Ridge Preservation/Decoronation

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Abstract

Dentoalveolar ankylosis of a tooth is a serious complication in growing individuals. The ankylosed root is continuously resorbed and replaced by bone, and an infraposition of the damaged tooth will develop. The normal alveolar development will be disrupted in this way, and prosthetic treatment will be compromised. Therefore, an ankylosed tooth should be removed before future orthodontic and/or prosthetic therapy is jeopardized. This article will present a method, decoronation, to remove an ankylosed tooth in such a way that the alveolar ridge is preserved and give guidelines for the timing to intervene. The decoronation method is described, and a possible explanation for the favorable outcome is discussed. Different aids to decide the time for intervention are presented. The alveolar ridge was maintained in buccal/palatal direction, and the bone level increased after decoronation in patients treated before or during pubertal growth periods. The bone level also increased in those treated after this period but not at the same rate, and in a few patients it was unchanged. The clinical finding that decoronation can maintain or reestablish normal alveolar conditions is important for successful implant insertion later. (J Endod 2013;39:S67–S72)

Key Words

Ankylosis, decoronation, implants, infraposition

The majority of traumatic dental injuries to the permanent dentition affect children between 8–10 years of age (1). The upper incisors, which are most commonly subjected to injury, might still be immature. At that age, erupting teeth change the position of the incisors, the alveolar process is developing, and growth of the jaws is intense. All these factors must be taken into consideration; therefore, treatment planning should be made with specialists in different fields.

Intrusions and avulsions constitute 0.5%–3% of traumatic dental injuries (2, 3) and are the most severe injuries because they involve damage to both the pulp and the periodontal ligaments. After these injuries, possible sequelae can be expected.

1. Both the pulp and the periodontal ligaments are damaged.
2. The pulp is devitalized, but the periodontal ligaments are vital.
3. Both the pulp and periodontal ligaments are vital.
4. The periodontal ligaments are damaged, but the pulp is vital.

Ankylosis is a common complication when the periodontal ligaments are damaged. The consequence is fusion of the alveolar bone and root substance. The first sign of ankylosis is a high percussion sound, followed by decreased mobility, replacement resorption, and an increasing infraposition in growing individuals.

An ankylosed root is continuously resorbed and replaced by bone, eventually sorbing the entire root. The condition is progressive, and to date there is no means of arresting or reversing the process. The rate of this resorption has been found to be related to age. Andersson et al (4) showed that in patients 8–16 years old at the time of avulsion, the rate of root resorption was significantly higher compared with patients 17–39 years old. In children and adolescents an increasing infraposition is another problem. Orthodontic extrusion is not possible. An ankylosed tooth can be compared with an implant and cannot be moved. Such an attempt will only result in intrusion of the adjacent teeth.

Treatment Options

A buildup may be a treatment option if the patient has passed the pubertal growth spurt and the infraposition is minimal. In growing individuals this is not recommended. The infraposition will increase, and buildups must be repeated, resulting in a long clinical crown with no esthetic success.

Surgical repositioning has been suggested when the ankylosed area is minimal (5). However, the long-term prognosis is poor, because the reduced marginal bone level is unchanged, and further ankylosis might be promoted.

Bone distraction by dento-osseous osteotomy of the segment has been reported, and different types of appliances have been suggested (6–8). However, this treatment must be postponed until growth of the jaws is completed. Fusion between the root and the adjacent bone still remains. If bone distraction by dento-osseous osteotomy of the segment is performed in a growing individual, infraposition of the damaged tooth might recur.

Autotransplantation is an alternative when crowding indicates extraction of a premolar. To achieve revascularization of the pulp and successful periodontal healing, the ideal root development should be three-fourths of the full root length (9). In such cases the whole root of the ankylosed tooth must be extracted. Loss of attached bone will not be a problem. The transplant with its sound periodontal ligament will induce new bone formation (10).

An ankylosed tooth left in situ in children and young adolescents will arrest the vertical growth of the alveolar ridge in the region, and tilting of adjacent teeth will
complicate the condition (Fig. 1). To prevent these adverse effects, the ankylized tooth should be removed. Clinical experience shows that extraction of an ankylized tooth may involve loss of attached bone, particularly the thin buccal plate of the maxilla.

It is well known that uncompleted extraction of teeth leads to undesirable lowering and diminished volume of the alveolar ridge. The resorption of the alveolar ridge is more pronounced on the buccal than on the palatal aspect of the alveolus (11–13).

As early as the 1970s it was shown experimentally that new marginal bone may form over the coronal surface of submerged roots covered with a mucoperiosteal flap (14–17). Very few inflammatory changes were seen when vital roots had been submerged, whereas this was a consistent finding periapically and pericoronally in submerged endodontically filled roots. From these findings the decoronation technique was developed.

The first study was published in 1984 (18) and a second in 2000 (19). Later several case reports have been reported (20–24).

The idea was to remove the crown and the root filling and maintain the resorbing root as a matrix for new bone development. The volume of the alveolar ridge could thus be preserved, allowing more optimal conditions for a later prosthetic solution.

## Decoronation Technique

A mucoperiosteal flap is raised at the place of the ankylized tooth, and the crown is removed with a diamond bur under continuous saline irrigation (Fig. 2A). The root filling is removed with an endodontic file, and the coronal part of the root surface is reduced to approximately 2 mm below the marginal bone (Fig. 2B).

The empty root canal is thoroughly rinsed with saline solution and allowed to fill with blood (Fig. 2C). This is very important because the blood clot is organized from the surrounding tissues. The mucoperiosteal flap is drawn over the alveolus and sutured with single sutures. A periosteal plastic (incisions in the periosteum to lengthen the flap to cover the alveolus) is contraindicated. A blood clot is formed in the gap between the labial and palatal mucosa (Fig. 2D).

### Figure 1. A 17-year-old boy with ankylosed left upper incisor. (A) Severe infraposition, tilting of adjacent teeth, and midline shift 4 years after avulsion and replantation. (B) Graphic illustration showing gradual bony replacement of the root, preventing it from erupting normally. (From Malmgren BM, Malmgren B, Malmgren O, Andreasen JO. Alveolar bone development after decoronation of ankylosed teeth. Endodontic Topics 2006;14:35–40.)

### Figure 2. Decoronation of ankylosed, infrapositioned incisor. (A) The crown is removed with a diamond bur under continuous saline irrigation. (B) The root filling has been removed with an endodontic file, and the coronal part of the root is reduced to a level of 1.5–2 mm below the marginal bone. (C) The empty root canal is thoroughly rinsed with saline and thereafter allowed to fill with blood. (D) The mucoperiosteal flap is drawn over the alveolus and sutured with single sutures. (From Malmgren O, Malmgren B. Orthodontic management of the traumatized dentition. In: Andreasen JO, Andreasen FM, Andersson L, eds. Textbook and Color Atlas of Traumatic Injuries to the Teeth, 4th ed. Oxford, UK: Blackwell Publishing; 2007:704–5.)
The removed crown can be shaped as a pontic with composite material and bonded to the adjacent teeth with acid-etch technique. When the wound has healed, a semipermanent acid-etch bridge can be performed if the canines are fully erupted. Otherwise, a lingual bar with a prosthetic crown or a partial denture can be used.

It was shown that during follow-up, a thickening or “down-growth” of the mucosa was clearly visible in most cases, and the bone level increased in the vertical direction. Sometimes this down-growth was so advanced that the pontic had to be removed and shortened (Fig. 3) (18). Therefore, the pontic should not cover the whole loss of bone and mucosa. In growing patients treated with decoronation, the alveolar ridge will be maintained in the buccal/palatinal direction, and the vertical height will increase (18).

**How Does Decoronation Work?**

The marginal collagen fiber system and periodontal fibers formed during eruption of teeth play an important role in the development of the alveolar ridge (25).

![Figure 3. Follow-up after decoronation of ankylosed incisor. (A) Clinical follow-up after decoronation. (B) Radiograph immediately after decoronation. (C) After 1 year. The pontic has been shortened because of addition of marginal bone. (D) Radiograph 12 months after surgery. A vertical shift of the marginal bone can be seen. The root remnants are totally resorbed. (From Malmgren B, Cvek M, Lundberg M, Frykholm A. Surgical treatment of ankylosed and infrapositioned reimplanted incisors in adolescents. Scand J Dent Res 1984;92:391–9.)](image)

![Figure 4. Graphic illustration of decoronated ankylosed maxillary central incisor. (A) Immediately after decoronation. The crown is removed below the cervical bone margin, and a blood clot is formed in the root canal. (B) A thin layer of bone apposition takes place over the resorbing root, and a new periosteum on top of the alveolar crest is formed. The ongoing eruption of the teeth induces bone apposition through traction from the fibers on the periosteum. (From Malmgren BM, Malmgren B, Malmgren O, Andreasen JO. Alveolar bone development after decoronation of ankylosed teeth. Endodontic Topics 2006;14:35–40.)](image)
When 2 adjacent teeth are erupting, bone apposition occurs on top of the interdental septum via forces from both the periodontal and gingival fibers. The forces from these marginal fibers form an active alveolar periosteum.

When a tooth becomes ankylosed, the periodontal fibers are partly or totally replaced by bone in the ankylosed area, and tooth eruption is arrested (Fig. 1B).

The interdental fibers are still linked to the ankylosed tooth and to the adjacent teeth and thus partly prevent their eruption. The linked fibers cause tipping of the adjacent teeth as they continue to erupt, and no marginal bone development can be seen in the region of the ankylosed tooth.

After decoronation a blood clot is organized from the surrounding tissues, and new bone is created. A new periosteum is formed on top of the alveolar crest, and the ongoing eruption of the adjacent teeth induces bone apposition through traction in the periosteum from the reorganized fibers (Fig. 4).

### Timing of Decoronation

In young patients there are advantages in retaining an ankylosed tooth for as long as possible as a space maintainer. However, it is important to intervene before the effect of infraposition makes a final prosthetic solution difficult because of the arrested alveolar bone growth. Therefore, it is important to keep in mind that progression of infraposition varies individually (26, 27). The rate of infraposition is correlated to the age when ankylosis is diagnosed and to the growth intensity of the face. There is a high risk of severe infraposition when ankylosis is

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**Figure 5.** Relationship between growth intensity and infraposition of ankylosed central incisor. (A) The right central incisor was replanted in a boy at 12.5 years of age. Slight infraposition can be seen after 1 year. (B) After 2 years there is a marked increase in infraposition. (C) After 3 years infraposition is severe. (D) Annual body height measurements during the observation period show a pronounced growth spurt, which is correlated with the infraposition. (From Malmgren B, Malmgren O. Rate of infraposition of reimplanted ankylosed incisors related to age and growth in children and adolescents. Dent Traumatol 2002;18:28–36.)

**Figure 6.** Schematic illustration of cephalometric changes of the face. (A) Horizontal growth of the face from age 8.6–9.8 years. (B) Vertical growth of the face from age 14.2–15.4 years. (From Malmgren B, Malmgren O. Rate of infraposition of reimplanted ankylosed incisors related to age and growth in children and adolescents. Dent Traumatol 2002;18:28–36.)
diagnosed before the age of 10. In these cases the ankylosed tooth should be monitored carefully every 6 months.

There is also a great risk of severe infraposition during the pubertal growth spurt (Fig. 5), and the time for this growth spurt varies individually. This variation means that normal growth distribution curves in relation to chronological age are not reliable. Annual body height measurement to evaluate the patient’s individual growth intensity and plaster casts or photos to study the dental effects are aids for the assessments.

There is also a difference between patients with horizontal and vertical growth of the face. The rate of infraposition is faster in vertical growers. Cephalometric radiographs might be used for the evaluations (Fig. 6).

**Long-term Results of Early Ankylosed, Decoronated Incisors**

Decoronations of 103 ankylosed incisors in 95 patients were performed between 1978 and 1999 at the Department of Pediatric Dentistry at Eastmaninstitutet in Stockholm, Sweden (unpublished data). The patient’s age at trauma varied from 6.8–17.8 years (mean, 10.7; median, 10.4), and age at decoronation varied from 9.3–22 years (mean, 14.9; median, 15). Most patients were followed for 4 years after decoronation.

The bone level increased after decoronation in patients treated before or during pubertal growth periods. The bone level also increased in those treated after this period but not at the same rate, and in a few patients it was unchanged, and continuous resorption of the root and replacement of lost substance by bone without pathologic changes were found. These findings confirm the results from our first study and show the importance of early intervention in growing individuals.

Implants had been inserted in 18 of the patients. Root remnants were still present in some cases but made no obstacle for insertion of the implants and the healing process (Fig. 7A–E). Also, Davarpanah and Szmukler-Moncler (28) have found that implant placement through impacted teeth integrates successfully.

**Summary**

- The clinical consequences of dentoalveolar ankylosis are complicated in growing patients. Therefore, treatment planning should be multidisciplinary.
- Early diagnosis of ankylosis is important, and progression of infraposition must be followed up.
- Timing of decoronation is important and should be planned regarding the age of the patient, the patient’s growth intensity, and growth pattern.
- The predictable success of decoronation supports the indication for replantation of avulsed teeth in children even when the extraalveolar conditions indicate that healing might be compromised by ankylosis (29).

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**References**


