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Pattern and Distribution of Symphysis and Parasymphysis Fracture among Patients of Road Traffic Accident at Tertiary Care Hospital Karachi

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ABSTRACT

Maxillofacial trauma resulting from road traffic accidents (RTAs) constitutes a significant public health burden, particularly in developing countries. **Objectives:** To establish the trend and location of symphysis and parasymphysis mandibular injuries and their relationship with the road traffic accident mechanism. **Methods:** This cross-sectional research was done at the Department of Oral and Maxillofacial Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, during a period of six months after receiving ethical approval. Non-probability consecutive sampling was used to include 122 patients aged 18-60 years who sustained a mandibular fracture as a result of RTA either at the symphysis or parasymphysis. The structured Performa was utilized in data collection, and SPSS version 23.0 in data analysis. Descriptive statistics were used, and a chi-square test was used to identify the association, and a p-value less than 0.05 was taken to be significant. **Results:** The average age of patients was 34.6 +9.8 years with the male preponderance (79.5%). The majority were related to motorcycles (69.7% and 78.7% of the cases, respectively), and most of the victims did not take any preventive measures (69.7%). The most commonly associated was the parasymphysis region (53.3%), which was then followed by symphysis (32.0%), and most fractures were unilateral (68.0%) and displaced (55.7%). A statistically significant relationship between mechanism of injury and fracture site (p=0.032) and fracture pattern (p=0.041) existed. **Conclusion:** Symphysis and parasymphysis mandibular fractures are mostly caused by motorcycle road traffic accidents, especially in young males.

INTRODUCTION

Mandibular fractures lie in the category of the most common maxillofacial injuries, and the symphysis and parasymphysis areas are most susceptible to these fractures because they are the most exposed and anatomically prominent areas, and because road traffic accidents (RTAs) continue to be the leading cause of trauma [1]. Preservation of occlusion and mandibular continuity is the main objective of the treatment in parasymphysis and symphysis fractures, which necessitates proper and timely surgical intervention [2]. In most developing countries, such as Pakistan, the mandibular fracture is caused most often by a road traffic accident, which is caused by a combination of poor enforcement of road traffic regulations, absence of wearing seat belts and helmets, and poor road facilities [3]. Wang et al. examined national trends, and they reported that mandibular fractures come at a high cost to the face, with mandibular fractures being the most frequent sustained injuries. In the South Asian context, road traffic accidents are the major cause of mandibular fracture, due to the impact forces generated during crashes, which may produce direct trauma to the mandible, leading to displacement, comminution, or multiple fracture sites depending on the direction and magnitude of the impact. There is considerable biomechanical work that indicates that stress-bearing areas of the mandible include the

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symphyseal and parasymphyseal areas, which are more likely to fracture during anterior-posterior forces like those resulting from a car collision or a fall forward in an accident [4]. These patterns can be used to choose the proper fixation system and forecast potential complications. Investigations in other areas have also continued to highlight the presence of RTAs as a significant causal agent of mandibular fractures, including parasymphysis fractures, and this phenomenon necessitates region-specific prevention tactics. [5,]. Asya *et al.* in their extensive retrospective study, found that RTAs were one of the most frequent etiological factors in anterior mandibular fractures, especially in men aged 20-40 years[6]. In addition, the fracture location and severity are directly influenced by the mechanism of injury; Hesham *et al.* described high-velocity fractures caused by vehicular trauma as usually complex or multifocal fractures of the anterior mandible, and low-velocity injuries as localized ones involving only one part of the body [7]. Nogami *et al.* also reported that dental injuries often go along with mandibular fractures of road traffic origin, especially in the symphysis region, which makes recovery of dental functions difficult and thus makes treatment more challenging [8]. The Middle East and South Asian research also resulted in recent reports on increased incidences of maxillofacial trauma in terms of increased urbanization and car density, which are the same and must be taken into consideration as the source of prevention initiatives, including helmet use and road safety education [9, 10].

Symphysis and parasymphysis fractures are common consequences of road traffic accidents (RTAs), particularly in rapidly urbanizing settings of developing countries like Pakistan, where trauma incidence is on the rise. Despite this, there is limited local data from tertiary care centers in Karachi regarding the specific patterns, distribution, and associated risk factors of these fractures, highlighting a significant gap in the existing literature. Understanding these epidemiological trends is crucial for improving clinical outcomes and guiding preventive strategies. Therefore, this study aimed to identify the pattern and distribution of symphysis and parasymphysis fractures among patients involved in RTAs presenting to a tertiary care hospital in Karachi. Given that the mandible plays a vital role in mastication, speech, and facial aesthetics, and is highly susceptible to trauma due to its prominent position, such insights may contribute to better management protocols and a reduction in the burden of mandibular injuries.

METHODS

The cross-sectional research was carried out during the period between 3rd June 2025 and 30th November 2025 at the Department of Oral and Maxillofacial Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, over a period of six months. The Institutional Review Board and Ethics Review Committee of JPMC (ERC No. F-2-81/2025-GENL/331-H/JPMC; dated 2nd June 2025) provided the ethical approval of the study on 2nd June 2025 and ensured that it was conducted in accordance with the Declaration of Helsinki and institutional guidelines on research ethics. All participants were enrolled using informed consent, which was signed. The outpatient department and inpatient units of the hospital were used to screen patients presented with fractures of the symphysis or parasymphysis of the mandible due to road traffic accidents (RTAs) until the required number of patients was obtained. The aged patients were included between 18 and 60 years of both genders who suffered fractures as a result of RTAs and were willing to take part after grasping the purpose and process of the study. Fracture patients, fracture of other parts of the maxillofacial, prior mandible fractures or surgeries, mentally unstable patients, pregnant or lactating women, and immunocompromised patients were excluded. Such exclusion criteria were used to limit confounding by non-RTA trauma, systemic conditions, or previous interventions that could influence fracture patterns, healing, or outcomes. The WHO Sample Size Calculator (version 2.0) was used to calculate the sample size. This was calculated using the prevalence of parasymphaxis fractures of the mandibular fractures, as expected, which has been reported to be 28.33% in a study conducted by Pendyala KS et al. The choice of this outcome variable was due to the fact that the main goal of the study was to identify the distribution and the trend of symphysis and parasymphysis fractures in mandibular injury by RTAs. The minimum sample size calculated based on a 95% confidence level and an 8% margin of error was 122 patients. It was found that this sample size was adequate to be able to estimate the prevalence of these fracture patterns in the study population with reasonable accuracy. A non-probability consecutive sampling technique was used in this study. The data was gathered through a structured proforma based on earlier published research on the epidemiology of mandibular fracture and a few adjustments in relation to the goals of the current research. The proforma contained data on demographic factors (age, gender, occupation, residence), injury factors (mechanism of RTA, type of the vehicle involved, and use of protective factors, helmets or seatbelts), clinical findings, radiographic findings, fracture site (symphysis, parasymphysis, combined), laterality (unilateral or bilateral), and fracture pattern. Direct patient interview and examination of clinical and radiographic records were used as data collection methods. Clinical examination was carried out in the normal aseptic conditions, and radiographic confirmation was done by the use of

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orthopantomogram (OPG) and/or computed tomography (CT) scan in cases where necessary. Fracture patterns were operationally defined in terms of the radiographic criteria that had been previously described in the maxillofacial trauma literature. The fracture that was referred to as a displaced fracture was a fracture that had lost its normal position in the anatomy. Fractures in which the anatomically set bone fragments were not moved far apart were termed a non-displaced fracture. A fracture that had three or more bone pieces was considered to be comminuted as exhibited through a radiograph. They were based on the standard radiographic classification criteria that are outlined in the former studies of mandibular trauma.

The statistical analysis and data input were done using SPSS version 23.0. The continuous variables, like age, were summarized as the mean and standard deviation, and the categorical variables, like gender, fracture site, and laterality, as well as fracture pattern, were summarized into frequencies and percentages. Besides the descriptive statistics, inferential analysis was also done to test the relationship among categorical variables, like the relationship between fracture site and mechanism of injury or use of protective equipment. The comparisons were done using the Chi-square test. A statistically significant p-value was considered to be 0.050 or less.

RESULTS

A total of 122 patients meeting the inclusion criteria were enrolled in the study. The mean age of participants was 34.6 ± 9.8 years (range: 18–58 years). Males predominated the study population (n= 97; 79.5%), while females accounted for 25 (20.5%) participants. Most patients resided in urban areas of Karachi (n=84; 68.9%) and were primarily employed in manual or field-based occupations (n=72; 59.0%)(Table 1).

Table 1: Baseline Demographic Characteristics of the Study Population(n=122)

Variables	Frequency (%)
Age (Years)	
18 – 30	48 (39.3%)
31 – 40	36 (29.5%)
41 – 50	27 (22.1%)
51 – 60	11 (9.0%)
Gender	
Male	97 (79.5%)
Female	25 (20.5%)
Occupation	
Field / labor-based	72 (59.0%)
Office/business	33 (27.0%)
Student	10 (8.2%)
Unemployed	7 (5.8%)
Residential Area	
Urban	84 (68.9%)
Rural	38 (31.1%)

Motorcycle-related accidents were the most common cause of mandibular fractures (n=85; 69.7%), followed by car accidents (n=21; 17.2%), bus/truck-related trauma (n=10; 8.2%), and pedestrian injuries (n=6; 4.9%). The majority of victims (n=96; 78.7%) were not using protective measures (helmets or seatbelts) at the time of the accident. Fractures predominantly involved the parasymphysis region (53.3%) followed by symphysis (32.0%), with most fractures being unilateral (68%) and displaced (55.7%). Motorcycle accidents were particularly associated with displaced parasymphysis fractures (Table 2).

Table 2: Mechanism of Injury and Fracture Characteristics (n=122)

Variables	Frequency (%)
Type of Vehicle Involved in RTA	
Motorcycle	85 (69.7%)
Car	21 (17.2%)
Bus / Truck	10 (8.2%)
Pedestrian	6 (4.9%)
Use of Protective Measures	
Yes	26 (21.3%)
No	96 (78.7%)
Fracture Location	–
Symphysis	39 (32.0%)
Parasymphysis	65 (53.3%)
Both	18 (14.7%)
Type of Fracture	
Unilateral	83 (68.0%)
Bilateral	39 (32.0%)
Fracture Pattern (on Imaging)	
Displaced	68 (55.7%)
Non-displaced	34 (27.9%)
Comminuted	20 (16.4%)
Site of Impact on Face	
Frontal	29 (23.8%)
Lateral	41 (33.6%)
Chin	39 (32.0%)
Other	13 (10.6%)

The association between the mechanism of injury and fracture characteristics was further analyzed. A statistically significant association was observed between mechanism of injury and both fracture location (p=0.032) and fracture pattern (p=0.041), indicating that high-velocity motorcycle trauma was more likely to produce displaced parasymphysis fractures. No significant association was found between the mechanism of injury and use of protective measures (p=0.058). These findings are summarized in table 3.

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Table 3: Association of Mechanism of Injury with Fracture Variables(n=122)

Characteristics	Motorcycle (n= 85)	Car (n=21)	Bus/Truck (n=10)	Pedestrian (n=6)	p-value
Fracture Location					
Symphysis	21(24.7%)	9(42.9%)	6(60.0%)	3(50.0%)	0.032*
Parasymphysis	56(65.9%)	10(47.6%)	3(30.0%)	2(33.3%)	
Both	8(9.4%)	2(9.5%)	1(10.0%)	1(16.7%)	
Fracture Pattern					
Displaced	54(63.5%)	7(33.3%)	5(50.0%)	2(33.3%)	0.041*
Non-displaced	22(25.9%)	9(42.9%)	3(30.0%)	2(33.3%)	
Comminuted	9(10.6%)	5(23.8%)	2(20.0%)	2(33.3%)	
Use of Protective Measures					
Yes	14(16.5%)	7(33.3%)	3(30.0%)	2(33.3%)	0.058
No	71(83.5%)	14(66.7%)	7(70.0%)	4(66.7%)	

*P<0.050 statistically significant(Chi-square test)

DISCUSSION

The current research evaluated the trend and the distribution of symphysis and parasymphysis fractures in patients who had road traffic accidents (RTA) in one of the tertiary care hospitals within Karachi. The results indicate that mandibular fractures continue to be among the most common consequences of facial trauma, especially after accidents on motorbikes, which contributed to almost 70% of all cases in this research. The mean age of the study sample was 34.6 ± 9.8 years, and the majority of them were young adult males working in the field. These results can be compared to Muralidhar *et al.* who also demonstrated the same demographic situation since males between their third and fourth decades were the majority of maxillofacial trauma victims [11]. A similar result was reported by Roccia *et al.* in the WORMAT project, where the same global predominance of young male patients with road-traffic-related facial injuries was observed, which is dependent on exposure and occupational mobility [12]. The most common mechanism of injury in the study (69.7%) was motorcycle collisions, and the next ones were car and bus/truck accidents. Similar findings were also reported in the works by Chuang *et al.* and Maharjan *et al.* which expressed a similar opinion by stating that motorcycles are the most common cause of facial fractures in the developing lands where helmet non-adherence is widespread [13, 14]. In the given study, it was also found that 78.7 % of patients were not wearing helmets or seatbelts during an injury, which supports the results reported by Wusiman *et al.* and Kanala *et al.* who state that the lack of compliance with the safety measures is one of the primary causes of mandibular injuries [15, 16]. Concerning the location of fracture, parasymphysis fractures were the most common (53.3%), symphysis (32.0%), and combined fracture (14.7%). These findings are consistent with the research of Hashmi *et al.* who underlined the anatomical susceptibility of the parasymphysis area because it is thinner in the cortex and has an approach to the canine fossa [17]. Equally, Jamal *et al.* (2023) and Khan *et al.* (2025) emphasized that high-velocity trauma normally causes anterior mandibular fractures, which need to be fixed with surgery to achieve the best alignment and functionality [18, 19].There was also a strong correlation between the mechanism of injury and the fracture site (p=0.032) and the fracture pattern (p=0.041), the motorcycle accidents were more likely to result in displaced parasymphysis fractures. These results are consistent with the literature of Kanala *et al.* (2021) and Roccia *et al.* (2022) that revealed that intense, high-velocity impacts of motorcycle collisions tend to produce intricate fracture patterns [16,12]. This observation was also reinforced by Gercek and Bayrakci (2025) who found that the degree and orientation of the parasymphysis and angle fractures after open reduction and internal fixation were of significant consideration in the remodeling of the mandibular condyles and alteration of the joint space. [20]. All these results together are used to underscore the fact that RTA, especially motorcycle accidents that do not involve protective gears, continue to be the number one cause of anterior mandibular fractures in Pakistan. Education on helmet use and enforcement of traffic laws and early surgical intervention on facial trauma would play a critical role in the reduction of the burden of facial trauma.

This project was done in one tertiary care facility and might not represent the trend of the fractures in the general population. The number of the samples was small, and only the cases connected to RTA were considered, without falling or assault cases being considered as other etiologies. Radiological evaluation was mainly admired on the basis of two-dimensional assessment instead of CT-based reconstruction that could have limited accurate assessment of the anatomy. It is suggested that future multicenter research using bigger cohorts and more sophisticated imaging be used to confirm these results. Strict prevention measures by encouraging helmet wearing, good driving skills.

CONCLUSIONS

This study concludes that road traffic accidents, particularly motorcycle collisions, are the predominant cause of symphysis and parasymphysis mandibular fractures in young adult males. The parasymphysis region was most frequently involved, with displaced unilateral fractures being the most common pattern. A statistically significant relationship was found between mechanism of injury and both fracture location and pattern, indicating that high-velocity motorcycle trauma is more likely to produce displaced anterior mandibular fractures. These findings highlight the urgent need for public health

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interventions focusing on road safety education, mandatory helmet use, and stricter traffic law enforcement to reduce the incidence and severity of mandibular fractures resulting from preventable road accidents.

Authors' Contribution

Conceptualization: HR
Methodology: HR, SG, AM, WB
Formal analysis: JA, HR, SG
Writing and Drafting: HR, AM, MM, WB
Review and Editing: HR, JA, SG, AM, MM, WB

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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