Preservative management of traumatized maxillary central incisor using fiber reinforced composite and mineral trioxide aggregate: Report of a case

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Abstract

The myriads of technological advancements in dentistry in last two decades have led to a dramatic shift from conventional invasive procedures to more conservative biomimetic therapies. In this series, management of traumatic dental injuries has taken a big leap in that now it is possible to conserve many of these teeth which were otherwise doomed to extraction. Depending on the extent of injury, esthetic and functional requirements, traumatic dental injuries can be managed by a variety of clinical procedures including composite resin restorations, reattachment of fractured fragment, endodontic therapy with or without post and core or lastly extraction. Reattaching natural tooth structure offers an advantage over the others in that it is instant, provides superior esthetics, preserves the natural tooth structure and is best accepted by the patient. This paper describes the comprehensive management of traumatized maxillary central incisor involving pulp exposure while maintaining pulp vitality and natural appearance of a tooth.

Key words: Fractured tooth, mineral trioxide aggregate plus, reattachment, Ribbond, traumatic dental injury

INTRODUCTION

Traumatic dental injuries present a major challenge to dental clinicians across the globe because of the young age[1] where it most frequently occurs, wherein loss of tooth may have lifelong consequences, psychological impact that it has on young minds, strict dependence of the outcome on the time lag between injury and treatment and the rapidity with which the condition needs to be diagnosed and subsequently treated. Timely intervention coupled with advanced dental materials available today can dramatically enhance esthetic results, prevent loss of natural tooth structure, and reduce the possibility of spread of infection following dental trauma.

Treatment of fractured anterior teeth is enigmatic because the judgment has to be made regarding the status and treatment of the exposed pulp regarding its conservative or conventional management.[2] This paper presents an ultraconservative approach towards management of a
TRAUMATIZED MAXILLARY CENTRAL INCISOR USING NEWER AND BETTER DENTAL MATERIALS

CASE REPORT

A young male patient aged 17 years reported with the complaint of broken upper front tooth as a consequence of sports injury 1-h back. He was carrying the fractured fragment with him in dehydrated condition. On thorough clinical examination, an oblique fracture of maxillary right central incisor with pulp exposure was noticed [Figure 1]. A diagnosis of Ellis class III fracture (fracture exposing enamel, dentin, and pulp) was made. Radiographic imaging suggested oblique fracture of the tooth with fracture line uncovering the pulp with normal periapical status. A multitude of treatment alternatives were considered: Simple reattachment procedure using dual cure composites; vital pulp therapy using mineral trioxide aggregate (MTA), followed by fractured fragment reattachment using fiber reinforced composites; endodontic treatment, followed by post and core and extraction as the last resort.

All the viable treatment alternatives were explained in depth to the patient and his legal guardians. Considering the young age of the patient and his desire to maintain his natural tooth structure, he and his guardians chose fractured fragment reattachment. As there was minute pulp exposure following trauma, Simple reattachment procedure using dual cure composites would not have offered predictable success. Hence, instead of a simple reattachment, vital pulp therapy using MTA, followed by fractured fragment reattachment, functionally strengthened by fiber reinforced composites was planned.

The fractured fragment was cleaned, verified for its fit on the fractured tooth and stored in normal physiologic saline to prevent further dehydration.

Informed consent was taken by the patient and the legal guardians and the fractured site was debrided using normal saline, followed by irrigation with 0.5% sodium hypochlorite solution for disinfection of exposed pulp tissue. A cavity was prepared in to the tooth using a round diamond point (Mani, Japan) and direct pulp capping was performed by placing 1-1.5 mm of freshly mixed MTA Plus (Prevest DenPro Limited, India) directly over the pulp. Following this, a flap was raised and apical extent of fracture site exposed to allow optimal bonding in subgingival area [Figure 2]. Hemostasis was achieved using a 20% ferric sulfate solution in the form of ViscoStat (Ultradent, USA) and Gelfoam (Pfizer, Newyork, USA). The fragment and the tooth were etched using Scotchbond Universal Etchant (3M ESPE, SP, Brazil) and bonding agent (Fusion Bond DC, Prevest DenPro, India) applied and cured. This was followed by cementation of fractured fragment to the retained tooth structure using ultra DC dual cure cement (Prevest DenPro, India) and cured. A Coe Pak Automix NDS (GC America Inc., Alsip, IL, USA) was formed into a rope and packed at the surgical site and the patient was recalled after 1-week for further treatment [Figure 3]. At recall visit after 1-week, patient was clinically reevaluated for pulpal and periodontal health and was found asymptomatic. To ensure the complete and effective reattachment of the fragment, a vertical groove of depth 2 mm was created using Tapered Fissure bur (Mani, Japan) on the palatal aspect, half on the reattached fragment and half on the tooth structure. A 2 mm segment of Ribbond (Ribbond Inc., Seattle, WA, USA) was approximated into the groove. The groove was then etched and Ribbond bonded and cured using ultra DC dual cure cement (Prevest DenPro, India) [Figure 3].
Excess cement was then removed using bard parker blade and cured. The restoration was kept slightly overcontoured. Finishing and polishing using Soflex contouring and polishing discs (3M ESPE, USA) was done to simulate the natural appearance of a tooth. The fracture line was indiscernible, and the patient was satisfied with the esthetic outcome of the procedure [Figure 4]. Occlusion was checked under all positions and patient was cautioned to avoid excessive biting forces on reattached tooth. A custom made mouth guard was delivered to the patient to prevent further dental injury. A 6 months follow-up period revealed positive tooth vitality on cold testing using ethyl Chloride Spray (Endo Ice, Coltene Whaledent, USA). Clinically, the restoration was intact and esthetically and functionally acceptable. Follow-up radiographs were normal without any evidence of periapical pathology [Figure 5].

**DISCUSSION**

Traumatic injuries to teeth constitute one of the most frequently encountered dental emergencies in dental practice, but its adequate treatment protocol is often overlooked. Such injuries occur mostly during first two decades of life, usually around 8-12 years and most of these injuries affect maxillary central incisors, followed by maxillary lateral incisors and mandibular incisors. They arise from a complex interaction of oral predisposing factors, environmental determinants, and human behavior.

A multitude of factors govern the choice of treatment in cases of fractured teeth. Reattachment of fractured anterior teeth offers a conservative line of treatment that immediately restores functional and esthetic requirements, but the possibility of such a treatment mandates the availability of fractured fragment in toto and in a well-preserved state.

In the present case, an ultraconservative approach was followed and reattachment procedure with reinforcement of fractured site via Ribbond was performed after vital pulp therapy using MTA, unlike many other cases reported in literature that involve endodontic therapy and postplacement for reattachment of fractured teeth.

Initial debridement of the fractured site was done using normal saline solution followed by disinfection of contaminated exposed pulp using 0.5% sodium hypochlorite, as higher concentrations could be lethal to vital contents of the pulp.

With the advent of MTA and MTA like materials with superior sealing properties, no longer teeth with traumatic dental injuries be doomed to endodontic intervention. Endodontic treatment followed by post and core might have offered a more predictable success rate in this case but at the cost of tooth vitality and loss of translucency and brightness of endodontically treated tooth.

Hence, in order to maintain pulp vitality and natural appearance of the tooth, direct pulp capping was performed using MTA plus. First described in the literature in 1993, MTA being a biomaterial has found several applications in dentistry particularly endodontics. MTA has been proved to be a successful pulp capping agent because of its excellent sealing ability and alkaline environment on setting with the gradual release of calcium ions. MTA has been shown to induce proliferation of pulpal stem cells, release of cytokines and formation of a hard tissue barrier.

One of the most important factors that should be considered while formulating a treatment protocol for
fractured teeth is an extension of the fracture line. It has been recommended to go in for a surgical procedure with minimum osteotomy and osteoplasty, whenever the extent of fracture is such that it infringes on the biologic width.\textsuperscript{13} In the present case, Flap was raised to expose the most apical extent fracture line, and hemostasis was achieved to allow optimal bonding in this critical area.

Several techniques of reattachment of teeth have been proposed. Wiegand \textit{et al}.,\textsuperscript{16} suggested making an internal groove in the fractured segment and in the remaining tooth, when the fragments are intact; or over contouring the area when there is a partial loss of hard tissue.

Reis \textit{et al}.,\textsuperscript{17} also emphasized on the importance of executing a bevel, a chamfer or an overcontour to improve prevent fracture following the bonding of a fragment. Andreasen \textit{et al}.,\textsuperscript{18} suggested the preparation of a chamfer after reattachment and filling it up with resin cement for reinforcement.

Reattachment of fractured fragment was earlier considered to be a temporary procedure until any definitive treatment could have been delivered. But now with the advent of new pre-impregnated fiber glass materials, it is possible to reattach fractured teeth as definitive treatment. In this case, initially simple reattachment was done followed by reinforcement of the fracture site with Ribbond and composite resin cement. Introduced in the year 1992, Ribbond comprises of bondable reinforced high strength polymer fibers.\textsuperscript{19} Properties like high elastic coefficient and resistance to traction\textsuperscript{20} makes it ideal to adapt according to properties of tooth structure. Form, function and esthetics was regained after reattaching the fractured fragment and composite build up. Instructions were given to patient and as suggested by Andreasen, a mouth guard was customized for the patient and patient advised to wear it to prevent any further sports-related dental injury.\textsuperscript{19}

After 1-year follow-up, clinical and radiographic examination revealed sound pulpal periodontal and periapical status.

\section*{CONCLUSION}

This paper reports the successful management of traumatic injury to maxillary central incisor with an imperceptible line of reattachment. Better and novel material formulations have allowed successful retention of the fractured tooth in its natural and vital state. After all, nature holds the key to our esthetic, intellectual, and psychological satisfaction.

\section*{Financial support and sponsorship}

Nil.

\section*{Conflicts of interest}

There are no conflicts of interest.

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