Using Cone Beam (CBCT) in Implantology

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Abstract: Cone beam computed tomography (CBCT) is a diagnostic imaging technology that has changed the way in which dental practitioners view the oral and maxillofacial region, teeth and the surrounding structures. CBCT is designed in such a way that 3D images are seen without distortion and superimposition which is similar to CT imaging. The advantages of CBCT are: simpler image acquisition, lower capital cost and less radiation dose to the patient.

Introduction
Radiographic examination is an important diagnostic tool in dental implants treatment planning. Information obtained from a conventional or a digital radiography is limited by the fact that the 3D anatomy of the area being imaged is compressed to a 2D image. The superimposition of structures is again a major limitation of the 2D image.

Cone Beam Computed Tomography (CBCT / CBVT) is a 3D x-ray imaging technology that exposes the patient to an x-ray beam in the form of a cone which is revolved around the patient. The benefit that this has over a CT scan is that a CBCT scan requires significantly reduced exposure times and so exposes the patient to significantly less x-ray radiation. However compared to a 2D x-ray there is still an increase in dose and so consideration is still required when recommending a 3D view. The European association of osseointegration (EAO) have given guidelines which states that cross sectional imaging is beneficial in preoperative assessment and treatment planning of dental implants and that should not be a regular protocol post operatively unless needed.

A CBCT scan captures multiple images (ranging from 150 to more than 600) in a single scan with fewer artifacts when compared to panoramic radiography. 3D Images are ideal for planning the placement of implants. As with all x-ray procedures CBCT carries a radiation exposure risk to the patient and so it is necessary to ensure that the dose is kept to a minimum and will provided optimum diagnostic information resulting in improved patient care.

CBCT collimates the x-ray beam to focus on the area of interest known as the field of view (FOV). It is advisable not to radiate outside of the area of interest so it is very important that the CBCT system offers a choice of FOVs ranging from small to medium to large allowing the user to select the optimum FOV for the treatment. This function may not be available in all CBCT units however it is essential so that the user can select the correct FOV for the treatment and more important has available a small Field of View (for example 5.5 x 5cm) which is in fact suitable for...
the majority of dental examinations. At this level the effective dose is small enough to increases those examinations that can be justified to have a CBCT scan.

CBCT images are isotropic with ranges from as low as 0.076 mm to 0.4 mm. The images in different planes and the multiplanar reformatted images had led to achieve the level of spatial resolution accurate in measurements such as in implants site assessment.

Indications for CBCT in implants
1. To assess the quantity and quality of the bone in the edentulous area.
2. The relationship of the implants to the neighbouring areas.
3. For the placement of implants in the desired area.
4. In designing a surgical guidance template.

Limitations of CBCT in implant planning
Crowns or metallic appliances in the mouth can cause artifacts of the 3D image. The metals causing artifacts can range from minimum to the extent that the image interpretation is difficult.

Conclusion
2D imaging has been serving the dental fraternity in their diagnosis and will continue to do in the future. The recent availability of 3D imaging using CBCT systems for treatment diagnosis and planning implant positioning gives the dentist more accurate information and improved patient care.

The Carestream CS 9000 3D has a FOV of 5 x 3.7 cm creating images with a resolution of 0.076mm. This resolution is beneficial for accurately planning implants and overall improved treatment.

References
2 Cone Beam CT for Dental and Maxillofacial Radiology Evidence-Based Guidelines, EUROPEAN COMMISSION RADIATION PROTECTION N° 172, 2012, pag-73

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