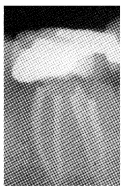
doi:10.1111/j.1365-2591.2008.01376.x



CASE REPORT

Conventional and surgical endodontic retreatment of a maxillary lateral incisor with unusual anatomy

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Abstract

Karabucak B, Ishii H, Kratchman SI. Conventional and surgical endodontic retreatment of a maxillary lateral incisor with unusual anatomy. *International Endodontic Journal*, **41**, 524–531, 2008.

Aim To describe conventional and surgical endodontic treatment of a maxillary right lateral incisor with an unusual root dilaceration and to discuss the treatment outcome.

Summary Root dilacerations refer to severe curvature or angulations that may occur anywhere along the length of a root. This anatomical deviation may present an unfavourable outcome if clinicians fail to recognize the difficulties. The following case report describes conventional and surgical endodontic treatment of a maxillary right lateral incisor with an unusual root dilaceration.

Key learning points

- Root morphology may present a challenge for clinicians during root canal treatment.
- Clinicians should be aware of the importance of surgical endodontics and be familiar with microsurgery principals and techniques.

Keywords: dilacerations, root canal treatment, surgical endodontics, unusual anatomy.

Received 13 July 2007; accepted 8 November 2007

Introduction

The term 'dilaceration' refers to severe curvature or angulations that may occur anywhere along the length of a root, affecting its crown, amelocemental junction, along the root, or the apex of the root. This anatomical deviation may present major problems not only during extraction but also endodontic treatment and orthodontic movement.

The true aetiology of this anomaly is unknown, however, it is assumed to be because of a disturbance in the growth of the epithelial root sheath of Hertwig (Lin *et al.* 1982). Acute trauma, scar formation, primary tooth germ developmental anomaly and/or genetics are considered to be contributing factors (Lin *et al.* 1982). Several cases, mostly in the maxillary anterior region, have been reported along with discussion of the cause and the

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management of dilacerated teeth. Initially, because of the nature of reported cases, trauma has been suggested to be a major factor in the formation of anatomical anomalies. Andreasen & Ravn (1971) studied permanent teeth with developmental disturbances secondary to injuries in the primary dentition. It was reported that only 25% of injuries resulted in root dilacerations, with the majority of cases involving maxillary central incisors (Andreasen & Ravn 1971, Andreasen *et al.* 1971). Smith & Winter (1981), in a case series, noted that a definite history of an injury to the mouth or to the deciduous predecessors was present in nine out of 12 cases exhibiting dilacerations.

Epidemiologic studies, however, have demonstrated that the prevalence of dilacerations in general was approximately 3.8%. Maxillary anterior teeth and mandibular incisors were the least affected teeth, exhibiting dilacerations in approximately 1% of cases (Hamasha *et al.* 2002, Malcic *et al.* 2006). The incidence of severe curvature was highest in the mandibular third molars (19.2%) and mandibular first molars (5.6%), suggesting that dilaceration is a true dental anomaly affecting mostly the posterior teeth (Malcic *et al.* 2006). A rare case of compound odontoma was also reported in association with an unerupted dilacerated maxillary incisor (Yeung *et al.* 2003).

Healing following root canal treatment is achieved through cleaning and shaping followed by complete filling of the root canal system. It has been previously speculated that persistent disease in single-rooted teeth could be because of unrecognized curvatures (Chohayeb 1983). Chohayeb (1983) visually and radiographically investigated dilaceration in permanent maxillary lateral incisors (480 extracted and 442 root filled incisors). She concluded that distolabial and mesiolabial dilacerations (more than 20 degree deviation from the normal axis) were most common in maxillary lateral incisors and also pointed out a high percentage of distolabial curvatures in cases with disease, which required nonsurgical and/or surgical retreatment (Chohayeb 1983).

The following case report describes conventional and surgical endodontic treatment of tooth 12 (FDI) with an unusual root dilaceration.

Case report

A 68-year-old African-American male was referred to the endodontic clinic at the University of Pennsylvania School of Dental Medicine for evaluation of tooth 12. The patient complained of occasional swelling and dull pain around the tooth. A dental history indicated that the tooth had been previously treated with nonsurgical root canal treatment and restored with composite resin. Clinical examination revealed mild pain to palpation associated with the buccal mucosa and a buccal sinus tract near the root tip of tooth 12. The tooth was also sensitive to percussion. A periodontal examination revealed probing depths within normal limits except a 5 mm mesial pocket; there was no mobility (Fig. 1).

Radiographic examination revealed radiolucency around an unusual root anatomy (Fig. 2a). The root filling appeared inadequate and did not follow the unusual configuration. Based on the dental history, clinical tests and radiographs, a diagnosis of previous root canal treatment with symptomatic periradicular pathosis was made. The treatment options were discussed with the patient. The patient was informed that root canal retreatment followed by possible endodontic surgery was the best option compared to surgery alone. The patient consented to the treatment plan.

After local anaesthesia and rubber dam isolation conventional endodontic access was made through the restoration and all root filling materials were removed. The working length was determined with a Root ZX apex locator (J. Morita, Irvine, CA, USA) and a radiograph; the root canal was cleaned and shaped with ProFile series 29 nickel titanium rotary instruments (Dentsply Tulsa Dental, Johnson City, TN, USA) under copious irrigation

Figure 1 Radiograph showing mesial periodontal defect.

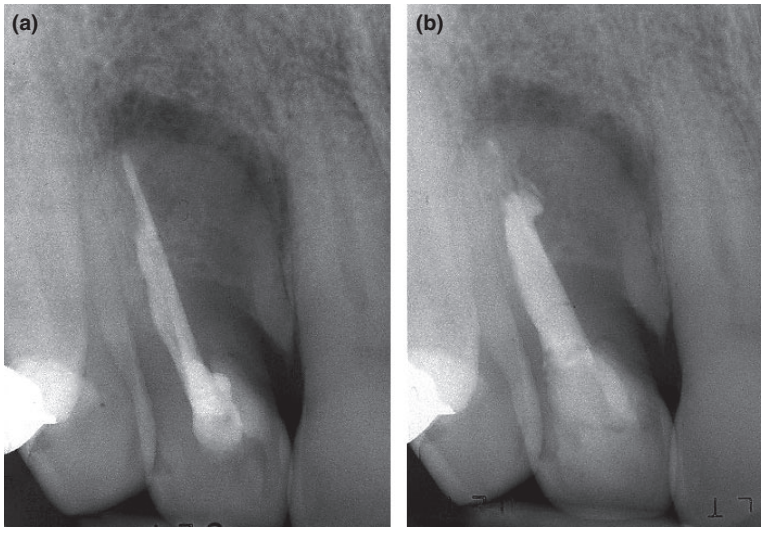

Figure 2 (a) Preoperative radiograph showing unusual severe root dilaceration. (b) Postoperative radiograph taken after endodontic retreatment.

with 3% sodium hypochlorite and 17% EDTA solutions. The canal was prepared to a size 7 ProFile (tip diameter of 0.465 mm). Calcium hydroxide was placed in the canal and the tooth was sealed with zinc oxide eugenol cement (ZOE). The patient returned 2 weeks after the initial visit for evaluation. The tooth was still symptomatic and the sinus tract still existed. After local anaesthesia and rubber dam isolation the canal was re-instrumented and irrigated using ultrasonics with 3% sodium hypochlorite solution. Calcium hydroxide was placed in the canal and the tooth was sealed with ZOE. The patient returned 2 weeks

Figure 3 Large granulation tissue covering the bony defect.

after the second visit for completion of treatment. The sinus tract and symptoms still persisted. After removal of calcium hydroxide, the tooth was filled with gutta-percha and Grossman sealer (Roth international, Chicago, IL, USA) using vertical condensation (Fig. 2b). The tooth was temporarily restored with Ketac glass–ionomer cement (3M ESPE Dental Products, St. Paul, MN, USA). The patient was informed that surgical treatment was necessary because of persistent symptoms and signs.

After local anaesthesia [2.5 carpules (4.5 mL) of 2% lidocaine with 1/50 000 epinephrine], a mucoperiosteal flap was elevated. A large amount of granulation tissue was attached to the flap (Fig. 3). After removing all the granulation tissue, extruded gutta-percha and an unusually shaped root was detected (Fig. 4). The perceived apex was not the anatomical apex and it may have been created iatrogenically during the previous root canal treatment. The dilacerated root surface with extruded gutta-percha was resected to allow clear visualization of unusual anatomic morphology and to remove the granulation tissue behind the root. The resected root surface was examined at high magnification. Untreated canal space was detected with methylene blue dye, which revealed the periodontal ligaments and pulpal remnants (Fig. 5a). Canal preparation was performed with KIS ultrasonic tips (Obtura Spartan, Fenton, MO, USA) under the microscope and the preparation was filled with Mineral Trioxide Aggregate (Dentsply Tulsa Dental) (Fig. 5b). The margin of the composite restoration at the mesial cervical area was examined with an explorer. Filling material was well adapted to enamel and cementum wall. A resorbable bilayer collagen membrane (Bio-Gide, Osteohealth Co., Shirley, NY, USA) was placed to cover the osteotomy to stimulate bone healing. The flap was repositioned and sutured with 5-0 nylon nonresorbable interrupted sutures (Assut Medical Inc., Pully-Lausanne, Switzerland). Postoperative radiographs were taken (Fig. 6a). The patient returned 3 days later for suture removal and reported no discomfort. Healing of the surgical site was excellent. The patient was examined clinically and radiographically at 3-month, 1-year and 2-year recalls. The tooth was asymptomatic. Periapical healing was observed radiographically (Fig. 6b). A periodontal examination revealed probing depths within normal limits except the mesial, 5 mm pocket depth still existed. The tooth exhibited no mobility.

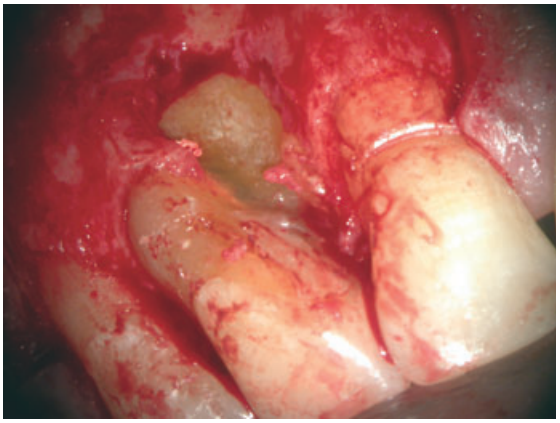

Figure 4 Extruded root filling and unusual root anatomy.

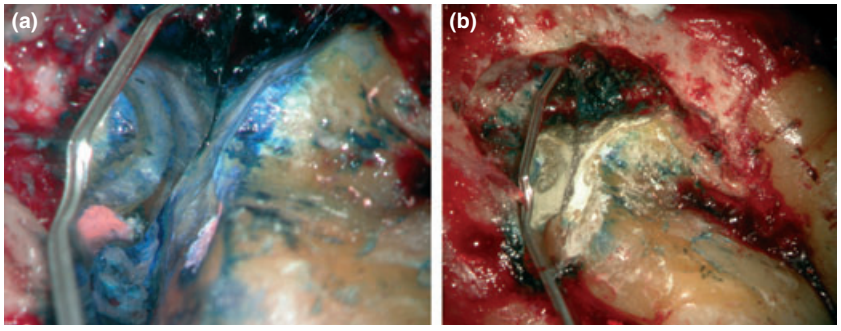

Figure 5 (a) Root resection, methylene blue staining. (b) Root-end filling, mineral trioxide aggregate.

Discussion

Prognosis of a root filled tooth partially depends on maintaining the original canal shape after instrumentation (Walton & Rivera 1996). It is essential to diagnose root dilacerations on preoperative and intermediate radiographs to prevent instrumentation related mishaps, i.e. apical ledging, zipping and perforation. However, a radiograph is a two-dimensional image; it can only show one direction of curvature, giving limited information on the actual angulation of a dilaceration (Trope *et al.* 1986, Baisden *et al.* 1992). Root dilacerations, especially with incisors, most commonly occur in the apical third of the root and mostly towards the labial surface (Chohayeb 1983, Malcic *et al.* 2006). Therefore, it is important for clinicians to take multiple radiographs from different angles before and during treatment to gain maximum information on root morphology in order to improve the treatment outcome.

Complex anatomy can limit the efficiency of removing pulpal tissue and bacteria during conventional root canal treatment, leading to unsatisfactory outcomes (Weller *et al.* 1995). The reported case presents a severe mesial dilaceration with a mid-root perforation on a maxillary lateral incisor. The preoperative radiographs revealed that the root filling was inadequate and did not follow the root curvature. Surgical endodontic treatment is an important option to achieve long-term success when conventional root canal treatment is unsuccessful or the root canal is calcified or perforated (Rubinstein & Kim 1999, 2002). The problems associated with this case would suggest that surgery would be the best

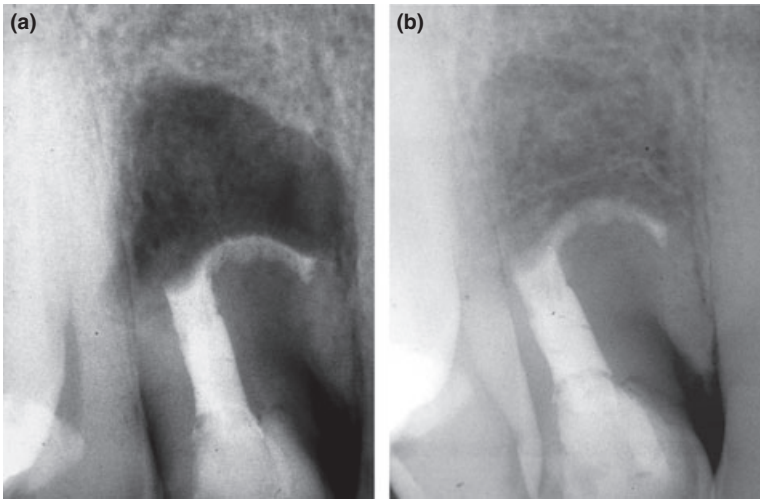

Figure 6 (a) Postoperative radiograph taken after endodontic surgery. (b) 2-year recall radiograph.

(or only) treatment option. Even with advances in surgical techniques and in dental materials apical surgery does not address the bacteria within the canal system or the quality of the coronal seal. Thus, conventional retreatment was indicated. Several attempts were made to establish the root canal path to the apex for complete biomechanical cleaning. A surgical approach became necessary to treat the peri-radicular disease that persisted.

This case report illustrates the importance of a surgical operating microscope when treating complex cases. Under high magnification, granulation tissue was carefully removed and a small osteotomy was made without removing excessive bone structure. After removing the granulation tissue and extruded gutta-percha, an unusually shaped root was visualized. Modern microsurgical techniques suggest a 3 mm apical root resection with an additional 3 mm root-end preparation. Kim *et al.* (2001) demonstrated that resection of the apical 3 mm with a 3 mm root-end preparation reduces 98% of the apical ramifications and 93% of the lateral canals during periapical surgery. In the present case, sectioning 3 mm of the root apex would have exposed the severely curved portion of the canal at approximately a 90-degree angle making it impossible to clean with ultrasonic tips. Also, when the granulation tissue was removed it was noted that the buccal bone was fenestrated. It was thought that sectioning the root apex would decrease bone support and create a bigger bony defect on the mesial side of the tooth. The decision was made to resect the dilacerated root surface enough to expose uncleaned apical canal space at the same time removing the extruded filling material. Ultrasonic microsurgical instruments facilitated conservative and precise preparation to clean the exposed canal space and to remove the filling material despite the severe curvature and irregular canal space.

Guided tissue regeneration has become a well-established treatment to help regenerate healthy periodontal structures with infrabony, furcation and recession defects. A barrier membrane placement over a small osteotomy during endodontic periapical surgery may not be beneficial towards bone healing (Garrett *et al.* 2002). However, several controlled studies have shown better outcomes when a barrier membrane is used to treat teeth with large periapical lesions in conjunction with periodontal defects or without cortical bone (Abramowitz *et al.* 1994, Pecora *et al.* 1995).

Preoperative periodontal examination revealed that probing depths were within normal limits except on the mesial side. A radiograph with a periodontal probe illustrated the

mesial periodontal defect was because of irregular root morphology (Fig. 1). To induce bone growth and correct this defect a resorbable bilayer collagen membrane was placed on top of the osteotomy and mesial defect before suturing the flap. Two-year recall radiographs show reconstitution of lamina-dura with excellent bone healing at the site; however, the 5 mm mesial periodontal defect still existed (Fig. 6b). The tooth is functioning and the patient is asymptomatic.

Conclusion

Correct interpretation of multiple radiographs and knowledge of the morphology can help clinicians recognize anatomical variations and improve treatment quality. Endodontic surgery cannot replace nonsurgical root canal retreatment, however when indicated, it is a treatment modality that can enhance the outcome.

Disclaimer

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