CASE REPORT

Endodontic and surgical treatment of a geminated maxillary incisor

A. Braun[1], T. Appel[2] & M. Frentzen[1]
[1]Department of Operative Dentistry and Periodontology, [2]Department of Oral and Maxillofacial Surgery, University of Bonn, Welschnonnenstr. 17, D-53111 Bonn, Germany

Abstract

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Aim A geminated maxillary incisor required complex multidisciplinary treatment to preserve health and restore aesthetics. This report describes the coordination of coronal division, root extraction, bone grafting, endodontic treatment and orthodontics in achieving treatment goals. It is the intention of this report to show how a difficult case could be managed by properly coordinated multidisciplinary care.

Summary Pulp testing of the geminated central right maxillary incisor gave a normal response. Radiographic investigation indicated a connection of the pulp chambers. Both the mesial and distal root were filled with gutta-percha. The connection between the two root canals was sealed with a flowable dentine-bonded resin. After dividing the crown with a diamond bur, the mesial part of the tooth was removed and the extraction socket was filled with beta-tricalcium phosphate ceramic (Cerasorb^{TM}). Radiographs taken immediately after surgery and after 6 months showed no periodontal or periapical lesions. No signs of external resorption were identified. The diastema between the central incisors was closed by orthodontic treatment.

Key learning points

- Geminated teeth may present aesthetic and functional problems which require multidisciplinary care.
- Careful clinical and radiographic examination is essential to decide on the fate of the coronal and root halves involved.
- A proper coordination between endodontic and surgical treatment may result in maintaining one tooth half, even if a midroot connection between the pulp chambers becomes evident.
- Orthograde endodontic treatment, hemisection and orthodontics may solve the aesthetic problem of a geminated tooth.

Keywords: beta-tricalcium phosphate, endodontic treatment, gemination, hemisection

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Correspondence: Dr Andreas Braun, Department of Operative Dentistry and Periodontology, University of Bonn, Welschnonnenstr. 17, D-53111 Bonn, Germany (Tel.: +49 228 287 2428; fax: +49 228 287 2444; e-mail: a.braun@uni-bonn.de).

Introduction

Fusion and gemination of permanent teeth may require treatment for aesthetic, orthodontic and functional reasons. Unusual crown size may be aesthetically disturbing, especially if anterior teeth are involved. The aetiology of tooth fusion is not known precisely. One reason may be a close contact between two adjacent tooth germs, allowing the enamel organ and the dental papilla to unite (Lowell & Solomon 1964). Genetic determination may also be evident in some cases (Moody & Montgomery 1934). The union of two developing tooth germs at the cemental level is called concrescence (Law *et al*. 1994). These teeth always have separate roots and separate coronal pulps. Another dental anomaly is gemination. Here the tooth germ tries to divide, but this division is incomplete and results in more-or-less completely separated roots and crowns (Blaney *et al*. 1982, Braham 1995). As it is difficult to differentiate between a tooth fusion and gemination, especially in cases of fusion between a regular and a supernumerary tooth, the term 'double tooth' has been introduced (Moody & Montgomery 1934, Lowell & Solomon 1964). But this terminology is very vague, as it disregards the aetiology of the different tooth abnormalities. The following report describes the endodontic and surgical treatments of a geminated right maxillary central incisor for aesthetic, orthodontic and functional reasons.

Report

The department of oral and maxillofacial surgery referred an 11-year-old girl for treatment of a geminated central right maxillary incisor for aesthetic and orthodontic reasons (Fig. 1). Her medical history was noncontributory. A small groove was observable between the clinical crowns. Thermal pulp testing gave a normal response and probing revealed no periodontal pocketing around the tooth. Radiographic investigation indicated a possible connection between the pulp chambers (Fig. 1). The corresponding tooth on the opposite side of the arch appeared radiographically and clinically normal. In view of the need to divide tooth 11 leading to extensive exposure of pulp tissue, endodontic treatment was prescribed. As the decision about the root to be preserved was to be made during surgery, endodontic treatment of both root canals was planned.

The treatment plan was explained to the patient and her family. With their permission the tooth was anaesthetized and isolated with rubber dam. Two access cavities were prepared, the pulps extirpated and the pulp chambers irrigated with sodium hypochlorite (2%). Coronal flaring was carried out with Gates Glidden burs, sizes 50 and 90. An attempt was made initially to determine the length of both canals with an apex locator. As no

Figure 1 Clinical photograph and radiograph of the geminated central incisor, as the patient presented for treatment.

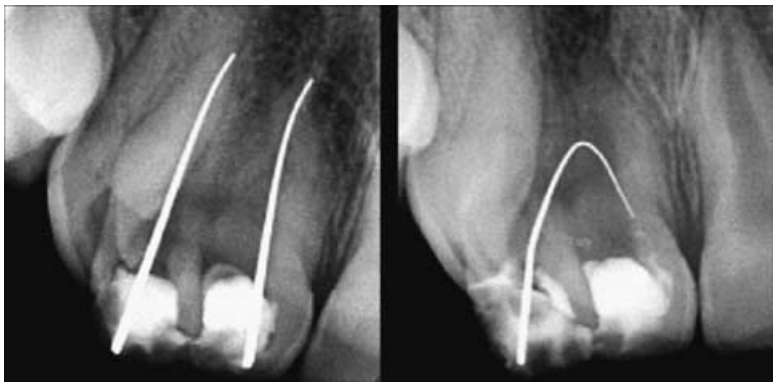

Figure 2 Radiographs using silver points to determine the length of the root preparation and to localize the midroot connection.

consistently reliable readings could be obtained, the length was determined using silver points. A curved probe was used to detect a midroot connection between the two main canals. After placing a silver point, the connection could be localized in the mid-third of the roots (Fig. 2). Both root canals were cleaned and shaped using hand files with a step back flaring technique (VDW GmbH, Munich, Germany) and constant irrigation with sodium hypochlorite (2%). The master apical file in both canals was an ISO size 40. Then the root canals and the midroot connection were dried. The distal root was obturated by cold lateral condensation of gutta-percha (Roeko, Langenau, Germany) using a calcium hydroxide containing sealer (Sealapex™, Kerr, Karlsruhe, Germany). Also the apical part of the mesial root was obturated by cold lateral condensation of gutta-percha, so that the connection between the two root canals could be sealed with a flowable dentine-bonded resin (Arabesk flow™, Voco, Cuxhaven, Germany). Both the mesial and the distal access cavity were sealed with a dentine-bonded resin (Arabesk™, Voco, Cuxhaven, Germany).

For hemisection, a full-thickness buccal flap was raised. Evaluating the outline and position of the roots after surgical access, it was decided to remove the mesial root, appearing much smaller than the distal one. The crown was divided with a diamond bur. During the process of sectioning, every attempt was made to remove tooth structure and alveolar bone only at the expense of the mesial part of the tooth, which was then extracted (Fig. 3). Subsequently rotary and nonrotary tooth contouring (Gracey-curettes, Hu-Friedy, Leimen, Germany) was performed to remove sharp margins, establishing an anatomy consistent with a normal central incisor. A flame-shaped finishing bur was then applied to recontour the mesial and incisal enamel surfaces and effect a simulation of a normal clinical

Figure 3 Sectioning the tooth at the expense of the mesial part, which will be removed.

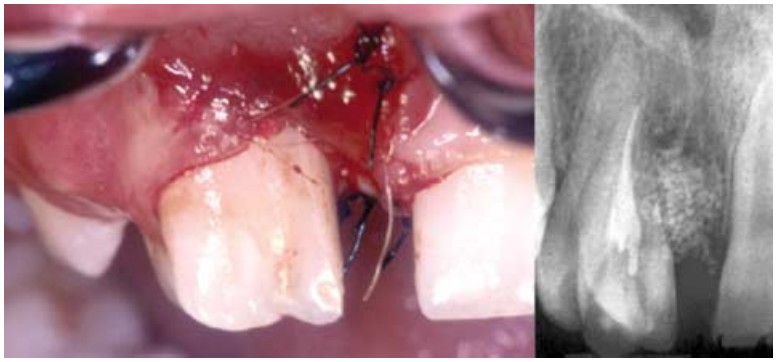

Figure 4 Clinical photograph and radiograph taken immediately postsurgically. The defect left by the extraction of the mesial tooth is filled with beta-tricalcium phosphate ceramic.

crown's morphologic structure. The extraction socket was filled with beta-tricalcium phosphate ceramic (Cerasorb^{TM}, Curasan, Kleinostheim, Germany) to avoid collapsing of the extraction socket and the flap was sutured, covering the extraction socket (Fig. 4). Radiographs taken immediately after surgery and after 6 and 14 months showed no periapical lesions. Signs of external resorption could not be detected, and no increase in probing depth was recorded despite radiographic evidence of some angular bony loss. Overall, the gingival tissue appeared clinically healthy and firmly adapted to the teeth. There was some bleeding upon gentle probing of the dentogingival region between tooth

(a)

(b)

Figure 5 Clinical photographs and radiographs taken six (a) and 14 (b) months postsurgically. The diastema is closed orthodontically.

11 and 21, possibly because of poor oral hygiene whilst wearing braces. The patient was told to brush her teeth carefully after every meal and to use dental floss to avoid plaque buildup between the teeth. The patient reported that she had been completely without symptoms. The diastema between the central incisors was closed by orthodontic treatment (Fig. 5). Six months after surgery, an orthodontic straight wire appliance was inserted. Space closure between the central incisors was accomplished by bodily movement of tooth 11 into the area augmented with beta-tricalcium phosphate ceramic within a further 6 months. After space closure, the appliance was removed and a retainer was inserted for stabilization.

Discussion

Traditional terminology such as concrescence, fusion, and gemination should be used as potential embryologic cause of the anomaly and not as an exact diagnosis (Calikshan 1992). To help to distinguish between fusion and gemination, it has been suggested that the teeth in the arch be counted with the anomalous crown counted as one. A full complement of teeth indicates gemination, whilst one tooth less than normal indicates fusion (Milazzo & Alexander 1982, Camm & Wood 1989). This rule is compromised if a normal tooth fuses with a supernumerary tooth (Croll *et al*. 1981, Peyrano & Zmener 1995, Kayalibay *et al*. 1996). In this case, the number of teeth is normal and differentiation from gemination is difficult or impossible. Concerning treatment, an exact differentiation between fusion and gemination may not be critically important (Kim & Jou 2000). In the present case, a tooth gemination of a maxillary central incisor has been described, demonstrating surgical hemisection and extraction of the mesial part of the tooth. Because of the midroot connection between the two root canals, the tooth was treated endodontically (Hülsmann *et al*. 1997). In this case, a flowable dentine-bonded resin was used to seal this connection. This procedure is one of several different treatment options. A pulpal communication could also be sealed with mineral trioxide aggregate (MTA). A lack of fill density was ascribed to MTA washout related to its long setting time (Kim & Jou 2000). A case of root resection without root canal treatment is also described; the exposed pulp chambers being covered by a full-thickness flap (David *et al*. 1997). In two cases, there was no evidence of pulpal necrosis in the resected teeth postoperatively. The bony defects subsequently ossified with radiodense alveolus and presumably cemental tissues over the external dentine surface of the resected interface. It is also possible to allow bridging with reparative dentine. A procedure is described, necessitating placement of sterile calcium hydroxide and zinc oxide eugenol/zinc phosphate paste over the exposed pulp in resections of vital roots (Stillwell & Coke 1986, Kohavi & Shapira 1990). In some cases, thermal and electric pulp testing confirmed a tentative diagnosis of irreversible pulpitis. Conventional endodontic therapy was used to treat the newly separated teeth (Stillwell & Coke 1986). Odontoplasty after the process of sectioning contributes to the process of hemisection and root amputation (Staffileno 1969). Failure to completely remove a furcation-like area may result in incomplete healing and persistence of inflammation because of plaque retention (Blank *et al*. 1985). The extraction of the whole tooth would have created a residual edentulous area after surgery that would have required a costly replacement of a prothesis in the future. Additionally, the wearing of a partial denture can promote the loss of alveolar bone in the anterior maxilla (Zerbo *et al*. 2001, Palti & Hoch 2002). In the case reported here, alveolar bone support was preserved by filling the extraction socket with beta-tricalcium phosphate ceramic. A residual defect on the mesial portion of the retained part of the tooth was avoided and orthodontic movement of the remaining root was possible. During endodontic and surgical therapy of teeth affected by anterior dental fusion or gemination, the dentist must be prepared for unusual root canal anatomy and irregular outline of the root. Required

treatment needs a multidisciplinary approach to manage and restore the function and aesthetic appearance.

Conclusion

The present case report indicates that geminated teeth may present aesthetic and functional problems, which may require endodontic treatment, hemisection and orthodontics. Careful clinical and radiographic examination is essential to decide on the fate of the tooth. Even if a midroot connection between the pulp chambers becomes evident, a proper multidisciplinary coordination may result in maintaining one tooth half.

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