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Case Report

Diagnosis of Vertical Root Fractures in Endodontically Treated Teeth

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Abstract

Vertical root fracture represents an endodontic pathology with a poor prognosis and with potential negative consequences on the structures around the involved tooth. Clinical and radiological signs and symptoms may not be present in the early stages and later they can mimic other endodontic or periodontal pathologies. The diagnosis of this complication is even more difficult in teeth with endodontic treatment. It is paramount to identify this condition early to prevent bone loss and compromising the subsequent prosthetic treatment.

Keywords: Root Fractures; Diagnosis; Endodontic Treatment

Introduction

Vertical root fractures (VRF) are cracks originated from the root, with various outline, displayed bucco-lingually most of the time and develop longitudinally along the root [1].

Although the speciality of endodontics and not only knows at the present time a remarkable process of development of new technology, nevertheless, the diagnosis of incomplete vertical radicular fractures remains challenging and the management of this condition is difficult as well. This is all the more important, as most of the time the treatment of this condition is extraction. Therefore, (ethically and legally), before the final decision is made, it is necessary to direct visualize the fracture line or fissure by various means, even if there are several clinical and imaging signs that can be characteristic of root fractures, as they can also mimic endodontic or periodontal diseases. Direct visualization of the fracture line is considered as the gold standard [2]. Even the single deep and narrow periodontal pocket, although it is considered pathognomonic, must be appreciated in context, considering that it can also be found in periodontal pathology [3].

On the other hand, an undiagnosed root fracture or fissure is just as damaging through the effects it produces on the periradicular bone, leading to its resorption and the subsequent complication of the prosthetic treatment plan [4].

In addition, the patient follows the endodontic treatment, which involves considerable effort and costs, when in fact, in this situation, the extraction of the irretrievably fractured tooth would be preventive against the unfavorable consequences of bone loss.

Not even cone-beam computed tomography (CBCT), a reliable diagnostic tool otherwise, with all the valuable information it brings in multiple critical situations, however, in this crucial aspect, it is not useful in accurately exposing the subtle fracture line and even less the crack, especially in the early stages when no indirect diagnostic signs are still visible.

Clinical Cases

Case 1

A 52-year-old female patient was referred to our clinic for endodontic consultation of tooth 14 (upper right first premolar) with a chief complaint of pain to biting on the respective tooth. The tooth was root canal treated some years ago. The tooth was tender to percussion and there was a deep palatal periodontal pocket, with no sinus tract. The tooth was a single mesial abutment for a fixed prosthesis.

A periapical radiograph (Figure 1a) showed a periradicular radiolucency in relation to the mesial aspect of the tooth. The root canal treatment was satisfactory, and no periapical lesion was present. There was a cast post cemented in both root canals.

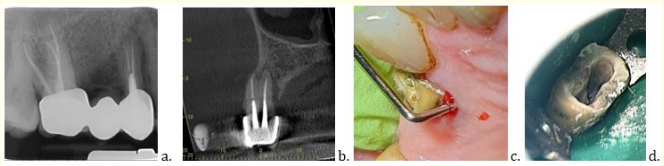

Figure 1: a. preoperative radiograph b. preoperative CBCT c. deep palatal pocket probing d. clinical image showing the root fissure.

CBCT scan (Figure 1b,c) revealed a vertical bone loss in relation to the palatal aspect of the tooth at the mid-root level in the coronal view.

After the removal of the post, we were able to visualize the palatal crack and VRF was confirmed (Figure 1d).

Case 2

A 45-year-old male patient was referred to our office for endodontic evaluation of tooth 46 (lower right first molar) with a chief complaint of a sinus tract that comes and goes and no pain. Root canal therapy was completed some years ago. The tooth presented a crown and was only slightly sensitive to percussion. Periodontal probing revealed depths were 2–3 mm except for a 7-mm probing associated with the mesial root, on the lingual aspect. There was a lingual sinus tract.

A periapical radiograph (Figure 2a) revelead a fiber post in the distal root and an incomplete root canal filling in the mesial root canals. There was a periapical lesion in relation to the mesial root.

CBCT imaging demonstrated lingual plate bone loss and bone dehiscence in relation to the mesial root in the axial and coronal views. There was also a periapical radiolucency in relation to the mesial root (Figure 2b).

After the removal of the crown and the mesial part of the coronal restoration, we could identify the fracture line in tne mesial root (Figure 2c).

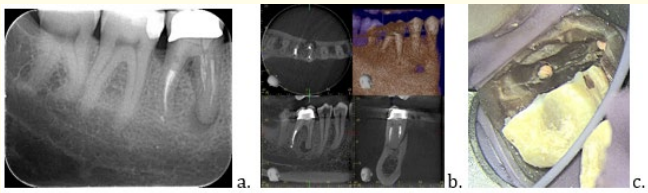

Figure 2: a. preoperative radiograph b. preopeative CBCT c. intraoperative image showing vertical mesial root fracture.

Discussion

For an accurate diagnosis, several aspects are crucial to consider; the detailed history of the respective tooth brings extremely useful clues that may indicate a vertical root fracture (VRF) early; coronally or crestally positioned sinus tract [5], deep-narrow periodontal defects, periradicular radiolucent halos and the widening of the root canal space, mild pain, the type of prosthetic restoration of the tooth, posts, the type of the tooth, history of previous VRF of other teeth, in short, a combination of clinical and radiographic features [6,7]. However, these clinical and radiographic findings usually are noted in later stages of VRF [8].

Although VRF can occur both in endodontically treated and non-endodontically treated teeth [9,10], however, it is found more often in treated teeth [11].

Prevalence of VRF in these teeth can reach 10.9% [12], or 32.1% of endodontically treated teeth over a 5-year follow-up period, VRF was identified as the cause of extraction [13].

Regarding the morphological type, the most affected teeth are the maxillary premolars and mandibular molars, and another related cause is cited to be teeth having undergone both conventional and surgical endodontic retreatment, attributed to dentin damage related to the endodontic retreatment procedures [14].

Digital periapical radiograph and CBCT are the imaging tools we have at our disposal. Unfortunately, both have significant limitations when detecting vertical root fractures [15].

Radiologically, when it is not a fracture with the separation of the fragments, only indirect signs can be noticed, such as a somewhat typical radiolucency for this condition, which appears around the root and not apically. These radiolucent areas can be masked by radiographs due to the anatomical structures, their small dimensions or the intact cortical bone plates and may result in misdiagnosis [16].

CBCT, even if it does not expose the fracture line as such, nevertheless, it is significantly more sensitive and accurate in detecting subtle areas of halo-type radiolucency of bone loss patterns and is indicative and suggestive of a VRF [17].

By exposing the three planes, CBCT overcomes these inconveniences and shows precisely where the bone resorption occurred, thus guiding the clinician in the diagnostic algorithm [18].

From the point of view of both clinical and imaging diagnosis, it is much more difficult to determine in teeth with previous root canal filling and complex coronal and radicular restoration, as both interfere with the radiological CBCT image, through the artifacts they produce [19,20]. To avoid these, it is essential to tailor and optimize the scanning parameters to each clinical situation, by considering the factors which could impact the diagnostic quality of CBCT imaging [21].

The diagnosis and exposure of these fissure lines requires the coronal disassembly of the prosthetic restoration, which can be quite laborious, or surgically, by raising a flap. Surgical exploration has the disadvantage of limiting the exposure of only the part of the root visible after raising the flap (buccal or, when accessible, palatal/lingual), while orthograde exploration does not allow the inspection of the entire root, especially the apical area [22].

It is a sensitive, delicate situation, when the patient must give his informed consent for a complex, but also expensive procedure, which has as a final result tooth extraction.

Our clinical cases show the most common clinical and imaging signs and symptoms related to VRF and the protocol for establishing the diagnosis when a fracture is suspected.

Conclusions

For the diagnosis of VRF, the history of the affected tooth and the clinical and radiological signs lead to the confirmation of this complication.

However, it is essential to visualize the fracture line, considering that they can mimic endodontic or periodontal pathology.

It is paramount to identify the VRF in the early stages as it helps preventing bone loss.

CBCT imaging allows a better visualization of specific bone loss patterns and guides to an accurate diagnosis.

CBCT and the dental operating microscope are essential in the diagnostic algorithm of VRF.

Bibliography

1. Rivera EM and Walton RE. „Cracking the cracked tooth code: detection and treatment of various longitudinal tooth fractures". *Am Assoc Endodontists Colleagues for Excellence News Letter* 2 (2008): 1-9.

2. PradeepKumar AR., *et al*. „Diagnosis of Vertical Root Fractures in Restored Endodontically Treated Teeth: A Time-dependent Retrospective Cohort Study". *Journal of Endodontics* 42.8 (2016): 1175-1180.

3. Tsesis I., *et al*. „Diagnosis of vertical root fractures in endodontically treated teeth based on clinical and radiographic indices: a systematic review". *Journal of Endodontics* 36.9 (2010): 1455-1458.

4. Patel S., *et al*. „Present status and future directions: vertical root fractures in root filled teeth". *International Endodontic Journal* 55 (2022): 804-826.

5. Tamse A., *et al*. „An evaluation of endodontically treated vertically fractured teeth". *Journal of Endodontics* 25.7 (1999): 506-508.

6. Liao WC., *et al*. „Vertical Root Fracture in Non-Endodontically and Endodontically Treated Teeth: Current Understanding and Future Challenge". *Journal of Personalized Medicine* 11.12 (2021): 1375.

7. von Arx T and Bosshardt D. „Vertical root fractures of endodontically treated posterior teeth: A histologic analysis with clinical and radiographic correlates". *Swiss Dental Journal* 127.1 (2017): 14-23.

8. Rosen E., *et al*. „Implant-associated Vertical Root Fracture in Adjacent Endodontically Treated Teeth: A Case Series and Systematic Review". *Journal of Endodontics* 42.6 (2016): 948-952.

9. Chan CP., *et al*. „Vertical root fracture in nonendodontically treated teeth--a clinical report of 64 cases in Chinese patients". *Journal of Endodontics* 24.10 (1998): 678-681.

10. Yoshino K., *et al*. „Prevalence of vertical root fracture as the reason for tooth extraction in dental clinics". *Clinical Oral Investigation* 19.6 (2015): 1405-1409.

11. Fuss Z., *et al*. „Prevalence of vertical root fractures in extracted endodontically treated teeth". *International Endodontic Journal* 32.4 (1999): 283-286.

12. Chen SC., *et al*. „First untoward events and reasons for tooth extraction after nonsurgical endodontic treatment in Taiwan". *Journal of Endodontics* 34.6 (2016): 671-674.

13. Karygianni L., *et al*. „Comparative assessment of the incidence of vertical root fractures between conventional versus surgical endodontic retreatment". *Clinical Oral Investigation* 18.8 (2014): 2015-2021.

14. Chavda R., *et al*. „Comparing the in vivo diagnostic accuracy of digital periapical radiography with cone-beam computed tomography for the detection of vertical root fracture". *Journal of Endodontics* 40.10 (2014): 1524-1529.

15. Patel S., *et al*. „The detection of vertical root fractures in root filled teeth with periapical radiographs and CBCT scans". *International Endodontic Journal* 46.12 (2013): 1140-1152.

16. Dias DR., *et al*. „Accuracy of High-resolution Small-volume Cone-Beam Computed Tomography in the Diagnosis of Vertical Root Fracture: An In Vivo Analysis". *Journal of Endodontics* 46.8 (2020): 1059-1066.

17. Tyndall DA and Kohltfarber H. „Application of cone beam volumetric tomography in endodontics". *Australian Dental Journal* 57 (2012): 72-81.

18. Schulze R., *et al*. „Artefacts in CBCT: a review". *Dentomaxillofacial Radiology* 40.5 (2011): 265-273.

19. Metska ME., *et al*. „Detection of vertical root fractures in vivo in endodontically treated teeth by cone-beam computed tomography scans". *Journal of Endodontics* 38.10 (2012): 1344-1347.

20. Gaêta-Araujo H., *et al*. „Optimization of Tube Current in Cone-beam Computed Tomography for the Detection of Vertical Root Fractures with Different Intracanal Materials". *Journal of Endodontics* 43.10 (2017): 1668-1673.

21. Wang P., *et al*. „Detection of dental root fractures by using cone-beam computed tomography". *Dentomaxillofacial Radiology* 40.5 (2011): 290-298.