

## Epidemiological assessment of oral and maxillofacial hard and soft tissue injuries: a one-year survey in Amin hospital of Isfahan city

### Ocena epidemiologiczna urazów miękkich i twardych tkanek jamy ustnej i twarzoczaszki – roczny przegląd przypadków w szpitalu Aman w Isfahan

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#### Abstract

**Introduction.** The increasing incidence of accidents expose individuals to a variety of traumas. With maxillofacial trauma being one of the most common and considering lack of reports on the incidence of maxillofacial injuries in Isfahan, the present study aimed to assess the oral and maxillofacial injuries in patients referred to Amin hospital in order to achieve better diagnostics, treatment and prevention of complications. **Material and methods.** In this descriptive cross-sectional study, the medical records of patients who sustained maxillofacial injuries and where referred to Amin hospital of Isfahan were evaluated within March 2015-2016. Hours, days and months of referral, duration of hospitalization, age, sex, marital status, cause of injuries, type and site of hard and soft tissue injuries, mean size of lacerations, related injuries and type of treatment plan were recorded. **Result.** The majority of patients were male

#### Streszczenie

**Wstęp.** Coraz większa liczba wypadków naraża ludzi na rozmaite typy urazów. Do najczęstszych należą urazy w obrębie twarzoczaszki, ale uwzględniając brak doniesień o częstości tego typu urazów w Isfahanie, niniejsza praca dokona oceny urazów jamy ustnej i twarzoczaszki u pacjentów kierowanych do szpitala w Amin w nadziei poprawy diagnostyki, leczenia i zapobiegania powikłaniom. **Materiał i metody.** Opisowe, przekrojowe badanie dotyczyło kart medycznych pacjentów, którzy doznali urazu twarzoczaszki i zostali skierowani do szpitala Amin w Isfahanie. Ocenę przeprowadzono za okres od marca 2015 do marca 2016. Przeanalizowano godzinę, dzień i miesiąc skierowania, okres hospitalizacji, wiek, płeć, stan cywilny, przyczynę urazu, rodzaj i lokalizację urazu tkanek miękkich i twardych, średnią wielkość rozcięcia, powiązane urazy i rodzaj wdrożonego leczenia. **Wyniki.** Większość pacjentów

#### KEYWORDS:

maxillofacial injuries, hard tissue, soft tissue

#### HASŁA INDEKSOWE:

urazy szczękowo-twarzowe, tkanki twarde, tkanki miękkie

(74%) and single (59/58%). Most subjects were in their twenties. Summer time on Thursdays and Saturdays between 6-12 PM were the most visited times. The patients mostly stayed 0-5 days in hospital. Injuries were mostly caused by road traffic accidents. The most common site of injuries was the nose (21/99%). In soft tissue injuries, lacerations were the most common with the longest ones in the forehead. Dental and orthopedic were the most related injuries. The most common bone fracture treatment was close reduction. **Conclusion.** Population's geographic and cultural features can affect the incidence of maxillofacial injuries, which will in return affect the treatment plans. Therefore, considering these parameters would be useful for appropriate health care policy and management protocols in every society.

## Introduction

Increasing incidence of accidents expose people to damage from a variety of traumas. According to Iran's emergency service assessments, unfortunately trauma is the main cause of death beside cardiovascular disease, cancer and stroke; in this regard Iran has the highest ranking in the Middle East. Because of the population concentration, life style, cultural background and socioeconomic status the incidence of maxillofacial injuries varies in different countries.<sup>1</sup>

Recent study in Mashhad stated that road traffic accidents and falls are the leading causes of maxillofacial fractures.<sup>2</sup>

Facial bone fractures have high impact on the esthetics and shape of the face. Consequences of facial fractures can affect people's life permanently as follows: deformation of growing jaw bones, temporomandibular joint and occlusion disorders, crushing and loss of bones, facial deformity and loss of teeth.<sup>3</sup>

Park et al. state that lacerations may largely differ when compared with the fracture. Therefore, it is necessary to continue collecting data from oral and maxillofacial laceration patients over time to establish optimal diagnosis and treatment strategies for oral and maxillofacial laceration.<sup>4</sup> Olusanya et al. in 2015 suggest that in Nigeria many studies have been undertaken on maxillofacial trauma but only a few have considered both hard

to mężczyźni (74%) nieżonaci (59/58%) pomiędzy 20 a 30 rokiem życia. Przyjęcia do szpitala najczęściej miały miejsce w lecie, w czwartki i soboty pomiędzy godziną 18 – 24. Czas hospitalizacji do 5 dni. Urazy były przeważnie wynikiem zdarzeń komunikacyjnych i najczęściej dotyczyły obszaru nosa (21/99%). W kategorii urazów tkanek miękkich, najwięcej było rozcięć, a najdłuższe w obrębie czoła. Powiązane urazy miały charakter ortopedyczny lub dotyczyły zębów. Złamania leczono nastawieniem zamkniętym. **Wniosek.** Cechy geograficzne i kulturowe dla danej populacji mogą mieć wpływ na występowanie urazów twarzoczaszki, co z kolei ma wpływ na plan leczenia. Branie pod uwagę tych czynników może być użyteczne przy planowaniu właściwej opieki zdrowotnej i metod postępowania w każdej społeczności.

and soft tissue injuries from the point of view of other etiological sources of trauma apart from road traffic accidents. Another statement in this study is that maxillofacial trauma poses a significant socioeconomic burden on affected individuals; presence of associated injuries in other body systems makes the matter worse; the authors suggest that more local studies on the outcome of management of maxillofacial trauma will contribute to the available literature in this field of study.<sup>5</sup>

Hence, knowledge of incidence and cause of maxillofacial traumas is important in order to provide appropriate treatments and prevention of morbidity and mortality in such cases. Due to lack of detailed reports on the incidence of hard and soft tissue injuries in Isfahan, in this study we sought to assess oral and maxillofacial tissue injuries in patients referred to Amin hospital to help in better diagnostics, treatment and prevention of complications.

## Patients and methods

This retrospective descriptive cross-sectional study included the medical records of all 240 patients with oral and maxillofacial injuries referred to Amin hospital of Isfahan over one year period of March 2015 to March 2016. Exclusion criteria concerned patients who returned home or passed away without treatment, and also incomplete

medical records. The number of excluded patients was not high and did not have a great impact on the results.

All demographic data and the patients' medical records and radiographs were reviewed to obtain information of data collection form.

Collection form consisted of several parts and included: date and time of referral, duration of hospitalization, demographic data (age, gender, marital status), etiology (road traffic accident, assault, fall, occupational injuries, etc.), site of hard tissue injury (upper face, mid face, lower face separately), type of soft tissue injury (laceration, abrasion, contusion, avulsion), length of lacerations, site of soft tissue injury (lip, cheek and zygomaticotemporal region, chin, forehead, nose, periorbital region, mouth), related injuries (orthopedic, dental, thoracic, ophthalmologic, cervical, nerve damage), type of bone fracture treatment (close reduction, open reduction, no treatment).

All the data were analyzed by SPSS version 20. Descriptive statistics for the incidence and quantitative variables were presented in frequencies, proportions and in tables. Data were calculated by t-test and presented in ranges and means; also Chi square test was used to explore differences between gender and age, cause of injury, hard and soft tissue injuries.

The present study was approved by the bioethics committee of Amin hospital, Isfahan, Iran. Ethical considerations were applied throughout the study, and the subjects' medical history was used solely for the purposes of the current study.

## Result

The majority of patients were male (74%) and single (59/58%). Most subjects were in their twenties and the mean age was 23/39 years. The most visited seasons, days and hours were summer times on Thursdays and Saturdays between 6-12 pm. The patients mostly stayed 0-5 days in hospital. Injuries were mostly caused by motor vehicle accidents followed by assault. The most common soft tissue injury was lacerations. In all types of soft tissue injuries, the lips and the nose were the most common sites. The longest lacerations were

in the forehead, while the nasal region had the shortest ones.

In this one-year study, 240 patients with oral and maxillofacial injuries were evaluated including 177 (74%) males and 63 (26%) females. Male to female ratio was 2.8:1.

Relative distribution of age amongst the patients was as follows:

Patients in their 20s (89 persons), 30s (48 persons), 10s (43 persons), 50s (19 persons), 40s (17 persons), under 10s (14 persons), 60s (4 persons), 70s (4 persons), in 80s (2 persons).

Distribution frequency of age according to gender was assessed (Table 1). The mean age in all samples was 28.78 years; in males and females 27.85 and 28.65 years, respectively. Minimum age was 4 years (in males) and 3 years (in females); the oldest patients were an 85-year-old male and a 58-year-old female.

In terms of marital status 40.41% were married (58 females, 39 males) and 59.58% were single (137 males, 6 females).

Seasonal distribution frequency shows that summer with 26.25% has the most referrals; winter (25.84%), spring (25.01%), and autumn (22.9%) follow respectively.

Distribution frequency of months of admission showed that maxillofacial injury patients were admitted mostly in February (10.84%). March and August follow with close 10%, and the least number of admissions were in November and December with 6.25%.

Regarding the day of referral, Saturdays with 17.08% had the highest rate; followed by Thursdays (16.67%), Fridays (15.83%) and Mondays (9.58%).

Assessing duration of hospitalization proved that 74.16% of patients were hospitalized for less than 5 days. Other busy days were between 5 to 10 days (15.41%) and over 10 days (10.41%). Most referrals were at 6 pm to 12 am (42.5%) and after that respectively 12 am to 6 pm (28.75%), 12 pm to 6 pm (15%) and 6 am to 12 pm (13.75%).

Distribution frequency according to cause of injury shows that motor vehicle accidents with 57.08% are the most common cause; assault with 25% comes next (Table 2).

Among all 240 patients referred to Amin

**Table 1.** Distribution frequency of age according to gender

Gender	Number (Percent)	Maximum age	Minimum age	Mean Age
Male	177 (73.75%)	85	4	27.85
Female	63 (26.25%)	58	3	28.65
All	240 (100%)	85	3	28.78

**Table 2.** Distribution frequency of injury causes according to gender

Cause of injury	Gender		
	Male	Female	All
Motor vehicle accident (%)	116 (84.67%)	21 (15.32%)	137 (100%)
Assault (%)	33 (55%)	27 (45%)	60 (100%)
Fall (%)	16 (51.61%)	15 (48.38%)	31 (100%)
Occupational accidents (%)	5 (100%)	0 (0%)	5 (100%)
Other factors (%)	7 (100%)	0 (.)	7 (100%)
All (%)	177 (73.75%)	63 (26.25%)	240 (100%)

hospital in the year of our study due to oral and maxillofacial injuries, 154 cases had hard tissue injuries along with soft tissue ones (Table 3, 4). These patients consisted of 121 males and 33 females, with 3.69:1 male to female ratio. The most common site of fracture out of 291 sites was in the mid face, which included fractures in the zygomatic bone (24.40%), the maxilla (23.39%), the nasal bone (21.99%), the mandible (21.29%), the orbit (roof, medial and lateral walls and rim) (8.59%) and naso-orbito-etmoidal bone (0.34%). Distribution frequency of zygomatic bone fractures is 15.81% in the zygomatic complex and 8.59% in the zygomatic arch. Distribution frequency of maxillary bone fractures are as follows: body and walls of the maxillary sinus (11.69%), LeFort I (3.09%), LeFort III (2.75%), blow out (2.07%), dento-alveolar fractures (2.07%) and LeFort II (1.72%). In the lower third of face, mandibular body fractures (6.53%) are the most common; other fractures occurred in the condyle (5.15%), parasymphysis (4.81), mandibular angle (2.4%),

dento-alveolar process (1.03%), symphysis (0.69%), ramus (0.34%) and coronoid process (0.34%) (Fig. 1).

Soft tissue injuries consisted of lacerations 39.79%, abrasions 29.42%, contusion 25.95% and avulsion 4.84%. The most frequently injured soft tissue sites were the nose (25.6%), the lip (20.41%), and the chin (17.99%); the cheek and the zygomaticotemporal sites were the least frequently injured (5.19%).

Average length of lacerations was 1.3 cm in the nose, 2.3 cm in the eyelid, 2.31 cm in the lip, 3.6 cm in the chin, 4.25 cm in the cheek and zygomaticotemporal region, 4.33 cm in the oral mucosa; the longest laceration was on the forehead with 7.6 cm.

Distribution frequency of related injuries in patients with hard tissue injuries are respectively as follows: dental (14.28%), orthopedic injuries (9.09%), facial region nerve damage (7.79%), eye injuries (3.89%), thoracic (2.59%) and neck injuries (0.64%).

**Table 3.** Distribution frequency of hard tissue injury sites according to gender

Site of hard tissue injuries	Gender		
	Male	Female	All
Orbit (%)	5.77%	2.82%	8.59%
NOE complex (%)	0.34%	0%	0.34%
Zygoma (%)	17.08%	7.32%	24.40%
Nasal (%)	16.19%	5.80%	21.99%
Maxilla (%)	17.23%	6.16%	23.99%
Mandible (%)	15.74%	5.55%	21.29%
	121 Individuals	33 Individuals	100%

**Table 4.** Distribution frequency of soft tissue injury sites according to gender

Soft tissue injury	Gender		
	Male	Female	All
Avulsion	3.5%	1.34%	4.84%
Abrasion	21.08%	8.34%	29.42%
Laceration	29.41%	10.38%	39.79%
Contusion	19.03%	6.92%	25.95%
	177 Individuals	63 Individuals	100%

In the case of fractures, the chosen type of treatment was close reduction in 63.36% and open reduction in 27.54%. The remaining (9.10%) were discharged without treatment and were only followed up.

## Discussion

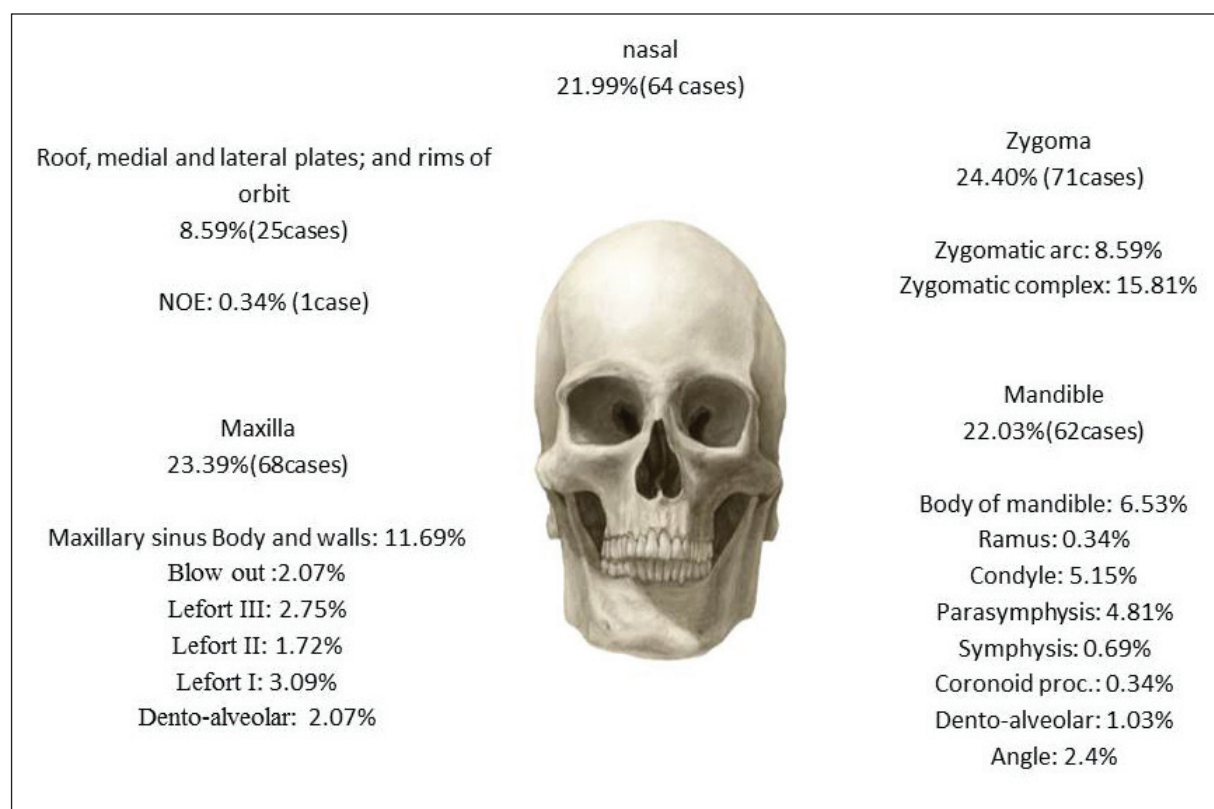
Trauma is one of the causes of death and it is well known that in most patients with multiple traumas, maxillofacial trauma can also occur. Maxillofacial region protects organs responsible for vital functions such as breathing, speaking, chewing, vision and smell. Therefore, special attention should be paid regarding oral and maxillofacial traumas.

The general rule of advanced trauma life support (ATLS) should be conducted for the initial

evaluation of maxillofacial injuries like any other trauma patients. Hence detection of maxillofacial causes is highly valued, and since cultural norms, social and geographical populations affect this assessment, it was decided to conduct the study at Amin hospital, which could provide a good sample of the city population.

According to the latest official enumeration, Isfahan is the third populous city of Iran. Our study was carried out in one of the main hospitals in this city, which is also a center for training of oral and maxillofacial residents.

Identifying the cause and distribution of maxillofacial injuries will help to prevent and treat them. Lots of previous studies had only examined bone fractures, but in this study we assess both hard and soft tissue injuries.



**Fig. 1.** Distribution frequency of hard tissue injury sites.

### Gender distribution

Gender distribution in our study was 74% in males and 26% in females (male to female ratio was 2.8:1). Review of recent studies in different countries shows that injuries are always more frequent in men; it is, therefore, suggested that men are more involved in social activities, and are consequently more exposed to life-threatening factors.

This ratio differs in various studies. In recent years, in studies carried out in the Middle East by *Motamedi*, *Klenk*, *Al Ahmad* et al. and *Mohajerani* et al., male to female ratio was in the range of 4.5:1 to 11:1.<sup>6-9</sup>

This statistics suggest fewer female social roles compared to the opposite sex at that time.

But the ratio of male to female in studies that have been done in recent years is closer to our study. As in the 3-year study of *Park* et al., which was done on 1742 patients referred to Pusan National

University Hospital, Korea in 2015, male to female ratio of 2.5:1 was reported. This reduction of ratio in three years can be a result of an increase in the number of female patients.<sup>4</sup>

*Olusanya* et al. in 2015, *Samieirad* et al. from 2012 to 2014, and *Arsalan* et al. in 2014, assessed oral and maxillofacial injuries in their corresponding societies and reported ratios that are close to the results in our study.<sup>5-7</sup>

So new studies suggest that in recent decades the role of women in the society has increased for socio-economic reasons; hence, male to female ratio is equalizing.

### Distribution of age

In our study, the average age is 28.78 years; that is similar to studies of *Samieirad* et al. with an average age of 20 to 30 years, *Hogg* et al. with an average age of 25 years, *Hernández* et al. with an average age of 21 to 30 years, and *Arabion* et al.

with an average age of 26.6 years; they all report patients in their 20s.<sup>8-14</sup> These results are also similar to the studies of *Adebayo et al.*, *Brasileiro et al.*, *Subhashraj et al.*, *Taher et al.*, *Haug et al.*, *Tanaka et al.* and *Cabrini et al.*<sup>9-21</sup> Mean age of 32.21 years in individuals that were in their 30s was reported by *Olusanya et al.* and in *Arsalan's et al.* study mean age of 40.3 years was reported in individuals that were in their 40s.

This evidence suggests that people in their 20s were more exposed to injurious factors compared to other age groups. As high amount of energy and physical force as well as accidents caused by high-speed motor vehicles is more common in this age group, this matter is somewhat explainable.

In the present study and a study done by *Olusanya et al.* patients below 10 years of age were the less affected group. This lower incidence has been attributed to socioenvironmental, general, physical and craniomaxillofacial anatomic factors in the pediatric age groups including a higher cranial to facial skeleton size, softer and more elastic bones, protective thick soft tissues, and lack of pneumatization of the paranasal sinuses; instead we often have superficial injuries.<sup>5</sup> In the study by *Park et al.*, most patients in the age group under 10 years were admitted with soft tissue injuries.<sup>4</sup>

### **Marital status**

Assessment of marital status showed that 41.40% of patients were married (58 females, 39 males) and 58.59% were single (137 males, 6 females). As could be expected in our culture, in the married group females, and in the unmarried group males, accounted for the highest number of injuries. None of similar studies examined marital status.

### **Seasons, months, days and hours of referrals**

*Samieirad et al.*, *Arabion et al.* and several other researchers in their studies reported October as the most frequent month of referral.<sup>10,14,16,22,23</sup> *Park* and *Hogg et al.* in their separate studies confirmed the same frequency of days and showed that injuries were more common on the weekends (Thursdays and Fridays), followed by Saturdays.<sup>4,12</sup>

In the present study, lots of referrals were

reported in summer and then in winter, which was the same as other reviews. The breakdown in the months of February, March and August was due to a higher proportion of people involved in risky situations such as long distance traveling and physical activities. August, due to summer holidays and the days near the end of the school year, and March, due to New Year holidays and travel had the most numbers of referrals. Few studies were conducted to evaluate the referral distribution by months of the year. Hence we assessed the frequency of days, months and seasons of referrals.

The study by *Olusanya et al.* was the only study that assessed the average days of hospitalization, like the present study does. They stated that the average days of stay were 12.6. In this study, 74.16% of patients were hospitalized for fewer than 5 days, followed by 15.41% patients who stayed for 5 to 10 days, and 10.41% whose hospitalization exceeded 10 days. Similar to a study by *Olusanya et al.*, most days of hospitalization concerned patients with associated injuries in other parts of the body while the shortest hospitalization concerned patients without related injuries.<sup>5</sup> No similar study was found about time of referral to hospital; in our study, most frequent hours were from 6 pm to 12 am (42.5%), 12 am to 6 am (28.75%), 12 pm to 6 pm (15%) and 6 am to 12 pm (13.75%). Most referrals were at the end of the day, which is related to the occurrence of accidents; the most common cause of injuries. It could be related to perilous driving at night, along with fatigue and lack of safety.

### **Cause of injuries**

Review of previous articles suggests that vehicle accident was the most common cause of maxillofacial injuries.<sup>15,20,23-25</sup> But other studies by *Arslan*, *Hussain* and *De matos et al.*, among others, determined assault as being the most common cause of injuries.<sup>11,26,27</sup> Also *Arsalan et al.* state that driving restrictions introduced by the government of Turkey have made assault injuries more prevalent compared with traffic accidents.<sup>11</sup>

*Olusanya et al.* also stated that the most common cause of trauma is motorcycling, and in the case of assault, an armed robbery.<sup>5</sup> *Taher et al.* in

their study reported that the most common cause of fractures in Iranian population is the use of firearms.<sup>18</sup>

### **Site of hard tissue injuries**

The highest and the lowest frequency of complex zygomatic fractures occurrence is in the zygomatic complex (15.81%) and the zygomatic arch (8.59%). The highest frequency of maxillary fractures is in the body and sinus walls of the maxilla (11.69%), and LeFort II (1.72%) is the lowest. In the lower third of the face, the frequency of mandibular body fractures (6.53%) is the highest, and the ramus (0.34%) and the coronoid process (0.34%) have the lowest frequency.

In the studies by *Zandi*, *Simons-Morton* and *Hussain* et al. more frequent fractures were reported in the nasal bone.<sup>26,28</sup> Results of *Adebayo* et al., *Brasileiro* et al. and several researchers revealed the highest prevalence of fractures in the mandible, and then in the nasal bone.<sup>29-32</sup> Likewise in our study, *Li* et al., *Schneider* et al. and other similar studies suggest the zygomatic complex to be the most affected bone.<sup>33-36</sup>

*Hogg* et al. also reported that most fractures occurred in the maxilla and the orbit.<sup>12</sup> *Anbiaie* et al., *Hernández* et al. and some authors state that the mandible is the most commonly fractured bone in their samples.<sup>2,5,14,37,38</sup>

Difference in frequency of fracture sites in various studies can be due to differences in causes of injuries. Advantage of our study like *Arslan* et al., compared to other studies, is in types of radiographs that were used. In this study, axial and coronal CT images were used for a closer look at the fractures.

### **Soft tissue injuries**

In this study, out of a variety of soft tissue injuries, laceration had the highest incidence and abrasions were next. Similarly to *Hussain* et al., *Fasola* et al. and *Ugboko* et al. also reported lacerations as the most common soft tissue injury.<sup>22,26,39</sup>

*Olusanya* et al. pointed out that in one third of patients only soft tissue injuries occurred; contusion and abrasion were the most frequent.<sup>5</sup> As expected, since the most common cause of injury

in this study were accidents in most cases only laceration was present, or they were accompanied by abrasion and contusion.

*Hill* et al. and *Worrall* et al. suggest the upper third of the face as the most common site in soft tissue injuries; they believe that it is due to the prominence of forehead and eyebrows.<sup>40,41</sup> *Samieirad* et al. have reported most soft tissue injuries in the lips and then in the chin, forehead and eyelids.<sup>10</sup>

However, *Olusanya* et al. have reported the cheek and the zygomaticotemporal region as the most common soft tissue injury sites, with almost 50% of them being lacerations.<sup>5</sup>

In our study soft tissue injuries were more common in the middle third of the face. Firstly the nose and secondly the lips were the most commonly reported sites. As the most prevalent hard tissue injuries happen in the middle third of the face (with the highest incidence in the nose), the frequency of soft tissue injuries also confirms it.

*Park* et al. in 2015 only assessed lacerations and suggested that because of the lack of accurate information about the size of lacerations by an expert in oral and maxillofacial surgery, future studies should be conducted for further examination.<sup>4</sup> Accordingly, this study assessed the average length of lacerations. The results were as follows: the shortest on the nose (1.3 cm) and the longest on the forehead (7.6 cm).<sup>4</sup>

### **Related injuries**

Few studies have been done on related injuries. *Olusanya* et al. reported that 15.8% of patients had no related injury, but rest of them had related injuries in other parts of the body including the head and neck, chest, abdomen, and the musculoskeletal system. Among these injuries, the head was the most frequently reported region (44%).<sup>5</sup>

*Arsalan* et al. reported related injuries in 15.3% of patients, most of which were in the upper part of the body (5.8%). The abdominal area was reported the least often (1.6%).<sup>11</sup>

*Gandhi* et al. state that 25.6% of trauma patients have related injuries with the most prevalent being orthopedic ones and in the head area.<sup>41-43</sup> As in



the previous study, *Samieirad* et al. report that orthopedic injuries (47.42%) and cranial injuries (21.64%) are the most common.<sup>10</sup>

We believe that the higher incidence of orthopedic injuries can be a result of accidents as they are the most common cause of injuries.

### Treatment

In studies similar to ours carried out by *Bali* et al., *Ansari* et al. and some other authors, close reduction was reported as the most common type of treatment.<sup>9,10,43</sup> In our study close reduction was performed in 63.36% of cases as well.

*Samieirad* et al., similarly to our study, report close reduction mostly done on nasal and zygomatic arch fractures; second choice of treatment was open reduction, but no treatment has high prevalence of choice.<sup>10</sup>

By comparing the obtained results in similar

studies, we concluded that the geographical location and culture of the studied population could significantly influence findings. Such studies are useful for health care system and their management of each region since epidemiological studies determine injurious situations and people affected by it.

In addition to the evaluation of trauma management, assessing efficacy of treatment and potential problems can lead to more effective treatment interventions in the future. It is noteworthy that the injury should not only be seen as a medical issue, social and economic problems have to be considered as well. Medical costs of treatment of injured patients, damage to individuals, decreased wages because of temporary or permanent disability, often lead to problems in rehabilitation, patients' return to the society and their job position.

### Acknowledgements

To our beloved Professor, late Dr. *Abolfath Hosseinzadeh Namin*, for his unfailing support, unconditional kindness and patient guidance he offered us throughout our studies. Were it not his constant encouragement and confidence in us, the road would have been much less smooth. May his soul rest in peace.

### Podziękowanie

Naszemu ukochanemu nieodżałowanemu Profesorowi, dr *Abolfathowi Hosseinzadeh Naminowi*, w podziękowaniu za niezawodne wsparcie, dobroć i cierpliwą radę, z których korzystaliśmy podczas studiów. Gdyby nie Jego stała zachęta i wiara w nas, droga studiów byłaby bardziej wyboista. Niech Jego dusza spoczywa w spokoju.

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- Received: 7<sup>th</sup> April 2017  
Accepted: 10<sup>th</sup> May 2017