Alveolar Bone Width Preservation after Decoronation of Ankylosed Anterior Incisors

Shaul Lin, DMD, Dvorah Schwarz-Arad, DMD, PhD,† and Malka Ashkenazi, DMD‡*

Abstract

Introduction: The aim of the study was to assess the alteration of alveolar ridge dimensions after decoronation procedures in children and adolescents at least 1 year after surgery. **Methods:** Twelve children who underwent decoronation of ankylosed maxillary anterior incisors with at least 1 year after surgery follow-up were recalled for reevaluation. All decoronations were performed when the ankylosed teeth were submerged 1–1.5 mm. During the recall appointment, impressions of the upper arch were obtained. The bucco-palatal alveolar dimensions of the decoronated teeth were measured on the cast at the mid-mesiodistal distance from the missing tooth and were compared with the distance from the contralateral healthy incisor. **Results:** Overall, 12 children (9 male and 3 female) were reevaluated up to 82 months after decoronation (mean, 49.58 $\pm$ 24 months). The mean age of the patients at the time of trauma was 9.83 $\pm$ 2.8 years. The average bucco-palatal dimension of the alveolar ridge at the mid-decoronation area was 9 $\pm$ 1 mm compared with 10.17 $\pm$ 0.9 mm at the contralateral homologous tooth (difference of 1.67 $\pm$ 1.12, P = .004). The findings show a positive statistical correlation between the duration of the follow-up period and the bucco-palatal dimension of the alveolar ridge (P = .027). **Conclusions:** Although decoronation of ankylosed young permanent incisors resulted in a decrease in the bucco-palatal dimension with time, it did not prevent additional alveolar growth that occurs with age in a developing child and thus may help maintain the alveolar bone ridge width, height, and continuity and assist in future rehabilitation with less invasive ridge augmentation procedures required for implant placement. *(J Endod 2013;39:1542–1544)*

Key Words

Ankylosis, dental trauma, replacement resorption, submerge

The incidence of dental trauma has increased significantly during the last decades, in particular to anterior teeth of children and adolescents (1, 2). The mean prevalence of dental and oral injuries reported in the literature has oscillated between 4% and 33%, depending on the sex and age of the patients (3, 4). Avulsion is defined as complete displacement of the tooth from its sockets that is associated with extensive damage to the pulp and to the periodontal tissues. Its prevalence ranges from 1%–16% of all traumatic injuries of the permanent dentition (5, 6). The ideal treatment of avulsed tooth includes immediate reimplantation into the alveolar socket at the site of injury. If this is not possible, the tooth should be stored in optimal medium (such as milk or Hank's balanced salt solution) and replanted into its original alveolar socket as soon as possible (7).

Unfortunately, in many cases the replantation is postponed, and the tooth is stored in inappropriate storage medium, or it undergoes extensive drying before replantation (8, 9). These situations result in an absence of vital periodontal ligament cover on the root surface (10). Intrusive luxation can also cause extensive damage to the root surface and the pulp. When the damaged area is unlimited, an inflammatory process takes place in the periodontal tissues, followed by reorganization of the new attachment apparatus (11). Osteoclasts from the adjacent alveolar bone repopulate the damaged area and with time form progressive replacement resorption and ankylosis. In a growing patient, when this process is left untreated, the eruption process of the reimplanted tooth is disrupted, inducing infrapositioning of the tooth, disturbance in the growth of the alveolar bone tilting of the adjacent teeth, and esthetic disturbance (12). Moreover, this situation complicates future prosthetic rehabilitation (10, 13, 14).

Immediate extraction on diagnosis of irreversible ankylosis is not routinely recommended for 2 main reasons. First, early extraction of an ankylotic tooth might be complicated by damage to the alveolar bone. Second, frequently the tooth may be retained for a few more years, providing the patient with an esthetic and functional solution (13, 14).

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 (15–18). Consistent findings demonstrated that very few inflammatory changes were observed periapically and pericoronally when vital roots were submerged. The decoronation technique was developed consequent to these findings. The first study was published by Malmgren et al (19) in 1984. Later several case reports were published (13,20–22). All of these articles suggest an alternative treatment for ankylosed teeth, which they define as decoronation. Decoronation includes surgical removal of the crown of the ankylosed tooth beneath the cementoenamel junction, enhancement of the internal replacement root resorption process by removing the root canal obturation, grinding of the inner wall of the pulp chamber, and flooding

From the *Faculty of Medicine, Technion, IIT, and Department of Endodontics and Dental Trauma, Rambam Health Care Campus, Haifa; †Schwartz-Arad Day-Care Surgical Center, Oral and Maxillofacial Surgery, Advanced Implantology, Periodontology and Endodontology, Ramat-Hasharon; and ‡Private Pediatric Dental Practice, Petach-Tikva, Israel.

Address requests for reprints to Dr Shaul Lin, Endodontics and Dental Trauma Department, School of Graduate Dentistry, Rambam Medical Center, Haifa, Israel. E-mail address: sh_lin@rambam.health.gov.il

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it with blood coagulum (10). According to Malmgren et al, this treatment enables the alveolar bone to grow occlusally and preserves the bucco-platal dimension of the bone. Recently this treatment has become a gold standard treatment for ankylosed teeth in children and adolescents (13, 22). This is in spite of the fact that no further studies were performed to verify the effect of decoronation on the width of the alveolar bone in relation to the decoronated tooth.

The aim of the present study was to assess the dimensions of the alveolar ridge resorption after decoronation procedures in children and adolescents at least 1 year after surgery in the bucco-lingual dimension.

Subjects and Methods

Twelve children who underwent decoronation of ankylosed maxillary anterior incisors with at least a 1-year follow-up period after surgery underwent reevaluation. All the decoronations were performed when the ankylosed teeth were submerged no more than 1.5 mm compared with the adjunction teeth on the day of the surgery. Reevaluation included an alginate impression of the upper arch and preparation of plaster casts. The bucco-palatal alveolar dimensions of the decoronated tooth were measured on the cast at the mid-mesiodistal space of the extracted tooth by using a digital caliper (Castroviejo Caliper, Full Length; Anthony Products, Aurora, IL). These results were compared with the bucco-palatal dimensions of the contralateral healthy incisor. The Ethics Committee of Rambam Hospital approved the study.

Statistical Analysis

Descriptive statistics were performed to analyze the ridge dimensions. The difference in the bucco-palatal dimension of the alveolar bone was evaluated by the paired *t* test; the effects of the age of the traumatic injury and the duration of follow-up of the bucco-palatal dimension of the alveolar bone were evaluated by the Spearman correlation coefficient test.

Results

Overall, 12 children (9 male and 3 female) were reevaluated 12–82 months (mean, 49.58 ± 24 months) after decoronation of their maxillary anterior incisors. The mean age of the patients at the avulsion event was 9.83 ± 2.8 years. All traumatized teeth were maxillary anterior incisors. Table 1 summarizes the bucco-palatal measurements of the ridge of the decoronated tooth and of its contralateral healthy incisor. The average bucco-palatal dimension of the alveolar ridge in the decoronation area was narrower by 1.67 ± 1.12 mm than that of the healthy contralateral incisor (9 ± 1 mm versus 10.17 ± 0.9 mm, respectively; $P = .004$). A positive statistical correlation was found between the duration of the follow-up and the bucco-palatal dimension of the alveolar ridge ($P = .027$). Thus, the longer the follow-up period, the greater was the resorption of the bucco-palatal dimension of the alveolar bone of the decoronated tooth. No statistically significant correlation was found between the age of the traumatic injury and the average bucco-palatal dimension of the alveolar ridge ($P = .124$).

Discussion

Ankylosis or replacement resorption after tooth injuries in a child and adolescent not only leads to loss of the affected teeth but might also interfere with the growth of the adjacent alveolar bone (10, 13, 14). Often extraction of an ankylosed tooth is not recommended because it may lead to considerable bone loss, mainly reduction of the bone volume in the buccolingual or palatal dimension. This may later necessitate an augmentation procedure (23). Decoronation is considered one of the optimal treatments for an ankylosed tooth in a child and adolescent. It is a simple and less traumatic procedure compared with extraction. Previous published studies have shown that this procedure is a reliable technique in terms of preservation of the width and height of the alveolar process (13,20–22). In addition, as shown in these case series, coronal bone preservation might occur, thereby enhancing the bone volume of a future implant site. Data from the literature as well as our observations demonstrate that no complications occur after decoronation of an ankylosed tooth, and that the decoronated root is gradually resorbed (14, 20). The present study shows that although decoronated teeth are associated with decreased bucco-palatal dimensions compared with the contralateral healthy tooth, the alveolar bone continues to grow with time. This might enable insertion of dental implant in the future without the need of guided bone regeneration. Consequently, this is currently an important option for treatment of ankylosed teeth in children and adolescents (23).

Resorption (hard and soft tissues combined) after the loss of a single tooth was substantial, and the reduction of the ridge was greater along the buccal surface than along the lingual and palatal surfaces in every specimen examined, although the absolute amounts and differences varied from one group of teeth to the next. As a result of this tissue modeling, the center of the edentulous site shifted toward the lingual or palatal aspect of the ridge. The observations made by Pietrokovski and Massler (24) were supported by recent findings presented by Schropp et al (25).

In 2004 Botticelli et al (26) extracted teeth that had endodontic and caries lesions combined with root or crown fractures. No tooth was removed because of advanced periodontal disease. In this study, the distance between the outer surfaces of the buccal or lingual/palatal bone wall was determined at surgery and at reentry after 4 months of healing. At surgery, this dimension was found to be 3.4 mm (buccal)

TABLE 1. Measured Ridge Dimensions at the Decoronated Tooth Compared with the Adjacent Homologous Tooth

Number	Age at trauma (y)	Follow-up time from decoronation (mo)	Ridge width at the decoronated tooth (mm)	Ridge width at the adjacent homologous tooth (mm)	Difference in mm
1	7	22	8.7	8.2	+0.5
2	12	32	10.3	10.8	−0.5
3	10	82	10.3	10.6	−0.3
4	16	70	10.1	10.5	−0.4
5	8	58	10.6	10.7	−0.1
6	13	46	8.2	11	−2.8
7	10	65	8	10	−2
8	8	75	9.8	10.2	−0.4
9	8	45	8	11	−0.3
10	6	12	7	8.5	−1.5
11	11	18	7.5	9.5	−2
12	9	70	9.5	11	−1.5

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and 3.0 mm (lingual/palatal). At reentry, the dimensions at the corresponding sites were 1.5 and 2.2 mm, respectively. In other words, during the 4-month interval after tooth extraction, the buccal bone dimension underwent "horizontal" resorption amounting to about 56%. The corresponding reduction of the lingual/palatal bone wall was 30%. The finding whereby resorption of the buccal and lingual/palatal bone walls occurs after tooth extraction corresponds with findings by others such as Pietrokovski and Massler (24) and Schropp et al (25).

The resorption of the alveolar process after tooth extraction in both jaws is significantly greater on the buccal aspect than the lingual or palatal; thus, the reduction in width of the maxillary alveolar ridge is greater than the loss of height (27–29). The significant loss of tissue contour takes place during the first month after tooth extraction, averaging 3–5 mm at 6 months (25,30–32). Schropp et al (25) reported a reduction of 50% of the width of the alveolar ridge at 12 months. Hence, preservation of the alveolus at the time of extraction of prominent roots in the anterior maxilla is crucial (33).

Decoronation provides certain advantages over other treatment options: (1) it is reliable in terms of width and height preservation of the alveolar process, (2) it is a simpler and more economical surgical procedure than ridge augmentation, and (3) vertical bone apposition is possible (13, 14).

Although many case reports describing decoronation can be found in dental literature, there is a paucity of cases that actually present successful implant insertion after decoronation (22, 34). In our case series, 2 of the patients who were older than 18 years underwent an implant without ridge augmentation. Furthermore, in our case series, we describe a rather long-term follow-up of several cases where bone preservation was evident after decoronation.

Our findings indicate that treatment of an ankylosed young permanent incisor by decoronation can enable maintenance of the alveolar bone ridge width and continuity and assist future rehabilitation with minimal, if any, ridge augmentation procedures required for implant placement.

Additional larger cohort, comparative studies are recommended to further elucidate our findings.

Acknowledgments

The authors deny any conflicts of interest related to this study.

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