Current and related literature abstracts

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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 show that the prevalence of mucosal disease secondary to endodontic or periodontal disease ranged from 5 to 38%. The prevalence of sinus pathology found on CBCT in 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.

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 expansive 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.
Before Cone Beam Computer Tomography (CBCT) became available, Multi Detector Computer Tomography (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.

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._

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**_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)


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