Mandibular trauma severity differences on motorcycle riders using half-face helmet and without helmet based on mandible injury severity score

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ABSTRACT

Introduction: The popular half-face helmet places the mandible at high risk of fracture during a motorcycle accident. The anatomical shape and position of the mandible make it more frequent to fracture. The purpose of this study was to compare the severity of mandibular trauma in motorcyclists using half face helmets and without using a helmet based on the Mandible Injury Severity Score (MISS). **Methods:** This research was a prospective cross-sectional study on 60 research subjects at the Emergency Unit of Hasan Sadikin Hospital, Bandung, between July 2019 - February 2020. The data were analyzed with the Mann-Whitney test to see the severity of mandibular trauma using a half face helmet and without a helmet based on MISS (Mandible Injury Severity Score). **Results:** Of 60 subjects of motorcycle accidents, 58.3% were <25 years old, 38 (63.3%) used half face helmets and 22 (36.7%) non-helmets, 83.3% of the patients were drivers, and 11.7% were passengers. Most fracture sites are parasymphysis, corpus, condylus, symphysis, and subcondylar. 48.3% of subjects had malocclusion, 56.5 with mild displacement, and 43,3% with moderate removal. The average MISS score for half face helmet users was 5.71 and compared to 7.45 for non-helmets. Based on the Mann Whitney test results, the MISS value was not significantly different. **Conclusion:** Riders who wore half face helmets and those who didn't wear helmets have the same risk of mandibular trauma based on the MISS. Motorcycle users should use a full face helmet to prevent mandibular fractures during traffic accidents.

Keywords: MISS; trauma of mandible; half face helmet; traffic accidents

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INTRODUCTION

In developing countries, motorcycles are a type of vehicle that is mostly used by people. It is easy to ride, efficient and can avoid traffic jams. Yet, it does not guarantee the main aspect of transportation, safety. Global Status Report on Road Safety (WHO 2018), has highlighted that the number of fatalities due to traffic accidents has reached 1.35 million per year. Motor vehicle accidents are still the main cause of facial bone fractures around the world with a prevalence of

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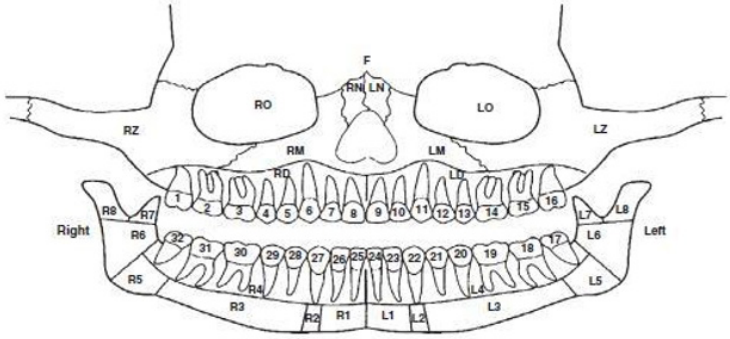
11%-88% cases.[1,2,3,4,5] Juli et al., stated that from all fractures in the facial area, two-third of it is mandibular fracture. Even though the mandible is the strongest and dense facial bone, its anatomy and position are more prone to fractures than other facial bones. The mandible can get injured because of its prominent position.[2,3,4,7]

Most motor vehicle accidents lead to severe fractures because the riders are not wearing protective equipment or helmets. There are two types of standard helmet in Indonesia: half-face and full-face helmets. Half-face helmets are the most common helmet used by motorcycle riders in Indonesia about 75%. The affordable price may be one of the reasons why half-face helmets are so popular. Compared to full face helmets, it significantly increases trauma risk to mandibles on motorcycle riders, as it only prevents the middle and upper face injuries, but zero protection over the lower face. Mandibular fractures may result in various functional and aesthetic sequences such as malocclusion, difficulty in chewing, chronic pain, and temporomandibular joint disorder. If the fracture does not receive proper treatment or when it is delayed, then the injury related to mandibular fractures can lead to minor injuries on the face and head even to the dangerous closed-brain injury.[4,5,6]

Mandible Injury Severity Score (MISS) is a scoring system to assess the severity of mandibular fractures. This system provides convenience in assessing the severity of mandibular trauma and serves as a predictive and prognostic mean to determine the treatment as well as provides information to the patient and family.[10,11,13] With the higher mobility and increasing number of motor vehicle accidents in Indonesia as well as the popularity of half-face helmets are the background of this research on mandibular trauma severity based on MISS.The purpose of this study was to compare the severity of mandibular trauma in motorcyclists using half face helmets and without using a helmet based on the Mandible Injury Severity Score (MISS).

METHODS

This study was a prospective cross sectional study method with measurement and observation carried out simultaneously at one time. The study sample was derived from the population of patients treated for isolated mandibular injury due to traffic accidents who were motorcyclists at the Emergency of Hasan Sadikin Medical Hospital Bandung by the oral and maxillofacial surgery (OFMS) service from July 1, 2019 through. February 31, 2020. Inclusion criteria were patients with mandibular trauma due to traffic accidents who were motorcycle riders with SNI (Indonesian national standards) half face helmets and do not use helmet over 17 years old with GCS < 8. Patients were excluded from the study if 1) they were younger than 17 years; 2) Patients refused radiography examination; 3) had incomplete or unavailable medical records; 4) forced discharge from the emergency room.



Fracture type	Location	Occlusion	Soft tissue involvement	Infection	Displacement
1. Incomplete (0) 2. Simple (2) 3. Comminute (3) 4. Bone defect (4)	L7, R7 (0) L1, L2, L4 R1, R2, R4 (2) L3, L8 R3, R8 (3) L5, L6 R5, R6 (4)	1. Normal (0) 2. Malocclusion (2) 3. Edentulous (2)	1. Closed (0) 2. Open intraorally (1) 3. Open extraorally (2) 4. Open intra and extraorally (3) 5. Soft tissue defect (4)	1. No (0) 2. Yes (3)	1. Mild (0) 2. Moderate (2) 3. Severe (4)

Figure 2. Mandible Injury Severity Score (MISS).[11]

Patients admitted to the Emergency Room and according to the inclusion criteria were examined with primary survey and secondary survey based on ATLS principles (advanced trauma life support). Patients were taken according to the chronology of trauma incidence, identified the fracture location on the head and face as well as torn, sharp penetrating wounds on the head and face. Then the clinical examination of the trauma site was done followed by the involvement of soft tissues, the relationship of occlusion and infection, and supporting examinations in the form panoramic radiographs or computed tomograms.

MISS is a valid measurement of injury severity on the mandible that can be used to predict the results, allocate resources, and produce a standard mandibular fracture severity to give different treatment alternatives. The predictor variables of MISS are 1) types of fracture (incomplete, simple, comminuted, bone defects); 2) fracture location (coronoid, symphysis, parasymphysis, alveolar bone, subcondylar, corpus, ramus); 3) occlusion features (normal, malocclusion, edentulous); 4) range of soft tissue damage (closed, open intra-orally, open extra-orally, intra and extra-orally, soft tissue injury); 5) presence of infection; 6) displacement between fragments (minor(< 2 mm), moderate (2 to 4 mm), major(> 4 mm). For the patient with multiple fractures, MISS is calculated based on the most severe fracture and 4 points are added for each additional fracture.[20,21]

Estimation of displacement between fragments is obtained from panoramic radiography or CT. Fractures without step-off seen in panoramic radiograph have displacement lower than 2 mm. All fractures extending through the bearing segment are considered open fractures. The fractures extending over 2 adjacent anatomical areas (for instance, parasympathetic and corpus) is assessed from the basal bone with the most dominant fractures.[21] The total sample in this study was 60 people who were patients with mandibular injuries due to traffic accidents on motorcycles. The results of the study were divided into two parts, namely descriptive analysis in the form of patient characteristics and an overview of the results of the study in general, as well as analysis of comparison tests to determine the relationship between the use of a half face helmet and the MISS (Mandible Injury Severity score). The collected data were then transferred to the recapitulation data in Microsoft Excel and analyzed using SPSS 20.0 and statistics test. The data analysis method used in this research was analytic descriptive analysis with comparative test. Before conducting the comparative test, a normality test of the data is carried out on the type of numeric data with the sample is more than 50 using the Kolmogorov-Smirnov test and the results show that the MISS p value < 0.05 (not normally distributed) and then analysis data was done with Mann-Whitney test.

RESULTS

The characteristics of patients based on table 1, indicated that the majority age was under 25 years old with a percentage of 58.3%, meaning that more than half of them were young, between 17 to under 25 years old. The second place were those between 26-35 years-old with a percentage of 20.0%. The majority of patients working as general employees had a proportion of 50% and the second was students.

Table 1. Patient characteristics

No	Characteristics	Amount	Percentage
1	**Age**		
	≤25 Year	35	58.3
	26-35 Year	12	20.0
	36-45 Year	5	8.3
	46-55 Year	1	1.7
	>55 Year	7	11.7
2	**Profession**		
	Housewife	5	8.3
	College student	13	21.7
	Student	5	8.3
	Government Employees	3	5.0
	General Employees	30	50.0
	Unemployment	4	6.7

From the 60 motorcyclist accidents from table 2 data, it was known that 38 people wore helmets, and 100% of them wore half-face helmets. Meanwhile, 22 people did not wear helmets with a percentage of 36.7%. As many as 60% of traffic accidents were single-vehicle accidents and 40% were multiple-vehicle accidents. It showed that 88.3% of the patients were riders and 11.7% were passengers.

Table 2. Helmet use and type of accident (n = 60)

No	Variable	Amount	Percentage
1	Helmet Use (Half face)		
	Yes	38	63.3
	No	22	36.7
2	Type of Accident		
	Single	36	60.0
	Multiple	24	40.0
3	Position		
	Motorcyclist	53	88.3
	Passenger	7	11.7

Table 3. Fracture location

No	Fracture Location	Amount	Percentage
1	Condyle	7	20.5
2	Corpus	7	20.5
3	Parasymphyisis	13	38.2
4	Ramus	1	2.9
5	Symphyisis	5	14.7
6	Subcondyle	1	2.9

Table 3 shows that fracture locations are the most in cases of motorcycle accidents was in the parasymphysis 38.2%, then the condyle and body with 20.5% and finally the symphysis with 14.7% cases.

Table 4. MISS characteristics

No		Amount	Percentage
1	Fracture type		
	Simple	21	35%
	Comminuted	4	6,6%
2	Occlusion		
	Normal	30	50%
	Malocclusion	29	48,3%
	Edentulous	1	1,6%
3	Soft tissue involvement		
	Closed	29	48,3%
	Open intraorally	14	23,3%
	Open Extraorally	3	0,05%
	Open intra and extraorally	12	20%
	Soft tissue defect	2	0,03%
4	Infection		
	Yes	0	0%
	No	60	100%
5	Displacement		
	Mild	34	56,6%
	Moderate	26	43,3%
	Severe	0	0

From the results of research data collection based on the translation of the MISS value in table 4, 35% of patients with simple fractures, 48.3% of patients had malocclusion, 1.6% fractured edentulous. 56.6% of patients experienced mild displacement and 43.3% the patient has moderate displacement. No infection was found In all study subjects because the clinical assessment was carried out at the same time when the patient came to the hospital In the Emergency Room.

Table 5. MISS score

Variable	Helmet Usage	
	a (n = 38)	No (n = 22)
MISS	,71 ±4,09	7,45±4,98

Mandible Injury Severity Score (MISS) of the riders who wore half-face helmets from table.5 had an average score of 5.71 with a standard deviation of 4.09, while those who did not wear helmets had an average MISS score of 7.45 with a standard deviation of 4.98.

Based on the MISS, the riders who wore helmets had a lower score compared to those who did not wear helmets. To prove whether this score gap was statistically significant or not, a comparative test analysis needed to be carried out.

Table 6. Comparative hypothesis test

Variable	Helmet Usage		p-value*
	Yes (n=38)	No (n=22)	
MISS	5,71±4,09	7,45±4,98	0,199

*)mann whitney test

Based on the results of data normality testing from table.6, it showed that the research data were not normally distributed, then the difference test hypothesis test was done using Mann-Whitney test as follows. Table 6 is the result of the comparative test using Mann-Whitney test. The average of the two data groups is said to have a significant difference if the p-value of the test result is less than 0.05.

Based on the results of the Mann-Whitney test, it showed that the MISS (p = 0.199> 0.05) was more than 0.05. It meant that the riders who wore half-face helmets and those who did not wear helmets had a MISS that was not significantly different.

DISCUSSION

The results of this study from characteristics of the research subject (table. 4) showed that the traffic accidents mostly happened to the young adult age group (≤25 years old) as many as 58.3%. The second place was the riders aged 26-35 years old with a percentage of 20.0%. at another study by Gopalakhrisna et al[24], who report the prevalence of maxillofacial injuries in the age range of 28.5 years old by 89.7%.

This shows that the majority of motorcycle accidents in Indonesia occur in the younger age group. The number of motorcyclists who wore helmets in this study (table. 2) was 63.3% higher than those who did not wear helmets of 36.7%. As many as 60% of traffic accidents were single-vehicle accidents and 40% were multiple-vehicle accidents. It showed that 88.3% of the patients were riders and 11.7% were passengers. Harnan Sign et al[25], was reported motorcyclists were the third commonest type of road users killed in traffic accidents accounting for 23.1% of all accident deaths and none of the victim was wearing helmet at the time of accident, 36.6% of motorcyclists were hit by Heavy Vehicles and 31.7% by car & jeeps. Majority accident occurred deaths by multiple-vehicle accidents.

The fracture locations of 60 patients with mandibular trauma base on table. 3 in this study were found at the highest incidence of parasymphysis fractures (38.2%) followed by condylar fractures (20.5%). The locations of mandibular fractures based on several studies in developing countries are varied. Obitade et al[26], report the incidence of mandibular fracture locations in Nigeria from 114 cases are corpus fractures (31.6%) followed by dentoalveolar fractures (21.9%)[33], Maximina et al[28], report the mostly affected locations of mandibular fracture are dentoalveolar (14%) as well as parasymphysis and condylus (11%).

It is reported that 20–60% of people who experience traffic accidents have some form of mandibular injuries. The likelihood of this injury increases when motorcycle riders do not wear helmets. This injury is not only traumatic, but also causes significant physiological, functional and aesthetic problems. The head and neck area is the most exposed area on the body, so it increases the risk of injury in traffic accidents. [26,27,33] The result of statistical analysis in table.6 from differences in the severity of mandibular trauma according to helmet use showed that the MISS ($p = 0.199 > 0.05$) was greater than 0.05.

It explains that the riders who wear half-face helmets and those who do not wear helmets have MISS that are not significantly different because half-face helmets can provide protection to the middle and upper face, but do not prevent lower facial injuries (mandible). The research by Ruslin et al[27], also show that motorcyclists who wear half-face helmets and not wearing helmets have NSE serum levels (head injury) that are not different since it provides limited protection to the head and facial area.

Half face helmed provides low protection against head injuries and the incidence of mandibular fractures [27,28,29] Saumi et al[28], report that riders who wear helmets have an increase in soft tissue injuries compared to those without helmets who have more fractures on the mandible and middle third of face.

This result is related to several factors including the type of helmet, helmet quality, helmet price, speed and vehicle safety features as well as the protection level of helmet.[31] The popularity of half-face helmets maybe accounts for the high incidence of mandibular fractures since it reduces upper and middle facial injuries but does not prevent lower facial injuries.[26,27,29,33]

The high number of motorcyclists who do not wear helmets, in addition to the popularity of half-face helmets in Indonesia is still a challenge for the Government, the community, and the Traffic Police Department to conduct comprehensive outreaches on the benefits of using standard helmets to reduce the incidence of mandibular fractures in traffic accidents. However, studies on helmet quality and the impact of speed on helmet use still require further research. [34,35,36]

CONCLUSION

Riders who wore half face helmets and did not wearing helmets has same risk of mandibular trauma based on the Mandible Injury Severity Score (MISS). Motorcycle users should use a full face helmet to prevent mandibular fractures during traffic accidents.

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