

Management of complicated crown fracture by reattachment with super bond: A case series

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ABSTRACT

Coronal fracture of teeth is a prevalent form of dental trauma. Mainly it affects anterior teeth due to accidental injury, but sometimes posterior teeth may also get affected. The immediate restoration of the original fractured segment not only offers an alternative treatment in the emergency but also restores patient's emotional and functional problem. Reattachment of the fractured fragment, if it is available can provide excellent and long-lasting esthetics because it maintains tooth original contour, anatomy, and surface texture. If fracture line is subgingival, then one of the main problems during reattachment is isolation. Super bond is a new adhesive material which can be used successfully to stabilize the fragment even if the isolation is compromised. This article reports on the treatment of three coronal fractures at various levels by fiber post and a new adhesive material, Super bond.

Key words: *Esthetic, Fracture reattachment, Super bond*

Dental injury in the form of coronal fracture is very commonly encountered and affects deciduous as well as permanent dentition. Coronal fracture has been reported to be as much as 92% of all the traumatic injuries of the permanent dentition [1]. In general, such type of injuries involves anterior teeth, especially maxillary incisors due to its position in arch making it more prone to traumatic injuries. However, sometimes, impact of trauma also causes fractures of maxillary or mandibular posterior teeth [2]. Ideally, a dental restoration should be as strong and natural as tooth structure. Therefore, in many clinical situations, reattachment of the fractured fragment restores the original tooth surface texture, contour, color, appearance, and shape of tooth [3]. Apart from the advantages above, reattachment provides a minimum sacrifice of the remaining tooth structure being less time consuming with more successful long-term results [4].

Management of the crown root fracture is also very challenging if periodontal ligament is involved, as access and isolation of fractured margin for restoration are difficult [5]. Variety of the treatment options is available for the management of the complicated crown-root fracture. The success of the reattachment depends on the several factors such as size of the fragment, periodontal involvement, biological width violation, duration of the fracture and contamination of the site, and material used for the reattachment [6]. Clinicians have used various techniques and materials to reattach fractured fragment of tooth, and the most common technique is to use a flowable composite resin. The problem associated with the

use of composite resin is strict maintenance of isolation, which becomes difficult and sometimes impossible when the fractured margin is subgingivally located.

Super bond (Sun Medical, Japan) is a newly introduced self-curing dental adhesive resin cement material based on acrylic resin technology. Manufacturers claim excellent bond strength to tooth structure (enamel and dentin), metal, porcelain, and dental resins with pulpal safety due to the formation of a hybrid layer (resin impregnated layer) in both enamel and dentin. This layer reinforces the tooth surface against recurrent caries and prevents the post-operative hypersensitivity. We report the treatment of three coronal fractures at various levels using this adhesive material, Super bond.

CASE REPORTS

Case 1

A 26-year-old male patient reported to the dental outpatient department, with the chief complaint of fractured maxillary central incisor due to fall on the ground a week ago. Intraoral examination showed Ellis Class III fracture in the right maxillary central incisor. The fractured fragment was mobile, and fracture line extended subgingivally up to 2 mm. Radiographic examination revealed oblique fracture running from mesioincisal angle of the crown to distocervical portion and extending subgingivally on the root. Any additional root fracture was ruled out. After a thorough examination, all treatment options were explained to the patients.

After informed consent, a treatment plan for reattachment of tooth fragment was considered (Fig. 1).

As the patient had poor oral hygiene, oral prophylaxis was performed first. During treatment, after local anesthesia fractured fragment was removed and kept in the saline to prevent its dehydration. After access opening, working length checked with the help of apex locator (J Morita) and confirmed radiographically. The root canal was irrigated with 3% sodium hypochlorite (Septodont Novar pharmaceuticals) and prepared up to F2 with Protaper Universal (Dentsply Maillefer, Ballaigues, Switzerland). The root canal was dried using paper points and obturated using lateral condensation technique with Gutta-Percha (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus sealer (Maillefer, Dentsply, Konstanz, Germany).

As the fractured margin was subgingival, the gingival flap raised for the attachment of fragment. After isolation, the fit of the fragment was checked. Green activator applied on both the segment and the tooth surface for 10 s. After rinse and dry, activated liquid was prepared and applied to the fragment and tooth surface, the fragment was placed in position and stabilized with finger pressure till the material sets. As it sets very fast, all these procedures were performed quickly. The flap was repositioned; sutured and post-operative instructions were given to the patients. The patient was regularly recalled and followed up to 6 months.

Case 2

A 24-year-old male reported to the department of conservative dentistry and endodontics, with the chief complaint of fractured lateral incisor due to motorbike accident 5 days ago. Intraoral examination showed Ellis Class III fracture in 22 and Ellis Class I fracture in 21. Careful examination revealed subgingival location of fractured margin. Radiographic examination showed additional horizontal incomplete fracture at the middle third of root.

After the examination, all treatment options were explained to the patient. As the patient was also willing to retain the tooth, reattachment of tooth fragment was planned. After informed consent, a single visit root canal treatment was performed. As additional root fracture was present in this case, intracanal post

placement was necessary for stabilization of the fragment. Post space was prepared with #3 Peeso Reamer (LARGO, DENTSPLY Maillefer, USA) and an esthetic post (Angelus, Reforpost, Londrina, Brazil) of suitable size was placed to check its fit. Fragment stabilization was done in the same manner as in case 1. Follow-up was done up to 6 months (Fig. 2).

Case 3

A 22-year-old male patient reported with the chief complaint of fractured upper right posterior teeth due to sudden bite on hard object 2 weeks ago. After intraoral examination, the fractured mesiopalatal cusp of the right maxillary first molar involving root surface was encountered. Radiographic examination showed incomplete root canal obturation and the absence of coronal seal. All treatment options were explained after the examination and as the patient wants to save the tooth, the treatment plan for reattachment of tooth fragment was considered.

After obtaining informed consent, local anesthesia was administered; the fragment was removed and kept in the normal saline to prevent its dehydration. Endodontic treatment completed in a single visit and post placed similar to case 2. Fractured piece was attached after raising the flap as described in the earlier case. Rest of the tooth was restored with resin composite (3M ESPE, USA). Post-operative instructions were given. After removal of sutures and healing of gingiva, crown preparation was done and porcelain fused to metal crown was cemented to restore the tooth. Follow-up was done till 6 months (Fig. 3).

DISCUSSION

Maintenance of the mechanical, functional, and biological integrity is the essential factor in the management of traumatized teeth [7]. However, such treatment often presents a clinical challenge for the operator. In literature based on the location of fractured margin, various treatment modalities are available [6]. According to Olsburgh *et al.* [8] when there is invasion of biological width, treatment options are:

- Removal of the fractured piece without any surgical procedure using composite resin at the gingival or subgingival level.



Figure 1: (a) Fractured maxillary right central incisor (b) after fragment (c) tooth fragment (d) pre-operative radiograph (e) post-operative (f) post-operative radiograph (g) 6 months follow up (h) follow up radiograph after 6 months

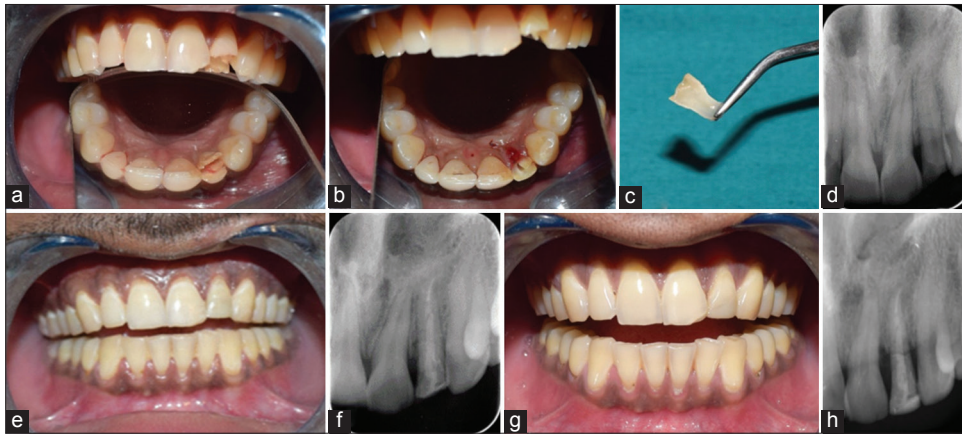


Figure 2: (a) Fractured maxillary left lateral incisor (b) after fragment removal (c) tooth fragment (d) pre-operative radiograph (e) post-operative view (f) post-operative radiograph (g) 6 months follow up (h) follow up radiograph after 6 months

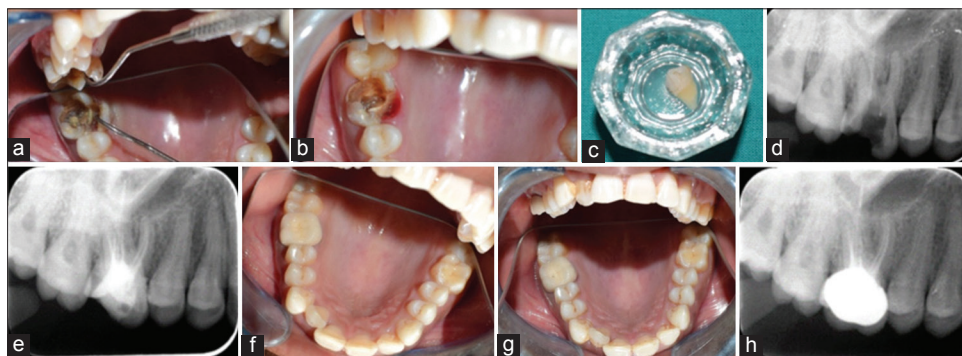


Figure 3: (a) Fractured mesiopalatal cusps of right maxillary first molar (b) after fragment removal (c) tooth fragment (d) pre-operative radiograph (e) post-operative radiograph (f) post-operative view after crown placement (g) 6 months follow up (h) follow up radiograph after 6 months

- b. Gingivectomy with or without osteotomy that allows the reattachment of fragment in a single appointment. This procedure involves exposure of the cervical margin and proper isolation for reattachment of separated part. Osteotomy is performed if required. This is possible only when an excellent adaptation of the fractured fragment is present which allows keeping a minimum amount of composite on the margin.
- c. Orthodontic extrusion: Disadvantage is the duration of treatment.
- d. Immediate surgical extrusion is a more traumatic procedure. Endodontic treatment is sometimes necessary and there is a risk of external resorption.

The most widely used treatment method for the restoration of the traumatized tooth is the composite resin restoration which offers esthetic management although color instability and tendency to accumulate plaque makes it less preferable [9]. There is, however, no synthetic material that can replicate esthetic characteristic like natural tooth [10].

Restoration of broken tooth was also been attempted by full crown, but it is a more invasive procedure, and it also weakens the traumatized tooth by removing more of tooth structure. Hence, whenever the fragment of fractured tooth is available and biological width is not violated reattachment should be considered as the first choice [11]. Using a natural tooth to restore the traumatized tooth within a single appointment provides an esthetic,

functional, and biological treatment. The flowable composite resin is the most commonly used material for reattachment of the fractured segment [7]. Although composite resin showed promising results in cases when fracture line is above gingival margin, the use of composite is not very easy when the fracture line is located subgingivally [12]. Maintenance of isolation is the greatest problem in such cases, and the composite material is not a biocompatible material for periodontal ligament adaptation [9].

During our literature search, we have found various procedures for reattaching fractured segment, but there are limited studies regarding the use of Super bond. In this case series, the material used for the reattachment is Super bond, self-curing dental adhesive cement. It contains 4-methacryloxyethyl trimellitate anhydride (4-META) as a diffusion promoter and tri-n-butylborane (TBB) as a polymerization initiator. 4-META is polymerized with methyl methacrylate (MMA) to form a copolymer and contributes to the excellent bonding property. TBB is tri-n-butylborane, an organic boron component presents in the catalyst. The catalyst reacts with oxygen in the air and water which are present on the tooth surface. The key to clinical success is that with TBB reaction proceeds in the presence of air and moisture. The 4-META/MMA-TBB resin is not affected by blood contamination, has a high tensile strength, and is biocompatible for periodontal ligament [13,14]. This material can be used successfully if the complete isolation is near impossible to achieve [15].

Table 1: Modified USPHS criteria for clinical evaluation of the restorations and evaluation scores

Category	Modified USPHS criteria for clinical evaluation of the restorations and evaluation scores			
	Alpha (A)	Bravo (B)	Charlie (C)	Delta (D)
Anatomic form	Restoration continuous with existing anatomical form and margins	Restoration is slightly over contoured or under contoured	Restoration is under contoured, dentin, or base exposed	Restoration is missing
Color match	Restorations match the shade and translucency of adjacent tooth structure	Discoloration between restoration and tooth structure within the normal range of tooth	O'Boyle KH, Norling BK, Cagna DR, Phoenix RD. An investigation of new metal framework design for metal-ceramic restorations. <i>J Prosthet Dent</i> 1997;78:295-301. normal range of tooth	Unacceptable color, shade, and translucency
Mobility	Good bonding of fractured segment	Fractured segment is partially retained with some portion of the restoration still intact	Fractured segment is mobile	
Marginal adaptation	Resin-enamel interface is excellent; restoration closely adapted to the tooth	No crevice is visible at margins	Crevice at margin, enamel exposed	Restoration is mobile, fractured, or missing
Marginal discoloration	No discoloration at margin	Slight staining can be polished away	Obvious staining cannot be polished away	Gross staining
Surface texture	Smooth surface	Slightly rough or pitted	Rough, cannot be refinished	Surface deeply pitted, irregular groove
Patient satisfaction	Fully satisfied	Satisfied	Unsatisfied	Unsatisfied

Table 2: Scoring criteria for all three cases

Clinical parameter	Case 1	Case 2	Case 3
Anatomic form	A	A	B
Color match	A	A	B
Mobility	A	A	A
Marginal adaptation	A	A	A
Marginal discoloration	A	A	A
Surface texture	B	B	B
Patient satisfaction	A	A	A

A: Alpha, B: Bravo, C: Charlie, D: Delta

All the cases were evaluated using the modified USPHS criteria listed in Table 1 [16]. In two cases, fiber post was also used to stabilize the fragment. Intraradicular stabilization of the fractured root using stainless steel or nickel-titanium files and metal or fiber posts has been reported in earlier literature also [17]. The patient was recently called for the 6 months follow-up. On each visit, tooth mobility, periodontal status, and radiographic examination were done. What can be more rewarding, if patients own natural teeth are retained, preventing him from psychological trauma of losing a natural tooth. All the three cases presented satisfactory result as evident from Table 2. The patient's natural tooth anatomy, form function, and esthetics all were restored.

CONCLUSION

Due to the increasing incidence of trauma to dental tissues and their supporting tissues, it is important to know all the available techniques and available materials along with their pros and cons. With patients increasing esthetic demands, one of the best options

to fulfill the requirements is to preserve teeth with reattachment treatments.

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