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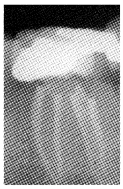

CASE REPORT

Horizontal/oblique root fractures in the palatal root of maxillary molars with associated periodontal destruction: case reports

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Abstract

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Aim To report two cases of palatal root fracture in maxillary molars that were successfully managed in the short term by root canal treatment and root amputation.

Summary In the first case, a 48-year-old woman with bony destruction and a deep periodontal pocket on the palatal root of tooth 26 (FDI) underwent root canal treatment. Bleeding into the palatal canal and radiolucent lines over the root suggested a fracture. Further evidence was provided by an electronic apex locator. Subsequent surgery confirmed the presence of a horizontal root fracture and the fractured root was removed. In the second case, a 75-year-old woman presented with pain from the left posterior teeth. Clinical examination revealed an oblique root fracture of tooth 27 palatal roots with abscess formation and a deep periodontal pocket. Palatal root amputation and odontoplasty were performed. This was followed by root canal treatment. Both teeth were preserved in the short term and early healing of these two cases was uneventful.

Key learning points

- Horizontal/oblique root fracture of the palatal root in molars is rare.
- A combination of periodontal and root canal treatment and palatal root amputation may allow short-term preservation of functional teeth.

Keywords: root fracture, horizontal, maxillary molar, palatal root.

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Introduction

Horizontal root fractures are uncommon in posterior teeth and pose a considerable threat for their preservation, because most root-fractured molars are probably extracted. Root fractures may be horizontal, vertical or oblique in pattern. Horizontal or oblique root fractures usually occur in the anterior teeth of young adults because of traumatic injury. Vertical root fractures are common in root-filled posterior teeth (Chan *et al*. 1999). A number of contributing factors have been implicated in root fracture, including traumatic injury, iatrogenic dental procedures (such as excessive compaction forces during root filling), trauma from the occlusion, post expansion because of corrosion products (Meister *et al*. 1980) and inflammatory root resorption resulting from advanced periodontitis (Bender & Freedland 1983). There have, however, been numerous reports describing vertical root fractures occurring in sound noncarious teeth (Wei & Ju 1989, Yeh 1997, Chan *et al*. 1999). Accurate diagnosis of root fractures is usually accomplished by detailed clinical and radiographic examinations. In the early stages, root fractures may show no specific signs and symptoms, making diagnosis difficult. Few reports have reported the clinical management of horizontal or oblique root fractures in posterior teeth. Two cases are presented with horizontal/oblique palatal root fractures in maxillary molars, which were preserved in pain-free function by palatal root amputation, odontoplasty and root canal treatment.

Case reports and results

Case 1

A 48-year-old woman was referred to the Department of Dentistry, National Taiwan University Hospital during the spring of 2006. She presented with persistent pain from tooth 26 (FDI) after root canal treatment by several local dentists. A review of the medical history was unremarkable, and she denied any habits such as chewing hard foods and betel quid or bruxism/clenching. Intraoral examination revealed generalized periodontitis. Tooth 26 had been endodontically accessed, with a cement dressing *in situ*. The tooth was painful to percussion and palpation, and displayed grade II mobility with 5-mm periodontal probing and purulent discharge palatally (Fig. 1a). Soft tissue examination revealed no signs of scaring or any other evidence of previous trauma. Radiographic examination revealed a horizontal radiolucent line on the palatal root and a diffuse radiolucent lesion surrounding the apical portions of the palatal and mesiobuccal roots. No intraradicular post was present, but root filling material was noted in the distobuccal root (Fig. 1b). Considering the clinical and radiographic findings, a horizontal fracture of the palatal root was suspected. With the pateint's consent, conventional root canal retreatment followed by amputation of the palatal root was planned. During root canal retreatment, bleeding was noted in the palatal canal. Examination with an electronic root apex locator (Root-ZX; Morita, Tokyo, Japan) confirmed that the files were communicating with the periodontal ligament space, providing further evidence for the possibility of a palatal root fracture. After root canal cleansing and shaping, the mesiobuccal and distobuccal canals were filled with gutta-percha and sealer (Canals; Showa Shizai Kako Co. Ltd, Tokyo, Japan) (Fig. 1c).

After local anaesthesia, a full-thickness palatal flap was reflected, and the horizontally fractured root segment was visualized (Fig. 1d) and removed (Fig. 1e). An odontoplasty was then performed to remove the overhanging edges of tooth structure. After soft tissue compression to control bleeding, the flap was sutured. Healing was uneventful and recall 2 months after surgery confirmed a decrease in the size of the radiolucent lesion. The

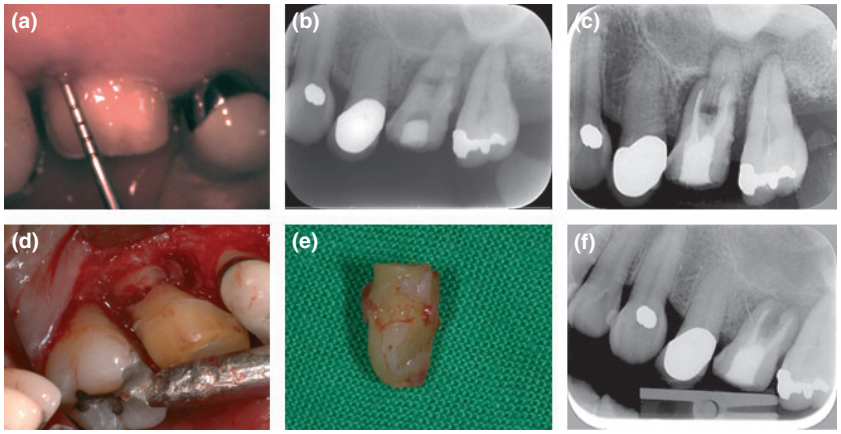

Figure 1 (a) A deep periodontal pocket over the palatal root of tooth 26 was noted. (b) Radiographic examination demonstrated a horizontal radiolucent line on the palatal root and the presence of radiolucent lesions surrounding the palatal and mesiobuccal roots. (c) Radiograph taken after root canal treatment of the mesiobuccal and distobuccal canals. (d) After reflection of a full-thickness flap, displacement of fractured palatal root and an intrabony defect were observed. (e) The extracted palatal root fragment. (f) Radiograph taken 2 months after palatal root amputation showing healing of the bony lesion.

extent of tooth mobility had improved, suggesting possible bony filling of the osseous defect (Fig. 1f). The patient was lost to follow-up and no further long-term evaluation was possible.

Case 2

A 75-year-old woman was seen at the Department of Dentistry, National Taiwan University Hospital during the winter of 2006. She complained of persistent pain over her left upper and lower posterior teeth. She denied all major systemic diseases. Intraoral examination revealed a periodontal abscess around the palatal side of her tooth 27 (Fig. 2a) and generalized moderate periodontitis. As a result of gingival recession, an oblique fracture of the palatal root was readily identified. The patient felt pain during percussion and tenderness over the palatal gingiva. Tooth 27 displayed grade III mobility with fremitus, and periodontal probing revealed a wide and deep pocket extending to the apical region of palatal root (Fig. 2b). Occlusal attrition was evident on the posterior teeth, although the posterior occlusion was generally stable. Radiographic examination revealed a circular radiolucency around the palatal root and no prior root canal treatment (Fig. 2c). No radiolucent fracture line was evident. Interestingly, her tooth 36 also showed a vertical root fracture on the mesial root (picture not shown). Considering the clinical and radiographic findings, the diagnosis was a combined periodontal–endodontic lesion because of oblique fracture of the palatal root of tooth 27. To immediately relieve soft tissue swelling and discomfort, a full-thickness flap was raised under local anaesthesia and the fractured palatal root was removed. This was followed by odontoplasty to remove the remaining tooth structure overhang. The fracture of the palatal root was oblique in pattern (Fig. 2d). Following odontoplasty, gross debridement of the necrotic pulp space was performed. Conventional root canal treatment was performed 1 week later after sealing of the exposed palatal canal orifice with light-curing glass–ionomer cement to prevent coronal leakage. After appropriate root canal debridement and shaping, the mesiobuccal and distobuccal canals were filled with gutta-percha and sealer by cold lateral condensation (Fig. 2e). Healing of the gingival tissue was uneventful (Fig. 2f) and a

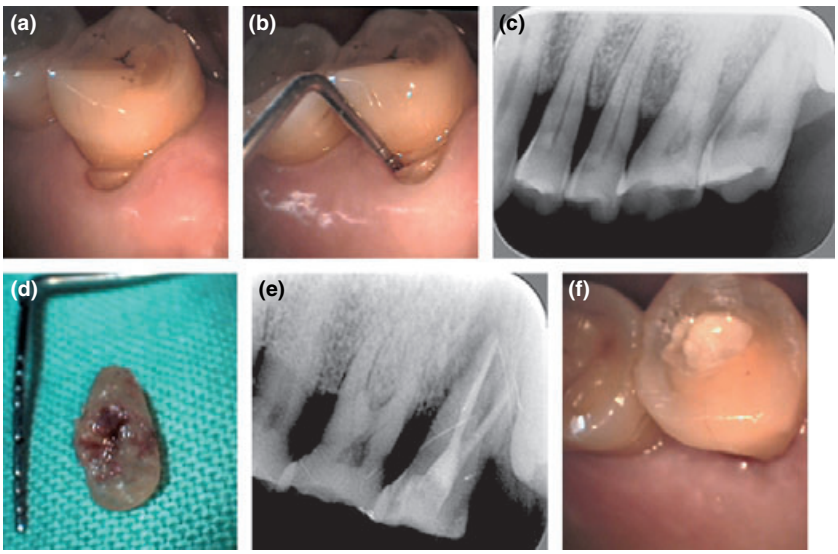

Figure 2 (a) Swelling over the palatal side of tooth 27 and concomitant root fracture. (b) Periodontal probing revealed the presence of a deep pocket. (c) Radiographic examination showed a diffuse radiolucent lesion around the tooth. (d) Extracted palatal root showing oblique fracture. (e) Radiographic evaluation of root canal treatment. (f) Clinical picture of the tooth, 2 months after initial treatment showed adequate short-term healing.

marked improvement in tooth mobility to grade I was noted 4 months after initial treatment. Regular follow-up appointment was arranged to evaluate the long-term treatment outcome for this patient. As horizontal/oblique root fractures are rare and root amputation is usually successful for treatment, cases with short-term treatment outcome are reported.

Discussion

Vertical root fractures may be encountered in nonendodontically treated and endodontically treated teeth, the latter being more common (Legan *et al.* 1995, Yang *et al.* 1995, Chan *et al.* 1999). Interestingly, reports of horizontal and oblique root fractures in the posterior teeth are rare. Legan *et al.* (1995) reported a case of horizontal root fracture in a premolar, possibly because of excessive traumatic force exerted during the cementation of an over-contoured adjacent crown. Jerome (1994) detected a horizontal fracture in the mesiobuccal root of a maxillary molar, which was because of traumatic injury during surgery to the maxillary sinus. In the current report, two cases are described with horizontal/oblique fractures in the palatal roots of maxillary molars concomitant with bony destruction. No previous history of exogenous trauma, post placement or surgery was elucidated.

Besides exogenous traumatic injury, understanding of the causes of horizontal/oblique root fracture is unclear. Yang *et al.* (1995) and Yeh (1997) suggested that root fractures might be related to special dietary or chewing habits. On the other hand, Bader *et al.* (2004) suggested that patient behaviors (such as chewing hard food or clenching teeth) were not major risk indicators for posterior tooth fracture. In the current female patients, no specific oral habit such as chewing betel quid (which contains coarse fibres) (Jeng *et al.* 2001) was identified, although widespread wear was apparent in case 2. This may suggest an occlusal element in the fracture of both 27 and 36.

Many reports have suggested that patient age is related to the risk of root fracture. The majority of patients with root fracture are over 40 years of age (Yeh 1997, Borelli & Alibrandi 1999, Bader *et al.* 2004). This is consistent with the current report. The dentitions of older adults may be predisposed to root fracture because of changes in dentine elasticity, increased numbers and size of restorations, the presence of more root-filled teeth (Gher *et al.* 1987) and the effects of long-term occlusal stress during mastication (Hiatt 1973). Although the occlusion of the two current patients was regarded as stable, a large access cavity in case 1 and severe attrition in case 2 may have predisposed the teeth to root fracture.

Root fractures often present no specific signs and symptoms. Because the onset of non-impact-related root fractures may be slow, early detection and diagnosis may be difficult, especially when there is no marked displacement. After progression for several months or years, the symptoms and signs of root fractures may become more obvious with the development of pulpal and periodontal lesions. Finally, the fractured segments may separate from the rest of the tooth structure and be observed during periodontal or root canal treatment. In most cases, horizontal/oblique root fractures should be suspected when a combination of the following symptoms is observed: pain, local swelling, tooth mobility, periodontal pocket, radiographic fracture lines, sinus tract, abscess formation, sensitivity to percussion or palpation or detection of fracture lines over root surfaces with an explorer. However, all these signs are nonspecific and not all fractures may be visualized by conventional dental radiography (Rud & Omnell 1970). Bleeding from the root canal during treatment and further confirmation with an electronic apex locator may be helpful for the early diagnosis of root fracture, as in case 1. In some uncertain cases, surgical exploration is indicated for diagnosis. The presence of periodontal destruction and abscess formation was observed in both of the current cases. Whether the periodontal destruction was because of root fracture or whether periodontal destruction around maxillary molar palatal roots may change masticatory force distribution leading to root fracture is unclear and worthy of further investigation.

The prognosis for vertical root fractures is generally poor, and root amputation or tooth extraction is the usual treatment strategy. Treatment alternatives for teeth with horizontal/oblique and vertical root fractures may depend upon the location and extent of the fracture, the length and bony support of the remaining roots. Additional factors include the extent and quality of remaining tooth structure, root morphology and distribution of occlusal forces for the final prosthesis (Hemptom & Leone 1997, Silverstein *et al.* 1999). The 4-year survival rate of maxillary molars after root amputation is reported to be 93% (Babay & Almas 1996) and long-term survival of teeth after root amputation ranges from 87% to 95% (Buhler 1994, Hemptom & Leone 1997). In the current cases, two maxillary molars with palatal root fractures were preserved in the short term by surgical removal of the fractured roots and adequate root canal treatment.

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