impact on the quality of treatment and communications during diagnosis, treatment, and follow-up process. In Korea, ten mandatory items for dental radiologic reports are as follows: 'Name, Age, Gender, Name of the examination, Date of examination, Findings, Conclusions, Reading Date, Reading doctor, and Clinic name'. In this study, the current status of the radiologic report and recorded items were investigated.

Materials and Methods
Members of the Korean Dental Association responded to a Google questionnaire survey. The questionnaire asked the respondents' affiliation, types of imaging modality, storage types of radiologic reports, and recorded items. The study conducted an online survey in November 2016 and 354 responses were analyzed.

Results
Two hundred eighty-six dentists replied they take periapical radiographs, and the rate of record for the name, age, gender, and date of examination was about eighty percent or more.

However, the rate for the name of examination, findings, conclusion, reading date, reading doctor, and the name of the clinic was about 50% or less. Only 3.1% of respondents replied they record all 10 mandatory items. There was no difference between the number of recorded items according to the type of the clinic, or the use of film or digital sensors, but the respondents use in-chart recording methods recorded significantly fewer items than those who use separate radiologic report formats or PACS systems. Similar results were shown in panoramic and CBCT imaging modalities. The recorded rate for the name, age, gender, and date of examination was higher and the rate for the other 6 items was lower than 50 or 60%.

Conclusions
Some of the mandatory items of the radiologic report are often missed, and guidelines for dentists are required.

E-149

Calcium hydroxyapatite dermal filler on CBCT: a case report

Joanne Briner Prenafeta[1*], Trinidad Mackenney[1], Michelle Briner Garrido[2], Andres Briner[1], Maria Teresa Vasquez[3], Daniel Pinto[1]
[1] Oral and Maxillofacial Radiology, Universidad Finis Terrae, Chile
[2] Oral and Maxillofacial Radiology, School of Dentistry, University of Missouri-Kansas city, United States of America
[3] Dermatocosmetica Farmaceutica, Universidad de Barcelona, Spain

Introduction
Aesthetic dermal fillers are widely used to improve facial appearance and prevent signs of aging. One of the most common fillers used are made of calcium hydroxyapatite. Radiographically it appears radioopaque, well defined and located within the soft tissue of the face. Its appearance is similar to that of calcifications or ossifications within the soft tissue. This is a diagnostic challenge and may lead to confusions while interpreting, if the radiologist is not aware of previous history of such procedure.

Case
A 43 y.o female patient presented to an imaging center located in Santiago, Chile referred for pain at the superior left quadrant. A CBCT was taken with Morita ® X800 (40x80mm). During image analysis a well-localized radiopaque entity of density similar to that of bone was seen in the soft tissue of the cheek, inferior to the lateral wall of the left maxillary sinus and buccal to teeth 2.4 to 2.7. This entity was surrounded by soft tissue. The implant and all teeth on this quadrant were asymptomatic and within normal limits.

Discussion
The differential diagnoses for this case were myositis ossificans or foreign body (dermal fillers). The patient was consulted about previous esthetic interventions and she confirmed to have used dermal fillers in the past. Once the radiographic diagnosis was complete, the dentist referred the patient to the dermatologist who did the procedure to determine the source of pain and treatment.

E-150

Myositis ossificans of masticatory muscles – a report of a rare case

Dong-Jung Lee[1], Hyun-Ok Kim[1], Jungho Park[1*], Sam-Sun Lee[1], Min-Suk Heo[1], Won-Jin Yi[1], Kyung-Hoe Huh[1], Jo-Eun Kim[1], Ju-Hee Kang[1]
[1] Department of Oral and Maxillofacial Radiology and Dental Research Institute, Seoul National University Dental Hospital, South Korea

Introduction
Myositis ossificans(MO) is a disease in which heterotropic bone deposition occurs in muscle or other soft tissues. In this report, we brief the rare case of MO of masticatory muscles.

Case
We retrospectively reviewed a case of a 62-year-old male patient who visited the department of oral and maxillofacial surgery with the complaint of mouth opening limitation. CT, panoramic radiographs and biopsy were executed.

Ossification of the right temporal muscle was observed in the CT scan of first visit, and the patient was diagnosed as MO. Swelling and enhancement were also found in right lateral pterygoid muscle, suggesting the possibility of ongoing myositis and ossification. 6 months later, on the CT image, ossification was also found even in the right medial pterygoid muscle. Another 6 months later, the patient underwent surgery for coronoidectomy, and resection of multiple ossifications in the right temporal, lateral pterygoid, medial pterygoid muscles. But the restriction of mouth opening persisted. Three months after the surgery, follow up CT showed the progression of ossification around the right condyle and also newly formed ossification in the left temporal and medial pterygoid muscles. Two years after the operation, the patient is refusing to further surgery, even though the ossifications of masticatory muscles have been progressed.

Discussion
MO is one of the diseases related to the restriction of mouth opening, and can be diagnosed accurately through the image of CT scan.

E-151

Epithelioid osteoblastoma of the maxilla, mimicking osteosarcoma : A case report

Kyung-youl Kang[1*], Kyung-Hoe Huh[1], Ju-Hee Kang[2], Jo-Eun Kim[2], Won-Jin Yi[1], Min-Suk Heo[1], Sam-Sun Lee[1]
[1] Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, South Korea
[2] Oral and Maxillofacial Radiology, Seoul National University Dental Hospital, South Korea

Introduction
Epithelioid osteoblastoma (EO) is rarely found in gnathic bone and is also called aggressive osteoblastoma because it grows faster and more aggressively than conventional osteoblastoma. In addition, clinical and radiological findings of EO are almost similar to common malignant tumors, even though it belongs to the benign categories. These factors often make it difficult to diagnose EO correctly. This report presents a case of EO which was difficult to differentiate from osteosarcoma (OS) both radiologically and histopathologically.

Case
A 30-year-old woman, who had been diagnosed with OS after incisional biopsy in another hospital, was referred for further evaluation and treatment. A chief complaint of the patient was a buccal and palatal swelling and tenderness on the right maxilla. CT, MR, PET, and ultrasonography were performed. Postcontrast enhanced CT and MR images revealed a large infiltrative bone-forming in the right maxilla. The mass was mostly composed of amorphous bone formation. The buccal and palatal cortex of the right maxilla were destroyed and the roots of the premolars were resorbed by and in-

e-Poster Presentation

separable from the bone-forming lesion. On PET/CT image, the lesion showed a marked FDG hyper-uptake. All the imaging findings were consistent with a malignant tumor such as OS. The patient subsequently underwent partial maxillectomy, but the final histopathological diagnosis was made of EO. The patient has been free of disease for 33 months follow-up period.

Discussion
EO should be included in the differential diagnosis of an infiltrative radiopaque lesion with massive amorphous bone formation and cortical destruction. Compared to OS, EO may present a relatively narrow zone of soft tissue components surrounding the amorphous bony mass.

E-153

Imaging features of rare but not extinct Lemierre syndrome - a case report

Nisha G Manila[1*], Sinan A Bana[2], Solaleh Shahmirzadi[1], Meharnaz A Tahmasbi[1], Hui Liang[1], Amin F Saad[2], Madhu K Nair[1]
[1] Diagnostic Sciences, Oral and Maxillofacial Radiology, Texas A&M College of Dentistry, Dallas, TX, United States of America
[2] Department of Diagnostic Radiology, Baylor University Medical Center Dallas, TX, United States of America

Introduction
Lemierre syndrome (LS) is a rare, potentially fatal sequel of bacterial infection in previously healthy adolescents and young adults, commonly developing in association with bacterial throat infection, palatine tonsil being the origin. Other possible causes are dental infections, parotiditis, mastoiditis, and otitis media. The bacteria primarily responsible for the infection is Fusobacterium necrophorum. Initial infection spreads into deep spaces of neck leading to an infected blood clot in the internal/external jugular vein. The thrombus may end up invading other vital organs, ending up in a fatal prognosis. A recent increase in incidence was reported owing to lack of timely treatment of throat infection.

Case
A 19-year-old female, recently seen by her physician for an upper respiratory infection and discharged home with oral antibiotics, presented with fever, sore throat and generalized weakness. Patient tested positive for fusobacterium and was admitted to the hospital for further evaluation. COVID-19 test was negative. Computed Tomography (CT) demonstrated enlargement of the left palatine tonsil and left external jugular vein thrombus. Contrasted chest CT showed multiple pleural/subpleural necrotic nodules. Patient was treated with IV ampicillin/sulbactam and discharged after 4 days.

Discussion
When a patient presents with trismus, abscess/cellulitis of masticatory areas should be suspected, and LS ruled out. The relative rarity and unfamiliarity of its features often results in misdiagnosis. Dentists who frequently encounter oropharyngeal infections must know the signs and symptoms of LS and be aware of possible complications including septic arthritis, hepatic and splenic abscesses, retrograde infection spread to cranial sinuses, and septicemia.

E-154

Gorlin-goltz syndrome: report of 3 cases

Pooja Nayak[1*], Anita D Munde[1], Anuja Avinash Deshpande[1], Sunil Mishra[1]
[1] Oral Medicine and Radiology, Pravara Medical Sciences (Deemed to Be University), India

Introduction
Gorlin–Goltz syndrome, also known as nevoid basal cell carcinoma syndrome (NBCCS), is a rare inherited autosomal dominant disorder. The existence of this syndrome dates back to dynastic Egyptian times. Although the prevalence of this syndrome varies with different ethnic groups, it is estimated to be 1 in 57,000 to 1 in 1,64,000. However, in Indian scenario, NBCCS has been rarely reported. Gorlin-Goltz syndrome is characterized by the triad of basal cell nevi, jaw keratocysts and skeletal anomalies. Diagnosis of the syndrome is based on major and minor criteria.

Case
We are presenting three cases of Gorlin-Goltz syndrome with detailed clinical, radiographic (Computed Tomography (CT) and Cone Beam Computed Tomography (CBCT)) and histopathological findings. All three cases were found in males with age ranging from 18 to 40 years, showed multiple odontogenic keratocysts involving both maxilla and mandible and evidence of falx cerebri calcification. Two cases showed evidence of bifid rib in chest radiograph. There was no evidence of skin lesions. Cystic lesions in all cases were treated surgically and no recurrence was found on follow up visits.

Discussion
Although Gorlin-Goltz syndrome is associated with the triad, it shows a wide spectrum of involvement of other system such as neurological, ophthalmic, endocrine and genital manifestations variably. It is a rare autosomal dominant inherited disorder which is caused by mutations to patched PTCH1; a tumor suppressor gene located in 9q22, 3-q31. This presentation emphasizes the importance of early diagnosis of nevoid basal cell carcinoma syndrome by oral health professionals using diagnostic criteria including histopathology and a multidisciplinary treatment approach to provide better treatment outcomes to the patient.

E-155

Questionnaire survey for evaluating the online clinical practice program

Ryutaro Kohashi[1*], Ken-ichiro Ejima[1,2], Yusuke Hayashi[1], Ko Dezawa[1], Yuka Sato[1], Kunihito Matsumoto[1,2], Kunihiko Sawada[1,2], Yoshinori Arai[1,2], Kazuya Honda[1,2]
[1] Oral and Maxillofacial Radiology, Nihon University School of Dentistry, Japan
[2] Division of Advanced Dental Treatment, Dental Research Center, Nihon University School of Dentistry, Japan

Introduction
Due to the spread of COVID-19, we attempted to implement an online clinical practice program using ICT. Specifically, students were viewing CT, MRI cross-sectional images using the external reference viewing system (TSUNAGU, NOBORI Ltd.) and learned 3D anatomical structure. We conducted a questionnaire survey to the students for evaluating the online clinical practice program.

Materials and Methods
A questionnaire survey was applied 151 students in the fifth year at our university. The questionnaire comprised 14 sections including any additional comments. After all online clinical practice program were finished, the survey was taken online.

Results
For the external reference viewing system, the students responded

to difficult about a system application installation slightly higher and it is not a problem about the operability. Many students evaluated that the external reference viewing system is easy to understand for the anatomical structures.

The online Q&A session were evaluated highly, but the network connection was not highly on any additional comments. Furthermore, many students hoped to continue using this system in the future.

Conclusions
Most students satisfied about this system for the clinical practice program. In the future, we will plan to improve this system and make the system available in some other grade.

E-156

A systematic review on incidental findings in cone beam computed tomography (CBCT) scans

Sandy Dief[1*], Niloufar Amintavakoli[1], Analia Veitz-Keenan[1]
[1] Oral and Maxillofacial Pathology, Radiology and Medicine, NYU College of Dentistry, United States of America

Introduction
The use of cone-beam computed tomography (CBCT) in the dental field is increasing. As a result of a broad field of view generated when using CBCT scans, incidental findings (IFs), which are discoveries unrelated to the original purpose of the scan, are frequently found. The aim of the systematic review is to analyze present literature and determine the prevalence of IFs using CBCT.

Materials and Methods
The authors followed guidelines to conduct a systematic review that included a search of several online databases of studies with their own prevalence of IFs among patients undergoing head and neck CBCT scans for different purposes. To assess the quality and risk of bias of the studies, STROBE criteria was used.

Results
The original search retrieved 509 abstracts of which only 10 articles met the inclusion criteria. The sample size varied between 90 – 1000 participants. The frequency of IFs of the 10 selected articles ranged from 24.6% - 94.3%. The most common IFs were in the airway. Three articles reported carotid artery calcifications with a prevalence of 5.7% -11.6%. Pathological findings were between 0.5% - 1.4%. The 10 selected studies had a risk of bias varying from moderate-low.

The percentage of non-threatening IFs was high, such as mucous retention cyst (55.1%), sinusitis (41.7%), vertebral degenerative changes (45.6%), soft tissue calcifications such as calcified stylohyloid ligament (26.7%), calcified pineal gland (19.2%), and tonsillolith (14.3%). Incidental malignancies were rare (1.4%).

Conclusions
Although the prevalence of IFs are high, not all are significant and require immediate medical attention, such as supernumerary teeth, vertebral degenerative changes, etc. However, the low prevalence of threatening IFs emphasizes that CBCT should not always be considered a substitution for conventional radiographs, but when used, they should be evaluated by an experienced radiologist.

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Author Index

READING AND LEADING DENTISTRY

Author Index

A

B

C

D

E

F

Author Index

G

H

I

J

K

Author Index

L

M

N

O

P

Author Index

P

R

S

T

U

V

Author Index

W

Y

Z

2021
Gwangju
KOREA
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