

# Reliability of CBCT diagnosing root fractures remains uncertain

## Abstracted from

Ma RH, Ge ZP, Li G.

Detection accuracy of root fractures in cone-beam computed tomography images: a systematic review and meta-analysis. *Int Endod J* 2016; **49**: 646-654.

Address for correspondence: Gang Li, Department of Oral and Maxillofacial Radiology, Peking University School and Hospital of Stomatology, #22 Zhongguancun Nandajie, Hai Dian District, Beijing 100081, China. E-mail: kqgang@bjmu.edu.cn.

## Question: Can cone-beam computed tomography reliably detect root fractures?

**Data sources** PubMed, Web of Science, Science Direct, Cochrane library, Embase, SCOPUS, CNKI and Wanfang databases were searched until April 2014 followed by hand searching of relevant references.

**Study selection** Using no language restrictions two authors independently assessed for inclusion of *in vivo* and *in vitro* studies involving at least ten teeth on the use of CBCT for diagnosing complete root fractures on non-endodontically treated teeth.

**Data extraction and synthesis** Two authors independently assessed for inclusion and performed quality assessment using QUADAS-2 (quality assessment of studies of diagnostic accuracy-2). A random effects model was used to calculate pooled sensitivity, specificity and likelihood ratio (positive and negative). In addition, the correlation between voxel size and diagnostic accuracy was calculated.

**Results** Twelve studies were included in the review. Seven used i-CAT with 372 teeth and four used 3D Accuitomo with 237 teeth (one study used both). For i-CAT pooled sensitivity was 0.83 (0.78 to 0.86), while specificity was 0.91 (0.87 to 0.93). For 3D Accuitomo sensitivity was 0.95 (0.90 to 0.96) and the specificity 0.96 (0.92 to 0.99). Correlation between voxel size and diagnostic accuracy was analysed among five subgroups for i-CAT and two subgroups on the 3D Accuitomo group. No statistically significant difference was observed based on voxel size.

**Conclusions** According to the authors CBCT provides clinically relevant accuracy and reliability to detect root fractures in untreated teeth independently of the voxel size.

## Commentary

Diagnosing a root fracture can be very challenging. Radiographic images may provide direct evidence and also show the changes that occur in the surrounding bone as a result, also known as indirect features. Indirect features include: localised widening of the periodontal ligament space, and periapical or periradicular rarefaction, isolated perilateral radiolucency, 'halo' radiolucency, periodontal radiolucency, vertical bone loss and bifurcation radiolucency.<sup>1-2</sup>

The significance of the diagnosis of root fractures is mainly related to the prognosis, since it's usually poor requiring extraction or root amputation. Early diagnosis can help: prevent damage to the surrounding structures and extra cost to the patient who may

otherwise undergo multiple unsuccessful endodontic procedures.

Since recently, CBCT scans are been used for diagnosing root fractures. Considering the number of CBCT scanners available offering different features, choosing the proper scanner to match the clinical application can be challenging. One of the important features is the size of the voxel. The voxel is the smallest element of a CBCT image and determines the resolution of the imaging system. Although the smaller voxel sizes result in higher resolution, they can also result in the reduction of the signal to noise ratio and consequently degrade the image quality, which in turn may affect the detection of root fractures.<sup>3</sup>

This systematic review focused on the effect of the voxel size on the detection accuracy of root fracture on CBCT images using only two types of commercially available scanners (i-CAT, and 3D Accuitomo). Other popular scanners offer a number of other features (besides different voxel sizes) including differences in the geometry of the arc of trajectory, number of raw basis images, type of x-ray source, type of detector, and more. All these features may affect the diagnostic efficacy of the images.<sup>3</sup> Consequently, the results of this study should not be extended to other scanners.

Another limitation of the review was the inclusion of *in vivo* and *in vitro* studies together. Furthermore, it is still not clear how the authors calculated sensitivity and specificity on the *in vivo* studies, considering that the gold standard for diagnosis of root fractures is the direct visualisation of the fracture. In addition, the presence of artifacts produced from metal restorations or root canal therapy, which degrades the quality of the images, were not included in the review.

Considering the limitations of the review, it remains uncertain what is the reliability in diagnosing root fractures for the scanners used in the review, especially when applied to clinical scenarios.

**Niloufar Amintavakoli and Silvia Spivakovsky**

*New York University, College of Dentistry, New York, USA*

1. Tamse A, Kaffe I, Lustig J, Ganor Y, Fuss Z. Radiographic features of vertically fractured endodontically treated mesial roots of mandibular molars. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006; **101**: 797-802.
2. Lustig JP, Tamse A, Fuss Z. Pattern of bone resorption in vertically fractured, endodontically treated teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; **90**: 224-227.
3. White SC, Farman A. Cone-Beam Computed Tomography: Volume Acquisition. In White SC and Pharoah MJ. *Oral Radiology: Principles and Interpretation*. 7th ed. pp. 185-219. Mosby; 2014.

*Evidence-Based Dentistry* (2017) **18**, 23. doi:10.1038/sj.ebd.6401223