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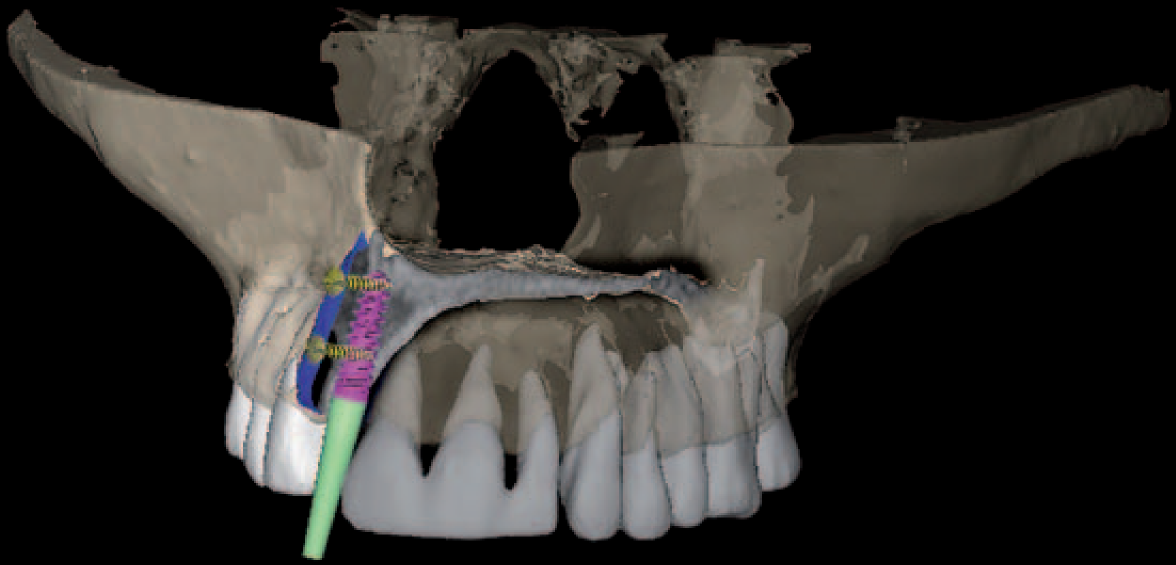

| **case report**
CBCT and guided surgery

| **industry report**
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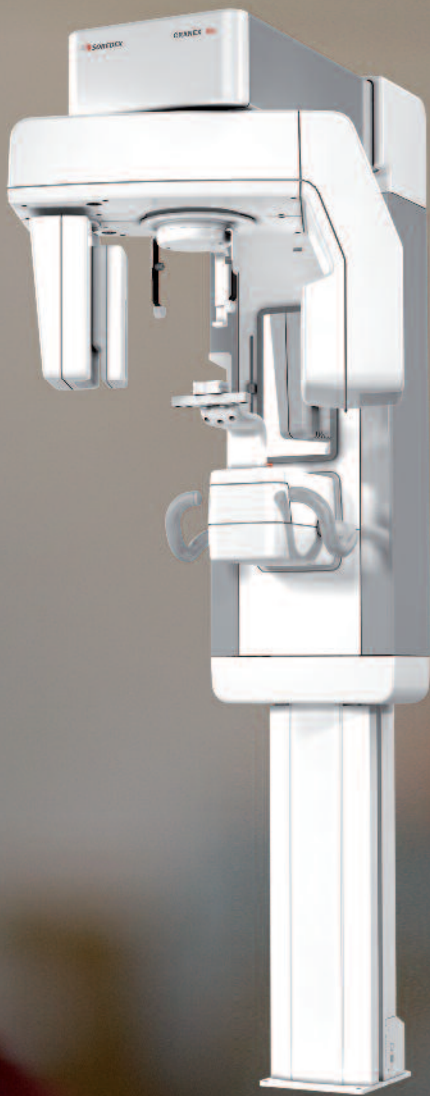

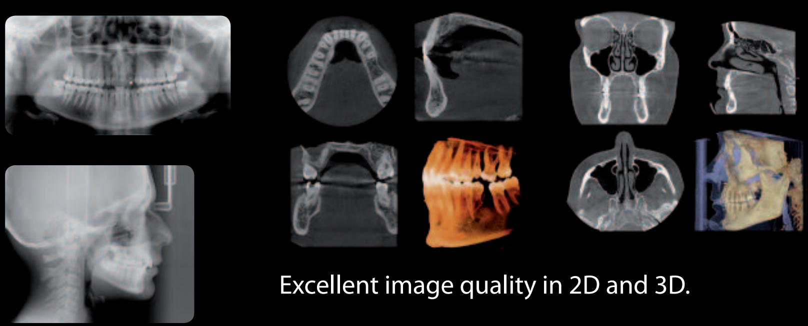

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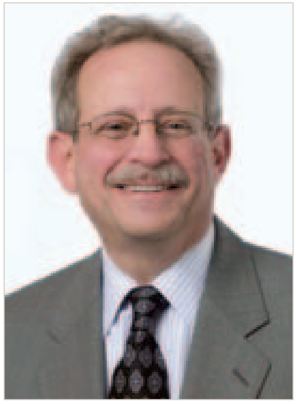


Dr Scott D. Ganz

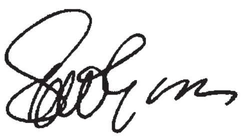
_**Our patients come** to us for a variety of different needs, and as practising clinicians, it is our obligation to properly diagnose and recommend an appropriate plan of treatment. Until recently, 2-D periapical or panoramic imaging modalities were utilised to diagnose periapical pathology, tooth decay, periodontal disease and root morphology for endodontic treatment, restorative dentistry, and assessment of potential implant receptor sites. These concepts were accepted and widely taught by radiology departments in dental schools worldwide as conventional diagnostic dentistry.

However, with the advent of CT, and now CBCT, it has become increasingly evident that 2-D imaging modalities may not provide the most accurate assessment of the region of interest. As an example, on a panoramic image of the mandibular symphysis, we may be able to determine the height of available bone, but we cannot ascertain the width, contour or quality of the bone for the potential placement of dental implants. The course of the mandibular canal is essential to avoid damage resulting in irreversible paraesthesia. In the posterior mandible, there is often a clearly defined lingual concavity that if not visualised could lead to potential complications.

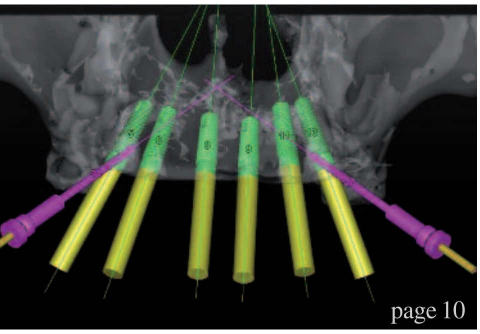
A few more considerations to think about: How important is it to know the actual width from the lateral to the medial wall of the sinus to determine the volume needed to fill the sinus to create the foundation for implant placement? Intraosseous vessels often reside within the lateral walls of the maxillary sinus and these cannot be determined with 2-D imaging modalities. It is important that they be visualised when contemplating a sinus augmentation procedure. Can the contour of the floor of the sinus be properly appraised when evaluating the posterior maxilla for a transcrestal approach with simultaneous implant placement? What about the presence of septa in the maxillary sinus? Septa are often problematic when they hinder the proposed treatment. Their presence and location cannot be determined from any 2-D radiography and may play a significant role in the long-term success of treatment.

Readers of past issues of our cone beam international magazine of cone beam dentistry have been exposed to a variety of clinical examples of how 3-D imaging modalities have been utilised in daily practice. However, there is one aspect of CBCT that may represent the most important reason that clinicians need to move from 2-D to the world of 3-D imaging: the ability to visualise anatomy in 3-D provides clinicians with an unprecedented appreciation that each patient is different. Each patient's anatomy is revealed to be individual and separate from another person's mandible or maxilla, each tooth, each alveolus, each inferior alveolar nerve or maxillary sinus. That individuality is so very important for clinicians to understand prior to commencing treatment and should serve as ample justification to enhance our diagnostic acumen to improve clinical outcomes and reduce complications for our many patients.

Please enjoy our latest issue, with our compliments. It is our mission to continue to present valuable content regarding this wonderful imaging modality and ancillary procedures that benefit from 3-D imaging technology. If you pick up one pearl from the articles enclosed, spread the word, tell your friends and share with your colleagues. Thank you!



Dr Scott D. Ganz
Editor-in-Chief

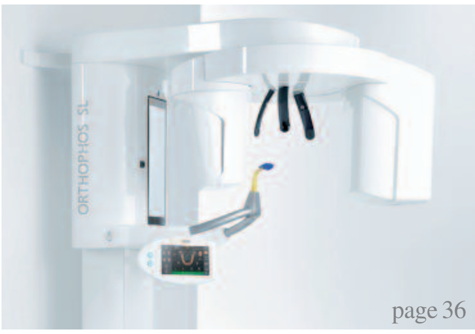

page 10


page 14


page 24

Cover image courtesy of Dr Scott D. Ganz


page 28


page 36


page 38

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Current and related literature abstracts

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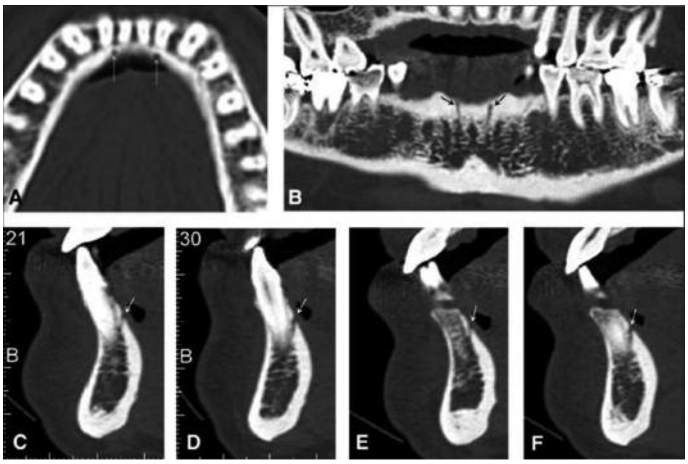

Fig. 1

Figs. 1a–f_ Axial view of foramina (white arrows) between mandibular central and lateral incisors (a). Panoramic view showing nutrient canals (black arrows) (b). Various sagittal views of nutrient canals proceeding to the lingual plate of cortical bone (c–f). "Computed tomography findings of mandibular nutrient canals" by Y. Kawashima, K. Sekiya, Y. Sasaki, T. Tsukioka, T. Muramatsu, T. Kaneda (Implant Dent. 2015 Aug;24(4):458–63).

_"Computed tomography findings of mandibular nutrient canals" by Y. Kawashima, K. Sekiya, Y. Sasaki, T. Tsukioka, T. Muramatsu, T. Kaneda (Implant Dent. 2015 Aug;24(4):458–63)

Nutrient canals are small neurovascular bundles originating from the incisive branch of the inferior dental canal, in the mandibular anterior region. These canals travel upwards to the apices and interdental areas of the mandibular incisors. Identifying these canals is essential in obviating clinical morbidity, which may include a neurosensory disturbance and/or haemorrhage. Their prevalence on traditional periapical films has been reported in the literature as anywhere from 5 to 40%. This study used CT images to assess canal prevalence, location, number, size, shape and Hounsfield units (HU) of the nutrient canals themselves.

The study showed that the prevalence of nutrient canals in the mandible is 94.3%, with the majority of these in the anterior region (92.7%), premolar region to a lesser extent (42%) and rarely in the molar region (1%). As for the exact canal locations, the preponderance of these canals was found between mandibular central and lateral incisors, both left and right. This is true because these teeth are furthest from the inferior alveolar canal and therefore require alternate blood supply. While gender specific differences were not observed, the prevalence of nutrient canals in the mandibular premolar region for males was greater than for females—a clinically significant difference. Additionally, there were no gender differences when comparing the HU of males and females. Age did impact the foramina size. The shapes of the foramina were generally ovoid and did not change shape with age. Lastly, the size of these canals ranged from 0.4 to 2.0mm in diameter. This paper underscores the diagnostic value of CT in visualising anatomy and reducing surgical morbidity.

_"Three-dimensional evaluation of alveolar bone and soft tissue dimensions of maxillary central incisors for immediate implant placement: A CBCT assisted analysis" by M.G. Kheur, N.R. Kantharia, S.M Kheur, A. Acharya, B. Le, T. Sethi (Implant Dent. 2015 Aug;24(4):407–15)

Proper diagnosis and treatment planning is critical when placing immediate implants in the maxillary anterior region. In order to achieve optimum aesthetic results detail must be paid to the soft tissues. The soft tissue around implants is affected by three major factors: the position of the implant within its receptor site, labial bone thickness and tissue biotype. Studies show that a minimum of 2mm labial bone thickness is sufficient to provide adequate soft tissue thickness. Thicker soft tissue will result in less recession and more stable interdental papillae. Additionally, thicker tissue will sufficiently mask potential discoloration of the underlying abutment. CBCT provides a cost-effective, low dose method of assessing both cortical bone thickness as well as tissue thickness.

In this study, cross-sectional images of maxillary central incisors where measured for facial and palatal

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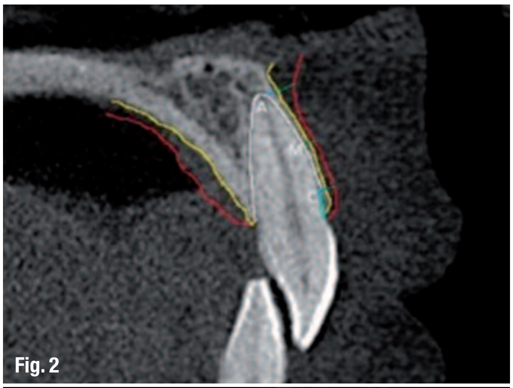

Fig. 2_Sagittal slice of maxillary anterior tooth demonstrating sufficient palatal bone for fixation. "Three-dimensional evaluation of alveolar bone and soft tissue dimensions of maxillary central incisors for immediate implant placement: A CBCT assisted analysis" by M.G. Kheur, N.R. Kantharia, S.M Kheur, A. Acharya, B. Le, T. Sethi (Implant Dent. 2015 Aug;24(4):407–15)

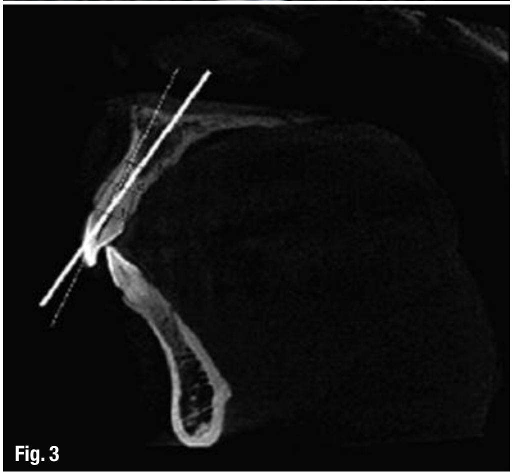

Fig. 3_ Sagittal section of maxillary and mandibular incisors. The thin white line is the long axis of the tooth and the thick white line in the long axis of the alveolus. "Angulations of anterior teeth with reference to the alveolar bone measured by CBCT in a Chinese population" by S. Zhang, X. Shi, H. Liu. (Implant Dent. 2015 Aug;24(4):397–401)

cortical thickness, facial and palatal tissue thickness and alveolar crest width. The bone and tissue thickness were measured at three locations: cervical, middle and apical. In the cervical areas, strong correlations were found between the labial bone thickness and corresponding soft tissue, palatal bone thickness and corresponding soft thickness as well as a correlation between bone thickness and bucco-palatal socket dimensions (wider sockets may associate with thicker labial cortices). The authors found no correlation between the position of the maxillary central incisor (forwardly inclined, normal or backwardly inclined) in the socket to the thickness of cortical bone in the cervical area. The majority of teeth (64 %) had proclined roots compared to 30 % having normally positioned roots, with the proclined teeth having a lower thickness of bone on the palatal in the apical area. As for the facial bone, this study demonstrated that 36.7 % had labial bone thickness greater or equal than 1 mm, whereas 63 % had < 1 mm of bone.

While no correlation was found between the position of the tooth in the alveolus and the labial cortical bone thickness, the tooth position does have significant implications for implant placement and underscores the importance CBCT analysis prior to tooth extraction. The position of the tooth in the socket can dictate the implant trajectory and this will, in turn, be affected if grafting is needed, as well as if the implant will be cement vs screw retained.

_"Angulations of anterior teeth with reference to the alveolar bone measured by CBCT in a Chinese population" by S. Zhang, X. Shi, H. Liu. (Implant Dent. 2015 Aug;24(4):397–401)

When placing immediate implants in the maxillary anterior region the position of the tooth within the alveolus must be evaluated prior to implant placement. Sagittal slices from CBCT are a cost effective way to do this with low dose radiation. This study evaluated the angulations of upper and lower anterior teeth with respect to alveolar bone in a Chinese population.

Sectional slices containing maxillary and mandibular central incisors, maxillary and mandibular lateral incisors and maxillary and mandibular canines were analysed to compare the angulation of the root relative to the bony housing itself (Fig. 3). The study found that maxillary anterior teeth were closer to the labial alveolar surface and therefore more divergent to the alveolus itself (17.65 degrees for the central incisor, 18.79 degrees for the lateral and 23.82 degrees for the canine). The mandibular incisors, however, were usually less than 8 degrees difference from the alveolus itself. Measurements of the maxillary alveolar bone were measured in three places: crestal, midroot and apical. What was noteworthy was that at the midroot level, the labial thickness was less than 1 mm in 77–90 %; 42.4 % of maxillary canine teeth were less than 5 mm and almost all maxillary anterior teeth had labial thicknesses less than 2 mm. The authors suggest these numbers as a plausible explanation to the higher frequency of perforation at the midroot level.

Given the greater incidence of the maxillary roots being closer to the labial plate the implant would be placed with a more labial inclination to access the available palatal bone necessitating the need of angled abutment. Conversely, because the mandibular incisors are closer in angulation to the alveolar bone it is more likely a straight abutment can be used. CBCT is, therefore, instrumental in treatment planning immediate implants in the anterior region prior to tooth extraction._

_about the author

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