

THE PATTERN OF DENTAL INJURY, INCIDENCE OF DENTAL CARIES AND DENTAL TREATMENT NEED AMONG MOTORCYCLE CRASH VICTIMS IN TANZANIA

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ABSTRACT:

Background: In motor traffic crashes, traumatic dental injuries and status of dentition is often overlooked. In most instances management of dental injuries require intact supporting dental tissues, however, in presence of dental caries the treatment may be complicated. This study aimed at determining the incidence of dental injury and dental caries, and the dental treatment needs among motorcycle crash victims in Tanzania.

Methodology: This was a hospital based cross-sectional study that included a total of 115 patients who were either drivers or passengers during motorcycle crash. The patients were examined and investigated for maxillofacial injuries, dental trauma and dental caries and treated accordingly. The data was analyzed using Statistical Package for Social Sciences (SPSS) Version 19 and statistical significance was set at p-value of <0.05.

Results: The incidence of dental trauma (DT) and positive caries experience (PCE) was 38.3% and 33.9% respectively, with males being exclusively affected. The mean number of teeth affected by dental trauma was 1.97 ± 3.9 . The anterior dentition was frequently affected (88.6%). The commonest types of dental injuries were avulsion, subluxation and lateral luxation. The mean DMFT was 1.66 ± 0.48 . Majority, 79.7% of the patients with DT and PCE needed dental treatment. The most common treatment modality was provision of prosthesis.

Conclusion: The findings of this study revealed that considerable number of motorcycle crash victims do suffer from dental injuries, and the caries experience among them is considerably high.

Keywords: Dental trauma, Dental caries, Treatment need, Motorcycle crash.



INTRODUCTION:

Motor traffic crashes related to motorcycles have been representing an epidemic for current societies in the developing world, and consequently, considering the rate of morbidity and mortality it causes, they have become a public health problem.^[1] Several studies from different parts of the world have reported an increase in road traffic crashes associated with motorcycles in recent times.^[1-5]

In recent years, motorcycles have become a common means of transport in many parts of Tanzania, be it in a rural or urban setting. Apart from commercial transportation use of motorcycles commonly referred to as 'bodaboda' in East Africa, actually meaning border to border, few individuals use them as private means of transport. The use of motorcycles has been influenced by several factors like low cost of purchase, less fuel consumption, and low

maintenance cost compared to cars. Other reasons like the fast nature of motorcycles thus avoiding traffic congestion, ease of navigation within poor road networks in unplanned urban settings, and the ease of learning how to ride a motorcycle have played a major part for their popularity.^[5]

Being one of the most exposed parts of the human body, the oral and maxillofacial region is vulnerable to varying degrees of injuries when the individual is subjected to crashes.^[6] The injuries that occur in this region may involve any structure including either hard or soft tissues. Among the hard tissue injuries, traumatic dental injuries are often overlooked. Dental injuries commonly occur during sports participation,^[7,8] however, traffic crashes also account for considerable proportion of such injuries.^[9] Most dental injuries affect the anterior teeth, especially the maxillary central and lateral incisors which can have physical, esthetic, and psychological impacts.^[10] Studies have shown that males experienced traumatic dental injuries at least twice as often as females.^[11]

Management of injured hard dental tissue includes extraction, endodontic treatment, and restoration of lost tooth tissue.^[11] For the injuries involving periodontal tissues, the treatment options are splinting of the teeth, extraction, re-implantation of tooth, and prosthesis.^[12]

Management of oral and maxillofacial injuries such as dental trauma and fracture of the mandible includes splinting and maxillomandibular fixation. These treatment modalities require an intact dental tissue, however, the dental tissue may have been affected by dental caries, consequently making the treatment complicated. In addition to that, with missing teeth, the management of those fractures that could be done by closed reduction becomes complicated as well. In some incidences, the carious teeth may develop infection and consequently, this may hinder healing of the bone.

Dental caries is one of the most common infectious multifactorial non-communicable disease that is characterized by progressive demineralization of the tooth, secondary to the action of bacterial acid metabolism.^[13,14] Although caries was not taken to be a major problem in Africa, there is now evidence of an increase in prevalence of dental caries in the continent.^[13,15]

In Tanzania several studies have been done regarding the incidence of oral and maxillofacial fractures in motorcycle crash victims, however, this is the first study that reports on dental injuries and dental caries status of the individuals involved in motorcycle crashes.

The aim of this study was therefore to determine the incidence of dental injury and dental caries, and the treatment need among motorcycle crash victims

attended at Muhimbili National Hospital in Tanzania.

radiographs and/or Computer Tomography Scan (CT- scan).

MATERIALS AND METHODS:

This was a descriptive, cross-sectional hospital-based study that involved motorcycle crash victims who had sustained oral and maxillofacial injuries and attended treatment at Muhimbili National Hospital (MNH) from December 2015 to November 2016. These victims were either drivers or passengers during the crash.

All the motorcycle crash victims were received, physically examined, and investigated for maxillofacial, dental trauma and dental caries. All the patients who had dental caries, dental trauma and maxillofacial injuries and who had consented were included in the study. These were interviewed using a specially designed questionnaire to obtain sociodemographic data, patient's complaints, causes of injury and associated symptoms, followed by thorough clinical (extra oral and intraoral) examination. Physical examination was done in the dental outpatient clinic while the patient was seated on a dental chair using natural or artificial light or in the ward while the patient was lying on the bed using also natural or artificial light. The clinical findings from the patients were then recorded in a special predesigned clinical form. Radiological investigations were ordered to aid in diagnosis. The investigations included conventional

Traumatic dental injuries were classified into trauma to the hard dental tissues and the pulp, and the periodontal tissues.^[11] While injuries to the hard dental tissues and the pulp included enamel infraction, enamel fracture, enamel- dentin fracture, complicated crown fracture uncomplicated crown-root fracture, complicated crown-root fracture and root fracture; injuries to the periodontal tissues included concussion, subluxation, extrusive luxation, lateral luxation, intrusive luxation, and avulsion.

Examinations for dental caries were carried out using the WHO standard criteria and procedures.^[16] Information on the Decayed, Missing and Filled Teeth Index (DMFT) was then derived directly from the data.

Depending on the final diagnosis, the treatment was planned. Teeth that had advanced caries, root fracture, or were in fracture line and were likely to impair bone healing were extracted. Endodontic treatment was offered to teeth that had intrusive or lateral subluxation injuries after successful splinting was accomplished, and also to teeth with crown fractures with pulp involvement, and those teeth which were diagnosed to have irreversible pulpitis. Simple restorations were done to those teeth which had crown fracture without pulp involvement and dental caries without signs of pulpitis. Prosthesis (dentures) was provided to patients who had

avulsed teeth or had undergone extractions during treatment. The delivery of dentures was done once healing had occurred as part of rehabilitation.

The data obtained from this study was entered into the computer and analyzed using Statistical Package for Social Sciences (SPSS) software Version 19. Cross-tabulation was done for categorical variables. Statistical significance testing was done using Chi-square test (X^2) whereby $p < 0.05$ was considered as statistically significant. Permission to conduct this study was sought through the department of Dental services, MNH.

RESULTS:

The study included a total of 115 patients who had been involved in motorcycle crashes either as drivers or passengers. Almost all the patients were males 112 (97.4%) with a male to female ratio of 37.3:1 and their age ranged from 14 to 66 years (mean age = 29.43 ± 8.88 years). The age group 20-29 years was the most affected with 59 (51.3%) patients followed by the age group 30-39 years with 34 (29.6%) patients. Patients aged 50 years and above were the least affected group. When age was dichotomized, the individuals aged less than 30 years were the most affected [Table 1].

More than half of the patients 66 (57.4%) had primary school education while those with secondary education and above were 39 (33.9%) and only 10

(8.7%) of the participants had no formal education (Table 1). Majority 60 (52.2 %) patients were employed by private companies followed by 19 (16.5%) patients who were doing business. About 74 (64.4%) patients with secondary school education and above were either civil servants or employee in private companies.

Regarding the environment where motorcycle crashes occurred, this study revealed that more than three quarters of patients got crashes while travelling on tarmac roads. Majority 88 (76.5%) of crash victims in this study were themselves the drivers during the occurrence of the crashes.

Trauma status of the dentition

Forty four (38.3%) patients, all males, had trauma to the dentition ranging from 1 tooth to all 32 teeth with a mean of 1.97 ± 3.9 teeth. More than a half (53%) of the victims with dental trauma lost 1 to 6 teeth each, while the remaining participants lost 7 or more teeth each [Figure 1].

The association between occurrence of dental trauma and age groups, status of the road, use of helmets, and fall from the motorcycle among the patients who sustained injuries during motorcycle crashes was not statistically significant ($p > 0.05$).

Among the 44 patients who had trauma to the dentition, 40.9% ($n=18$) of them had injury to the teeth on both upper and lower jaws while those who had

injury to either maxillary or mandibular teeth only were 16 (36.4%) and 10 (22.7%) patients respectively. Trauma in both jaws affected the anterior teeth in 39 (88.6%) patients and posterior teeth in 18 (40.9%) patients. The difference in occurrence of dental injury between anterior teeth and posterior teeth in the maxilla was statistically significant ($p < 0.05$), while it was statistically insignificant ($p > 0.05$) in the mandible.

Almost all 34 victims except one who had sustained dental trauma to the upper jaw had their teeth in the anterior segment traumatized compared to only 9 victims who had teeth in the posterior segment affected. On the other hand, there were 28 victims of motorcycle crash who sustained dental trauma to the lower jaw, of whom 24 had dental trauma in the anterior segment and 14 had dental trauma involving the posterior segment. The difference in mean number of injured teeth between anterior and posterior teeth was statistically significant ($p = 0.000$). The most common type of dental trauma was tooth avulsion followed by subluxation and lateral luxation while root fracture was the least type of dental trauma encountered [Table 2].

The central incisors were the most commonly affected teeth followed by lateral incisors in both jaws. The trend on dental trauma was observed to depend on the anatomical location of the tooth in the jaw, whereby, as one moved posteriorly, the frequency of occurrence of dental trauma decreased. The anterior

teeth were more affected in the maxilla, however, the difference in mean number of teeth affected in either jaw was statistically not significant ($p = 0.574$). The posterior dentitions were more affected in the mandible, however, the difference in mean number of teeth affected in either jaw was statistically not significant ($p = 0.254$) [Figure 2]

Caries experience

Regarding caries status among the 115 patients involved in motorcycle crashes, 39 (33.9%) patients, exclusively males had a positive experience of caries. The number of patients with positive experience of caries increased as the age of the study participants increased, however, the observed difference of caries experience among age groups was statistically insignificant ($p > 0.05$).

The DMFT score ranged from 0 to 23 with an overall mean DMFT score of 1.66 ± 0.48 for all the patients. 19 (16.5%) patients had at a positive decay component. The number of carious teeth per person ranged from 1 tooth to 3 teeth and the mean score for the decay component was 0.23 ± 0.58 . The number of missing teeth due to caries per patient ranged from 1 tooth to 23 teeth and majority had only one tooth missing. The mean score for the missing component for the group was 1 ± 2.89 . None of the patients had even a single filled tooth.

Treatment need

Out of the 115 patients included in this study, 74 (64.3%) had trauma to

dentition and/or positive experience of dental caries., among these, 9 patients had both dental trauma and positive caries experience, 39 patients had only dental trauma, and 30 patients had only positive caries experience.

Among the 74 patients, 59 (79.7%) patients had treatment need. The number of teeth that required treatment ranged from 1 tooth to 19, with the mean number of teeth requiring treatment being 4.32 ± 3.61 . The most common treatment needed among the patients was the provision of dentures, followed by extraction and splinting [Table 3].

DISCUSSION:

Injuries to the orofacial area affect a significant number of trauma patients, and consequences of trauma to this region can include any combination of dental, bone, or soft tissue injuries.^[17] Therefore, apart from undergoing medical evaluation and possible treatment, the victims of motor traffic crashes should be investigated for possible dental, oral and jaw-related injuries.^[18]

When assessing the traumatic status of the dentition, it is also necessary to evaluate the caries status of the dentition. This is important because some of the treatment options (such as splinting and maxillomandibular fixation) for management of dento-alveolar and jaw injuries require intact dental tissues. This study was undertaken to determine the incidence of dental injury and dental

caries, and to assess the treatment need among motorcycle crash victims.

The findings of this study pointed out that majority of the victims of motorcycle crashes in this region were males, with a male to female ratio of 37:1. The predominance of male victims in motorcycle crashes has also been observed in studies from Kenya,^[2] Cameroon,^[5] Brazil^[19] and Finland.^[20] Despite the similarity in results, the male to female ratio in those studies ranged from 1.8:1 to 9.1:1, which was very low compared to the findings in the current study. The most probable explanation for the predominance of male victims is that men are bread earners of the families in several occasions, and that would entail frequent movements from place to place thereby increasing their risk of getting involved in crashes.

This study revealed the 20-39 years age group to be the most frequently involved in motorcycle crashes, the results which correspond to those of studies done in other African countries.^[2,5,21] To the contrary, these results differed from findings of a study done in Finland^[20] which reported the under 20 years age group as the most commonly affected. These findings, however, fall within the indexes given by WHO, which showed that traffic crashes were the major cause of death among the 15-29 years age group and the 3rd cause of death in the 30-44 years age group.^[1]

Majority of the participants in this study had primary school education and most

of them were privately employed. With a low level of education, getting a decent office job is very difficult in this country and as a result, the increased use of motorcycle as a working tool could reflect the rising level of unemployment among less educated young individuals.^[19]

Individuals who had higher levels of education and decent jobs, and got involved in motorcycle crashes, majority had motorcycles for personal use or had hired 'boda boda' in attempt to get to their destinations fast. For these individuals, motorcycles were used because they probably regarded them as effective transportation means that reduced time wasted in traffic congestion within the poor road networks and unplanned urban transportation.

Regarding the environment where the motorcycle crashes occurred, this study observed that more than three quarters of the victims got crashes while they were travelling on the tarmac roads. Probably due to the smoothness of the tarmac roads and lack of corrugations it could be easy to achieve a high speed. Moreover, the tarmac roads are always busy, thus the combined effect of high speed, high traffic volume and/or traffic lights could force motorcyclists to make sudden deceleration that would lead to skidding of the motorcycle on the road, with eventual crashing and causing injuries to the victims.

To date, a limited number of articles that describe the type and frequency of dental injuries associated with facial trauma have been published.^[22] In the current study, the incidence of dental trauma in motorcycle crash victims who had sustained oral and maxillofacial injuries was about 38% which was lower than what has been reported by Zhou et al.^[23] but slightly higher than incidences reported from studies by Gassner et al.^[24] and Lieger et al.^[22] The differing results of the reported incidences could be attributed to several factors such as type and duration of study and, inclusion and exclusion criteria. This study revealed that on average 1.97 teeth were injured per patient which was lower than findings by Zhou et al.^[23]

Similar to findings in other studies,^[22-25] results in this study revealed that maxillary teeth were more affected than mandibular teeth. The preventive effect of the maxilla on the mandible was considered as one of the reasons for the lesser incidence of dental injuries in the mandibular arch. Another reason could be due to better bony anchorage in the mandibular arch which acts like a wedge during forceful occlusion.^[22,25]

The findings of the current study also depicted a significant difference in the occurrence of dental injury between anterior and posterior teeth in the maxilla but not in the case of mandibular dentition. These findings could be attributed to the anatomy of the facial region. The posterior aspect of the maxilla is protected by the protruding

zygoma, thus the force directed to the posterior region is usually reduced significantly by the zygoma before reaching the posterior aspect of the maxilla, while on the other hand the mandible is an exposed and mobile bone. Though it is a strong bone it has certain areas of weakness such as the angles and region of the mental foramen. Thus these factors may play role similarly in dental injuries apart from fracture of the mandible.

The commonest teeth injured in this study were maxillary central incisors followed by mandibular central incisors, findings which were similar to those from other studies.^[23,25] The central incisors are more protrusive teeth especially in the maxillary arch that makes them more prone to injury.

Similar to findings in other studies,^[23,25] tooth avulsion (54.5%) was the commonest type of dental injury observed. Contrary results have been reported in other studies.^[22,26] whereby the commonest injury was crown fracture, and subluxation was reported as commonest type of injury by Gassner et al.^[24] It is assumed that the big number of dental avulsions and luxation injuries were probably the result of severity of trauma due to high-energy impacts.^[25]

Among the patients with oral and maxillofacial injuries, about 34% of them had a positive experience of caries with a mean DMFT score of 1.66 ± 0.48 , which was low compared to another study^[13]

in Tanzania that had reported a mean DMFT of 4.67. The number of patients with positive experience of caries increased as the age of the study participants increased and the observed difference of caries experience between age groups was statistically insignificant. This might be explained by the fact that dental caries being a cumulative process with aging the progression of untreated caries in risky individuals was likely to be higher in older than in younger individuals.

More than half (64%) of the victims of motorcycle crashes had dental injury and/or positive experience of dental caries, and among them 79.7% had treatment needs. The observed average number of teeth per patient that required treatment was 4.32 ± 3.61 . These findings warrant the necessity of thorough dental examination in patients with maxillofacial injuries, and not to concentrate on very obvious facial bone fractures only.

Provision of dental prosthesis was the most common treatment modality rendered to the patients, followed by extraction and splinting, that reflects the types of injuries the patients had suffered during the crashes. Dentures were constructed for the individuals who had lost their teeth by avulsion or had extraction. The dentures were made once the definitive management of maxillofacial injuries was undertaken. Extraction was done for teeth that had advanced caries, root fracture or teeth

which were within fracture lines and were likely to impair bone healing.

Knowledge on the association of either dental caries or dental injuries and maxillofacial fractures is a basic tool that should be imparted to the physicians attending the victims. This is of utmost importance because the avulsed teeth or subluxated teeth could find their way to the airway thereby causing obstruction. Moreover, in case the patient had dental caries and had to undergo maxilla-mandibular fixation (MMF) the offending tooth could be the source of pain or even orofacial infection that eventually could compromise bone healing.

CONCLUSION:

The findings of this study portrayed the occurrence of dental injuries, the dental caries experience, and treatment need among victims of motorcycle crashes who had sustained oral and maxillofacial injuries. Males were more likely to be involved in motorcycle crashes, with young volatile individuals being at a higher risk. About two-fifth of the victims of motorcycle crashes with maxillofacial injuries had associated dental injuries,

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and the most frequently involved teeth were the anterior teeth. The most common type of dental injury was avulsion. The caries experience among the victims was considerably high with one-third of them having positive caries experience. The commonest treatment for the dental injuries among the crash victims was provision of prosthesis. A wider longitudinal prospective study could serve to document the incidence of dental injuries in patients with maxillofacial trauma.

Recommendation: From the findings of this study, it is recommended that:

- There might be a need of designing and providing the motorcyclists with a protective device such as a mouth guard (such as those worn in sports), that would aid in preventing dental injuries to the anterior teeth.
- There should be a platform for continuing education to the motorcyclist with regards to oral health.

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TABLES:

Table 1: Occurrence of Dental Injuries in relation to selected risk factors

Variable	Dental trauma		P-value
	Yes	No	
Age			
<30	26 (38.2)	42 (61.8)	0.995
30+	18 (38.3)	29 (61.7)	
Education			
No formal	3 (30)	7 (70)	0.120
Primary	21(31.8)	45 (68.2)	
Secondary and above	20 (51.3)	19 (48.7)	
Occupation			
No employment	4(50)	4(50)	0.244
Peasant and petty traders	2 (14.3)	12 (85.7)	
Civil Servants	6 (42.9)	8 (57.1)	
Business and private employees	32 (40.5)	47 (59.5)	
Use of helmet			
Yes	20 (37.7)	33 (62.3)	0.915
No	24 (38.7)	38 (61.3)	
Collided with			
Motor vehicle	24 (35.3)	44 (64.7)	0.850
Object (e.g. pole, wall)	10 (40)	15 (60)	
Person/animal	3 (42.9)	4 (57.1)	
No collision	7 (46.7)	8 (53.3)	

Table 2: Frequency distribution of number of teeth that sustained different type of dental trauma in relation to location in both jaws

Type of dental trauma	Maxilla		Mandible	
	Anterior segment	Posterior segment	Anterior segment	Posterior segment
Sub luxation	11	3	10	5
Lateral luxation	9	3	9	6
Extrusive luxation	7	2	4	2
Avulsion	21	5	16	5
Crown fracture with pulp involvement	1	-	3	3
Crown fracture without pulp involvement	6	2	2	1
Root fracture	1	-	1	-

Table 3: Distribution of patients according to treatment need and age group

Type of treatment	Age group					Total
	10-19	20-29	30-39	40-49	50+	
Extraction	-	8	8	-	2	18
Filling	1	4	4	1	-	10
Crown	-	2	1	-	-	3
Endodontics	-	3	2	1	-	6
Splinting	-	9	2	-	-	11
Denture	1	17	11	4	2	35

FIGURES:

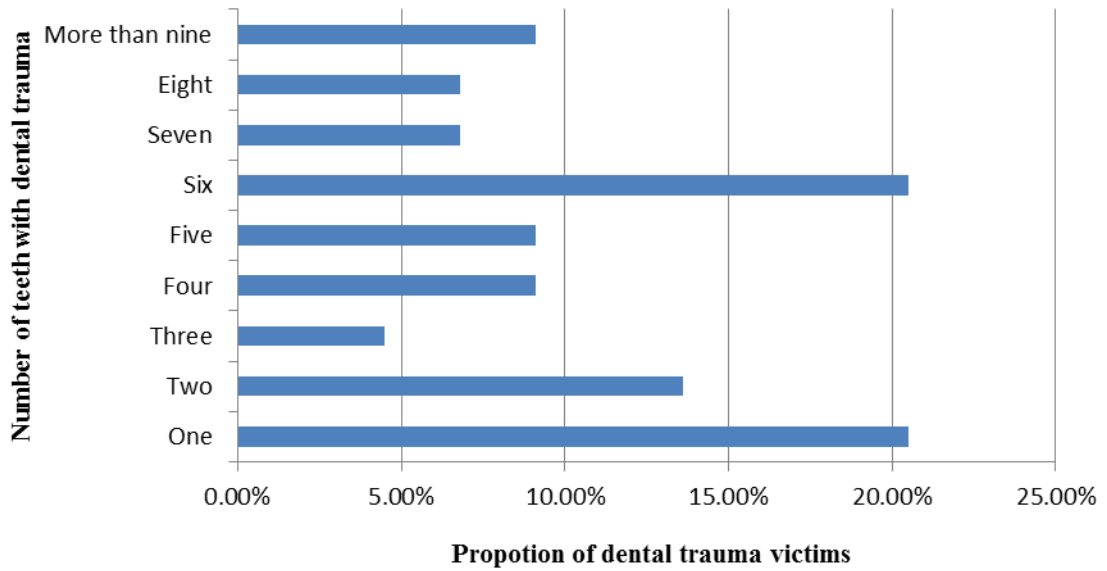
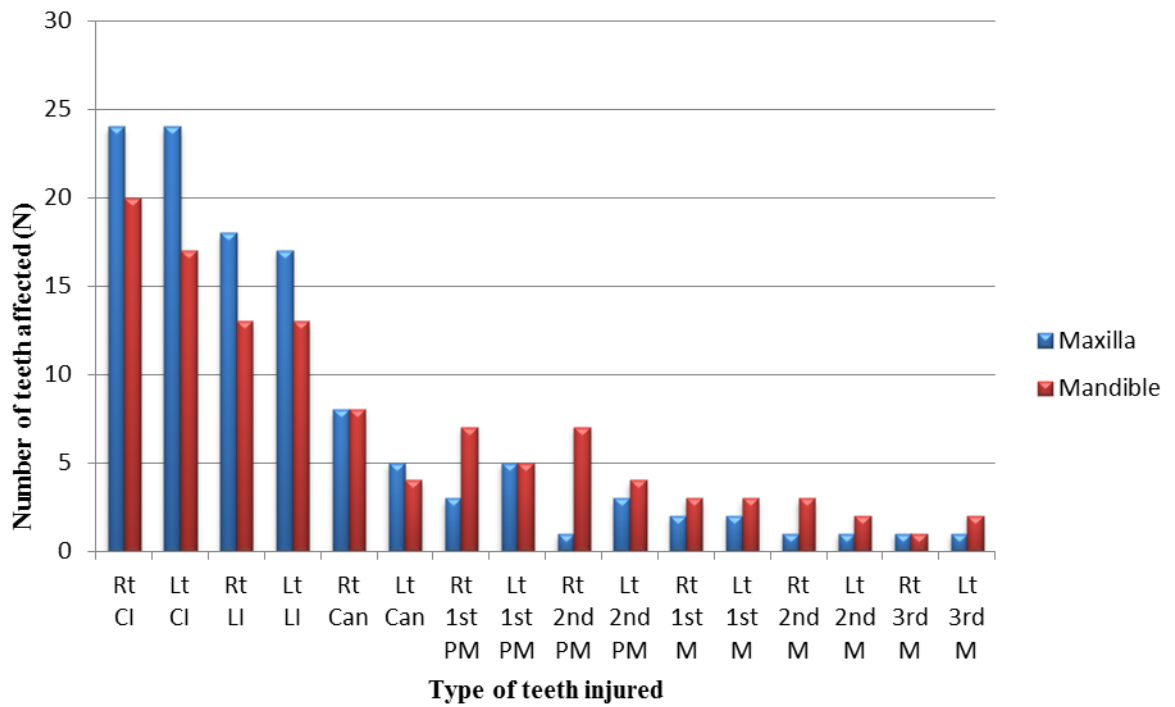


Fig 1: The proportion of dental trauma victims according to number of teeth affected



Key: CI-Central Incisors, LI-Lateral Incisors, Can- Canine, PM- Premolars, M- Molars, Rt- Right, Lt-Left

Fig 2: Frequency of dental trauma to different types of teeth on both jaws