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EDITORIAL

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Radiographs and CBCT – time for a reassessment?

Well-designed prospective clinical studies are essential to determine the outcome of endodontic treatment. The results from these studies allow us to estimate the prognosis of various treatments, thus greatly assisting the patient to make an educated informed decision on the best treatment option for their unique endodontic problem.

In endodontics for nearly 100 years this assessment has been carried out with the aid of radiographs. Essentially, this radiological assessment of the presence or absence of a periapical radiolucency provides a more objective assessment of the endodontic status of the tooth than relying on the patient's history and clinical examination. However, radiographs are not infallible; 50 years ago, a classic study by Bender & Seltzer (1961) highlighted the fact that periapical lesions confined to the cancellous bone could not be detected predictably. In fact, the endodontic literature is replete with studies highlighting the limitations of conventional radiographs; these constraints include the compression of the complex three-dimensional anatomy into a two-dimensional shadowgraph, anatomical noise and geometric distortion. Ultimately, these deficiencies may result in the underestimation of the size or, in some cases, the complete radiographic absence of existing periapical pathosis (Bender 1997, Lofthag-Hansen *et al.* 2007, Paula-Silva *et al.* 2009a). In one recent study of root filled mandibular posterior teeth, 25.9% of periapical lesions detected with CBCT were not detected with intraoral radiographs (Bornstein *et al.* 2011).

Small volume cone beam computed tomography (CBCT) is a novel three-dimensional imaging system that overcomes all of these limitations. *Ex vivo* studies using reference standards have clearly highlighted the superior accuracy of CBCT in detecting periapical lesions (Özen *et al.* 2009, Patel *et al.* 2009). More recently, *in vivo* studies have concurred with these findings. Paula-Silva *et al.* (2009b,c) intentionally infected root canals in dog's teeth, these teeth were then sub-divided into different groups; some groups were root filled, the others were left as positive and negative control groups. Six months post-treatment the dogs were killed and a histopathological examination of the periapical tissues was carried out. The periapical radiograph and CBCT assessments were compared to these histopathological findings, and the results from this study confirmed the superior accuracy of CBCT for detecting the presence and absence of apical periodontitis, as well as the poor sensitivity of periapical radiographs in detecting existing apical periodontitis. They also found that radiographs underestimated the size of periapical pathosis when compared to the histological reference standard.

This improved accuracy with CBCT comes at an increased radiation dose to the patient. The smallest field of view is the most relevant for endodontic imaging as this type of scan results in a significantly reduced effective dose to the patient (Loubele *et al.* 2009). It also reduces the amount of unnecessary anatomy being scanned and therefore having to be reported upon (Holroyd & Gulson 2009, Patel & Horner 2009). Furthermore, evidence is emerging to suggest that adjusting the exposure parameters away from the manufacturer's default settings reduces the effective dose without adversely affecting the diagnostic yield of the CBCT scan (Durack *et al.* 2011). A recent study found that there was no difference in the diagnostic yield of CBCT images for assessing periapical lesions when the arc of rotation of the CBCT scanner was reduced from 360° to 180°, thus halving the number of projection images and therefore reducing the radiation exposure to the patient (Lennon *et al.* 2011).

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It is time for our speciality to re-evaluate the way we assess the outcome of root canal treatment. We should think seriously about using CBCT to assess the outcome of treatment in specific situations. For example, when comparing different treatment strategies (single versus multiple visit root canal treatment, or different preparation and/or instrumentation techniques) the increased accuracy of CBCT may highlight differences that could be of clinical relevance and otherwise may be overlooked by periapical radiography. Only then can we give our patients a true guide of the likely prognosis of endodontic treatment.

Finally, we have to acknowledge our patient's right to an informed choice, especially when other diagnostic means are inconclusive. In these cases it would be desirable, considering its diagnostic value and the limited radiation exposure, to suggest the use of CBCT to confirm the presence or absence of apical periodontitis.

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