# Without a shadow of doubt

X-rays were discovered by Wilhelm Conrad Röntgen in 1895, for which he was awarded the first Nobel Prize in Physics in 1901. In 1896, shortly after the discovery, the first radiograph of teeth was taken. In the early days, as with many disciplines in healthcare, radiography revolutionised the practice of endodontics. It helped popularise root canal therapy and bestowed the treatment with respectability. It is possible to see, albeit only an image, all that was previously hidden and not visible to the naked eye.

Radiographs are needed at every stage of endodontic treatment: from diagnosis as part of preoperative assessment, peri-operative working length determination, to post-operative confirmation of satisfactory completion. It does not end there. Radiographs are also needed at follow-up as it is one of the methods used for evaluating treatment outcome. Epidemiological studies, clinical investigations and randomised controlled trials have all relied on radiography. The use of radiography in endodontics is so ubiquitous that it may serve to congratulate or condemn clinicians for their treatment efforts.

Unfortunately, radiographic images captured on x-ray films or via digital sensors are two-dimensional 'shadowgraphs' with inherent problems of geometric distortions and anatomical noise. The correct interpretation of radiographs is also dependent on the clinician's knowledge of the anatomy being assessed, appreciation of the limitations of conventional radiography and experience in assessing the two-dimensional images. Endodontic lesions confined within cancellous bone may not be discernible on radiographs; they may be obscured by the overlying cortical bone, depending on its thickness. In addition, there is a poor correlation between radiographic and histological findings.

Cone beam computed tomography (CBCT), or digital volume tomography (DVT), is a relatively new three-dimensional imaging technique. The extra-oral CBCT scanner has been exclusively designed for imaging the maxillofacial skeleton and to overcome some of the deficiencies of conventional radiography. The volumetric data set obtained from a CBCT scan is usually reconstructed using sophisticated computer software to allow viewing of the images in the axial, sagittal and coronal planes. CBCT produces undistorted and more accurate images of the area under investigation. CBCT has been reported to be more sensitive and able to detect endodontic lesions which are not visible on conventional radiographs.

CBCT has many clinical applications including enhancing diagnosis, aiding the management of dental trauma, resorption lesions, and the planning of endodontic surgery. Since CBCT is able to detect lesions that are not discernible on conventional radiographs, it should also enable more objective and accurate assessment of treatment outcomes. Will the results of previously published systematic reviews on treatment outcomes, based on conventional radiography, prove to be over-optimistic? In cases of failures, CBCT may be used to help diagnose the cause. Will the application of this newer imaging tool for this purpose lead to more litigation in the blame game? Whatever the future holds, without a shadow of doubt CBCT will have a major impact on everyday clinical practice and further revolutionise endodontics, just as when x-rays were first discovered.

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