

Maxillofacial Injuries at the Komfo Anokye Teaching Hospital, Kumasi, Ghana: A Preliminary Study

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Abstract

Background: The aetiology and pattern of maxillofacial injuries vary in different parts of the world and even the same country. The purpose of the study was to determine the epidemiology of maxillofacial injuries at a tertiary Hospital in Ghana. **Methodology:** This is a six-month (January to June 2015) prospective study. Information on age, sex, aetiology, injury type etc. was collected using a specialized design data collection form. Data was analyzed using the SPSS 17th version. Ethical approval was obtained. **Result:** The total study sample was 111 with a male to female ratio of 2.5:1. Majority (34.2%) were within the ages of 21 to 30 years. Majority of the victims were urban dwellers. Most of the injuries occurred on the highway (42.3%) and in the evening (35.2%). Only a small percentage (5.4%) of the road traffic crashes (RTC) victims were in some form of protection. Twenty-one (18.9%) of the injuries were intentional, of which 18 (85.7%) were assault. The commonest maxillofacial injury was a combination of soft and hard tissues 72 (64.7%). The commonest cause of maxillofacial soft tissue injuries was RTC, 72.8%. Laceration (55.6%) was the most common soft tissue injury recorded. Mandibular fractures constituted the commonest hard tissue injuries. **Conclusion:** This study has shown that road traffic crashes are the most common cause of injuries to the maxillofacial region. The mandible is the most frequent site of fracture, while the commonest soft tissue injury is laceration. Majority of the victims were young energetic males and adherence to road traffic regulations was very low.

Keywords

Maxillofacial, Injury, Road Traffic Crash, Mandibular, Le Forte, Fracture

1. Background

The maxillofacial region is the most unprotected part of the body and hence vulnerable to injuries which may vary from minor soft tissue injuries to a combination of soft and hard tissue injuries. Soft tissue injuries, whether isolated or in combination with other injuries, are among the most common traumatic craniofacial injuries encountered in emergencies. These injuries account for nearly 10% of all emergency department visits [1] [2] [3]. Unfortunately, very few studies of maxillofacial injuries include soft tissues.

Findings from epidemiological surveys from across the world on maxillofacial injuries vary from country to country and even within countries. These are influenced by the socioeconomic status and cultural practices of the study population [3] [4] [5].

Various studies from the globe have shown that, etiological factors of maxillofacial injuries also vary and are dependent on geographical location. In the USA, more than three million facial injuries occur every year and the leading cause is assault. This is also true for other developed countries, such as Canada, Australia, and Germany [6] [7].

The story is different in Africa and the West African sub-region where Road Traffic Crush (RTC) is the leading cause of maxillofacial injuries [1] [5]. However, a recent study by Fasola *et al.* in Nigeria saw an increasing trend in injuries resulting from assault, falls and sports [8].

The causes and pattern of maxillofacial injuries within a community can provide a guide to the design of programmes geared towards prevention and treatment. The pattern of these injuries depends on the mechanism of injury, magnitude and direction of impact force and anatomical site [5] [6] [9].

In Ghana, even though there are limited studies on maxillofacial injuries in general, such studies reveal RTC as the commonest etiological factor. A preliminary study by Parkins *et al.* on at the Korle-Bu Teaching Hospital revealed a similar trend as other African countries [10].

However, a periodic study of the etiological factors for maxillofacial injuries helps to assess the effectiveness of road traffic safety measures within various part of the country. The purpose of this study was to determine the prevalence of maxillofacial injuries at the Komfo Anokye Hospital (KATH), Kumasi, Ghana, a tertiary referral and a teaching hospital that serves the middle and the northern belts of Ghana.

2. Study Method

This was a six-month prospective study of maxillofacial injuries (thus physical trauma to the face which may include soft, bony tissues or both) seen at KATH. The data was collected from the accident and emergency and the oral and maxillofacial surgery units of the hospital. Ethical approval for the study was by the KATH/KNUST Committee for Human Research Publications and Ethics.

A specially-designed data collection form was used. Information on age, sex,

etiology, injury type and severity of the injury was obtained from victims of injury. All patients with maxillofacial injuries that reported to KATH Accident and Emergency Department and the Maxillofacial Unit during the period under study were included.

The following patients were excluded from the study:

- 1) Patients with burn injuries.
- 2) Patients who at the time of examination had expired.
- 3) Patients who were treated elsewhere and referred to KATH for management of complications.

Data collected was entered onto Epi info data 3.1 database and cleaned by running programmes on legal values and consistency checks. The data was then exported to the Statistical Package for Social Sciences (SPSS 17th version) for the final analysis. Descriptive statistics was used to summarize and display results in tables and charts. Chi square and correlation or regressions was used to find the association between categorical and continuous variables respectively. The testing of the hypothesis of the study was set at 95% confidence interval (CI) and significance level of $p < 0.05$.

3. Results

3.1. Demographics

The total number of injury victims studied was 111 comprising 79 males and 32 females with a male to female ratio of 2.5:1, mean age of 27.9 years and standard deviation of 13.00. The minimum age was 3 years and the maximum was 70 years with majority (34.2%) of the patients being within the age range of 21 to 30 years. Urban dwellers made up 65% while the remainders were rural settlers. The vast- majority of the victims had basic and/or secondary education, with middle/junior high school (JHS) being in the majority i.e. 27.9%, followed by secondary 25.2%, then primary 23.4%. Those with tertiary education constituted 8.1% and while those with no education made up 13.5% of the injured. Regarding employment/occupation status, unemployed persons and students had the highest frequencies of 18 and 17 respectively. Farmers, petty traders, artisans and civil/public servants were also among the injured.

Motor Vehicle Crash (MVC) was common among the age groups of 21 - 30 years and 31 - 40 years constituting 47.1% and 23.5% respectively. Pedestrian knockdown (PK) was found to be common for the age groups <10 years and 11 - 20 years, being 40% and 20% respectively. Motor Cycle Crash (MCC) was most common among the 21 - 30 years age group followed by the 31 - 40 years age group. Bicycle Crash (BC) was predominant among the 21 - 30 years age group constituting 50% followed by the age group 11 - 20 years with 33.3%.

Falls were common for the age groups 21 - 30 years and 31 - 40 years with 28.6% each affected. Assault was found common among the age group of 11 - 20 years and 41 - 50 years with 22.2% being affected in each age group.

3.2. Aetiology and Circumstance of Injury

Most of the injuries occurred on the highway (42.3%) and in the evening (35.1%). Only 5.4% were of the RTC victims wore some form of protection. Twenty-one (18.9%) of the injuries were intentional, out of which 18 (85.7%) were due to assault (**Figure 1 & Figure 2**).

3.3. Pattern of Injury

The commonest maxillofacial injury seen was a combination of soft and hard tissues 72 (64.7%). Road traffic crash was responsible for most (72.8%) of the soft tissue injuries, followed by assault (16%). Laceration was the most common soft tissue injury recorded with the major aetiological agent being MVC. However the major aetiological factor for the second most common soft tissue injury seen *i.e.* Abrasion was MCC.

Hard tissue injuries of the face were divided into upper, middle and lower third. The most frequently affected site was the lower third. Seventy-five percent of the upper third fractures were frontal bone/sinus fractures, while orbital and

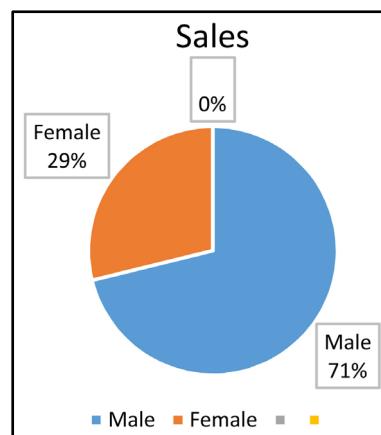


Figure 1. Gender distribution. Gender distribution with male to female ratio of 2.5:1.

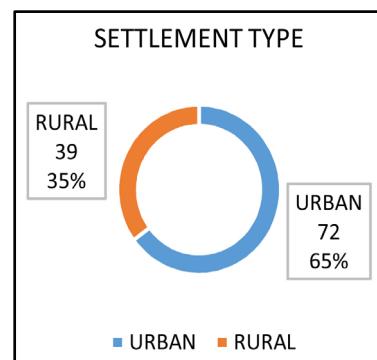


Figure 2. Settlement type. Almost two thirds 72 (65%) of the population under study were urban settlers.

sphenoidal fractures were 8.3% each.

Among the middle third fractures Le Fort 1 fracture was the most common, followed by zygomatic bone fracture. Parasymphyseal fracture was the most common in the mandible constituting 44.2%. Condylar fractures were the least encountered.

MVC and Assault were the commonest causes of Le Fort I fractures, and parasymphyseal fractures. The commonest cause of zygomatic fractures was Motor Cycle Crash. Assault was the main aetiology for frontal bone fractures. MVC and MCC were the most common mechanism of injury for Le Fort III maxillary fractures, and body fractures of the mandible.

4. Discussion

The findings from this study reveal that, the most common maxillofacial injury at KATH is the combination of soft and hard tissue, with road traffic crash (RTC) being the commonest aetiological factor. Lacerations were the most common soft tissue injuries and mandibular fractures accounted for majority of hard tissues injuries. Most of the victims were between the ages of 21 and 30 years, most of whom were males.

Epidemiological studies worldwide have revealed that age and sex are important factors that influence the occurrence of maxillofacial trauma [11] [12]. Recent data indicates a 3:1 male: female incidence ratio worldwide [5]. Similarly, majority 71% of the population under study were males with the male to female ratio being 2.5:1 which confirms that males are more at risk than females. The high frequency of males may be due to their greater participation in high risk activities which increases their exposure to risk factors such as driving vehicles, sports that involve physical contact, an active social life and drug use, including alcohol consumption.

The present study shows that majority (34.2%) of those with maxillofacial injuries were between the ages of 21 to 30 years, followed by those aged 31 to 40 years (20.7%), while the lowest incidence was found in the extreme age groups, above fifty years (3.6%) and below five years (11.7%) (**Table 1**). These findings are consistent with previous studies [11] [13]. However, some other studies, have shown that, the dominant age groups with a high incidence of injury were 0 - 10 years and 11 - 20 years respectively [11] [14] [15]. The possible reasons for the higher frequency of maxillofacial injuries in the third and fourth decades may be due to the fact that people in this period of life are more active and are more likely to engage in sports, fights, violent activities, industrial work and high speed transportation.

This study showed that most of the injured were urban dwellers (65%) (**Figure 2**). This may be as a result of the brisk activities, increased vehicular traffic, industrial activities and population density of the urban centers. Most of the population under study was unemployed (16.2%) and school going age 15.3%. Majority (65.8%) had no formal education or had only basic level education,

Table 1. Age distribution.

Age Range	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<10	12	10.8	10.8
	11 - 20	19	17.1	27.9
	21 - 30	38	34.2	62.2
	31 - 40	23	20.7	83.8
	41 - 50	14	12.6	96.4
	51 - 60	1	0.9	97.3
	61+	3	2.7	100.0
Total		111	100.0	100.0

Age distribution ranging from 3 years to 70 years with majority of them within 21 to 30 representing 34.2%, followed by 31 to 40 age group with 23 representing 20.7%. The least frequency was within the age 51 to 60.

accounting for the low socioeconomic status of the victims. Interestingly only five of the injured (4.5%) were drivers, suggesting that majority of the patients with maxillofacial injuries were a mixture of passengers on mass or commercial transport and pedestrians (**Figure 3 & Figure 4**).

Amongst the demographic factors, gender and religion were found to be statistically significant factors that influenced the occurrence of maxillofacial injuries with p-values 0.01 and 0.004 respectively (**Table 2**). The significance of gender as a predictor of maxillofacial injuries is a true reflection worldwide [10] but religion might differ from place to place depending on the dominant religion of the particular study population. Even though age and settlement showed an association with the occurrence of maxillofacial injuries, they were not statistically significant. A similar study of a longer duration and with a larger sample size may be required to validate this finding.

It was observed that in 42% of the patients, the injuries occurred on the highway, while others occurred on the streets of towns, in homes, at work places, on the farm/bush and at recreational/school sites (**Figure 5**). The higher frequency of the injuries occurring on the highways and streets explains why RTC were the most common cause of maxillofacial injuries. In Ghana, this could be attributed to the poor state of roads and poor quality of public transportation.

The finding that the frequency of occurrence of maxillofacial injuries increased from night to evening (**Figure 6**) may be attributed to the fact that, vehicular activities increase gradually from the morning to the evening and slow down or cease in the night. Furthermore, drivers are most often alert in the morning. Sometimes commercial drivers in their efforts to beat time and increase their earnings take no rest during the day and get exhausted hence lose concentration towards the evening leading to more crashes.

In this study, RTC (motor vehicle crash, motor cycle crash, bicycle crash and knock down) was the leading cause of maxillofacial injuries. Out of the seventy-eight injured patients 43% were as a result of motor vehicle crash, 36% for

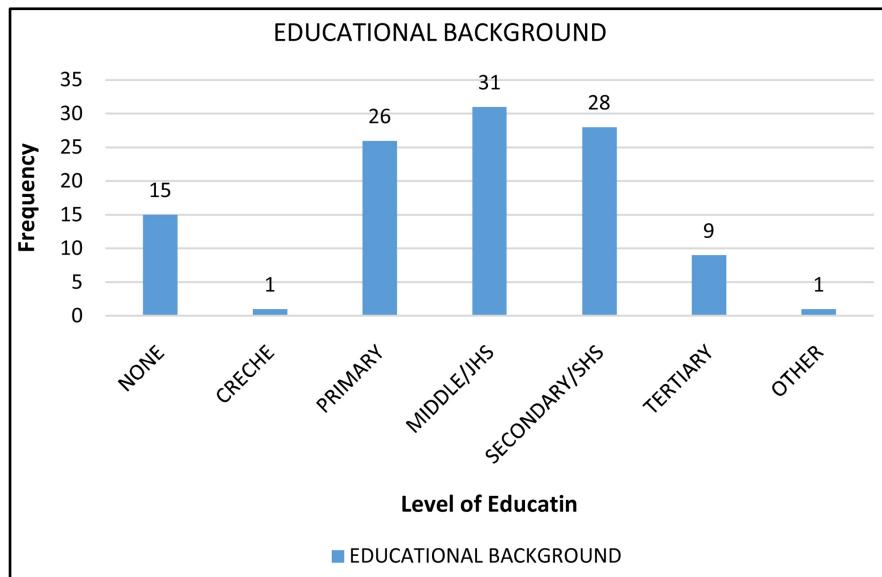


Figure 3. Educational background. The educational background of the population shows that those with middle/JHS level of education were the majority 31, followed by secondary 28, then primary 26. Tertiary was 9 and no education was 15.

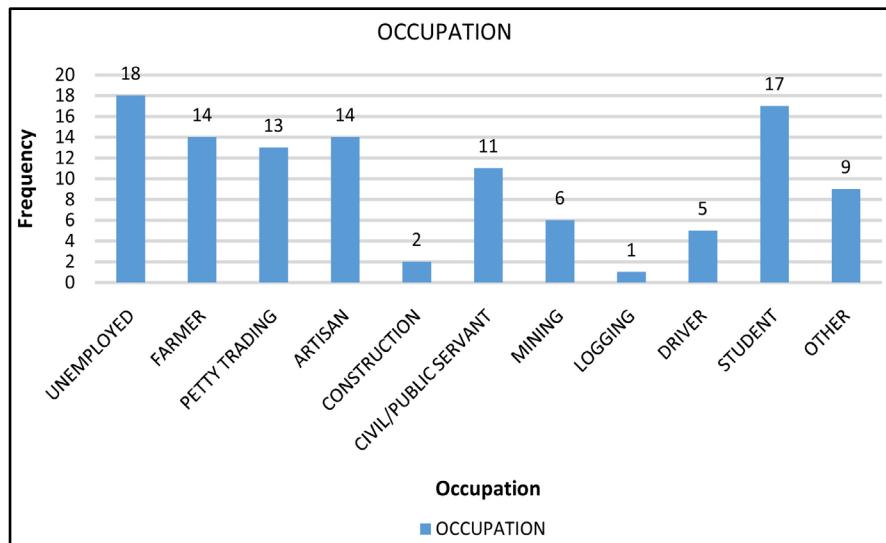


Figure 4. Occupation. Majority of the population were unemployed and student with frequency of 18 and 17 respectively. Farmers, petty traders, artisans and civil/public servants were in the middle belt with 14, 13, 14, and 11 respectively.

motor cycle crash, 8% for bicycle crash and 13% were pedestrian injuries (**Table 3**). Assault (16%) ranked as the second most common cause of maxillofacial injuries at KATH. This supports other studies in Ghana, the West African sub region, Africa and other developing countries [1] [5] [7] [11] [13] [15] [16]. By contrast, a recent study by Teshome *et al.* in North West Ethiopia found interpersonal violence as the major cause of maxillofacial injuries [14]. Some studies from developed countries, with improved environmental, socioeconomic conditions, and proper enforcement of road traffic protective regulations and rules,

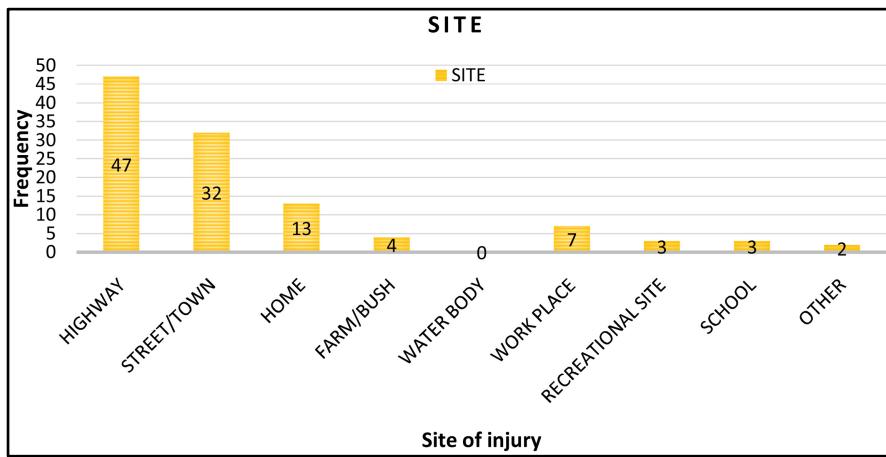


Figure 5. Site of accident/crash. In 42% (47) of them the injuries occurred on the Highway with followed by Street/Town 28.8%. Home and work place were the next with 13 and 7 respectively. Farm/Bush was 4, whiles recreational site and schools were 3 each. There was recorded incident on water body.

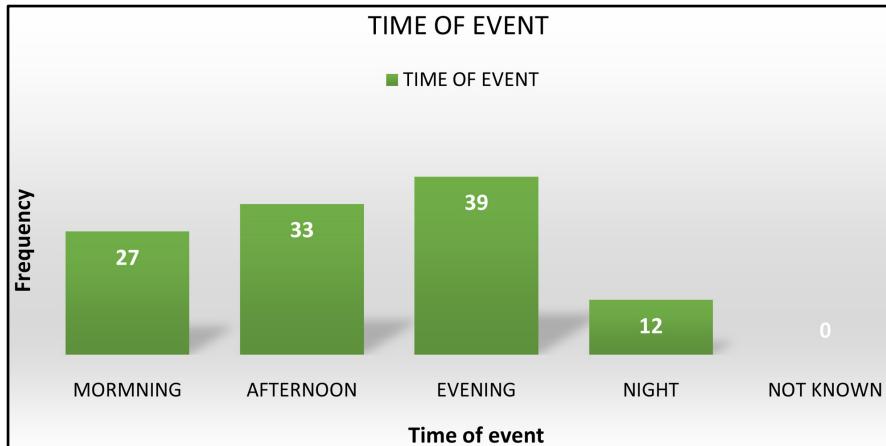


Figure 6. Time of occurrence. Majority of the events leading to maxillofacial injuries occurred in the evening with 39 (35.1%) followed by afternoon 33 (29.7%), then morning 27 (24.3%) with the least occurring at night 12 (10.8%).

Table 2. Demographic variables and chi-square test of hypothesis.

Demographic variables	Pearson Chi-square value	P-value
Age	74.24 ^a	0.157
Gender	20.19 ^a	0.010
Education	48.32 ^a	0.460
Occupation	92.24 ^a	0.358
Settlement	11.89 ^a	0.156
Religion	46.44 ^a	0.004

show that assault is now the leading cause of maxillofacial injuries [13] [16] [17] [18]. The differences in aetiological factors between developing and developed countries may be attributed to the differences in socioeconomic factors, national

Table 3. Mechanism of Injury.

Cause of Injury	Frequency	Percent
Motor vehicle crash	34	30.6
Pedestrian knockdown	10	9.0
Motor Cycle crash	28	25.2
Bicycle crash	6	5.4
Gunshot	1	0.9
Fall	7	6.3
Assault	18	16.2
Bite	2	1.8
Sports	4	3.6
Unknown	1	0.9
Total	111	100.0

The most common cause of maxillofacial injuries was MVC 34, followed by MCC 28. Assault was the third most common cause 18 followed by Pedestrian knock down 10. Fall 7, BC 6 and sport 4 came 4th, 5th and 6th respectively. The least was gunshot 1. Two human bites was also recorded. Together Road Traffic Crash (MVC, MCC, BC and PK) constituted 77% of all the mechanism of maxillofacial injuries. Followed by Assault 18%.

infrastructure (particularly roadways, traffic regulations and legislation), and other behavioural practices and checks such as alcohol consumption and policing. It was interesting to note that, majority (60%) of the pedestrian knockdown victims were female and most (40%) of them were below the age of 10 years (**Table 4**). It is very common in Ghana to see children, mostly girls, within this age group selling by the road side and in traffic or crossing busy streets by themselves and this may have contributed to the higher frequency of pedestrian knockdowns in this age group.

Soft tissue injuries, may present as isolated injuries or in combination with other injuries. In this study, it was revealed that soft tissue injuries with or without hard tissue injuries constituted 95% of maxillofacial injuries that presented at KATH for the period under review (**Table 5**). Despite the high incidence of maxillofacial soft tissue injuries, there is no reported systematic review of maxillofacial soft tissue injuries in Ghana. However, the findings from the present study are similar to that reported by Hussain HM *et al.* [19]. However, motor vehicle crash was the most frequent cause (29%) followed by motorcycle (27%) (**Table 6**), which differs from the findings of Hussain *et al.*, where motorcycle accident was the most common cause. This difference may be due to the differences in the preferred mode of transport in the two populations.

In the present study, laceration was found to be the most common maxillofacial soft tissue injury. Out of the 135 soft tissue maxillofacial injuries recorded 56% were lacerations, 24% were abrasions, 12% were avulsions and 8% were contusions (**Figure 7**). This is concordant with previous studies by, Sudhashraj K *et al.* and Zargar M. *et al.* in India, [20] [21] but differ from a study from East Delhi, India [22] where abrasions and contusions were more common. The

Table 4. Gender distribution and cause of injuries.

Gender	MVC	PK	MCC	BCC	GUNSHOT	FALL	ASSAULT	BITE	SPORTS	UNKNOWN	TOTAL
MALE	22	4	25	5	1	7	9	2	3	1	79
FEMALE	12	6	3	1	0	0	9	0	1	0	32
TOTAL	34	10	28	6	1	7	18	2	4	1	111

Table 5. Type of injury.

Injury	Frequency	Percent
Soft tissue	33	29.7
Hard Tissue	6	5.4
Both	72	64.9
Total	111	100.0

The common maxillofacial injury was a combination of soft and hard tissues 72 (64.7%). Soft tissue only was 33 (29.7%) whiles hart tissue only was 6 (5.4%).

Table 6. Distribution of soft tissue injury and mechanism of injury.

Mechanism of injury	Number presenting with soft tissue injury	N%
Motor Vehicle Crash	30	29
Pedestrian Knockdown	10	9.6
Motor Bike Crash	28	27
Bicycle crash	5	5
Gunshot	1	0.9
Fall	6	5.8
Assault	17	16
Bite	2	1.9
Sports	4	3.9
Unknown	1	0.9
Total	104	100

The common cause of maxillofacial soft tissue injuries was RTC. 72.8%, followed by assault resulting is 16% of the maxillofacial soft tissue injuries. Of the RTCs, MVC was the major aetiological factor causing 30 of the soft tissue injuries followed by MCC 28, PK 10 and BC 5.

difference may be due to varying aetiological factors prevailing within a particular period and environment.

Furthermore, the results of this study show that MVC was the commonest cause of laceration, avulsion and contusion while MCC was the commonest aetiological factor for abrasion. The findings from this study agree with other studies within the sub-region that human bite is the commonest maxillofacial bite injury. Studies conducted in Ghana, Zimbabwe, Nigeria and Papua New Guinea have shown that human bite is common and in most instances the assailant is a

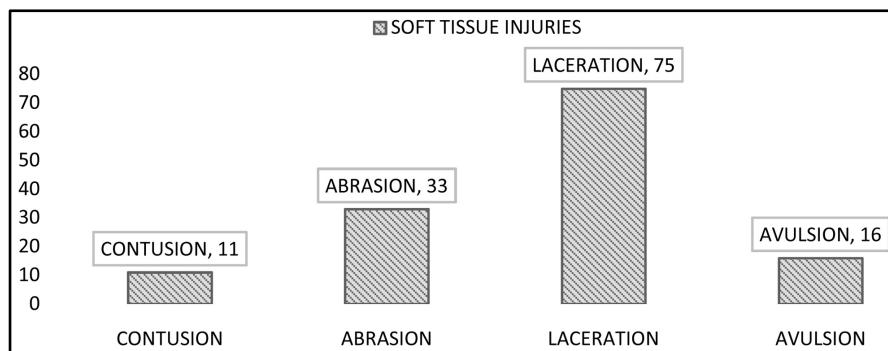


Figure 7. Soft tissue injuries.

person known to the victim [23] [24] [25]. The reason why there were no animal bites recorded may be a result of the short duration of this prospective study. It is likely that a study of a longer duration with a larger sample size may present different results.

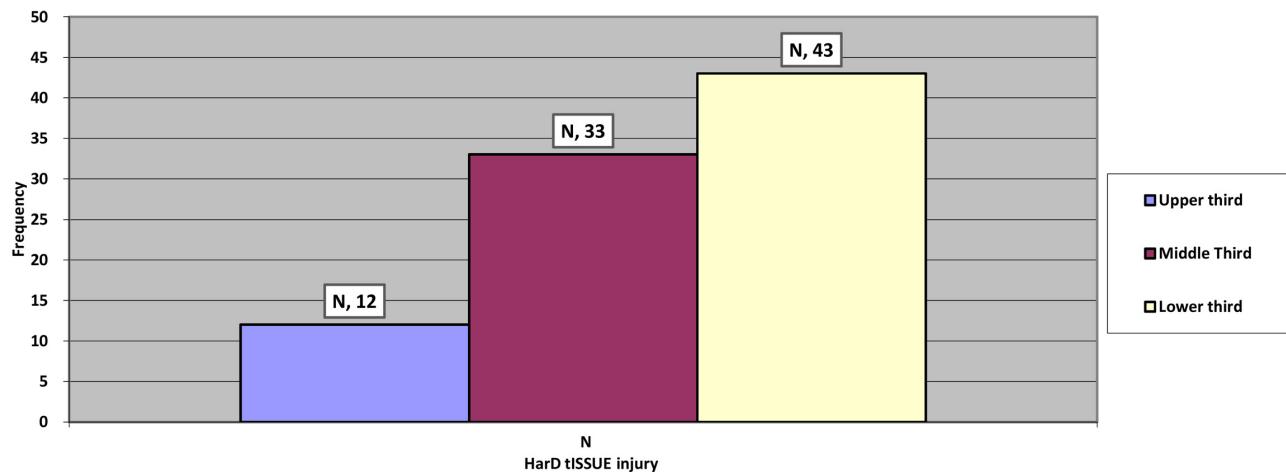
This study showed that 64.9% of victims sustained a combination of soft and hard tissue injuries, with 29.7% sustaining soft tissue injuries only and 5.4% sustained hard tissue injuries only (**Table 5**). The most common mechanism of injury was MVC. This agrees partly with a study by Ogundipe O.K and Afolabi A [11] in Nigeria involving 664 patients. In their study, most patients (50.4%) sustained a combination of skeletal, dental and soft tissue injuries. However, the most common aetiological factor was motorcycle crashes.

The lower third (mandible) was found to be the site most frequently affected (48.3%) followed by the middle third (37.9%) with the upper third (18.8%) being the least affected area in this present study (**Figure 8**). A similar pattern was also demonstrated by Parkins *et al.* [10] in a 3-year retrospective study of 68 cases of maxillofacial injuries which were seen in the oral surgery department of the Korle-Bu Teaching Hospital Ghana. Forty-five percent (45%) had mandibular fracture followed by maxilla 20% then zygoma, 16.8% and nasoethmoidal complex 3.5%.

Even though there are a lot of studies on maxillofacial fractures, very few include upper third fractures. Frontal bone fractures constituted 75% of the upper third fractures. Le Fort I fractures twelve (51.5%) were the most common mid-face fractures, followed by zygomatic arch fractures nine (36.4%).

Parasymphyseal fractures were the most common (44.2%) of the lower third fractures, followed by the body of the mandible (30%). This agrees with other studies [26] [27] [28] that parasymphyseal fracture pre-dominates over other sites of the mandible.

Previous studies have indicated that, in maxillofacial injuries the ratio of mandible to zygomatic to maxillary fracture is 9:4:1.3 [29]. This pattern ratio was different from what was observed in this study with mandible to zygomatic to maxilla being 3.6:1:1.4. The differences in this ratio could be attributed to the differences in the mechanism of the injuries.

**Figure 8.** Distribution of hard tissue injuries.**Table 7.** Distribution of mechanism of injury and type of fracture.

	MHC	PK	MBC	BC	GS	FALL	ASSAULT	BITE	SPORT	UNKNOWN	TOTAL
FRONTAL BONE	1	1	2	0	1	0	4	0	1	1	11
ORBITAL BO	0	1	0	0	0	0	0	0	0	0	1
ORB-SPH	0	0	0	0	0	0	0	0	0	0	0
FRN-ORB CPX	0	0	0	0	0	0	0	0	0	0	0
LEFORTE I	7	0	3	0	0	0	7	0	0	1	18
LEFORTE II	1	0	0	0	0	0	0	0	0	0	1
LEFORTE III	3	0	3	0	0	0	1	0	1	1	9
ZYGOMATIC BONE	5	0	8	0	0	0	0	0	0	2	15
SYMPHYSEAL	1	0	0	0	0	1	1	0	0	0	3
PARASYMPHYSEAL	7	0	7	1	0	0	3	0	0	1	19
BODY	5	0	5	0	0	2	1	0	0	0	13
ANGLE	0	0	0	0	0	2	1	0	0	0	3
CONDYLE	0	0	0	0	0	0	1	0	0	0	1
COMMUNITED	1	0	0	0	0	0	0	0	0	0	1
PANFACIAL	1	0	0	0	0	0	0	0	0	0	1
DENTOALVEOLA	1	0	0	0	0	1	0	0	0	0	2
TOTAL	16	0	12	1	0	6	19	0	0	1	55

MVC and Assault were the common causes of Leforte I, and a Parasympphyseal fractures with 7 each. The common cause of Zygomatic fractures was MBC 8 followed by MCC.5. Assault was the main aetiology for frontal bone fractures 5. MVC and MBC were the common mechanism of injury for Leforte III, 3 each and body fractures of the mandible 5 each.

Adi. M and co-workers (1990) [29] audited the distribution of site of mandibular fracture and its relationship to aetiology. In their study they demonstrated that RTC caused more parasympphyseal fractures followed by the mandibular body; and falls were associated with more condylar fractures while physical assaults produced more parasympphyseal and angle fractures. They again reported

that the most common bone of the facial skeleton that fractured other than the mandible was the zygomatic bone. In contrast with Adi M *et al.*, the most common bone other than the mandible to fracture was the maxillary bone at KATH. Again assault caused more Le Forte 1 fractures just as motor vehicle crush and assault caused more frontal bone fractures followed by body and angle of the mandible (**Table 7**). However, it was similarly observed that road traffic crash was the leading cause of the maxillofacial hard tissue injuries that presented at KATH. This was in contrast to a study by Copcu E and colleagues [30] who demonstrated that assault victims had a higher frequency of angle fractures; those sustaining sports related injuries had subcondylar and angle fractures, while fall victims had subcondylar and parasymphyseal fractures. These differences again may be attributed to the varying aetiological factors.

Mandibular fractures seem to have the highest frequency across several studies even though other studies have reported mid face fractures as the more frequent site [31]. This may be attributed to the fact that the mandible is the most prominent and only freely movable maxillofacial bone and hence stand a high risk of fracturing than the other facial bones which are well fixed and stable.

5. Conclusion

This study has shown that young males are most commonly affected by maxillofacial injuries seen at KATH and the mandible is the most frequent site of fracture. Road traffic crash accounts for the majority of the injuries. Soft tissue injuries were common with lacerations being predominant. Adherence to injury prevention and road safety measures appeared was very low.

Abbreviations

MVC, Motor Vehicle Crash; MCC, Motor Cycle Crash; BC, Bicycle Crash; PK, Pedestrian Knockdown.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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