

Dental CT versus Radiography in the Detection of Vertical Root Fractures

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Abstract

Aims & Objectives: To compare the findings of Radiography and Computed Tomography (CT) in the diagnosis of vertical root fractures and to correlate our findings post operatively.

Material and Methods: We evaluated 22 cases of clinically suspected vertical root fractures those who were referred to us for Dental CT and compared findings of Radiography and CT. Radiography was carried out in the Oral Radiology department and Dental CT was carried out using Philips Brilliance multislice CT scanner. The findings of Radiography and CT were then compared by two experienced radiologists independently. All patients were confirmed intraoperatively.

Results: The sensitivity of Radiography for detection of vertical root fracture was 27% for reviewer I and 25% for Reviewer II. The specificity of Radiography for detection of vertical root fracture was 100% for both the reviewers. The sensitivity of CT for detection of vertical root fracture was 93% for reviewer I and 95% for Reviewer II. The specificity of CT for detection of vertical root fracture was 94% for Reviewer I and 100% for Reviewer II.

Conclusion: In conclusion, CT is an indispensable tool for the detection of vertical root fractures and scores far better over Radiography.

Keywords: Vertical root fractures, Dental CT, Dentscan

INTRODUCTION

Vertical root fractures are longitudinally oriented fractures of the root which usually involve endodontically treated teeth. They extend from the root canal to the periodontium. The fracture can involve the entire length of the root or only a part of it. It may affect only one or both sides of the root. Their diagnosis is very challenging since they have very diverse clinical features and they are often missed on Radiography.¹ There are a number of radiological features like separation of root fragments, visualization of a lucent fracture line, clear space near a root filling or post, bone loss or dislodgement of filling material. Since a vertical root fracture necessitates extraction of the tooth, it would be better to find a more efficient and reliable means of establishing the diagnosis preoperatively so that prosthetic rehabilitation may be initiated and the cost and effort of an ineffective apical root resection may be avoided.² Dental CT

has proved time and again to be an indispensable tool in the diagnosis of vertical root fractures. The basic purpose of this study was to compare Radiography with Dental CT for diagnosis of vertical root fractures.

MATERIAL AND METHOD

We evaluated 22 cases of clinically suspected vertical root fractures those who were referred to us for Dental CT and compared findings of Radiography and CT. Informed consent was obtained from all the patients. Radiography was carried out in the Oral Radiology department and Dental CT was carried out using Philips Brilliance multislice CT scanner. Reconstructions were performed using the Dentscan software at the Extended workstation. We first drew a planning line along the arch of the jaw and then panoramic and cross sectional reconstructions were

done. All the images were then evaluated including axial, coronal, saggital, panoramic and cross sectional views. The findings of Radiography and CT were then compared by two experienced radiologists independently. All patients were confirmed intraoperatively. The signs of fracture on Radiography were separation of root fragments, visualization of a lucent fracture line, clear space near a root filling or post, bone loss or dislodgement of filling material. CT findings of a root fracture were characterized by a separation of the adjacent root segments or the demonstration of a hypodense fracture line.

OBSERVATIONS AND RESULTS

15 out of the 22 clinically suspected were found intraoperatively to have a fracture. Two experienced radiologists evaluated the images independently for vertical root fracture. On Radiography evidence of a fracture was indicated by direct visualization of a radiolucent line, separation of root fragments, clear space near a root filling or post, bone loss or dislodgement of filling material. CT findings of a root fracture were a linear hypodense line traversing the root of the tooth vertically or separation of adjacent root segments. The sensitivity and specificity of dental radiography and CT were then determined separately for each reviewer.

On Radiography, Reviewer I correctly diagnosed fracture in 4 of the 15 teeth. Diagnoses were false negative in 11 cases. All 7 cases without fracture were diagnosed correctly hence there were no false-positive results. The sensitivity was 27% and the specificity was 100%. The sensitivity and specificity for Reviewer II was 25% and 100%.

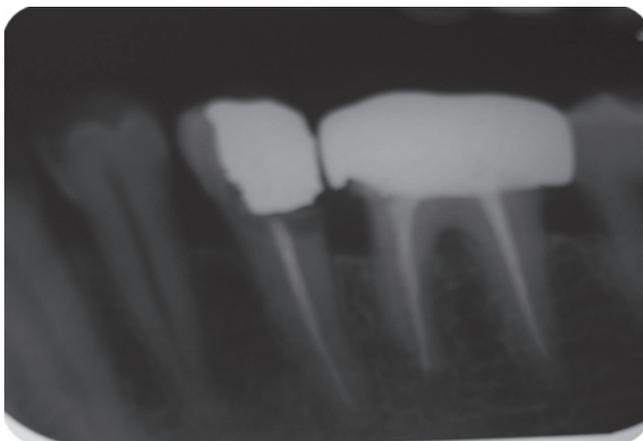


Figure 1a: Case with clinical suspicion of vertical root fracture. Fracture line not visualized in IOPA view

On Dental CT Reviewer I diagnosed 14 of the 15 fractures correctly. There was 1 false-negative case. There were 6 correct negative diagnoses and no false-positive results. The sensitivity and specificity of reviewer I was 93%

and 100%, respectively. The sensitivity and specificity for Reviewer II was 95% and 100%. The average sensitivity and specificity of Dental CT were 94% and 100%, respectively (Figure 1a & 1b).

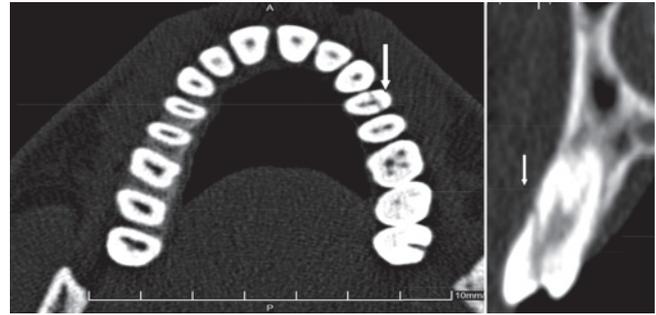


Figure 1b: Cross sectional and axial CT sections clearly show the fracture line

DISCUSSION

Patients present with pain, tenderness and local swelling after endodontic treatment. There are only a limited number of reports in the radiology literature that deal with the problem of dental vertical root fractures. These fractures are clinically very challenging.^{3,4} Horizontal root fractures are typically of traumatic origin and are relatively simple to diagnose. Vertical root fractures are usually iatrogenic and often follow endodontic treatment.⁵ They occur in vital teeth with an intact pulp as a result of conservative restorations (filling restoration such as amalgam filling) or in endodontically treated teeth (pulp-extracted teeth with root fillings that are consequently not vital) as a result of excessive pressure used during endodontic treatment. They can also be caused during dental filling or placement of a post. Detection of a vertical root fracture is of clinical importance since it necessitates extraction of the tooth. Clinical signs of the fracture develop slowly and are usually not apparent until 1 or 2 years after injury.

In our study, the sensitivity of Radiography for detection of vertical root fracture was 27% for reviewer I and 25% for Reviewer II. The specificity of Radiography for detection of vertical root fracture was 100% for both the reviewers.

The sensitivity of CT for detection of vertical root fracture was 93% for reviewer I and 95% for Reviewer II. The specificity of CT for detection of vertical root fracture was 94% for Reviewer I and 100% for Reviewer II.

In a study conducted by Soraya Youssefzadeh et al¹ who studied 42 teeth showed CT was 100% sensitive and specific for diagnosing vertical root fracture.

Radiographic signs are usually absent as the orientation of X- ray beam may not be parallel to the plane of fracture. Superimposition also limits its sensitivity for detection of longitudinal fracture.

CONCLUSION

In conclusion, vertical root fractures are a very difficult diagnostic challenge because the clinical signs and symptoms are highly variable and Radiography is also very unreliable. There is no single pathognomonic clinical or radiographic feature. However, though CT is an indispensable tool for the detection of vertical root fractures and scores far better over Radiography, it would

only be indicated in difficult where Radiography is negative despite clinical suspicion due to the high radiation dose as compared to Radiography.

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