Multiple traumatic injury to maxillary incisors in an adolescent female: treatment outcome with two years follow-up

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Summary

Number, type and severity of dental injuries per patient differ according to the patient's age and the cause of accident. The trauma group resulting from pedestrian-, bicycle-, and car-related injuries is usually dominated by multiple dental injuries, injuries to the supporting bone and soft-tissue injuries.
This report describes a case of a 16.2-year-old female who suffered traumatic injuries to her permanent maxillary incisors after a car accident. Concussion of tooth 12, extrusive luxation of tooth 11, avulsion of tooth 21 and subluxation with complicated crown fracture of tooth 22 were observed at the emergency visit 75 minutes after the trauma. Tooth 21 was dry stored for 15 minutes, then in milk for 60 minutes. The treatment plan according to IADT guidelines was performed with the satisfaction of the dentists and the patient. After 1 year follow-up a replacement root resorption of tooth 21 was diagnosed; it was then considered severe at the time of the 2 year control visit.
Educational programs are essential to optimize the treatment outcome both at the accident site and also at the dental office.

Key words: permanent incisor, extrusive luxation, avulsion, crown fracture, replantation, root resorption.

Introduction

Number, type and severity of dental injuries per patient differ according to the patient's age and the cause of accident (1). Traffic accidents may be focused as a possible increasing cause of dental injuries and represented 10% of the etiologic factors in a sample of Norwegians aged 7-18 years (2) and 7.5% in Austrians with a mean age of 17.8 years (SD error 0.287) (3). Car accidents particularly accounted for 5.6% of the oral and dental injuries in Israeli population during childhood and adolescence (4) and for 2% in a study conducted at the Boston Children's Hospital Medical Center and two private pedodontic officers in 1979 (5). The trauma group resulting from pedestrian-, bicycle-, and car-related injuries is usually dominated by multiple dental injuries, injuries to the supporting bone and soft-tissue injuries (6).
The present case report describes the treatment outcome of traumatic maxillary incisors injuries of a 16.2-year-old female due to a car accident, with a follow-up of 2 years.

Case report

A healthy 16.2 year-old female was referred to the dental office after suffering trauma to her maxillary incisors, following a car accident occurred 75 minutes before.
Facial bone and TMJ examination revealed no pathological signs and symptoms, while intraoral examination showed concussion of tooth 12; extrusive luxation of tooth 11; avulsion of tooth 21 and subluxation with complicated crown fracture of tooth 22 (Figs. 1 and 2). Tooth 21 was dry stored for 15 minutes, then in milk for 60 minutes. Panoramic and periapical radiographs excluded bone and root fractures (Fig. 3). Spontaneous pain was present in the region of maxillary incisors.
With the parents' and patient's informed consent, a local anesthetic was administered. The tooth 11 was gently pushed back into its socket; the root of tooth 21 was rinsed with saline, such as its alveolus to remove the contaminated coagulum, prior to its replantation in its socket with a gentle pressure; the tooth 22 was treated with pulp capping with calcium hydroxide and a

Figure 1. Intraoral view at the time of traumatic injury.

Figure 2. Tooth 21.

dentin bonding agent to create a seal against bacterial invasion into dentinal tubules. The fractured crown fragment wasn't available. The dentin and pulp protection was incorporated into the splint.

A functional splinting with an orthodontic 0.016-inch stainless steel wire and composite resin was positioned from tooth 13 to tooth 23 (Fig. 4) for a period up to 2 weeks, as suggested by the guidelines of the International Association of Dental Traumatology (IADT).

Systemic antibiotic (amoxicillin 2 g for day for 7 days) and analgesic medicament on demand were prescribed. The patient received instructions about an appropriate soft diet and about an adequate oral personal hygiene (chlorhexidine 0.12% mouth rinse twice a day for 1 week and a soft toothbrush to brush her teeth after each meal).

After 3 weeks, and not after 2 weeks as planned, teeth 11, 21 and 22 where endodontically treated (Fig. 5) and the splint was removed.

Afterwards tooth 22 was restored with a glass-fiber endodontic post build-up and an alumina ceramic crown (Figs. 6 and 7).

Figure 3. Periapical radiograph at the time of traumatic injury.

Figure 4. Functional splinting with an orthodontic 0.016-inch stainless steel wire and composite resin.

The patient was scheduled for follow-up and was monitored weekly in the first month after the trauma, then after 3 months, 6 months, 1 year and 2 years.

An initial phase of replacement root resorption of tooth 21 was suspected at the 6 months radiographic control (Figs. 8 a, b) and became evident 6 months later (1 year follow-up) (Figs. 9 a, b). The last radiographic examination during the 2 years recall revealed a dramatic increase of replacement root resorption of tooth 21 (Fig. 10), so that its survival rate became low. Clinically, a gingivitis particularly on the maxillary arch due to poor oral hygiene was diagnosed (Fig. 11).

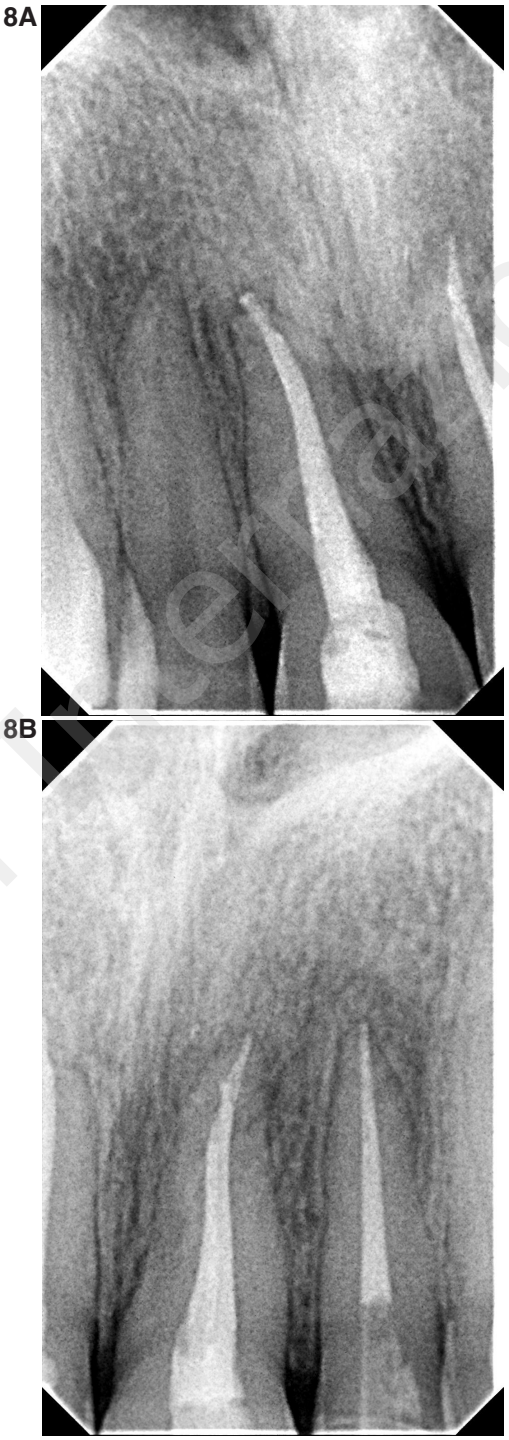
Discussion

In case of multiple injuries the treatment can be complicated and usually requests a multidisciplinary team approach. The present clinical report refers about 5 concurrent types of dental trauma involving teeth mineralized tissues and their supporting tissues: concussion of

Figure 5. Periapical radiograph after endodontic treatment when the splint was removed.

Figure 6. Glass-fiber endodontic post build-up and preparation of tooth 22.

Figure 7. Restoration of tooth 22 with an alumina ceramic crown.



Figures 8A and B. Periapical radiographs at 6 months control visit.

tooth 12, extrusive luxation of tooth 11, avulsion of tooth 21, subluxation and complicated crown fracture of tooth 22, according to Andreasen's classification (7), which is the most frequently used (8) and the more comprehensive system which allows for minimal subjective interpretations (1).

Extrusive luxation is an uncommon type of injury in per-

Figures 9A and B. Periapical radiographs at 1 year recall visit.

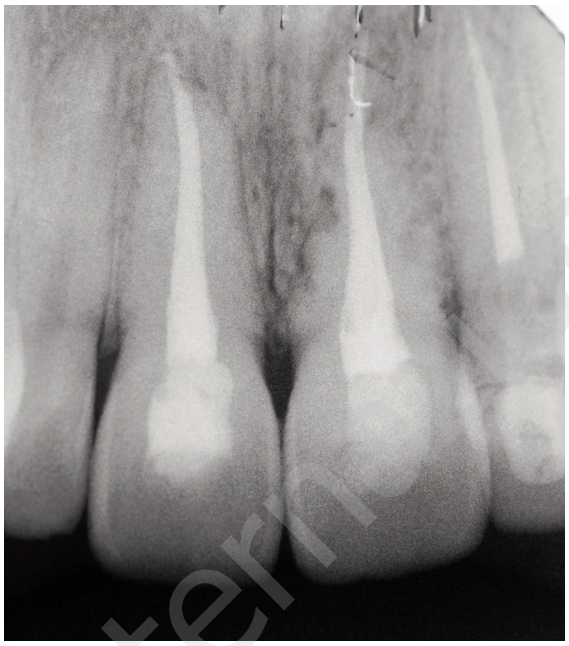


Figure 10. Periapical radiograph at 2 years recall visit.

Figure 11. Intraoral view at 2 years recall visit.

manent dentition. The tooth, in this case report tooth 11, appears elongated with bleeding from periodontal ligament and mobile. Pain is present during occlusion and an increased periodontal ligament space is diagnosed by means of a periapical radiograph. The stage of root formation and the severity of extrusive luxation are usually the major parameters influencing pulp healing. Up to 43% of prevalence of pulp necrosis was referred by Lee et al. (9) and Humphreys et al. (10), so an endodontic treatment was considered for tooth 11.

Tooth 21 on the contrary was avulsed. Avulsion represents a dramatic situation in dental traumatology, particularly in subjects who have not yet reached the maximum peak growth rate. Although replantation is the usual procedure, it must be considered a temporary measure because many teeth are lost due to root resorption. Prognosis depends mainly on length and type of extra-alveolar storage, stage of root development and contamination of the root surface (11). In this clinical case, the development of the root was already completed, so that the revascularization of the pulp was extremely limited; the first 15 minutes it was kept dry and in the next 60 minutes in milk. In 1981, Andreasen JO (12) observed 70.5 ± 17.3% of periodontal healing of mature permanent incisors of monkeys after 18 minutes of dry storage. Milk can be considered the best storage medium for avulsed teeth available at the time of trauma or shortly after. Blomlöf (13) referred that 71% of periodontal ligament cells were viable after 3 hours in

milk storage and 50% after 12 hours. Other researchers such as Huang et al. (14) and Rozenfarb et al. (15) confirmed the validity of milk as storage medium for exarticulated teeth.
Before prosthodontic rehabilitation, tooth 22 was emergency treated with calcium hydroxide for pulp capping and a dentin bonding agent mainly to control pain and sensitivity sealing dentinal tubules. A definitive restoration with glass-fiber post build-up and alumina ceramic crown was chosen to maximize the patient's esthetic request.
Finally a wire-composite splint was placed from tooth 13 to tooth 23 according to IADT guidelines (16, 17). Splint is justified by medico-legal aspects, periodontal ligament cells protection and patient comfort. Flexible splint was preferred to rigid splint to preserve physiologic teeth mobility and avoid further damage to periodontal ligament as dentoalveolar ankylosis. Wire-composite splinting, in this case 0.016-inch stainless steel wire and composite resin, is a simple and fast technique without laboratory procedures and it is useful when an emergency treatment occurs with a compromised working field. Moreover it allows a good oral hygiene (11, 18).
The patient was scheduled for follow-up: recall visits were planned weekly in the first month, then after 3 and 6 months, yearly in the first 5 years.
Unfortunately the patient deserted the 2 weeks recall visit, so the splint was removed only after 3 weeks and the endodontic treatment of teeth 11, 21 and 22 was performed in the same occasion.
Replacement root resorption of tooth 21 was suspected after 6 months, was confirmed after 1 year and appeared severe after 2 years recall. All the other teeth were in good condition and a poor oral hygiene was observed.
Although splinting time of 14 days or less is recommended by IADT and 1 week may be adequate, its duration doesn't affect the likelihood of successful periodontal healing after replantation (19, 20). However a short period must be considered the best practice today. So in this case the replacement root resorption may be caused by an inadequate tooth storage: if the tooth isn't kept in milk immediately but only after a period in dry storage, the prognosis would probably be the same of any other dried and replanted tooth. Dead cells cannot be revitalized by milk (21).
Finally, infraocclusion of tooth 21 wasn't observed because of physical maturity of the patient (22), for which a future implant rehabilitation is planned.

Conclusion

Traumatic injuries to permanent maxillary incisors represent a dramatic situation from an aesthetic point of view that involve the social and psychological behavior of the patient.
The dentist can offer an emotional support to the young patients and their parents, but when the accident causes multiple complex dental injuries the prognosis is often unfavorable and the teeth survival is compromised.
So educational programs are essential to optimize the treatment outcome that depend both on a timely and adequate emergency treatment at the site of the accident, and on a multidisciplinary therapeutic approach by the dentists.

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