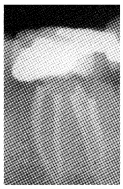

CASE REPORT

Orthodontic movement of two root fractured teeth: a case report

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Abstract

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Aim To illustrate significant tipping orthodontic movement of root fractured teeth.

Summary As the frequency of root fractured maxillary teeth is related to increased overjet and reduced lip coverage, orthodontic treatment may increase lip coverage and reduce the risk of trauma or its severity. It may also be necessary to move previously traumatized teeth. Two root fractured teeth were tipped through a considerable angle (19°) to reduce a large overjet and followed up for 5 years.

Key learning points

- Reduction of large overjets involving root fractured teeth may not affect pulp vitality.
- Root fragment separation prior to orthodontics did not appear to increase in this patient, but angulation of the fragments did not completely follow the major change to the coronal part of the tooth.

Keywords: orthodontics, prognosis, root fracture.

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Introduction

Relatively little has been written on the relationships between endodontics and orthodontics. While rapid tooth movement may result in pulpal injury, orthodontic movement of traumatized teeth presents little risk of resorption if the pulp condition is normal. The need to reposition teeth with root fractures presents a clinical dilemma for orthodontist and endodontist. In the permanent dentition, root fracture predominantly affects the maxillary incisor region with the central incisors being the most commonly involved teeth (Andreasen & Andreasen 1994). Injuries are associated with malocclusion (Zachrisson & Jacobsen 1974), patients with an increased overjet being more liable to fractures (Dearing 1984). There is a strong correlation between the extent of overjet and frequency of fracture (O'Mullane 1973, Järvinen 1979). Trapping of the lower lip under the maxillary incisors maintains proclination and is a significant trauma risk factor (O'Mullane 1973, Dearing 1984). Correction of overjet to reduce this risk is an indication for

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orthodontic treatment (Shaw *et al.* 1980), but most patients are assessed for orthodontics in the late mixed dentition period by which time some teeth are already traumatized. Brin *et al.* (1991) report that the combination of trauma and orthodontic treatment resulted in a high prevalence of loss of vitality and of pulp canal obliteration. If roots are fractured, healing may include the interposition of hard tissue, connective tissue, or granulomatous tissue, the healing type being related to the type of injury, severity of luxation and degree of closure of the apical foramen at the time of injury (Andreasen 1989). It is possible to orthodontically move root fractured teeth provided that sufficient care is taken (Zachrisson & Jacobsen 1974, Hovland *et al.* 1983, Erdemir *et al.* 2005). This report describes the reduction of a very large overjet of two root fractured maxillary central incisors, which remained free of adverse pulp and periodontal changes before and after treatment.

Case report

A twelve-year-old boy presented to the Department of Oral Sciences, University of Otago School of Dentistry for management of his proclined maxillary incisors. He was in the late mixed dentition stage with a Class II division 1 malocclusion on mild skeletal II bases (ANB 5.5°) and with edge-to-edge molar relationships on both the right and left sides. The maxillary incisors were proclined (116°) with a 10 mm overjet and 100% overbite complete to the palate. The lower lip was trapped under the maxillary incisors. The medical history was noncontributory. The patient reported trauma to his maxillary incisors during a basketball game 2 years previously, but treatment had not been sought. The teeth were asymptomatic with normal colour and mobility. Both teeth responded to vitality testing using refrigerant spray and electronic tests (Endo-Frost, Coltène/Whaledent, Langenau, Germany; Vitality Scanner 2006, Analytic, Orange, CA, USA). A periapical radiograph revealed apical third root fractures of both maxillary central incisors (Fig. 1). The incisor position seen on lateral cephalometric radiograph is shown in Fig. 2.

Orthodontic treatment involved extraction of the maxillary first premolars and mandibular second premolars and fixed orthodontic appliances for both arches. The appliances were not placed on the maxillary central incisors until the canines had been

Figure 1 Periapical radiograph prior to treatment.

Figure 2 Initial incisor position on lateral cephalometric radiograph.

Figure 3 Periapical radiograph 1 month before treatment completion.

retracted. The majority of tooth movement was performed using Class II intermaxillary elastic traction. The maxillary left central incisor was initially rotated 40° distopalatally and then brought into the line of the arch by the completion of treatment. Figure 3 shows the periapical situation 1 month before completion, which took 2 years and 10 days. The patient was debonded in a full Class I molar relationship with 10% overbite and 1 mm overjet. The maxillary incisor angulation had been reduced to 97° and the mandibular incisor angulation was reduced by 1° (Table 1). Electronic pulp testing at 3-month intervals during treatment showed a diminished initial response. Levels then reverted to normal and remained so during the treatment. The responses at the completion of treatment were slightly reduced, but tooth mobility and colour were unchanged.

Table 1 Cephalometric changes at T1 (pre-treatment), T2 (post-treatment) and T3 (5 years post-treatment)

	T1	T2	T2–T1 (change)	T3 (5 years)	T3–T1 (5-year change)
UIA	116	97	19	105	–1
LIA	93.5	92.5	–1	90	–3.5
ANB	5.5	5.0	0.5	3	–2.5
OB (mm)	8	1	–7	3	–5
OJ (mm)	10	1	–9	1	–9
Go-Me (mm)	72	78	6	79	1
ANS- Me (mm)	66	72	6	76	10

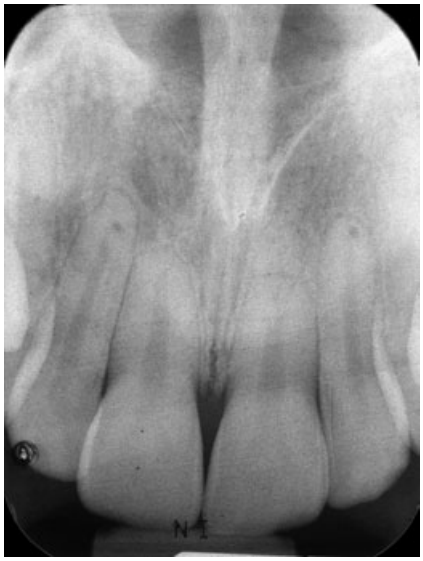

Figure 4 Periapical radiograph at 5-year review.

At 5-year recall both teeth had remained asymptomatic, the teeth were in normal function and mobility was comparable to that of adjacent teeth. There had been no colour changes and the soft tissues were healthy. The periapical condition is shown in Fig. 4.

In the 2 years of treatment, the patient's mandibular length (Go-Me) increased 6 mm but in the 5-year period since debonding his mandible grew only 1 mm horizontally. This contrasted with his vertical growth. During pre-treatment his lower face height (ANS-Me) was 66 mm. At the end of treatment it was 72 mm and after 5 years 76 mm (Table 1). This demonstrates that he continued to grow vertically while most of his horizontal growth had ceased. Cephalometric superimposition of the pre- and post-orthodontic tooth positions are shown in Fig. 5.

Discussion

While recommendations have been published regarding the orthodontic management of root-filled teeth (Drysdale *et al.* 1996) and the effect of orthodontics on pulp vitality has been reviewed (Hamilton & Gutmann 1999), there is little literature to assist in the orthodontic management of teeth with root fractures. Zachrisson & Jacobsen (1974) noted that while an observation period of 2 years is recommended prior to the commencement of treatment, most complications arise during the first year after trauma.

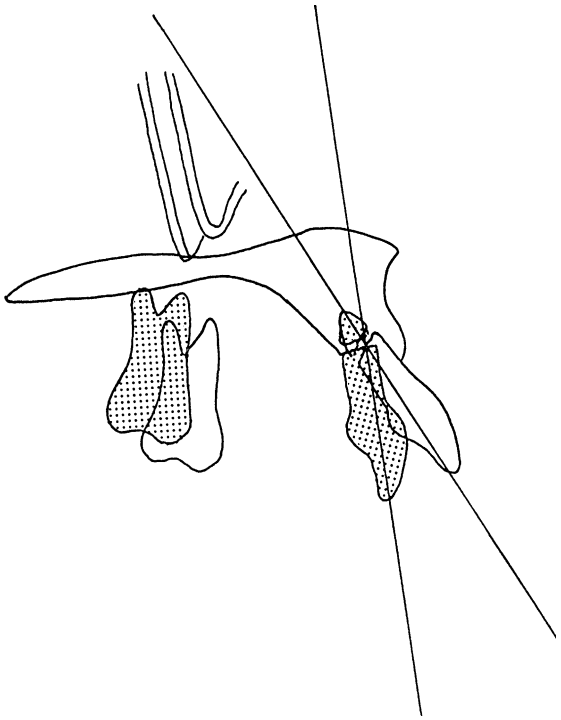

Figure 5 Change in maxillary incisor position superimposed on the key ridge.

The severity of the trauma for this patient was unknown but no treatment had been received. The accident occurred 2 years prior to orthodontics and periapical radiographs taken prior to treatment showed no evidence of pathosis. Pulp sensitivity tests were normal prior to orthodontics and altered pulp responses with treatment underway may in part be due to altered positioning of the test stimuli because of the presence of brackets. Physiological reduction in the size of the pulp may also have played a role, but there was no evidence of pulp canal obliteration. The outline of the incisors seen on a post-treatment cephalogram showed a tipping of the teeth through 19° with the root fragments being maintained in their pre-treatment orientation creating an apparent 'bend' in the root. The vertical position of the maxillary incisors remained relatively constant and thus the teeth appear similar when the preoperative periapical view is compared with that taken following treatment (Figs 1 and 3).

The post-treatment periapical views show no evidence of pathology although there is some evidence of rounding of the fracture margins, representing minor external surface resorption (Andreasen 1989). Pulp sensitivity tests indicated that the teeth were able to be tipped back and torqued with no apparent adverse effects. Torquing movements into the palatal cortex may be associated with root resorption (Ten Hoeve & Mulie 1976) but for this patient the majority of change was tipping. Torquing movements were kept to a minimum and the central incisors were bonded as late as possible as part of the treatment plan. This seems to be a rational approach when large orthodontic movements of root fractured teeth are required.

Conclusion

When care is taken, significant orthodontic movements of teeth with fractured roots may be possible without adverse pulpal effects.

Disclaimer

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