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Combined technique with dentin post reinforcement and original fragment reattachment for the esthetic recovery of a fractured anterior tooth: a case report

CASE REPORT

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Abstract – This case report describes the esthetic and functional recovery of a maxillary central incisor. The treatments used were dentin post (biological post) reinforcement and reattachment of the fragment. From the outcomes achieved, it can be concluded that this technique is promising and is yet another alternative method that can be used for the recovery of fractured anterior teeth.

Traumatic injuries to maxillary anterior teeth occur quite frequently, especially in children and adolescents and are commonly related to oral factors, environmental factors, and human behavior (1). Studies show that, among the traumatic injuries to permanent teeth, the one most commonly treated by dentists is the enamel/dentin crown fracture. (2–4). A full recovery of this injury requires the reconstruction of color, anatomical form, translucency, curvature of the smile line, and harmony with the other teeth. The restoration of a fractured tooth has to be free of leakage, satisfactory function and esthetics (5).

Esthetic and functional problems can lead to anxiety in the traumatized patient (6, 7). In this light, Ramos-Jorge et al. (7) found that adolescents who had a crown fracture restored with composite resin found it more difficult to perform daily activities, such as eating, talking, and showing their teeth without any embarrassment, than did individuals with no medical history of trauma in the permanent dentition. It is still unknown if individuals who have fractured teeth restored using their own dental fragment (Biological Restoration), compared to those whose fractured teeth have been restored with resin that actually perform better in daily activities. It is believed that performance is better, considering the enamel's original shape and color, brightness and surface texture, physiological wear, and the sensation of not having lost the tooth all comfort the patient. (8–10). The use of original fragments for reattachment was reported as either 'satisfied' or 'very satisfied' in terms of parental and patient satisfaction (11).

Natural tooth fragments can also be used to make a dentin post for strengthening the root canal in extensively damaged teeth. Dentin posts have been used in the primary dentition with promising clinical and laboratory results (10, 12, 13). However, further studies are needed to assess the long-term behavior of these posts in the permanent dentition. The purpose of the present article is to describe a combined treatment approach joining the homogeneous bonding of the fragment and dentin post (biological post) reinforcement.

Case report

A 12-year-old boy was referred to the Pediatric Dentistry Clinic at Federal University of Vales do Jequitinhonha e Mucuri (UFVJM) – Diamantina/Brazil, reporting a fracture of the maxillary central incisors due to a fall having occurred two months earlier. After the traumatic event, only one fragment was found. The fragment of tooth 11 had been bonded.

Fig. 1. Initial clinical aspect.

Upon clinical examination, it could be observed that the child had undergone previous treatments of teeth 11 and 21, both fractured due to the same trauma, but presented unsatisfactory morphological and functional recovery. The fracture accounted for 2/3 of the crown of tooth 11. In addition, tooth 21 presented an unsatisfactory restoration extending from the middle third to the incisal edge (Fig. 1). Radiographic examination revealed endodontic treatment and an endodontic post preparation of the canal of tooth 11 (Fig. 2). The treatment proposed for the patient was fragment reattachment associated with intraradicular reinforcement by means of a dentin post for tooth 11 and replacement of the unsatisfactory restoration of tooth 21. The fragment of tooth 11 had been bonded by another dentist using an adhesive system but had come loose from the remaining fragment and since then had been stored in a saline solution so as to maintain its hydration and natural color. The patient's parents were informed about the proposed treatment and signed a written consent form authorizing the completion of the procedure, as the dentin post is made from extracted teeth.

Fig. 2. Radiographic aspect of endodontic treatment.

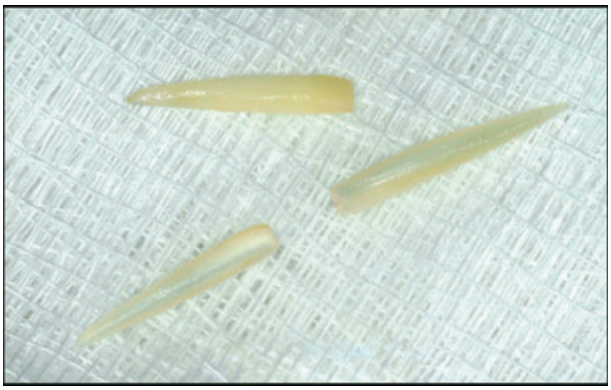

Fig. 3. Dentin posts previously created in the laboratory.

First, the internal walls of the canal were set using wide drills at a low rotation speed and was sealed using glass ionomer cement (Vidrion R-SS White, Rio de Janeiro, RJ, Brazil). The dentin post that best fit the canal was selected from the posts previously made in the laboratory (Fig. 3). These posts were obtained from extracted canines, which had been duly donated by patients from the surgery clinic at the same institution and underwent sterilization (autoclave at 121°C for 15 min). The coronary portion was separated from the root and underwent: (i) mesio-distal root sectioning, in the direction of long axis; (ii) the removal of cement; and (iii) abrasion using diamond drills under intense cooling in such a way as to form dentin posts.

During the next appointment, the post was placed within the canal to check its adaptation (Fig. 4a,b), and the adhesive cementation under absolute isolation was performed as follows: post and root canal were etched with 37% phosphoric acid for 15 s, washed and dried (Fig. 4c,e,f). Next, the adhesive system (Adper Single BOND2; 3M ESPE, Irvine, CA, USA) was applied to both and polymerized for 20 s (Fig. 4d,g). Cementation was performed using dual-cured resin cement (C & B Cement; Bisco, Schaumburg, IL, USA). Before the polymerization of the cement, a groove in the inner portion of the fragment was constructed, allowing a better adaptation to the tooth and the dentin post. The fragment was conditioned, received the same adhesive system as described above, and was filled with resin cement. After the fragment had been correctly positioned, the cement excess was removed and the polymerization of the joint fragment/post was carried out for 40 s. The region was molded with alginate and a plaster model was made on which the contours of tooth 21 were re-shaped. A silicone guide was created to assist the intra-oral reconstruction with composite resin (Z-100; 3M ESPE).

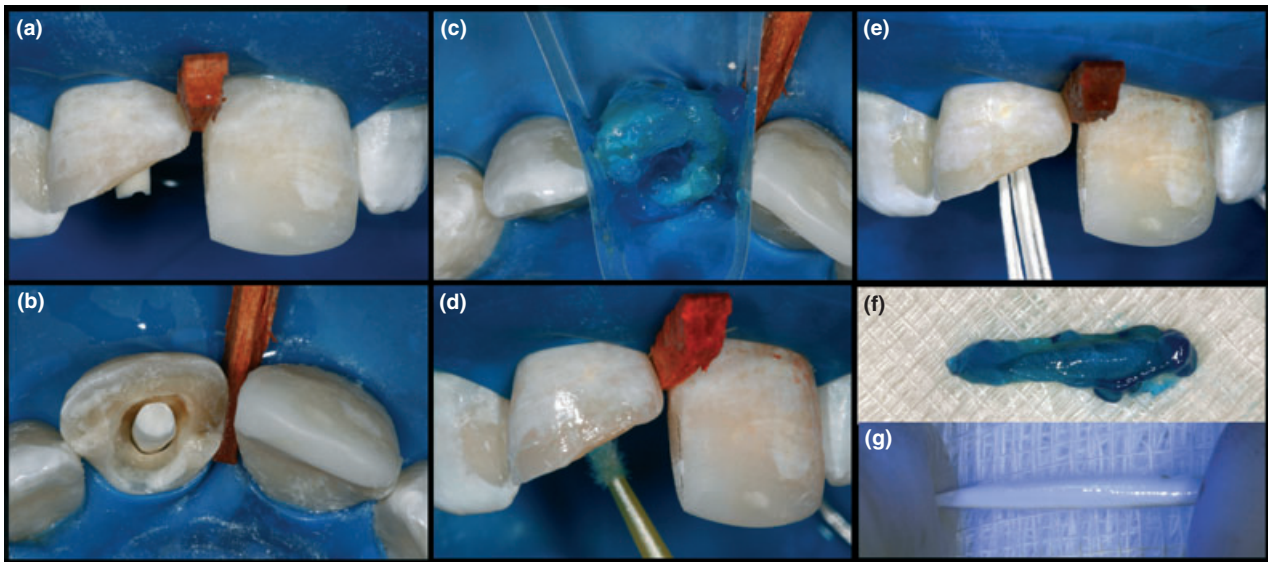

Fig. 4. (a,b) Vestibular and incisal aspects of the postadaptation within the canal; (c) Root canal and tooth etching with 37% phosphoric acid; (d) Application of adhesive system to root canal and tooth; (e) Drying of root canal; (f) Postetching with 37% phosphoric acid; (g) Polymerization of adhesive system on post.

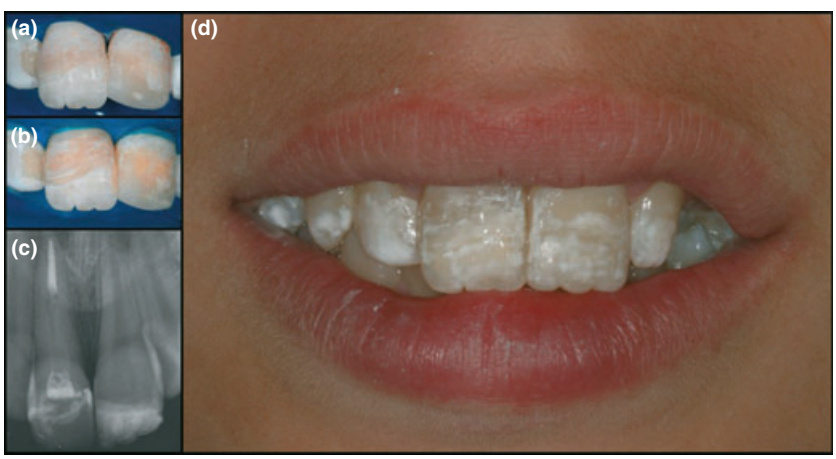

Fig. 5. (a) Aspect immediately after fragment reattachment; (b) Creation of bevel on the joining line; (c) Final radiographic aspect; (d) Final aspect of the teeth after esthetic recovery.

The restored tooth was highlighted using a white pigment, which allowed the features of the fluorosis of the teeth to be copied. This same highlighting was also performed on the fracture line of tooth element 11 which, together with the creation of a bevel, appeared to mask the joining line between the tooth and the fragment (Fig. 5). Beveling is also a method used to augment the retention of the reattached fragment. Premature occlusal contacts were removed and proper information regarding oral hygiene was offered. After a 1-year follow up, the clinical and radiographic findings showed good functional and esthetic results (Fig. 6).

Discussion

The choice of clinicians as regards the restorative treatment of fractured teeth directly affects the treatment prognosis and requires a careful consideration of several factors, such as the extent and pattern of the fracture, the endodontic involvement, and the possibility of using the fragment in the reattachment process (14). In this case, as the fragment of tooth 21 was not found, it was restored with composite resin, reproducing the anatomical details of the homologous tooth. On the other hand, tooth 11 was restored using its own fragment, thus allowing for the maintenance of properties that are inherent to the tooth, such as the quality of the enamel surface smoothness and inimitable combination of colors (5, 15, 16). Reis et al. (9) suggest that clinicians choose a reinforcement technique such as enamel beveling, external chamfer or internal grooves to improve the fracture strength of the reattachment, as simple reattachment without additional preparation may not restore even half of the fracture strength of intact teeth.

Some fractures greatly compromise the dental structure resulting in the need for additional forms of restoration to provide the dental fragment with better retention and stability, which is commonly achieved by the use of screw-posts, cast-posts, or dentine pins (16).

The use of a dentin post provides biocompatibility, a resilience that is comparable to the original tooth,

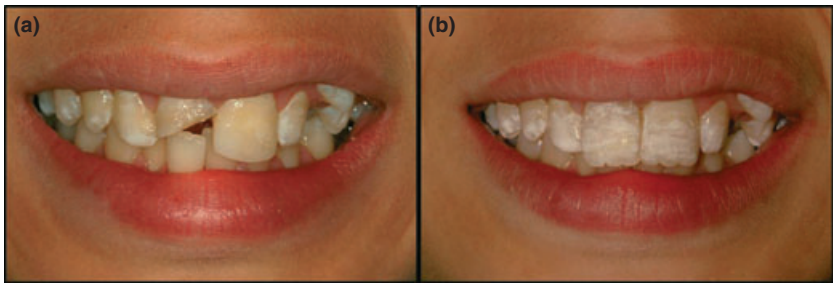

Fig. 6. (a) Initial aspect of smile; (b) Aspect of smile after 1-year follow up.

excellent adhesion to the dental structure and composite resin, and a low cost, as dentin posts are made from donated extracted natural teeth (10, 13, 17, 18). Furthermore, the formation of a sole biomechanical system (monoblock) by means of an adhesion joining the dental structure, the cement agent, and the dentin post allows for a better distribution of stress along the root (13), minimizing the rate of adhesive and cohesive failure. Steel and titanium posts have higher elastic modulus than dentin, causing a concentration of stress at the tooth-restoration interface, with an increased risk of tooth fracture when subjected to occlusal loads (19). When a fiber post, which has lower elastic modulus, is subjected to the same loads, debonding of the postrestoration joint occurs (20). Meira et al. (21) observed that lower elastic modulus may rise the risk of spontaneous debonding of the post, instead of vertical fracture of the root.

Concerning the ethical aspect, it is necessary to clarify to the patient and/or his parents or guardian that the post is made from duly donated and properly sterilized extracted teeth, thus preventing biosecurity risks. However, a tooth fragment obtained from another patient may be rejected, which is a disadvantage of this technique. The teeth used in biological restoration procedures can be obtained from Human Teeth Banks or in non-profit institutions, which store and provide teeth for didactic, clinical, and scientific use (22). The low number of Human Teeth Banks and the limited dissemination of the technique make this an uncommon routine in dental practice.

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