Case Report

Conservative treatment of an ankylosed tooth after delayed replantation: a case report

Díaz JA, Sandoval HP, Pineda PI, Junod PA. Conservative treatment of an ankylosed tooth after delayed replantation: a case report.

Abstract – An 8-year-old boy sustained avulsion of his upper right maxillary central incisor and lateral luxation of his upper left maxillary incisors. Subsequently, the upper right maxillary central incisor developed replacement resorption, and both upper left maxillary incisors developed pulpal canal obliteration. In the ankylosed tooth, decoronation procedure was performed, and in the 44-month follow-up period the involved alveolar site showed vertical apposition of bone and continuing replacement resorption. Decoronation is a surgical procedure that allows preservation of the bone volume for the future, avoiding aesthetic disturbances and more aggressive treatments in cases where other therapeutic alternatives are not feasible.

Jaime Andrés Díaz[1], Hector Paulo Sandoval[1], Patricia Irene Pineda[1], Pablo Antonio Junod[2]

[1]Dental Department, Faculty of Medicine, University of La Frontera, Temuco; [2]Private Practice, Temuco, Chile

Key words: decoronation; ankylosis

Jaime Andrés Díaz, Departamento Odontología Integral, Facultad de Medicina, Universidad de La Frontera, Manuel Montt 112, 4° Piso, Casilla 54-D Temuco, Chile
Tel.: 56 45 325775
Fax: 56 45 325777
e-mail: felicar@hotmail.com

Accepted 18 October, 2005

Avulsion is a serious injury that causes damage to dental and surrounding tissues. The involved tissues are the periodontal ligament (PDL), the alveolar bone, the gingiva, the pulp and the cementum (1). The healing process is a very complex one and it is affected by various factors, including the age of the patient, length of extraoral storage period, storage medium used and replantation management, amongst others (2). There is strong scientific evidence that avulsed permanent teeth recover their function and aesthetics after replantation under ideal conditions, and PDL healing is an important success factor in immature or mature teeth (3). Immediate replantation into its own socket is one of the strongest factors contributing to favourable PDL healing in avulsed young permanent teeth (4). The results of a prospective follow-up study of 400 permanent incisors by Andreasen have reaffirmed that immediately replanted teeth – within the first 5 min – have the best prognosis for PDL healing. Nowadays, immediate replantation is the best therapy for traumatic tooth avulsion (5, 6).

When large areas of PDL are lost or damaged during avulsion, healing may occur from the alveolar side of the socket and lead to a union between the root surface and the alveolar bone, and disappearance of the PDL space. This fusion is known as dentoalveolar ankylosis or replacement resorption, the most frequent PDL healing complication and the most difficult to diagnose in replanted teeth (4). This type of resorption is progressive, and eventually involves the entire root. The rate of resorption varies with age and growth rate. Replacement resorption will be faster in 8- to 16-year-old patients than in older patients, where the involved tooth may remain functional for a longer time (7).

There is no treatment for arresting or reversing this condition to date (8). Clinical signs of ankylosis like high metallic percussion sound and restricted – or absence of – tooth mobility often precede the radiographic diagnosis. In those cases, when labial and/or lingual root surfaces are compromised by replacement resorption radiographs are unable to show this healing phenomenon rendering the diagnosis more difficult. This clinical entity can be diagnosed during the first 2 months after injury and most often within a year after a severe trauma (9).

Dental ankylosis in permanent dentition usually appears after trauma to the anterior teeth in patients in early mixed dentition, a period of incomplete root formation and dynamic alveolar bone growth in the maxilla. Ankylosis or replacement resorption is severe sequelae after young permanent avulsed tooth replantation, as well as in teeth with intrusive luxation (8). This complication interferes with localized jaw development (i.e. local arrest of dentoalveolar growth), and the affected tooth appears in infraocclusion or intruded when compared with adjacent teeth, resulting in a severe bony defect that is difficult to correct (8, 10). In addition, the ankylosed tooth is often accompanied by tilting of neighbouring teeth (11). We can observe this healing complication especially in growing children. In several clinical studies of avulsed and replanted teeth, infraocclusion is related to the age of the patient at the time of ankylosis development (12). The risk of severe infraposition is particularly great if ankylosis develops before the growth spurt (9). In adults, this process may lead to a progressive resorption of a root surface in a replanted tooth without involving the alveolar process development (5).

During the maxillar and mandibular growth, teeth continue with their eruption process, and simultaneously form alveolar bone, thus increasing the vertical height. Ankylosis arrests dental eruption and alveolar bone formation in the affected area (13).

In growing patients, treatment resolution of ankylosed teeth after replantation requires multiple additional considerations, such as: (i) diagnosis of adjacent teeth, (ii) infraposition degree of the involved tooth, (iii) type of occlusion, (iv) age of the patient and (v) root development of potential donor teeth. The alternative treatments include autotransplantation of the tooth with viable PDL, orthodontic closure and decoronation (10). Decoronation is a therapy for infrapositioned ankylosed permanent incisors, where the tooth is sectioned in the cervical area, thus allowing a certain regeneration of the alveolar height (11).

This report shows a delayed replantation case and an 18-month ankylosis evolution follow up. Additionally, it included a 44-month follow-up period after the decoronation procedure. During this follow-up period, healing in relation to upper left maxillary incisors pulpal canal obliteration (PCO) was evaluated.

Case report

An 8-year-old boy sustained a bicycle accident with serious oral and facial sequelae. After medical evaluation, dental examination was required. The clinical examination revealed absence of the upper right maxillary central incisor and anterior crossbite of both upper left maxillary central and lateral incisors. The teeth with displacement injuries had slight sensitivity to buccal digital palpation and high metallic sound to percussion. The clinical diagnosis was avulsion of the upper right maxillary central incisor and lateral luxation of upper left maxillary central and lateral incisors. After injection of infiltrative anaesthesia and cleansing of the affected area with glucosaline and chlorhexidine solution (Oralgene®, Laboratorio Maver, Santiago, Chile), digital reposition of upper left maxillary incisors was carried out. The avulsed tooth was carried in a paper napkin and placed in glucosaline solution. After 2 h of extra-oral storage, the immature upper right maxillary central incisor was replanted and splinted with a flexible wire-composite splint (Fig. 1). One million IU IM Sodium Penicillin was administered and amoxicillin plus clavulanic acid (Amolex®, Laboratorio Andromaco, Santiago, Chile; 875 mg) twice a day for 1 week was prescribed.

One month later – at radiographic examination – the replanted tooth showed bowl-shaped resorption cavities compatible with inflammatory root resorption, and endodontic treatment with calcium hydroxide was initiated. After this procedure, the splint was removed (Fig. 2).

The patient was scheduled for a clinical and radiographic evaluation of the root healing process. Two months later, the replanted tooth presented signs of ankylosis on percussion testing. Eighteen months later, the upper right maxillary central incisor presented a marked infraocclusion (Fig. 3). The radiographic examination showed severe replacement and inflammatory root resorption. The upper left maxillary central incisor and the lateral incisor developed a total PCO and normal root development (Fig. 4).

Fig. 1. Postreplantation radiograph. Both central incisors with immature root formation and open apex.

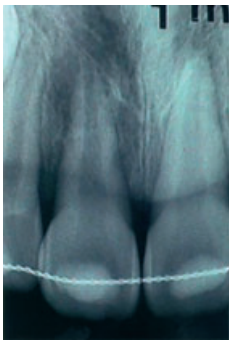

Fig. 2. Radiographic examination of the right maxillary central incisor with extensive osteitis and images compatible with inflammatory root resorption (bowl-shaped) 1 month after replantation.

Fig. 3. Clinical view 18 months after replantation showing marked infraocclusion of the upper right maxillary central incisor before the decoronation procedure.

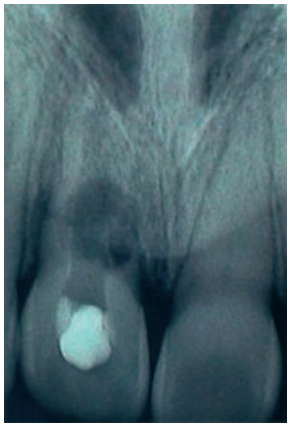

Fig. 4. Radiographic examination 18 months after replantation showing severe replacement and inflammatory root resorption of tooth 1.1. Left upper maxillary central incisor shows narrowing of the entire root canal (pulpal canal obliteration) and normal root development.

Decoronation was chosen as the treatment option for the upper right maxillary central incisor, because: (i) jaw growth was not yet complete, (ii) tooth transplantation was contra-indicated, as bicuspids were not yet erupted and the patient's overjet was less than 2 mm, (iii) orthodontic closure was also contraindicated, as the patient did not present maxillary arch length deficiency (good alignment of teeth and normal occlusion), (iv) an ankylosed tooth cannot be moved orthodontically, because it can result in intrusion of the adjacent teeth, (v) the complete extraction of an ankylosed tooth may allow loss of alveolar bone and (vi) in future, after jaw development, implant rehabilitation could be carried out.

A buccal mucoperiosteal flap was introduced between tooth 5.3 and 2.2 under local anaesthesia. The crown of the ankylosed tooth was removed with a high-speed diamond bur under continuous glucosaline irrigation. Later, the remainder of the necrotic pulp tissue and calcium hydroxide were removed from the root canal, to allow it to be filled with blood coagulum. Finally, the decoronated root was left within the alveolar bone, the mucoperiosteal flap was repositioned, and the gingival margins were reapproximated with sutures (Fig. 5). The crown of the ankylosed tooth that was removed was utilized as a temporary adhesive pontic with composite resin and wire splint to the adjacent teeth (Fig. 6).

Fig. 5. Radiographic diagnosis immediately after decoronation procedure showing root with advanced replacement resorption within the alveolar socket.

Fig. 6. Postoperative decoronated tooth as a temporary adhesive pontic.

After decoronation, healing of the alveolar bone was followed for 44 months. At 12 months postoperatively, radiographs showed continuing replacement resorption of root fragment and at 2 years an additional apposition of bone in the alveolar socket were observed (Fig. 7). At the last control performed 44 months postoperatively, radiographs showed the presence of small root remnants and an increase in alveolar bone height at the decoronation site (Fig. 8). During this follow-up period, the patient was asymptomatic and pleased with the conservative treatment (Fig. 9). Implant rehabilitation of the upper right maxillary central incisor was planned for the future when the decoronated root would fully resorb and the body growth would be completed.

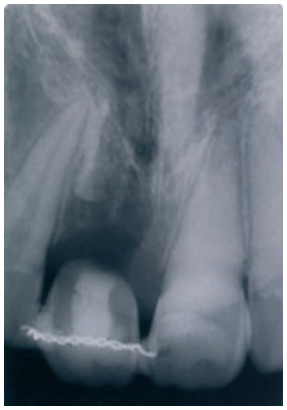

Fig. 7. Radiograph 24 months after decoronation showing continuing replacement resorption of root fragment and apposition of bone. The upper left maxillary central and lateral incisors show total pulpal canal obliteration.

Fig. 8. Radiograph 44 months postoperatively showing small remnants of decoronated root and signs of bone apposition. Note the upper left maxillary central incisor with complete pulpal canal obliteration, and signs of dentine apposition after lateral luxation in young permanent teeth.

Fig. 9. Frontal view of the decoronated tooth 44 months postoperatively.

Discussion

During the surgical procedure, the remainder of the necrotic pulp tissue and calcium hydroxide sealer should be extracted from the root canal, and thoroughly rinsed with glucosaline solution, because it may cause irritation and could become an obstacle to the bone healing process (8–13). Radiographic signs of PCO in upper left maxillary incisors were the best evidence of pulpal survival after lateral luxation injury. The odontoblasts show their vitality through dentine apposition, rendering the pulp canal treatment unnecessary.

One week is the accepted splinting time for an avulsed tooth after replantation, by consensus opinion of the International Association of Dental Traumatology board members. In this patient, the wire-composite flexible splint was removed 1 month later, because of noncompliance with clinical check-ups. This over-extended splinting time after replantation might have played an important role in ankylosis development, along with the extended extra-alveolar time and dry storage.

Ankylosis or replacement resorption is a frequent sequelae of severe permanent tooth injuries like avulsion and intrusion, especially in young patients. In adult patients, implant treatment is feasible after extraction of the involved tooth. In growing children, however, ankylosed teeth are not only removed for functional and/or aesthetic reasons, but also to prevent disturbances in the alveolar bone growth. Ankylosis also takes place when the osseointegrated implants are inserted in adolescents in the anterior region, when their growth is not yet finished (12). In young patients the implants behave in a manner similar to ankylosed teeth (13).

In this case, the decoronation procedure was planned when the patient presented 3–4 mm infraposition of the involved tooth in relation to the adjacent teeth. As the patient was about to begin the pubertal growth spurt, a rapid increase in infraposition could be expected. This treatment should be considered: (i) for young patients with rapid progress in infraocclusion, (ii) buccal displacement

of the involved tooth and (iii) high risk of tilting of the adjacent teeth (11). A greater infraposition of the ankylosed tooth would present serious, aesthetic and functional alveolar disturbances. Forty-four months after this simple surgical procedure, coronal bone apposition and no remnants of decoronated root are observed at the radiographic examination, thereby enhancing the bone volume for future treatment. The extraction or surgical removal of a complete ankylosed tooth leads to bone loss, especially the thin buccal plate of the maxilla (11).

The aesthetic replacement of the tooth after decoronation in children at mixed dentition may present difficulties. The possible therapies are: (i) fixation of the replacement tooth to the adjacent teeth, (ii) use of a removable acrylic partial denture or (iii) lingual arch wire with bands on the second primary molars, and decoronated crown fixed to the arch wire (4). In this case, the crown of the ankylosed tooth that was removed was splinted with composite resin and wire to the adjacent teeth as a temporary adhesive pontic. The patient was informed that this device would be his aesthetic solution until his maxillary growth concluded (Fig. 9). This alternative was chosen because of both the high caries risk and the activity of the patient. Besides, the second upper primary molars already showed signs of mobility.

This case report showed that: (i) decoronation is a simple and safe surgical procedure to preserve the width and the height of the alveolar bone, (ii) this treatment is a less traumatic technique compared with the complete extraction of an ankylosed tooth, (iii) it should be considered as a treatment option for teeth affected by replacement resorption when orthodontic closure and bicuspid autotransplantation are not feasible and (iv) decoronated crown as a temporary adhesive pontic treatment is well accepted by the patient.

In summary, decoronation is a simple and conservative surgical technique for the management of infrapositioned ankylosed replanted incisors in young patients to allow and preserve the normal size of the alveolar bone, avoiding aesthetic disturbances and more aggressive treatments.

References

1. Barrett EJ, Kenny DJ. Avulsed permanent teeth: a review of the literature and treatment guidelines. Endod Dent Traumatol 1997;13:153–63.
2. Kinirons MJ, Boyd DH, Gregg TA. Inflammatory and replacement resorption in reimplanted permanent incisors teeth: a study of the characteristics of 84 teeth. Endod Dent Traumatol 1999;15:269–72.
3. Tsukiboshi M. Autotransplantation of teeth: requirements for predictable success. Dent Traumatol 2002;18:157–80.
4. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. Endod Dent Traumatol 1995;11:76–89.
5. Barrett EJ, Kenny DJ. Survival of avulsed permanent maxillary incisors in children following delayed replantation. Endod Dent Traumatol 1997;13:269–75.
6. Ebeleseder KA, Friehs S, Ruda C, Pertl C, Glockner K, Hulla H. A study of replanted permanent teeth in different age groups. Endod Dent Traumatol 1998;14:274–8.
7. Andersson L, Bodin I, Sorensen S. Progression of root resorption following replantation of human teeth after extended extraoral storage. Endod Dent Traumatol 1989;5:38–47.
8. Malmgren B. Decoronation: how, why and when. J Calif Dent Assoc 2000;28:846–54.
9. Malmgren O, Malmgren B, Goldson I. Orthodontic management of the traumatized dentition. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth. Copenhagen: Munksgaard;1994. p. 587–633.
10. Filippi A, Pohl Y, Von Arx T. Decoronation of an ankylosed tooth for preservation of alveolar bone prior to implant placement. Dent Traumatol 2001;17:93–5.
11. Malmgren N, Cvek M, Lundberg M, Frykholm A. Surgical treatment of ankylosed and infraposition reimplanted incisors in adolescents. Scand J Dent Res 1984;92:391–9.
12. Kawanami M, Andreasen JO, Borum MK, Schou S, Hjorting-Hansen E, Kato H. Infraposition of ankylosed permanent maxillary incisors after replantation related to age and sex. Endod Dent Traumatol 1999;15:50–6.
13. Westwood RM, Duncan JM. Implants in adolescents: a literature review and case reports. Int J Oral Maxillofac Implants 1996;11:750–5.