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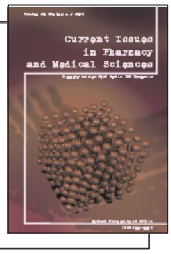

Surgical treatment of dentoalveolar injury in the anterior region of maxilla

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ABSTRACT

Traumatic injuries of teeth and alveolar bone are common in oral surgery departments. Maxillary incisors are the most frequently injured teeth. The right diagnosis is crucial for proper treatment method. Time elapsed between the accident occurrence and emergency treatment plays an important role. The aim of our research work was to present a case of a 25-year old female patient referred to Chair and Department of Oral Surgery, Medical University of Lublin who sustained dentoalveolar trauma of the maxillary anterior region including alveolar process fracture, extrusive luxation of all maxillary incisors, apical root fracture and lacerated upper lip. The surgical treatment consisted of repositioning the displaced teeth and alveolar bone fracture. The fracture was stabilized with the use of orthodontic brackets and orthodontic wire. PRP was used to promote bone healing after apicoectomy during second stage of surgical management.

Keywords: alveolar fracture, tooth extrusion, splinting, apical fracture

INTRODUCTION

Dentoalveolar trauma is a serious condition, which often causes numerous complications, mainly esthetic and functional disorders. These can lead to lowering patient's self-esteem as it appears most commonly in the visible anterior region of jaws.

Three most common classifications of dental trauma are WHO, Andreasen and Ellis. Among them Andreasen's division seems to be the most clear and useful in everyday practice. It contains 19 groups including teeth, periodontal structures, gingival and oral mucosa injuries (Tab. 1) [2,10,14].

Traumatic injuries of teeth and alveolar bone usually result from falls, contact sports, violence or traffic accidents. Males experience more dental traumas comparing to females and the male-to-female ratio ranges from 1.3-2:1 [6]. Maxillary central incisors are the most frequently injured teeth and the second most common are maxillary lateral incisors [7]. Crown fractures without pulp exposure (uncomplicated) are the most frequently occurring injuries varying from 25 to 70% in different studies [11]. Less common are other traumas including: luxation (3.5–26%), displacement (7.9–62%), intrusion (3.6–21%), alveolar fractures 5.5%, soft tissue injuries (47–58%), avulsion (4–22%) [11]. Among predisposing and risk factors authors reported maxillary overjet greater than 3.5mm, prominent maxillary incisors, lip incompetence, previous dental trauma or lack of mouthguards and helmets while playing contact sports [6].

CASE REPORT

A 25-year old female patient referred to Chair and Department of Oral Surgery, Medical University of Lublin. The woman had sustained dentoalveolar trauma to the maxillary anterior region 5 days earlier. She had been hit by a male riding a bike. No loss of consciousness appeared. Immediately after the incident, the woman was examined in the local emergency unit where only thumb injury of right hand was detected.

An extra- and intraoral examination supported by both panoramic and periapical radiographs revealed (Fig. 1, Fig. 2):

– fracture of the maxillary alveolar process in the region of teeth 12-22, movable,

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Table 1. Classifications of dental trauma

Andreasen	World Health Organization	Ellis
Crown infraction. Incomplete fracture of the enamel	Fracture of enamel of tooth	Simple fracture of the crown, involving little or no dentine
Uncomplicated crown fracture. A fracture confined to the enamel or dentine but not exposing the pulp	Fracture of crown without pulpal involvement	Extensive fracture of the crown, involving considerable dentine but not the dental pulp
Complicated crown fracture. A fracture involving enamel and dentine, and exposing the pulp.	Fracture of crown with pulpal involvement	Extensive fracture of the crown, involving considerable dentine and exposing dental pulp
Uncomplicated crown-root fracture. A fracture involving enamel, dentine, cementum, not exposing the pulp	Fracture of root of tooth	The traumatized tooth that becomes non-vital, with or without loss of crown structure
Complicated crown-root fracture. A fracture involving enamel, dentine and cementum, and exposing the pulp	Fracture of crown and root of tooth	Total tooth loss
Root fracture.A fracture involving dentine, cementum, and the pulp	Fracture of tooth, unspecified	Fracture of the root, with or without loss of crown structure
Concussion. Injury without abnormal loosening or displacement but with marked reaction to percussion	Luxation of tooth	Displacement of tooth, without fracture of crown or root
Subluxation (loosening). Injury with abnormal loosening but without displacement of the tooth	Intrusion or extrusion of tooth	Fracture of the crown *en masse* and its replacement
Intrusive luxation (central dislocation)	Avulsion of tooth	
Extrusive luxation (peripheral dislocation, partial avulsion)	Other injuries including laceration of oral soft tissues	
Lateral luxation		
Exarticulation (complete luxation)		
Comminution of alveolar socket		
Fractures of facial or lingual alveolar socket wall		
Fractures of alveolar process with and without involvement of the socket		
Fractures of the mandible or maxilla with and without involvement of the tooth socket		
Laceration of gingiva or oral mucosa		
Contusion of gingiva or oral mucosa		
Abrasion of gingiva or oral mucosa		

Fig. 1. Radiographic view of teeth 12 and 11 after trauma. Fracture line and teeth extruded from the sockets.

Fig. 2. Radiographic view of teeth 21 and 22 after trauma. Teeth extruded from the sockets, apical fracture of tooth 21.

- associated extrusive luxation of all maxillary incisors (12,11,21,22),
- apical root fracture of tooth 21,
- tooth 11 in distorotation,
- tooth 12 and 11 endodonticaly treated, root canal of tooth 12 not completely obturated, tooth 11 with a visible excess of sealer in the apical bone structures,
- swollen upper lip with the purulent exudate from the wound.

The patient was in a good health with no past medical history.

TREATMENT

The surgical treatment consisted of repositioning the displaced teeth and alveolar bone fracture under local anesthesia by using finger pressure. The fracture was stabilized with the use of orthodontic brackets and stainless steel (SS) 0.18 orthodontic wire attached to teeth 15–25. The appliance was left in a passive mode. The lacerated upper lip wound was debridated, rinsed with 0.5% metronidazol solution and partially sutured on the edges.

A rubber drain was left in the wound. The patient was supported with drug therapy including: Augmentin 1 g (every 12 hours for 7 days), Metronidazol 250 mg (500 mg every 8 hours for 7 days) and Ketonal forte (every 8 hours in case of severe pain).

The woman was advised to use chlorhexidine rinse twice a day for two weeks, eat a soft diet for two weeks, and maintain meticulous oral hygiene.

Return appointments were made daily for the next 3 days. During the first appointment, the drain was removed and the wound cleansed. The woman was referred to the Department of Orthodontics for a check -up of brackets position. On the next visits she had her 18 and 28 buccaly erupted teeth removed and injured site controlled. The wound was healing properly and the patient had the sutures removed 7 days after suturing. The traumatized teeth 21,22 tested negative for cold and endodontic treatment 4 weeks after the injury was advised (Fig. 3). The patient was informed that for tooth 12 root canal re-treatment is advised, however, she did not decide to do it. Woman agreed to undergo apicoectomy of both lateral and central incisors.

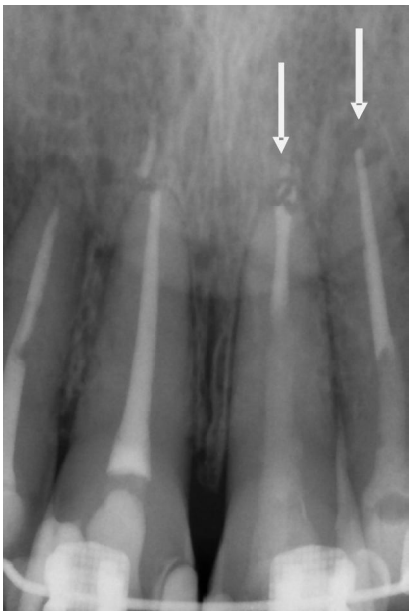

Fig. 3. Radiographic view of teeth 12, 11, 21 and 22 after endodontic treatment of teeth 21 and 22.

Eight weeks after emergency treatment the patient returned to our clinic for further treatment. The orthodontic brackets and splint were removed. No pathological movement of alveolar process was noticed. In local anesthesia the trapezoidal flap ranging from teeth 13–23 was created and apicoectomy of teeth 12,11,21,22 was conducted (Fig. 4, Fig. 5). Patient's venous blood was collected and centrifuged to gain PRP (Platelet Rich Plasma) which was used to fill the bone cavity. The wound was sutured and periapical radiograph was made to check the effect of the procedure. The patient received prescription for Duomox 1.0g (every 12 hours for 7 days) and Ketonal forte (every 8 hours in case of pain).

Fig. 4. Radiographic view of teeth 12 and 11 after apicoectomy. Fracture line is invisible which indicates bone healing.

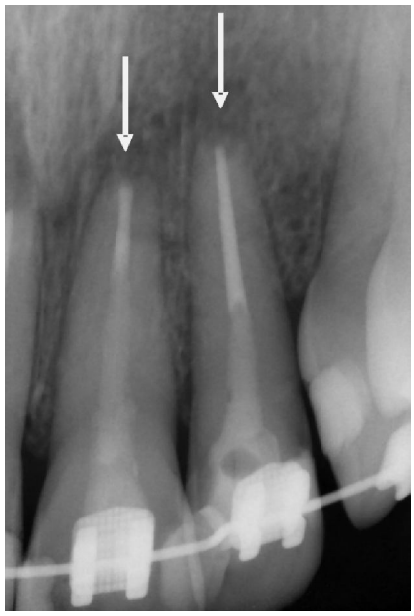

Fig. 5. Radiographic view of teeth 21 and 22 after apicoectomy. Excess of sealer and fractured root removed

The woman returned the next day for a check-up and in another 10 days for suture removal. The patient did not complain any disorders and the wound was completely healed without alveolar process mobility. The patient was informed to visit the clinic in the next 3, 6 and 12 months period for radiological and clinical control of the operated site.

DISCUSSION

Fractures of maxillary alveolar process and front teeth are reported to account for 5-18% of all skeleton injuries, often concomitant with other maxillofacial structures [1,8]. Accidents that involve bicycles and other sports activities stand for 30% of facial region injuries [9]. Preservation of bone anatomical integrity and prevention of post-traumatic crest deformity is an important issue in dental surgery. Maxillary incisors are the most often injured teeth with the highest prevalence of single injury [11]. In the presented case trauma of 4 upper incisors involved alveolar fracture causing teeth extrusion with consequent damage to the pulp and periodontal ligament, root fracture and soft tissue damage.

Time plays an important role in treatment of any kind of maxillofacial injuries. Immediate treatment (early reposition and stabilization) promotes the fastest healing process of traumatized tissues [3]. According to Andreasen, it is more difficult to perform repositioning of dislocated teeth 48 hours after injury [9]. The prevalence of complications after traumatic luxations are reported to occur: pulp necrosis in 64%, pulp obliteration in 24%, progressive root resorption in 5%, marginal bone loss in 7% [6].

In case of combination of extrusive luxation and alveolar process fracture the pulp necrosis depends on the time elapsed between the accident and emergency repositioning as well as on the stage of root development. It was reported in literature that pulp necrosis appears with a frequency of 26% in this kind of injuries thus making root canal treatment not required in most cases [8]. In the presented case there were factors that contributed to appearance of pulp necrosis: long period of time (5days) between accident and treatment, teeth with complete root formation, root fracture. In luxated teeth with pulp necrosis root canal treatment is indicated. Otherwise, infection-related resorption of root is a serious complication [11]. To prevent it, root canal treatment in teeth 21, 22 was performed in 4 weeks after the incident.

It has been shown that antibiotic treatment plays an important role in soft tissue infection. However, it has not been proven to influence healing of traumatic dental injuries [11]. In this case, it was decided to prescribe antibiotics mainly because of the purulent exudation of upper lip wound and secondly due to long period of time elapsed between injury and surgical intervention. The healing process was supported by the use of chlorhexidine rinse, which helps to maintain excellent oral hygiene which is crucial in these cases.

Regarding the treatment of alveolar process fracture, various methods have been described including wiring, miniplates and screws, titanium mesh plates, splints, orthodontic braces [15]. The perfect splint should be semi-rigid, passive and provide physiologic mobility of teeth. Moreover, it cannot interfere with occlusion, speech and proper oral hygiene [13].

It was decided to use orthodontic brackets and 0.18 SS wire (stainless steel wire is a non shape memory alloy). It is important not to apply orthodontic forces on the teeth, however some studies claim that there is always some force ranging up to $27.33x10^{-2}N$. Rectangular or NiTi (Nickel-Titanium) wires should not be used as they develop higher force than round or square stainless steel or cobalt – chrome [5].

In our case, the immobilization was left for a period of 8 weeks because of alveolar bone fracture. No difference was found in healing of teeth splinted for 2 or less months and for longer splinting time [4]. Prolonged immobilization periods may lead to dento-alveolar ankylosis or external root resorption [13].

PRP was used to promote bone healing due to accumulation of growth factors. Many of these factors have been shown to enhance one or more phases of osteogenesis. PDGF, EGF, and FGF-2 have been shown to stimulate proliferation of osteoblastic progenitors. TGF-b increases matrix synthesis (eg, type I collagen) *in vitro* and *in vivo*. Angiogenic factors, including VEGF and FGF-2, can potentially enhance early angiogenesis and revascularization [12].

In conclusion, early emergency treatment of maxillofacial trauma is of great importance for successful healing process. The importance of a multidisciplinary approach to each case has a big influence on overall success. In this case, surgical, endodontic and orthodontic procedures were combined to restore esthetic and function of injured areas.

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