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Reattachment of anterior teeth fragments using a modified Simonsen's technique after dental trauma: report of a case

CASE REPORT

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Abstract – This is a case report of a 9-year-old boy with complicated crown fractures of two traumatized teeth: left maxillary central and lateral incisors. The central incisor presented a small pulpal exposure of approximately 1 mm and the lateral incisor had an ulcerated and exposed pulp. Endodontic management included direct pulp capping, partial pulpotomy, and restorative management including reattachment of the teeth fragments using a modified Simonsen's technique. The reattached fragments were assessed clinically and radiographically at 12 months. The teeth remained vital, there were no color changes, and the restorations had an acceptable appearance.

Trauma to the facial area generally involves the teeth and their supporting structures; the most frequent causes are falls, traffic accidents, domestic violence, fights, and sports. Most dental injuries occur during the first two decades of life, especially between 2 and 3 years and between 8 and 12 years of age; they occur more often in boys than in girls (1–3). Fractures of permanent teeth comprise the most frequent type of dental trauma. Traumatic fractures of anterior teeth are a common problem in children and adolescents owing to their active lifestyle. The teeth most commonly involved are the maxillary incisors because of their vulnerable position in the mouth. Dental trauma in the anterior region of the mouth is often characterized by tooth avulsion and coronal fracture with or without pulp exposure; 26–76% of these injuries involve loss of hard dental tissues (4, 5), and this type of trauma may involve enamel, dentin, or pulp. Fractures involving enamel, dentin, and pulp represent 4–16% of all traumatic lesions to the permanent dentition (6–9). Treatment depends on the structures involved. The treatment options of enamel-dentin crown fractures with pulpal exposure are direct pulp capping, partial pulpotomy, pulpectomy, or extraction (10). Coronal fractures of permanent teeth with pulp exposure present both endodontic and restorative challenges. For young patients in whom the exposed pulp maintains its vitality, pulpotomy is the best endodontic treatment option. A partial pulpotomy, known as the Cvek technique, is indicated for teeth having the following characteristics: (i) small pulp exposure, (ii) treated within 14 days of trauma, (iii) caries free, (iv) open apex or thin dentinalwalls, and (v) vital and asymptomatic pulp. This technique involves amputation of the dental pulp 2 mm apical to the affected pulp tissue (11). It is not recommended for those cases in which the pulp exposure is extensive or where there is a 2-week lapse between trauma and treatment. A pulpotomy is indicated for those patients wherein the pulpitis has not progressed beyond the coronal pulp, bleeding after amputation is not excessive, and the blood has a normal coloring.

Techniques of fragment reattachment have been published since 1964, when Chosak and Eidelman reported a case that involved reattaching the natural fragment of an incisor (12). A variety of reattachment techniques have been employed over the years. Simonsen's technique describe a 'bevel' type of preparation to provide a finishing line for restoration in order to preparate the edge of enamel prisms in the ideal 'end on' relationship for etching and bonding, and no further overlap of resin onto the enamel surfaces for improve retention. This technique is very similar to the 'chamber shoulder' technique proposed by Jordan (13). The fractured enamel margin is beveled at approximately 45° forming an area of enamel about 1–1.5 mm wide. This area of enamel is used for retention and the

composite bonded to the enamel is finished to the finishing line formed by the bevel (14, 15). In this study, the technique proposed by Simonsen was modified by the application of dental adhesive and the incorporation of interproximal notches in order to adapt the fragment perfectly to the tooth remnant.

The purpose of this case report is to present a modified Simonsen's technique for reattaching tooth fragments after dental trauma.

Case report

A 9-year-old boy was referred to our clinic because of crown fractures of the left maxillary central and lateral incisors as result of playing with a metal pole, presenting to the clinic 2 h after the trauma. The patient's medical history was unremarkable. There was no apparent trauma to the soft tissues per extra- and intraoral examination. The intact teeth fragments were recovered at the accident site by his classmates and brought to the clinic by his mother. Clinical examination revealed complicated crown fractures of both traumatized teeth. The left maxillary central incisor presented a small pulpal exposure of approximately 1 mm while the left maxillary lateral incisor had an ulcerated and exposed pulp. There was no sign of trauma to the adjacent teeth, which were vital and not mobile. Periapical radiographic examination showed complete root development, closed apices, no periapical pathology, and absence of root or alveolar bone fractures (Fig. 1).

The possibility of reattaching the same teeth fragments were explained to the patient's mother and, owing to the lower cost compared with an indirect restoration, she expressed the desire to maintain them. Endodontic management included direct pulp capping and partial pulpotomy. The treatment plan was accepted.

A local anesthetic was administered and the affected teeth were isolated with a rubber dam. For direct pulp capping the central incisor, the area was carefully irrigated with alternate solutions of sterile saline and chlorhexidine (Consepsis; Ultradent Products, St Jordan, UT, USA) and dried gently with sterile cotton pellets. Immediately, self-hardening calcium hydroxide (Dycal; Dentsply Caulk, Milford, ME, USA) was placed over the fracture line with a round-head metallic applicator, followed by a layer of glass ionomer (Vitrebond; 3M Espe, St Paul, MN, USA), and photopolymerized for 40 s. For the lateral incisor partial pulpotomy treatment, a No. 330 tungsten round bur (with continuous saline rinsing) was used to amputate the pulp close to the exposure site to a depth of 2 mm. The blood was noted to be light red, and homeostasis was evident in 3 min. A dressing of calcium hydroxide paste (Viarden, Mexico City, Mexico) was placed, followed by a cover of glass ionomer (Vitrebond), and photopolymerized for 40 s.

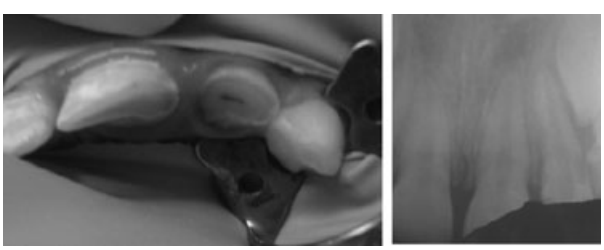

Fig. 1. Initial clinical image (left) of patient 2 h after trauma with fractured left maxillary central and lateral incisors. Initial radiograph (right) showing loss of dental structure and enlargement of the periodontal ligament of the left maxillary central incisor and an absence of root or alveolar bone fractures.

To avoid dehydration during clinical and radiographic evaluation and endodontic therapy, the teeth fragments were immersed in saline solution. Teeth fragments and remnants were prepared as follows: (i) Notches of 1–1.5 mm on approximal sides within the enamel were made by using a No. 1 round diamond bur in both of the fragments and in the remaining crowns (these fragments were placed on a wax bar for easier manipulation). In these notches, we not apply the beveling; notches were made in order to guide the correct adaptation of tooth fragments. (ii) Both the fragments and the remaining dental structures were acid etched using 37% orthophosphoric acid for 30 s for the enamel and 15 for the dentin; the acid was eliminated by rinsing with distilled water and drying. (iii) Dental adhesive (Prime and Bond NT, Dentsply Caulk, Milford, ME, USA), was applied to both the fragments and the teeth and light cured for 40 s; (iv) a flowable resin (Tetric Flow, Ivoclar Vivadent AG, Schaan/Liechtenstein) was used to adhere the fragments to the teeth; a thin layer of this resin was placed in the notches and across the fractured surface of the teeth to allow for a small excess of material when the fragments were repositioned, then flowable resin was light cured for 60 s labially and palatally. Figure 2 shows the preparation of approximal notches; (v) finally, the residual excess at the restorative margins were finished and polished with finishing burs and discs.

Clinical and radiographic examinations were made after treatment (Fig. 3). 12 months after the trauma, the patient showed no periodontal or periapical pathology, and no pulpal signs or symptoms. The teeth were found to be vital; the restoration was functional and aesthetically acceptable (Fig. 4).

Discussion

Among the child and teenage population, the possibility of suffering orofacial trauma is high and is considered a serious dental public health problem (16). Of these traumas, dental crown fractures play a major role, comprising an estimated 70% of all orofacial trauma (4). Crown fractures with pulp exposure represent 18 to 20% of traumatic injuries involving the teeth, the majority being in young permanent teeth (17). Studies have reported that tooth fragment reattachment is an alternative for restoring aesthetics and function of the injured teeth. Various techniques have been used for this: (i) circumferential enamel bevel (14, 18), (ii) external chamfer (19, 20), (iii) V-shaped enamel notch (15), (iv) internal dentin groove (18, 21), and (v) superficial overcontouring (20, 21). When pulp vitality is involved,

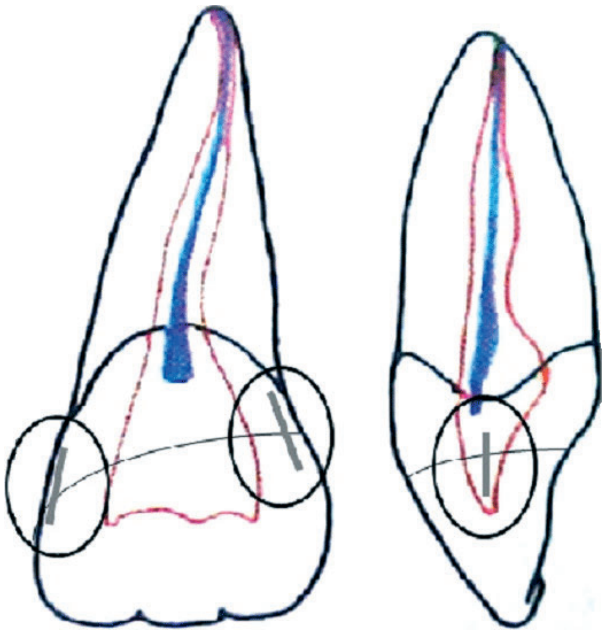

Fig. 2. Diagram showing preparation of interproximal notches.

Fig. 3. Reattachment of tooth fragments after treatment (left). Post-treatment radiograph (right) showing pulpotomy in left maxillary lateral incisor and direct pulp capping in left maxillary central incisor with reattachment of the dental fragments.

case management becomes complicated. For traumatized teeth with complicated crown fractures, treatment options include direct pulp capping, partial pulpotomy, pulpotomy, pulpectomy, and extraction. Pulp exposure caused by dental trauma has a better prognosis because of the absence of microorganisms associated with caries. Kanca reported a case of a patient in whom an incisor, fractured through the pulp, was replaced with the original tooth fragment. A 5-year follow-up revealed a vital pulp (22). Koparal and Ilgenli described the case of a patient having a pulp extirpation and root canal filling for a fractured maxillary right incisor with ulcerated pulp. They used the tooth fragment for restoration; at 1-month follow-up, the reattachment was stable (23). Zorba and Özcan reported a clinical technique to reattach a traumatized maxillary lateral incisor using a direct, fiber-reinforced post system. They reported an acceptable patient appearance at the 1-year follow-up (24). Ozel et al. (25) described the case of a patient presenting with a fractured maxillary left central incisor with exposure of dentin, but without pulp exposure. The

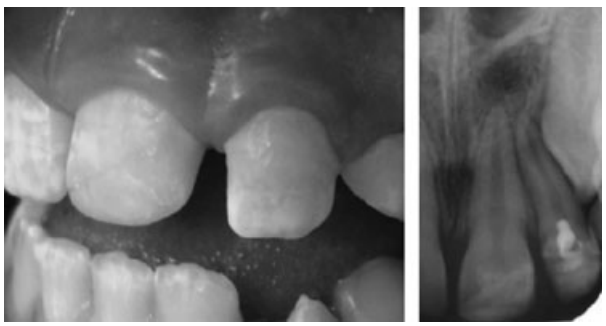

Fig. 4. Clinical (left) and radiographic (right) examinations twelve months after the trauma, the patient showed no periodontal or periapical pathology, and no pulpal signs or symptoms.

tooth fragment was reattached using a self-etching adhesive and a microhybrid composite. At the 3-year follow-up, the restoration was considered successful and the tooth remained vital. Arapostathis et al. (26) reported on a patient with fractured maxillary right and left central incisors having uncomplicated crown fractures of both teeth. They performed a simple reattachment using a light-cured composite between the fragment and the remainder of the tooth without additional preparation. Clinical and radiographic examination at 12 months after trauma showed no periodontal or periapical pathology, and the restorations were functionally acceptable and aesthetically gratifying.

In the present case, we decided to use direct pulp capping and partial pulpotomy on each affected tooth, with the use of tooth-fragment reattachment using a modified Simonsen's technique. For this decision we considered the size of the exposure, interval between the accident and treatment, age of the patient, and maturity of the roots. The technique proposed by Simonsen was modified by the application of dental adhesive (Prime and Bond NT, Dentsply Caulk, Milford, ME, USA) and the incorporation of interproximal notches to adapt the fragment perfectly to the tooth remnant. Reattachment of a dental fragment is possible due to the improvement of the adhesive technique and restorative materials, like flowable resin (Tetric Flow, Ivoclar Vivadent AG, Schaan/Liechtenstein). In this study, we included some modifications to the Simonsen's technique: (i) dental adhesive was applied to both fragments; (ii) a flowable resin was used to adhere the fragments to the teeth; a thin layer of this resin was placed in the notches and across the fractured surface to allow for a small excess of material when the fragments were repositioned; (iii) notches were made in the interproximal spaces. We presumed that the use of interproximal notches allows the fragments to be accurately aligned and adapted, placing the unaltered fragment edges in better orientation and reapproximation. Flowable resin permits lap joining the fragments, and a minimum of restorative material is exposed on the surface along the fracture line.

These options of both endodontic and restorative treatments have advantages in that they are quick and easy to perform, maintain natural tooth color, and

preserve tooth structure for better retention of the reattached tooth fragments. These fragments were assessed clinically and radiographically at 6 months and found to still have vitality, no color change, and acceptable appearance. A longer follow-up period is required.

The time at which the trauma occurred is fundamental; the success of reattachment depends partly on how dehydrated the tooth fragment is. Fragments dehydratated for longer than 1 h have significantly reduced resistance to fracture. Also, prolonged dehydratation may cause esthetic problems. In the present case, the patient reached our clinic 2 h after the accident but, because they were maintained in a humid environment until reattachment, the fragments did not show dehydratation.

The best restorative option for treating fractured anterior teeth is reattachment of the tooth fragment because the tooth's original anatomic form, contour, surface texture, color, occlusal alignment, translucence, and function are maintained. Also, reattachment provides a positive psychological response, and it is a relatively simple procedure (28–30). Since the development of resin composites and bonding systems, reattachment of tooth fragments has become the preferred alternative to a restoration; it is a better way to achieve chemical and mechanical reattachment of the remaining dental structure (25, 26). Bonding of the crown fragment is a logical restorative treatment option when the trauma results in minimal or no violation of the biological width, when the crown fragment is retrieved following the trauma, when it is relatively intact, and when it adapts well to the remaining tooth (30). Recently Andreasen et al. (31) estimated that two out of three children suffer a traumatic dental injury before adulthood and established that the problem of trauma in children is not reflected by the active participation of pediatric dentists in acute treatment, follow-up, or research on this topic.

Although the reattachment of fractured tooth fragments is not a final treatment, it offers an excellent restorative option for clinicians and patients because it restores tooth function and aesthetics, requires less time in the dental office, and represents a cost-effective approach.

References

1. American Academy of Pediatric Dentistry Council on Clinical Affairs. Guidelines on management of acute dental trauma. Pediatr Dent 2008-2009;30:175–83.
2. Santos Filho PC, Quagliatto PS, Simamoto PC Jr, Soares CJ. Dental trauma: restorative procedures using composite resin and mouthguards for prevention. J Contemp Dent Pract 2007;8:89–95.
3. Forsberg CM, Tedestam G. Etiological and predisposing factors related to traumatic injuries to permanent teeth. Swed Dent J 1993;17:183–90.
4. 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.
5. Andreasen JO, Andreasen FM Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1993:216–56.
6. Stockwell AJ. Incidence of dental trauma in the Western Australian School Dental Service. Community Dent Oral Epidemiol 1988;16:294–8.
7. Forsberg CM, Tedestam G. Traumatic injuries to teeth in Swedish children living in an urban area. Swed Dent J 1990;14:115–22.
8. Perez R, Berkowitz R, McIlveen L, Forrester D. Dental trauma in children: a survey. Endod Dent Traumatol 1991;7:212–3.
9. Cavalleri G, Zerman N. Traumatic crown fractures in permanent incisors with immature roots: a follow-up study. Endod Dent Traumatol 1995;11:294–6.
10. García-Godoy F, Pulver F. Treatment of trauma to the primary and young permanent dentitions. Dent Clin North Am 2000;44:597–632.
11. Cvek M. A clinical report on partial pulpotomy and capping with calcium hydroxide in permanent incisors with complicated crown fracture. J Endod 1978;4:232–7.
12. Chosack A, Eidelman E. Rehabilitation of a fractured incisor using the patient's natural crown - case report. J Dent Child 1964;31:19–21.
13. Jordan RE, Suzuki M, Gwinnett AJ, Hunter JK. Restoration of fractured and hypoplastic incisors by the acid etch resin technique: a three-year report. J Am Dent Assoc 1977;95:795–803.
14. Simonsen RJ. Traumatic fracture restoration: on alternative use of the acid etch technique. Quintessence Int 1979;10:15–22.
15. Simonsen RJ. Restoration of a fractured central incisor using original tooth fragment. J Am Dent Assoc 1982;105:646–8.
16. Tapias MA, Jiménez-García R, Lamas F, Gil AA. Prevalence of traumatic crown fractures to permanent incisors in a childhood population: Móstoles, Spain. Dent Traumatol 2003;19:119–22.
17. de Blanco LP. Treatment of crown fractures with pulp exposure. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1996;82:564–8.
18. Walker M. Fractured-tooth fragment reattachment. Gen Dent 1996;44:434–6.
19. Davis MJ, Roth J, Levi M. Marginal integrity of adhesive fracture restorations: chamfer versus bevel. Quintessence Int 1983;14:1135–46.
20. Reis A, Francci C, Loguercio AD, Carrilho MR, Rodriques Filho LE. Re-attachment of anterior fractured teeth: fracture strength using different techniques. Oper Dent 2001;26:287–94.
21. Baratieri LN, Monteiro Júnior S, de Albuquerque FM, Vieira LC, de Andrada MA, de Melo Filho JC. Reattachment of a tooth fragment with a ''new'' adhesive system: a case report. Quintessence Int 1994;25:91–6.
22. Kanca J III. Replacement of a fractured incisor fragment over pulpal exposure: a long-term case report. Quintessence Int 1996;27:829–32.
23. Koparal E, Ilgenli T. Reattachment of subgingivally fractured central incisor tooth fragment: report of a case. J Clin Pediatr Dent 1999;23:113–6.
24. Zorba YO, Özcan E. Reattachment of coronal fragment using fiber-reinforced post: a case report. Eur J Dent 2007;1:174–8.
25. Ozel E, Cildir A, Ozel Y. Re-attachment of anterior tooth fragment using a self-etching adhesive: a case report. J Contemp Dent Pract 2008;9:77–83.
26. Arapostathis K, Arhakis A, Kalfas S. A modified technique on the reattachment of permanent tooth fragments following dental trauma. Case report. J Clin Pediatr Dent 2005;30:29–34.
27. Maia EA, Baratieri LN, de Andrada MA, Monteiro S Jr, de Araújo EM Jr. Tooth fragment reattachment: fundamentals of the technique and two case reports. Quintessence Int 2003;34:99–107.
28. Hegde RJ. Tooth fragment reattachment - an esthetic alternative: report of a case. J Indian Soc Pedod Prev Dent 2003;21:117–9.

29. Macedo GV, Diaz PI, De O Fernandes CA, Ritter AV. Reattachment of anterior teeth fragments: a conservative approach. J Esthet Restor Dent 2008;20:5–18.
30. Macedo GV, Ritter AV. Essentials of rebonding tooth fragments for the best functional and esthetic outcomes. Pediatr Dent 2009;31:110–6.
31. Andreasen JO, Lauridsen E, Daugaard-Jensen J. Dental traumatology: an orphan in pediatric dentistry? Pediatr Dent 2009;31:153–6.