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From Breakage to Brilliance, The Power of Fragment Reattachment- A case report

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Abstract

Coronal fracture of the anterior teeth is mainly common among children and adolescents. Though diverse treatment modalities are available, tooth fragment reattachment is generally considered a viable treatment option due to simplicity, natural aesthetics, and functional success. This case report highlights in detail the fragment reattachment procedure of a fracture central incisor in a 11 year old patient.
Fragment reattachment was found to be a functional and aesthetically acceptable treatment option in restoring the integrity of fractured permanent incisors irrespective of the time elapsed. Reattachment provides rapid outcome thereby, imparting an overall sense of optimism and confidence. It is relatively inexpensive compared to other comprehensive treatment procedures. The procedure is very simple, requiring less chair-side time.

Keywords: Fragment reattachment, Traumatic dental injury, fractured central incisor

INTRODUCTION

Dental trauma is any injury to the teeth, gums, jawbone or soft tissues of the mouth. Accidents, such as falls, car wrecks and sports-related injuries are the main cause of traumatic dental injuries. Early treatment gives the best chance for full recovery. Traumatic dental injuries (TDIs) of permanent teeth occur frequently in children and young adults. Crown fractures and luxations of these teeth are the most commonly occurring of all dental injuries. Proper diagnosis, treatment planning, and follow up are important for achieving a favorable outcome.
Of all physical injuries, injury to the orofacial region comprises of around 5% [1] and about 92% of patients who seek consultation for oral injuries report with traumatic dental injuries (TDIs). Traumatic dental injuries have physical, psychological, and social impact and, in general, affect the overall quality of life of patients. Most commonly reported traumatic dental injury is fracture of crown in the maxillary anterior teeth region especially in preschool children and in adolescents.[2, 3] Therefore, dental injuries necessitate an emergency intervention and management that should aim at restoring function and aesthetics of the fractured tooth to near normal.
Management of crown fracture depends upon a wide array of factors; type of fracture (complicated/uncomplicated), degree, pattern of fracture, age of the patient and stage of tooth eruption.[4] Diverse range of treatment options are available for the restoration of fractured tooth including full coverage crowns, post and core, and composite restorations. With the rise of newer adhesive systems, tooth fragment reattachment, which was earlier times considered as an interim restoration, has evolved as an established treatment modality.[5,6]
Chosack and Eidelman in 1964 were the first to report fragment reattachment according to literature. Some authors propose a technique of "simple reattachment" with no additional preparation while others have proposed a variety of preparations for the reattachment of fractured fragment.[7-13]
In 1982, a "V-shaped, notched bevel" preparation was employed to restore a fractured central incisor using acid etch technique and microfilled composite resin.[14] This technique is popularly known as Simonsen's technique. Several modifications in the technique have been developed over the time. A modified Simonsen's technique was proposed, in which "notches" were prepared on the proximal surfaces of both the fragment and the remaining crown. These notches were meant to guide the correct adaptation of the tooth fragments. These modifications aim to increase the longevity of the restoration while maintaining the aesthetics and function of the reattached fragment[15].
With the advancements in the adhesive technology, minimally invasive technique has evolved and progressed in every aspect of dentistry. Historically, clinicians relied upon conventional cements[7] and interlocking minipins[16] for

reattachment of the tooth. In 1974, Tennery[17] reported tooth fragment reattachment using acid etch technique. Shortly after that, use of bonding agents for micromechanical retention became widespread.[18,19]

ADVANTAGES

Tooth fragment reattachment is indicated when the fractured segment is available and there is minimal or no discrepancy in the fit between the fractured segment and tooth.[15] This technique has many advantages viz.,The original color, contour, and texture of tooth is preserved in fragment reattachment procedure. It is a highly conservative procedure that requires little or no tooth preparation. Wear rate of the incisal edge is same as the adjacent tooth, compared to composite restoration, which abrades at a faster rate.[14] Patient presenting with TDIs agonized from negative psychological impact. Reattachment provides rapid outcome thereby, imparting an overall sense of optimism and confidence. It is relatively inexpensive compared to other comprehensive treatment procedures. The procedure is very simple, requiring less chair-side time.

TECHNIQUES FOR FRAGMENT REATTACHMENT

Initially what began as a simple "fixing" procedure by rejoining with conventional cements,[7] the tooth reattachment procedure has evolved into a recognized treatment option with an unprecedented and accordant outcome.[20- 22] Since it was first reported in 1964,[7] several modifications in the tooth reattachment have been proposed. Although there is no established consensus as to which technique yields best result, some techniques do offer advantage over others.

1. **Simple reattachment:** It entails the reattachment of the fragment without any additional preparation of either the tooth or the fragment. This technique can be applied in cases where the fractured segment and tooth fit together completely without any discernable disruption between the segments.[23] It has been shown that reattachment without any additional preparation recovers only 50% of the fracture resistance as compared to a sound tooth.[24] Srilatha et al[25] have reported a fracture strength recovery of around 36.6% compared to a sound tooth in simple reattachment technique which suggests that this technique results in a fracture strength of even less than 50% of a sound tooth. On the contrary, Worthington et al[26] reported no difference in the bond strength in teeth reattached with simple technique compared to those with additional preparation. It a relatively noninvasive procedure and has an advantage of providing superior esthetics.[27]

2. **Enamel bevel**: Proposed by Simonsen in 1979, this technique involves preparation of a 45° bevel circumferentially on enamel margins of both, fragment and the tooth[9]. The author proposed that during beveling, minimal enamel is removed, and the prepared surface shows an ideal end on relationship of enamel prisms for optimum etching and bonding. However, a study conducted by Dean et al[28] concluded that there is no significant difference in retention between enamel bevel preparation and simple reattachment. According to Simonsen,[9] this technique offers superior aesthetic as the fracture line is concealed behind layer of composite. This assertion was disproved by Simonsen in 1982, when he proposed internal enamel groove preparation as the band of composite on the labial surface showed discoloration over time. Another drawback reported is the loss of precise fit of the fragment because the preparation is done prior to the reattachment.

3. **V-shaped internal enamel groove:** This technique was also put forth by Simonsen in 1982 to overcome the drawbacks of the earlier methods.[14] In this procedure, an internal V-shaped notch bevel is prepared inside the labial enamel of both the tooth and the fragment while keeping the outer enamel surface intact. Simonsen advocated preparation of a conventional 45° bevel on the palatal surface approximately about 1.5mm. However, many other authors proposed preparation of a V-shaped internal groove all the way around the tooth. Reis et al have reported from their study that there is an increase in the bond strength by 60%, as a result of beveling or preparation of an internal enamel groove before reattachment compared to a simple reattachment. Since the preparation is done before reattachment, loss of fit of fractured fragment may still be evident[12].

4. **Internal dentine groove:** It involves preparation of a dentinal groove (1 mm deep × 1 mm wide) in the fractured fragment and the tooth before reattachment. Srilatha et al,[25] in a study compared four different reattachment techniques and have reported that internal dentine groove has shown to attain a fracture strength recovery of 89.2% in relation to a sound tooth. The superior fracture resistance is attributed to the increased area of adhesion and the additional resin infiltration in the groove which acts as an opposing force to the compression load. According to Diangelis and Jungbluth,[29] preparation of an internal dentine groove provides increased bond strength and inhibits the eventual darkening due to devitalization of dentine in the fragment. However, the composite resin exposed to the oral cavity undergoes discoloration and abrasion over time with resultant aesthetic loss.[30]

5. External chamfer: This technique was unveiled to overcome the problem of loss of fit due to prebonding preparation techniques. In this technique, a chamfer is created along the fracture line after the reattachment procedure. Abdulkhayum et al[31] from their study have reported a fracture strength recovery of 60.3% in relation to a sound tooth compared to simple reattachment technique which shows a fracture strength recovery of 44.3%. Yilmaz et al[32] evaluated

success of fragment reattachment using "V-shaped double chamfer" technique. None of the cases reported with fragment detachment at 24 months follow-up. The author put forth thye fact that the high success rate to the use of flowable composite resin and reinforcement of the fracture line with double chamfer technique. It allows for better reapproximation of the fragment and the tooth.[24]

6. **Overcontour:** This technique involves preparation of a groove along the fracture line extending coronally and apically after reattaching the fragment. Srilatha et al[25] have reported a fracture strength recovery of 91.4% compared to a sound tooth, highest among all the above-mentioned techniques. Likewise, Reis et al[12] unveiled that there was the highest fracture strength recovery of 97.2% compared to sound tooth with composite overcontouring.[12] This has been attributed to the increased adhesion area which allows greater delivery of composite on the tooth that promotes a more favorable distribution of forces in the enamel. However, the gradual loss of aesthetics due to abrasion of resin over time has been evident.[27]

7. **Vertical groove:** This is a relatively new technique in which 2 vertical grooves of 2-mm depth and width are prepared on the labial surface of the tooth after reattachment.[33] The grooves accommodate fiber-reinforced composite posts placed extracoronally to aid in the retention of the fragment. Karre et al[33] have reported fracture strength recovery of 62% in relation to a whole tooth with this technique. The placement of fiber post in the fracture site reinforces the adhesion thereby increasing the fracture resistance.

SURVIVAL RATE OF REATTACHED FRAGMENT

With the advances in adhesive technology, fragment reattachment has evolved as a fairly reliable treatment option with consistent and predictable outcomes. Many cases with long-term follow-up have shown promising results in regard to the retention and aesthetics of the restored teeth.[20–22, 34] In a multicenter study by Andreasen et al[35] on 334 number central incisors restored with reattachment, it was reported that 50% and 25% of the teeth remained intact after 5 years and 7 years of follow-up, respectively. In another study, 50 reattached teeth displayed 80% survival rate at 5-year follow-up[36]. Several authors have also reported that fragment reattachment could be considered as a viable treatment alternative for fractured teeth as a result of trauma.[4, 6, 37]

FACTORS AFFECTING THE SURVIVAL OF TOOTH AFTER FRAGMENT REATTACHMENT

Several factors have been reported to affect the longevity of the fragment reattachment; reattachment technique, material used for reattachment, presence or absence of an intermediate material, and rehydration of the fragment prior to reattachment. Many authors have recommended preparation of the fragment and/or tooth before reattachment[9, 10, 14, 29] while others have proposed that preparation of the fragment and/or tooth does not affect the bond strength of the reattached tooth.[8, 26]

Various bonding systems (multimodal, self-etch, total etch) and intermediate materials (traditional composites, flowable composite, or glass ionomer cement) have been used for fragment reattachment.[6, 27, 30] Some authors emphasize that the technique used for reattachment is the primary factor affecting the bond strength rather than the material.[12, 38] In contrast, many authors advocate that both the technique employed and the material used for bonding are primary factors affecting the bond strength of reattached fragment.[39–41]

According to Bruschi et al,[27] neither the technique nor the material alone could restore the fracture strength of tooth close to an intact tooth. However, association of proper technique and bonding system employed for reattachment could help achieve the impact strength of reattached tooth similar to that of a sound tooth.[27] Farik et al[42] demonstrated that the type of adhesive system used directly influences the fracture strength of the bonded tooth. In another study, Pagliarini et al[43] evaluated the effectiveness of existing adhesives in fragment reattachment. The author concluded that fourth-generation adhesives showed superior bond strength compared to fifth-generation adhesives. Likewise, Bruschi et al[27] compared the impact strength of total-etch and self-etch adhesives and reported that strength achieved after reattachment with total-etch adhesives is significantly higher than the self-etch adhesives.

The use of light-cured, dual-cured, or self-cured luting cements, flowable composites, and conventional composites as intermediated materials have been proposed. Many authors have concluded that presence of an intermediate material does not have a direct influence on the impact strength of the reattached fragment.[12, 27] However, Pusman et al[41] have reported that the type of adhesive used for bonding and the intermediate material affects the fracture strength of the tooth.

The storage of fragment prior to reattachment has also been shown to affect the bond strength of the tooth and the fragment. Farik et al[44] reported that bond strength of reattached fragment is reduced if the fragment is held dry for more than 1 h before the procedure. The authors recommend storage in wet media for at least 24 h prior to reattachment if the fragment was held in a dry environment initially.[44] In contrast to this study, Yilmaz et al[37] have proposed that the storage media of the fragment does not affect the survival rate of the reattached tooth. In addition, Capp et al[24] reported that fracture strength of a fragment that has been stored in a dry media for up to 48 h could be restored by keeping the

fragment in a wet media for 30 min prior to the procedure. Another concern in relation to dry storage of the fragment is the color disharmony between fragment and the tooth. However, at the 1-year follow-up, the tooth recovered its natural translucency.[14]

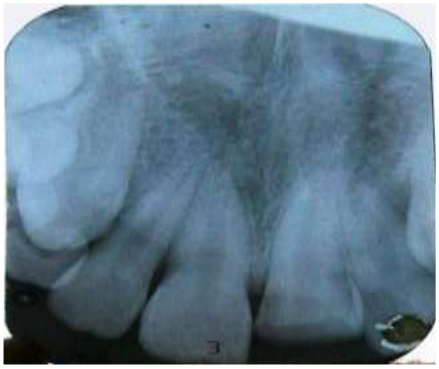
CASE REPORT

A 11-year-old boy reported to the Department of Pedodontics and Preventive dentistry with the chief complaint of broken front tooth in the upper front tooth region for past 5 hrs. The parents were more concerned about the esthetics of the child, and they wanted an aesthetic replacement of the anterior tooth. Intraoral examination revealed Ellis Class III fracture in 21 **(Fig 1, 2).** The fractured tooth fragment was recovered by the patient at the site of the injury and maintained in a storage media (milk) for 2 hours **(Fig 3)**. Intraoral Periapical Radiograph revealed, fractured 21**(Fig 4).**

(Fig 1- Ellis ClassIII fracture in 21**)**

(Fig 2- Ellis ClassIII fracture in 21**)**

(Fig 3- Fractured segment**)**.



(Fig 4- Intraoral Periapical Radiograph revealing, fractured 21 with Ellis Class III fractue**).**

The fit of the fractured segment with the tooth was checked and any discretion when the segment was approximated with the tooth structure was noted. As there was no discrepancy, the treatment plan was decided to be simple fragment reattachment. The tooth fragment had been stored in milk for 2 hours and did not show any significant change in color. An immediate endodontic intervention followed by bonding of the fractured segment was planned.
Single-visit endodontic therapy was performed for the fractured central incisor. An access cavity was prepared, working length determined, and biomechanical preparation was carried out with the help of ProTaper rotary file till F3 using the crown-down technique. Copious irrigation of the root canal was intermittently done during instrumentation with 1.3% sodium hypochlorite and normal saline. The canal was dried with absorbent paper point, and obturation was done by sectional method maintaining apical seal. **(Fig 5).**

(Fig 5- Obturation completed in 21**).**

The tooth fragment was disinfected with sodium hypochlorite solution and then rinsed properly with water. The fragment was then carefully seated on the remaining tooth and light cured. During curing, firm and stable finger pressure was applied to the coronal fragment to closely approximate it to the tooth. After curing, excess composite was removed with a diamond finishing bur. Afterward, final polishing was done with Enhance (Dentsply) kit. **(Fig 6).**

(Fig 6- Final polishing completed in 21**).**
Follow-up examinations were carried out at 10-month interval. The tooth remained normal in esthetics and function.

CONCLUSION

Development in the field of adhesive dentistry has enabled clinicians to adopt minimally invasive procedures in the clinical practice. Fragment reattachment is a relatively simple procedure and can be opted as a treatment modality in fractured teeth. Several modifications in the preparation technique have been proposed. However, none of the techniques could restore fracture strength equal to that of an unrestored natural tooth. Nevertheless, implementation of proper technique and adhesive material could help achieve satisfactory outcome in terms of retention and aesthetics.
This case report has offered many considerations for a pediatric dentist when considering replacement of fractured anterior teeth at an early age.

DECLARATION OF PATIENT CONSENT

The author certifies that they have obtained all appropriate patient consent forms. In the form, the child's guardians have given their consent for their child's images and other clinical information to be reported in the journal. The guardian understands that their child's name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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REFERENCES:

1. Eilert-Petersson E, Andersson L, Sorensen S. Traumatic oral vs. non-oral injuries. An epidemiological study during one year in a Swedish county. Swed Dent J. 1997;21:55–68.
2. Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. Int J Oral Surg. 1972;1:235–239.
3. Andreasen FM, Andreasen JO. Crown fractures, eds. Textbook and Color Atlas of Traumatic Injuries to the Teeth. Mosby; 1994:219–256.
4. Ajayi DM, Adebayo GE. Survival of reattached tooth: a systematic review. J West Afr Coll Surg. 2018;8(3):59–84.
5. Cem Güngör H, Uysal S, Altay N. A retrospective evaluation of crown-fractured permanent teeth treated in a pediatric dentistry clinic. Dent Traumatol. 2007;23(4):211–217.
6. Poubel DLN, Rezende LVML, Almeida JCF, et al. Tooth fragment reattachment
7. Chosack A, Eidelman E. Rehabilitation of a fractured incisor using the patient's natural
8. Bona AD, Boscato N. Clinical evaluation of allografts and homografts for restoration of
9. Simonsen RJ. Traumatic fracture restoration: an alternative use of the acid etch technique.
10. Walker M. Fractured-tooth fragment reattachment. Gen Dent. 1996;44:434–436.
11. Davis MJ, Roth J, Levi M. Marginal integrity of adhesive fracture restorations: chamfer versus bevel. Quintessence Int Dent Dig. 1983;14(11):1135–1146.
12. 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;26:287–294.
13. Baratieri LN, Monteiro Junior 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(2):91–96.
14. Simonsen RJ. Restoration of a fractured central incisor using original tooth fragment. J Am Dent Assoc. 1982;105:646–648.
15. Ojeda-Gutierrez F, Martinez-Marquez B, Rosales-Ibanez R, Pozos-Guillen AJ. Reattachment of anterior teeth fragments using a modified Simonsen's technique after dental trauma: report of a case. Dent Traumatol. 2011;27(1-3):81–85.
16. Spasser HF. Repair and restoration of a fractured, pulpally involved anterior tooth: report of a case. JADA. 1977;94:519–520.

17. Tennery TN. The fractured tooth reunified using the acid-etch bonding technique. Texas Dent J. 1978;96:16–17.
18. Marder C. Restoration of a fractured anterior tooth. JADA. 1978;96:113–115.
19. Starkey PE. Reattachment of a fractured fragment to a tooth. J Indiana Dent Assoc. 1979;58:37–39.
20. Mendes L, Laxe L, Passos L. Ten-year follow-up of a fragment reattachment to an anterior tooth: a conservative approach. Case Rep Dent. 2017;2017:2106245.
21. Martos J, Pinto KVA, Miguelis TMF, Xavier CB. Management of an uncomplicated crown fracture by reattaching the fractured fragment—case report. Dent Traumatol. 2017;33(6):485–489.
22. dos Santos CL, Trevisan CL, Luvizuto ER, Panzarini SR, Poi WR, Sonoda CK. Uncommon crown-root fracture treated with adhesive tooth fragment reattachment: 7 years of follow-up. Compend Contin Educ Dent. 2011;32(9):E132–E135.
23. Lo Giudice G, Lipari F, Lizio A, Cervino G, Cicciù M. Tooth fragment reattachment technique on a pluri traumatized tooth. J Conserv Dent. 2012;15(1-3):80–83.
24. Capp CI, Roda MI, Tamaki R, Castanho GM, Camargo MA, De Cara AA. Reattachment of rehydrated dental fragment using two techniques. Dent Traumatol. 2009;25:95–99.
25. Srilatha SJ, Chhasatia N, Rani PJ, Mathur E. Reattachment of fractured anterior teeth-determining fracture strength using different techniques: an in vitro study. Contemp Dent Pract. 2012;13:61–65.
26. Worthington RB, Murchison DF, Vandewalle KS. Incisal edge reattachment: the effect of preparation utilization and design. Quintessence Int. 1999;30(9):637–643.
27. Bruschi-Alonso RC, Alonso RC, Correr GM, et al. Reattachment of anterior fractured teeth: effect of materials and techniques on impact strength. Dent Traumatol. 2010;26(4):315–322.
28. Dean JA, Avery DR, Swartz ML. Attachment of anterior tooth fragments. Pediatr Dent. 1986;8:139–142.
29. Diangelis AJ, Jungbluth M. Reattaching fractured tooth segments: an esthetic alternative. J Am Dent Assoc. 1992;123(8):58–63.
30. Reis A, Kraul A, Francci C, et al. Reattachment of anterior fractured teeth: fracture strength using different materials. Oper Dent. 2002;27:621–627.
31. Abdulkhayum A, Munjal S, Babaji P, et al. In-vitro evaluation of fracture strength recovery of reattached anterior fractured tooth fragment using different re-attachment techniques. J Clin Diagn Res. 2014;8(3):208–211.
32. Yilmaz Y, Zehir C, Eyuboglu O, Belduz N. Evaluation of success in the reattachment of coronal fractures. Dent Traumatol. 2008;24:151–158.
33. Karre D, Duddu MK, Swathi SS, Bin Mohsin AH, Bharadwaj B, Barshaik S. Conservative vertical groove technique for tooth rehabilitation: 3-year follow-up. Case Rep Dent. 2018;2018:2012578.
34. Fatima S, Alam S, Kumar A, Andrabi SMUN, Rehman A. Minimal intervention treatment of crown-root fracture in a mature permanent tooth by MTA pulpotomy and fragment reattachment: a case report. Aust Endod J. 2021;47(2):365–371.
35. Andreasen FM, Noren JG, Andreason JO, Engelhardtsen S, Lindh-Stromberg U. Long-term survival of fragment bonding in the treatment of fractured crowns: a multicenter clinical study. Quintessence Int. 1995;26:669–681.
36. Vijaykumaran V. Evaluation of crown restoration of fractured anterior teeth using original tooth fragment. J Dent Res. 1998;77:696.
37. Yilmaz Y, Guler C, Sahin H, Eyuboglu O. Evaluation of tooth-fragment reattachment: a clinical and laboratory study. Dent Traumatol. 2010;26(4):308–314.
38. Bhargava M, Pandit IK, Srivastava N, Gugnani N, Gupta M. An evaluation of various materials and tooth preparation designs used for reattachment of fractured incisors. Dent Traumatol. 2010;26:409–412.
39. Demarco FF, R-M Fay, Pinzon LM, Powers JM. Fracture resistance of re-attached coronal fragments–influence of different adhesive materials and bevel preparation. Dent Traumatol. 2004;20:157–163.
40. Rajput A, Ataide I, Lambor R, Monteiro J, Tar M, Wadhawan N. In vitro study comparing fracture strength recovery of teeth restored with three esthetic bonding materials using different techniques. Eur J Esthet Dent. 2010;5:398–411.
41. Pusman E, Cehreli ZC, Altay N, Unver B, Saracbasi O, Ozgun G. Fracture resistance of tooth fragment reattachment: effects of different preparation techniques and adhesive materials. Dent Traumatol. 2010;26:9–15.
42. Farik B, Munksgaard EC, Kreiborg S, Andreasen JO. Adhesive bonding of fragmented anterior teeth. Endod Dent Traumatol. 1998;14:119–123.
43. Pagliarini A, Rubini R, Rea M, Campese M. Crown fractures: effectiveness of current enamel-dentin adhesives in reattachment of fractured fragments. Quintessence Int. 2000;31:133–136.
44. Farik B, Munksgaard EC, Andreasen JO, Kreiborg S. Drying and rewetting anterior crown fragments prior to bonding. Endod Dent Traumatol. 1999;15:113–116.