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Treatment of oblique crown fractures in maxillary premolars using adhesive tooth fragment reattachment: 19 years of follow up

CASE REPORT

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Abstract – This report presents an oblique crown fracture in the maxillary right premolars of an adolescent because of fall, which was treated using adhesive tooth fragment reattachment. The impact of the mandible base to the floor caused minor fractures in multiple teeth, severe fracture of teeth 14 and 15, and condylar fractures. The fragments of teeth 43, 45, 46, and 16 were lost at the site of accident. The condylar fractures were managed with a non-surgical conservative approach combining mandibular immobilization and stabilization of temporomandibular joints with maxillomandibular fixation using acrylic splints. After 3 months, the interocclusal splints were removed, and the patient was referred for dental care. Teeth 14 and 15 presented complicated oblique crown fractures causing separation of the buccal and palatal fragments, which were in place, attached to the gingival tissue. Tooth 15 presented chronic hyperplastic pulpits. The fragments were banded for stabilization during the endodontic treatment, and the bands served as matrix for adhesive tooth fragment reattachment. The other fractured teeth received direct composite resin restorations. After 8 years, tooth 16 developed pulp necrosis and was treated endodontically and restored with composite resin. Clinical and radiographic examination 19 years after trauma showed a good adaptation of the tooth fragment/composite resin restoration, good periodontal health, no signs of root resorption, and intact lamina dura.

Dental trauma is not an uncommon event in young patients; one in every five children suffers traumatic injuries to the permanent incisors (1). As much as 97% of dental trauma cases involve the maxillary permanent incisors, and only 3% of traumas are related to the other dental groups (2). The incidence of trauma to the maxillary premolars has been reported to be around 0.6% (3).

The etiology and severity of tooth injuries vary considerably (4). They may affect coronal (enamel, enamel–dentin, or enamel–dentin–pulp) and radicular structures at different levels. Tooth fractures with periodontal involvement are more complex (5) and may lead to tooth loss (6). A number of treatment strategies can be used for the functional and esthetic rehabilitation of these cases. Possible options are orthodontic extrusion of the remaining portion of tooth and restoration, crown lengthening with osteotomy/osteoplasty and restoration, immediate or delayed implant surgery (7), and construction of a bridge (5). In more severe cases, tooth fractures may be accompanied by condylar fractures (2, 8). Treatment choice for these patients will depend primarily on accurate diagnosis and planning based on clinical and radiographic findings (9, 10).

The consequences and implications of traumatic injuries may be immediate or appear as delayed events such as necrosis and resorptions (11). The prognosis is invariably related to the characteristics of the traumatized teeth and the nature of the trauma. One of the determinant factors for having success in treating severe tooth fractures is having a multidisciplinary approach involving areas like surgery, endodontics, periodontics, and prosthodontics (4, 5, 10, 12, 13). The complexity of the treatment plan increases proportionally to the number of affected structures. Treatment duration and costs should also be weighed in more complex cases, and continuous follow up of case progression and care are fundamental for long-term success (14, 15).

Traumatisms that involve only the tooth crown are usually managed only with direct restoration or adhesive tooth reattachment when a fragment is available (10). Adhesive fragment reattachment offers an effective and conservative treatment option in some cases because it reduces the treatment costs, shortens the operative time, and improves the reproduction of tooth characteristics (15). This report presents a case in which a young patient suffered multiple tooth fractures, ranging from minor to severe injuries, and condylar fractures because of fall. The treatment of oblique crown fractures in the maxillary right premolars using adhesive tooth fragment reattachment is described, and the clinical and radiographic findings after 19 years are presented.

Case report

A 13-year-old female patient was examined at the Clinic of Endodontics of Ribeirão Preto Dental School, University of São Paulo, Brazil, 3 months after suffering a fall because of a near-syncope episode in the bathroom. The impact of the mandible base to the floor caused multiple tooth fractures and damage to the temporomandibular joint (TMJ) bilaterally. The condylar fractures were managed during emergency care with a non-surgical conservative approach combining mandibular immobilization and TMJ stabilization with maxillomandibular fixation using acrylic splints. After 3 months, the interocclusal splints were removed, and the patient was referred for dental care.

The intraoral clinical examination revealed enamel–dentin fracture of the incisal portion of tooth 43, lingual cusp of tooth 45, mesiobuccal cusp of tooth 46, and mesiobuccal cusp of tooth 16. These teeth did not present pulp exposure and responded to thermal stimuli and percussion. Teeth 14 and 15 presented severe crown fractures causing pulp exposure as a result of separation of the buccal and palatal fragments. In both teeth, the fragments were secured by the gingival tissue, and a chronic hyperplastic pulpitis (pulp polyp) had developed in tooth 15 (Fig. 1a). Heavy plaque and calculus deposits were observed. Periapical radiographs taken from different angulations confirmed oblique crown fractures without root involvement (Fig. 1b).

The fragments were aligned in the correct position and were banded with stainless steel strips and zinc phosphate cement (S.S. White, Rio de Janeiro, RJ, Brazil) to provide stabilization for the endodontic treatment (Fig. 2a) and adhesive fragment reattachment and to avoid unnecessary removal of sound dental tissue during these procedures. In tooth 15, the band was fastened with orthodontic wire to increase fragment stabilization.

After rubber dam isolation, the access cavities were prepared with round carbide and Endo Z burs (Dentsply/Maillefer, Ballaigues, Switzerland), and the working length was established 1 mm short of the radiographic apex (Fig. 2b). Canals were instrumented according to a crown-down technique using sequential K-files (Dentsply/Maillefer), being irrigated with 2 ml of 1% NaOCl at each change of file. After instrumentation, the canals were filled with 17% EDTA (Odahcan-Herpo Produtos Dentários Ltda., Rio de Janeiro, RJ, Brazil) during 3 min, flushed with saline, dried with absorbent paper points, and obturated with gutta-percha (Dentsply Ind. and Com. Ltda., Petrópolis, RJ, Brazil) and zinc oxide

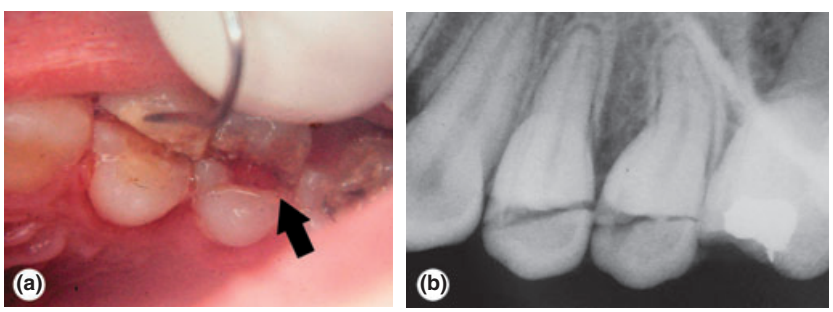

Fig. 1. Preoperative clinical and radiographic images. (a) Intraoral clinical view showing separation of the buccal and palatal fragments and heavy plaque deposits in the maxillary right premolars. The arrow indicates the development of chronic hyperplastic pulpits (pulp polyp) in tooth 15. (b) Periapical radiograph showing an oblique fracture line in the coronal portion of teeth 14 and 15.

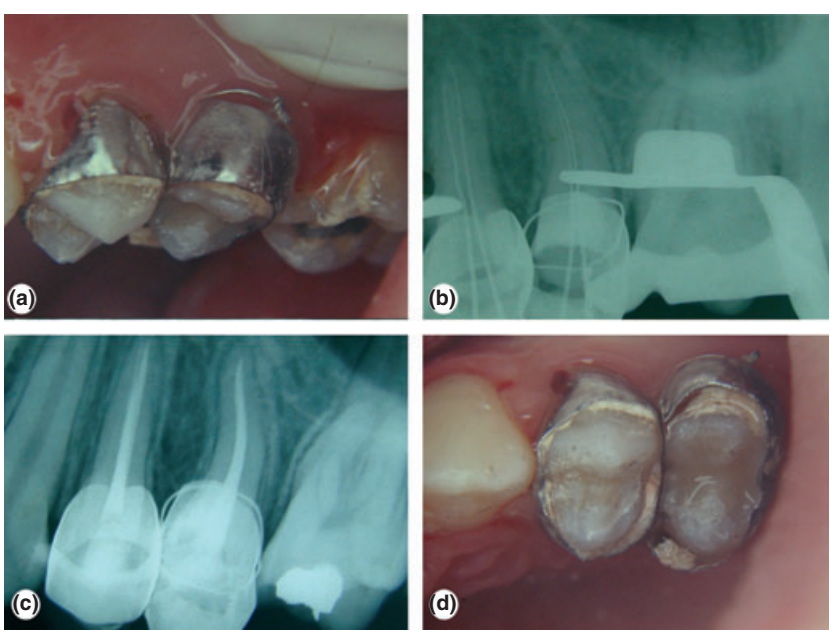

Fig. 2. Panel of intraoperative clinical and radiographic images. (a) Stabilization of the fragments with metallic bands for endodontic treatment and subsequent adhesive tooth fragment reattachment with composite resin in teeth 14 and 15. (b) Radiographic confirmation of root canal length. (c) Radiographic image showing well-compacted fillings extending to 1 mm short of the apex. (d) Teeth 14 and 15 after completion of the restorative procedures.

and eugenol-based cement (Fill Canal® sealer; Dentsply Ind. and Com. Ltda.). Buccolingual and mesiodistal radiographs were taken to confirm that all specimens had well-compacted fillings with correct apical extension (Fig. 2c). To avoid crown darkening, care was taken during irrigation and suction procedures to remove rests of blood clot, and the pulp chamber was cleaned from rests of sealer using a sponge soaked in alcohol. Cleaning of the pulp chamber also eliminated eugenol traces that could interfere with resin polymerization.

In each tooth, a bevel was made along the cavosurface margin of the access cavity and the fracture line to increase fragment retention. The coronal fragments were then etched with 37% phosphoric acid, rinsed thoroughly, and gently air-dried. Tooth crown reattachment was performed using an adhesive restorative technique with a total-etch adhesive system (Prime & Bond NT®; Dentsply Caulk, Milford, DE, USA) and a light-cured microhybrid composite resin (APH®; Dentsply Caulk). Restoration of the fractured premolar crowns was complemented with composite resin using the bands as matrices (Fig. 2d). The bands were then removed from the premolars, and teeth 43, 45, 46, and 16 received direct composite resin restorations. All restorations were polished, and occlusal adjustment was made to eliminate premature contacts and occlusal interferences. The patient received instructions on oral hygiene and was advised about the importance of long-term follow up owing to case complexity. Fifteen days after treatment, radiographic and clinical images of the premolars showed absence of a fracture line and restorations with good shape, contour, and esthetics (Fig. 3a,b).

The patient was scheduled to return at 6-month intervals for routine dental care. Clinical and radiographic examination showed good function and esthetics of the restored teeth at all visits. Only minor repairs and polishing were required.

After 8 years, the patient complained of mild but persistent pain on tooth 16, the clinical examination showed a sinus tract in the labial gingiva of this tooth. Radiographic tracking of the sinus tract path with a gutta-percha point revealed origin in the periapical area of tooth 16, which was non-responsive to pulp vitality tests, indicating necrosis (Fig. 4). Conventional endodontic treatment was given, and the tooth was restored with composite resin. Necrosis was considered a secondary complication of the previous trauma, as the tooth had suffered crown fracture.

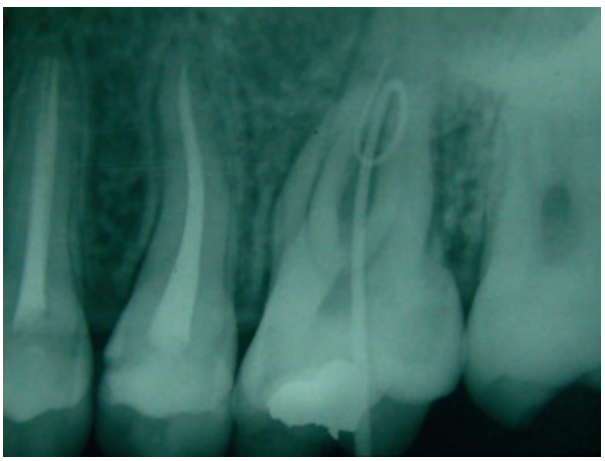

Fig. 4. Gutta-percha cone indicating that the sinus tract origin was the periapical area of the maxillary right first molar (8 years of follow up).

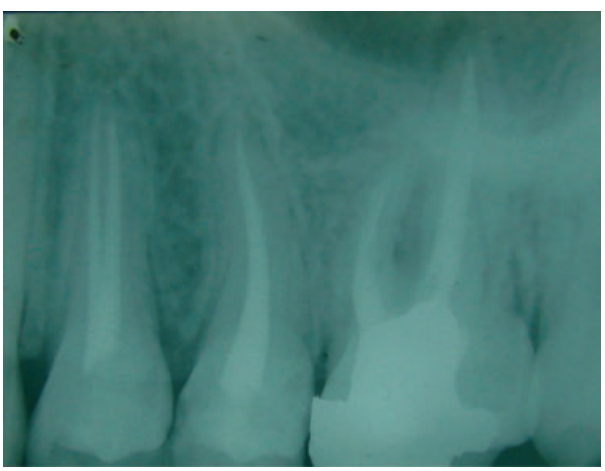

Fig. 5. Periapical radiograph taken 19 years after adhesive fragment reattachment of teeth 14 and 15, and 11 years after obturation of tooth 16, showing absence of fracture line, good periodontal health, no signs of root resorption and intact lamina dura.

Clinical and radiographic examination 19 years after trauma showed a good adaptation of the tooth fragment/composite resin restoration of teeth 14 and 15, as well as good periodontal health, no signs of root resorption and intact lamina dura for both premolars and the maxillary right first molar (Fig. 5).

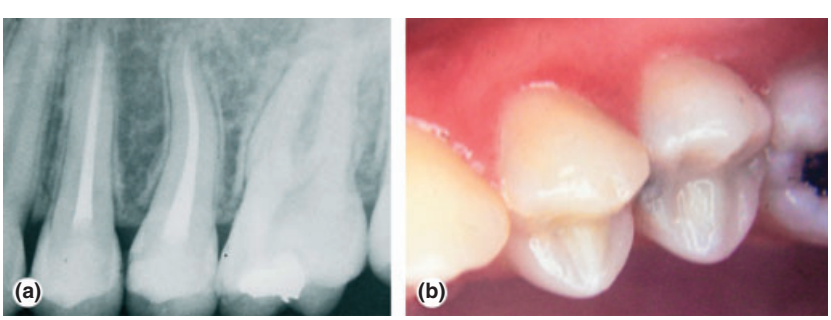

Fig. 3. Radiographic (a) and clinical (b) images 15 days after treatment showing absence of fracture line and polished restorations with good shape, contour, and esthetics.

Discussion

Accidental falls are the main cause of dental trauma (1, 3, 16), and anterior teeth are the most frequently affected (13). In this report, a trauma to the mandible base because of a fall caused articular trauma and multiple fractures in maxillary and mandibular posterior teeth of the same side.

As bicuspid teeth, premolars are more susceptible to fracture caused by traumatic forces than molars (17). Types of fracture may include uncomplicated and complicated crown fractures, as those of the patient of this report, crown-root fractures (5, 9, 18), and fractures involving skeletal structures such as bone plates and TMJs (2, 17), which may lead to dental avulsion (6).

Condylar fractures can be treated with full-arch interocclusal stabilization splints or surgery (2). As the bone fragments were in the correct position, an interocclusal splint was used in the present case as a more conservative intervention. The fracture healed after 3 months, and the patient was referred for dental treatment.

Tooth 15 developed pulpal polyp during healing of the condylar fracture. Hyperplastic pulpitis is a type of irreversible chronic open pulpitis that occurs usually in young teeth where the pulp chamber has been exposed by caries or trauma and a hyperplastic tissue develops. It is asymptomatic, except during mastication, when pressure of the food bolus may cause discomfort (19). In immature teeth, the depth of pulp inflammation is a critical factor for pulp healing after pulpotomy because calcium hydroxide has no beneficial effect on the healing of inflamed pulp. Depending on the size of the exposure, time elapsed after injury, and type of pulp exposure (carious or traumatic), different levels of pulpal amputation have been recommended (19). Pulpectomy was indicated for the patient of this case because the tooth had fully developed roots and closed apices.

Although adhesive tooth fragment reattachment cannot be considered a durable procedure for the management of extensive fractures (15, 20, 21), this technique was used in the present case because it offers an effective, relatively simple, and conservative treatment option. It reduces the treatment costs, shortens the operative time, and improves esthetics because the original color, translucency, brightness, texture, shape, and contour of the natural tooth structure are recovered. In addition, bonding of the fractured tooth fragment provides a more resistant restoration to staining and abrasion than composite reconstruction. As the margins of the restoration are established in natural tooth structure, gingival problems are less frequent. Esthetics and function are reestablished with the tooth in position, which implicates a positive psychological, emotional, and social response from the patient. In the present case, 19 years of follow up showed clinical and radiographic evidence of excellent case progression.

It is therefore important that dentists warn their patients on the importance of collecting fragments of fractured teeth because of traumatic injuries and instruct them on the use of adequate wet storage medium, so that the fragments can be suitable for reattachment. In the present case, the fragment was maintained in the oral cavity since the moment of accident, which avoided desiccation and discoloration.

Long-term clinical and radiographic follow up of teeth that suffer complex traumatic injuries is essential for identifying damage to adjacent teeth and pathologies secondary to the trauma that might compromise case prognosis. In the present case, a fistula originating from the maxillary right first molar developed after 8 years, indicating a chronic necrotic process.

This case report demonstrates the importance of establishing a multidisciplinary approach for a successful management of dental trauma and its possible sequelae, especially when unusual tooth fractures are involved. After almost two decades of follow up, the attached coronal fragments are in position with good esthetics as well as clinical and radiographic signs of periodontal health and root integrity, thus indicating treatment success.

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