



ORIGINAL ARTICLE

Pediatric maxillofacial and dental trauma: A retrospective review of pediatric emergency management in Riyadh, Kingdom of Saudi Arabia

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Abstract *Background:* Due to the high prevalence of oral and maxillofacial (OMF) trauma in city of Riyadh, a special focus on pediatric trauma is needed. The purpose of this audit was to assess the protocol followed by the OMF unit at King Khalid University Hospital (KKUH) on pediatric trauma patients. The trauma incidence, mechanism of injury, volume, the type of pediatric trauma operated and dental management were analyzed.

Materials and Methods: A quantitative retrospective review of 223 patients, at pediatric emergency unit of KKUH, Riyadh, KSA from January 2017 to July 2018, was done. The data retrieved included variables such as, age, gender, and cause of injury, site of injury, type of injury, and assessment of jaws, and teeth. Data regarding the type of investigations, treatment protocol, follow up visit, and dental management, were extracted from the medical records.

Results: Of the 223 pediatric patients presenting to the emergency unit, 116 (52%) were under the age of 5 years. A total of 64.4% of patients reported “self-fall” as the cause of injury. Soft-tissue injuries were common in 63 (56.8%) of patients in the form of lacerations 87 (41.2%). Involvement of the teeth in the injury was observed in 57 patients, in which 33 (57.9%) patients were reported to have tooth/teeth avulsions, 15 (26.3%) patients had luxation and 9 (15.8%)

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patients had crown fractures. 27 (47%) patients were referred to the pedodontist for a follow-up visit.

Conclusions: It can be concluded that clinicians facing maxillofacial trauma in an emergency department need to have access to useful and practice guidelines. The study also showed the need for more manpower-oriented training such as a pedodontist and a general dentist to join the OMFS team to manage pediatric patients. The regional referral hospitals should be equipped to decentralize the management of these patients to the Dental University Hospital.

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1. Introduction

Over the past few decades, the function of the hospital emergency department (ED) has changed from a position that mainly handles severe injuries and other medical emergencies to a source of primary care. The visit to the ED of any health facility is generally led by an emergency team who assist patients presenting with acute conditions due to injury, accident, disaster or poor health condition that requires immediate medical care and management (Wong et al., 2012). On the other hand, dental emergency visits can be described as the treatment of patients with orofacial problems that interfere with their lives or the function of their organs (Agostini et al., 2001). Dental emergencies are defined as facial bone fractures, facial space infections, soft-tissue lacerations, acute dentoalveolar abscess, dento-alveolar injuries and uncontrolled hemorrhage as defined by the American Dental Association (ADA) and the American Association of Oral and Maxillofacial Surgeons (AAOMS) (Deluke, 1976).

The etiology of maxillofacial trauma differs depending on the predominant socioeconomic, cultural, and environmental factors (Andreasen et al., 2018). The type of injury can vary from simple soft tissue or dentoalveolar injury to more complex maxillofacial skeletal fractures (GLENDOR, 2009, Hecova et al., 2010, Wright et al., 2007, Guedes et al., 2010). Most pediatric maxillofacial injuries include dentoalveolar and soft-tissue injuries, while the occurrence of facial fractures is just 1% to 14.7% (Kumaraswamy et al., 2009). However, most dental emergencies in hospital EDs do not meet the definition of emergency as described by the ADA and AAOMS. Some studies have observed that dental decay is the main cause of most emergency visits (Quiñonez et al., 2009, Sakai et al., 2005).

The Oral and Maxillofacial Surgery (OMFS) unit of King Khalid University Hospital (KKUH), accepts both adult and pediatric trauma cases. The team covers all OMFS emergency disciplines (infection, trauma, pathology, and dental pain) and they work on a rolling rotation of one week to manage all emergencies. The purpose of the study was to assess the protocol followed by our OMFS unit at KKUH on pediatric trauma patients who were managed between January 2017 and July 2018. We also analyzed the incidence, mechanism of injury, volume, the type of pediatric trauma operated on, and their dental management. The outcome of this study enables us to compare the magnitude of this problem with other hospitals in the region and internationally. Furthermore, the findings of this study will serve as a reference point that may influence the formulation of future patient management protocols.

2. Methods

2.1. Study design

A quantitative retrospective review of 223 medical records was performed between 1 January 2017 to 31 July 2018 at the pediatric emergency unit at (KKUH), Riyadh, Kingdom of Saudi Arabia (KSA). The target population was children aged 0 to 12 years who had a maxillofacial emergency. Only children presenting for maxillofacial emergencies were included, while children attending regular dental health problems were excluded. After receiving ethical approval from the institutional IRB committee (E- 17–2748), the data was collected using a structured data collection form. The form included variables such as time, date of patient's visit, age, gender, cause of injury, site of injury, type of injury, assessment of mid-facial, mandible, and teeth. The type of investigations, the specialty of consultant attended, treatment protocol, follow up visit, and dental management data were retrieved. Data were analyzed using SPSS software after calculating descriptive statistics (frequencies, percentages, mean and standard deviation) which were used to describe the categorical and quantitative study variables. The confidentiality of personal information of the patients was maintained.

3. Results

Of the 223 pediatric patients presenting to the emergency unit, 116 (52%) were under the age of 5 years and 132 (59.2%) were males. A total of 64.4% of patients reported "self-fall" as the cause of injury (Table 1). The lower facial region, which was observed in 189 (84.7%) patients, was the most common site of injury. Soft-tissue injuries were reported in 63 (56.8%) patients, in the form of lacerations 87 (41.2%). Involvement of the teeth in the injury was observed in 57 patients, among whom 33 (57.9%) patients reported to have tooth/teeth avulsions, 15 (26.3%) patients had tooth luxation and 9 (15.8%) patients had crown fractures (Table 2). Investigations were conducted in 72 patients, of which plain radiography was used in 33 (45.8%), CT scan in 36 (50%), and CT with contrast in 3 (4.2%) patients. Antibiotics and analgesics were used as immediate treatment in 183 (82.1%) patients. More than 90% (201) of patients were attended by the OMFS team (Table 3). Regarding management, 144 (64.6%) patients received definitive management, in which soft-tissue management was carried out in 93 (64.6%) patients. Nine (6.2%) patients underwent reduction and fixation of the dentoalveolar fracture using an arch bar, while other unspecified definitive management was

Table 1 Distribution of gender, age, cause of injury among the pediatric patients attending emergency unit of KKHU (223).

Variables	No (%)
<i>Age groups (in years)</i>	
< 5 years	116(52)
> 5 years	107(48)
<i>Gender</i>	
Male	132(59.2)
Female	91(40.8)
<i>Cause of injury(n = 219)</i>	
RTA	18(8.2)
Inter-personal violence	3(1.4)
Falling	141(64.4)
Sports injury	3(1.4)
Unknown causes	54(24.7)

Table 2 Distribution of Anatomical site of Oral Maxillofacial (OM) region involved, type of injury, jaw fractures, and teeth involvement among the pediatric patients attending emergency unit of KKHU (n = 223).

Variables	No (%)
<i>Anatomical site of OM region</i>	
Mid face	24(15.3)
Lower face	189(84.7)
<i>Type of injury(n = 153)</i>	
Soft tissue	63(56.8)
Laceration	87(41.2)
Abrasion	3(2.0)
<i>Jaw fractures(n = 11)</i>	
Condyle	8(72.7)
Angle	3(27.3)
<i>Teeth involvement(n = 57)</i>	
Fractures	9(15.8)
Avulsions	33(57.9)
Luxation	15(26.3)

done in 42 (29.2%) patients where no details were mentioned. Conservative management was performed in 96 (43.1%) patients, including antibiotic and analgesic prescription, parental reassurance, and follow-up for cases of undisplaced fractures or dental trauma that may require specialized management (Table 4).

Regarding anesthesia for management, 75 (59.5%) patients were managed under local anesthesia (LA), while 42 (33.3%) were managed under LA combined with conscious sedation in the ED. Nine (7%) patients were managed under general anesthesia (GA). Three (1.5%) cases were seen by a pedodontist at the ED, and the remaining cases were evaluated by the OMFS team and managed either under general or local anesthesia. The patients followed by pedodontists were treated for extractions (9 patients, 30%), pulpectomy (3 patients 10%), restoration (3 patients, 10%) and other (12 patients, 40%) were under follow-up (Table 5). The high percentage of extrac-

Table 3 Distribution of type of investigations, immediate treatment, consultations and attending personal for the pediatric patients attending emergency unit of KKHU(n = 223).

Variables	No (%)
<i>Imaging(n = 72)</i>	
Plain radiography	33(45.8)
CT-scan	36(50.0)
CT with contrast	3(4.2)
<i>Immediate treatment</i>	
Antibiotics & Analgesics	183(82.1)
<i>Attending personal</i>	
Maxillofacial surgeon	201(90.1)
Other attending personnel	3(1.3)

Table 4 Distribution of type of management (definitive & conservative), length of hospital stay, reasons for discharge, for the pediatric patients attending emergency unit of KKHU (n = 223).

Variables	No (%)
<i>Definitive management</i>	
Yes	144
No	(64.6)
	79
	(35.4)
<i>If Yes (n = 144)</i>	
Soft tissue management	93
Splinting with arch bar	(64.6)
Other definitive management	9(6.2)
	42
	(29.2)
<i>Conservative management</i>	
Yes	96
No	(43.1)
	127
	(56.9)
Duration of Hospital stay hours for treatment (mean \pm sd.,)	3.5(1.2)
<i>Reasons for discharge(n = 195)</i>	
patient is discharged after seeking maxillofacial care	174
patient require admission for observation, and further management	(89.2)
Patient is discharged against medical advice.	18(9.2)
	3(1.5)

tions revealed that the patients were delayed in their presentation for actual management, which was due to the lack of an

established protocol for the immediate treatment of pediatric patients with dental injuries.

4. Discussion

This retrospective study reported 223 patients for pediatric emergency who presented with maxillofacial injuries. Data collection included a descriptive analysis of cause, type of injury, the investigations performed, and case management. Our data showed that 52% of the patients were below the age of 5 years. This finding was similar to other studies. Maxillofacial injuries have been reported to account for 75% during pediatric age versus adolescence (Pettersson et al., 1997). Because of the higher cranial mass-to-body ratio, children are more vulnerable to craniofacial trauma (Wymann et al., 2008). It was reported that the incidence of pediatric facial fractures ranges from 1% to 14% in children of below 16 years of age and less than 1% in children of less than 5 years of age (Sakai et al., 2005). This finding was consistent with our findings as we reported an incidence rate of 5% for mandibular fractures among the pediatric population.

In our study subjects, in 151 (64%) patients the major cause of injury was “self-fall”, and the literature indicates the causes for injuries in the maxillofacial region as traffic accidents or collisions, accidental falls, being hit by an object, violence and sports (Glendor, 2009, Glendor and Andersson, 2007). The etiological factors differ by age; falls are common in childhood, and later, sports-related injuries become frequent, while violence and traffic accidents are the main causes of trauma in adolescence and adulthood (Sakai et al., 2005, Gassner et al., 2004, Vyas et al., 2008). In general, children being active in their daily life, sports-related injuries, and accidental falling

are the most common reasons for dental injuries in them (Shayegan et al., 2007, Lauridsen et al., 2012).

The cause of trauma was found to be unknown for 58 (28%) patients. This could be either due to poor documentation and history taking or probably due to medico-legal reasons such as child abuse. In 90% of cases, the offenders are parents or caregivers, especially in young children (Gassner et al., 1999). Importantly, up to 50% of all child abuse-related physical injury occurs in the area of the head and neck (Donaruma-Kwoh and Wai, 2010, Costello et al., 2005). A major study conducted on over 3385 subjects in the developmental age with cranio-maxillo facial trauma showed that violence accounted for about 3.9% of cases (Gassner et al., 2004).

Regarding TMJ trauma, some authors have shown that approximately 18% of the cases result from abuse (Monnazzi et al., 2017). Violence-related fractures are most commonly associated with the angle region, while road accidents typically involve condyle, body, and parasymphyseal fractures (Nasser et al., 2013). In the present study, 8 (3.5%) patients reported a condylar fracture and 3 (1.3%) patients reported an angle fracture. Regarding the face and neck, the oral cavity is less often affected by violence, but the health worker can easily detect lesions at this level (bruising of the hard palate, fractured teeth, lacerations, burning of mucosae, etc.) during the examination (McAndrew and Marin, 2012, Nelms et al., 2009). Updated evidence-based guidance is needed to aid dentists, pediatricians, surgeons, teachers, parents, schools, and sports staff in the prevention and first aid of children and adolescents in the event of dental trauma. It is also prudent to conduct an orderly assessment of the medical and legal suggestions (Flaherty et al., 2014).

Soft-tissue injuries 63(56.8%) were common in the form of lacerations in 87 (41.2%), while 25% of children suffered from dental trauma in the form of teeth avulsion in 33 (14.7%) patients, luxation in 15 (6.7%) patients, and crown fracture in 9 (4%) patients. Other studies have shown crown fractures, followed by concussion and subluxation in the permanent dentition (Díaz et al., 2010, Alonge et al., 2001), subluxation was more common in the primary dentition (38.6%) followed by avulsion (16.6%) (Díaz et al., 2010). Maxillary incisors account for up to 96% of the fractured teeth among the pediatric population (Alonge et al., 2001, Wymann et al., 2008, Gassner et al., 2004, Lauridsen et al., 2012). About half of the patients with facial injury have a dentoalveolar injury at the same time, but its prevalence among children is higher (Gassner et al., 1999, Guedes et al., 2010, Gassner et al., 2003). Despite the relatively high percentage of dental trauma (25%), our data reported no dentoalveolar fracture. Moreover, the variation in the percentage of fractures may be due to the shortfall of standardized epidemiological protocols which make it difficult to compare among countries. Cultural and socio-economic behavior as well as adherence to road safety and the role of vehicles regarding child rear seats also explain some of the variations (Zeng et al., 1994).

According to the European guidelines on orofacial and dental trauma, recommendations are made regarding the immediate treatment of crown fractures and dental avulsions and the general evaluation of the condition of the patient following the trauma. Furthermore, a clear and detailed description of trauma circumstances, clinical evidence, diagnostic/therapeutic activity performed, and the possible long-term prognosis should be included. In the section “Dental trauma

Table 5 Distribution of referrals, follow up visits and type of management by Pedodontist for trauma cases and management of soft tissue laceration for the pediatric patients attending emergency unit of KKUH (n = 223).

Variables	No (%)
<i>Referrals and follow up (n = 57)</i>	
Seen in the ER by pediatric dentist	3(5.5)
Case seen in ER by OMFS then referred to pediatric dentist during the follow up visit	27 (47.3)
Case not show on follow up or not accepted for evaluation	27 (47.3)
<i>Type of management by Pedodontist for trauma cases (n = 30)</i>	
Pulpotomy	3(1.9)
Pulpectomy	3(1.9)
Restoration	3(1.9)
Follow up	12 (7.4)
Extraction	9(5.6)
<i>Management of Soft tissue laceration (n = 126)</i>	
Local anesthesia	75 (59.5)
Sedation and local anesthesia	42 (33.3)
General anesthesia	9(7.1)

due to child neglect and/or abuse,” we emphasized that health professionals, including dentists, are legally required to report any suspicion of abuse (Cagetti et al., 2019).

Trauma diagnosis and treatment should be carried out according to definite protocols that initially involves the detailed collection of medical history and the circumstances of the traumatic event, along with the clinical examination and radiological investigations, a second phase that involves definitive therapeutic management and a third phase of monitoring the patient. Trauma management, particularly in children, deals with treating soft tissues, bone trauma and care of life-threatening injury which are based on clinical and radiographic examinations (Karim et al., 2010, Bell et al., 2007). A protocol for triage and assessment of pediatric patients who have had a craniofacial injury has been published in the literature (Haug and Foss, 2000). Certain injury patterns should lead the emergency physician to suspect child abuse. These include multiple physical injuries to the head and neck, missing or broken teeth, fracture malunion, and multiple fractures in various stages of healing (Cagetti et al., 2019).

More than 90% of the patients in our study were attended by the OMFS team. Both definitive and conservative management was performed in these patients. Under definitive management, soft tissue management was performed in 93 patients. About 89.2% were discharged after maxillofacial care was provided. Of 57 patients who presented with dental trauma, 30 patients underwent treatment by the pedodontist. Twenty-seven (47.4%) patients were seen in the ED by the OMFS, and then referred to the pedodontist for a follow up visit, whereas 60 (31.7%) patients did not present for the follow up visit or were not accepted for evaluation. Dental treatment by the pedodontist was delayed for 27 patients waiting for the recall visit, and 60 patients were not referred. The latter was not clear from the patient record if the parents refused the treatment or did not attend their follow-up visit. According to dental trauma guidelines, immediate treatment and general assessment should be performed for crown fractures and tooth avulsions. A dental trauma certificate should be issued to the patient at that time (Cagetti et al., 2019). It has been recommended that facial trauma requires a multidisciplinary approach: the management of facial bone fractures is the responsibility of the maxillofacial surgeon, while the dentist is responsible for dental and oral soft-tissue lesions. Only parents and/or caregivers are permitted to consent to dental treatments in pediatric trauma patients. However, urgent diagnostic and therapeutic procedures (such as wound sutures, reduction of displaced teeth, re-plantation of the tooth, managing pulp exposure, etc.) should be performed, if necessary, to avoid worse outcomes (Cagetti et al., 2019). Because there is no pedodontist for on-call duty in KKUH, all patients are examined by the OMFS team. If the patient needs a pedodontist consultation, they are referred to the pediatric dental clinic for management. Thus, general dentists/pediatric dentists need to be equipped and knowledgeable about the latest guidelines and should attend refreshing courses on management of orofacial injuries (Al Mahmoud et al., 2019, Alyasi et al., 2018). However the limitation of the study was that it is retrospective and based on the availability and accuracy of the information in the clinical notes.

It can be concluded that clinicians (pediatricians, ED staff, or dentists) facing maxillofacial trauma in an ED need to have access to useful and practice guidelines. The study also showed

the need for more manpower-oriented training such as a pedodontist and a general dentist to join the OMFS team to manage pediatric patients. The regional referral hospitals should also be equipped to decentralize the management of these patients to the KSU Dental University Hospital. Additionally, we emphasize educating the parents and school teachers through regular community dental education programs

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Ethical approval

The ethical approval and facilitating letter of this study were obtained from King Saud University (ethic approval no. E-17-2748 dated 29.11.2017).

Patient consent

A written informed consent was obtained from all the participants who participated in this study.

Declaration of Competing Interest

The authors declared that there is no conflict of interest.

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