

Digital imaging, 3D-imaging and what then ...?

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The possibility of digitally acquiring dental radiographic images was introduced in the late 80's. The first digital sensor systems were only able to capture an image; storage, archiving and retrieval was not possible. The image could be examined on the computer screen or on prints made on thermo sensitive paper. The contrast resolution was only 6 bit (64 gray values). Digital radiography has gone through a tremendous development since these early days. The contrast resolution is now up to 16 bit, which is approximately a thousand fold increase. The rapid evolution of computer technology has stimulated an equally impressive development of the image features and characteristics. Not only contrast resolution has improved, also the spatial resolution (number of pixels per square mm) is constantly increasing. The pixel size of current sensor systems can be as small as 20 μ , which is more than actually required for dental diagnostic tasks. As a consequence, storage requirements increased exponentially and file transmission times would have been much longer if the transmission speed had not gone up at an even higher rate. Another result of the increased computer power is the development of image processing procedures, which were not easily possible (or even not possible at all) in the era of conventional film based imaging. Examples are digital subtraction radiography and three-dimensional reconstructions and interactive visualization. Especially the application of three-dimensional image reconstruction means a big leap forward in diagnostic radiography. An inherent short-coming of conventional plain projection radiography is that the resulting image is a two-dimension representation of the three-dimensional real world. Traditional projection radiography does not provide information about the third dimension. As a result, the extent of objects and the position relative to other structures in its neighborhood cannot be deduced from these images. Three-dimensional visualization, however, shows the position of internal structures, with respect to adjacent structures. It gives a clear representation of the extent of lesions and structures. Furthermore, images can be rotated and cross-sectional images can be produced to create the best view of normal and abnormal structures, without an additional radiation dose to the patient. The latest developments in three-dimensional imaging are related to the display of these images. Immersive 3D display and 3D illusions using half transparent mirrors give the observer a feeling as if the objects in the image are real objects. Simulation of surgical procedures, advanced diagnosis and more accurate assessment of bone dimensions or root canal shape are potential applications made possible by this new technology. Many new applications are experimental and very expensive yet. However, from the past we have learned that this should not be a reason to stop the development of these new applications. The technological possibilities are available at reasonable costs by the time the diagnostic options have been developed and adequately tested.

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**Advances in clinical applications of new technologies in
oral and maxillofacial radiology**

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The oldest intraoral machines were standing on the floor and around 1920 the first wall mounted machines were manufactured, for example one by the Victor Company. The wall mounted machine persists to this day. Over the past several decades hand held portable intraoral machines have been developed for special applications such as for military field operations or possibly for forensic applications but none was introduced to the general market and none were approved for general use by regulatory bodies. Recently this technology has been approved by the USA Drug and Food Administration (FDA) and a company called Aribex introduced the Nomad portable x-ray machine to the general dental profession and some analyses will be presented. Panoramic radiology was developed concurrently in the USA in San Antonio by the military and in Finland by professor Patero in the late 1950s. Of course film based machines dominated the market until recent years when direct digital panoramic machines were introduced as well as panoramic cassettes utilizing photostimulable phosphor plates (PSPs) as a simple digital conversion method. The most common direct digital panoramic sensor is the charge coupled device (CCD). Recently a Finnish company (Ayat) and a Japanese software manufacturer (Axion) have combined with an American Panoramic manufacturer (Panoramic Corporation) to produce not only higher quality panoramic images but with the capability to create many ROIs from a single panoramic scan and simulating intraoral periapical images each with the individual capability to probe the panoramic layer to find better details. The key to this technology is the new cadmium telluride (CdTe) sensor. Some evaluations of this technology will be presented. Another new application of an old technology is the introduction by a Finnish manufacturer (Planmeca) of the capability of a panoramic machine to produce subtractive images. The key to this technology is the fact that the ProMax machine is equipped with an occlusal arch index patient positioner / repositioner. A demonstration of this software and technology will be presented. Since late in the 20th century cone beam computed tomography (CBCT) has been developed and is being actively commercialized today. Many dental applications have been advocated and the next wave of adoptions will possibly involve orthodontic applications such as space analysis and 3D cephalometry. We have patented a process to produce CBCT subtractive images which will be demonstrated. The focus of this presentation will be the clinical applications of new emerging and developing near future technologies.

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Biological Basis for Action of Radiation Protection in Oral and Maxillofacial Radiology

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Lecture description:

Recent progress in understanding biological basis for radiation carcinogenesis indicates that even small radiation doses are not entirely without risk. A small fraction of the malignant diseases occurring in the population can be attributed to natural background and man-made radiation. Since diagnostic medical exposure is the major source of radiation exposure of the population, radiologists, referring medical and dental practitioners should be aware of the dose-response relation in the risk of radiation carcinogenesis and its mechanisms. Recognition and repair of DNA double-strand break, cell cycle checkpoint and signal transduction mechanisms in relation to expression of gene mutation and apoptotic cell death are major variables that influence the risk of radiation carcinogenesis.

In reviewing the epidemiologic and biological evidence, the action for justification of X-ray examination and optimization of the protection should be based on the risk of individuals for more efficient use of radiation exposure in diagnostic imaging.

Learning Objectives (Participation will enable the attendee to:)

1. Describe the epidemiological evidence on cancer risk by a lowest dose of radiation.
2. Evaluate a relative cancer risk attributable to low doses of radiation.
3. List any epidemiological evidence of cancer risk by diagnostic medical and dental radiation exposure.
4. List biological factors that influence risk of carcinogenesis by a low dose of radiation.
5. Describe variable sensitivities to radiation carcinogenesis among human subpopulations.

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**Great Patents in Medical Imaging:
Research, Invention and the Patent Application Process**

Barry Pass

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Lecture description:

The lecture will begin with a discussion of the patent application process and its relationship to research and the inventive process. There will then be a discussion of the hallmark patents in medical imaging over the past century. Conventional X-ray imaging, CT, MRI, nuclear medicine, ultrasound and optical imaging will be discussed. The talk will conclude with a discussion of the controversies surrounding inventorship and patent rights in medical imaging.

Learning Objectives:

1. Understand the patent application process and its relationship to research and the inventive process.
2. Become familiar with the principles and history of the great patents in medical imaging.
3. Understand the difficulties in establishing claims to inventorship and intellectual property rights.

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Cone beam computer tomography for image guided oral and maxillofacial surgery

Georg Eggers

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Lecture description:

Image guided surgery becomes more and more common in oral and maxillofacial surgery, predominantly based on Computer Tomography (CT) image data. Recently, Cone Beam Computer Tomography (CBCT) was introduced as a new modality for maxillofacial imaging. The predominant indication of CBCT in the field of image guided maxillofacial surgery is dental implant placement. In the lecture, technical properties of CBCT image data and differences to CT are discussed, as well as current trends in the technical development of imaging devices. The impact on the usability of CBCT in image guided maxillofacial surgery beyond dental implant placement will be discussed.

Learning Objectives:

1. Current status of image guided oral and maxillofacial surgery
2. Technical considerations concerning cone beam computer tomography image data
3. Indications for cone beam computer tomography in image guided maxillofacial surgery.

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Imaging diagnosis of salivary gland diseases

Zuyan Zhang

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Lecture description

The modalities for diagnostic imaging of salivary gland diseases include plain film radiology, conventional sialography, computed tomography, magnetic resonance imaging, ultrasonography, and scintigraphy. Plain film radiography can demonstrate sialoliths and the possible involvement of adjacent osseous structures. Conventional sialography is the most appropriate imaging modality for obstructive and associated inflammatory conditions, which primarily involve the ductal system. Ultrasound, CT, and MRI are appropriate for evaluation of a space-occupying mass. Scintigraphy can provide important physiologic information of the glands, which is helpful for evaluation of the functional disorders of salivary glands. The imaging features of the salivary gland diseases will be presented.

Learning Objectives

1. to compare the advantages and disadvantages of various imaging modalities used for diagnosing salivary gland diseases
2. to know how to select appropriate imaging modalities for diagnosis of disorders of salivary glands
3. to interpret image features of the salivary gland diseases

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Clinical, radiological and pathological implantology

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Lecture description:

The use of oral implants has grown extensively due to increased demand for dental care. Recently, surface modification of materials has become an important area in medical engineering. Although a number of chemical and physical methods for such surface modification have already been established, there is still an urgent need to establish a method whereby titanium surfaces may be “biologically” modified for use in regenerative medicine. In this lecture, I am going to talk about the implant-tissue interface, epithelium, fibrous connective tissue and bone, and bone response to implant, in terms of Clinical, radiological and pathological points of view.

Learning Objectives (Participation will enable the attendee to:)

1. Clinical Implantology
2. Radiological Implantology
3. Hisito-pathological Implantology

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**Malignant tumors and chronic infections in the masticator space:
assessment with in vivo single-voxel 1H magnetic resonance spectroscopy**

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The differential diagnosis between malignant tumors and chronic infections in the masticator space remained challenging by using conventional CT and MR imaging. The single-voxel 1H MR spectroscopy (1H-MRS) was aimed at exploring the availability of differentiation both lesions. Based on our observation, three 1H-MRS types were identified: type 1, lesions without Choline signals (only found in chronic infections); type 2, lesions with Choline signals and Choline/Noise ratio less than 3 (found in both lesions); and type 3, lesions with Choline signals and Choline/Noise ratio more than 3 (only found in malignant tumors). Statistically, there was significant difference between both lesions when Choline/Noise ratio was applied to evaluate. In vivo single-voxel 1H-MRS may be helpful in assessment of the masticator space lesions. Differences of Choline signals and Choline/Noise ratios between malignant tumors and chronic infections provide valuable information in differentiation of these two lesions.

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Imaging of tumors and their mimics

Tore A. Larheim

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Lecture description:

In the jaws, a number of benign and malignant tumors, as well as tumor-like conditions may be found. Imaging characteristics of some of these conditions will be shown and discussed, with particular focus on the relative diagnostic value of CT and MR imaging.

Learning Objectives:

1. obtain knowledge of imaging characteristics of some benign and malignant conditions in the jaws
2. to obtain knowledge of whether or not it possible to differentiate between different conditions, by imaging

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Radiology in Endodontics

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Lecture description:

The most commonly used clinical tool in endodontics is without doubt the radiograph. The radiograph gives us invaluable information before, during and after endodontic treatment. However, the radiograph has its limitation mainly because it depicts a three dimensional object in only two dimension. Consequently, conventional radiographs sometimes show false positive or false negative signs. In these cases, some other means of diagnosis should be added to arrive at an accurate diagnosis. In this respect, newly developed “cone-beam CT” is quite useful. We present in this lecture a cone-beam CT, in addition a pulpal vitality test using laser Doppler systems.

Learning Objectives

1. To know usefulness of radiograph in endodontics
2. To know limitation of radiograph
3. To know a newly developed “cone-beam CT” in the endodontic field
4. To know a newly developed “laser Doppler system” as a pulp diagnosis

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Relationship between clinical and magnetic resonance imaging diagnoses and findings in degenerative and inflammatory temporomandibular joint diseases: A systematic literature review

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Lecture description:

The aim of this article was to describe evidence for a relationship between diagnoses and findings of clinical examination and diagnoses and findings of MRI examination for degenerative and inflammatory TMJ diseases. The literature search yielded 219 titles. After data extraction and interpretation with the QUADAS tool, 23 studies remained. No clear evidence was found for a relationship between clinical and MRI diagnoses and findings. This review reveals a need for studies with improved quality in reporting of samples; examination techniques; findings; and definitions and rationales for cutoffs, categories, and diagnoses. We recommend that standardized protocols such as the RDC/TMD and STARD statement be implemented in future studies.

Learning Objectives:

1. Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool
2. Standardized protocols of clinical diagnoses and findings for TMJ diseases
3. Standardized protocols of MRI diagnoses and findings for TMJ diseases
4. Evaluation of evidence
5. Methodological consideration of the systematic review

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Dental PACS Development in Korea

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Lecture description:

Picture archiving and communication system (PACS) is an image information technology system for the transmission and storage of medical images. The benefits of PACS are manifold, including cost savings, decreased environmental pollution, the customer satisfaction, etc. In Korea, the first full PACS was installed at Samsung Medical Center in 1994. However, the rate of distribution was very slow. The turning point was the government's approval for the medical insurance reimbursement for full PACS examinations on November 1999. The number of hospitals with full PACS has steeply increased. By the end of the year 2007, PACS was installed at 799 medical institutes, including most of University Hospitals and hospitals with more than 100 inpatient beds (by Health Insurance Review and Assessment Service). The first full dental PACS was installed at Wonkwang University Dental Hospital in 2002. Now, ten out of eleven University Dental Hospitals in Korea implemented full dental PACS. The current status of dental PACS at Korean University Dental Hospital will be presented.

Learning Objectives:

1. the history and benefits of PACS
2. the situation of very acute climbing up of PACS diffusion in Korea
3. the current status and technological factors of dental PACS installation in Korean University Dental Hospitals
4. the future perspective of dental PACS

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IGRT management of Head and Neck Cancer with Tomotherapy

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Lecture Description:

Head and Neck (H&N) cancer was a significant cause of morbidity and mortality of man in Taiwan. Radiotherapy plays an important part in the treatment of H & N cancer. But recurrence and local-regional failure were still in high incidence. Great efforts are underway to widely investigate using new technology, such as helical tomotherapy which may allow using new technology in radiotherapy as IMRT, IGRT for dose escalation to tumor and reducing the toxicity of the normal tissues.

In this presentation, we will discuss recent advance in H & N cancer radiotherapy, with special consideration in the application of IMRT and IGRT to improve outcome.

Tomotherapy as a new technology for reducing toxicity will be discussed.

Learning Objectives:

1. Conception Target Volume in Radiation Oncology
2. Mechanism of Tomo-therapy
3. Dose distribution of Tomo-therapy
4. Role of Normal tissue Protection

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**VX2-induced rabbit oral and hind limb squamous cell carcinoma (SCC)
- An imaging and cytohistopathological study**

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Lecture description:

The purpose of the first part study is to evaluate the advantages and disadvantages of FDG-PET and Ultrasound(US) examination on VX2-induced rabbit SCC in oral maxillofacial region and hind limb. The aim of second part study is to examine the cytology and histology of the VX2 induced tumors, cervical lymph nodes (LN) and distant metastasis upon direct implantation of VX2 tumor tissue into the cheek and submandibular areas and hind limb of rabbits.

Learning Objectives:

1. Ultrasound examination should be considered as a valuable supplemental diagnostic imaging tool to FDG-PET examination.
2. The results of this investigation showed that VX2 tumor implantation on both cheek & submandibular areas of rabbits are a potential way for local LN invasion of head & neck cancers and distant metastasis (lung) research of hind limb cancer.
3. The cytology and histopathological findings of primary tumors and metastatic cervical LN and lung revealed poorly differentiated SCC.

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Osteoporosis and Radiographs

Akira Taguchi

Matsumoto Dental University, Nagano

Lecture description

Osteoporotic fractures are crucial health concerns worldwide. There are many asymptomatic elderly patients who should undergo skeletal bone assessment. Several screening tools have been developed and applied over the world; however, a large number of asymptomatic patients still remain under-diagnosed. Recent studies suggest that dental radiographs, especially panoramic radiographs, may be a useful tool for identifying individuals at risk of having osteoporotic fractures. If dentists around the world understand how they can screen these patients before fractures and refer them to medical professionals, dental clinics may be one of “platform” in screening for osteoporosis.

Learning Objectives

1. Understand the relationship between bone mass of general skeletons and jaw bones.
2. Understand as to how we can identify asymptomatic elderly with osteoporosis by panoramic radiographs
3. Screen asymptomatic elderly with osteoporosis in their own dental clinics and refer them to medical professionals

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Imaging of the TMJ: current concepts

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Lecture description:

Radiographic imaging of the temporomandibular joint is not a new modality. The anatomical location of the TMJ and its position surrounded by other bone structures, make it difficult to create an unobstructed view of the TMJ. Several projection techniques have been proposed in the past to achieve this result. With the introduction of Cone Beam CT in dentistry, we have a new imaging modality that allows us to create three-dimensional images of the TMJ without the overprojection of adjacent anatomical structures. Cross-sectional imaging and interactive three-dimensional imaging will help to create images never thought of in the era of film based two-dimensional projection radiography. This lecture will help to select the most appropriate imaging technique for specific TMJ-disorders.

Learning Objectives:

1. to interpret 2D and 3D images of the normal TMJ.
2. to recognize the most common TMJ-disorders.
3. to compare different TMJ imaging modalities and describe the advantages and disadvantages of these techniques.
4. to use selection criteria for TMJ imaging modalities in different situations.
5. to recognize imaging errors and know how to correct them.

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An overview of the status of Oral and Maxillofacial Radiology in South Korea

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Although x-ray had been used in Dental Clinic and taught as Roentgenology as a part of other lectures, the independent lecture was established at Seoul National University in 1953. Korean Academy was organized as Korean Academy of Dental Radiology in June, 1959. The first independent Department was separated from the Department of Oral Surgery at Seoul National University in 1963. Nowadays, there are 6 national and 5 private dental schools in South Korea. Each dental school has a Department of Oral and Maxillofacial Radiology, which fulfills its role in student education and clinical service. What is specially noteworthy is that 8 of the 11 dental schools have or will change from the 2 + 4 year system to 4 + 4 year system (postgraduate course). Which ever the case, both systems provide a four year program for the achievement of a Doctor of Dental Surgery (DDS) or a Doctor of Medicine in Dentistry (DMD). To enter the dental schools with the 4 + 4 year system, applicants should possess an undergraduate degree. The curriculum has also been or is being amended according to this change. Although the contents of courses for Oral and Maxillofacial Radiology are not much different among dental schools, the methods and structure of education are various. All dental schools have their own training program for Oral and Maxillofacial Radiology in school (master and PhD program) and dental hospital (residency program), independently. The specialty for Oral and Maxillofacial Radiology was recognized in the dental society since 1965. The governmental recognition of the specialty for Oral and Maxillofacial Radiology had set in with the 9 other specialties since 2005.

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Dental education in Thailand

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There are 8 public and one private dental schools in Thailand and all of their study programs are authorized by the Thai Commission on higher education. The programs provide for both undergraduate and postgraduate levels. Moreover, the postgraduate programs are divided into two tracks: educational and professional. The educational track is comprised of Master and Ph.D. degrees, whereas the professional track includes higher graduate diplomas and Thai specialty boards. Normally, students study for six years in the undergraduate program and earn the Doctor of Dental Surgery degree. Each dental school determines its own curriculum. A minimum of 180 credits is required. However, most of the dental school programs provide excessive study credits, during which most of the teaching is through one-way communication from the instructor to the student. As a result, the dental students have a lack of critical and analytical thinking skills and limited self-study time. The Thai Dental Council is aware of the above issues. Therefore, competency-based learning was established as a guideline for the schools to amend their curricula. Moreover, a Thai dental licensure examination was introduced for the undergraduate students in this year. This examination will be held in two parts, when the students finish their third and sixth years, to evaluate pre-clinical and clinical knowledge, respectively. Consequently, all Thai dental schools need to adjust their curricula to conform to the licensure examination. Oral and Maxillo-Facial Radiology (OMFR), including undergraduate and postgraduate courses, are also effected by the new guideline and examination. Inevitably, OMFR is finally reinforced by the dynamic changes in Thai dental education. The growth of updated technologies, including digital imaging and cone-beam computed tomography, demand for implant and orthodontic treatments, and the need for forensic dentistry in personal identification, are all considered to be factors supporting the development of OMFR in Thailand.

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Status of Oral and Maxillofacial Radiology in dental schools and dental imaging facilities in major cities of Bangladesh

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Currently, there are about 3500 registered dental surgeons in Bangladesh with a population of 140 million. There are three (3) government/public and nine (9) private dental schools that offer 5 years Bachelor of Dental Surgery (BDS) degree graduating 300-350 dental surgeons every year. Additionally, one graduate institute (Medical University) offers post graduate Diploma (DDS), Masters (MS) and fellowship (FCPS) programs in field of Oral and Maxillofacial surgery, Prosthodontics, Operative and Orthodontics. While there is no separate Dental Radiology program as such but is included within the Operative dentistry. Most radiological services, however, are provided in all these institutions, major hospitals as well as private commercial vendors or diagnostics centers. Here in this survey, we intend to assess the status of overall dental radiographic service, education and knowledge amongst the dental practitioners as well as dental students. A questionnaire was mailed and physically handed over to the offices of 468 private general dental practitioners (GDPs), 27 diagnostic centers, 10 dental institutions and 7 private multidisciplinary hospitals in Dhaka and Chittagong, two largest cities. The response rate of the questionnaire was 62%. The survey showed that periapical is the most common type of dental radiographs used. 15% of GDPs reported to have used periapical radiographs in their offices and the rests (85%) GDPs referred their patients to diagnostic center for both periapical and panoramic X-Rays. None of the GDPs utilized automatic processing in their offices. Only 6% used film holder, rest have their patients hold the film. Study also showed that only 26% of the diagnostic centers were using the digital panoramic radiographs. Only 20% of dental educational institutions have panoramic radiograph facility and the rests have only periapical X ray facility. Only 1% of the GDPs have RVGs. Study also showed that in Dhaka city, majority of the dentists use Kodak film (Ultra speed E). The Panoramic X-Ray equipments are about 7-9 years old and only 15% of the dental practitioners are aware of servicing the equipment. The overall knowledge of technical details was limited. The survey outcome from Chittagong is similar to that of Dhaka city. Results showed that the standard of radiographic procedure, maintaining guidelines, radioprotection, and equipment handling are very poor. This study reveals a concerning flaw in overall dental radiology in Bangladesh. Standards of radiological services are considerably lower than that of developing countries. To amend such alarming and dismal radiological services, providers require improved undergraduate training, provision of post graduate courses/training program in the field of Dental Radiology as well as proper guidance issues by the appropriate authorities.

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The developmental trend of oral radiology in China

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From the point of view of the development of oral radiology in Peking University School of Stomatology, the developmental trend of oral radiology in China was surveyed. In the past more than half century, especially in the past 20 years, a great advance occurred in the department of oral radiology of Peking University School of Stomatology. The staffs and faculties of the department are almost double than 20 years ago. Simultaneously, more advanced imaging equipments were settled down in the department, such as high resolution spiral CT, cone beam CT, equipments of digital radiography and computed radiography, Color Doppler Unit, and etc. About five hundred patients undergo radiographic examinations on the average every day in Peking University Hospital of Stomatology. Education of oral radiology for undergraduate students has been much more emphasized. With the advancement of imaging, oral radiology plays more and more important role in the field of stomatology. Linking clinical work and imaging diagnosis more closely is another important point in the development of oral radiology department of Peking University School of Stomatology, especially in the field of temporomandibular disorders, diseases of salivary glands and interventional radiology. Some basic research works related have also got good achievements. The similar situation has also occurred in more and more dental schools of China, especially in the key dental schools. The trend of oral radiology is bright in China. However, we do face some problems in the development of oral radiology. So far, oral radiology is still not a speciality in China. This is a big problem which blocks the developmental speed of oral radiology in China. In addition, the budget for purchasing imaging equipments is still in low water comparing with the valuable price of these equipments.

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Status of Oral and Maxillofacial Radiology in India

Kikkeri S. Nagesh
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At the time of Independence in 1947 there were only three Dental Colleges in India and as on now the number of Dental Colleges is 271 with total BDS intake of 21130. The colleges are distributed geographically in all regions of India. BDS course is of five years duration after 12 years of school education. The students are admitted under different categories by differential tuition fees as most of the colleges are self financing institutions. MDS course is offered in nine specialities namely: Oral Medicine & Radiology, Conservative Dentistry, Oral Surgery, Prosthodontics, Pedodontics, Periodontics, Community Dentistry, Orthodontics, and Oral Pathology. Duration of MDS course is of three years. Total number of colleges offering MDS in various specialities is 122. Total number of Dental Colleges offering MDS in the speciality of Oral Medicine & Radiology is 67. Total intake in Oral Medicine and Radiology is 190. During three years the students are trained in the following areas. The students maintain log book of work done in the department during the period of training. Library Dissertation, Thesis, Synopsis, Case History, Radiographs, Peripheral postings, Seminars, Journal clubs, Clinical Pathological conferences, Lectures for BDS and Conference–poster/paper presentations. Logbook of the work done is submitted to department at the end of three years. The students are posted in Major hospitals like NIMHANS, Bangalore Institute of Oncology, Sevakshetra Hospital for training in two areas. Oral Medicine - where they emphasis on Dental Management of medically compromised patients. Radiograph which consists of conventional radiograph like Intra oral, Periapical Occulsal radiograph, OPG and other extra Oral Radiographs. The students are trained in various techniques of these radiograph and maintain record of the interpretations. Students are posted to centers where there is MRI and CT Scan facilities are available and trained in interpretations of these investigations. Students are examined by panel of examiners two from institution and two from outside university and successful candidates are conferred MDS in Oral Medicine and Radiology. In R.V.Dental College there are BDS course with an intake of 60 students and MDS in 8 specialities. Two candidates per year for MDS in Oral Medicine and Radiology. The following are the faculty members involved in training: Dr.K.S.Nagesh, Professor & HOD and Principal, Dr.Asha R Iyengar, Professor, Dr.Jyoti Gupta, Associate Professor, Dr.Divalakshmi M.R., MDS, Lecturer, Dr.Sushma Mehkri, MDS, Lecturer. So far, three batches of students are passed out from the department.

K.S. Nagesh:

1992-: Working as Professor & Head of the Department of Oral Medicine & Radiology D A Pandu Memorial R V Dental College

1991-2005: Member, Dental Council of India

Past President of Indian Academy of Oral Medicine & Radiology

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The development of dentomaxillofacial radiology in Hong Kong for the past 25 years

Thomas Li

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The Faculty of Dentistry, The University of Hong Kong was founded in 1982. As a new dental school then under British colonial rule, nearly all teaching and equipment were a direct copy of the United Kingdom. Most teaching staff was from England as well. For the first 10 years, the emphasis was on developing the undergraduate program; not much postgraduate teaching was available. In the 1980's, dentomaxillofacial radiology (DMFR) was limited to interpretation of oral and dental pathology using panoramic machine and intra-oral projections. It was in the mid 1990's when the Faculty was equipped with the Soredex Scanora machine, which started to change the prospective of DMFR. Radiographic projections became sectional to 3 dimensional instead of just 2D. It was in the early 2000's when helical and then cone beam CT's were installed in the dental school, there was fundamental changes in radiographic examination. The increase in demand for dental implant and its required imaging contributed to the rapid changes. As the importance for diagnostic imaging grows, the demand for postgraduate training also increased. In 1997, the dental school started the first class of students for postgraduate diploma in dental surgery (oral radiology). This is a two years part-time program designed for general dental practitioners to have further training the DMFR in order to meet the modern practice requirement. There is plan to upgrade this program to a two year full-time master programme in the future.

Thomas Li

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Oral and maxillofacial radiology in Japan

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Between countries, there may be some differences in the situation of oral and maxillofacial radiology (OMFR) in various aspects, such as history, undergraduate and postgraduate educations and clinical practice. Japanese society for oral and maxillofacial radiology started in 1960 and now has more than 1000 members including some foreign investigators. Annual scientific meeting and 4 local meetings are held. Sixteen committees address various problems in OMFR. Regarding education, we have 29 universities for dental education and all of them have department or section for OMFR education. In this symposium, I will present the OMFR in Japan regarding following items.

1. Brief history and current status of Japanese Society for Oral and Maxillofacial Radiology.
2. OMFR in undergraduate education.
3. OMFR in postgraduate education.
4. OMFR in university hospital and general practice.

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Keynote: Multi-dimensional imaging for dental practice

Allan G Farman

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The future is here... 2D shadows being replaced by 3D and 4D anatomically precise diagnostic images. The radiograph no longer restricted to static interpretation of disease processes. Modern images are providing simulations and facilitating image-guided treatment. Sand grains compressed into silicon-based detectors... sensing different portions of the electromagnetic spectrum and other radiant energies... bits and bytes encoding structure and volume element shades... wired and wireless transmission, archiving and display. Artificial intelligence “screaming out” – look again. Haptic... Robotics... future dental clinicians as architects of biologic and esthetic harmony... We will look at present day imaging technologies available both to the dental practitioner through referral of patients to outside services or integration into the dental office... and we will peek into the predictable futures trends likely to occur over the next two to three years. Pitfalls as well as potentials for improved healthcare will be addressed.

Topics overviewed will include multi-dimensional imaging:

- Enabling technologies
- Limiting parameters
- Safety considerations and selection criteria
- Dental implantology
- Temporomandibular joint/craniofacial practice
- Cephalometric image generation
- Laser-generated models and stents
- Computer-aided diagnosis
- Image-guided treatment

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1982; Diplomate American Board of Oral and Maxillofacial Radiology

1988-95; 2005-Current: Scientific Editor, American Academy of Oral and Maxillofacial Radiology.

1994-97: President, International Association of DentoMaxilloFacial Radiology

1995-Current: Founder and Chair: International Congress and Exposition on Computed Maxillofacial Imaging.

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Efficacy of CBCT in Endodontics and Dental Traumatology

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In dentistry, X-ray images are a major point of reference for diagnosis in Endodontics. However, conventional dental and panoramic images are inevitably limited because they are two-dimensional. For this reason, the author decided to use the CBCT (3D Accuitomo. J. Morita Manufacturing Corporation). Many dentists probably think that a CT apparatus, which is both large and complex, would be used mostly to plan implant therapy. However, the author found that the micro CT does not take up so much space as one might expect and frequently uses it in the diagnosis of a wide variety of conventional dental diagnoses. My presentation will discuss the efficacy of CBCT especially in the Endodontic field including dental traumatology with showing many clinical cases.

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Cone beam computed tomography and clinical application for dental implant

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Dental implants have become part of routine treatment plans in many dental offices because of their increasing popularity and acceptance by patients. It is important to be able to place the implants in the mandible and maxilla with a high degree of precision. No tool in dentistry plays a more vital role in diagnosis and treatment planning than radiography. Appropriate preplacement planning, in which imaging plays a pivotal role, helps to ensure a satisfactory outcome. The development of precise presurgical imaging techniques and surgical templates allows the dentist to place these implants with relative ease and predictability. Before attempting to treat a patient with a dental implant, dentists must determine jaw size, boundaries and orientation of the vertical long axis of the jaw. In addition, internal anatomy should be visualized in 3-dimensional perspectives, including the proximity of nasal fossae, neurovascular bundles, pneumatization of the maxilla, soft tissue morphology and bone quality. Imaging information will allow optimum placement of the implants and enhance the success, both short and long term, of all subsequent stages of the procedure. The use of computed tomography for dental imaging procedures has increased recently. Cone beam computed tomography (CBCT) systems have been designed for imaging hard tissues of the dentomaxillofacial region. CBCT is capable of providing high resolution in images of high diagnostic quality. This technology allows for 3-dimensional representation of the dentomaxillofacial skeleton with minimal distortion, but at lower equipment cost, simpler image acquisition and lower patient dose. Because this technology produced images with isotropic sub-millimeter spatial resolution, it is ideally suited for dedicated dentomaxillofacial imaging. We provide a brief overview of cone beam scanning technology and basic principles of currently available CBCT systems. Also, we focus on various clinical applications of CBCT imaging procedures and the diagnostic role of CBCT for dental implant placement.

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What will be changed by CBCT analysis?

Koutaro Maki

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At the beginning stage of CBCT history, some critical comments for its application were presented by researchers who have no foresight or no experience. A few years later, as the second stage, we summarized possibilities and limitations provided by CBCT in our Orthodontics.

- 1) Visualization of the actual conditions which could not be seen in 2D images. Since precise evaluation of alveolar bone has become possible, diagnoses may change radically, and our therapeutic techniques themselves might be affected.
- 2) Simulation of treatment that could only be imagined. 3D simulation is indispensable for the selection of the optimal method which including orthognathic surgery and is useful for explanations to patients.
- 3) Clarification of biological mechanisms that could not be explained. Biomechanical analysis (3D FEM) by using CBCT data and other functional information, will become our important tool for the determination of treatment goals.
- 4) Substitution of modalities that have been used. All data for the diagnosis can be substituted. Cephalometrics and panoramic X-ray images were regenerated from volumetric CBCT data. Image data will be used also for automatic preparation of appliances as they are combined with the CAD/CAM technology.
- 5) New image processing algorithm for measurement of actual CT value. To correct the CT value in CBCT image, software program which eliminate the beam hardening was developed by Hitachi Corp. (Tokyo, Japan). Bone density measurement will gave more useful information to dental field.

This history also taught us the necessity of creative and strong mind for advancement of dental treatment and dental science.

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Intraoperative CBCT – the future of image guided surgery

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In general image guided surgery relies on sufficient preoperatively acquired slice imaging data i.e. CT or MRI DICOM stacks. The datasets are transferred to so-called navigation interfaces which consist of a special GUI (graphical user interface) for segmentation and finally navigation purposes. Datasets can be segmented prior to navigation to reduce the file size and to increase response speed of the navigation interface. In the OR the patient has to be referenced on the pre-acquired dataset/s. This is normally done with fiducial markers or optical reference markers. Both of them are tracked by an infrared stereo camera system. This process is a simple triangulation to calculate the exact position of a marker or a landmark in a 3d coordinate system. It is similar to GPS. There is one big issue – accuracy. Accuracy depends on the spatial resolution of the datasets, strictly speaking the voxel size. Up to now the major limitation for navigation accuracy is the reference method. To overcome traditional referencing procedures intra OR imaging units (3D C-arms) will be used. Beside of the aforementioned facts there are a lot of indications for intraoperative 3D imaging. Direct intraoperative control of the therapeutic outcome is by far the most important issue. It reduces the number of additional interventions and the related monetary efforts. Therefore we see a strong influence on further quality assurance approaches in craniomaxillofacial surgery. A rather new field for intraoperative imaging can be identified for orthognathic surgery. It offers the possibility to update preoperative planning and to control the osseous changes of the current intervention. This is done by import of the C-arm data into the planning interface and a consecutive fusion with the prior acquired dataset. Finally one has to ask for the radiation burden linked with intraoperative imaging. Our measurements revealed that an examination with a BV Pulsera 3D-RX (Philips, Best, The Netherlands) in high resolution mode leads to an effective dose of 86 μ Sv. This is comparable to a standard dental CBCT examination.

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Understanding Dental Full PACS and Dental HIS

Kee-Deog Kim and Hyok Park

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Lecture description:

Picture Archiving and Communication System (PACS) is a medical image storage and transmission system, which transmits medical images, in particular over high speed communication networks after converting them in digital format, and stores medical images in digital format instead of common x-ray films. PACS consists of four major parts; Acquisition, Network, Storage, and Display.

For successful installation of dental full PACS, it is very important to understand the existing imaging modalities, work flow, treatment procedures, characteristics in image search and other specific hospital environments. Also it must be considered for Hospital Information System (HIS) such as Order communication System (OCS) and Electric Medical Record (EMR) system. Yonsei Dental Hospital which owns about 263 dental unit chairs, is one of the true digital dental hospitals, successfully installed dental full PACS in Feb. 2004, and also successfully installed dental EMR in Nov. 2007. In this workshop we will discuss the consideration factors of dental full PACS and EMR. And we will share the experience of fully digitalized dental hospital.

Learning Objectives

1. To understand the concept and components of Dental Full PACS and HIS
2. To understand the operating system of Dental Full PACS and HIS
3. To share the four year experience of Dental full PACS
4. To understand Digital Dental Hospital Environment

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MR Imaging of the Temporomandibular Joint

Tore A Larheim, Kazuya Honda and Mika Otonari

University of Oslo, Norway, Nihon University, Tokyo, Tokyo Dental College, Chiba

Lecture Description:

A common cause of chronic facial pain is Temporomandibular Disorder (TMD), being a collective term for a number of conditions affecting the TMJ and masticatory muscles. Most common of these is myofascial pain or muscle disorder, another is internal derangement with or without osteoarthritis. Less common disorders are inflammatory diseases, fractures, developmental disturbances, ankyloses, neoplasias or tumor-like conditions, and congenital malformations. Symptoms for the most common disorders are similar, with variable or incessant pain and limited mouth opening. These disorders are multifactorial in nature and associated with somatic and psychological complaints that include fatigue, sleep disturbances, anxiety and depression. To determine the diagnosis and the most suitable course of action, clinical examination must be supplemented with imaging examinations. Although various methods have been used to assess TMJ conditions, MRI gives more diagnostic and differential diagnostic information than other imaging methods available.

Learning Objectives:

The objective of this workshop is to give training on the basic knowledge required for the diagnosis of the TMJ disorders.

Workshop Contents

1. Anatomy of the TMJ
2. Protocol on MRI examination
3. Diagnosis of the TMJ

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Mika Otonari-Yamamoto

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2000: Research Fellow, Department of Radiology, Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston
2005: Assistant Professor, Department of Oral and Maxillofacial Radiology, Tokyo Dental College

Ultrasonography of the Head and Neck

Takafumi Hayashi and Yoshiko Ariji

Niigata University, Niigata and Aichi-Gakuin University, Nagoya

Lecture description:

We will offer the chance to study and experience head and neck sonography using a hand-carried ultrasound system. Normal sonographic anatomy and the characteristic pathological findings of various diseases involving the head and neck region including some advanced topics will be lectured.

Learning Objectives (Participation will enable the attendee to:)

In this course, learners are expected to acquire the sonographic description of morphological and functional status of the head and neck structures as follows:

- 1) Major salivary glands (submandibular and parotid glands)
- 2) Cervical lymph nodes
- 3) Masticatory muscles (masseter and temporalis muscles)
- 4) Temporomandibular joint

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CT/MRI of the Head and Neck

Tohru Kurabayashi and Jun-ichi Asaumi

Tokyo Medical and Dental University, Tokyo and Okayama University, Okayama

Lecture description:

CT/MRI has proved to have excellent ability in demonstrating normal anatomy and pathologic processes in the head and neck. Whereas CT best depicts bone structures, MRI is superior to CT in evaluating soft tissues. The contents of bone lesions may also be better visualized on MRI. In this workshop, among a variety of lesions in the head and neck, we would like to focus on those occurring in the jaw bones or the adjacent soft tissues. We will present their representative CT and MR images and discuss the imaging characteristics that provide important clues to differential diagnosis.

Learning Objectives (Participation will enable the attendee to:)

1. Odontogenic cysts in the jaw bones. Radicular cysts are the most common odontogenic cysts found in jaw, followed by dentigerous cysts. Other cysts include nasopalatine duct cysts, solitary bone cysts and aneurismal bone cysts.
2. Benign odontogenic tumors in the jaw bones. Cystic ameloblastomas and odontogenic keratocysts develop sometimes in the jaw as a monolocular cystic lesion.
3. Cystic masses developing in the floor of the mouth and/or suprahyoid neck. Ranulas and other cystic masses including dermoid/ epidermoid cysts, branchial cleft cysts, thyroglossal duct cysts and several types of cystic tumor.

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Video Fluoroscopic Swallowing Study (VFSS) - The “Gold Standard” Investigation-

Koji Takahashi

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Lecture Description:

The video fluoroscopic swallow study (VFSS) is the most commonly utilized instrumental assessment tool to determine the nature and extent of an oropharyngeal swallowing disorder. The studies are captured using fluoroscopy in video or digitized format that allows detailed analysis of the oropharyngeal swallowing process. The VFSS does not diagnose the etiology of the swallowing disorder; instead, it determines the details of oropharyngeal swallow dysfunction and helps guide decisions regarding behavioral swallow therapy based on those findings.

Indications:

1. To identify normal and abnormal anatomy and physiology of the swallow.
2. To evaluate integrity of airway protection before, during, and after swallowing.
3. To evaluate the effectiveness of postures, maneuvers, bolus modifications, and sensory enhancements in improving swallowing safety and efficiency.
4. To provide recommendations regarding the optimum delivery of nutrition and hydration.
5. To determine appropriate therapeutic techniques for oral, pharyngeal, and/or laryngeal disorders.
6. To obtain information in order to collaborate with and educate other team members, referral sources, caregivers, and patients regarding recommendations for optimum swallow safety and efficiency. Methodology, indications, contraindications, limitations and interpretation of VFSS will be discussed in this hands-on workshop.

Learning Objectives:

1. This workshop aims to enable the radiologists and other specialists to start and run VFSS labs.
2. Methodology, indications, contraindications and limitations of VFSS will be discussed in this hands-on workshop.
3. The VFSS case interpretation exercise in this workshop also ensures the participants to be able to accurately interpret the VFSS reports.

Koji Takahashi:

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Radiotherapy of Head and Neck Cancer

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In the treatment of head and neck cancer, clinicians should consider the functional results of the treatment. Surgery sometimes causes a severe deformity or a dysfunction of the swallowing and/or phonation. Some cancers can be cured with radiation therapy (RT) without these deformities or dysfunctions. RT can be divided into two groups, including external beam radiation and brachytherapy using small sealed sources of radioisotopes. To improve the treatment results of the external beam radiation, hyperfractionation, accelerated radiation, chemoradiation (CRT), or RT with molecular targeting therapy has been examined. Radiation dose escalation using hyperfractionation resulted in a higher local control rate. Concurrent CRT, or RT with molecular targeting therapy, has been shown to improve not only the local control rate but also the survival rate. Intergroup study of SWOG, RTOG and ECOG has revealed that concurrent CRT for nasopharyngeal cancer (NPC) had improved the survival rates compared with RT alone. Asian NPC is an endemic cancer and most of them are classified as poorly differentiated cancer. Two major Asian trials have drawn different conclusions. A randomized trial from Singapore showed a higher survival rate in the CRT group than the RT group, whereas Hong Kong trial reported the same survival rates between the two. Therefore, it has not been clarified whether the concurrent CRT improves the survival rate for the Asian population, compared with RT alone. Brachytherapy using small sealed sources can deliver a higher dose to the tumor. In the procedure of brachytherapy, radiation exposure to the medical staffs and isolation of the patients in the shielded rooms had been the critical problems. These problems are solved by using the high dose rate remote afterloading system. We carried out a phase III trial comparing the low dose rate and high dose rate brachytherapy for the mobile tongue. This trial showed the same local control rate between two treatments; consequently, we stopped to use the low dose rate brachytherapy for head and neck cancer. In recent years, new RT techniques such as intensity modulated radiotherapy (IMRT), stereotactic radiotherapy, particle beam therapy and so on has been developed. Using IMRT, radiation doses to the critical organs such as the salivary glands and spinal cord can be reduced with maintaining a higher dose to the tumor. Recurrent NPC can be re-treated by RT with relatively smaller risk of severe adverse effect, using stereotactic radiation. The particle beam therapy is effective for the radio-resistant tumor such as malignant melanoma, adenoid-cystic carcinoma and osteosarcoma. In Osaka University Hospital, we have a long history to treat the head and neck cancer patients with dental radiologists. The cooperation between the medical and dental schools is a very important factor for the successful treatment of the patient with head and neck cancer, especially oral cancer.

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The Application of the Teleradiology System in Island Areas

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Purposes: In recent years, Japan has experienced an increasingly population of aging people. It is understandable that it is difficult for the old patients to go to dental clinics regularly and it is difficult to provide high quality dental care to the elderly people in the areas where meteorological conditions are severe or islands areas. In order to correct the above-mentioned problem, telemedicine system has been introduced to some hospitals recently. In 2005, our faculty was selected to conduct the “The training program of medical staff who can contribute to community medicine” by the Ministry of Education, Culture, Sports, Science and Technology. Thus, we have introduced the teleradiology system as means of remedying the above-mentioned situation.

Materials and methods: This teleradiology system (ViewSend Medical, ViewSend Co.Ltd) of our dental hospital can send or receive an X-ray images, voice etc., from an island area clinic through a telecommunication line. In addition, the optical fiber cable and the ADSL could be used for the line. Moreover, by using the regional IP network, the line is secure. At the same time, this system can carry out the marking of the ROI in real time by sharing an image. Moreover, diagnosis and conference can also be performed from a Web camera or a microphone.

Results: An intern doctor may encounter a case which is difficult to diagnose, and the case might need advanced treatment at the clinic in an island area. The introduction of this teleradiology system will help the intern doctor to solve the problem by obtaining the advice of an instructor and a specialist in our dental hospital at the island area clinic.

Conclusion: This system will support a dental treatment of intern doctors in an island area, and will further improve their diagnosis and treatment technique. Therefore, this will render medical service to island areas. This presentation will introduce the teleradiology system and give you details about it

Dental teleradiology system : Application of Dental-X.net

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Purposes: Teleradiology systems is electronically transmit radiographic images and consultative text from one site to another. Common approaches to overcoming the shortage of radiologists are visits to rural clinics or hospitals, and the mailing of radiographs to urban specialists. Increasing attention is being focused on the feasibility of using teleradiology to transmit radiographic images over internet from underserved areas to consulting radiologists. Major advances in telecommunications and computer systems and advances in the ability to capture medical information in digital form have accelerated the ability to apply telemedicine methods in a practical and affordable manner. These enabling factors are especially relevant to radiology, which currently stands out as one of the most technologically and clinically advanced areas for telemedicine applications. We established the dental teleradiology system: Dental-X.net which uses a general computer system. The purpose of this study was to introduce the dental-x.net system.

Materials and methods: We performed a pantomography and dental radiograph which was using general films. The scans were digitized using a generic digital camera and sent to Dental-X.net with interpretation. Radiologist evaluated the digitized images on monitor. Reports were then e-mail to the referring dentist.

Results: This system was able to perform the transfer of the pantomography and dental radiograph image and the impression of views with a general computer system easily.

Conclusion: Dental-X.net system supports the use of general computer hardware and software for emergent teleradiology in which most of the transmitted studies consist of maxillofacial radiograph.

Craniofacial and upper airway characteristics in patients with obstructive sleep apnea – a cephalometric study

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Purpose: The aim of this study is to assess the morphological characteristics of craniofacial and upper airway structures typical of patients with obstructive sleep apnea, through a lateral cephalogram.

Materials and methods: The study was conducted in M. R. Ambedkar Dental College and Hospital, Departments of sleep medicine at SBM Jain Hospital and St. John's Medical College & Hospital, Bangalore. The study had approval of the ethical committee. Thirty patients with history of obstructive sleep apnea, documented through overnight polysomnography, were taken as case subjects, after informed consent. Patients, either totally edentulous, or with all posterior teeth missing, or with past history of surgeries in the cervico-craniofacial region, or minimal cerebral dysfunction, were excluded. Thirty healthy, asymptomatic subjects, referred to our department for lateral cephalogram and in whom bone growth is complete i.e. above 20 years of age, were taken as controls. Digital lateral cephalograms were obtained in the standing position, with the Frankfort horizontal line parallel to floor during the end-expiration phase. The patients were instructed not to swallow during exposure. These cephalograms were then traced for craniofacial and upper airway measurements. The data thus arrived at were compared among the cases and control and statistically analyzed using t-test, to obtain the objectives.

Results: It was observed that there was a statistically significant difference between control group and case group with respect to SNA ($P<0.05$), SNB ($P<0.001$) and ANB ($P<0.01$). Mean SNA and SNB values were found to be larger in controls compared to cases. In ANB, the mean value was found to be larger in case group compared to control group. The mean PNS-ANS length was found to be greater in controls compared to cases. No significant difference was observed between control and case group in Go-Me, Ar-Go and R-GnC3 values ($P>0.05$). With regard to positioning of hyoid bone and epiglottis mean MP-H values, ANS-H values and ANS-Eb values are found to be greater in case group compared to control group. It was noticed that there was a significant difference between control and case group with respect to maximum soft palate thickness [MPT ($P<0.01$)], superior pharyngeal airway space [SPAS ($P<0.01$)] and middle airway space [MAS ($P<0.05$)]. Mean MPT, SPAS, MAS values were higher in case group. But no significant difference was observed between control and case groups with respect to inferior airway spaces IAS1 and IAS2 ($P>0.05$).

Mean BMI (31.8- considered obese) and neck circumference values were found to be greater among OSA cases.

Conclusion: To our knowledge this is one of the first of attempts, to study the characteristics of the morphology of the upper airway and craniofacial structures in Indian OSA patients. In this comparative cephalometric study remarkable differences were found in the variables among OSA and control subjects. It can be concluded that maxillary micrognathia, mandibular retrognathia, increased soft palate thickness, decreased upper airway spaces contribute to OSA. A caudally placed hyoid bone also plays a major role as a variable among OSA patients. Obesity and greater neck circumference have strong association with OSA.

Evaluation of Oral Appliance for Treatment of OSAHS with Three-dimensional CT

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Purposes: To evaluate the adjustable oral appliance in treatment of obstructive sleep apnea and hypopnea syndrome (OSAHS) by three-dimensional CT reconstruction.

Methods and materials: 20 patients diagnosed OSAHS by PSG (apnea/hyponea index (AHI) range 14.0-59.6) were included in the study. The upper airway was scanned at the time of normal respiration and Müller maneuver by spiral CT (GE lightspeed ultra). Each patient was treated using adjustable OSAHS oral appliance and adjusted several times until his subjective symptoms were improved. One month later, each patient was re-evaluated by PSG and re-scanned by three-dimensional CT in two positions. The cross-section area with its corresponding sagittal and transverse diameters and the volume at retropalatal and retroglossal regions, the site and range of upper airway stricture was studied. T-paired test was used in data analysis.

Results: There were significant differences between before treatment and one month after wearing oral appliance. The transverse diameter and cross-section area were increased significantly at retro-palatal and retro-lingual level ($P<0.05$). The volume of upper airway were augmented statistically ($P<0.05$). Müller's test, before and after treatment, indicated that obstructive sites were decreased obviously.

Conclusions: The upper airway three-dimensional CT reconstruction presents distinct advantage in diagnosis stricture localization of OSAHS and prediction the adjustable oral appliance's effective of OSAHS. It's worth of wider utilization.

Analysis of Brain Activities of Healthy Adults during Unilateral Maximal Voluntary Clenching by f-MRI

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Purpose: To investigate the brain activities using functional magnetic resonance imaging (fMRI) during unilateral maximal voluntary clenching tasks in healthy subjects.

Methods: 14 healthy, right-handed subjects participated in this study. Two unilateral maximal clenching tasks were performed. Task 1 was biting a cotton roll with the right molars, and task 2 was biting a cotton roll with the left molars, while the contralateral molars were without contact. The task sessions were designed in a block manner. Image data was analyzed off-line using SPM99 software which is affinitive to MATLAB version 6.5. Group analyses of the data were performed to identify the activated areas of brain.

Results: Group analysis displayed the significant bilateral activations in inferior frontal gyrus (IFG), precentral gyrus, and right superior temporal gyrus (GTs) for unilateral right clenching task ($p < 0.01$, voxels > 20). When $p < 0.001$ and voxels > 10 , only ipsilateral activation in IFG and medial frontal gyrus were found. For unilateral left clenching task, group analysis displayed the significant activations in left GTs, insular, GTs, and precentral gyrus ($p < 0.01$, voxels > 20). When $p < 0.001$ and voxels > 10 , only left activations in IFG, insular, and GTs were found. The brain activation modes of unilateral maximal clenching task were divided into three types as follows: stronger right hemisphere activation, stronger left hemisphere activation, and stronger ipsilateral hemisphere activation.

Conclusion: These findings indicated that inferior frontal gyrus and precentral gyrus were related to unilateral clenching task and individuals had different activation modes when performing unilateral clenching task.

Carotid Artery Calcification Detected on Panoramic Radiographs in the Patients with Metabolic Syndromes

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Purposes: People with metabolic syndrome have high incidence to develop cardiovascular diseases and cerebrovascular accidents. One of the risk factors for stroke is the carotid atheroma which can break off to form an embolus and occlude intracerebral artery. Several studies demonstrated that the routine panoramic dental radiographs were helpful in identifying the patients with carotid artery calcification. The purpose of the present study was to determine the prevalence of carotid artery calcification detected on panoramic radiographs in the patients with metabolic syndromes.

Materials and methods: Eighty five persons from King Chulalongkorn Memorial Hospital who had metabolic syndrome were informed and consented for evaluation of the carotid artery calcifications. Metabolic syndrome is defined as any person who has central obesity, plus two of the following four additional factors: raised triglycerides, reduced HDL-cholesterol, raised blood pressure, or raised fasting plasma glucose level. Central obesity is defined as waist circumference ≥ 90 cm for south Asian men and ≥ 80 cm for south Asian women. Panoramic radiograph was obtained to evaluate the radiopaque mass locating inferior to the mandibular angle and adjacent to the cervical vertebrae at the level of the C3-C4 intervertebral junction. As a gold standard, ultrasound imaging studies of carotid artery were performed for each individual to confirm the presence of carotid artery calcification.

Results: Of the 85 subjects, there were 28 male and 57 female. The mean age of these subjects was 59.8 years with a range of 33 to 75 years. Nineteen patients or 22.4 percent were found positive for carotid artery calcifications detected on panoramic radiographs. Eight of them or 9.4 percent had bilateral calcifications. Eleven of them or 12.9 percent had unilateral calcification either on the right side or the left side. No significant difference was found between the left and the right sides.

Conclusion: The patients with metabolic syndrome have high prevalence of carotid artery calcification seen on panoramic radiographs and should be aware of potential stroke.

First in-vivo OCT Images of Human Labial Glands

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Purposes: Minor salivary glands play an important role in the physiology and pathology of the oral cavity. Biopsies from these glands provide key findings in diagnostic procedures for Sjögren's syndrome. Recently, optical coherence tomography (OCT) has emerged as a high-resolution non-invasive clinical imaging application. The purpose of this study was to show OCT images of human labial glands.

Materials and methods: Our National Hospital for Geriatric Medicine, National Center for Geriatrics and Gerontology has jointly developed a new swept-source optical coherence tomography (SS-OCT) system (Santec OCT-2000®) with Santec Corporation Japan. Labial gland OCT imaging was carried out using this system in a 26-year-old male volunteer using a hand-held in-vivo OCT scanning probe. The labial tissue was scanned in a superior to inferior direction in two and three dimensions.

Results: We present here what we consider to be the first 3-D ultra-high resolution images of in-vivo OCT human labial minor salivary glands in the literature. The OCT images reveal epithelium, connective tissue, lobes and duct. OCT is capable of providing simultaneous and non-invasive structural information with high resolution.

Conclusion: We consider the SS-OCT system to be a safe, novel method for imaging of oral microstructure, and the ultrahigh-resolution imaging enables improved visualization and segmentation of the lower labial glands. In the near future, this new clinical imaging modality will have a definite clinical impact in the diagnosis of Sjögren's syndrome and xerostomia.

The Somatic X-ray Effect of the Single Dose on the Adult Mice of the "Quacker-Bush" Strain

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Objectives: As X-ray is an ionizing radiation, it can have biological effects on cell or tissue, therefore studies on possibly harmful somatic effects, like those in the present work is still needed. To know on harmful somatic x-ray effects on male and female mice such as the number of young mice and the weight of male and female parental mice.

Methods and Materials: To know the young number of 100 mice used in this experiment are described in the following details : 30 mice consisting of 15 male mice no irradiated and 15 female mice were irradiated by 1x200 rad, 2x200 rad, and 3x200 rad, 30 consisting of 15 male were irradiated by 1x200 rad, 2x200 rad, and 3x200 rad, and 15 female mice no irradiated, 30 mice consisting 15 male mice and 15 female mice were irradiated by 1x200 rad, 2x200 rad, and 3x200 rad, and 10 mice no irradiated left for control. To know the weight of male and female parental mice, 15 male mice and 15 female mice above were irradiated by x rays were weight evaluated during 10 days.

Results: Were obtained that the effect of x-ray upon the number of young mice gives a great effect used ANAVA statistical analyses, from the distribution of the table, the alpha of 5 % = 2,8 (3;48) is very significance, and the alpha of 1 % = 4,22, with alpha of 5 % = 3,19 (2;48) is very significance and 2,29 (6;48) is no significance, the alpha of 1% = 5,08 and 3,2. Were obtained that effect of x-ray upon the weight of male and female parental mice, indicated that irradiation of male and female parental mice on whole body cause decrease in their weight, followed by increase in weight afterwards.

Conclusion: The effect of x-ray upon the number of young mice gives a great effect. The effect of x-ray upon the weight of male and female, that a faster reaction in male parental mice was observed compare with that in female parental mice.

PET/CT – Technology, Instrumentation and Applications –

Norio Arai

GE Yokogawa Medical Systems, Ltd.

Recent development of imaging technology brings new direction for clinical diagnosis and treatment. PET/CT is gradually recognized as the clinical tools and now widely available in Japan. This lecture gives brief review of its history and theory of positron emission tomography and advantage and effectiveness of functional anatomical imaging like PET/CT. The lecture covers recent technological investigation and clinical applications. It will also indicate molecular imaging like PET/CT supports drug development as a sort of biomarkers.

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PET/CT imaging for the Head and Neck Tumor

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CT/MRI has widely been used for treatment planning and post-treatment follow-up of patients with head and neck tumor. Recently, the usefulness of PET/CT imaging for this purpose has also been reported. In this lecture, I would like to discuss the advantages and the pitfalls of PET/CT for the diagnosis of head and neck tumor, i.e. detecting primary tumor, metastasis and tumor recurrence, and evaluating treatment response, referring to our clinical cases and relevant articles.

Learning Objectives:

1. The summary of PET/CT examination
2. The usefulness of PET/CT imaging for the diagnosis of head and neck tumor
3. The pitfall of PET/CT imaging for the diagnosis of head and neck tumor

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Craniofacial Oncologic Imaging: a Changing Perspective

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PET technology is a multidisciplinary science. The advances in radiotracer chemistry have played a pivotal role in driving the field in new directions in studies of human physiology. Since its synthesis in 1976, 2-fluorine-18-fluorodeoxyglucose (2-[¹⁸F]FDG) has been the most widely used radiotracer for PET studies in oncology and neuroscience. The development of radiotracers to monitor the efficiency of gene therapy and organ transplantation has become a new area of research, one in which work will continue in the future. PET-CT fusion imaging can be a modality of choice as it eliminates false positives and false negatives of PET findings, hence more accurate identification of tumor margins and metastasis is possible. However detection of large tumors in clinically inaccessible areas, spotting recurrent tumors obscured by scar tissue at the site of incipient radiation or post operative necrosis, locating the primary lesion in unknown primary tumors are also important indications of this technique. The scope of this modality is also discussed in terms of inflammatory and endocrinal lesions wherein the assessment of bone metabolism plays a pivotal role. The fusion of PET and CT images could optimize the interpretation of a certain category of PET examination and potentially improve the diagnostic accuracy of both modalities. The fusion imaging technique consists of the anatomic detail provided by computed tomography with metabolic information. Pretherapeutic radiological tumor staging includes evaluation of the size, location, and extent of the primary tumor and infiltration into surrounding vascular, visceral and bony structures. Both detection and differentiation of tumor recurrence and post therapeutic changes are necessary for efficient follow up and for increasing the salvage rate by reducing the delay between treatment of the primary and the recurrences. Listing functional and anatomical data via fusion imaging (PET-CT) provides additional clinical relevant information. This modality is superior in staging of disease, biopsy site selection, radiotherapy and guiding of treatment planning. This presentation encompasses interesting case reports of variety of lesions. It also discusses the utility and recent applications of this imaging modality.