



CASE REPORT

Extraoral endodontic treatment, odontotomy and intentional replantation of a double maxillary lateral permanent incisor: case report and 6-year follow-up

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Abstract

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Aim To describe combined endodontic, surgical and orthodontic treatment of a maxillary lateral incisor fused with a supernumerary.

Summary Double tooth is a dental irregularity consequent to fusion of two or more teeth or dental gemination. The teeth most commonly involved are deciduous, but in 0.1% of cases permanent teeth are affected, in which case aesthetic, functional and periodontal problems can result. This paper reports a clinical case of a double tooth in the position of the maxillary right lateral permanent incisor. Combined orthodontic, endodontic and surgical treatment (intentional replantation) allowed the tooth to be retained without periodontal compromise and with a positive orthodontic result both immediately and 6 years following intervention.

Key learning points

- A conservative approach that addresses periodontal, pulpal and tooth tissues, can result in the retention of a double tooth.
- Maintenance of the root and alveolar bone in young adults at least until full skeletal maturation should be the main treatment objective.

Keywords: double tooth, extraoral root canal treatment, fusion, intentional replantation, orthodontic.

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Introduction

Fusion and gemination are irregularities in tooth development (Duncan & Helpin 1987). It is often difficult to differentiate between gemination and fusion and it is common to refer to these anomalies as 'double teeth' (Brook & Winter 1970, Yuen *et al.* 1987). The differential diagnosis between the two types of irregularities is nonetheless important in determining appropriate treatment. In fact, in gemination subdivision of the tooth bud is incomplete, giving rise to two dental units, the width of which in the mesio-distal dimension can be twice the dimensions of a single dental unit (Rada 1991, Aryanpour *et al.* 2002). This bifid tooth is considered as a single tooth unit: the number of teeth is normal and the double tooth shares a pulp chamber. By contrast, in fusion the originally separate tooth buds unite at the crown level (enamel) or at the crown and root levels (enamel and dentine). The number of teeth is 'normal-1' and the pulp chambers are separate (Surmont *et al.* 1988, Neves *et al.* 2002). These definitions make a reliable diagnosis between fusion and gemination difficult when a normal tooth and supernumerary tooth are involved. Some authors classify as gemination a fusion case in which the union has occurred with a supernumerary element (Surmont *et al.* 1988, Neves *et al.* 2002). The diagnosis can be further complicated by such overlapping irregularities as a congenitally missing tooth (Brook & Winter 1970, Surmont *et al.* 1988). Both anomalies occur more frequently in the primary dentition, particularly in the canine-incisor region. They appear to follow preferential morphological patterns during formation, preferably involving maxillary central and lateral incisors and mandibular lateral incisors and canines. Cases in the molar/premolar region are rare, and when found are usually in permanent teeth (Turell & Zmener 1999, Nahmias & Rampado 2002). The incidence of unilateral occurrence is estimated in the literature to be 0.5% in the deciduous and 0.1% in the permanent dentition. The incidence of bilateral occurrence is estimated at around 0.02% for both types of dentition (Duncan & Helpin 1987, Tasa & Lukacs 2001, Tomizawa *et al.* 2002). There seems to be an overall lower incidence of double teeth in Caucasians than in Asians (Tasa & Lukacs 2001, Tomizawa *et al.* 2002, Mays 2005). As far as the aetiology is concerned, many theories have been proposed (Stephen *et al.* 1987); including genetic factors (Moody & Montgomery 1934), local metabolic interference during tooth bud differentiation, traumatic or inflammatory causes. To explain fusion, some authors suggest a lack of space as the cause of deep penetration of the dental follicles, whilst gemination can be interpreted as an attempt of a supernumerary tooth to form (Duncan & Helpin 1987). Others believe that the basis of both anomalies is the persistence of dental lamina between two or more buds (Surmont *et al.* 1988). Other studies have found an association between double teeth and nondental congenital deformities such as syndactyly hands (Miles 1954), strabismus and nail malformation (Toth & Csemi 1965, Brook & Winter 1970). Fusion and gemination are generally asymptomatic and do not require treatment, and if aesthetically acceptable, the patient may even decide to retain the anomalous tooth (Hashim 2004). However, double teeth can cause aesthetic and functional problems: carious lesions on the grooves, particularly in the fusion zone; periodontal problems associated with the grooves that extend subgingivally; asymmetries, as fusion and gemination occur in the anterior segment; malocclusions, especially when supernumeraries are involved (Hulsmann *et al.* 1997); and endodontic complications, which are frequent because of the reduced thickness of enamel and dentine (Tsesis *et al.* 2003). In the literature, two types of therapeutic approaches exist, one surgical (Marechaux 1984, Braun *et al.* 2003, Tsurumachi & Kuno 2003) including such options as extraction, hemisection, intentional removal and replantation, which are rapid but disadvantageous in that they require endodontic, surgical, and prosthetic treatment (the remaining part of the crown must be rebuilt with a crown or with composite resin). The

other, more conservative approach consists of the mesio-distal reduction of the oversized tooth through stripping procedures, which would preserve pulpal health and would avoid recourse to prosthetic treatments. Contrasting views exist in the literature on maintenance of pulpal health following the various procedures (Hong *et al.* 2006). The use of orthodontic devices is almost always required and constitutes an important phase of the therapy (Delany & Goldblatt 1981). Treatment therefore depends on the clinical situation and can require multidisciplinary orthodontic, prosthetic and surgical treatment (Vega del Barrio *et al.* 1988, Rada 1991, Velasco *et al.* 1997). In this report, the combined orthodontic, endodontic and surgical treatment (intentional replantation) of a double maxillary lateral incisor is described, with a follow-up after 6 years.

Case report

In 1998, a 9-year-old boy was diagnosed as follows (Figs 1–3):

- Skeletal class I
- Dental class II malocclusion, with crowding in both the maxillary and mandibular arches
- Unilateral left posterior crossbite
- Suspected gemination or dental fusion with a supernumerary of tooth number 12

The treatment plan was the following:

From February 1998 to July 2001, orthodontic treatment was provided in order to correct the transverse variance between the maxillary and mandibular arches, correct anterior crowding and align the teeth. Irregularity in the dimension and shape of the right lateral incisor created space problems. It took up the canine space, forcing it to erupt buccally. The diagnosis of fusion with a supernumerary tooth was derived from the observation of the overall number of teeth and the radiographic examination, which demonstrated two separate roots. The tooth displayed physiological mobility and positive response to electric pulp sensitivity testing. To rule out the possibility of there being merely a simple supernumerary tooth as opposed to fused roots, because it was not completely clear from the preoperative radiography, the area was surgically explored in July 2001. Fusion of the roots was revealed. Surgery was then scheduled 1 week later. The absence of pulpal connections between the two roots was confirmed by probing with endodontic files, after which the fused tooth was extracted. Root canal treatment was completed extraorally. Shaping of the canal was completed with hand instruments (FlexoReamer; Dentsply Maillefer Instruments, Ballaigues, Switzerland) to a size 50



Figure 1 Preoperative view of the double right maxillary lateral incisor: frontal view.



Figure 2 Preoperative radiograph of the double maxillary lateral incisor showing two completely separate pulp chambers.



Figure 3 Buccal pocket probing: the periodontal probe can be inserted 10 mm apically, following the incision between the roots.

master apical file. The canal system was irrigated with 250 mL of sterile saline solution. Root canals were dried prior to the final filling procedure with sterile individual absorbent paper points. Canal filling was achieved with vertical compaction of gutta-percha (Mynol

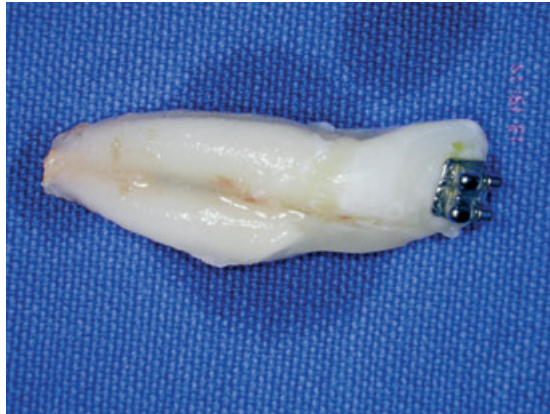


Figure 4 Picture showing the tooth ready for intentional replantation: extraoral endodontic treatment, odontoplasty and composite fillings have been completed.

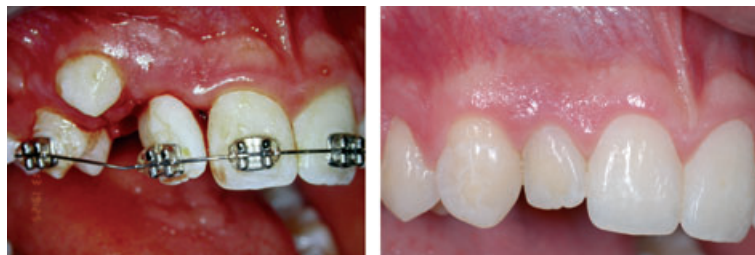


Figure 5 Left: immediate post-replantation lateral view: the tooth is splinted to the adjacent teeth with a 0.016-inch orthodontic wire. Right: clinical picture at 6-year follow-up: lateral view.

MF, Mynol; Block Drug, Jersey City, NJ, USA) and sealer (Pulp Canal Sealer; Kerr, Orange, CA, USA). The apices of the roots were carefully checked and excess gutta-percha and cement were removed. The tooth, kept constantly in sterile saline solution, was resected extraorally at the crown level, discarding the distal section (Fig. 4). Then, the mesial part of the fused tooth was replanted once the blood clot had been removed from the socket with a saline solution wash. The total amount of time from intentional extraction to replanting was 20 min. The tooth was then splinted to adjacent teeth with an orthodontic appliance (0.016-inch wire) (Figs 5 and 6). No orthodontic force was applied to it for 30 days. Three weeks after the surgery, once tissues were healed, odontoplasty was performed to restore the shape of the lateral incisor. After 30 days of functional splinting, the tooth was subjected to minor orthodontic forces and the bracket was finally removed from the lateral incisor at the conclusion of the orthodontic treatment. Final alignment with the canine was performed using the straight wire technique, which made it possible to resolve the dental class II malocclusion 18 months later. At the 6-year check-up, the replanted tooth was periodontally and endodontically healthy, and its position in the arch appeared stable and aesthetically acceptable (Figs 5 and 6, right).

Discussion

Numerous case reports have illustrated various therapeutic methods for the treatment of permanent double teeth: simple extraction (Foster 1987, Hernandez-Guisado *et al.* 2002,

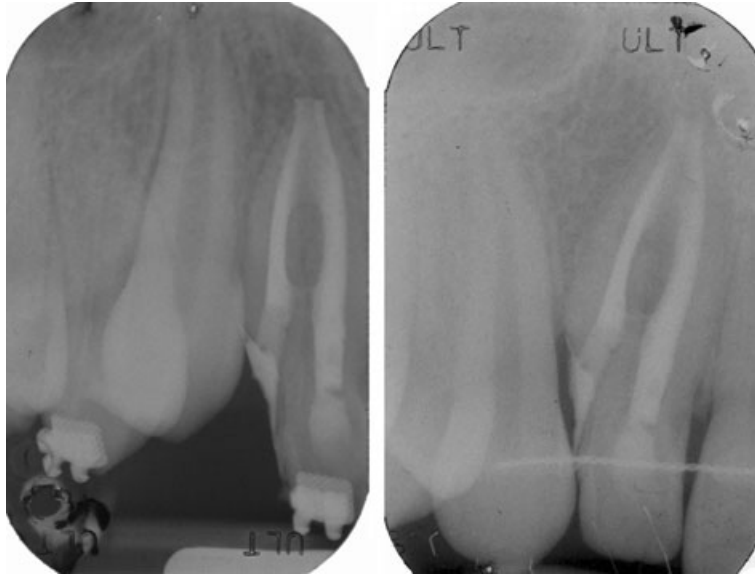


Figure 6 Left: immediate postoperative periapical radiography. Right: periapical radiograph at 6-year follow-up.

Mancuso 2003); reduction of the mesio-distal dimensions through stripping followed by orthodontic treatment (Weiss 1980); dental camouflage (Garattini *et al.* 1999, Ballal *et al.* 2006); intraoral (Marechaux 1984, Hulsmann *et al.* 1997, Tsurumachi & Kuno 2003, Oliván-Rosas *et al.* 2004) or extraoral hemisection of the tooth or the root with intentional dental replantation (Tsurumachi & Kuno 2003). Intentional replantation is a technique aimed mainly at the resolution of endodontic pathosis impossible to treat by conventional orthograde endodontic therapy, and with contraindications for apical surgery (Bender & Rossman 1993, Nuzzolese *et al.* 2004, Peer 2004, Herrera *et al.* 2006). Other motives for intentional replantation described in the literature are treatment of extrusive dislocation (Martins *et al.* 2007) and periodontally compromised teeth (Tozum *et al.* 2006). This method also proves useful when maintenance of the alveolar bone is necessary for prosthetic and implant treatment (Simon & Kimura 1974, Schwartz-Arad *et al.* 2004). The success of intentional replantation, estimated as the tooth retention rate, is reported on average to be 67% (Friedman 2002) and up to 93% (Andreasen *et al.* 1995a) and seems to be linked to three factors: previously existing endodontic pathosis and chronic infection, the length of extraoral treatment and the type of splinting. Observation for a period of at least 4 years has shown that replanted teeth have signs of endodontic infection in 60% of cases (12 extractions of 20 replantations) compared to 100% of uninfected teeth (six of six) (Pohl *et al.* 2000). The motive for extraction was inflammatory resorption or apical periodontitis. Double tooth is usually treated before it develops endodontic pathosis: endodontic therapy can thus be carried out, reducing the possibility of canal infection to a minimum. In replantation, there is an opportunity for even greater control to eliminate infection. The time from extraction to replantation and the preservation and handling methods of the tooth are probably of crucial importance for maintaining the vitality of the periodontal ligament (Andreasen *et al.* 1995a). Intentional replantation can be accurately planned: the root can be preserved by soaking in sterile saline solution throughout the entire intervention, the length of which may be reduced to a minimum. In the present case, the extraoral time was 20 min. The replanted tooth has less chance of undergoing ankylosis when a functional stimulus is applied to the periodontal ligament through the use

of a nonrigid splint maintained for a short period of time (1–2 weeks) (Pohl *et al.* 2000, Peer 2004, Herrera *et al.* 2006). In the case described here, the orthodontic wire itself ensured retention of the replanted tooth: a 0.016-inch wire was positioned passively on brackets. In other words, a functional splint with minimal freedom of movement was applied, capable of restoring periodontal ligament function. After 30 days of functional splinting, the tooth was subjected to a slight orthodontic force without consequences, as demonstrated by Pohl *et al.* (2000). The bracket was removed from the replanted tooth at the conclusion of the orthodontic treatment. The success of this type of treatment is correlated to both the crown and root morphology. In this case, the root morphology observed in the intraoral and panoramic radiographs and upon visual inspection did not appear to contraindicate replantation or risk of root or alveolar fracture during the extraction or replantation itself (Peer 2004). Finally, preoperative analysis of double tooth morphology and its extraoral resection, have made possible both accurate control of the smoothness of the margins and of the odontoplasty, without sacrificing the periodontal ligament, thus improving the tooth's prognosis (Blank *et al.* 1985). Tsurumachi & Kuno (2003) described a case similar to the present case; that is, treatment of a complete fusion of tooth 12 with a supernumerary having two separate roots and without connections between the pulp chambers. The treatment plan consisted of the extraction, extraoral hemisection of half of the fused tooth and the replantation of the remaining part. The complete separation of the double tooth did, however, cause a loss of periodontal tissues in the root area affected by the resection, with potential periodontal problems in the long term. Damage to the periodontal ligament, besides favouring periodontal disease, can be associated with root resorption and/or ankylosis (Andreasen *et al.* 1995a,b, Tsurumachi & Kuno 2003). Root resorption is the major cause of loss of replanted tooth. The degree of contamination and the duration of tooth dessication before replantation are the major risk factors in the resorption of replanted teeth in children suffering dental trauma. The prevalence in the literature for resorption of teeth without visible contamination after 2 years is approximately 57%, following replantation (Kinirons *et al.* 2000). Maintenance of the tooth and the alveolar bone are nevertheless crucial in growing patients: both from the psychological point of view as well as for hard and soft tissue maintenance, which, in case of an unsuccessful replantation because of resorption and/or root ankylosis, may facilitate implant therapy in adulthood (Simon & Kimura 1974, Schwartz-Arad *et al.* 2004). In the case presented, at the 6-year follow-up (2001–2007), there was no gingival recession, no pathological periodontal pocket formation, no loss of bone margin and no evidence of root resorption and/or ankylosis. The orthodontic and aesthetic problem was therefore resolved, even if the median line was disaligned.

Conclusions

This case report illustrates the treatment of a double tooth dental malformation through combined endodontic, surgical and orthodontic treatments. In particular, intentional replantation proved to be effective and without complications even after 6 years. Treatment of a double tooth may be difficult to standardize. Preservation of teeth during the age of development, even with uncertain prognosis, appears crucial for maintenance of the anatomy of the alveolar process for eventual implant therapy in adulthood.

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