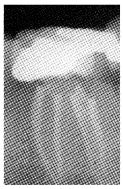

CASE REPORT

Continued root formation of a pulpless permanent incisor following root canal treatment: a case report

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Abstract

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Aim To present a case of a pulpless permanent incisor that continued root formation following root canal treatment.

Summary A healthy 8-year-old girl with a history of dental trauma resulting in a coronal fracture involving enamel, dentine and pulp was referred by her general dental practitioner for treatment and evaluation of tooth 21. The tooth had a necrotic pulp and periapical rarefaction was evident radiographically. The canal was prepared, dressed with $Ca(OH)_2$ and then filled with a rolled gutta percha cone and Roth's root canal sealer. A radiograph exposed eight years post-treatment, showed evidence of continued apical formation.

Key learning points

- Teeth with necrotic pulps and periapical rarefaction may show evidence of continued apical formation after root canal treatment.
- Hertwig's epithelial root sheath may be more resistant than expected to trauma and infection.

Keywords: pulpless teeth, root canal treatment, root formation.

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Introduction

Traumatic injuries to young permanent teeth are common, affecting 30% of children (Andreasen & Andreasen 1994). The majority of accidents occur when root formation is incomplete, and the effects may be extensive (Andreasen & Andreasen 1994). The teeth most commonly traumatized in children are the maxillary central incisors. The peak incidence for trauma occurs between 8 and 10 years of age, when the roots of the incisors are developing. If during this time, the pulp becomes necrotic as a consequence

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of the traumatic episode, no further development and maturation will take place, resulting in a necrotic incisor with an open apex and fragile root walls (Mackie *et al.* 1988). A healthy pulp is generally regarded as essential for proper formation of the root in a developing tooth (Torneck & Smith 1970). However, it is known that Hertwig's root sheath, under favourable conditions, can organize the apical cells and cause continued formation of the root even after the pulp is necrotic, provided the root sheath is not destroyed (Cooke & Rowbotham 1988). Reaming and/or filing in young teeth with open apices can damage the periapical tissues and may prevent normal continued root development by injuring the residual odontogenic cells (Torneck *et al.* 1973). The solutions used to disinfect the root canals are caustic and may add more insult to the injury (Marquez-Aviles & Miller 1980). It has also been reported that normal root configuration was not found after calcium hydroxide treatment (Mizutani 1985), which may be because of damage to the root sheath during endodontic treatment.

Many studies have looked at root growth subsequent to trauma and have highlighted the importance of the epithelial root sheath of Hertwig in continued root formation (Andreasen *et al.* 1995). The root sheath is usually sensitive to trauma; however, in some circumstances it may resist damage from trauma and infection (Cvek 1992). Various authors have assumed from radiographic evidence that, after a period of inactivity caused by infection, root formation can be resumed. The basis of this assumption is that the epithelial sheath of Hertwig may remain intact and be ready to resume its function, once the reservoir of infection has been removed from the canal system.

The aim of this case report is to demonstrate continued apical development that morphologically resembled normal root formation following root canal treatment of an immature tooth with a necrotic pulp and apical periodontitis.

Report of case

A healthy 8-year old girl was referred to the Endodontic Department of Shiraz University, School of Dentistry for treatment of tooth 21. She had suffered a traumatic incident the previous year. Clinical examination revealed a fractured mesial incisal edge exposing the pulp to the mouth; thermal and electric pulp sensitivity tests confirmed that the pulp was necrotic. No tenderness to palpation and percussion tests was evident. There were no significant periodontal probing depths, and adjacent teeth appeared and tested within normal limits. Radiographically a periapical rarefaction was evident around the apex of tooth 21.The root canals of this tooth and the adjacent teeth were wide (Fig. 1).

There was no evidence of swelling or tooth mobility at presentation but the patient had previously experienced pain and intra-oral swelling in the 21 region. A draining sinus tract was seen in the mucolabial fold near the apex of the affected tooth, which had been present for a few weeks. Review of the medical history revealed nothing of relevance. A diagnosis of pulp necrosis with chronic apical periodontitis (CAP) was made. Therefore, nonsurgical root canal treatment was initiated. After access cavity preparation, the working length of the tooth was obtained and biomechanical preparation was performed to the radiographic apex with a size 40 K-file.

Subsequent preparation was performed 1 mm short of the radiographic apex. The canal was copiously irrigated with 2.6% sodium hypochlorite. Calcium hydroxide powder mixed with isotonic buffered saline (Merck, Darmstadt, Germany) was the inter-appointment dressing material placed in the canal with a lentulo paste filler. The tooth was then sealed with Cavit (EPSE, GmbH Seefeld Oberbay, Germany). The sinus tract closed soon after treatment, and at the next appointment, the canal was filled with a rolled gutta percha cone and Roth's root canal sealer (Roth Drug Company, Chicago, IL, USA). The final radiograph showed a satisfactory root filling (Fig. 2).

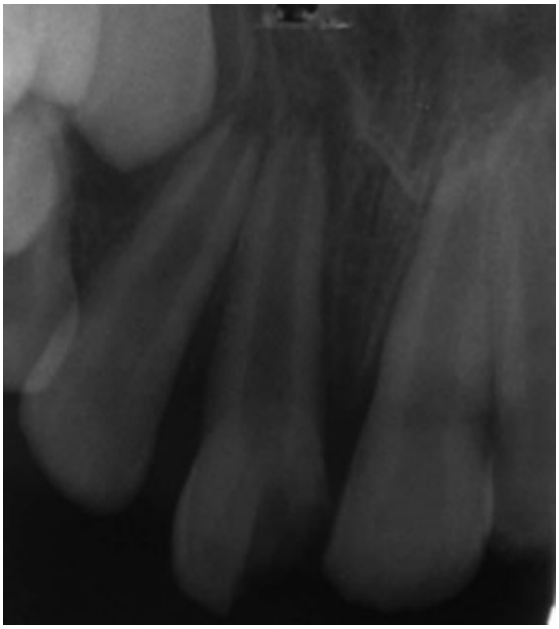

Figure 1 Radiograph at initial examination. Tooth 21 has a necrotic pulp and apical periodontitis.

Figure 2 Radiograph of root filling.

The tooth was then provisionally restored with Cavit, and the patient referred to the Restorative Department for a permanent coronal restoration.

Eight years after the start of treatment, the patient was referred for replacement of the coronal composite restoration. A radiograph showed regeneration of the periradicular

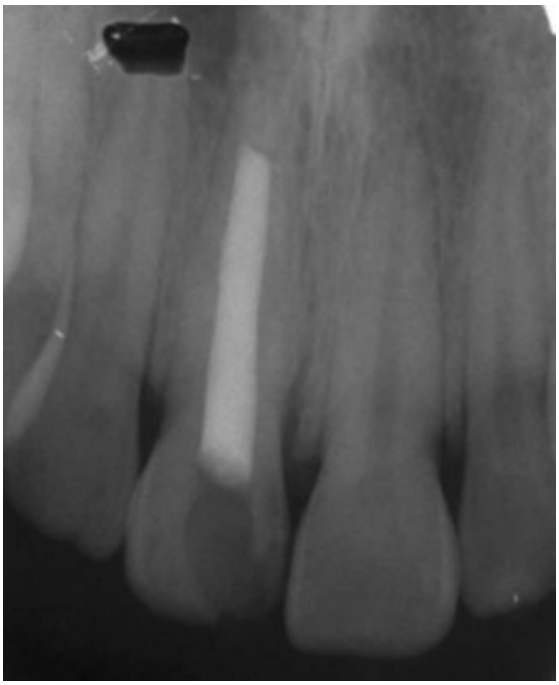

Figure 3 Eight years after canal filling a morphologically mature apex has formed that seems to have enclosed the gutta percha within the canal.

tissues, a normal periodontal ligament space and lamina dura, and continued apical formation that appeared to enclose the gutta percha within the root (Fig. 3).

Root length was approximately that of the contra lateral counter part. In addition, the tooth was free of any symptoms and the sinus tract remained healed.

Discussion

This case is an example of apical root-end completion following trauma and subsequent root canal treatment. Despite the loss of pulp vitality, apical root formation continued, probably because of residual odontogenic cells of the apical portion of the pulp, including Hertwig's root sheath that remained vital and active.

Epithelium is thought to be resistant to inflammatory changes (Cooke & Rowbotham 1988, Cvek 1992). Thus, it is possible that in this case Hertwig's sheath survived, retaining its ability to continue its role of root organization or root development when the inflammatory process was eliminated. Accordingly, if bacteria are removed and a material that is non-irritant to periapical tissues is subsequently introduced into the root canal, Hertwig's sheath may continue root-end completion in an apparently normal manner (Cooke & Rowbotham 1988, Andreasen *et al.* 1995). The cells in the periapical region of an incompletely developed tooth may be considered to be pluripotential and thus subject to differentiation into cells which can form normal dental tissues after the inflammatory reaction resolves (Frank 1966, McCormick *et al.* 1983, Smith *et al.* 1984).

Rule & Winter (1966) stated that root growth was only possible where the epithelial root sheath of Hertwig has retained its specialized function. In the present case report, it appears that in spite of trauma and infection, the root sheath of Hertwig remained viable and continued to map out the apical segment, resulting in apical root-end completion and

root lengthening. The apex formed post-operatively appeared to resemble a normal apex, morphologically.

From a practical point of view, the need for regular, long-term clinical and radiographic review is advocated for all trauma cases.

Disclaimer

Whilst this article has been subjected to Editorial review, the opinions expressed, unless specifically indicated, are those of the author. The views expressed do not necessarily represent best practice, or the views of the IEJ Editorial Board, or of its affiliated Specialist Societies.

References

Andreasen JO, Andreasen FM (1994) *Textbook and Color Atlas of Traumatic Injuries to the Teeth*, 3rd edn. Copenhagen, Denmark: Munksgaard.

Andreasen JO, Borum MK, Andreasen FM (1995) Replantation of 400 avulsed permanent incisors. *Endodontics and Dental Traumatology* **11**, 69–75.

Cooke C, Rowbotham TC (1988) Closure of open apices in non-vital immature incisor teeth. *British Dental Journal* **165**, 420–1.

Cvek M (1992) Prognosis of luxated non-vital maxillary incisors treated with calcium hydroxide and filled with gutta-percha. *Endodontics and Dental Traumatology* **8**, 45–55.

Frank AL (1966) Therapy for the divergent pulpless tooth by continued apical formation. *Journal of American Dental Association* **72**, 87–93.

Mackie JC, Bentley EM, Worthington HW (1988) Closure of open apices in non-vital immature incisor teeth. *British Dental Journal* **165**, 169–73.

Marquez-Aviles JR, Miller J (1980) Beechwood creosote, Formocresol: Bactericidal and irritant properties for endodontia. *British Dental Journal* **149**, 105–8.

McCormick JE, Weine FS, Maggio JD (1983) Tissue PH of developing lesions in dogs. *Journal of Endodontics* **9**, 47–51.

Mizutani T (1985) Experimental studies of pulpectomy in permanent teeth with incompletely formed calcium hydroxide paste with addition of silicon oil. *Shikwa Gakuo* **10**, 1363–409.

Rule DC, Winter GB (1966) Root growth and apical repair subsequent to pulpal necrosis in children. *British Dental Journal* **120**, 586–90.

Smith W, Leeb IJ, Torney DL (1984) A comparison of calcium hydroxide and barium hydroxide as agents for inducing apical closure. *Journal of Endodontics* **10**, 64–70.

Torneck CD, Smith JS (1970) Biologic effects of endodontic procedures on developing incisor teeth, I. Effect of partial and total pulp removal. *Oral Surgery, Oral Medicine, Oral Pathology* **30**, 258–66.

Torneck CD, Smith JS, Grindahl P (1973) Biologic effects of endodontic procedures on developing incisor teeth. II. Effect of debridement and disinfection procedures in the treatment of experimentally induced pulp and periapical disease. *Oral Surgery, Oral Medicine, Oral Pathology* **34**, 532–40.