Post Traumatic Biological Restoration: A Report of Two Cases

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Abstract

Introduction: Anterior tooth fracture is the most frequent sequel of traumatic injuries, which dental practitioners have to deal with. Proper reconstruction of extensively damaged teeth, both aesthetically and functionally, is the main goal to be achieved. A new approach of fragment reattachment procedure known as “Biological Restoration” can be an alternative to achieve this goal.

Case Series: This case series presents two such cases wherein the aesthetic and functional recovery of extensively damaged central maxillary incisors through preparation and adhesive cementation of “Biological Posts and Crowns” was performed. Both biological crowns, post and dental fragments, were obtained from natural, extracted teeth of another individual.

Conclusion: The technique of “Biological Restoration” presents a low-cost option and alternative technique for the morpho-functional recovery.

Keywords Trauma; “Biological Restoration”; Anterior tooth fracture; Reconstruction; Aesthetic and functional recovery

Introduction

One of the greatest assets an individual can have is a “smile” that shows beautiful, natural teeth. An untreated and unsightly fracture of an anterior tooth can affect the behavior of an individual, and can have a widespread impact on his/her psyche. The teeth most commonly affected by trauma are the maxillary incisors, with a reported share of 96% of all the crown fractures (Andreasen and Ravn, 1972). This kind of injury mainly affects children and adolescents, with males considered as being at a higher risk than females (Zerman and Cavallieri, 1993). In the pre-adhesive era, clinicians utilized various restorative modalities for the fractured teeth which included pin-retained inlays and cast restorations (Goenka et al., 2010). Although great scientific and technological advances regarding the restorative and adhesive materials in recent time had made the restoration of mutilated teeth a great success (Galindo et al., 2000), but to date there is no material that has proven to be as effective as natural structure considering mechanical and biological properties of the natural tooth structure (Galindo et al., 2000; Kaizer et al., 2008). Recently, with the advancement in the materials and bonding techniques, this new method of retaining fractured natural teeth segments is gaining momentum (Grewal and Reeshu, 2008; Yilmaz et al., 2008; Demarco et al., 2008). Biological restorations, made from natural extracted teeth, appear to be extremely promising with regard to the esthetics as well as the cost (Imparato et al., 1998). However, biomechanical properties of these biological restorations are yet to be determined for the long term clinical use and success. Biological restorations are perfect in terms of esthetic and bonding to the mutilated tooth structures with the use of resin cements having modules of elasticity same as that of the tooth to be restored (Asmussen et al., 1999). We present herewith two such cases of biological restoration of extensively traumatized, badly mutilated teeth.
Case Series

Case 1

An 11 year old girl reported with the chief complaint of traumatized and broken upper front teeth. On examination, 11 showed Ellis Class II fracture whereas 21 had undergone Ellis Class IV fracture (Figure 1, 2). Informed consent was obtained from the parents before proceeding with the treatment. Endodontic therapy was carried out for both teeth under local anaesthesia and composite build-up was done in relation to 11 in first visit (Figure 3a, 3b). In second visit, post-space was prepared in relation to 21, followed by cementation of glass fiber post (Figure 3c). Core build up was done around the coronal portion of the post together with circumferential beveling (Figure 4a, 4b). This was followed by alginate impression of the prepared tooth (21). A natural tooth was then selected, disinfected with sodium hypochlorite solution and reduced to the desired shape using diamond burs. Approximation of this fragment was carried-out on the model, and any existing fissures between the fragment and model in the cervical region were filled-up with composite resin (Figure 5). In third visit, sterilized tooth fragment was attached to the prepared crown with flowable composite resin. Excess composite was removed using a probe and curing of the fragment was done followed checking for occlusion and finishing was accomplished (Figure 6a, 6b).
Figure 4 (a) & (b): Core build up done using glass fiber post

Figure 5 Approximation of the fragment being carried out on model

Figure 6 (a) & (b): Post-operative photograph after cementation of prepared crown fragments

Case 2
A 13 year old boy reported with a chief complaint of broken upper front teeth. On examination, left maxillary central incisor was found to be fractured. Past dental history revealed root canal treatment of the same tooth 1 year back post history of trauma. Clinical and radiographic examination revealed broken restoration in relation to 21 (Figure 7a, 7b). The child's parents were informed about the treatment plan and consent was taken. Re-obturation of the tooth was accomplished in a single visit (Figure 8). In the next visit, removal of the obturating material from
the coronal one-third of the root to receive intra-canal portion of the biological post was done. At the same time, donated extracted tooth was selected and autoclaved at a temperature of 115 °C for 40 min. After sterilizing, tooth was trimmed to obtain a fragment presenting approximately the same preparation shape and was checked for fit (Figure 9, 10). Following this, the prepared fragment was etched for 30 seconds with 37% phosphoric acid followed by dentin bonding agent and dual cure adhesive resin application on the prepared surface of both fragment and remaining tooth surface and cured for 60 seconds. After the completion of restoration, the occlusion was checked and finishing was done (Figure 11a, 11b).

Figure 7 (a) & (b): Pre-operative photograph and radiograph revealing broken restoration in relation to 21

Figure 8 Re-obturation performed in relation to 21

Figure 9 Preparation of tooth fragment
Discussion

Biological restorations provide a viable restorative alternative for the teeth with extensive or gross, destructive involvement, with the advantages of being with excellent aesthetics as well as strength, which allows the preservation of remaining tooth structure strengthening it to one of the best restorative structures with endurance as against the artificial restorative procedures. Another advantage of using tooth fragments as restorative materials is that the natural tooth structures have physiologic, age-related, regressive changes which make them more realistic in their appearance and make them better adapted to the contours of the grossly affected teeth with lost tooth structures (Sanches et al., 2007). Biological restorations not only mimic the missing part of the natural teeth, but are also bio-functional and biocompatible (Kapur et al., 2005). The use of biological posts, made from naturally extracted teeth, represents a feasible option for strengthening of the root canal, and presents numerous other potential advantages. Major disadvantages of the biological restorations include the difficulty in obtaining
teeth with the required dimensions and characteristics, including color, which is a major hindrance in getting required aesthetics. Another possible drawback of these procedures is the possibility of the ethical concerns raised in this aspect (Sanchez et al., 2007). Several factors may govern the choice of a re-attachment procedure including adhesive systems and retentive features in the form of circumferential bevels which are given before the re-attachment procedure, placement of chamfer lines at the sites of fractures after bonding procedures, and, using V-shaped enamel notches and internal grooves or superficial over-contouring over the fracture lines to enhance the retention and aesthetics of the replaced structures (Goenka et al., 2010). However, studies have shown that neither different techniques nor the various restorative materials were able to attain fracture resistance as against the natural counterparts (Demarco et al., 2004). Biological restorations seem not only to promote the dentine stress preserving the internal dentine wall of root canal but are highly biocompatible and adapt to conduct configuration favoring greater tooth strength and retention as compared to artificial options. They present resilience comparable to original tooth structures and offer excellent adhesion to tooth structures and composite resins at reasonably low costs. However, unfortunately, the amount of strength recovery needed to maintain the re-attached fragment in function is not known for longer durations, thereby, mandating further studies in this regard before biological restorations can be validated as successful substitutes for the current restorative procedures (Reis et al., 2004). In our cases, we used different techniques and materials for two different patients of nearly the same age group so as to evaluate the best bond in similar body conditions. In Case 1, the fragment had small dimensions and hence, the use of an adhesive system was the best choice because a thin bonding agent layer was required not to interfere with fragment adaptation along with additional retentive feature in the form of glass fibre post and a circumferential bevel. In Case 2, there was gross destruction of tooth structure making the procedure even more technique sensitive for long term retention of the replaced/re-attached biological restoration. The persistence of any possible gaps existing at tooth/fragment interface was another challenge to overcome. However, the successful outcome of the procedures at 6-month follow-up made us to conclude that these procedures should be adapted in other patients as well for achieving a high degree of aesthetics with reinforcement of the tooth structures left-out after extensive destruction.

Conclusion

Biological restoration procedures have a practical clinical applicability and are viable and cost-effective restorative procedures for both permanent and primary teeth with severely damaged crowns. The only concerns for such procedures include the compatibility between the transplanted and naive tooth structures, their availability and the ethical concerns raised in this regard. Within their limitations, it seems that biological post core and crown offer excellent esthetics and functional advantages to achieve the morpho-functional restoration of extensively damaged teeth.

Conflict of Interest
None Declared.

Author’s Contributions
Manuscript preparation, edit and final proof checks.

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