# Vertical root fracture detection performance: Hybrid CBCT VS CBCT

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**Abstract**

Cone beam computed tomography (CBCT) has been wildly used in various disciplines of dentistry, including the endodontic task of investigating for vertical root fracture (VRF). Previously, CBCT systems were dominated by medium to a large field of view (FOV). As for high cost and large machine size, newly designed CBCT systems started to develop by combining them with digital panoramic radiography into one machine. These new models of the CBCT system were called hybrid CBCTs. This study aims to compare the difference in VRF detection performance using various FOV in hybrid CBCT and conventional CBCT units. Forty permanent mandibular premolar teeth were endodontically prepared and individually inserted into a dry human mandible. All teeth were scanned before and after induction of VRF using 4x4 and 8x8 cm FOVs. One observer randomly evaluated all radiographic datasets. Ten percent of samples were randomly selected for repeated observation with a two-week separation. The area under the receiver operating characteristic curve (AUC) for hybrid CBCT and conventional CBCT are 0.835 and 8.847, respectively. Slightly better detection ability with conventional CBCT is revealed. The smaller FOV and voxel sizes, the better VRF detection is observed in both machines. In conclusion, detection of VRF with hybrid CBCT might not be different from that in conventional CBCT systems, and smaller FOV might associates with higher detection ability.

***Keywords***: *CBCT; Field of view; FOV; Hybrid CBCT; Vertical root fracture*

## 1. Introduction

Vertical root fractures (VRF) are one of the most difficult clinical dilemmas to be diagnosed and treated. They have also been reported as the third most common cause of tooth loss after dental caries and periodontal disease (Garcia-Guerrero et al., 2018). Most VRFs occur in endodontically treated teeth and have similar symptoms to chronic apical periodontitis or chronic periodontitis (Huang & Lee, 2015). Due to its unspecific signs and symptoms, the diagnosis of VRF is difficult and often requires prediction rather than definitive identification (Khasnis et al., 2014). Eskandarloo and colleagues reported that direct visualization is the only procedure to confirm the presence of the VRF (Eskandarloo et al., 2016). Therefore, surgical exploration, including a full-thickness flap operation and direct examination of surrounding bony defect and root with high-magnification and illumination, is obliged (Cohen, Blanco & Berman, 2003). Nevertheless, this is quite an invasive method.

Conventional and digital 2-dimensional intraoral radiographs have been the most common modalities in detecting VRF in routine clinical practice (Kamburoglu et al., 2010). However, there are some limitations, as VRF can only be seen on the periapical radiographs when the central x-ray beam is parallel to the fracture line. Presentation of the radiolucent fracture line give the radiographic diagnosis of VRF, but an absence of these lines can occur due to superimposition of adjacent structures and give the false-negative diagnosis instead (Neves et al., 2014).

Since the cone beam computed tomography's introduction to dentistry, this technology offered 3-dimensional (3D) visualization, with high resolution and accurate information of hard tissues. Therefore, CBCT has been recognized as an important diagnostic tool with great potential for diagnostics, treatment planning and follow up in many dental fields within the past two decades. Thus CBCT has become a valuable imaging modality in dentistry and is increasingly employed (Willy, Dorothea & Bernd, 2010). As for VRF,