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Periodontal and endodontic perspectives of vertical root fracture: A case report

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SUMMARY

A 35-year-old patient reported with sharp pain on biting and sensitivity to cold concerning the first right premolar. On recording the history, clinical examination and tests such as vitality, bite test, transillumination, periodontal probing and radiographs a diagnosis of cracked tooth syndrome (CTS) was made. The root canal treatment was completed, but the patient did not turn up for the coronal restoration, resulting in a vertical root fracture and extraction.

VRF's (Vertical Root Fracture) are more commonly encountered following endodontic treatment. Also, in teeth without endodontic treatment, with habits like bruxism and eating coarse, hard food. Early diagnosis of cracked teeth and fractures is critical for a clinician since it permits a conservative and preventive approach. Delay in diagnosis and treatment will result in involvement of the underlying periodontium, causing periodontal pockets, abscess formation and bone loss thereby further complicating the outcome

Keywords: VRF (Vertical root fracture), cracked tooth, probing depth, bruxism periodontal abscess.

Key messages: Early diagnosis of Vertical Root Fracture and prevention of progression is the key to conservative management and successful outcome. Coronal restoration following root canal therapy goes a long way in advancing such lesions.

INTRODUCTION

A VRF is a complex clinical scenario that mostly occurs due to the generation of lateral wedging forces during compaction of gutta-percha for obturation or post-placement, which are the initiators of stresses and strains (1). Additional masticatory forces in patients with chronic parafunctional habits can lead to the extraction of the affected tooth. It is also detected in intact teeth in patients with chronic trauma from occlusion such as bruxism, clenching, eating hard foods such as nuts and thermal cycling (2). The teeth most predisposed to fracture are the maxillary and mandibular premolars, the mesial roots of the mandibular molars, the mesiobuccal roots of the maxillary molars, and the lower incisors (3). This type of fracture is usually diagnosed by secondary symptoms that develop following the primary treatment, often when the coronal restoration has already been completed. The fracture line itself is often not directly visible, and therefore the history, clinical and radiographic signs and symptoms are important factors which can lead to a correct diagnosis. It is vital to pay attention to the patient's chief complaints, a thorough clinical examination and proper scrutiny of periapical and bitewing radiographs (4). Hence, in more advanced cases it requires an interdisciplinary approach with an endodontist and periodontist to rule out similar appearing endodontic – periodontal lesions.

CASE REPORT

A 35-year-old female patient presented with a chief complaint of severe sensitivity to heat, cold and sharp pain on chewing in the upper right first premolar tooth (tooth number – 14) for two weeks. On intraoral examination, the tooth was intact with attrition but no carious involvement, the gingiva was healthy, with no signs of inflammation or pockets.

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Fig. 1. Gingival swelling three months following root canal treatment

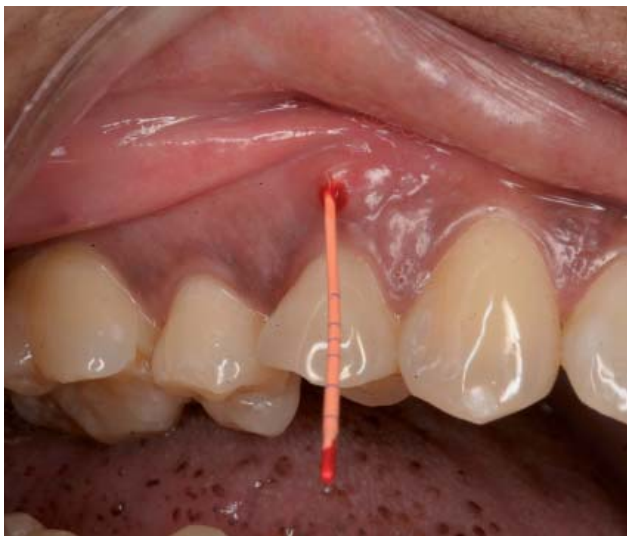

Fig. 2. Gutta-percha point inserted into the sinus tract

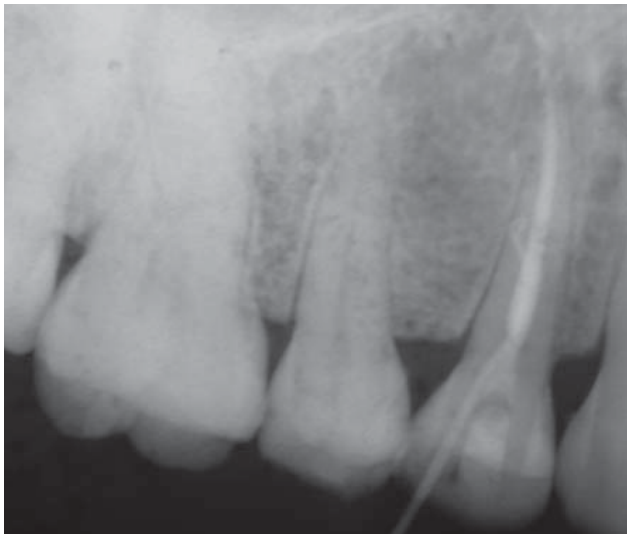

Fig. 3. IOPA Radiograph with the insertion of gutta-percha

Fig. 4. Clinical presentation after four months

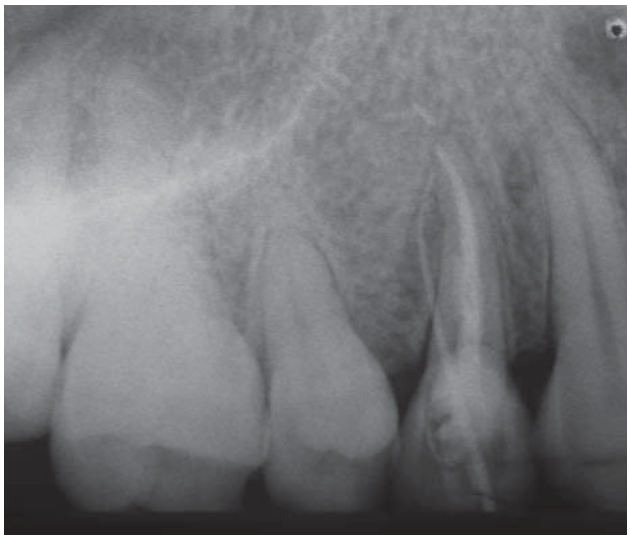

Fig. 5. IOPA Radiograph with the insertion of gutta-percha

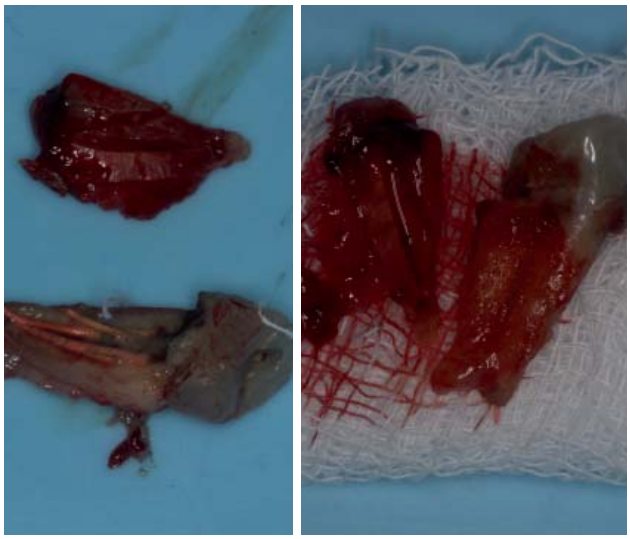

Fig. 6. Extracted tooth fragments

The tooth was tender on vertical percussion, and the patient had an anterior deep bite, several fractured cusps in the posterior molar regions, wear facets and generalised attrition. Fiberoptic light was used for transillumination but a crack was not visible. The tooth was vital and the cold test had an immediate exaggerated response. The bite test revealed pain on releasing the bite which was indicative of cracked tooth. No visible changes were noted on the Intraoral periapical radiograph. Hence, a differential diagnosis of cracked tooth was arrived at based on the clinical presentation. Root canal treatment was performed in a single visit, and the tooth was kept out of occlusion. She was advised to use the night guard fabricated for the parafunctional habit. The patient was educated, motivated and recalled for coronal onlay restoration the next week; however, the patient only reported three months later.

On clinical examination, the condition had worsened, the gingiva in the 1st premolar region was inflamed, there was a periodontal abscess with a draining sinus in the attached gingiva concerning the same tooth (Figures 1, 2). The patient had pain on lateral percussion and narrow pocket probing depth of 6mm mid buccally with purulent discharge. An intraoral periapical radiograph was taken with gutta-percha introduced into the sinus tract, which traced towards the mid-root region (Figure 3).

The patient was advised extraction of the tooth suspecting a vertical root fracture, but she was not convinced. One of the main reasons for progress of the condition in this patient was the patient relying on internet information and general disbelief that a healthy tooth with no decay would require extraction. Abscess drainage and root planning of the area was performed, and the patient was put on a course of antibiotic, Amoxicillin 500 mg, for five days, warm saline rinse and 0.2% chlorhexidine mouth wash was prescribed.

She reported a month later with further worsening of the periodontal signs and fractured palatal cusp. On examination, the tooth had discolored, there was bleeding on probing and purulent discharge from the gingival sulcus (Figure 4). A periodontal abscess was present on the buccal attached gingiva and palatal mucosa. Probing depth was a narrow sinus tract type probing of 7 mm in the mid buccal region and swelling of the extraoral, buccal area in the premolar region. This time the radiograph revealed more extensive bone loss and the gutta percha traced to the apex of the tooth (Figure 5). The patient was recommended extraction and delayed implant placement due to active periodontal infection. On obtaining consent from the patient, the tooth was uneventfully extracted by an oral surgeon. The vertical fracture was visible on the extracted tooth (Figures 6).

She was recalled for a check-up 1week later. There was uneventful healing in the area. Due to financial constraints, the patient has opted to undergo treatment for implant placement after six months

DISCUSSION

According to the American Association of Endodontists (AAE), cracks have been categorised into five types: craze lines, fractured cusp, cracked tooth, split tooth, and vertical root fracture (VRF) (5] A vertical root fracture (VRF) initiates in the root at any level, longitudinally oriented in a buccolingual direction and is usually a complete or incomplete fracture (6). Sharp pain during mastication, unexplained cold sensitivity and pain on the release of bite pressure is characteristic of Cracked tooth syndrome (CTS) (7). Deep probing depths of >6 mm accompany the crack when advanced, which is an important factor in the prognosis of the tooth. A 65% prevalence of cracks was detected in intact teeth (2).

Most experienced clinicians are challenged when it comes to diagnosis of a cracked tooth. When periodontal symptoms arise, the condition maybe difficult and confusing to diagnose. It therefore requires an interdisciplinary approach, with and endodontist and periodontist to rule out similar appearing lesions. The importance of listening to the patients' chief complaint, usually such as pain on biting and hypersensitivity to cold is an essential first step. Various other diagnostic aids lead to confirmation of VRF, such as positive bite test, patient experiences pain on release of bite. Transillumination is positive when the light penetrates the tooth structure up to the crack, leaving the part beyond the crack relatively dark. Pulp sensitivity test may resemble pulpitis and the presence of gingival swelling, narrow sinus tract tracing with concomitant radiographs. Radiograph may be challenging to interpret or only evident at later stages in the progression of the fracture as a space beside a post or root canal filling. Periapical radiographs with two different angulations may help in identification (6). Magnification using either loupes or an operating microscope and dyes such as methylene blue or tincture of iodine can help detect a fracture line (7).

Although CBCT has been used and there are some cases where it was helpful, the main problem with is the masking of the fracture line by the obturating material or posts making it an unreliable tool. With the CBCT devices currently available, the

width of an unseparated fracture may be too small and undetectable. The smallest voxel size currently available for a CBCT device is about 0.075 mm, CBCT imaging would not be able to visualize a root fracture unless the fracture width was greater than 0.15 mm (7). Literature from meta -analysis and systematic reviews conclude that the use of CBCT in the detection of VRF as a diagnostic tool may be unreliable (8, 9). Enhanced CBCT imaging – such as reaching a better signal-to-noise ratio, a smaller voxelsize, and application of advanced algorithms to segment fracture lines – may hold a better potential to enhance the image to detect early-stage VRFs in the future.

When a vertical root fracture forms, whether complete or incomplete, it communicates with the underlying periodontium. As the fracture line extends into the periodontal ligament the bacterial plaque and gingival crevicular fluid seep through the gingival sulcus, the area becomes a source of chronic inflammation and results in a deep pocket and sinus tract formation (10). The typical VRF associated probing must be differentiated from a periodontitis related pocket probing in which the latter has a wider coronal opening and is not taut (7). Surgical full-thickness flap reflection may eventually be required to visibly confirm its presence along with the type of bone loss. Periodontal breakdown and bone resorption is rapid in premolars where the buccal cortical plate is thin. Most commonly dehiscence type bone resorption in the buccal cortical plate develops (6). In teeth associated with a periodontal abscess, fenestration type bone resorption occurs on the buccal aspect when the fracture is along the root without involving the coronal or apical parts of the root (10).

The prognosis and management for cracked teeth depend on the severity, position of the crack, the pain and discomfort experienced by the patient. If the involved part of the tooth is relatively small and the crack does not involve the pulp, the tooth could be restored conservatively using resins, inlays, or crowns (11). Patients with worsening chronic symptoms such as tooth hypersensitivity, pulpal involvement periodontal abscess and deep probing depths, root canal treatment (RCT) is mandatory before completing the coronal restoration. Early detection of cracked and fractured teeth can enable the establishment of conservative preventive strategies in order to avoid complications. Single rooted teeth generally have a poor prognosis when there is advanced involvement. Molars, on the other hand, can be salvaged by treatment with root resection and hemisection and coronal restoration. Persistence of symptoms, severe destruction of the underlying periodontium and loss of attachment can hamper the prognosis and lead to extraction of the tooth. (2, 10, 12).

CONCLUSION

VRF's are challenging and confusing to detect clinically. Hence various tests along with the patient's signs and symptoms have to be taken into consideration to arrive at a confirmatory diagnosis. Early detection is vital and can be managed conservatively since the management depends on the extent and severity of the lesion. Following root canal treatment, a coronal restoration is mandatory.Progress into the underlying periodontium can hamper the prognosis and lead to extraction of the tooth.

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