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Case Report

Reattachment of subgingival complicated fractures of anterior teeth

Capt Saleem Akhtar^a, Lt Col Nilav Bhagabati^{b,*}, Maj R. Srinivasan^c,
Brig S.K. Bhandari^d

^a Dental Officer (Conservative Dentistry & Endodontics), 1 Air Force Dental Centre, Air Force Station, Palam, Delhi Cantt, India

^b Graded Specialist (Conservative Dentistry & Endodontics), Command Military Dental Centre (Southern Command), Pune 411040, India

^c Dental Officer (Conservative Dentistry & Endodontics), Military Dental Center, Bolarum, Secunderabad 500010, India

^d DDGDS (E&S), Dte Gen of Dental Services, IHQ of MoD (Army), New Delhi, India

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Introduction

A comprehensive treatment plan is an essential prerequisite towards successful rehabilitation of complicated fractures of anterior teeth. While it is imperative to restore the biological, functional and esthetic form, adequate consideration must also be given to the patient's desire and his or her attitude towards treatment.¹

Literature reports a wide range of treatment modalities for restoration of fractured anterior teeth. These include resin

composite restorations with or without pins or posts; placement of definitive crown after orthodontic extrusion, osteotomy or osteoplasty; extraction of the residual root followed by immediate or delayed implant placement; fixed partial dentures; and reattachment of the fractured tooth fragment.^{1–3}

With the improvement of adhesive materials, reattachment of tooth fragment has become a more predictable technique with several advantages. It is a conservative procedure that maintains the original tooth contour, texture and translucence; is economical and obtains esthetics in a single appointment.³ Subgingival tooth fractures can also be restored successfully with this method.²

The present paper describes two cases wherein reattachment procedures were successfully carried out in anterior teeth with oblique and horizontal fractures respectively involving or occurring at the subgingival level.

Case 1

A 34-year-old male patient reported with the chief complaint of a fractured upper anterior tooth due to trauma resulting in pain and bleeding through the line of fracture. Clinical examination revealed an oblique crown-root fracture in tooth no 11 (Maxillary Right Central Incisor). The fracture line extended

* Corresponding author. Tel.: +91 8412015953 (mobile).

E-mail address: nilavbhagabati@gmail.com (N. Bhagabati).
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Fig. 1 – (a): Pre-operative photograph. (b): Pre-operative radiograph. (c): Mobile tooth fragment removed. (d): Radiograph showing completed RCT and repositioning of the separated fragment over the fractured tooth. (e): Post-operative radiograph. (f): Clinical photograph of post-operative follow up. (g): Pre-operative photograph (Labial view). (h): Pre-operative photograph (Palatal view). (i): Full thickness flap raised. (j): Partial palatal flap raised. (k): Fractured segment detached and area cleaned and dried. (l): Fiber post cementation. (m): Post-operative radiograph. (n): Clinical photograph of post-operative follow up.

from the middle third on the buccal aspect of the tooth to the cervical third on the palatal aspect. Pulp was exposed and the fragment was retained in place due to its attachment with the junctional epithelium and connective tissue. Radiographic examination revealed a horizontal fracture line with no discernable vertical root fracture or injury to the adjacent teeth (Fig. 1a and b).

The patient was informed of the various treatment modalities available and the relative advantages and disadvantages of each including the prognosis. He chose the reattachment procedure for the reasons that it would alleviate the pain and restore the esthetics in the shortest possible time. After obtaining the patient's consent and administration of local anesthesia (2% lignocaine with 1:80,000 adrenaline,

Septodont, Saint Maur-des-Fosses Cedex, France), a palatal flap was raised to gauge the subgingival extent of the fracture line and to remove the mobile tooth fragment (Fig. 1c). Thereafter, root canal treatment (RCT) was initiated and the canal was prepared using hand K files (Mani Inc, Tochigi, Japan) up to the apical size 60 followed by step back preparation. Obturation was done with gutta percha (Dentsply Maillefer, Ballaigues, Switzerland) and resin based sealer (AH Plus, Dentsply DeTrey, Konstanz, Switzerland) using lateral condensation technique. Thereafter, the fractured segment was repositioned over the fractured tooth with V-shaped grooves on exposed surfaces and filled with Glass Ionomer Cement (GIC) (GC Fuji II, GC Corporation, Tokyo, Japan) (Fig. 1d). To prevent the effects of moisture on GIC, a coating was applied to allow the cement to set. This was followed by post space preparation and cementation of a fiber post (Parapost, Coltene Whaledent, Alstatten, Switzerland) (Fig. 1e). Subsequent to this step, a circumferential V-shaped groove was made along the line of fracture and the entire groove was filled with flowable light cure (LC) composite material (Filtek Supreme Ultra Flowable Restorative, 3M ESPE, Minnesota, USA). The soft tissue flap was repositioned and suture given with 5–0 silk. The patient was recalled after one week for evaluation and suture removed. This was followed by recall periods of 1 week, 1 month, 6 months and thereafter every 6 months. The reattachment procedure was deemed successful at a follow up period of 2 years as there were no complications or complaints from the patient (Fig. 1f).

Case 2

Clinical examination of a 22-year-old female patient reporting with fractured anterior teeth revealed the following: (a) horizontal fracture at cervical third of the crown of tooth number 21 (Maxillary Left Central Incisor) with mobility of the tooth fragment; (b) fracture of tooth no 22 (Maxillary Left Lateral Incisor) at middle third without mobility of fragment; and (c) enamel-dentin fracture of tooth number 11 (Fig. 1g and h). She desired immediate restoration of the compromised dentition due to an impending social engagement within next 6 weeks.

RCT was initiated in tooth 21 and 22 and the teeth obturated by sectional method followed by post space preparation. An over contour preparation was made after adhesion of the fragment in 22 and filled with flowable LC composite resin (Filtek Supreme Ultra Flowable Restorative, 3M ESPE, Minnesota, USA). In addition, a fiber post (Parapost, Coltene Whaledent, Alstatten, Switzerland) was cemented in the prepared post space to reinforce the fragment against dislodging forces. Thereafter, a full thickness flap extending from mesial line angle of 11 to mesial line angle of 23 was raised buccally followed by a partial palatal flap to expose the remaining tooth stump of 21 (Fig. 1i and j). The fractured segment was detached under local anesthesia and the entire area cleaned and dried (Fig. 1k). The fractured fragment was then cemented to the remaining tooth using the same method as in case 1 (Fig. 1l–n). In addition, the fractured portion of tooth 11 was restored with composite resin (Brilliant NG, (Parapost, Coltene Whaledent, Alstatten, Switzerland)).

Discussion

No single dental disturbance has greater psychological impact on the patient than the loss or fracture of anterior teeth.⁴ The selection of an appropriate treatment option depends on various factors: the type of fracture and its relationship to the alveolar crest; degree of pulpal involvement; level of eruption and occlusal characteristics; apex formation; prognosis, and the patient's needs and attitude towards treatment.^{1,4} Each treatment option has its relative advantages and disadvantages. However, techniques that speed up and simplify treatment and improve long term success rate are of potential value.⁴

The first published case of reattachment of a fractured tooth fragment was reported in the year 1964 by Chosack and Eidelman and the procedure was described as a 'temporary restorative modality'.⁵ Prior to the commonplace use of adhesive technology in dentistry, fragment reattachment was considered as a 'transitional treatment option' to postpone definite treatment until an age when gingival margin contours were relatively stable.⁶ However, with the improvements in adhesive systems, plethora of studies and case reports reporting the strength, consistency and longevity of various reattachment techniques and materials in patients of various age groups were published. This resulted in a greater understanding of the factors influencing the potential success.⁷ Presently, this procedure may be aptly described, as stated by Liew, as 'a short to medium term temporary restoration with the potential for indefinite service'.⁸

Despite large number of publications presenting different approaches of reattachment of tooth fragments, longevity of the procedure is not predictable. A few clinical studies have shown that these restorations last beyond 7 years.⁹ Andreassen et al, in a multicentre clinical study of 330 reattachment cases, reported retention indexes of 50% and 25% at 2.5 and 7.0 years respectively.¹⁰ Cavalleri and Zerman compared fragment reattachment versus direct adhesive restorations for treatment of coronal fractures. The best result after 5 years was of tooth fragment reattachment technique, particularly regarding esthetic results.¹¹ Thus, it can be inferred, that among the conservative approaches that are available, the reattachment technique offers reasonable prognosis and longevity.

The treatment plan in both cases was partly influenced by patient's requirements. However, as the fracture lines demonstrated unfavorable fracture pattern, careful treatment plan was essential to achieve clinical success. The first case presented with an oblique fracture proceeding in an apical direction from the labial to lingual aspect. This is seen in 85% of traumatized incisor fractures and exhibits low resistance to labially applied forces. The second case also presented with an unfavorable horizontal fracture pattern due to the absence of lingual support. Such unfavorable fracture patterns, once restored, exhibits a low resistance to labially applied forces which mimic trauma force vectors.⁷ Hence it was imperative that the restored fragments be reinforced with techniques that exhibit high fracture resistance to labially applied forces.

Ries et al in an in-vitro study showed that the percentage of recovery vis-a vis various individual techniques was 97.2% for

over contour and 90.5% for internal groove technique; whereas it was only 37.1% for simple reattachment.¹² These percentages vary in various studies based on the methodology applied. However, it has been widely appreciated that internal groove technique and over contour provides highest fracture strength recovery. Thus, a combination of reattachment techniques with individually demonstrated evidence of having high fracture strength recovery was used in both the cases to ensure long term longevity of the attached tooth fragments. In addition, a fiber post was cemented in the prepared post space to provide additional reinforcement against forces acting from labial direction.

The choice of the adhesive system may depend on the clinician's experience with a specific material and the literature reports on its performance.¹³ In the present instance, GIC and flowable LC composite were used to reattach the fragments in both the cases. GIC represents a class of materials that exhibits chemical bonding to tooth structure primarily due to chelation of carboxyl groups of the constituent polyacids with the calcium in the apatite of the enamel and dentin.^{14,15} It was preferred over composites in the internal groove technique in order to overcome the attenuation of polymerizing light intensity which occurs when light activation is performed through the teeth. In addition, it was preferred over chemical or dual cure versions of resins to obviate the color change which occurs over a period of time due to the presence of amine accelerators.¹³ Although the shear bond strengths of GIC measured in laboratory are only approximately 3 MPa as against a proposed goal of 20 MPa or higher necessary to provide successful bonding, its clinical retention is excellent. This is because clinical longevity depends not just on bond strength, but also on dislodging forces. Composite resins undergo significant polymerization shrinkage, which creates stresses at the resin-dentin interface that can rupture dentinal bonds on the order of 20 MPa. Because GIC generates low stresses on setting, they are well retained even with bond strengths as low as 3 MPa.¹⁵

To overcome the limitations in the material and technique described above, an additional method to enhance the fracture strength recovery was incorporated in the clinical procedures. The LC flowable composites used in the over contour technique flows readily, spreads uniformly, and intimately adapts to a cavity form to produce a desired dental anatomy. Because of their greater ease of adaptation and greater flexibility as a cured material, their use in and near gingival areas is of clinical importance.¹⁶ Flowable LC was used in both the cases as it is indicated in situations where there is poor accessibility and where excellent adaptation is required. In both cases, reattachment procedures were carried out in teeth with fractures involving or occurring at the subgingival level. Hence, despite the poorer wear resistance when compared to other variants of composites available, LC flowable composite was chosen as a restorative material in both the cases.

Our treatment approach met the immediate rehabilitation requirements of both the patients and provided for the functional and esthetic needs till a follow up period of 2 years without any complications. However, the reattachment procedure is not without its disadvantages. Till date, there is not enough scientific evidence on the long term retention of teeth

restored with this technique. In addition, the percentage of recovery in terms of resistance to incisive forces on a reattached tooth is not satisfactory for some of the techniques used. Although the treatment approach used in both cases met their objectives as a 'short to medium term plan', the real merits of reattachment technique is that other restorative options can still be instituted in the event of a failure.⁹ This technique would have special significance in our Armed Forces dental health care delivery system, particularly in the primary and secondary setups, wherein the needs of the dependent clientele are required to be met in fewer sittings and with limited resources. Currently, neither well-designed, methodologically sound, multi-centric research studies nor suitable modalities of injury prevention are available.¹⁷ However, the following interventions are recommended: (a) Improve knowledge of traumatic dental injuries and their management at all levels in form of lectures during the yearly dental inspections; (b) Special emphasis on training of instructors in training institutes, and also at unit level; (c) Mandatory use of mouth guards for contact sports; (d) Compulsory use of helmets while driving two wheelers for all personnel whether in or out of cantonment area; and (e) Orthodontic correction of teeth at risk for traumatic dental injuries.

Conflicts of interest

All authors have none to declare.

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