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PERIODONTAL IMAGING

Cone beam computed tomography

BACKGROUND

The diagnosis of periodontal disease relies not only on an evaluation of the patient's signs and symptoms and a survey of his or her medical and dental history but also on the results of radiographic evaluation. Conventional radiographic imaging has played a decisive role in determining the diagnosis, but newer methods may surpass the conventional imaging's quality of results. Cone-beam computed tomography (CBCT) is a newer technique that offers the ability to eliminate distortions and to visualize structures in all 3 orthogonal planes. However, it remains more expensive than conventional techniques and delivers a higher dose of radiation to the patient. A comparison was done between conventional and 3-dimensional imaging for evaluating infrabony defects, height of the alveolar bone crest, furcation involvement, and periodontal ligament space.

METHODS

A systematic review was done on 13 studies that had been identified through a search of the MEDLINE and Embase databases. Of these studies 4 covered infrabony defects, 3 discussed the height of the alveolar bone crest, 3 were on furcation involvement, 2 discussed periodontal ligament space, and 1 covered infrabony defects, furcation involvement, and the periodontal ligament space. All but 4 of the studies were in vitro investigations and all used different scanning parameters, so it was difficult to compare their findings directly.

RESULTS

Infrabony Defects

When artificially created infrabony defects were considered, the measurements made using periapical radiographs and CBCT were compared with control measurements from dry skulls. CBCT was both more precise and more accurate than conventional radiographs. In addition, CBCT offered the ability to identify the defects in both the buccal and lingual aspects of the teeth.

One study assessed the accuracy of CBCT in identifying clinical bone defects by comparing observations made using tomographic images with those directly observed on skulls. CBCT was able to identify 3 times as many fenestrations as direct visualization, leading to several false positive results. Another study compared periodontal defect measurements made using periapical radiographs, panoramic films, CT, and CBCT with histological specimens. The image quality obtained using CBCT was better in terms of contrast, brightness, distortion, overlay, and clarity of structures. CBCT was also able to demonstrate smaller deviations than had been viewed on histological specimens.

Alveolar Bone Crest Height

Because of its accuracy depicting horizontal bone loss, CBCT was more accurate than conventional radiographs for evaluating alveolar crest height in most studies. One study found that the diagnostic accuracy of CBCT images for horizontal bone loss in anterior tooth sites was low, however. One in vivo study compared bone height measurements from digital intraoral radiographs with CBCT images to obtain surgical measures to assess the treatment outcomes after regenerative interventions. CBCT yielded satisfactory results and reliably detected graft resolution compared to direct surgical measures.

Furcation Involvement

The accuracy of CBCT imaging for detecting artificially created furcation involvement ranged from 78% to 88% in macerated pig mandibles. A comparison of intraoral digital radiographs and CBCT images also found greater accuracy for the CBCT method. When in vivo studies were considered, CBCT and surgical measurements agreed in 84% of cases. Thus 3-dimensional radiographic techniques have proved extremely useful for assessing the outcomes after furcation defect treatment.

Periodontal Ligament Space

The studies on the various imaging techniques to estimate periodontal ligament space have reported varying results. Some find CBCT to be more accurate than conventional radiography for detecting marginal widening of the periodontal space. However, periapical radiographs have been found superior for measuring periodontal spaces equal to or smaller than 200 μm. The results may be the result of observers' lack of experience with CBCT.

DISCUSSION

Image quality with CBCT tends to be superior to that of conventional modalities. A number of factors can influence image quality and imaging results. These should be considered when comparing

Clinical Significance

Imaging protocol parameters can affect the accuracy and quality of the images obtained by any imaging system. CBCT can also be less accurate in the hands of people who aren't well versed in the uses and techniques of CBCT. Further studies, particularly in vivo investigations, are needed, but CBCT appears to be the best imaging technique for evaluating infrabony defects, alveolar bone crest height, furcation lesions, and periodontal ligament space.

various imaging approaches. Overall, it appears that for the specific instances evaluated in this review, CBCT is more accurate and reliable than 2-dimensional conventional imaging techniques.

Choi IGG, Cortes ARG, Arita ES, et al: Comparison of conventional imaging techniques and CBCT for periodontal evaluation: A systematic review. *Imaging Sci Dent* 48:79-86, 2018

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PULP INJURY

Biodentine

BACKGROUND

Vital pulp therapy (VTP) has been recommended for the treatment of reversible pulpitis and proved itself an attractive option, conserving the defense mechanisms of the pulp and enabling dentin formation. Evidence is now indicating that it may be a useful intervention regardless of whether the patient's clinical signs and symptoms suggest reversible or irreversible pulpitis. Mineral trioxide aggregate (MTA) is an alkaline material that stimulates dentin bridge formation and offers both good sealing ability and biocompatibility. Its use in VPT has been highly successful, but it has the drawbacks of discoloring teeth, requiring a long setting time, and being more expensive. Biodentine (BD) is a calcium silicate–based material that has the same clinical applications as MTA but is associated with better physicochemical properties, micromechanical anchorage, no tooth discoloration, a fast setting time, and ease in handling. Long-term studies are not available for BD because it's relatively new as a capping material in mature permanent teeth. A comparison was done of VPT with MTA or BD to evaluate the clinical successfulness of the 2 materials in adults.

METHODS

Sixty-eight patients (mean age 32.5 years, range 16 to 51 years) with 68 vital permanent teeth with deep caries were randomly assigned to treatment with BD or MTA. A complete examination was performed, including radiographs, before the procedure. Local anesthesia was used for the caries excavation. After pulp exposure, hemostasis was obtained using sodium hypochlorite, then the teeth were capped with BD or MTA. Follow-up examinations, including radiographs, were done after 6 months and 1, 2, and 3 years.

RESULTS

Most of the patients reported moderate pain preoperatively. One week after the procedure, 7 patients had postoperative discomfort with mild cold sensitivity.

At 6 months, 4 failures occurred, with each patient having reported severe pain the second day after having a pulpotomy. A 100% success rate was achieved with all other treatments, for an overall success rate of 93.3%.

At 1 year, 1 tooth had experienced a broken coronal restoration and pulp exposure and was excluded. In addition, 1 BD-treated tooth had a large periapical lesion and was considered unsuccessful. Two patients did not participate in the follow-up. Overall success rate at this point was 98%.

At 2 years, all the teeth were both clinical and radiographic successes, although 1 patient did not participate in the follow-up. At 3 years, 1 patient had a fractured tooth and 1 did not attend the follow-up examination. The BD group had 2 failed cases and the MTA group had 1. All of the teeth treated with MTA had some discoloration, but none of the BD teeth did. There was neither canal obliteration nor a dentin bridge seen radiographically. The success rate overall was 93.8%, with a rate of 91.7% for BD and 96.0% for MTA. The difference was not statistically significant.

DISCUSSION

Both BD and MTA offer good success rates when used as direct pulp capping material or pulpotomy material in permanent