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Treatment of multiple traumatized anterior teeth associated with an alveolar bone fracture in a 15-year-old schoolboy: a 2.5-year follow up

CASE REPORT

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Abstract – We report a case of multiple dental traumas in a 15-year-old schoolboy who was hit by a stone. Clinical examinations revealed the avulsion of teeth 21, 22, and 23, an uncomplicated crown fracture of tooth 41, and a complicated crown fracture (CCF) of teeth 11, 31, and 33. An alveolar bone fracture and a root fracture in the apical third of tooth 23 were as well noted on radiographs. The avulsed teeth were replanted and rigidly splinted after an extraoral dry time of 90 min. Endodontic treatments were performed on teeth with CCFs. The dental morphology was restored using polyethylene fiber-reinforced composite resin. Endodontic obturations were performed on replanted teeth after the arrest of external root resorptions by a long-term calcium hydroxide dressing. Esthetics and function were recovered with a 2.5-year follow-up period.

Dentoalveolar traumas involving multiple teeth are not common and occur after certain trauma events such as sport, violence, and traffic accident (1, 2). Children and adolescents are mostly affected, during dental and alveolar development (3). Wright et al. (1) reported a frequency of 16% of traumatic dental injuries (TDIs) in the 12- to 15-year age-group. In a 12-year systematic review of the literature, Glendor (4) stated that most TDIs affect a single tooth and still involve the anterior teeth and particularly maxillary incisors. A frequency of 75% is reported by Borssen & Holm (5). Trauma accounts for between 26% and 76% for uncomplicated crown fracture (UCF) (6), 15.5% for complicated crown fracture (CCF) (7), 7.7% for root fractures (8), 4–22% for avulsion, 5.5% for bone alveolar fracture, and 47–58% for soft tissue injury (7, 9). Concomitant dental injuries may be difficult to manage, mainly with additional complications related particularly to delayed treatments. Diagnosis, appropriate interventions, and long-term follow up are crucial (6, 10, 11).

The aim of this paper is to emphasize the importance of managing various types of traumas, in a 15-year-old adolescent, to ensure the best possible functional, esthetic, and psychological outcomes.

Case report

The patient, a 15-year-old schoolboy, was referred on February 2008 to the endodontics department of Monastir, Tunisia, for multiple traumatized teeth. His father reported that he was hit by a stone thrown by another schoolboy while playing. The patient was unconscious for few seconds. Three teeth were avulsed with abundant hemorrhage, and others were fractured. He was transferred to the medical center of the school and then to the department of oral medicine and surgery. The patient's immunization record was checked. The avulsed teeth, brought in a napkin, after an extraoral dry time of 90 min, were immersed in saline. Contusions of the lips as well as the socket were disinfected with chlorhexidine 0.12%. The teeth were replanted and rigidly splinted under local anesthesia. Systemic antibiotics were prescribed for 7 days (amoxicillin 2 g day^{-1}). Instructions were given to his father as for the use of oral disinfection, soft tooth brushing, and diet.

The following day, clinical examinations showed an arc bar splint extending from the first right molar to the second left one, UCF of teeth 41, and a CCF of teeth 11, 31, and 33 (Fig. 1a–c). The latter were extremely sensitive to air and to pulp vitality testing with cold spray and, on radiographs, their periodontal ligaments were thick. An alveolar bone fracture associated with a root fracture at the apical level of tooth 23 was also recorded (Fig. 2a–d).

Pulpectomies were performed on teeth with CCF, under local anesthesia (adrenaline 1:100 000), and the canals were prepared and disinfected with 2% sodium hypochlorite. They were dried with sterile paper points and obturated with Pulp Canal Sealer-EWT (Kerr Sybron Dental Specialties, Glendora, CA, USA) and

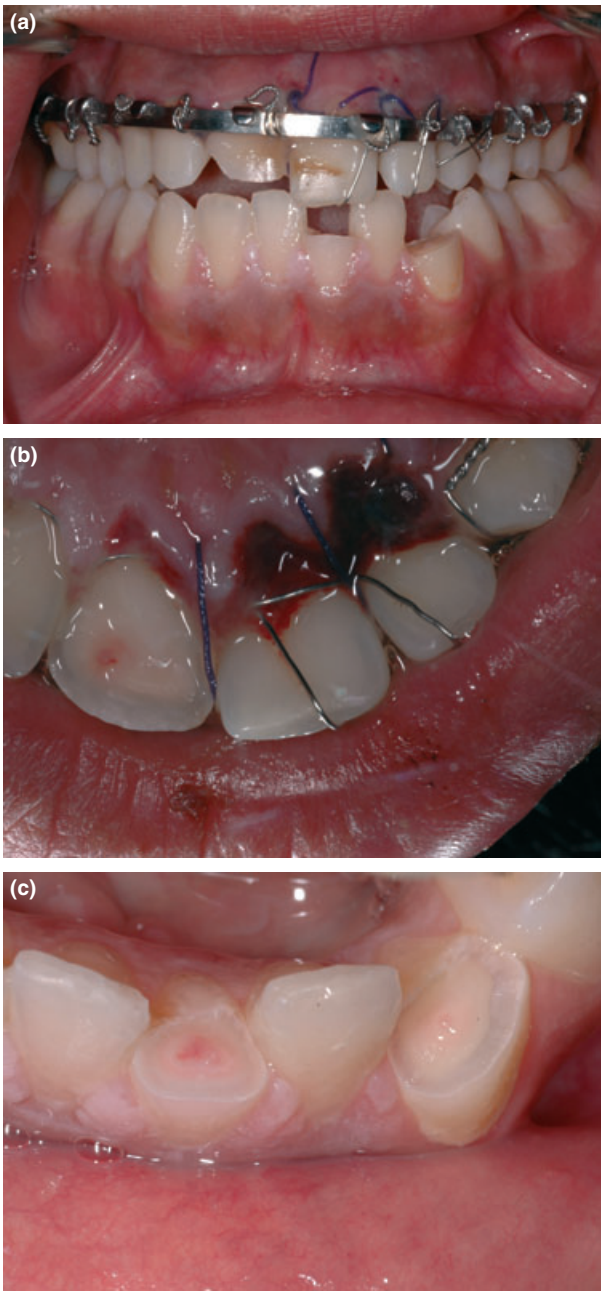

Fig. 1. (a) Initial clinical view, rigid splinting of the replanted teeth. (b) Palatal view, complicated crown fracture on tooth 11. (c) Occlusal view, uncomplicated crown fracture on tooth 41 and CCf on teeth 31 and 33.

thermoplasticized gutta percha (Systeme B, Obtura-Spartan Corp., Fenton, MO, USA) (Fig. 3a–c).

Four weeks later, the patient presented with an alveolar abscess. Radiograph revealed external root resorptions of teeth 22 and 23. No resorption was evident on tooth 21 (Fig. 4a). Surgical drainage and opening of the access cavities of the replanted teeth were performed. All canals were prepared, copiously irrigated with sodium hypochlorite, and filled with calcium hydroxide (powder with no added radiopaque material mixed with saline) by a lentulo spiral and condensed with an appropriate endodontic plugger after working length determination. A periapical radiograph was taken to ensure that the material filled the canals and reached the apices. $Ca(OH)_2$ had been renewed each 2 months and for a total period of 8 months. Healing of the resorptions by hard tissue deposition was confirmed radiographically. Endodontic obturations were performed as described earlier (Fig. 4b). Ankylosis was evident clinically after 2 months. The teeth were immobile and exhibited a high percussive tone.

The initial morphology of the fractured teeth was restored with a microhybrid composite resin (Vit-l-escence; Ultradent Products Inc., South Jordan, UT, USA) reinforced with polyethylene fibers (Ribbond Reinforcement Ribbon, Ribbon, Scottle, WA, USA). After isolating the teeth with a rubber dam, intracanal retentions were created by Gates-Glidden burs (Maillefer, MI, USA) no. 2 and no. 3. After etching the dental surface with 35% phosphoric acid (Ultra-Etch; Ultradent Products Inc) and application of the bonding agent (PQ1 adhesive system; Ultradent Products Inc), polyethylene fibers, conditioned with the bonding agent, were placed into the canals, covered with A2 Perma-Flo flowable composite (Ultradent Products Inc), and light-cured (Fig. 5a). The restorations were completed by using the composite's incremental technique (Fig. 5b).

Radiographs after 2.5 years showed normal periodontal ligament of the fractured teeth and more extensive replacement resorption on tooth 23 (Fig. 6a,b).

Discussion

Dentoalveolar traumas involving multiple teeth are rare and published as case reports (2, 12). Onetto et al. (13) reported a frequency of 11% for trauma involving three or more teeth. In the present case, three types of traumas including both maxillary and mandibular anterior teeth were seen. The mechanism of injury was unusual and also uncommon. Huang et al. (14) reported that 0.9% of the patients were hit by an object.

For teeth with CCFs, the treatment was rather guided by the amount of the remaining dental tissue and the requirements for crown retentions (15). After endodontic obturations, polyethylene fibers were used as it was previously described (16) as a central core stump to strengthen the resin composite restoration. In fact, the advent of these fibers increased their clinical applications in restorative dentistry. They are resistant to stretch, distortion, and traction. Moreover, they are translucent and lead to very good esthetic results (16, 17).

As for the avulsed teeth, although replantation was performed after an extraoral dry time of more than 60 min, the major challenge for us was to treat the infected alveolar bone fracture and arrest the external inflammatory root resorptions (laterally and apically) to prevent rapid teeth loss and consequently favor both alveolar bone healing and the predictable replacement resorption. The latter will be faster in younger patients (8- to 16-year-olds) than in older ones (18). Andreasen et al. (19) reported a survival rate of about 55% for mature replanted teeth after 10 years. In fact, endodontic treatments were initiated 6 weeks after replantation,

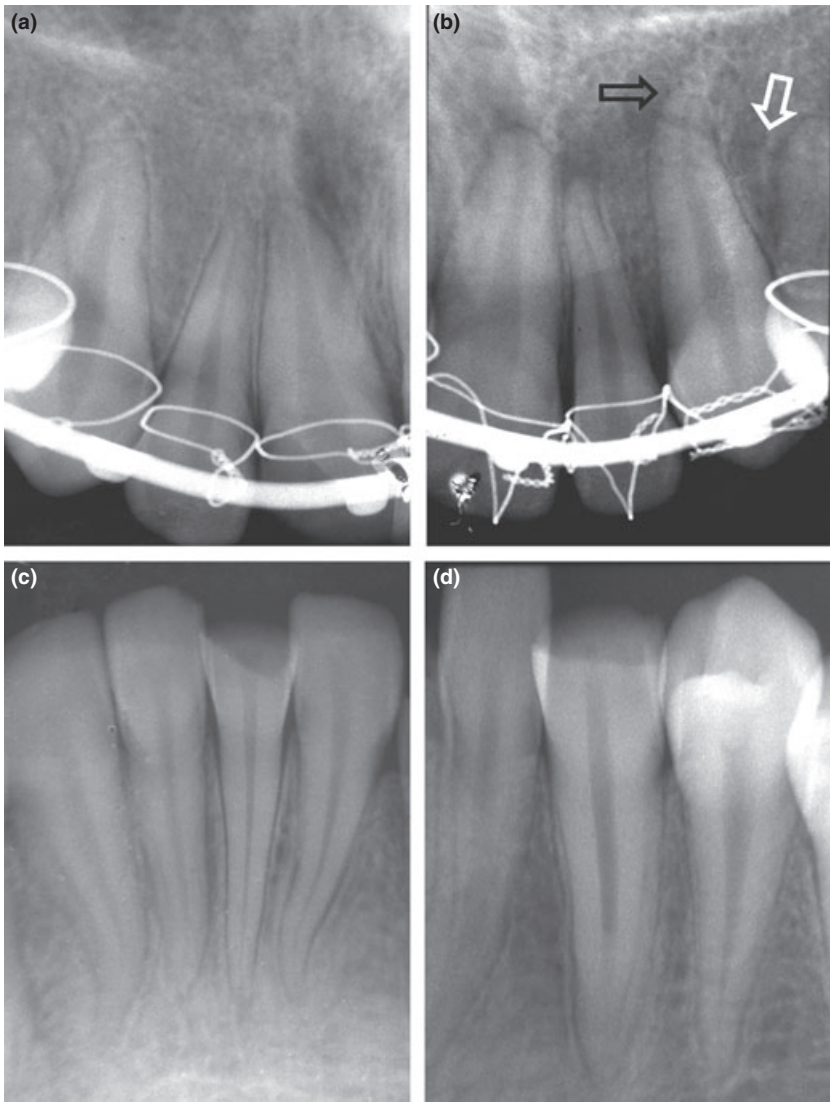

Fig. 2. (a) Preoperative radiograph of tooth 11. (b) Preoperative radiograph of the replanted teeth. Note an apical root fracture (black arrow) and an alveolar bone fracture (white arrow). (c) Preoperative radiograph of teeth 31 and 41. (d) Preoperative radiograph of tooth 33 with two roots.

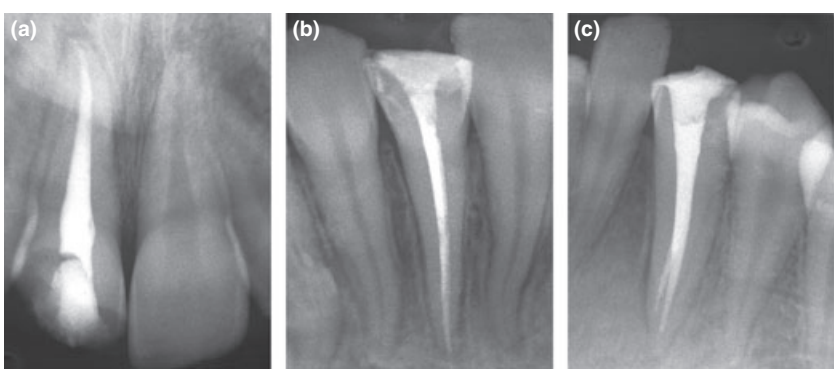

Fig. 3. (a) Endodontic obturation of tooth 11. (b) Endodontic obturation of tooth 31. (c) Endodontic obturation of tooth 33.

time within which bacteria from the necrotic pulp invade more rapidly the wide tubules, stimulate osteoclastic cells which lead to root resorption (20, 21). This process is common and requires complex interactions of inflammatory and resorbing cells, hard tissue, cytokines, and enzymes (22, 23). It has been reported that

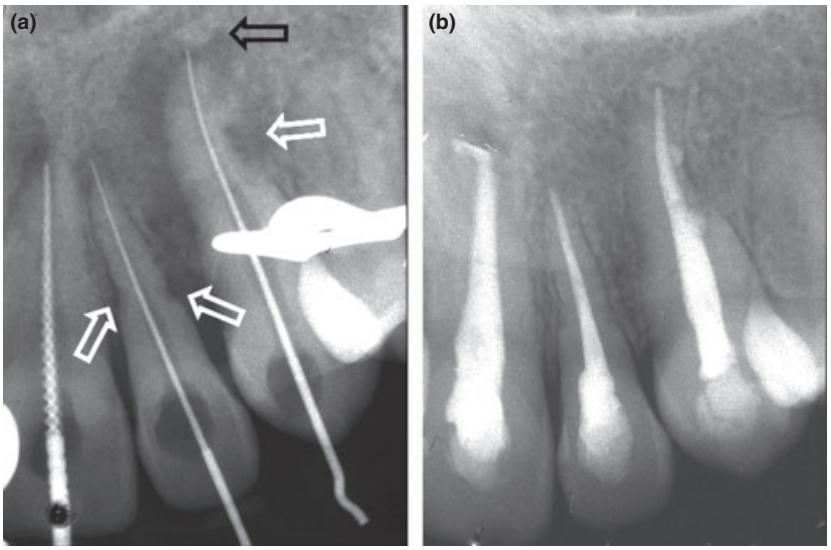

Fig. 4. (a) Radiograph revealed inflammatory root resorptions (white arrows) and periapical radiolucent lesions. The fractured apex is displaced (black arrow). (b) Endodontic obturations. Note healing of the resorptive defects.

Fig. 5. (a) Polyethylene fibers used as a central core stump. (b) Postoperative clinical view.

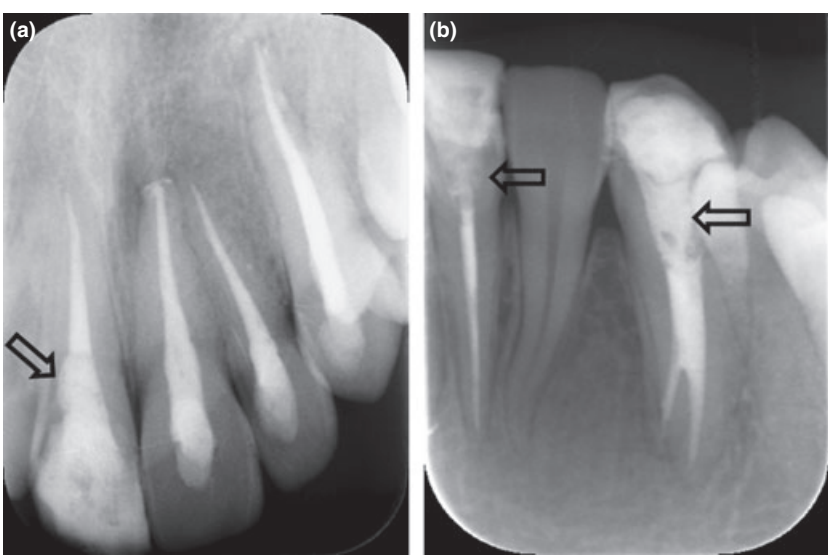

Fig. 6. (a) Follow-up radiograph after 2.5 years. Polyethylene fiber-reinforced composite resin (black arrow) and replacement resorption. (b) Follow-up radiograph after 2.5 years. Polyethylene fiber-reinforced composite resin (black arrows).

inflammatory resorption was usually detected after 1 month (19), with a higher prevalence in teeth in which pulps were removed after 10 days (24). Thus, endodontic treatment should be performed within 7–10 days (11, 25). In the present case, the abscess was drained and the canals were disinfected with $Ca(OH)_2$ for several months without surgical removing of the fractured apex of tooth 23. To maintain its pH at a bactericidal level, $Ca(OH)_2$ was periodically renewed based on radiographic control of its radioopacity (26).

It has been shown that the arrest of the resorptive process is attributable to diffusion of hydroxyl ions at the root surface, through dentinal tubules (27). This aseptic environment induced healing of the defect, rather by bone formation, in the present case, because of dental and periodontal cell damages (28). Recently, MTA has been reported to be effective in the management of inflammatory root resorption (29, 30).

Replanting teeth immediately is not always possible, particularly in multitraumatized patients. A low replantation rate is reported by Tzigkounakis et al. (21) and Petrovic et al. (31).

Actually, the patient is nearly 18 years old; infraocclusion is minimal, < 2 mm (32). Bleaching is not necessary to treat discoloration of the replanted teeth to avoid cervical resorption (33). The patient and his parents were advised that further replacement of the replanted teeth by implants could be planned after complete resorption of the roots. Indeed, prosthetic treatments of the restored fractured teeth should be considered.

In conclusion, treating various traumas in several teeth and in growing patients could be challenging for the dentist. We may consider, after these 2.5-year period, that rehabilitation in terms of esthetic and function was successful. However, better knowledge of the current guidelines will improve dental trauma care, in general and emergency care, in particular.

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