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Assessment of Maxillofacial Soft Tissue Injuries in Trauma Patients: A Cross-Sectional Study

Malik Farhan Hameed [1] Zeenia Arbab [2] Syed Hassan Mehboob Bukhari [3] Muhammad Ali [4]

[1,2,3,4] Department of Oral and Maxillofacial Surgery, Sardar Begum Dental College, Peshawar, Khyber Pakhtunkhwa, Pakistan.

ABSTRACT

Background: Maxillofacial soft tissue injuries are common among trauma patients and place a considerable burden on emergency and surgical services. The pattern and severity of these injuries are influenced by demographic characteristics and mechanisms of trauma. To assess the pattern, severity, and predictors of maxillofacial soft tissue injuries among trauma patients in a hospital-based cross-sectional study.

Study Design: A Cross-sectional study.

Place and Duration of the Study: The study was conducted in the Department of Oral and Maxillofacial Surgery, Sardar Begum Dental College, Peshawar, over a period of six months from July 2024 to December 2024.

Materials and Methods: A total of 230 trauma patients presenting with maxillofacial soft tissue injuries were included in the study. Data on demographic characteristics, trauma etiology, injury type, and severity were collected and analyzed. Descriptive statistics summarized the data. Associations between categorical variables were examined using the Chi-square test. Binary logistic regression analysis was performed to identify independent predictors of severe injury. A p-value < 0.05 was considered statistically significant.

Results: Most patients were males (70.4%), with the highest proportion aged 26–35 years (29.6%). Road traffic accidents (45.2%) were the leading cause of injury, followed by assault (25.2%) and falls (18.3%). Lacerations were the most common injury type (41.7%). A significant association was observed between trauma etiology and injury severity ($p < 0.001$), with road traffic accidents contributing the largest proportion of severe injuries. Gender was also significantly associated with injury type ($p = 0.018$). Logistic regression analysis identified road traffic accidents as an independent predictor of severe injury (Adjusted OR = 4.21; 95% CI: 1.54–11.48; $p = 0.005$).

Conclusion: Road traffic accidents are the primary cause and strongest predictor of severe maxillofacial soft tissue injuries, particularly among young adult males. Strengthening road safety measures is essential to reduce the burden of these injuries.

Key Words
Maxillofacial Injuries, Soft Tissue Trauma, Road Traffic Accidents, Cross-Sectional Study, Injury Severity, Logistic Regression

Corresponding Author
Dr. Zeenia Arbab | Registrar, Department of Oral and Maxillofacial Surgery, Sardar Begum Dental College, Peshawar, Khyber Pakhtunkhwa, Pakistan.
Email: dr.zinnia.arbab@gmail.com

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INTRODUCTION

Maxillofacial soft tissue injuries are among the most common presentations in emergency and trauma departments worldwide [1]. These injuries include lacerations, abrasions, contusions, avulsions, and puncture wounds affecting the facial region, and they may occur either in isolation or in association with underlying skeletal fractures [2]. Due to the anatomical complexity and aesthetic importance of the face, soft tissue injuries require prompt evaluation and appropriate management to minimize functional impairment and cosmetic deformity [3].

Globally, trauma remains a leading cause of morbidity and mortality, particularly among young adults, with road traffic accidents (RTAs), interpersonal violence, and falls being the primary etiological factors [4]. In developing and urbanizing

regions, RTAs contribute significantly to maxillofacial trauma due to increasing motorization, inadequate road safety measures, and non-compliance with protective devices such as helmets and seat belts [5]. Assault-related injuries are also increasingly reported, reflecting changing social and behavioral patterns [6].

The epidemiological distribution of maxillofacial injuries shows a clear male predominance, often attributed to greater exposure to high-risk activities, occupational hazards, and interpersonal violence [7]. Studies have consistently reported that individuals in the second and third decades of life are most commonly affected, as this age group is more socially and economically active [8]. Furthermore, the pattern and severity of soft tissue injuries vary depending on the mechanism and force of impact, with high-velocity trauma typically resulting in more extensive tissue damage [9].

Understanding the demographic profile, causes, injury patterns, and severity distribution of maxillofacial soft tissue trauma is essential for improving emergency care planning, preventive strategies, and public health interventions [10]. Despite numerous studies on maxillofacial fractures, limited data focus specifically on soft tissue injury patterns and their predictors in trauma patients. Therefore, this cross-sectional study was conducted to assess the demographic characteristics, etiology, injury patterns, and predictors of severity of maxillofacial soft tissue injuries among trauma patients presented to Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional study was carried out in the Department of Oral and Maxillofacial Surgery, Sardar Begum Dental College, Peshawar, over a six-month period from July 2024 to December 2024.

Sample Size and Sampling Technique

The study population consisted of trauma patients diagnosed with maxillofacial soft tissue injuries during the study period. The sample size was calculated using the formula for cross-sectional studies:$n = Z^2 \times p (1 - p) / d^2$, where Z represents the standard normal value at a 95% confidence level (1.96), p is the estimated prevalence, and **d** is the margin of error. Since the exact prevalence of maxillofacial soft tissue injuries in the target population was not known, a prevalence of 50%was assumed to obtain the maximum sample size. Using a 5% margin oferror, the minimum required sample size was calculated to be 196 participants. To increase statistical power and account for possible incomplete records, a total of 230 patients were included in the final analysis.A non-probability convenience sampling technique was used.

Inclusion Criteria

- Patients of both genders
- Patients from all adult age groups
- Patients presenting with isolated or associated soft tissue injuries of the maxillofacial region

Exclusion Criteria

- Patients with life-threatening systemic injuries requiring immediate intensive care
- Patients with incomplete medical records
- Patients unwilling to participate in the study

Data Collection Procedure

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Sardar Begum Dental College, Peshawar, (NO.1161/SBDC, Dated: 24/04/2024) prior to the commencement of data collection. All procedures were carried out in accordance with ethical standards, and informed consent was obtained from all participants before their inclusion in the study. Confidentiality and anonymity of patient information were strictly maintained throughout the research process.

Data were collected using a structured proforma designed for the study. Information regarding demographic characteristics (age, gender, residence), etiology of trauma (road traffic accidents, assault, falls, sports injuries, occupational injuries), type of soft tissue injury (laceration, abrasion, contusion, avulsion, puncture wound), and injury severity (classified as mild, moderate, or severe based on clinical assessment and extent of tissue involvement) was recorded. Injury severity was categorized into mild, moderate, and severe based on the extent of soft tissue damage and clinical presentation.

Mild: Superficial injuries such as minor abrasions or small lacerations that required minimal treatment and did not involve significant tissue loss.

Moderate: Injuries involving deeper lacerations or contusions requiring suturing or minor surgical management but without extensive tissue loss.

Severe: Extensive soft tissue damage including large lacerations, avulsions, or injuries requiring complex surgical repair, hospitalization, or multidisciplinary management.

Clinical examination was performed by trained maxillofacial surgeons following standard diagnostic protocols.

The primary outcome variable was injury severity (categorized as severe and non-severe for regression analysis). Independent variables included age group, gender, and etiology of trauma. Injury type was also analyzed to determine distribution patterns and association with demographic factors.

Statistical Analysis

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics such as frequency and percentage were used to summarize categorical variables. The Chi-square test was applied to assess associations between categorical variables, including etiology and injury severity, as well as gender and injury type. Binary logistic regression analysis was performed to identify independent predictors of severe injury, and results were presented as odds ratios (OR) with 95% confidence intervals (CI). A p-value of less than 0.05 was considered statistically significant.

RESULTS

The demographic distribution of the study participants (n = 230) indicates that the majority of patients were young adults, with the highest proportion in the 26–35 years age group (29.6%), followed by 36–45 years (23.5%) and 18–25 years (22.6%), while individuals aged ≥56 years constituted the smallest group (9.5%). Males predominated significantly, accounting for 70.4% of cases, compared to females (29.6%), suggesting greater exposure of males to trauma-related risk factors. Most participants were from urban areas (64.3%), indicating a higher incidence of maxillofacial injuries in urban populations, possibly due to increased vehicular traffic and population density. More than half of the participants were single (53.9%), and nearly half were employed (48.7%), reflecting that economically active individuals were more frequently affected. Regarding educational status, the largest proportion had secondary education (41.7%), followed by higher secondary (27.0%), while only 19.1% were graduates and above. Overall, the findings demonstrate that young, urban, employed males with secondary-level education constituted the majority of trauma patients with maxillofacial soft tissue injuries in this study.

Table 1: Demographic Characteristics of Study Participants (n = 230)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–25	52	22.6
	26–35	68	29.6
	36–45	54	23.5
	46–55	34	14.8
	≥56	22	9.5
	Total	**230**	**100**
Gender	Male	162	70.4
	Female	68	29.6
	Total	**230**	**100**
Residence	Urban	148	64.3
	Rural	82	35.7
	Total	**230**	**100**
Marital Status	Single	124	53.9
	Married	94	40.9
	Divorced/Widowed	12	5.2
	Total	**230**	**100**
Occupation	Student	48	20.9
	Employed	112	48.7
	Self-Employed	34	14.8
	Unemployed	36	15.6
	Total	**230**	**100**
Educational Level	Primary	28	12.2
	Secondary	96	41.7
	Higher Secondary	62	27.0
	Graduate &Above	44	19.1
	Total	**230**	**100**

The distribution of etiology of trauma among the study participants (n = 230) shows that road traffic accidents (RTAs) were the leading cause of maxillofacial soft tissue injuries, accounting for 45.2% of cases. This was followed by assault, which contributed to 25.2% of injuries, indicating a substantial role of interpersonal violence in facial trauma. Falls represented 18.3% of cases, while sports-related injuries (7.0%) and occupational injuries (4.3%) were less common causes. Overall, the findings highlight that high-velocity vehicular accidents and violence are the predominant contributors to maxillofacial soft tissue injuries in the studied population, emphasizing the need for improved road safety measures and violence prevention strategies.

Table 2: Etiology and Types of Maxillofacial Soft Tissue Injuries

Variable	Category	Frequency (n)	Percentage (%)
Etiology of Trauma	Road Traffic Accidents	104	45.2
	Assault	58	25.2
	Falls	42	18.3
	Sports Injuries	16	7.0
	Occupational Injuries	10	4.3
Type of Soft Tissue Injury	Lacerations	96	41.7
	Abrasions	64	27.8
	Contusions	44	19.1
	Avulsions	16	7.0
	Puncture Wounds	10	4.3

The distribution of types of maxillofacial soft tissue injuries among the 230 patients indicates that lacerations were the most common presentation, accounting for 41.7% of cases. Abrasions were the second most frequent injury type (27.8%), followed by contusions (19.1%). More severe forms of soft tissue damage, such as avulsions (7.0%) and puncture wounds (4.3%), were comparatively less common. This pattern suggests that most injuries resulted from blunt and sharp force trauma mechanisms, commonly associated with road traffic accidents and assaults, leading predominantly to lacerations and abrasions rather than extensive tissue loss or penetrating wounds

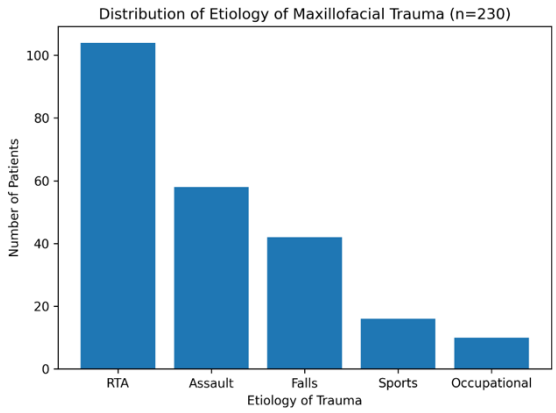

Figure 1: Distribution of etiology of maxillofacial trauma among study participants (n = 230). Road traffic accidents were the most common cause of injury.

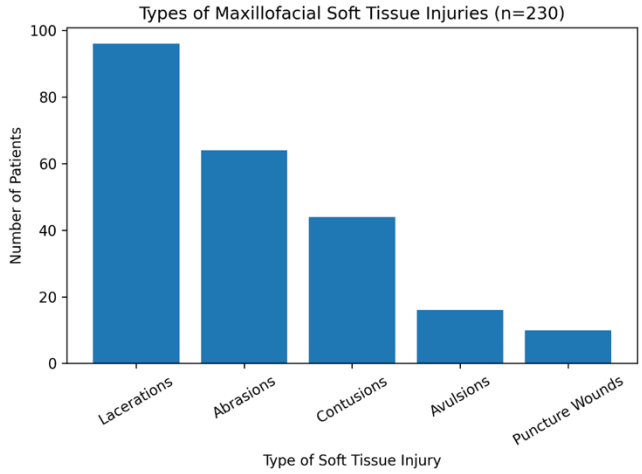

Figure 2: Types of Maxillofacial Soft Tissue Injuries Observed among Trauma Patients. Lacerations were the most Frequently Reported Injury Type

The association between etiology of trauma and injury severity demonstrated a statistically significant relationship ($p < 0.001$). Road traffic accidents (RTA) showed the highest proportion of severe injuries (28.9%) and moderate injuries (44.2%), indicating that high-velocity mechanisms are more likely to result in extensive soft tissue damage. In contrast, falls and sports injuries were predominantly mild in severity, accounting for 61.9% and 75.0% mild cases respectively, with very few severe injuries reported. Assault-related injuries were mainly mild (44.8%) to moderate (41.4%), with a smaller proportion classified

as severe (13.8%). Occupational injuries also showed a higher proportion of mild cases (60.0%) and minimal severe involvement (10.0%). Overall, the findings suggest that the mechanism of trauma significantly influences injury severity, with road traffic accidents being the primary contributor to severe maxillofacial soft tissue injuries.

Table 3: Association of Etiology and Gender with Injury Severity and Type (n = 230)

Etiology	Mild n (%)	Moderate n (%)	Severe n (%)	Total	p-value
RTA	28 (26.9)	46 (44.2)	30 (28.9)	104	
Assault	26 (44.8)	24 (41.4)	8 (13.8)	58	
Falls	26 (61.9)	14 (33.3)	2 (4.8)	42	
Sports	12 (75.0)	4 (25.0)	0 (0.0)	16	
Occupational	6 (60.0)	3 (30.0)	1 (10.0)	10	
Total	**98**	**91**	**41**	**230**	**< 0.001***

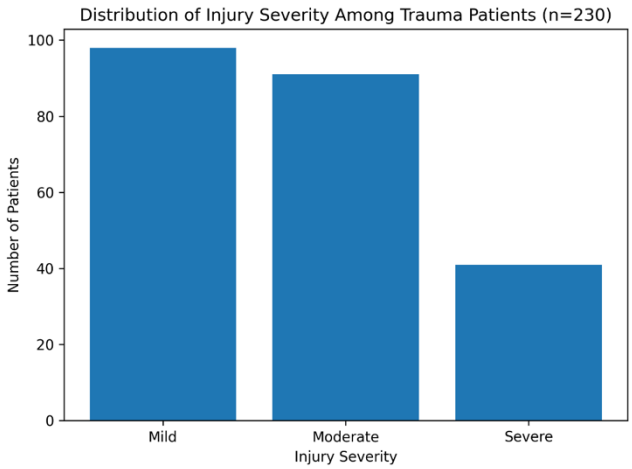

Figure 3: Distribution of Injury Severity among Study Participants Showing Mild, Moderate, and Severe Maxillofacial Soft Tissue Injuries

The logistic regression analysis identified factors associated with severe maxillofacial soft tissue injury. With respect to age, although increasing age groups showed higher crude odds of severe injury compared to the 18–25 years reference group, none of these associations reached statistical significance in either crude or adjusted analysis ($p > 0.05$). Participants aged ≥46 years demonstrated higher odds (AOR = 1.88; 95% CI: 0.74–4.71), but this was not statistically significant ($p = 0.18$). Regarding gender, males had significantly higher crude odds of severe injury compared to females (OR = 2.36; 95% CI: 1.05–5.31; $p = 0.037$); however, this association lost statistical significance after adjustment (AOR = 2.08; 95% CI: 0.91–4.75; $p = 0.081$), suggesting possible confounding by other variables. In contrast, etiology showed a strong and statistically significant association with severity. Patients involved in road traffic accidents had nearly five times higher crude odds of severe injury (OR = 4.89; 95% CI: 1.85–12.94; $p = 0.001$) and remained a significant independent predictor after adjustment (AOR = 4.21; 95% CI: 1.54–11.48; $p = 0.005$). Assault and occupational injuries were not significantly associated with severe outcomes, while sports injuries showed no association. Overall, the findings indicate that road traffic accidents are the strongest independent predictor of severe maxillofacial soft tissue injury in this study population.

Table 4: Logistic Regression Analysis for Predictors of Severe Maxillofacial Soft Tissue Injury (n = 230)

Variable	Category	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age Group	18–25 (Ref)	1.00	—	1.00	—
	26–35	1.42 (0.65–3.12)	0.37	1.28 (0.54–3.01)	0.56
	36–45	1.76 (0.78–3.94)	0.17	1.52 (0.64–3.63)	0.34
	≥46	2.10 (0.89–4.96)	0.09	1.88 (0.74–4.71)	0.18
Gender	Female (Ref)	1.00	—	1.00	—
	Male	2.36 (1.05–5.31)	0.037*	2.08 (0.91–4.75)	0.081
Etiology	Falls (Ref)	1.00	—	1.00	—
	RTA	4.89 (1.85–12.94)	0.001*	4.21 (1.54–11.48)	0.005*
	Assault	2.15 (0.74–6.22)	0.16	1.92 (0.63–5.83)	0.25
	Sports	0.00	0.99	0.00	0.99
	Occupational	1.30 (0.14–11.87)	0.82	1.11 (0.12–10.54)	0.93

DISCUSSION

The present cross-sectional study evaluated the demographic characteristics, etiology, injury patterns, and predictors of severity among patients presenting with maxillofacial soft tissue injuries. The findings demonstrated that young adult males were predominantly affected, with road traffic accidents emerging as the leading cause and strongest predictor of severe injury.

In this study, males constituted the majority of patients (70.4%), which is consistent with previous epidemiological reports indicating male predominance in maxillofacial trauma cases [11, 12]. This gender disparity is commonly attributed to increased exposure of males to high-risk occupations, outdoor activities, aggressive behavior, and vehicular driving patterns [13]. Similar findings have been reported in regional and international trauma studies, where male-to-female ratios ranged between 2:1 and 4:1 [14].

The highest incidence was observed in the 26–35 years age group, reflecting the vulnerability of economically productive and socially active individuals. Comparable age distribution patterns have been documented in several hospital-based trauma studies, where the second and third decades of life were the most affected [15, 16]. This may be explained by increased mobility, occupational exposure, and involvement in interpersonal violence during these years.

Road traffic accidents were identified as the most common etiology (45.2%) and were significantly associated with severe injuries ($p < 0.001$). Logistic regression analysis further confirmed RTA as an independent predictor of severe soft tissue injury. These findings align with previous research demonstrating that high-velocity impacts from vehicular collisions result in extensive soft tissue damage due to direct blunt force trauma and secondary impact mechanisms [17, 18]. In contrast, falls and sports-related injuries were predominantly mild, likely due to lower energy transfer.

Lacerations were the most frequent type of soft tissue injury (41.7%), followed by abrasions and contusions. This pattern is consistent with earlier studies reporting lacerations as the most common facial soft tissue presentation in emergency departments [19]. The prominence of lacerations may be attributed to sharp or irregular surfaces encountered during road traffic accidents and assaults.

A statistically significant association was found between gender and type of injury ($p = 0.018$), with males exhibiting a higher proportion of lacerations. This observation may reflect differences in trauma mechanisms, occupational exposure, and behavioral risk factors between genders [20]. Although male gender showed increased odds of severe injury in crude analysis, it did not remain an independent predictor after adjustment, suggesting that the mechanism of injury plays a more critical role than gender alone.

The model explained approximately 28% of the variability in injury severity, indicating that other factors such as alcohol consumption, helmet use, seatbelt compliance, and environmental conditions may also contribute to injury outcomes [21-23]. Future studies incorporating these behavioral and environmental variables may provide a more comprehensive understanding of predictors of severe facial trauma.The logistic regression model explained approximately 28% of the variance in injury severity (Nagelkerke $R^2 = 0.28$), indicating that while the variables included in the model significantly contributed to predicting severe injuries, additional factors such as alcohol consumption, helmet use, seatbelt compliance, and environmental conditions may also influence the severity of maxillofacial trauma.

The findings of this study highlight the need for targeted preventive strategies, particularly improved road safety enforcement, public awareness campaigns, and strict adherence to protective measures such as helmet and seatbelt use [24]. Early assessment and proper management of soft tissue injuries are also essential to minimize complications, infection, scarring, and functional impairment.Overall, the study reinforces the significant role of high-velocity trauma in determining the severity of maxillofacial soft tissue injuries and underscores the importance of public health interventions aimed at reducing trauma incidence.

Despite providing valuable insights into the epidemiology and predictors of maxillofacial soft tissue injuries, this study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships between risk factors and injury severity. Second, the study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings to other regions or healthcare settings. Third, certain behavioral and environmental factors such as alcohol consumption, helmet use, seatbelt compliance, and timing of injury were not assessed and may influence injury outcomes. Future multicenter studies incorporating these variables are recommended to provide a more

comprehensive understanding of predictors of severe maxillofacial trauma.

CONCLUSION

This cross-sectional study evaluated the demographic profile, etiology, injury patterns, and predictors of severity among patients presenting with maxillofacial soft tissue injuries. The findings revealed that young adult males were the most commonly affected group, highlighting the vulnerability of economically productive age groups to facial trauma. Road traffic accidents emerged as the leading cause of injury and were identified as a significant independent predictor of severe soft tissue damage. Lacerations were the most frequently observed injury type, followed by abrasions and contusions.A statistically significant association was observed between trauma etiology and injury severity, emphasizing the impact of high-velocity mechanisms on the extent of facial tissue damage. Gender was significantly associated with the type of injury; however, it was not an independent predictor of severity after adjustment for other variables. These results underscore the critical role of mechanism of injury in determining clinical outcomes.Overall, the study highlights the growing burden of maxillofacial soft tissue injuries, particularly those resulting from road traffic accidents. Strengthening road safety regulations, promoting the use of protective devices, and implementing public awareness programs are essential to reduce the incidence and severity of such injuries. Early diagnosis, proper clinical assessment, and timely management remain crucial in minimizing complications and improving functional and aesthetic outcomes.

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AUTHORS CONTRIBUTION

Concept & Design of Study: Dr.Malik Farhan Hameed, Dr. Zeenia Arbab
Drafting: Dr. Syed Hassan Mehboob Bukhari
Data Analysis: Dr.Muhammad Ali
Critical Review: Dr. Zeenia Arbab, Dr.Malik Farhan Hameed
Final Approval of Version: All authors (Dr.Malik Farhan Hameed,Dr. Zeenia Arbab, Dr.Syed Hassan Mehboob Bukhari, Dr.Muhammad Ali)

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