



Journal of Indian Society of Pedodontics and Preventive Dentistry

Dentistry

Official journal of the Indian Society of Pedodontics and Preventive

Year : 2019 | Volume : 37 | Issue : 1 | Page : 99--106

Long-term management of an ankylosed young permanent incisor replanted within 2 h of avulsion: A case report with a 10-year follow-up

Tarun Walia¹, Neeta Chandwani²,

¹ Department of Growth and Development, College of Dentistry, Ajman University, Ajman, UAE

² Al Maher Medical Center, Dubai, UAE

Correspondence Address:

Dr. Tarun Walia

Department of Growth and Development, College of Dentistry, Ajman University, Ajman
UAE

Abstract

Tooth avulsion is a severe form of luxation injury that involves damage to both the pulp and the periodontal ligament. Avulsed teeth need to be replanted immediately in order to restore esthetics and function. Delayed replantation often results in ankylosis of the tooth which is a common sequela following avulsion injuries. An ankylosed tooth with a necrotic periodontal membrane does not move along with a growing alveolus leading to an arrest in height and width of the alveolar bone causing the tooth to be infraoccluded in a growing individual. This case report describes the multidisciplinary treatment and long-term management of an avulsed permanent central incisor in an 8-year-old child with delayed replantation.

How to cite this article:

Walia T, Chandwani N. Long-term management of an ankylosed young permanent incisor replanted within 2 h of avulsion: A case report with a 10-year follow-up. J Indian Soc Pedod Prev Dent 2019;37:99-106

How to cite this URL:

Walia T, Chandwani N. Long-term management of an ankylosed young permanent incisor replanted within 2 h of avulsion: A case report with a 10-year follow-up. J Indian Soc Pedod Prev Dent [serial online] 2019 [cited 2020 Jun 4];37:99-106

Available from: <http://www.jisppd.com/text.asp?2019/37/1/99/252894>

Full Text

Introduction

Traumatic dental injuries are most commonly seen in children between the ages of 8 and 12 years.[1] Majority of the affected teeth in this age group are maxillary incisors. This is also the period when root closure of these teeth is taking place along with active jaw growth.[2] Severe dental trauma such as intrusion, lateral luxation, or avulsion carries a high risk of pulpal necrosis and injury to the periodontal tissues leading to ankylosis and root resorption.[3] The most important factor in the management of avulsed permanent teeth is the healing of the periodontal membrane (PDM) which depends on (i) extra-alveolar time, (ii) extra-alveolar storage medium, (iii) age of the child, and (iv) the replantation management technique.

Immediate replantation of the affected teeth within the first 5 min of avulsion carries the best prognosis for favorable PDM healing.[4] However, such an early and quick replantation is not performed in every traumatic tooth avulsion. As per the International Association of Dental Traumatology (IADT) treatment guidelines, delayed replantation along with

dry extra-alveolar storage beyond 60 min increases the risk of dentoalveolar ankylosis and replacement root resorption.[5] This involves the direct union of alveolar bone with root cementum along with loss of the periodontal ligament (PDL) space.

In a growing child, the teeth continue to erupt along with concurrent maxillary and mandibular jaw growth which increases the vertical height of the alveolar process and helps in development of alveolar bone.[6] However, an ankylosed tooth does not erupt along with the adjacent teeth resulting in its infraposition compared to the adjacent unaffected teeth and a halt in alveolar growth in the area.[7]

The infrapositioned ankylosed tooth, if retained beyond the active growth spurt apart from esthetic concerns can lead to reduced alveolar bone in height and width. This can compromise future prosthetic restorations due to lack of sufficient alveolar bone.[8]

Malmgren et al. recommended the decoronation technique in a growing child, where the clinical crown of an ankylosed tooth is sectioned at the cemento-enamel junction and the root is left inside the alveolus.[9] The ongoing eruption of the adjacent teeth induces bone apposition through traction from the fibers on the periosteum. This allows the bone formation until the full dentoalveolar growth is completed.[10]

Many case reports on the role of decoronation in the management of ankylosed traumatized permanent teeth can be found in the literature.[7],[11],[12],[13] Majority of the reported patients were managed by maintaining the decoronated space followed by future placement of dental implants.[12],[14],[15],[16] As per the author's knowledge, there are no cases reported in the literature where the decoronated space closure has been managed at a very early age with orthodontic treatment and composite remodification of teeth to mimic the contralateral central and lateral incisors.

The present case report describes the delayed replantation of a young permanent central incisor which led to ankylosis and replacement root resorption. Decoronation technique was performed on this tooth and the extraction space was managed by orthodontic space closure and esthetic reshaping of maxillary anterior teeth. A long-term 10-year follow-up is also discussed.

Case Report

An 8-year-old female AA, reported to the dental department of NMCH with a history of oral trauma due to a fall at home which resulted in an avulsion of the right maxillary central incisor, tooth 11 (Fédération Dentaire Internationale numbering system). The child presented with her parents within 2 h of the injury with the tooth having been stored in tap water since the time of the injury.

A thorough medical history and evaluation was completed, which was unremarkable. The child's immunizations were up to date and a tetanus booster dose had been completed. Informed consent was obtained from the parents. A complete extraoral, intraoral examination and radiographic evaluation were conducted which confirmed the absence of tooth number 11. There was slight abrasion of the upper lip and small laceration of around 1.5 mm of the labial gingival mucosa adjacent to the left maxillary central incisor (tooth number 21). The clinical diagnosis of avulsion was made for tooth number 11 with approximately two-thirds of its normal root length formed. The avulsed tooth had an immature and wide open root apex corresponding to Nolla's stage 9 of tooth development.

A periapical radiograph revealed the complete absence of tooth 11 from its socket with no associated alveolar fractures or displacement of adjacent teeth. The decision to replant tooth 11 was made and a detailed discussion was carried out with the parents regarding the nature of the trauma and the prognosis of tooth 11. The parents were informed that the prognosis of the replanted tooth might be questionable due to the long extraoral time and the nonphysiologic storage medium. They were also made aware that the tooth might undergo replacement resorption and it would require a long-term follow-up.

After using the infiltration technique to anesthetize the area, tooth 11 was replanted back into the socket with slight digital pressure taking care not to touch the root surface [Figure 1]. Position of the replanted tooth was verified clinically and radiographically. The tooth was immobilized and stabilized for 14 days with a flexible wire composite etch splint. A 0.1% chlorhexidine oral rinse, Peridex™ (3M ESPE, St Paul, MN, USA) was prescribed for 1 week along with systemic antibiotic, as per the IADT trauma protocol for avulsed teeth (Augmentin™ 312 mg, 5 ml three times for 7 days GSK, Brentford, Middlesex, UK, Ireland).{Figure 1}

The child was recalled after 10 days and an apexification procedure was initiated [Figure 2]. Nonsetting calcium hydroxide paste (Ca[OH]2), tgpaste (tgDent, Technical and General Ltd, London, UK) was used as an intracanal medicament to slow down the osseous replacement of the tooth and help in apical barrier formation. The splint was removed after completion of the pulp extirpation on 14th day following the trauma.{Figure 2}

The child was recalled every 3 months for clinical and periapical radiographic examination to confirm the apical barrier formation. Calcium hydroxide paste was reintroduced when it was depleted in more than half the canal space and the access opening was closed with glass ionomer cement.

A dull sound on percussion was noticed at the initial 3-month follow-up visit while radiographic signs of replacement resorption were observed on the second three monthly follow-up visit that further progressed to advanced levels at subsequent 3-month follow-up visits [Figure 3]. Apical barrier was formed radiographically 9 months postreplantation. {Figure 3}

The parents missed the next two recall appointments and only reported when the involved tooth (tooth 11) had discolored and was also shorter in length in comparison to adjacent teeth [Figure 4]. A periapical radiograph confirmed the advanced signs of replacement resorption [Figure 5]. Decoronation procedure was planned as any further delay would have lead to a much larger defect in alveolar bone width and height. {Figure 4}{Figure 5}

Decoronation procedure

A full-thickness mucoperiosteal flap was raised under local anesthesiaThe clinical crown of the ankylosed tooth was removed with a high-speed diamond bur all along the cemento-enamel junction. The coronal part of the remaining root was further removed up to 2 mm below the crestal bone with a slow-speed round bur under copious amount of water [Figure 6] and [Figure 7]The remaining Ca(OH)₂ paste was removed with normal saline. Rotary Gates Glidden drill (Kerr Dental, Orange, CA, USA) was used to go beyond the apex into the periapical boneThe bleeding thus induced filled the canal lumen and the decoronated root was left within the alveolar bone and gingival margins were suturedAn acrylic removable partial denture (RPD) with Hawley's retainer was delivered; the natural crown of the ankylosed tooth was used as a pontic. {Figure 6}{Figure 7}

The parents were presented with the following two options for a long-term permanent restoration: (i) To close the space orthodontically around the age of 12–13 years and cosmetic reshaping of the right maxillary lateral and right permanent canine (teeth 12 and 13, respectively) with composite resin OR and (ii) to maintain the decoronated space until the age of 18 years followed by an implant placement. They preferred the option of closing the decoronated space orthodontically. The RPD served as a temporary replacement of the missing tooth for the next 3 years. The child was recalled every 6 months for clinical and radiographical follow-up. At the age of 10.6 years, gingival contour of the extracted space was almost at the same level of the adjacent natural teeth [Figure 8].{Figure 8}

Fixed orthodontic treatment was initiated at 12 years of age when the resorption of remaining amount of decoronated root was almost complete [Figure 9]. In the next 30 months, the right permanent lateral incisor (tooth 12) was moved mesially to substitute for the missing central incisor (tooth 11). Simultaneously, the right permanent canine (tooth 13) was also mesialized orthodontically to substitute for the lateral incisor [Figure 10]. Restorative reshaping of teeth 12 and 13 was done with composite resin to mimic the color and morphology of contralateral central and lateral incisors [Figure 11]. A postorthodontic treatment periapical radiograph at around 18 years of age confirmed almost complete resorption of the decoronated root with good root angulation of teeth 12 and 21 [Figure 12].{Figure 9}{Figure 10}{Figure 11}{Figure 12}

Discussion

As per the IADT treatment guidelines, an avulsed permanent tooth with dry time longer than 60 min has a poor long-term prognosis.[5] The PDL cells become necrotic and are not expected to heal leading to disappearance of PDL space. This results in union of alveolar bone and root surface, the process known as dentoalveolar ankylosis or replacement resorption. The involved tooth is remodeled in a similar way to bone remodeling, with bone gradually replacing the entire root. Replacement root resorption is more progressive and faster in a growing child. The growth of alveolar process is dependent upon the healthy PDL. However, in an ankylosed tooth, the vertical growth of the alveolar process will not occur in the absence of PDL resulting in infraposition of the tooth, particularly in growing individuals.[17]

In the current case, since the child was very young and reported within 120 min, immediate replantation of the avulsed tooth was planned without any further delay. Andreasen et al. have also stated that reliability of the healing predictors of storage time and storage medium has yet not been completely determined. PDL healing can still be expected in some cases even after prolonged extraoral dry storage.[18] Despite a questionable prognosis of the avulsed tooth in the present case, the decision to immediate replant the tooth was made in order to minimize the chances of the expected outcome of an eventual ankylosis and root resorption. Replantation of an avulsed tooth in a growing child would also help to maintain alveolar bone contour, restore esthetics, and function. Lin et al. presented a structured treatment protocol for traumatized teeth that are at risk of developing ankylotic root resorption. They concluded that option of reimplantation of the avulsed teeth should always be considered irrespective of the negative long-term prognosis.[19]

Pulp revascularization technique should be attempted in an avulsed immature tooth if it is replanted within 1 h of the trauma.[5] Potential revascularization of the pulp space was not considered an option in the present case despite the root apex being open. Nonstorage of the avulsed tooth in an osmolality balanced medium and extraoral dry time of almost 120 min led to a questionable pulpal prognosis. The risk of replacement root resorption was more than the chances of revascularization and such resorption is rapid in teeth of a growing child.[5] Pulp extirpation if delayed until the development of clinical or radiographic evidence of necrosis can hasten the infection-related root resorption as necrotic pulp will further irritate the already damaged PDL. Hence, placement of Ca(OH)₂ in the intracanal space was initiated after 10 days postreplantation. Di Fiore and Hartwell reported a successful case of pulp revascularization with continued root growth and apical development of an avulsed immature permanent maxillary central incisor in an 8-year-old child. However, in their case, the involved tooth was replanted within 1 h after traumatic avulsion and was followed only for over 1 year. The radiograph at 15 months postreplantation showed narrowing of the root canal with partial pulp calcification.[20]

As per the IADT guidelines, the recommended time period for intracanal paste placement is up to 30 days.[5] However, in the current case, nonsetting calcium hydroxide paste was placed for 9 months until the formation of an apical barrier. The average time period of apical barrier formation with Ca(OH)₂ paste is between 6 months and 12 months and is routinely used to treat infection related root resorption and help delay replacement root resorption.[21],[22],[23] The advantages of keeping calcium hydroxide paste for a longer duration far outweighed the consequences of dentine brittleness and root fracture often seen with its use.[24]

Apexification with mineral trioxide aggregate (MTA) was not considered an option due to two possible complications: (i) unfavorable eventual outcome of ankylosis-related replacement root resorption will lead to its infrapositioning and (ii) due to the young age of the child, an active growth spurt would have necessitated decoronation later on.

During the decoronation procedure, bleeding is provoked in the canal space by inserting the instrument beyond the periapex. Since it is difficult to remove the MTA material from the canal with a root canal instrument or ultrasonic instruments, the apical plug formed by MTA is often difficult to bypass which will not induce the intracanal bleeding.[25] There is also a chance that some MTA attached to the root dentine could remain in the root canal. This would interfere with the formation of an active periosteum over the resorbing root and prevent it from serving as a matrix for future bone formation.

After ankylosis is diagnosed, treatment options such as early extraction of the ankylosed tooth and orthodontic space closure is not indicated in a young growing child. Early extraction will result in further damage to the alveolar bone.[15] Orthodontic space closure cannot be undertaken if infrapositioning of the ankylosed tooth occurs before the complete eruption of adjacent permanent lateral incisor and permanent canine. Both these teeth are required to close the extracted space followed by composite esthetic reshaping.[26]

Discoloration is a very common feature in an ankylosed tooth.[27] In the present case, tooth discoloration was seen after 18 months of dental trauma. Infraocclusion of an ankylosed tooth in a growing child can be managed with periodic clinical crown lengthening with composite resin. In the current case, the discolored crown did not justify the regular addition of composite as it would have led to suboptimal esthetic results. Composite tooth buildup is an effective alternative in an older patient in the postpubertal growth phase, where very little infraposition is further expected.[28]

Decoronation was decided for rehabilitation of the alveolar bone ridge in the current case. This procedure is indicated in children with PDL injuries occurring before or during pubertal growth periods that resulted into dentoalveolar ankylosis. Timing of decoronation is the most critical factor in the preservation of alveolar bone height and width and is clinically recommended when an ankylosed tooth is in infraposition by one-eighth to a quarter of the homologous tooth.[29] In the present case, decoronation was performed around the age of 9 years once shortening of clinical crown by more than 2 mm was noticed. In another study by Malmgren et al., infraocclusion was seen if ankylosis occurred before the age of 10 years or before the early growth spurt. They also observed no further infraocclusion of the alveolar process in growing patients who had decoronation before or during pubertal growth periods.[9] Decoronation procedure is contraindicated in situations when ankylosed root has microbial infection such as the presence of chronic periapical lesions, fistulas, old unconsolidated root fractures, and active advanced periodontal disease.[30]

The extraction space as a result of decoronation can be managed either by (i) orthodontic space closure, (ii) autotransplantation with a premolar, and (iii) space maintained for placement of implants later.[28]

Orthodontic space closure is a biologically correct option[9],[28] and was planned in the present case because it allowed adjacent teeth to move bodily together into extraction space. Mesialization of adjacent incisor and canine with their healthy PDL membrane further supplements the growth of the alveolar process.[27] Both permanent lateral incisor and canine were anatomically favorable for composite shaping to allow early esthetic rehabilitation. However, decoronation followed by orthodontic shifting of laterals and canine is not indicated in spaced dentition, congenital missing teeth, and partial anodontia cases.

Many studies have confirmed that the esthetic and functional outcome with space closure can be satisfying and almost indistinguishable from natural dentition if careful orthodontic treatment is combined with clinical techniques adapted from esthetic dentistry.[31],[32],[33] Color change over a period of time is a common occurrence with composite resins. If required, the reshaped lateral incisor and canine can be easily replaced with porcelain veneers or full ceramic crowns later. Andresson and Malmgren stated that orthodontic movement of lateral incisors and canines produces more esthetically pleasing and symmetrical result when both central incisors are lost.[17] In the current case, both the patient and her parents were highly satisfied with the final result.

Studies have revealed that autotransplantation of a premolar has many advantages of bone regeneration with high success and survival rate.[27],[34],[35] According to Zachrisson, autotransplantation represents a biological approach where the transplanted tooth retains the potential to induce alveolar bone growth.[36] However, it is only an option for children in whom orthodontic extractions are indicated. Extraction of a premolar for autotransplantation was not an option in the present case as the mandibular permanent right first molar had a poor prognosis due to carious pulp involvement and was indicated for extraction. The parents also did not consent to the autotransplantation procedure as it would be completed under sedation or general anesthesia.

Placement of osseointegrated implants is a useful treatment option for adults where skeletal growth is completed.[37] The child in the present case was young and in active growth period. She needed to wait for at least 8 years before receiving a final prosthesis and would need to manage with either a removable retainer or fixed bonded bridge.[38]

Mohateb et al. conducted a systematic review on effectiveness of the decoronation technique in treatment of ankylosed teeth and concluded that if space is maintained for placement of implants later, then the alveolar bone width would be slightly compromised and require additional bone grafts.[39] Combination of orthodontic closure of decoronated space and esthetic remodification of mesially relocated teeth in the present case provided an early and permanent result in comparison of later replacement with implant-supported prosthesis.

Conclusion

Management of ankylosis and replacement related tooth resorption due to delayed replantation of an avulsed permanent tooth involves a long-term multidisciplinary approach. Early diagnosis of dentoalveolar ankylosis in growing children is essential for planning and timing of the treatment. Infrapositioned ankylosed tooth in a growing child can be managed successfully with the decoronation technique. Orthodontic closure of the extracted space results in an early esthetic permanent outcome and should be considered a favorable option in the treatment planning of traumatized ankylosed teeth.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Acknowledgment

We would like to acknowledge the faculty of the Orthodontics and Restorative Departments, European University College, Dubai, UAE, for orthodontic space closure and composite remodification of teeth.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- 1 Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. *Int J Oral Surg* 1972;1:235-9.
- 2 Malmgren B. Ridge preservation/decoronation. *Pediatr Dent* 2013;35:164-9.
- 3 Andreasen FM, Pedersen BV. Prognosis of luxated permanent teeth – the development of pulp necrosis. *Endod Dent Traumatol* 1985;1:207-20.

- 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 Andersson L, Andreasen JO, Day P, Heithersay G, Trope M, Diangelis AJ, *et al.* International association of dental traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol* 2012;28:88-96.
- 6 Cohenca N, Stabholz A. Decoronation-a conservative method to treat ankylosed teeth for preservation of alveolar ridge prior to permanent prosthetic reconstruction: Literature review and case presentation. *Dent Traumatol* 2007;23:87-94.
- 7 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.
- 8 Sapir S, Shapira J. Decoronation for the management of an ankylosed young permanent tooth. *Dent Traumatol* 2008;24:131-5.
- 9 Malmgren B, Cvek M, Lundberg M, Frykholm A. Surgical treatment of ankylosed and infrapositioned reimplemented incisors in adolescents. *Scand J Dent Res* 1984;92:391-9.
- 10 Malmgren BM, Malmgren B, Malmgren O, Andreasen JO. Alveolar bone development after decoronation of ankylosed teeth. *Endod Topics* 2006;14:35-40.
- 11 Lin S, Schwarz-Arad D, Ashkenazi M. Alveolar bone width preservation after decoronation of ankylosed anterior incisors. *J Endod* 2013;39:1542-4.
- 12 Mahakunakorn N, Chailertvanitkul P, Kongsomboon S, Tungkulboriboon J. Decoronation as a treatment option for replacement root resorption following severe intrusive trauma: A case report. *Oral Health Dent Manag* 2014;13:266-70.
- 13 Díaz JA, Sandoval HP, Pineda PI, Junod PA. Conservative treatment of an ankylosed tooth after delayed replantation: A case report. *Dent Traumatol* 2007;23:313-7.
- 14 Calasans-Maia MA, Neto AS, Batista MM, Alves AT, Granjeiro JM, Calasans-Maia MD. Management of ankylosed young permanent incisors after trauma and prior to implant rehabilitation. *Oral Surg* 2014;7:45-51.
- 15 Sigurdsson A. Decoronation as an approach to treat ankylosis in growing children. *Pediatr Dent* 2009;31:123-8.
- 16 Sala M, Mendoza-Mendoza A, Yañez-Vico RM. Decoronation: An alternative treatment for replacement root resorption. *Case Rep Dent* 2017;2017:2826948.
- 17 Andersson L, Malmgren B. The problem of dentoalveolar ankylosis and subsequent replacement resorption in the growing patient. *Aust Endod J* 1999;25:57-61.
- 18 Andreasen JO, Malmgren B, Bakland LK. Tooth avulsion in children: To replant or not. *Endod Topics* 2006;14:28-34.
- 19 Lin S, Ashkenazi M, Karawan M, Teich ST, Gutmacher Z. Management of ankylotic root resorption following dental trauma: A short review and proposal of a treatment protocol. *Oral Health Prev Dent* 2017;15:467-74.
- 20 Di Fiore PM, Hartwell GR. Dental pulp revascularization in a replanted avulsed immature maxillary permanent central incisor. *Eur Endod J* 2017;2:1-7.
- 21 Chawla HS. Apical closure in a nonvital permanent tooth using one Ca(OH)₂ dressing. *ASDC J Dent Child* 1986;53:44-7.
- 22 Trope M. Root resorption due to dental trauma. *Endod Topics* 2002;1:79-100.
- 23 Haapasalo M, Endal U. Internal inflammatory root resorption: The unknown resorption of the tooth. *Endod Topics* 2006;12:60-79.
- 24 Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. *Dent Traumatol* 2002;18:134-7.
- 25 Boutsioukis C, Noula G, Lambrianidis T. *Ex vivo* study of the efficiency of two techniques for the removal of mineral trioxide aggregate used as a root canal filling material. *J Endod* 2008;34:1239-42.
- 26 Sabri R. Treatment of a class I crowded malocclusion with an ankylosed maxillary central incisor. *Am J Orthod Dentofacial Orthop* 2002;122:557-65.
- 27 Day PF, Duggal MS, High AS, Robertson A, Gregg TA, Ashley PF, *et al.* Discoloration of teeth after avulsion and replantation: Results from a multicenter randomized controlled trial. *J Endod* 2011;37:1052-7.
- 28 Day PF, Kindelan SA, Spencer JR, Kindelan JD, Duggal MS. Dental trauma: Part 2. Managing poor prognosis anterior teeth – treatment options for the subsequent space in a growing patient. *J Orthod* 2008;35:143-55.
- 29 Malmgren B, Malmgren O. Rate of infraposition of reimplemented ankylosed incisors related to age and growth in children and adolescents. *Dent Traumatol* 2002;18:28-36.
- 30 Consolaro A, Ribeiro Júnior PD, Cardoso MA, Miranda DA, Salfatis M. Decoronation followed by dental implants placement: Fundamentals, applications and explanations. *Dental Press J Orthod* 2018;23:24-36.
- 31 Tuverson DL. Orthodontic treatment using canines in place of missing maxillary lateral incisors. *Am J Orthod* 1970;58:109-27.
- 32 Rosa M, Zachrisson BU. Integrating esthetic dentistry and space closure in patients with missing maxillary lateral incisors. *J Clin Orthod* 2001;35:221-34.
- 33 Kokich VO Jr., Kinzer GA. Managing congenitally missing lateral incisors. Part I: Canine substitution. *J Esthet Restor Dent* 2005;17:5-10.
- 34 Paulsen HU, Andreasen JO. Eruption of premolars subsequent to autotransplantation. A longitudinal radiographic study. *Eur J Orthod* 1998;20:45-55.
- 35 Czochrowska EM, Stenvik A, Zachrisson BU. The esthetic outcome of autotransplanted premolars replacing maxillary incisors. *Dent Traumatol* 2002;18:237-45.

- 36 Zachrisson BU. Planning esthetic treatment after avulsion of maxillary incisors. *J Am Dent Assoc* 2008;139:1484-90.
- 37 Andersson L. Surgical considerations in treatment of the growing trauma patient; implant treatment, tooth transplantation or other treatment alternatives. Lecture no, XXV, 7th World Congress on Dental Trauma. Florence; 1996.
- 38 Wood M, Thompson VP, Romberg E, Morrison G. Resin-bonded fixed partial dentures. II. Clinical findings related to prosthodontic characteristics after approximately 10 years. *J Prosthet Dent* 1996;76:368-73.
- 39 Mohadeb JV, Somar M, He H. Effectiveness of decoronation technique in the treatment of ankylosis: A systematic review. *Dent Traumatol* 2016;32:255-63.

Thursday, June 4, 2020

[Site Map](#) | [Home](#) | [Contact Us](#) | [Feedback](#) | [Copyright and Disclaimer](#)