

# Maxillofacial Fractures among Motorcycle Crash Victims Attended at a Tertiary Hospital in Tanzania

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## ABSTRACT

**Introduction:** Motorcycles have become a popular choice of transport in Tanzania, hence there is an increase in motorcycle crashes. Considering the high rate of motorcycle crashes, magnitude and seriousness of the injuries in the head and neck region, studying the pattern of maxillofacial injuries in motorcycle crash victims (MCV) is inevitable. The aim of the study was to investigate the occurrence, types, and treatment of maxillofacial fractures in MCV at Muhimbili, a tertiary national hospital in Tanzania.

**Materials and methods:** This was a descriptive, cross-sectional, and hospital-based study that included all MCV. These were received, interviewed (including the use or nonuse of helmets and alcohol intake), physically examined, and investigated for maxillofacial injuries. Maxillofacial fractures were categorized as mandibular, midface, and upper third of face (frontal) fractures. Management of the injuries included supportive, medical, and surgical treatment. The data were analyzed using Statistical Package for Social Sciences (SPSS) Version 20.

**Results:** A total of 116 MCV predominantly (113, 97.4%) men were included in this study with a male-to-female ratio of 37.7:1. The crash victims were aged between 14 years and 66 years (mean of  $29.43 \pm 8.88$ ), and the 20 years and 39 years age group was the most affected. More than half (53.4%) of the victims had not put on helmets and only 18.1% of the victims were under the influence of alcohol during the crashes. The majority (89.7%) of MCV sustained maxillofacial fractures whereby 71.2% had mandibular fractures, 66.3% had midface fractures, and 9.6% had frontal bone fractures. The severity of injuries significantly correlated with the speed of motorbikes during crashes. Maxillomandibular fixation (MMF) was the commonest treatment modality of the fractures employed.

**Conclusion:** The findings of this study revealed that young men (14–39 years) were more prone to motorcycle crashes. The majority of MCV did not wear helmets and only a few were under the influence of alcohol during the crashes. The mandible and zygoma were the frequently fractured bones and the odds of multiple fractures increased with increased speed of motorbikes.

**Clinical significance:** The results of this study cast light on the pattern and burden of oral and maxillofacial injuries in Tanzania, thus serving as the basis for future interventions to improve the injured patient outcomes, and reduce morbidity and mortality. The information obtained from this study can be used by public health researchers to improve health policies on road traffic crash prevention.

**Keywords:** Maxillofacial fractures, Motorcycle crashes.

## ABSTRACTO

**Introducción:** Las motocicletas se han convertido en una opción popular de transporte en Tanzania, por lo tanto, hay un aumento en los choques de motocicletas. Teniendo en cuenta la alta tasa de accidentes de motocicleta, la magnitud y la gravedad de las lesiones en la región de la cabeza y el cuello, es inevitable estudiar el patrón de lesiones maxilofaciales en víctimas de accidentes de motocicleta (MCV). El objetivo del estudio fue investigar la aparición, los tipos y el tratamiento de las fracturas maxilofaciales en MCV en Muhimbili, un hospital nacional terciario en Tanzania.

**Materiales y métodos:** Este fue un estudio descriptivo, transversal y hospitalario que incluyó todos los MCV. Estos fueron recibidos, entrevistados (incluido el uso o no uso de cascos y consumo de alcohol), examinados físicamente e investigados por lesiones maxilofaciales. Las fracturas maxilofaciales se clasificaron como fracturas mandibulares, de la cara media y del tercio superior de la cara (frontal). El manejo de las lesiones incluyó tratamiento de apoyo, médico y quirúrgico. Los datos se analizaron utilizando el Paquete Estadístico para Ciencias Sociales (SPSS) Versión 20.

**Resultados:** Se incluyeron en este estudio un total de 116 hombres con MCV predominantemente (113, 97.4%) con una relación hombre-mujer de 37.7: 1. Las víctimas del accidente tenían entre 14 y 66 años (media de  $29,43 \pm 8,88$ ), y el grupo de 20 y 39 años fue el más afectado. Más de la mitad (53.4%) de las víctimas no se habían puesto cascos y solo el 18.1% de las víctimas estaban bajo la influencia del alcohol durante los choques. La mayoría (89.7%) de MCV sufrió fracturas maxilofaciales por las cuales el 71.2% tenía fracturas mandibulares, el 66.3% tenía fracturas de la cara media y el 9.6% tenía fracturas de huesos frontales. La gravedad de las lesiones se correlacionó significativamente con la velocidad de las motocicletas durante los choques. La fijación maxilomandibular (MMF) fue la modalidad de tratamiento más común de las fracturas empleadas.

**Conclusión:** Los hallazgos de este estudio revelaron que los hombres jóvenes (14-39 años) eran más propensos a los choques de motocicletas. La mayoría de los MCV no usaban cascos y solo unos pocos estaban bajo la influencia del alcohol durante los choques. La mandíbula y el cigoma fueron los huesos frecuentemente fracturados y las probabilidades de fracturas múltiples aumentaron con el aumento de la velocidad de las motos.

**Importancia clínica:** los resultados de este estudio arrojan luz sobre el patrón y la carga de las lesiones orales y maxilofaciales en Tanzania, lo que sirve como base para futuras intervenciones para mejorar los resultados de los pacientes lesionados y reducir la morbilidad y la mortalidad. La información obtenida de este estudio puede ser utilizada por investigadores de salud pública para mejorar las políticas de salud en la prevención de accidentes de tránsito.

**Palabras clave:** Accidentes de motocicleta, Fracturas maxilofaciales.

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## INTRODUCTION

Motorcycles have become a popular choice of transport in most parts of Tanzania since they are affordable and cost-effective,<sup>1,2</sup> and as such their increase has led to a rise in motorcycle crashes. Motorcycle crash injuries constitute a significant number of motor vehicle crash-related hospital admissions and deaths each year in most developing nations.<sup>3</sup> Motorcycles are motorized vehicles that almost always leave the body unprotected and vulnerable to different types of injuries,<sup>1</sup> among them being maxillofacial injuries.

Maxillofacial injuries involve soft and hard tissues of the face extending from the frontal bone superiorly to the mandible inferiorly and vary from soft tissue lacerations to complex fractures of the maxillofacial skeleton.<sup>4</sup> They can occur isolated or in combination with other serious injuries, including cranial, spinal, upper and lower body injuries.<sup>5</sup> Maxillofacial fractures are often associated with severe morbidity, loss of function, disfigurement, and significant financial cost, therefore they represent one of the most important health problems worldwide.<sup>6</sup> The presentation, severity, and pattern of maxillofacial fractures depend on the etiology, the magnitude of the causative force, impact duration, acceleration imparted by the object to the part of the body struck, and the rate of acceleration change.<sup>7,8</sup>

Management of complicated facial fractures is challenging even to the most experienced maxillofacial surgeon due to the presence of coexisting injuries and complexity of the fractures, which makes it more difficult to consolidate the experience and develop realistic treatment protocols.<sup>8</sup> Over the years, several treatment modalities of maxillofacial fractures have been used including intraoral wiring and splints, internal fixation using wires, and rigid osteosynthesis. Currently, titanium plates and screws are preferred, though bioresorbable plates and screws are preferred to titanium in children.<sup>9</sup>

Considering the high rate of motorcycle crashes and the magnitude and seriousness of injuries in the head and neck region,<sup>10</sup> a clearer understanding of the demographic pattern of maxillofacial injuries aids healthcare providers to plan and manage these injuries. Moreover, such epidemiologic information can also be used to guide the future funding of public health programs geared toward injury prevention.<sup>8</sup> The aim of this study was to investigate the occurrence, types, and treatment of maxillofacial fractures among MCV at a tertiary hospital in Tanzania.

## MATERIALS AND METHODS

This was a descriptive, cross-sectional hospital-based study involved MCV who 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 crashes.

All MCV who attended at MNH Oral and Maxillofacial Department, with oral and maxillofacial injuries were received, interviewed, physically examined, and investigated. Those patients who were found with soft and hard tissue injuries and had consented to participate were recruited in the study. Interviews were conducted using a specially designed questionnaire to obtain data on sociodemographic characteristics, the use or nonuse of helmets and alcohol at the time of the crash and information on roadworthiness during the crash. A thorough clinical (extra and intraoral) examination was performed, followed by radiologic investigations (conventional radiographs or computed tomographic scan) and the findings were then recorded in a special predesigned

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clinical form. Depending on the final diagnosis, treatment was planned and conducted according to the standard protocol.

Maxillofacial fractures were categorized as mandibular, midface, and upper third of face (frontal) fractures. The multiplicity of fractures was classified into simple (when any facial bone had 1–2 fractured sites) and multiple (when any facial bone had three or more fractured sites).

The data obtained from this study were entered into computer and analyzed using SPSS software Version 20. Statistical significance testing was performed using Chi-square test ( $\chi^2$ ) and significant level  $p < 0.05$  was considered statistically significant. The ethical clearance for this study was sought from the Ethical Committee of the Muhimbili University of Health and Allied Sciences. Permission to conduct this study was sought from the administration of MNH.

## RESULTS

This study involved 116 patients who had sustained maxillofacial injuries following motorcycle crashes either as passengers or drivers. Almost all 113 (97.4%) crash victims were men with a male-to-female ratio of 37.7:1. The age of the victims ranged from 14 years to 66 years (mean age = 29.43 ± 8.88 years). The majority (81%) of the victims were aged between 20 years and 39 years (Table 1).

A greater proportion (77.6%) of the victims were from urban settings. More than half 66 (56.9%) of the victims had at least primary education, followed by (34.5%) with secondary and college education. Most 61 (52.6%) victims were privately employed followed by business persons and civil servants (Table 1).

Most 51 (44%) motorcycle crashes occurred in the urban setting mainly in urban streets. The majority 89 (76.7%) of the crashes happened on tarmac roads. Although the crashes occurred all over the day, the peak 35 (30.2%) crash incidences were in the evenings (Table 2).

Almost half (48.3%) of the victims claimed that they were traveling on fair knots of speed of 40–60 km/hour during the crashes. About 62 (53.4%) of MCV used no helmets during crashes and of those who wore helmets, majority (79.6%) had half face-covering helmets. Less than 20% of the crash victims were under the influence of alcohol during the crashes. The majority 90 (77.6%) of the victims were drivers (Table 2).

Nearly all 101 (87.1%) crashes involved the collision of the motorbikes with either other vehicles, pedestrians, or objects. The most frequently encountered 41 (40.6%) collisions were between motorcycles and motor vehicles, followed by motorcycles with other motorcycles 27 (26.7%), and others collided with objects, such as light posts, trees, and walls (25, 24.8%). Collision between a motorcycle and a human/animal was the least 8 (7.9%) observed

**Table 1:** Frequency distribution of study participants according to sociodemographic characteristics

Sociodemographic characteristic	Frequency (n) (n = 116)	Percentage
<b>Sex</b>		
Male	113	97.4
Female	3	2.6
<b>Age groups (years)</b>		
<20	9	7.8
20–39	94	81
40–59	12	10.3
>60	1	0.9
<b>Locality</b>		
Rural	26	22.4
Urban	90	77.6
<b>Occupation</b>		
No employment	6	5.2
Peasant	7	6.0
Petty trader	7	6.0
Business	19	16.4
Civil servant	14	12.1
Private employee	61	52.6
Student	2	1.7
<b>Education</b>		
No formal education	10	8.6
Primary education	66	56.9
Secondary education	25	21.6
College and above	15	12.9
<b>Marital status</b>		
Married	54	46.6
Divorced	2	1.7
Widow	1	0.9
Cohabited	11	9.5
Single	48	41.4

**Table 2:** Frequency distribution of study participants according to circumstances of crashes

Circumstance	Frequency (n) (n = 116)	Percentage
<b>Location of the crash</b>		
Highway	47	40.5
Urban streets	51	44.0
Local rural roads	18	15.5
<b>State of the road</b>		
Tarmac	89	76.7
Earth road	27	23.3
<b>Time of crash</b>		
Morning	20	17.2
Midday	15	12.9
Evening	35	30.2
Night (with street lights on)	21	18.1
Night (with street lights off)	25	21.6
<b>Speed of travel</b>		
40 km/hour or less	23	19.8
41–60 km/hour	56	48.3
61–80 km/hour	33	28.4
Above 80 km/hour	4	3.4
<b>Helmet use</b>		
Yes	54	46.6
No	62	53.4
<b>Influence of alcohol</b>		
Yes	21	18.1
No	95	81.9
<b>Patient's role</b>		
Driver	90	77.6
Pillion/passenger	26	22.4
<b>Number of persons on motorbike during crash</b>		
Driver alone	66	56.9
Driver and one passenger	47	40.5
Driver and two passengers	3	2.6

type. The majority (76, 65.5%) of the MCV in this study reported to have had lost consciousness for an estimated time that lasted a few minutes to several hours.

Fractures of the maxillofacial bones were observed in 104 (89.7%) crash victims, whereby 74 (71.2%) had mandibular fractures, 69 (66.3%) had midface fractures, and only 10 (9.6%) had frontal bone fractures. The parasymphysis was the most commonly fractured site of the mandible, followed by the symphyseal region while the ramus was the least affected site (Table 3).

The midface fractures occurred in multiples, with the majority 23 (33.3%) occurring in combinations of two types of midface fractures, followed by a single type of fractures (15, 21.7%). The zygomaticomaxillary complex fracture is the most commonly encountered midface fracture, followed by Le Fort I and Le Fort II fractures. Fracture of the fronto-orbital suture was the least common midface fracture observed. Among patients with frontal bone fractures, the anterior table of the frontal sinus was fractured in eight patients, while the remaining two patients had fractures of both anterior and posterior tables (Table 3).

Regarding the risk factors associated with the occurrence of maxillofacial injuries, there was a significant association with gender of the victim ( $p = 0.001$ ), number of individuals on the bike during the crash ( $p < 0.001$ ), and role of the victim either as a passenger or driver ( $p = 0.006$ ). Men had 20 times higher odds of sustaining maxillofacial injuries compared with women (95% CI 1.7, 247.6). Moreover, drivers had nine times higher odds of sustaining maxillofacial injuries compared with passengers (95% CI 2.6, 35.2).

About 55 (47.4%) crash victims were classified to have multiple fractures of the facial bones and there was a significant association between the multiplicity of fractures and the speed of motorbikes during crashes ( $p = 0.05$ ), whereby the odds of multiple fractures of the facial bones increased with increased speed of motorbikes (Table 4).

The association between lack of use of helmet and occurrence of head injury was statistically significant ( $p = 0.044$ ). There was no statistically significant association between the role of the victim and type of helmet used with the presence of either mandibular or midface fracture and multiplicity of fractures (Table 5).



**Table 3:** Distribution of motorcycle crash victims according to the number of fractured sites and anatomical location of mandibular fracture and types of midface fractures

Fracture pattern	Frequency (n)	Percentage
Number of fracture sites of the mandible per person (n = 74)		
One	33	44.6
Two	29	39.2
Three	5	6.8
Four	6	8.1
Five	1	1.4
Anatomical location of fracture of the mandible (n = 74)		
Symphysis	30	40.5
Parasymphysis	31	41.9
Body	24	32.4
Angle	10	13.5
Ramus	1	1.4
Condyle	16	21.6
Alveolar bone	23	31.1
Types of midface fractures (n = 69)		
Zygomatic arch	28	40.6
ZMC	42	60.9
Le Fort I	33	47.8
Le Fort II	31	44.9
Le Fort III	14	20.3
Orbital blowout	12	17.4
Nasal	15	21.7
Nasal orbital ethmoid	14	20.3
Frontal orbital suture	6	8.7
Frontal nasal suture	13	18.8
Types of frontal bone fractures (n = 10)		
Anterior table only	8	80
Anterior and posterior tables	2	20

**Table 4:** Univariate analysis for the multiplicity of fractures and speed of motorcycle

Speed of motorcycle	Odds ratio	95% CI
≤40 km/hour	1.0	1.0
41–60 km/hour	4.422	1.334–14.666
61–80 km/hour	8.312	2.287–30.215
≥80 km/hour	14.250	1.162–174.801

Apart from maxillofacial injuries, 22.4% of the crash victims had associated injuries to other parts of the body. The most commonly encountered injuries were head injury (14, 53.8%), other skeletal injuries (11, 42.3%), and ophthalmological/ocular injuries (9, 34.6%). Other injuries included cerebral contusion and chest injuries that affected 5 (19.2%) crash victims each, ear and abdominal injuries equally occurred in 2 (7.7%) victims each, and only 1 patient had cervical spine injury.

This study also showed that 109 (94%) MCV had concurrent soft tissue injuries. The most common (67, 61.5%) site affected was the orbital region, while the ears (6, 5.5%) were the least affected regions (Fig. 1).

Management of the MCV was divided into supportive, medical and surgical treatment. Tetanus toxoid was the most frequent supportive management followed by intravenous fluids given to 101 (87.1%) and 93 (80.2%) victims, respectively. Almost all crash victims received analgesics and antibiotics. Maxillomandibular fixation of the jaws was the commonest 80 (69%) treatment done, followed by open reduction and internal fixation (ORIF) (Table 6).

## DISCUSSION

The findings of this study indicated that motorcycle crashes were more common in men than women similar to what has been reported worldwide.<sup>1,11–14</sup> The reported male-to-female ratio vary from one geographical location to another depending on socioeconomic activities in different communities. In the current study, the observed male-to-female ratio of 37:1 was higher compared with 25.5:1 as reported in Turkey,<sup>15</sup> and 15.1:1 reported in Malaysia;<sup>13</sup> however, most studies reported ratios of 1.8:1–9.1:1.<sup>1,11–14,16,17</sup> A significant association ( $p = 0.001$ ) between gender of the victim and occurrence of maxillofacial injuries was noted in this study, whereby men had 20 times higher odds of sustaining maxillofacial injuries compared with women. Men were at a greater risk of crashes and maxillofacial injuries compared with women because of the increased use of motorcycles as means of travel as they ran passenger transportation as part of their job.<sup>13</sup> With regards to the difference in male-to-female ratio between our study and those from other parts of the world, the probable explanation could be due to cultural and social structure of the area of study. In Tanzania, it is not common to find women riding motorcycles, and when they use them as passengers they caution the drivers not to over speed and hence the drivers probably tend to ride the motorcycles decently.

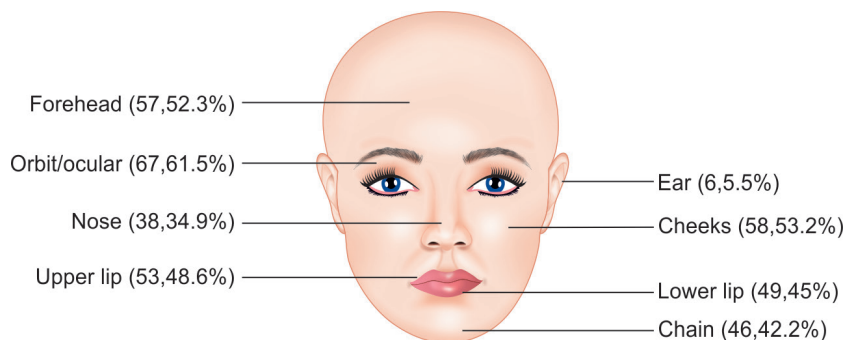
Majority of the victims of motorcycle crashes were young individuals with a mean age of 29 years which was almost comparable to other means which have been reported in several studies elsewhere.<sup>1,3,13,14,18</sup> The pride of riding motorcycles and competition for passengers sometimes compel the young motorcyclists to ride in competitive speeds that expose them to risks of crashing amidst the busy traffic jams. During this study, a typical profile of a motorcycle casualty in Tanzania was a male rider 20–39 years old, findings which were contrary to those in a report from Malaysia where the crash victims were younger (16–25 years). This could be because in Tanzania, driving licenses are given to more aged individuals (18 years and above) only unlike Malaysia where at the age of 16 years, an individual could officially get a valid riding license.<sup>13</sup>

In the current study, most crashes occurred in the urban streets, a finding that was not surprising since majority of the victims were urban dwellers. The occurrence of crashes in the urban streets could be attributed to the narrowness of the roads and lack of side roads for motorcycles which eventually could lead to accumulated and congested streets, thereby increasing the chances of crashes. Furthermore, a general observation showed that motorcyclists were not bound by traffic rules and regulations which applied to other motor vehicle users; this gave them an opportunity to drive haphazardly with increased chances of crashes and risking other peoples' lives.

Most of the crashes occurred while the victims were traveling on tarmac roads. This finding could be due to the high speed the motorcycles could achieve on tarmac roads as a result of smoothness and lack of corrugations. Since the tarmac roads were always busy, the combined effect of high speed, high traffic volume,

**Table 5:** Distribution of motorcycle crash victims according to the role of victim and use of helmet during crash

	Role of the victim			Use of helmet			Type of helmet used		
	Driver (n = 90)	Passenger (n = 26)	p value	Yes (n = 54)	No (n = 62)	p value	Full face (n = 11)	Half face (n = 43)	p value
Occurrence of mandibular fractures	61 (67.8%)	13 (50%)	0.097	33 (61.1%)	41 (66.1%)	0.575	6 (54.5%)	27 (62.8%)	0.617
Occurrence of midface fractures	57 (63.3%)	12 (46.6%)	0.116	34 (63%)	35 (56.5%)	0.476	7 (63.3%)	27 (62.8%)	0.959
Occurrence of head injury	11 (12.2%)	3 (11.5%)	0.299	3 (5.6%)	11 (17.7%)	0.044	1 (9.1%)	2 (4.7%)	-
Multiplicity of fractures	55 (50%)	10 (38.5%)	0.925	25 (46.5%)	30 (48.4%)	0.822	5 (45.5%)	20 (46.5%)	0.950



**Fig. 1:** Distribution of soft tissue injuries according to anatomical sites

and/or traffic lights could force motorcyclists to make sudden deceleration that would lead to skidding of the motorcycles on the roads, with eventual crashing and causing injuries to the victims.<sup>19</sup>

A significant number of MCV reported that they had not put on helmets during the crashes. Some investigations have suggested that wearing a helmet had no protective effect against facial injuries while others reported statistically significant decreases in the incidence of facial injuries in helmeted patients.<sup>20</sup> The usage of helmets in this study was found to have no effect on the occurrence of facial injuries, but it had a protective effect against the occurrence of head injuries. About 47% of MCV in this study were wearing helmets during the crashes, this was lower than what has been reported in some studies<sup>2,18,20</sup> but higher than in other studies.<sup>4,14,21</sup> In most developing countries, people avoid taking safety measures probably due to lack of strict law enforcement regarding the use of safety gears.

In the current study, the observation that 77% of the victims were the riders of the motorcycles during the crashes was slightly higher than what has been reported in other studies.<sup>4,14,21</sup> Logistically, the riders were the first ones to come into contact with whatever object they collided with. It was also deduced that most of the crashes occurred while the drivers were alone on the motorbikes, most probably this was during the time the drivers rushed at high speed back to their stations to have other picks after dropping their previous passengers. Moreover, when the drivers were alone, there was no one to limit their speed of travel.

The incidence of facial bone fractures in this study was 89.7%, which was higher than what has been reported in other studies elsewhere<sup>1,3,22</sup> but slightly lower than what was reported in Nigeria.<sup>14</sup> In this study, the mandible was the commonest bone fractured either in isolation or in combination with other bones, while the frontal bone was the least affected. These findings concurred with the results of other studies.<sup>14,18,23</sup> The higher

**Table 6:** Management of motorcycle crash victims who had sustained maxillofacial fractures

Type of management	Frequency (n) (n = 116)	Percentage n/n × 100
<b>Supportive</b>		
Tetanus toxoid	101	87.1
Intravenous fluids	93	80.2
Blood transfusion	7	6.0
Tracheostomy	2	1.7
<b>Medical</b>		
Analgesics	111	95.7
Antibiotics	110	94.8
<b>Surgical</b>		
Alveolar splinting	14	12.1
MMF	80	69.0
Circumzygomatic suspension	16	13.8
ORIF	46	39.6

MMF, maxillomandibular fixation; ORIF, open reduction and internal fixation

incidence of mandibular fractures could be theorized to be due to its prominence and mobility as compared to the strongly supported middle third of the face which allows the scattering of impact forces along the architectural framework of the bones.<sup>7,18</sup>

More than half of the fractured mandibles had multiple fractured sites. Such an occurrence could be supported by the idea that the mandible could be regarded as a single bone reaching both sides, hence, direct fractures on the impact side were often followed by an indirect fracture on the opposite side.<sup>9,24</sup> The parasymphysis was the commonest anatomical site affected in this study, similar to findings in some studies.<sup>25,26</sup> The parasymphysis was the

commonest site affected probably due to the presence of the canine teeth with its long roots that weakened the structure. Also, the cross-section of the parasymphysis region allowed a greater force per unit area to develop, thereby increased in concentration of tensile strength leading to a fracture at the site of maximum convexity of the curvature.<sup>25</sup>

The commonest bone of the midface that was fractured in this study was the zygomatic bone, a finding that was in concurrence with some studies<sup>13,27,28</sup> but contrary to another study<sup>22</sup> in which the maxilla was the commonest midface bone fractured. The predominance in occurrence of zygomatic bone fracture could be attributed to its prominence in the facial skeleton, and therefore, it is more prone to be subjected to impact during collisions and falls.<sup>13,28</sup>

Concomitant injuries which were observed in almost a quarter of the crash victims were lower than what has been reported in Malaysia,<sup>29</sup> but higher than findings in a Nigerian study.<sup>14</sup> Like in other studies,<sup>14,29</sup> head injury was the commonest concomitant injury among the patients in the current study. This could be due to the close proximity of the cranium to the midface complex.<sup>30</sup> Some authors have reported high incidence of cervical spine injuries associated with maxillofacial trauma in motor traffic crash victims,<sup>31</sup> however, in the current study, the incidence was extremely low at 0.9%.

The current study revealed a significant association between multiplicity of fractures and the speed of motorbikes during crashes whereby the odds of the multiplicity of fractures increased with increased speed of motorbikes. When an object is moving at high speed, it has high kinetic energy, and once it comes to a sudden stop, the force (energy/distance traveled) generated becomes high. Thus, the severity of bone fracture is determined by traumatic agent force.<sup>32</sup>

In this study, analgesics and antibiotics were frequently prescribed in maxillofacial injuries. Unique situations such as contamination of fracture sites from the sinuses, exposure of fractures to intraoral bacteria from mucosal tears, and delay in fracture management, intuitively suggest that there may be benefit of antibiotics administration in craniofacial fractures.<sup>33</sup>

The commonest definitive management of fractures of the maxillofacial region in this series was MMF followed by ORIF. Maxillomandibular fixation has been commonly used in isolated fractures of the mandible which were not severely displaced. On the other hand, ORIF has been commonly used for midfacial fractures. Although most of advanced settings have been using plates and screws for the management of almost all fractures, in our settings this could not be achieved because majority of the victims could not afford the high costs for ORIF, thus a cheaper method used was MMF.

The limitation of this study was that it was a hospital based one, and thus limited to those patients referred to the OMFs service at a tertiary hospital in Tanzania. Records of persons with motorcycle-related injuries that were not referred to our center were not included. However, the information obtained from this study can still be used for further public health researches to improve health policies on road traffic crashes prevention.

## CONCLUSION

This study was undertaken to portray the occurrence of maxillofacial fractures in MCV. Young men were commonly affected, and most of the crashes occurred on highways. There was significant association between severity of injury and speed of motorbikes during crash. The mandible and the zygoma were the frequently

fractured bones, while head injury was the commonest concomitant injury. Majority of MCV who sustained maxillofacial injuries did not wear helmets during crashes. Helmets had protective effect on occurrence of head injuries but no effect on occurrence of facial fractures. Maxillomandibular fixation was the commonest treatment modality.

## RECOMMENDATION

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

- There is a need of enforcing and sustaining laws and regulations on the use of protective gears among motorcycle users;
- There should be a platform for continuing education to the motorcyclist with regards to risk factors associated with motorcycle crashes; and
- To minimize road traffic crashes motorcyclists should also be bound by the existing rules and regulations.

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