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Combined technique with glass-fibre-reinforced composite post and original fragment in restoration of traumatized anterior teeth – a case report

CASE REPORT

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Abstract – Dentoalveolar trauma is frequently encountered by dental practitioners. In some instances, saving a child's traumatized permanent teeth can create difficulties for the child, the parents and the dentist. Reattachment of a crown fragment is a conservative treatment that should be considered for crown fractures of anterior teeth. This case describes the clinical reattachment of an original tooth fragment. A 10-year-old male presented at the Department of Pediatric Dentistry with a complex crown fracture of the left maxillary central incisor 1 day after the trauma occurred. Following endodontic treatment, a glass-fibre-reinforced composite root canal post (FRC Postec®; Ivoclar Vivadent AG, Schaan, Liechtenstein) was inserted to increase retention and distribute stress along the root. The dental restoration was completed using the original fragment and a dual-cured resin composite (Variolink® II; Ivoclar Vivadent AG). Clinical and radiographic examinations at 1-year recall showed the glass-fibre-reinforced composite root canal post and restoration to be in place, indicating the success of the treatment in maintaining the fractured tooth. Thus, we conclude that reattachment of a tooth fragment using a dual-cured resin composite and a glass-fibre-reinforced composite root canal post is an alternative method for the rehabilitation of fractured teeth that offers satisfactory aesthetic and functional outcomes.

Injuries to primary and permanent dentition are among the most common types of trauma to occur in the maxillofacial region (1, 2). Traumatic tooth injuries in children are most frequently the result of an accidental fall, although they may also occur as a result of a traffic accident, impact sports or play (3, 4). Because of their exposed position in the dental arch, maxillary incisors are the teeth most commonly involved in dental trauma, and in most cases, damage occurs to the crown (5, 6). Following maxillary incisors, traumatic injuries occur most frequently in upper and lower lateral incisors and the upper canines; however, the rate of traumatic injury is significantly higher for maxillary incisors than for other teeth (7).

Traumatic injury that involves a permanent tooth can sometimes create a difficult situation for the child, the parents and the dentist, who may opt for treatment that aims to save the original traumatized tooth. Recent improvements in the aesthetics of restorative materials have enabled excellent results in the restoration of damaged teeth with minimal sacrifice of any additional tooth structure.

The immediate reattachment of a dental fragment should be considered in treating patients with crown fractures of anterior teeth. This technique may be used for uncomplicated coronal fractures in which the fracture margin is located coronal to the gingival level, with visual and physical access to all fracture surfaces (8). In order to avoid dehydration and discolouration, the detached fragment should be recovered immediately after the trauma and placed in a preserving medium. Some authors suggest using physiological saline solution at 37°C (9), whereas others consider water or saliva to be adequate storage media for fragment preservation, possibly in a closed container (10).

Traumatized anterior teeth require quick functional and aesthetic repair. Composite materials are commonly used for aesthetic restorations in clinical practice (11); however, these materials have poor mechanical resistance. Different approaches for strengthening composite materials have included reinforcing their resinous matrix with fibres (12) or using glass-fibre posts consisting of glass-interlaced filaments. The use of fibre-reinforced materials in restorative dentistry has met with increasing acceptance over time (13).

Technological developments have led to improvements in the composition, aesthetics, radiopacity and

shape of glass-fibre posts (14–17). Manufacturers have recently begun to produce radiopaque posts. Modifications have also been made to post configuration, with the aim of achieving better adaptation to root canal shape. The translucent glass-fibre post has a modulus of elasticity similar to that of dentine and offers adequate mechanical properties (16, 18). Although, light can be transmitted through the translucent glass-fibre post, it is possible to use a bonding procedure that combines an acid-etching technique with a light-cured adhesive system and dual-cured resin cement (17). Moreover, it is possible to light-cure the cement and bonding system in only one step, thus simplifying and shortening the clinical procedure (19).

In the case reported here – a complex crown fracture requiring endodontic treatment – the use of fibres aimed to create a central support stump in order to restore dental morphology and avoid the difficulties, including possible failure, encountered when other adhesive techniques have been used to reattach an original fragment.

Fig. 1. Clinical appearance of central incisors with crown fracture.

Case Report

A healthy, 10-year-old boy was referred to the pediatric dentistry clinic with the chief complaint of trauma to the permanent maxillary left central incisor. According to his parents, the child had experienced two traumatic injuries. The first occurred at age 9 when he fell while playing at school, resulting in pain and bleeding around the gingiva of both maxillary central incisors and a fracture of the maxillary right central incisor. However, the patient was not brought for treatment at this time. The second traumatic injury occurred as a result of falling while playing soccer and affected the maxillary left central incisor. A fractured tooth segment was recovered at the site of the injury and placed in milk.

One day after this second traumatic incident, the patient was referred to our clinic. The patient was conscious, and there was no evidence of head or neck trauma. Extra-oral examination revealed no significant abnormalities, and intra-oral examination revealed neither lacerations nor evidence of alveolar bone fracture. Both maxillary central incisors were fractured, but the teeth presented with normal mobility. Clinical examination showed a Class II fracture of the maxillary right central incisor and a Class III fracture of the maxillary left central incisor (Fig. 1) (9).

The maxillary left central incisor pulp chamber was exposed, and the necrotic parts of the pulp chamber were excavated. A confirmatory vitality test carried out using a Periflux 4001 Master Laser Doppler Flowmetry (Perimed, Stockholm, Sweden) revealed no response, and it was concluded that the pulp of both teeth had become necrotic as a result of previous trauma. A radiograph indicated complete root formation and a closed apex and did not show any other fracture or injury on the adjacent tooth (Fig. 2). A treatment plan was decided upon that comprised immediate endodontic treatment of both maxillary central incisors and reattachment of the fractured left maxillary central incisor crown fragment.

Following cleaning, the root canals were filled with a calcium hydroxide-based sealer (Sealapex; Sybron/Kerr,

Fig. 2. The radiograph of the maxillary central incisors.

Indústria e Comércia Ltd, Guarulhos, SP, Brazil) and gutta-percha using the vertical condensation technique. The gutta-percha was then partially removed, leaving the apical 4 mm of the filling to maintain a good seal (20, 21), and a glass-fibre-reinforced composite root canal post (FRC Postec®; Ivoclar Vivadent AG, Schaan, Liechtenstein) was placed in the canal. A hole was drilled in the centre of the original crown fragment (Fig. 3), and both the intact coronal portion of the tooth

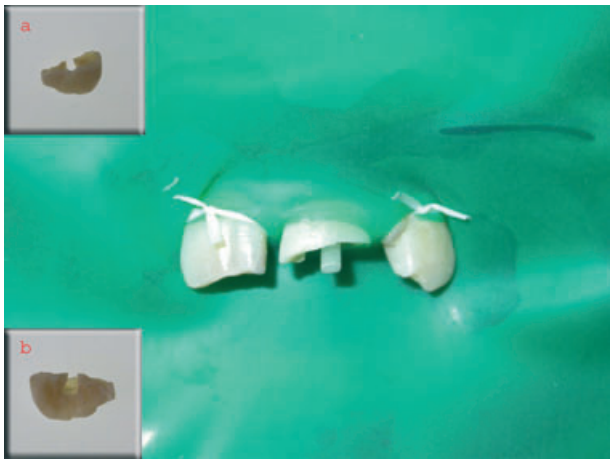

Fig. 3. Clinical appearance of glass-fibre post and original fragment: (a) Labial view, (b) Palatal view.

and the original crown fragment were etched with 37% phosphoric acid gel for 20 s, rinsed for 20 s and dried with a gentle stream of air. An adhesive (Excite® DSC; Ivoclar Vivadent AG), a dual-curing luting system (Variolink II; Ivoclar Vivadent AG) and a glass-fibre-reinforced composite root canal post (FRC Postec®) were sequentially applied according to the manufacturer's instructions. Endodontic treatment was completed in 1 week, during that time the original crown fragment was preserved in a sterile saline solution. Following this, the original fragment was accurately placed and photopolymerized for 40 s. The maxillary right central incisor was then restored using a composite resin (Tetric Ceram; Ivoclar Vivadent AG) (Fig. 4).

Clinical and radiographic follow-up examinations confirmed the effectiveness of the combined restoration technique using the glass-fibre-reinforced composite root canal post and the original crown fragment (Fig. 5). Follow-up examinations conducted at 3, 6, 9 and 12 months revealed no pathological signs (i.e. mobility, percussion, colour change, ankylosis, internal and/or external resorption) in either of the restored teeth. At

Fig. 4. Intraoral view of the patient after the restoration of the permanent maxillary central incisors.

Fig. 5. The radiograph of the maxillary central incisors after the restoration.

1 year post-treatment, clinical and radiographic examination (Fig. 6) revealed a stable reattachment of the crown fragment with no colour change.

Discussion

It is beneficial to quickly restore the function and the aesthetics of a fractured tooth. The reattachment of a fractured crown fragment may be the most conservative and desirable treatment of choice for anterior teeth, providing an instant return to the natural appearance upon reattachment of the original tooth fragment. Successful reattachment is highly dependent upon the rapid retrieval of the fragment (22), which should be preserved in physiological solution, sterile saline or water to prevent any change in colour due to dehydration (9, 10). In this case, the crown fragment was stored in a sterile saline solution during the treatment period, and no discolouration was observed during post-treatment follow-up examinations. Simonsen (23) reported that rehydration of a dehydrated fragment may occur within several months. During a 1-year follow-up, Toshihiro & Rintaro (22) observed that a reattached crown fragment could return to its original colour and translucency after 1 month without further adverse changes.

Cavalleri & Zerman (24) reported that the long-term prognosis for reattached crown fragments appears to be better than for composite resin restorations. Andreasen et al. (25) indicated that the reattachment of a

Fig. 6. Control radiograph 1 year after the treatment.

crown fragment using a dentin bonding system in combination with enamel acid etching may provide protection against pulpal infection, thereby reducing pulpal complications in vital teeth. However, regular follow-up is still necessary to confirm pulp vitality as well as aesthetics.

In the present case, we used an adhesive, a dual-curing luting composite system, a glass-fibre-reinforced composite root canal post and the original crown fragment. This technique provides reinforcement to the restored segments and should increase both durability and survival (11). The bonding of a post to the tooth structure should improve the prognosis of the restored tooth by increasing post retention (11) and reinforcing the tooth structure. The effectiveness of the combined technique of glass-fibre-reinforced composite root canal post and original fragment was confirmed during follow-up examinations, with no restoration fractures detected during the follow-up period.

Compared with alternative techniques such as composite resin restorations, screw-posts, cast posts and dentine pins, reattachment with a glass-fibre post offers several advantages, including good aesthetic and functional outcomes, reinforcement of restored segments and ease and speed of restoration. To our knowledge, this is the first case in which a glass-fibre post and an original crown fragment have been used together. This technique provides immediate aesthetic and functional rehabilitation to the fractured tooth. The treatment requires little chair time and minimum patient compliance. No complications were experienced during the 18-month follow-up. However, before this type of combined restoration can be advocated as a routine procedure in crown fractures, longer follow-up periods and more patients are required to substantiate the efficacy of the technique.

Conclusion

The combined use of a glass-fibre-reinforced composite root canal post and an original crown fragment is a simple and efficient procedure for the treatment of traumatized anterior teeth that appears to offer excellent aesthetic and functional results.

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