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Mini Review

Role of CBCT in Periodontal Diagnosis; Mandatory or Overkill

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Abstract

Radiographs have been a very essential tool for diagnosis as well as prognosis and treatment planning in dentistry. However, there are various limitations associated with the use of 2 dimensional radiographs which are most commonly used. The use of 3 dimensional radiographs has a number of advantages over the conventional techniques, especially in the field of periodontics. This review aims to shed light on the importance of CBCT as a diagnostic aid in routine periodontal practice.

Keywords: CBCT; Radiographs; Furcation; Intra-bony defects; Implant

Introduction

Periodontal disease is a chronic inflammatory disease that effects the tooth supporting apparatus. As bone loss is an inevitable feature of periodontitis, radiographs are a valuable tool as an adjunct to clinical examination. The most commonly used; periapical and panaromic radiographs, have several limitations such as [1] the 2 dimensional natures of the image, distortion and magnification of the X-rays, and super-imposition of adjacent anatomical structure. Therefore bony defects on buccal and lingual sides / furcation involvements and root concavities to go un-noticed. Intra-oral radiography also underestimates bone loss due to projection geometry and or observer errors. [2,3].

The simplicity of procuring the images, its accuracy and ability to blend with treatment planning has made CBCT a standard of care in implant dentistry. While previous studies have demonstrated that CBCT images provide exact information on the extent and morphology of bone defects, it is still not used routinely in periodontal diagnosis [4]. This review aims to give an insight into the absolute and relative indications for the use of CBCT in periodontal diagnosis and treatment planning [5].

Horizontal bone loss, the commonest form of bone loss in periodontal disease is easily diagnosed using conventional radiographs in the interproximal areas. While CBCT images have shown greater accuracy while co-relating to direct measurements no significant differences have been reported between CBCT and conventional periodontal diagnosis. [6,7] Indiscriminate use of CBCT for routine periodontal diagnosis and care thus continues to be excessive.

However specific clinical situations may warrant their use as has been outlined below:

Furcation Involvement

Furcation involvement is widely regarded as a strong negative predictor of periodontal disease progression and is used as a prognostic indicator of the disease. Planning a treatment strategy for furcation involvement requires assessing the radicular bone. When assessing the bone support in the intra-radicular area, particularly the maxillary molar, conventional radiographs can be misleading. Evidence suggests that detailed information of furcation involvement was given by the CBCT images of maxillary molars with an 82.4% intra-surgical accuracy [5,8]. Recent studies have however concluded that diagnosis of incipient furcation lesions was still best made using clinical evaluation [9].

Periodontal Ligament Space

The discontinuity of the lamina dura is the first sign of peri-

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odontitis that can be seen on a radiograph. By creating a phantom model with artificial periodontal ligament space, Ozmeric et al. evaluated the relationship between CBCT and conventional radiographs and discovered that the periapical radiographs were superior to CBCT for evaluating periodontal ligament space [10]. In contrast, another in vitro study found that CBCT was better than conventional radiography in visualizing the periodontal ligament space [1].

Nimish Prakash, however demonstrated that CBCT images were equally capable of demonstrating LD(lamina dura) as periapical radiographs and that coronal sections of the CBCT should be used for anterior teeth and sagittal section in the posterior teeth would be beneficial [12].

Infra Bony Defect

In a systematic review, Letícia Fernanda Haas, have stated that different studies comparing the use of CBCT *vs* conventional two-dimensional imaging in artificial bone defects have shown that CBCT has a sensitivity between 80 and 100% while intraoral radiographs have 63 and 67%. When comparing CBCT with periapical and panoramic radiography the former showed no distortion, no overlapping images and real size compatibility [13].

Ability to Assess Root Morphology and Associated Patterns of Bone Loss

Zhao et al.'s (2013) report on the advantages of using CBCT included the capacity to evaluate first premolar root concavities and the pattern of bone loss that goes along with them. Based on where the concavity originated, they classified roots concavities into five different categories [14]. Type I -no concavity, Type II - concavity originated in the enamel, Type III - coincidence with the CEJ, Type IV below the CEJ (but in the top 2/3 s of the root), and Type V was within the bottom 1/3 of the root. Ramp, Plane, or Crater are the three categories used to describe the related bone loss pattern. 100% of maxillary first premolars had mesial concavities, with Type II being the most prevalent at 35.7%. Following normal radiographic assessment, information this specific is not always known, or at least not with certainty. The prognosis assessment and treatment plan can be made better by having more detailed information available.

Role of CBCT in Regenerative Periodontal Therapy

Grading the bone loss forms the basis for regeneration; the use of conventional radiographic methods for the same proves to be inadequate due to superimposition of the images. The use of CBCT may substitute surgical re-entry as it provides 3D images and precise measurement of the affected site which is nearly equivalent to direct surgical measurement [15].

Ito et al. evaluated the effectiveness of regenerative treatment using CBCT. The GTR membrane's template was created using the axial dimension. It was discovered that the membrane could be easily tailored and fitted to the root surface of either the maxillary or mandibular arch by using the membrane template. When CBCT was used, it was also observed that the membrane trimming time was reduced [16].

Advances in CBCT

New generations of dental in-office scanners are designed to increase bone density estimation, decrease radiation exposure, and decrease equipment expenses.

Metal artifact reduction (MAR) found in the newer generation of scanners could potentially help to confirm diagnoses of complex restorative cases and reduces the risk of mis-interpretation [2].

CBCT as A Soft tissue Assessment tool: Soft tissue assessment such as the width of keratinised tissue and other mucogingival parameters are difficult to perform using conventional CBCT. Recently, soft tissue CBCT (ST CBCT) was introduced and was used to determine the dimension and the relationship of the structures of dento-gingival unit and palatal mucosa [17].

Conclusion

AAP's Best Evidence Consensus (BEC) series concludes that conventional assessment was still considered the gold standard but that in certain situations CBCT imaging may be beneficial as long as the “As Low As Reasonably Achievable” (ALARA) principle is applied [18]. Specifically CBCT imaging may offer considerable diagnostic and prognostic advantage in maxillary furcation and intra-bony defects that require regeneration and root concavities. With improvements in imaging technology especially involving the soft tissues this spectrum of use may be expanded to provide better diagnostic and prognostic information to the clinician.

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