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CASE REPORT

Utilization of Different Management Concepts in Fractured Tooth Fragment Reattachment: A Report of Three Cases

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ABSTRACT

Traumatic injuries of teeth involve varying degrees of damage to the supporting soft tissues or the teeth itself. A very common injury to the permanent dentition affecting children and adolescents during their growing years is the anterior crown fracture.

Recent developments in restorative material, placement techniques, preparation designs, and an adhesive protocol allow clinicians to predictably restore fractured teeth. With the advent of adhesive dentistry the process of fragment reattachment has become simplified and more reliable. This procedure provides an improved function, is relatively faster to perform and at the same time provides long lasting esthetics.

This paper discusses various innovative techniques of fracture reattachment depending on the complexity of the case.

Keywords: Tooth fracture, Reattachment, Dentin bonding agent, Tooth colored posts, Biologic width, Resin composite restoration, Rely X.

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INTRODUCTION

Uncomplicated crown fractures are a frequent form of dental injuries encountered in a dental clinic requiring immediate management. Uncomplicated crown fractures are a frequent form of dental injuries encountered in a dental clinic requiring immediate management. A variety of factors influences the success of the treatment and these include the extent, pattern of fracture and more importantly the restorability of the traumatized tooth. Other factors like secondary trauma, the availability of the fractured fragment, etc. determine the prognosis of the condition.[1-3]

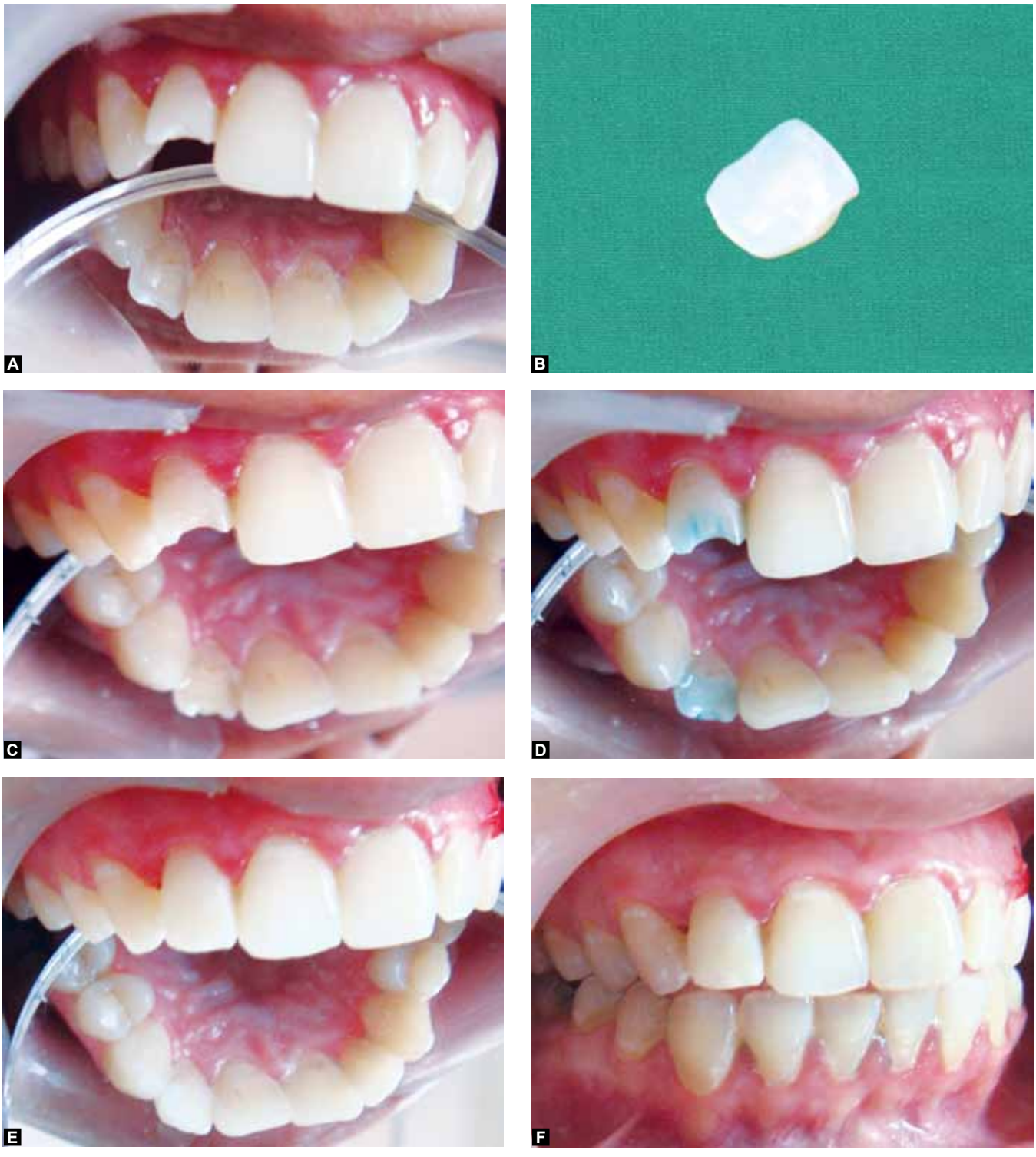
An acceptable alternative to traditional restoration of a fractured tooth if fragment reattachment which is conservative esthetic and at the same costeffective. This is one of the options available when there is minimal violation of the biological width of the tooth.[3-8]

The advantage of this treatment option when the fragment is available is the minimal sacrifice of the remaining tooth during restoration and offers a predictable long-term war as compared to direct composite restoration.[9] Clinical trials of tooth fragment reattachment using dentin bonding agents or adhesive luting systems have reported restoration of function and esthetics.[3,10]

CASE REPORTS

Case 1

An adolescent male presented with a history of fall resulting in fracture of the upper anterior teeth region (Fig. 1A). Preoperative assessment and diagnosis was done to evaluate the vitality of the tooth number 12 which gave a positive result. A diagnosis of Ellis class 2 fracture of 12 was made. The fragment was brought by patient wrapped in a dry handkerchief with an elapsed time of 20 minutes (Fig. 1B). The fragment was then stored in saline to prevent dehydration. The tooth was isolated and mock placement of the fragment into position was done to evaluate the result. As fragment reattachment can be problematic by free hand, it was adapted on a thermoplastic stent like sticky wax. The fragment was prepared for reattachment by giving an external chamfer bevel and retentive grooves on both the fragment and the tooth (Fig. 1C). Acid etching was done on both the fragment and the tooth using 37% phosphoric acid for 15 seconds (Fig. 1D) and thoroughly rinsed off. Both the fragment and the tooth dentin were kept moist and excess water was removed using blotting paper. Dentin bonding agent was applied to both the substrates and light cured for 15 seconds. A flowable composite (Filtek Z-350, 3M ESPE) was used for filling the interfragmentary space

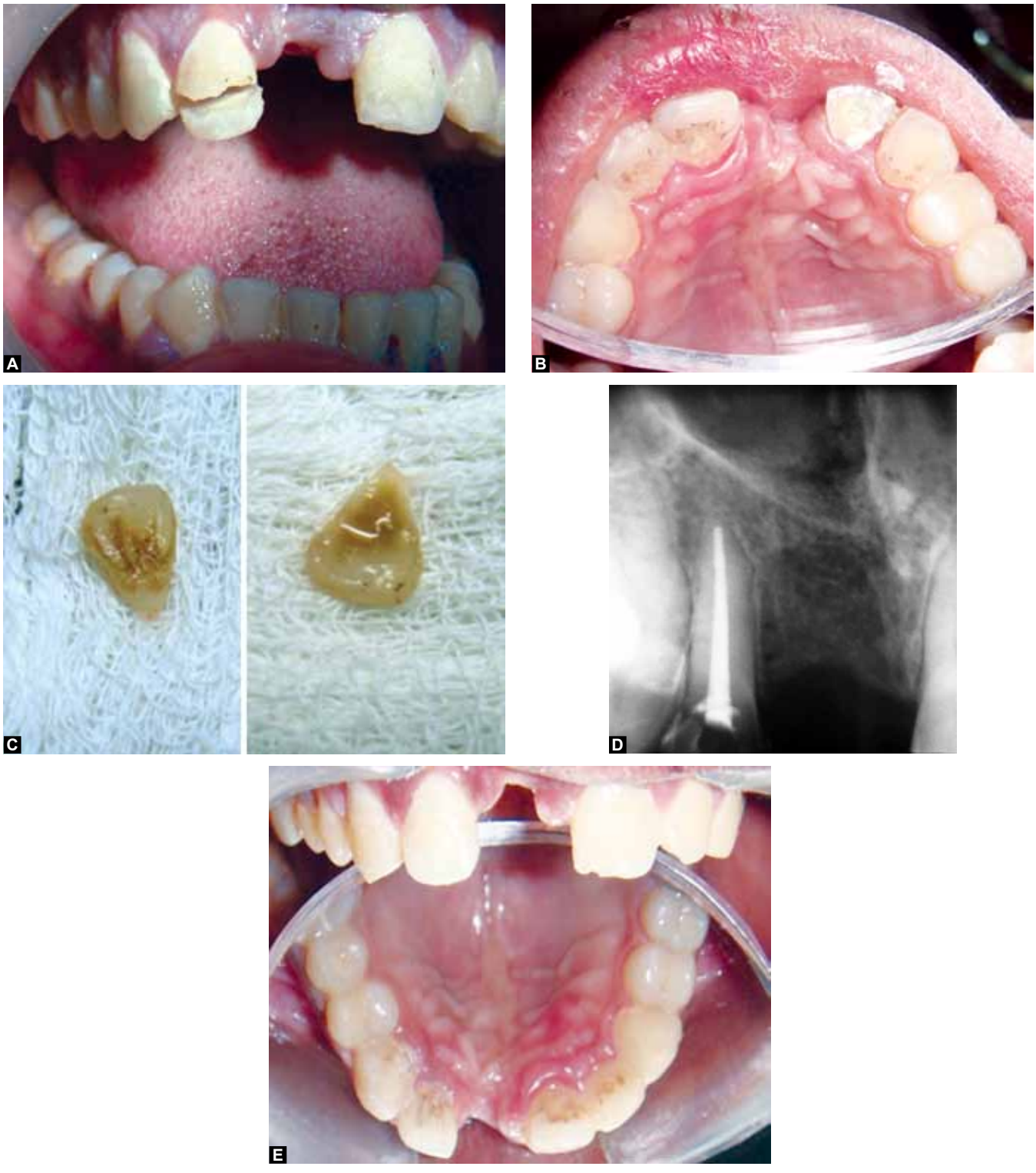


Figs 1A to F: (A) Preoperative fractured 12, (B) fractured fragment, (C) external chamfer bevel and retentive grooves, (D) acid etching, (E) reattachment of tooth fragment and (F) postoperative after 1 month (case 1)

and the fit was re-verified. The excess was removed and the composite layer was polymerized from both the buccal and palatal surface. Finishing and polishing was done using Soflex disks (Figs 1E and F).

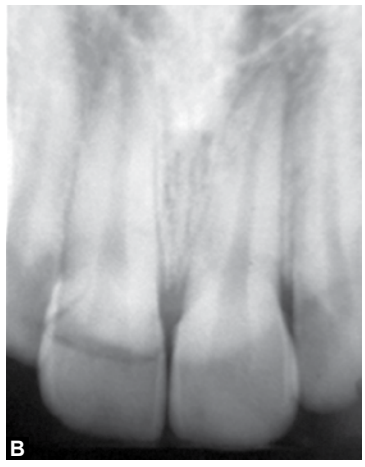
Case 2

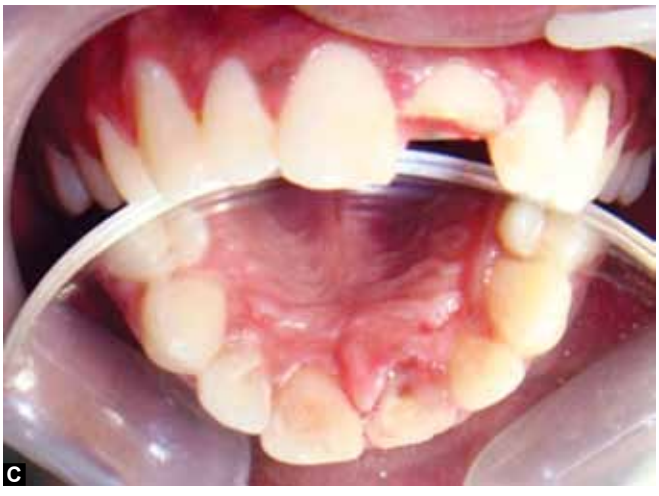
A 29-year-old female patient reported for seeking an emergency treatment for her fractured upper right lateral incisor following a road accident the previous day. The patient complained of pain and mobility of the front teeth on eating food and during breathing and chewing. Remaining tooth was not mobile and surrounding tissues were healthy. Clinical examination intraorally revealed an Ellis class 3 fracture on tooth number 12 (Fig. 2A). The fracture line was evaluated clinically and a radiograph was taken to confirm the diagnosis. After local anesthesia, the fractured

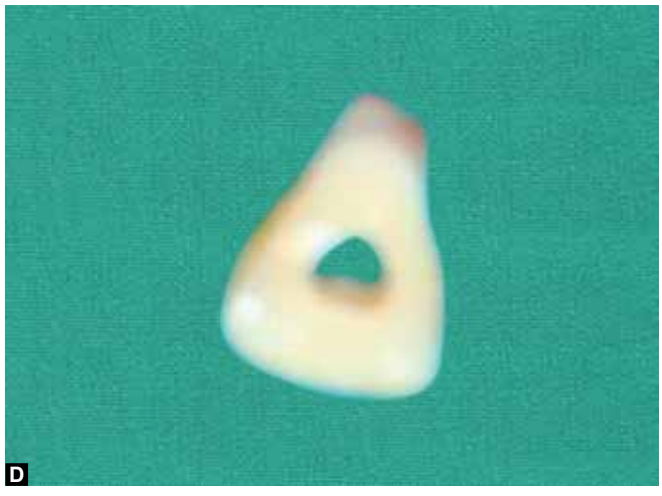


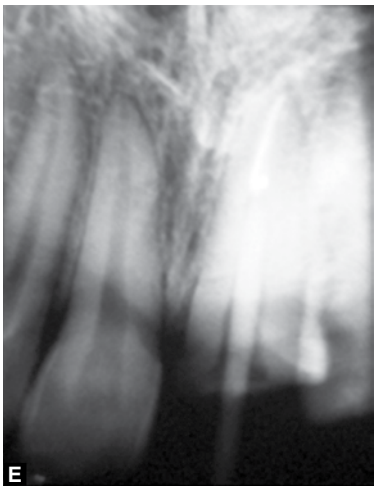
Figs 2A to E: (A) Preoperative view, (B) preoperative occlusal view, (C) fractured fragment from lingual side and fractured side, (D) radiograph of root canal treatment and (E) postoperative (case 2)

part was carefully separated and stored in saline to prevent dehydration (Figs 2B and C). Since there was clinical exposure of pulp, a single visit root canal therapy was done (Fig. 2D). The fragment was then assessed for placement in the original position with help of a thermoplastic stent. The margins of the tooth and fragment were well fitting with little interfragmentary space. The tooth fragment was prepared for reattachment by removing the dentin tissue around the pulp chamber with a large round bur. The same procedure was done on the tooth, and a retentive groove was made in pulp chamber. Acid etching was done on both the fragment and the tooth using 37% phosphoric acid for 15 seconds and thoroughly rinsed off. Both the fragment and the tooth dentin were kept moist and excess water was removed using blotting paper. Dentin bonding agent was applied in two coats to both the substrates, gently air thinned and light









Figs 3A to F: (A) Preoperative view, (B) Preoperative radiograph, (C) occlusal view after removal of fractured fragment, (D) fractured fragment, (E) radiograph of light transmitting post, (F) retentive grooves (case 3)

cured for 15 seconds. The pulp chamber from the fragment was also filled with flowable composite (Filtek Z-350, 3M ESPE) to reinforce the teeth. The fragment was then placed on the fracture site and carefully aligned and smoothness of the margin was checked. Excess composite was removed and the tooth was polymerized from both buccal and labial aspects. Restoration finishing and polishing was carried out with Soflex disks and occlusion was evaluated (Fig. 2E).

Case 3

An 18-year-old male presented with the history of fall, 2 days ago. He complained of pain in upper front tooth during breathing and chewing. Initial examination revealed the presence of a horizontal fracture on teeth number 21 involving three fourths of the crown and involving the pulp (Fig. 3A). A diagnosis of Ellis class 3 fracture on 21 was made. On clinical examination, fracture line was seen in


Figs 3G and H: (G) Postoperative, (H) Postoperative after 1 month (case 3)

cervical region which extending palatally in apical direction. The fractured segment was still attached to the soft tissues at palatally.

The radiographic examination showed an oblique crown-root fracture in 21 involving the pulp and absence of root and bone fractures (Fig. 3B). The fracture line was above the alveolar crest (Fig. 3C). After local anesthesia the remaining fragment was carefully removed and placed in saline to prevent dehydration (Fig. 3D). Root canal therapy of the affected teeth was carried out as there was pulpal exposure. Resin based (AH-Plus, Dentsply) sealer was used for endodontic treatment. Surgical crown lengthening of the teeth was carried out to expose the line of fracture palatally and hemostasis was achieved. Post space was done with the corresponding drill to receive a prefabricated light transmitting post (DT Light Post). The prefabricated post was checked in the canal for adaptation (Fig. 3E). The fragment was then adapted to the tooth and fit was verified. After isolation, root canal walls as well as the fractured tooth fragment were subjected to etching with 35% phosphoric acid for 20 seconds, rinsed thoroughly and dried with followed by application of dentin bonding agent (Adper Single Bond 2, 3M ESPE) with a micro brush in two coats and gently air dried and cured for 15 seconds. Bonding agent was also applied to the light transmitting post. Dual curing resin cement (Relyx ARC, 3M ESPE) was then applied to the canal walls fractured surface of tooth, tooth fragment and fiber post. The fiber post was introduced in the root canal and fractured fragment was then accurately placed back on to the tooth and was reapproximated to the original position and the excess cement was removed. Polymerization was done for 40 seconds through the incisal, buccal and lingual directions. For further reinforcement two vertical grooves (Fig. 3F) were made over the reattached tooth, across the reattachment and filled with microhybrid composite (Filtek Supreme, 3M ESPE), and light cured for 40 seconds. Subsequently, finishing and polishing was done using Soflex disks (Figs G and H).

DISCUSSION

Coronal fracture by trauma accounts for 92% of traumatic injuries affecting the permanent dentition, with the maxillary incisors being more involved in males when compared to females.[1]

Dental trauma often has a major impact on social and psychological well being of a patient.[11]

Several treatment modalities have been suggested for the treatment of such cases depending upon the location and extent of the fracture line. Earlier the fractured tooth fragment was removed and residual tooth structure was treated by restoration followed by crown, post and core restoration followed by crown, gingivectomy or alveoloplasty was advocated, if fracture line was extending subgingivally, extraction followed by RPD/FPD.

The treatment modality varies from simple reattachment to complex interdisciplinary approach. Treatment alternatives for fractures involving biologic width include crown lengthening, flap surgery, osteotomy/ostectomy and rapid orthodontic tooth extrusion. Although evidence based literature shows that materials do not play an important role in fracture strength recovery, the advantage of reattachment of fractured fragments include immediate restoration of esthetics and function along with excellent time resource management.[12]

Reattachment of fragment may offer following advantages.[13]

1. Better esthetics.
2. Incisal edge will wear at a rate similar to that of the adjacent teeth.
3. Replacement of fractured portion may be less time consuming than time needed for completion of a provisional restoration.

With the advent of newer materials and techniques, reattachment of the fractured fragment has now become quite popular. It is now possible to achieve excellent results with reattachment of fractured tooth fragments provided the biologic factors and techniques are logically assessed and managed. The use of natural tooth substance clearly eliminates the problem of differential wear, shade mismatch and difficulty in contour and texture reproduction associated with a restorative material.[12] Other factors that might influence the choice of technique include the need for endodontic therapy, extension of fracture, quality of fit between fragments and the fracture pattern.

Several designs have been employed by clinicians with regard to bevels, chamfers, dentinal and enamel grooves to aid the techniques of fragment reattachment. Badami and associates[14] have shown neither the bevel nor the material used could obtain the original fracture resistance of the tooth. Specimens prepared with chamfer and bonded had a fracture resistance of 40 to 60%, with internal dentin groove and over contour it reached around 90%. A simple reattachment procedure as in the first case is indicated, since bevel with flowable composite improves fracture strength recovery. The resistance of the fracture segment can be directly proportional to the surface area of adhesion. Most of the 5th generation bonding agents increased the fracture resistance of reattached coronal fragments when used with conjunction with unfilled resin. Extensively fractured fragments have to be restored with conjunction with a resin. The highest fracture resistance was obtained by chemically cured composite followed by light cured and resin cement and least by only dentin bonding agent.

Amir et al in 1986[15] have shown that the coronal pulp chamber can be used as reinforcement; thereby avoiding excess tooth preparation in cases where endodontic therapy is indicated and further stated that the direction of fracture line is an important aspect in re-restorability and has a direct bearing on the prognosis of teeth.

Extensive damage of the anterior tooth structure warrants reinforcement using fiber posts. Tooth colored fiber posts have several advantages like improved esthetic, ability to bond to tooth tissue, having a modulus of elasticity similar to that of dentin and being more fracture resistant. The newer variety of nonmetallic posts are made of either ceramic or fiber reinforced materials like carbon, quartz or glass in an epoxy matrix. By using glass fiber post with composite core and with recent advances in adhesive techniques and materials, one can create a onobloc, a multilayered structure with no inherent weak inter-layer interfaces. The unique advantage of this system is that it reinforces the teeth structure through this concept. Therefore, the integrity of the final endodontic-restorative continuum monobloc approaches that of the original healthy tooth itself.[16] An additional use of fiber posts is that it helps to distribute the stress to remaining radicular dentin.

The flowable composite not only reinforces the tooth but also helps in achieving higher bond strengths of the fractured segments. Flowable composite also minimizes the inclusion of air voids. Several studies have shown that replacement of composite using dentin bonding agents give strength to the root.[3]

When they are used with resin cements they have a decreased chance of microleakage. The resin luting cements exhibits good bond strength to the tooth, easy to use and predictable. Resin based sealers are used treat teeth planned for restoration of light posts as eugenol based sealers may inhibit the set of resin cements. The amine accelerator necessary for dual polymerization can cause the color of the luting cement to change over time, so the light cured resins are more preferable.[17] An additional groove was also given on labial surface, which was filled with microhybrid composite in case 3 and 4 after reattachment. Reis et al in 2002[6] showed improved fracture resistance with this additional procedure. Since light cured resins are more color stable they are recommended in areas of esthetic concern.

If the fracture line is supragingival, the procedure for reattachment will be straight forward. However when the fracture site is subgingival or intraosseous, orthodontic extrusion with a postretained crown may be necessary. Alternatively, surgical techniques such as electro surgery, elevation of tissue flap, clinical crown lengthening surgery with removal of alveolar bone and removal of gingival overgrowth for access to the fractured site are all viable methods for bonding fractured component. It has been suggested that whenever the fracture site invades the biologic width, surgery should be performed with minimum osteotomy and osteoplasty (Barteiri et al 1990).[4]

CONCLUSION

Reattachment proved to be a successful technique in these cases for restoring immediate esthetics and function. Reattaching a tooth fragment with dual cure adhesives may be successfully used to restore fractured teeth with adequate strength. However because few long-term studies have been reported in literature, the patient should be informed of possible interim nature of the treatment.

CLINICAL SIGNIFICANCE

With the advent of adhesive dentistry the process of fragment reattachment has become simplified and more reliable. This procedure provides an improved function, is relatively faster to perform and at the same time provides long lasting esthetics.

This paper discusses various innovative techniques of fracture reattachment depending on the complexity of the case.

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