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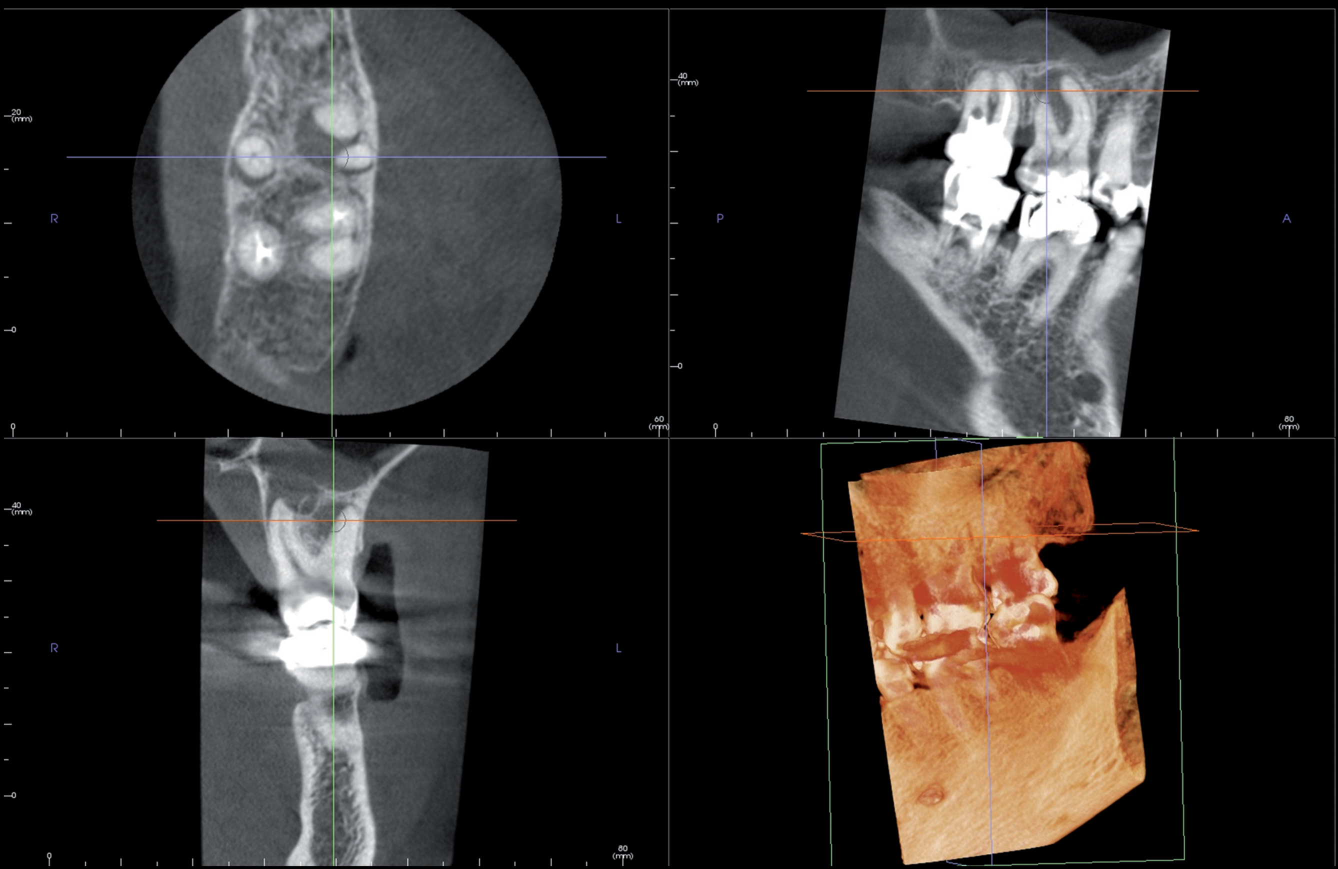

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Dr Scott D. Ganz

CBCT—not just for implants!

_The advent of Cone Beam Computed Tomography (CBCT) has paved the way for clinicians to adopt the technology for a variety of different treatment modalities, including dental implants, oral surgery, orthodontics, endodontics, TMJs, airway analysis, sleep apnoea, guided surgery applications, and more. Many of these procedures and related concepts have been highlighted within the pages of cone beam magazine.

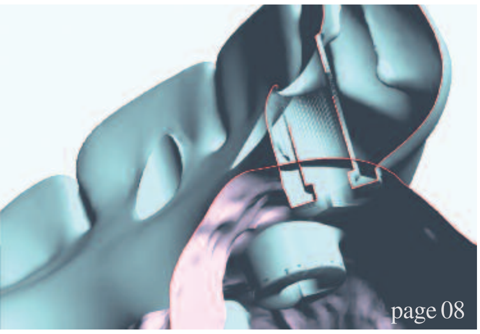
The use of CBCT diagnostic imaging has proved to be a vital, important, and perhaps invaluable tool to visualise patient anatomy in order to evaluate dental implant receptor sites and avoid adjacent vital anatomy. However, there are many potential sites which are found to be deficient in available bone width, height, and volume. These sites may be critical to the desired restorative outcome, and therefore may require additional pre-prosthetic surgery to ensure long term implant and soft-tissue stability. It is well-documented that hard- and soft-tissue grafting can play an important role in managing potential implant receptor sites. Pre-operative CBCT evaluation is becoming more and more important for the proper evaluation of deficient sites.

The use of CBCT and interactive treatment planning software applications are continuing to evolve as an aid to helping clinicians improve their appreciation of sites deficient in available bone, and to plan the most appropriate treatment alternative for each patient's needs. The planning process has been enhanced through the use of pre-surgical diagnostic models, intra-oral scanning, simulated virtual bone grafting, fixation or tenting screw placement, and the use of 3-D printing to create biomedical models, and more.

It is our goal for the readers of cone beam magazine to be exposed to the many evolving uses of CBCT imaging modalities and how CBCT serves as a foundation for many procedures that go well "beyond" dental implants. Perhaps the incredible potential will be realized as multiple technologies are merged together to define the most efficient and cost effective digital workflow.

Please enjoy our latest publication, and expand your horizons!

Dr Scott D. Ganz
Editor-in-Chief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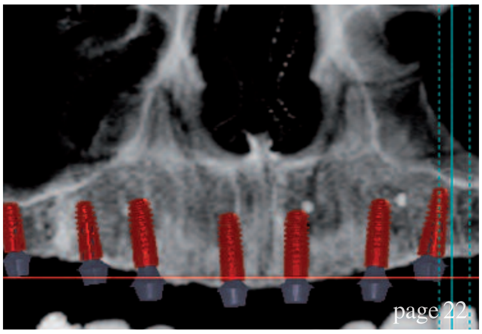
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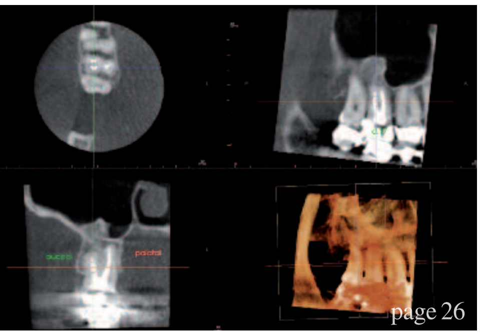
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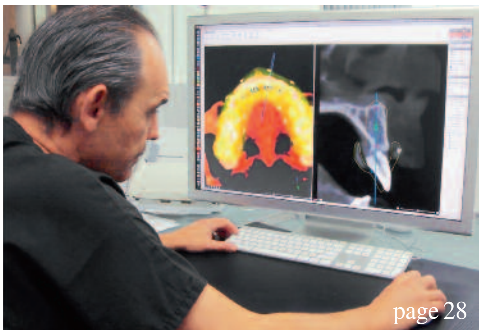
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Current and related literature abstracts

Author_ Dr Barry A. Kaplan, USA

_"A guide to recognizing maxillary sinus pathology and for deciding on further preoperative assessment prior to maxillary sinus augmentation" by B. Friedland & R. Metson (Int J Periodontics Restorative Dent. 2014 Nov–Dec;34(6):807–15)

Cone Beam Computed Tomography (CBCT) is playing an increasingly important role in diagnosis and treatment planning of dental implants, and can serve as an excellent preoperative tool prior to sinus grafting procedures. When implants are placed in the maxillary arch, consideration must be given to the pathology and anatomy of the maxillary sinuses. Studies shows that the prevalence of mucosal disease secondary to endodontic a periodontal disease ranged from 5 to 38%. The prevalence of sinus pathology found on CBCT on asymptomatic patients has been estimated to range from 25 to 56%. The literature is in agreement that a mucosal thickening of 1–2 mm or less is normal.

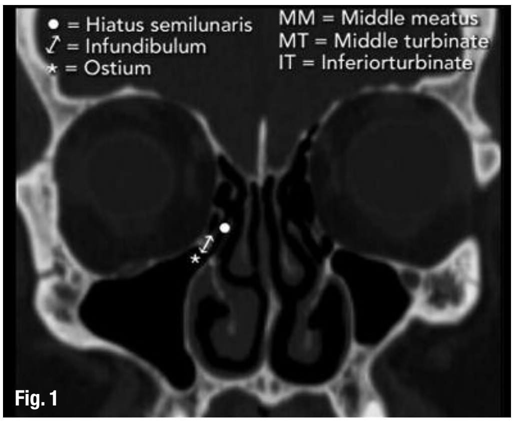

Fig. 1_Friedland B, Metson R; A guide to recognizing maxillary sinus pathology and for deciding on further preoperative assessment prior to maxillary sinus augmentation. Int J Periodontics Restorative Dent. 2014 Nov–Dec;34(6):807–15.

Mucositis, the most common sinus pathology, is the term for mucosal thickening and is associated most commonly with apical infection and allergies. Mucous drains from the sinus through the ostium, which is located superiorly in the sinus, and should be away from the surgical area to be grafted; the disadvantage is that there is no gravitational drainage due to the ostium's superior placement. The next most common pathology is a mucous retention cyst. It normally appears as dome shaped and is usually the result of a blocked mucous gland duct. Sinus polyps occur when there is inflammation and oedema in the lamina propria of the sinus membrane. Polyps are solid unlike retentions cysts, which are fluid filled. Both appear similar radiographically, although polyps are more likely to be pedunculated whereas a cyst is more likely to have a broad base. Some less common sinus pathologies are a mucocele, which is when the ostium is blocked and mucous accumulates in the sinus. Mucoceles are expansile in nature and can cause sinus wall displacement. When displacement occurs, it makes it easier to differentiate between a large mucous retention cyst and a mucocele. Benign and malignant tumours can grow large and are capable of destroying any sinus boundary.

Opacities in the sinus can be antroliths, osteomas and exostoses. Antroliths are opacities from mineralisation around organic material and are not attached to the bony wall, whereas osteomas and exostoses are attached to the bony wall. Lastly, some pathology may arise from outside the sinus and invade into the sinus. Examples of these would be odontogenic cysts and radicular cysts.

With CBCT imaging modalities, most sinus pathologies have a similar opacity, making it hard to distinguish between pathologies; greater emphasis should then be placed on evaluating the shape and distribution of lesions. It is therefore critical to have a scan of the entire sinus up to the orbital floor, because it is the superior aspect of the lesion that helps to make a final differentiation (e.g. dome shaped, straight or meniscus). A complete scan of the sinuses also helps to determine whether the ostium is blocked. A blocked ostium will have greater likelihood of morbidity following implant surgery since bacteria and debris will not be able to adequately drain. It should be noted that referral is warranted for any patients manifesting sinus pathology regardless of whether or not they are having bone grafting or implants placed.

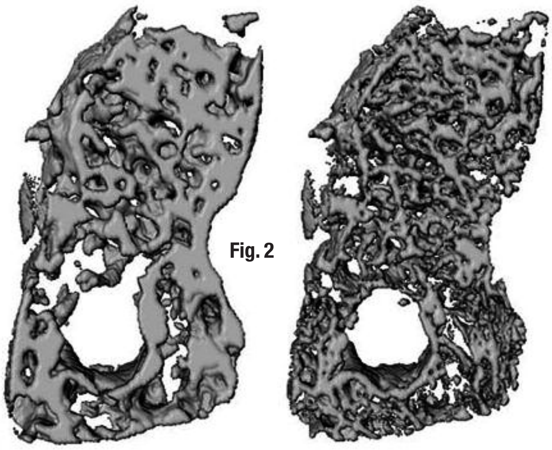

Fig. 2

Fig. 2_ Pauwels R, Jacobs R, Singer SR, and Mupparapu M; CBCT-based bone quality assessment: are Hounsfield units applicable? Dentomaxillofacial Radiology 2015 44:1.

_"CBCT-based bone quality assessment: are Hounsfield units applicable?" by R. Pauwels & R. Jacobs, S. R. Singer, and M. Mupparapu (Dentomaxillofacial Radiol. 2015;44:1)

Before Cone Beam Computer Tomography (CBCT) became available, Multi Detector Computer Tomgography (MDCT) was the principle method of 3-D imaging in the diagnosis and treatment planning for dental implants. With MDCT, bone densities were evaluated using Hounsfield Units (HU), which is a measure of radiodensity measured from beam attenuation of axial slices. With CBCT, because of the angulation of the slices as the beam rotates around the head, regions of the same density in the skull can have a different grayscale value (GV) in the reconstructed CBCT dataset.

Other factors affecting grayscale values with CBCT include limited field of view, higher amounts of scattered radiation, limitations with reconstruction algorithms, exposure parameter differences, and endo/exomass, which is defined as the amount of mass inside and outside the FOV. These variables can lead to a variability of GVs, particularly in axial slices as well as between slices. Therefore, essential differences between MDCT vs CBCT complicates the use of quantitative grey values for CBCT.

Given these issues, the article states that quantitative use of GVs in CBCT should be generally avoided at this time. Greater emphasis is being placed on a newer paradigm, which would focus more on a structural evaluation of the bone (i.e. trabecular pattern) rather than bone density. The paradigm shift is in part related to implant surfaces that have a higher degree of engineering to facilitate osseointegration, whereas older machined surfaces relied more heavily on bone density alone. New ways of analysing bone structure are being developed that focus more on 3-D trabecular bone architecture, bone surface and volume and spacing between trabeculae and marrow spaces.

_"Temporomandibular joint diagnostics using CBCT" by T.A Larheim, A.K. Abrahamsson, M. Kristensen, L.Z. Arvidsson (Dentomaxillofac Radiol. 2015;44(1): 20140235)

Only in the past 15 years has Cone Beam Computed Tomography (CBCT) been used for the imaging and analysis of the TMJ. Prior to this, Multidector Computed Tomography (MDCT) was one of the main modalities for evaluation of the TMJ. Studies have shown, however, that CBCT is comparable in its accuracy to MDCT when comparing distances of joint spaces and cortical surface details. One of the main indications of CBCT with respect to TMJ diagnostics is to elucidate bony changes in patients with Osteoarthritis (OA). CBCT has been determined to be accurate in determining bony surface changes as well as erosive changes seen in Rheumatoid Arthritis (RA) at the condylar head. The articular surfaces can be accurately imaged to evaluate for osteophytes (angular bony projections) and a normal rounded appearance of the condylar surface with or without the presence of erosion. Other indications for CBCT for TMJ are intra-articular fractures and fibro-osseous ankylosis. One study showed that clinical decision making changed when based on CBCT after previously being based on physical and panoramic evaluation. CBCT is a cost-effective alternative to CT for the evaluation of TMJ although more sensitive to artefacts. Diagnostic evaluation of TMJ using CBCT is limited to osseous joint components and cortical bone integrity._

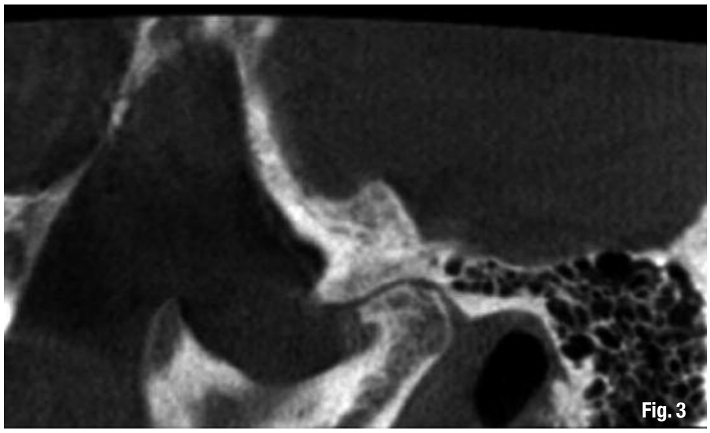

Fig. 3

Fig. 3_ Larheim TA, Abrahamsson AK, Kristensen M, Arvidsson LZ; Temporomandibular joint diagnostics using CBCT. Dentomaxillofac Radiol. 2015;44(1):20140235.

_about the author cone beam

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Digital possibilities in fabrication of implant prostheses

Author_Dr Joannis Katsoulis, Switzerland

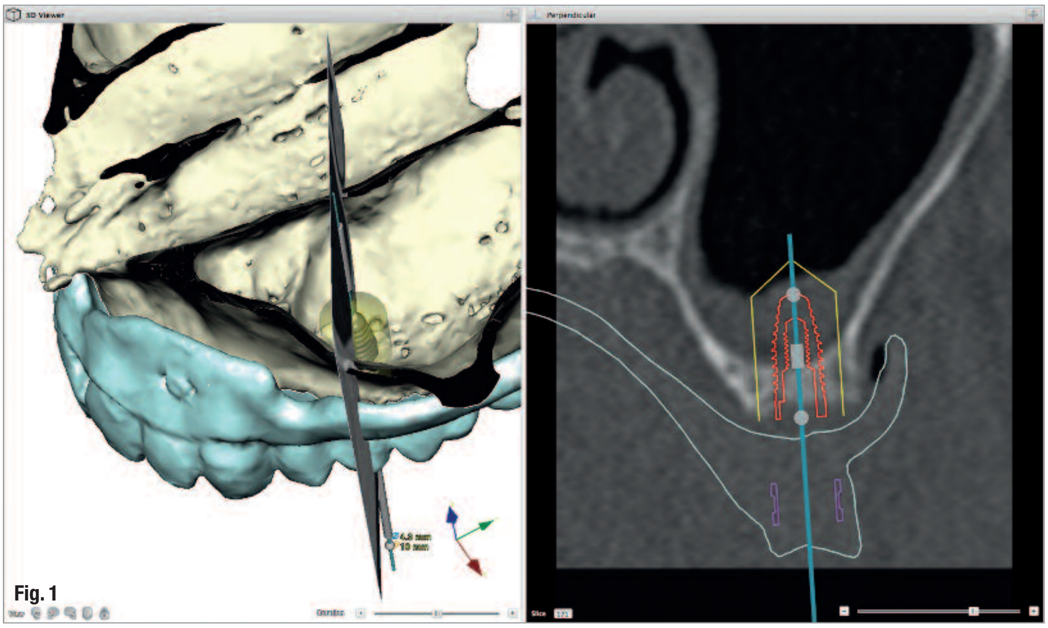

Fig. 1

Fig. 1_Virtual 3-D implant-planning based on volume tomography.

_Introduction

In contemporary dental medicine, computers and implants are closely linked. By dealing with this topic, the question arises whether one can speak about a(n) (r)evolution in planning and manufacturing of tooth- and implant-supported reconstructions in the field of implant prosthetics.

Dental prosthetics are concerned with the restoration of lost teeth and tooth-bearing tissues in the oral cavity. Loss of teeth and edentulism are quite frequent in old age and often the main reasons to visit a dentist. Hence, dental implants have become important means of therapy, whereby computer-assisted procedures play an increasing role in the daily routine of the dental practice. Thus, it is no contradiction to use modern computer technology and new materials equally for young and old people.

The continuous advancement of specialised fields in radiological imaging, manufacturing methods in the engineering industry und dental implantology have extended the possibilities of decision making, planning and surgical as well as prosthetic realisation of a therapeutic plan. Actually, this proceeding of dental medicine only has been made possible by bringing together these formerly independent disciplines, which basically depend on the increased performance of digital data processors.

_Revolution or evolution?

Despite these developments, many colleagues do not consider a computer a helping advice in their daily routine. Any digitalisation of a certain practice area needs a modification and adaption of the whole team's workflow, depending on the scope of digitalisation. This requires a large effort of all employees involved, the willingness to learn from earlier mistakes and to keep pace with the progressing digital technologies. One thing is certain: Innovations in dental medicine do occur more often and faster nowadays. Therefore, revolution or evolution does not depend on the given digital possibilities but rather on the individual experience and know-how.

In dental medicine, computer technology is no more a real technological revolution. Virtual implant-planning based on volume tomography has facilitated the decision making and information for a patient for quite some time now (Fig. 1). Computer-assisted implant placing occurs with high precision in partially or fully edentulous patients.[1] Here, the so-called backward planning ensures a high level of predictability of the surgical and prosthetic result. The surgical realisation of the 3-D planning with stereolithographic splints is an important advancement in complex cases and can contribute to less invasive and rapid proceedings in selected cases. By this, one can precisely determine whether a completely "flapless" procedure is possible for single or all planned implants in the jaw and which augmentative technique is indicated.[2] Especially for older patients with relatively more risks when implanting, a well-planned, minimally-invasive proceeding with a shortened operation time is of advantage.[3, 4]

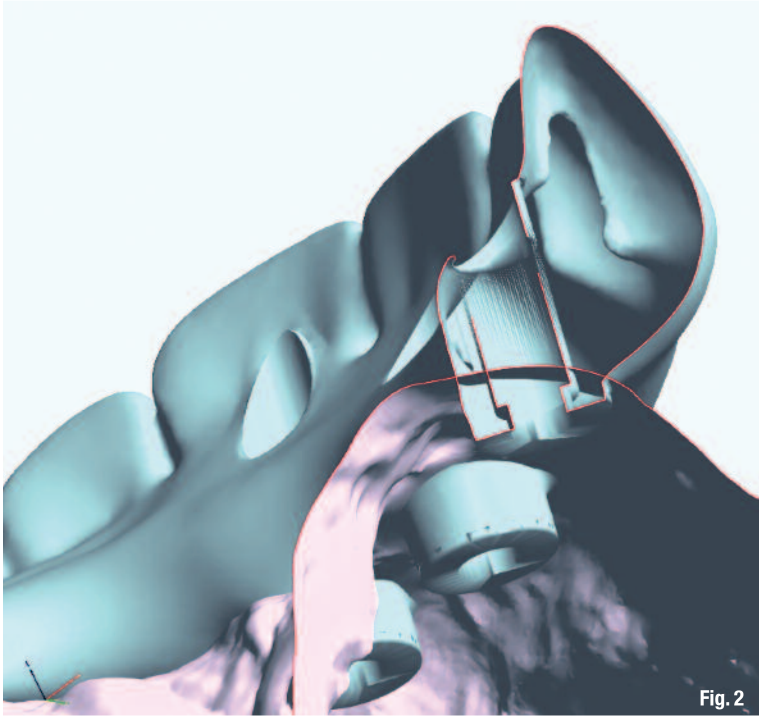

Fig. 2

Additionally, the digitalised anatomical and prosthetic conditions can be analysed virtually and with the help of clearly-formulated criteria contribute to the decision making in case of either fixed or removable implant-borne reconstructions.[5] It has turned out that the proportion of bone in the upper jaw is clinically often overestimated.[6] According to the characteristics of an atrophy of the alveolar ridge, the prosthetic-oriented planning will control the implant positioning and type of reconstruction of the operation virtually in advance.

Fig. 2_Digital design of CAD/CAM-FDP framework.

Fig. 3

Fig. 3_Full-ceramic reconstructions.