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Reattachment using a fragment from an extracted tooth to treat complicated coronal fracture

CASE REPORT

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Abstract – Reattachment of fragment is the preferred alternative to restore the fractured teeth, offering several advantages. Partial pulpotomy has demonstrated satisfactory results as a conservative treatment for pulp exposures because of trauma. This study reports a case in which the treatment of a complicated coronal fracture was accomplished by partial pulpotomy and reattachment of a dental fragment obtained from an extracted tooth using composite resin. The results show the feasibility of the conservative pulp therapy and the restorative approach.

Reattachment of the fractured fragment is currently the preferred technique (1), representing a simple and low-cost method, which allows the maintenance of incisal function in dental structure, provides better and long-lasting esthetic results, maintains the tooth form and color, produces minimal tooth loss, increases wear resistance, and thus, improves masticatory function (1–3). A multi-centered clinical study which evaluated the long-term survival of fragment bonding in the treatment of fractured crowns indicated that tooth reattachment is a realistic alternative to the placement of conventional resin-composite restorations (4). Demarco et al. (5) observed that both the used materials and the tooth preparation technique could influence the fracture resistance fracture of reattached teeth. Reis et al. (1) highlighted the need of additional preparation (bevel, chamfer, over contour) to enhance the resistance to fracture of the reattachment technique.

When the fractured fragment is available after the trauma and if it is in good condition, the reattachment represents the best treatment choice (2). Nevertheless, in some situations the fragment could either not be found or be so damaged that the reattachment of the proper fragment is impossible. Some reports have highlighted the possibility to bond a fragment obtained from an extracted tooth to the fractured tooth, with good results (6–9). The extracted tooth should come from a 'bank of teeth' (7) and sterilization is mandatory (7, 10).

The most common injuries of anterior teeth are uncomplicated crown fractures (Ellis Class I and II), restricted to the enamel or enamel/dentin fracture without pulp exposure (3). However, complicated fractures with pulpal exposure can frequently occur (2) and they represent a challenge for the clinicians. Despite the low rate of success for conservative treatments in pulps exposed because of dental caries (11), partial pulpotomy could represent a predicable option for exposed pulp after dental trauma (12–14). Even pulp exposed to oral environment for more than 24 h could be repaired following capping with calcium hydroxide (15).

This study describes a clinical case of tooth reattachment performed in a fractured upper incisor with pulp exposure, which was treated with conservative pulp therapy and restored with a dental fragment obtained from an extracted tooth.

Case report

A 23-year-old man was refered to the restorative dentistry clinic, 24 h after he had a car accident. The patient presented an injured face and coronal fracture of the left central incisor (Fig. 1). Intra-oral examination

Fig. 1. A 23-year-old man presented an injured face and coronal fracture of the left central incisor, after a car accident.

Fig. 2. Fracture involving the enamel, dentin and pulp exposure. The exposed pulp is covered by a pseudo-membrane.

revealed that the fracture was located in the medium third of the crown, pulp exposure could be noticed and it was covered by a pseudo-membrane (Fig. 2). The patient reported that the fractured fragment was not found. The patient also complained that he had experienced a mild pain when cold beverages were ingested. Further radiographic examination demonstrated no fracture of the root, alveolar bone or socket (Fig. 3).

After local anesthesia, rubber dam isolation was performed, which was disinfected with 2% chlorhexidine digluconate. The pseudo-membrane was then removed and after removing the pulp chamber roof, a sharp spoon excavator was used to excise the coronal pulp 2 mm above the pulp exposure, in the so-called partial pulpotomy technique. Visual inspection of the pulp tissue based on hemorrhage, color and resistance to excision was performed (Fig. 4). Following hemorrhage control with 0.9% saline solution, the remaining vital pulp tissue was protected using calcium hydroxide powder (Fig. 5), which was covered by calcium hydroxide cement (Hydro C; Dentsply, Petrópolis, Brazil). Resin-modified glass–ionomer cement (Vitremer; 3M ESPE, St. Paul, MN, USA) was used to seal the cavity as a provisional restoration (Fig. 6) and radiographic examination was performed after conservative therapy conclusion. The provisional restoration remained in place for 10 weeks. During this period, the patient returned to the dental clinic twice and no complaint was made regarding discomfort with the conservative pulp treatment. In one of these visits, the restorative options were informed

Fig. 3. Radiographic examination demonstrating no fracture of the root, alveolar bone or socket.

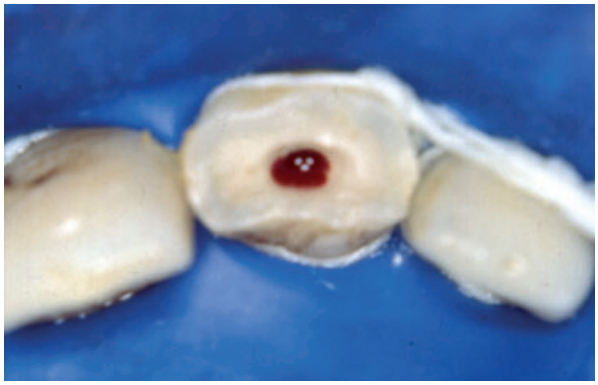

Fig. 4. Partial pulpotomy technique was performed with a sharp spoon excavator after removing the pseudo-membrane. Visual inspection of the pulp tissue based on hemorrhage, color and resistance to excision was performed.

to the patient: composite resin restoration or ceramic veneer restoration, and the second option was rejected because of the cost. The patient was informed that reattachment of the fractured fragment could be the preferred treatment option, but not in his case, if the fragment was not found after the accident. An alternative option could be the reattachment of a dental fragment obtained from an extracted tooth that was stored in the 'bank of teeth' of the dental school. The patient was explained the ethical aspects and sterilization procedures and he consented to the study. Impressions were taken from the patient to obtain a replica of the clinical situation, where the dental fragment of the extracted tooth could be adapted. An extracted central incisor, which presented shape and color similar to that

Fig. 5. After hemorrhage control, the remaining vital pulp tissue is protected using calcium hydroxide powder.

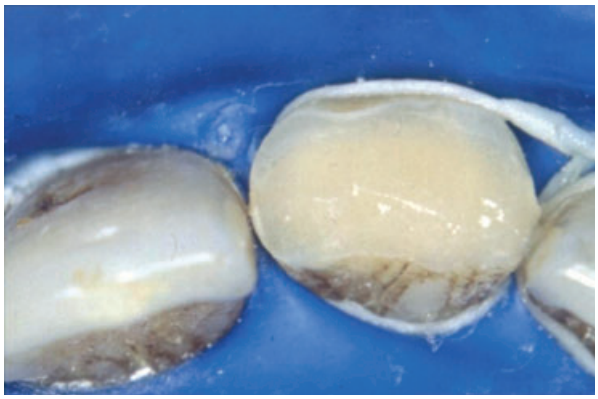

Fig. 6. Resin-modified glass–ionomer cement used to seal the cavity as a provisional restoration

of the patient's fractured tooth, was chosen and sectioned with a diamond disk under air–water cooling. The fragment was sterilized in humid heat at 120°C for 30 min before reattachment (7, 10).

Following the 10-week period, the patient was recalled and a new periapical radiographic examination was taken to observe any changes in the periodontal tissues and to access the presence of the dentin barrier (Fig. 7). With the rubber dam in place, the provisional restoration was removed and the presence of the dentin barrier was ensured with an endodontic file (Fig. 8). The dentin barrier had completely sealed the exposed site. Calcium hydroxide cement (Hydro C; Dentsply) and a resin-modified glass–ionomer liner (Vitrebond; 3M ESPE) were placed over the dentin barrier. The sectioned fragment was then tested in the fractured tooth (Fig. 9) and an incisal guide was produced with godiva to orientate the reattachment. Both the fragment and the tooth remnant were etched with 37% phosphoric acid. Following washing and gentle drying, two coats of adhesive system Single Bond (3M ESPE) were applied over the moist dentin. The fragment was bonded to the tooth using a light-curing composite resin (Filtek Z250; 3M ESPE) (Fig. 10). An occlusal view shows that there was a good incisal relationship with the neighboring

Fig. 7. Radiographic examination taken 10 weeks after pulpotomy treatment. Periapical region is normal and there is no clear evidence of dentin barrier formation.

Fig. 8. Removal of provisional restoration and testing the presence of the dentin barrier with an endodontic file.

teeth (Fig. 11). Thereafter, a round diamond bur was used to produce a circumferential chamfer in the adhesive interface (Fig. 12). The chamfer was conditioned, the same adhesive system was used and the chamfer region was filled with composite resin. The occlusion of the reattached tooth was checked to avoid the presence of premature contact. The reattached tooth is observed soon after the end of the treatment (Fig. 13). After 6 months (Fig. 14), good functional and esthetic resolution was observed, but some degree of color mismatch was noticed with the other teeth. Despite that, the patient was satisfied with the final result.

Discussion

Some reports in the literature have suggested the possibility of bonding a fragment obtained from an

Fig. 9. Fragment being adapted in the fractured tooth.

Fig. 11. A good incisal relationship with adjacent teeth.

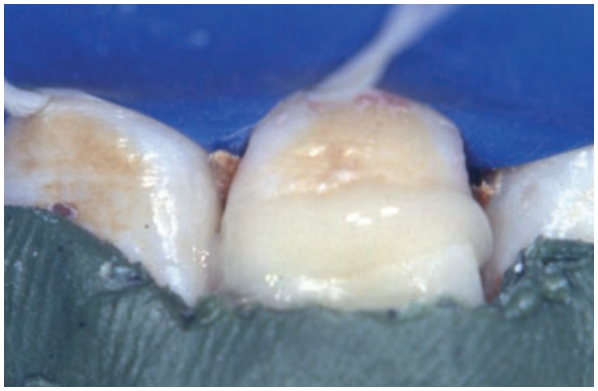

Fig. 10. An incisal guide prepared using godiva. After acid etching and adhesive application, the fragment was bonded using a light-curing composite resin.

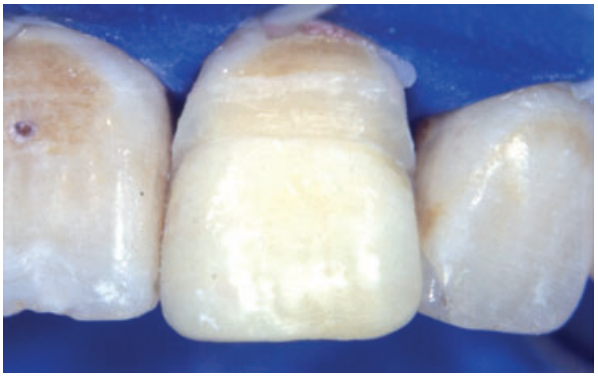

Fig. 12. Circumferential chamfer at the tooth–fragment interface filled with the same light-cured composite.

Fig. 13. Reattached tooth soon after the end of treatment.

extracted tooth to the tooth remnant when the proper fragment is lost (6–9). Based on these previous reports, in this study a tooth from a bank of teeth was selected and sectioned for bonding in the fractured tooth. In Brazilian dental schools, banks of teeth are formed following guidelines laid down by ethics committees and the donors must give written consent for their utilization. Third molars predominate and the principal usage is for research purposes.

Even though the adaptation of the fragment obtained from the extracted tooth presents some advantages, similar to those produced with the reattachment of the proper fragment (maintenance of the incisal guide in tooth structure and physiological wear), certain limitations are observed with this technique. A more preventive approach in dentistry has decreased the availability of teeth and this fact may hinder the availability of a tooth with color and shape similar to that of the fractured tooth (7). The clinician also spends more time in preparing a correct adaptation of the fragment. In addition, careful procedures should be undertaken regarding sterilization and storage of these teeth (7, 10). In the case of color mismatch, it is important to highlight that the color is influenced by the oral environment and little color discrepancies could be solved in the long term, [dental fragment shows some mimetic ability to match color of the neighboring teeth (10)]. However, even after 6 months, there was a mismatch of color (Figs 14 and 15).

Another problem with the adaptation of a fragment obtained from an extracted tooth is the possibility of cross-sectional infection and to prevent it the roots of the teeth stored in a teeth bank should be sectioned and pulp

Fig. 14. Mismatch with adjacent teeth after 6 months.

tissue must be removed, before teeth disinfection in chlorhexidine digluconate and freeze storage. Before use, the teeth must be sterilized in humid heat (120°C for 15 min) (7). All these guidelines were followed and the procedures were only performed after obtaining written consent from the patient. In the case reported, the incisor used was extracted due to periodontal problems of the donor.

Generally, the reattached tooth will not achieve a fracture resistance similar to that of the sound tooth (5). In the case reported here, a total etch adhesive and a light-cured composite resin were used. Reattachment solely with the bonding agent should be avoided due to the low recovering strength (1, 3, 5). The use of a chemical or a dual cure material could be an interesting alternative to ensure a better polymerization degree and, as a consequence, improved adhesion (5). However, the incompatibility between a light-curing adhesive agent and a chemical or dual curing material can occur, impairing adhesion (16). Also, the degradation of the tertiary amine in these materials could produce color alterations in the composite materials with aging (17). Therefore, a light-cured composite resin was used in this study, which could provide partial resistance recovering and good esthetic results (5) and a circumferential double chamfer was used to improve the fracture resistance (1, 3).

In this case, the pulp remained exposed for 24 h to the oral environment. Conservative partial pulpotomy with calcium hydroxide has demonstrated good results when treating pulp exposures in fractured teeth (12–14), even after exposure to the oral environment (15). Calcium hydroxide can stimulate the pulp healing, producing a dentin bridge which completely obliterates the exposure site after 90 days (18). Also, it is important to point out that visual inspection of the pulp during pulpotomy revealed reddish bleeding, consistent pulp tissue and normal hemostasia, which are all indicative of a good prognosis (19).

In this study, we followed up the case for 6 months. Longer follow-up studies with additional cases are warranted.

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