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Injury Severity Score–Based Analysis of Oral and Maxillofacial Injuries in Major Trauma Patients

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Abstract

Background/Objectives: Trauma is increasingly recognized as a major cause of morbidity and mortality, particularly among the economically active population. Facial injuries are frequently encountered in major trauma cases and can lead to serious complications if not promptly assessed. This study aimed to evaluate the clinical characteristics of oral and maxillofacial trauma and emphasize the importance of early assessment of these injuries in relation to other affected regions.

Methods: A retrospective analysis was conducted on 188 patients with oral and maxillofacial injuries admitted to the Emergency Department of Pusan National University Hospital between 2018 and 2020. Data collected included demographics, injury mechanisms, sites of trauma, Injury Severity Scores (ISS), and patterns of multidisciplinary treatment. Of 188 included subjects, 108 patients were classified as severe according to ISS analysis.

Results: Traffic accidents accounted for the majority of cases (61.2%). Soft tissue injuries (52.1%) and blow-out fractures (29.8%) were the most common. 108 patients had ISS higher than 16 and among these 29 had very severe injuries (ISS ≥ 25), with panfacial fractures observed more frequently in this group. Head and neck injuries were highly prevalent (71.8%), often requiring coordination with neurosurgery. Missed diagnoses occurred in 28 patients not initially evaluated by an oral and maxillofacial surgeon.

Conclusions: The findings suggest that early and accurate evaluation of oral and maxillofacial injuries in major trauma is critical to avoid delayed diagnoses and complications, and that involvement of oral and maxillofacial surgeons during initial trauma management may improve diagnostic precision and facilitate interdisciplinary treatment.

1. Introduction

Trauma, physical injury resulting from an external force or violent event, remains a significant contributor to morbidity and mortality. In recent years, the number of emergency department visits has risen steadily, influenced by evolving lifestyles and shifts in disease patterns. The prompt and accurate evaluation of major trauma patients has become increasingly critical to improving outcomes and optimizing resource utilization in acute care settings. In South Korea, a national data collection system, the National Emergency Department Information System (NEDIS), was established in 2003 to systematically monitor emergency care outcomes and manage emergency medical institutions. As of 2019, NEDIS encompassed 401 out of 402 emergency departments nationwide, representing a 99.8% participation rate. According to NEDIS data, trauma is the leading cause of death among individuals aged 44 years or younger, particularly within the economically active population, and imposes a substantial socioeconomic burden due to the high costs of resuscitation, surgical intervention, rehabilitation, and long-term care [1]. Globally, injuries account for nearly 8% of all deaths, making them a significant contributor to mortality [2]. Each year, an estimated 4.4 million deaths are attributable to

trauma, with associated economic losses approaching 1.9 trillion USD [3]. In the Korean context, the socioeconomic burden of trauma-related injuries increased by 14.7% between 2015 and 2020, reaching approximately 20 trillion KRW[1]. Maxillofacial trauma is a common consequence of major trauma, accounting for nearly 15% of emergency department presentations worldwide[3, 4]. Such injuries are often accompanied by other systemic injuries and may be underdiagnosed or delayed in recognition, complicating patient management. Timely and precise severity assessments are critical for patients with multiple trauma, as they help mitigate secondary complications and improve both morbidity and mortality outcomes. Several standardized scoring systems are used in trauma assessment: the Glasgow Coma Scale (GCS) for neurological function, the Revised Trauma Score (RTS) for physiological parameters, and the Abbreviated Injury Scale (AIS) for anatomical injury severity[5–9]. Building on these, the Injury Severity Score (ISS), introduced by Baker et al. in 1974, remains one of the most widely adopted tools for evaluating polytrauma and predicting mortality [10, 11]. The ISS is calculated by summing the squared AIS scores of the three most severely injured body regions, and an ISS ≥ 16 is generally considered to indicate severe trauma [11]. The National Trauma Data Bank currently categorizes trauma severity as minor (ISS 1–9), moderate (10–15), severe (16–24), and very severe (≥ 25).

Despite its widespread use, limited studies have specifically examined the application of ISS to oral and maxillofacial (OMF) trauma within the context of major trauma patients. Given the high prevalence of concurrent head and neck injuries and the risk of delayed diagnosis without specialized evaluation, further research is needed to clarify the clinical patterns of OMF trauma and its association with injury severity.

Therefore, the present study retrospectively analyzed major trauma patients admitted to the Emergency Department of Pusan National University Hospital between 2018 and 2020, focusing on those with OMF involvement. The aim was to describe the clinical characteristics of these injuries, evaluate their distribution according to ISS severity categories, and emphasize the importance of early OMF assessment in multidisciplinary trauma care.

2. Patients and Methods

2.1 Study Population

A total of 809 trauma patients admitted to the Emergency Department of Pusan National University Hospital between January 2018 and December 2020 were retrospectively reviewed. Among these, 700 patients had an Injury Severity Score (ISS) of ≥ 16, fulfilling the criteria for major trauma ; however, only 188 patients had injuries to the OMF region.

- Inclusion criteria were: (1) admitted from trauma injuries with initial examinations to complete AIS ; and (2) documented injuries involving the oral and maxillofacial (OMF) region.

- Exclusion criteria were: (1) absence of OMF involvement; (2) admission for non-traumatic conditions; and (3) insufficient clinical or radiologic data to verify OMF injury characteristics.

After applying these criteria, 188 patients with OMF-related injuries were included in the final analysis. No upper or lower age restrictions were applied, and pediatric patients were eligible if they met the ISS threshold.

- **ISS subset and handling of missing data.**

Injury Severity Scores (ISS) were calculable only for patients with complete Abbreviated Injury Scale (AIS) coding and sufficient imaging or clinical documentation. Of the 188 patients included in the OMF trauma cohort, 108 met ISS ≥ 16 and classified as severely traumatized and among these, ISS ≥ 25, which were classified as very severely traumatized,comprised 29 patients. All 188 patients were retained in the ISS analysis. No age restrictions were imposed; pediatric patients were retained when AIS/ISS data were available. Data abstraction was performed independently by two trained investigators (OMFS residents) and discrepancies were resolved by a board-certified OMFS. Inter-rater reliability for AIS coding was assessed on a random 10% sample ($\kappa = 0.82$; 95% CI, 0.76–0.88)). Missing demographic or injury variables were reported as such and not imputed.

2.2 Operational Definitions and Diagnostic Criteria

Fractures were defined and coded according to the International Classification of Diseases, 10th Revision (ICD-10): S02.4 (zygomaticomaxillary complex [ZMC] fractures), S02.3 (orbital floor fractures), S02.6 (mandibular fractures, including condyle, ramus, angle, body, parasymphysis, and symphysis), S02.2 (nasal bone fractures), and S02.5 (tooth injuries). Soft tissue injuries were identified based on clinical and imaging findings. “Missed diagnosis” was defined as a fracture or injury not identified during the initial emergency assessment but subsequently detected within 72 hours of admission. Imaging modalities included plain radiography and computed tomography (CT), which were routinely performed for suspected facial fractures. All radiologic interpretations were confirmed by board-certified radiologists, and clinical diagnoses were verified by oral and maxillofacial surgeons (OMFS).

2.3 Injury Severity Score

Trauma severity was assessed using the Injury Severity Score (ISS), derived from the Abbreviated Injury Scale (AIS; 2005 update, Association for the Advancement of Automotive Medicine). The ISS comprises six body regions (head and neck, face, chest, abdomen/pelvis, extremities, and external areas), each scored from 1 (minor) to 6 (maximum severity). The ISS was calculated as the sum of the squares of the three highest AIS scores ($A^2 + B^2 + C^2$), with a theoretical maximum of 108. An ISS ≥ 16 was considered indicative of severe trauma, and ISS ≥ 25 was classified as very severe trauma.

2.4 Data Collection and Abstraction

Clinical data were abstracted from electronic medical records and imaging archives by two independent reviewers (OMFS residents) trained in trauma chart review. A standardized data collection form was

used to extract demographic variables, mechanism of injury, fracture site, ISS components, need for multidisciplinary consultation, and complications. Inter-rater reliability was assessed in 10% of randomly selected cases, with discrepancies resolved by consensus with a senior OMFS consultant. Cases with missing or incomplete data were excluded from the analysis.

2.5 Statistical Analysis

Data were summarized using descriptive statistics. Inter-rater reliability for ISS scoring between coders was calculated. Comparisons between groups were performed using chi-square test. A p-value < 0.05 was considered statistically significant. All analyses were conducted using SPSS version 22.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Gender and Age

The 188 subjects comprised 141 males and 47 females, yielding a male-to-female ratio of approximately 3:1. Males accounted for 75.0% (95% CI, 68.6–80.6%) of cases, whereas females accounted for 25.0% (95% CI, 19.4–31.4%). A chi-square goodness-of-fit test confirmed that this predominance of male patients was statistically significant ($p < 0.001$). The mean age was 48.8 years (range, 7–84 years), with male patients in their 50s representing the largest age group (Table 1). A chi-square test of independence showed no significant difference in the distribution of age groups between sexes ($p = 0.221$), indicating that the age profile of OMF trauma did not differ meaningfully between male and female patients.

Table 1

Distribution of trauma patients by age group and sex. Age groups are recorded in 10-year intervals. The 80 + group is shown as “≥80.” The highest number of patients was observed in the 50–59 age group; overall male-to-female ratio ≈ 3:1.

Age	Male	Female	Total
0–9	1	0	1
10–19	8	5	13
20–29	18	6	24
30–39	19	1	20
40–49	16	5	21
50–59	43	13	56
60–69	22	7	29
70–79	13	8	21
≥ 80	1	2	3
P = 0.221	**P < 0.001***		
Total	141		47
*Chi-square test. A p-value < 0.05 was considered statistically significant			

3.2. Cause of Injury

Traffic accidents (TA) were the most common cause of injury (115/188, 61.2%), followed by falls (21.8%), slips (9.0%), collisions (4.8%), fist trauma (0.5%), and unspecified causes (, 2.7%). Among traffic accidents, out-of-vehicle incidents were the most frequent subtype (37.4%). Male patients in their 50s—who exhibited the highest fracture frequency—were most often injured in traffic accidents (Tables 2,3, and 4).

Table 2
Distribution of injury etiology by sex.“Etc.” denotes unspecified or unknown causes.

Etiology	Male	Female	Total
Traffic accidents	84	31	115
Falls	31	10	41
Slips	14	3	17
Collisions	9	0	9
Fist trauma	0	1	1
Etc.	3	2	5
Total	141	47	188

Table 3
Subclassification of traffic accidents by sex. “Unknown TAs” indicates cases for which the specific traffic mechanism was not recorded.

Traffic Accidents	Male	Female	Total
Out-car TAs	25	18	43
In-car TAs	22	9	31
Motorcycle TAs	26	1	27
Bicycle TAs	5	1	6
Train TAs	2	1	3
Unknown TAs	4	1	5
Total	**84**	**31**	**115**

Table 4
Age distribution by cause of trauma

Traffic Accident	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80-	Total
	1	**9**	**16**	**14**	**11**	**35**	**15**	**13**	**1**	**115**
In-car TA	0	2	3	5	6	10	3	2	0	**31**
Motorcycle TA	0	4	9	5	0	6	2	1	0	**27**
Bicycle TA	0	1	0	0	0	3	1	1	0	**6**
Pedestrian TA	1	2	3	2	4	15	9	7	0	**43**
TA etc	0	0	1	2	1	1	0	2	1	**8**
Industrial accident	0	0	2	2	1	1	0	0	0	**6**
Fall down	0	5	5	4	6	13	6	2	1	**42**
Slip down	0	0	0	0	2	5	4	5	1	**17**
Violence	0	0	0	0	1	1	0	1	0	**3**
Etc	0	0	0	0	0	1	4	0	0	**5**
Total	**1**	**14**	**23**	**20**	**21**	**56**	**29**	**21**	**3**	**188**

3.3. Injury Sites

3.3.1. Oral and Maxillofacial Region

Injuries to the oral and maxillofacial (OMF) region were categorized as soft tissue injuries, blow-out fractures (BOFs), zygomaticomaxillary complex (ZMC) fractures, nasal bone fractures, maxillary fractures, mandibular fractures, tooth injuries, panfacial fractures, and other associated injuries (cranial, torso, or extremity fractures). Panfacial fractures (PF) were defined as concurrent injuries involving BOF, ZMC, nasal bone, maxillary, and mandibular fractures. Soft tissue injuries were the most common (98/188), followed by BOFs (60/188), ZMC fractures (53/188), nasal bone fractures (40/188), maxillary fractures (19/188), mandibular fractures (20/188), and tooth injuries (29/188)(Fig. 1). Panfacial fractures were observed in 12 patients, and other associated injuries were documented in 49 patients (Table 5).

Table 5
Pattern of injuries of oral and maxillofacial region (n = 188 patients) “Etc.” includes injuries outside the maxillofacial region (e.g., cranial, torso, extremities). Panfacial injuries indicate concurrent fractures involving multiple facial structures. Patients may present with more than one injury; therefore, totals may exceed 188.

Soft tissue	Count (n)	% of patients (n = 188)
	98	**52.1%**
BOF	60	31.9%
ZMC fracture	53	28.2%
Nasal bone fracture	40	21.3%
Maxilla fracture	19	10.1%
Mandible fracture	20	10.6%
Tooth injury	29	15.4%
Panfacial fracture	1	6.4%
Etc.	49	26.1%

3.3.2. Other Anatomical Regions

Among the 188 patients with OMF trauma, concomitant injuries to other anatomical regions were frequently observed according to ISS classification (Fig. 2). The most commonly affected regions were the head and neck (135/188, 71.8%), followed by the extremities (99/188, 52.7%), chest (98/188, 52.1%), abdomen and pelvis (73/188, 38.8%), and external areas (71/188, 37.8%) (Table 6).

Table 6
Distribution of concomitant injury areas according to ISS classification (n = 188, multiple injuries allowed). *Patients may have injuries in multiple ISS anatomical regions; Each patient may contribute up to three region selections; therefore, the sum of category counts may exceed the cohort size (maximum possible = 188 × 3 = 564). The table reports the number of times each region was included among a patient's three most severely injured regions.

Head and neck	**Count (n)**	**% of patients (n = 188)**
	135	**71.8%**
Extremities	99	52.7%
Chest	98	52.1%
Abdomen/pelvis	73	38.8%
External areas	71	37.8%
Total	476*	

3.4. ISS Calculation

ISS was calculated according to standard AIS-derived methods by summing the squares of the three highest AIS scores for each patient. ISS was calculable for 188 OMF-related patients who had complete AIS coding and sufficient clinical/imaging documentation. calculation reported the frequency with which each anatomic region was selected among the three most severely injured regions for the ISS-calculable cohort (n = 188). The mean ISS for all subjects was 22.9 (mean male = 22.5; mean female = 24.0) (Fig. 3). Table 7 presents the ISS category distribution for the severe ISS analysis cohort(n = 108): ISS 16–24 (n = 79) and ISS ≥ 25 (n = 29).

Table 7
Distribution of ISS categories among patients with severe ISS (n = 108). Mean ISS for the ISS cohort = 22.9 (males 22.5; females 24.0).

ISS Category	**n**	**%**
16–24 (severe)	79	73.1%
≥ 25 (very severe)	29	26.9%
Total	108	100%

3.5. Missing Multidisciplinary Treatment

Among the 188 patients, 28 (14.9%) were initially admitted to the emergency department without the involvement of oral and maxillofacial surgeons and were subsequently referred to OMFS after OMF injuries were identified with delay. In this study, a missed diagnosis was defined as an OMF injury not

documented in the initial emergency department assessment but first identified within 72 hours of admission. Subsequently, the 28 transferred patients required the following interventions or diagnoses: eight tooth extractions (due to traumatic mobility or root fracture), six facial bone fractures requiring operative intervention, four conservative dental treatments (including root canal therapy), four soft tissue repair procedures, three cases of malocclusion requiring follow-up care, two temporomandibular joint disorder diagnoses, and one death (Table 8).

Table 8
Interventions and Diagnoses in Patients with Initially Missed OMF Injuries

Outcome / Complication	Number of Patients
Tooth extraction	8
Facial bone fracture	6
Dental conservative treatment	4
Soft tissue repair	4
Malocclusion	3
TMJ disorder	2
Death	1

4. Discussion

Similar to the GCS, RTS, and AIS, the ISS is a well-established and reliable method for assessing the severity of major trauma. It is particularly useful in estimating morbidity and mortality in patients with multiple traumas. In recent years, the ISS has gained widespread global use for standardizing trauma severity assessments and facilitating inter-institutional and international comparisons. [8][9] Of the 809 major trauma patients admitted to the Emergency Department of Pusan National University Hospital between January 2018 and December 2020, 188 patients (23.2%) sustained oral and maxillofacial (OMF) injuries. The male-to-female ratio was approximately 3:1, with a mean patient age of 48.78 years. Male patients in their 50s represented the most frequently affected demographic. This finding is consistent with previous studies, although some variability in gender distribution has been reported. In developing countries with high reliance on motorcycles vehicle, economically active population is more often involved in such trauma and Singaram et al. reported that the adults from 20 to 40 years age groups were more commonly involved, with a male to female ratio of 3:1 [12]. Epidemiology of maxillofacial fractures in northwest China reported a ratio of 3.9:1 and a mean age around 35.9 years, with ~ 65% in the 20-49 years bracket [13]. Epidemiological pattern of maxillofacial fractures in northern China found a 3.04:1 ratio, mean age ~ 36.1 years, with most patients in their 20s [14]. Despite these differences, the higher incidence among males is a recurring pattern, which may be attributed to greater social activity, higher alcohol consumption, and increased exposure to traumatic risk factors among men.

Regarding the causes of injury, this study found that traffic accidents (TAs) were the leading cause, accounting for 115 cases (61.17%), with out-of-vehicle TAs being the most common subtype (43 cases). This trend was especially notable among male patients in their 50s. Comparatively, Jang et al. identified slips as the most common cause (54.2%), Singaram et al. also reported traffic accidents as predominant [12, 15]. The high proportion of TA-related injuries in our cohort likely reflects the study's focus on major trauma patients, who are more prone to sustaining multiple injuries across various anatomical regions. Road traffic accidents are the leading cause of maxillofacial injuries globally [3, 12, 16]. In a study involving 1,350 patients, Mijiti et al. found that 42.2% of these injuries resulted from traffic incidents. The study also highlighted a significantly higher incidence in developing countries, attributed to large populations and rapid economic growth [17]. In particular, concomitant injury involving PF was also caused mainly by the traffic accidents in south Korea [16].

In terms of facial injury distribution, Jang et al. reported mandible fractures as the most frequent, followed by maxillary fractures, nasal bone fractures, zygomaticomaxillary complex (ZMC) fractures, and blow-out fractures (BOFs) [15]. Similarly, Ahmad et al. identified mandible fractures as the most common, followed by maxillary fractures, nasal bone fractures, ZMC fractures, and BOFs. Awais et al. reported mandible fractures as predominant, with ZMC fractures, nasal bone fractures, and maxillary fractures following [18]. Khan et al. also observed mandible fractures as the most frequent, accompanied by common soft tissue injuries, nasal, and ZMC fractures [19]. In the present study, soft tissue injuries were the most common (98 cases), followed by BOFs, ZMC fractures, nasal bone fractures, maxillary fractures, mandible fractures, dental injuries, and panfacial fractures. While there is no universally agreed-upon definition of a panfacial fracture (PF), it is commonly described as a facial injury involving at least three out of the four axial regions of the facial skeleton—namely, the frontal bone, the upper and lower midface, and the mandible. These findings suggest that, among major trauma patients, injuries to the orbital and midfacial regions are particularly prevalent. Different PF configurations are associated with distinct concomitant injuries and complications. Patients with fractures involving the frontal region tend to present with higher clinical disease classification grades and are more likely to require intensive care unit admission [16].

Among the 188 patients with oral and maxillofacial injuries, concurrent head and neck injuries—as defined by the ISS classification—were observed in the majority (135 cases). This emphasizes the clinical importance of evaluating for head and neck injuries when facial trauma is present in patients with major trauma. According to ISS data, the highest frequency of severe injury was in the head and neck region, followed by the face, extremities, chest, abdomen and pelvis, and external regions. This pattern highlights that those major injuries to the head, neck, and facial regions may significantly contribute to increased mortality. In particular, cerebral hematomas, cerebral contusions, and PFs were associated with elevated ISS scores, underscoring the need for prompt and accurate initial evaluation and intervention. Although PF in this study were associated with ISS of 3–4, indicating moderate severity, their high incidence and anatomical proximity to the brain may increase the risk of mortality. Management of PF in patients with concomitant injuries aims not only to preserve life but also to restore the structural, functional, and aesthetic integrity of the maxillofacial region, while simultaneously

addressing associated injuries. Given the frequent involvement of adjacent anatomical structures, a thorough and multidisciplinary assessment is essential [20]. Of particular concern is the risk of traumatic brain injury, which increases proportionally with the severity of facial trauma due to the direct anatomical continuity between the facial and cranial cavities. Neurological evaluation is therefore critical in all cases of significant facial trauma. Cerebral edema may occur in patients with associated head injuries or when fractures extend into the cranial base, necessitating urgent neurosurgical consultation[3, 4]. These cases may demand intensive treatment measures, such as the use of osmotic agents to reduce intracranial pressure and careful monitoring of intracranial dynamics. Neurological issues frequently involve cranial nerve impairment, with facial nerve injuries occurring in approximately 7–10% of temporal bone fracture cases [21]. In major trauma patients with facial injuries, early neurological assessment and timely referral to neurosurgical specialists are crucial. The mean ISS in this cohort was 22.9, with most patients scoring around 20. While this reflects a life-threatening degree of trauma according to ISS standards [6, 7, 22, 23], the findings suggest that with prompt, coordinated, and comprehensive multidisciplinary care, both survival and functional recovery are achievable. Of the 188 subjects, 108 were categorized as severely injured for the ISS ≥ 16. Maxillofacial trauma refers to injuries affecting the facial bones, soft tissues, and dental structures. Given the complex anatomy of the facial region and its significance in both function and appearance, careful assessment and prompt, multidisciplinary management are essential to restore form, maintain function, and minimize long-term complications [24–26]. Among these, 29 patients were again classified as having very severe trauma according to the National Trauma Data Bank criteria, with ISS scores of 25 or higher. The mean ISS in this subgroup was 32.14. Similar to the broader cohort of patients with ISS ≥ 16, BOFs were the most common injury type, followed by ZMC fractures and nasal bone fractures. This consistency suggests that the pattern of facial injury among major trauma patients remains similar regardless of ISS classification. However, patients with more extensive midfacial injuries tended to have higher ISS scores.

Panfacial fractures were observed in 7 of the 108 patients with ISS ≥ 16 (6.48%) and in 4 of the 29 patients with ISS ≥ 25 (13.79%), indicating that the frequency more than doubled in the more severe group (an increase of 57.14%). This finding implies a strong association between panfacial fractures and higher trauma severity, as well as a potentially increased risk of mortality. Another finding in this study was that PF patients also complained of postoperative complications during the follow-up period. Hwang et al., as cited by Soleimani et al., reported the occurrence of neurological disorders and ophthalmic complications, including diplopia, in patients with PFs [27, 28]. Correspondingly, Jang et al. identified ophthalmologic complications as the most frequently associated sequelae of PF [16]. Their findings underscore the elevated risk of orbital injuries, reinforcing the necessity for early and comprehensive evaluation of orbital involvement regardless of the specific fracture pattern. Particular vigilance is warranted for signs of enophthalmos and diplopia, as timely management is critical to prevent permanent functional impairment. The reduction of ophthalmic complications is most effectively achieved through meticulous preoperative assessment and proactive intervention during the initial surgical treatment. Eric et al. reported a proportional relationship between ISS scores and tracheostomy frequency in maxillofacial trauma patients, suggesting the need for careful airway management and

early consideration of tracheostomy in cases of severe facial trauma [29]. Similarly, Justin et al. found that the mean ISS for patients with simple midface injuries was 15.4, while those with complex midface injuries, such as Le Fort II and III fractures, had a significantly higher mean ISS of 23.6 [30]. Their findings also showed increased rates of intracranial injuries and mortality in patients with more severe midfacial trauma, which aligns with the present study's results. The timing of intervention is a critical determinant of treatment outcomes. For isolated facial fractures without substantial soft tissue injury, early definitive management within 72 hours is advocated to minimize complications arising from edema and fibrosis. Conversely, in patients with polytrauma or critical illness, a staged approach grounded in damage control principles—prioritizing initial stabilization followed by delayed reconstruction—is recommended [31].

While this study employed the ISS developed by Baker et al.[11], it is recognized that several other trauma assessment tools have been developed, including the Trauma and Injury Severity Score [32], its updated version, the A Severity Characterization of Trauma [23], and the New Injury Severity Score [33]. Additionally, Zhang et al. [34] proposed the Maxillofacial Injury Severity Score, which integrates functional parameters such as malocclusion, trismus, and facial deformity, potentially offering a more comprehensive evaluation of maxillofacial trauma. Although these alternative scoring systems provide valuable insights, they were not utilized for comparative analysis in this study due to limitations in data availability and scope. Future research incorporating these tools may further refine trauma assessment and management strategies. Furthermore, a recent study by Lin et al. explored the epidemiological factors related to PFs. and demonstrated that both anatomic PF classifications and the Facial Injury Severity Scale correlated significantly with various concomitant injuries and complications. The combined application of PF categories and Facial Injury Severity Scale showed improved predictive value for associated injuries in PF patients, underscoring the importance of continued evaluation of specialized trauma scoring systems [20].

5. Conclusions

The incidence of trauma patients, particularly those with major injuries, continues to rise. In this study, while critical (life-threatening) injuries specific to the oral and maxillofacial (OMF) region were not observed, the region was commonly affected—often in conjunction with head and neck trauma—reflecting broader national trends. Given this prevalence, prompt and precise initial evaluation by oral and maxillofacial surgeons is essential to minimize secondary complications and optimize outcomes.

When trauma to the head and neck is suspected, early multidisciplinary collaboration, especially with neurosurgeons, is vital due to the proximity of these regions to neurologically critical structures. The ISS, based on the AIS, proved useful for quantifying trauma severity and estimating patient prognosis, including mortality risk.

The current study investigated the significance of incorporating the ISS into the triage and evaluation of major trauma patients. Utilizing the ISS facilitates a more structured and efficient clinical workflow by promoting improved communication among multidisciplinary teams and ensuring timely specialist

involvement. Evidence from the literature suggests that such systematic approaches enhance emergency management, potentially reducing morbidity and optimizing patient outcomes in complex trauma cases. Although alternative scoring systems may offer additional insights—particularly for maxillofacial injuries—the ISS remains a valuable tool in guiding coordinated care. Future studies should explore the comparative utility of these scoring systems to further refine trauma assessment and treatment strategies.

Abbreviations

ISS	Injury Severity Score
NEDIS	the National Emergency Department Information System
OMF	Oral and maxillofacial
GCS	Glasgow Coma Scale
TAs	Traffic Accidents
OMF	Oral and Maxillofaical
RTS	Revised Trauma Score
AIS	Abbreviated Injury Scale
PF	Panfacial Fracture
BOF	Blow Out Fracture
ZMC	Zygomaticomaxillary Complex

Declarations

Ethics approval and consent to participate :

This study was conducted in accordance with the principles of the Declaration of Helsinki regarding medical research ethics and was approved by the Institutional Review Board of Pusan National University Dental Hospital (IRB No. PNUDH-2025-06-005). Patient consent was waived due to the retrospective nature of the study and minimal risk to participants, as approved by the institutional review board.

Consent for publication:

Not applicable. This study did not involve identifiable individual data or images requiring consent for publication.

Competing interests:

The authors declare no conflicts of interest.

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Author Contribution

Conceptualization, Jae-Yeol Lee; Data curation, Eun-Jung Kim,Ji-Young Yoon; Formal analysis, Jihye Ryu; Project administration, Jihye Ryu; Supervision, Jae-Yeol Lee; Writing – original draft, Jihye Ryu; Writing – review & editing, Jihye Ryu.

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All authors contributed to the work described in the paper and take full responsibility for its content. The authors read and approved the final manuscript.

Data Availability

The data that support the findings of this study are not publicly available due to privacy and ethical restrictions. The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request and with appropriate institutional approvals.

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Figures

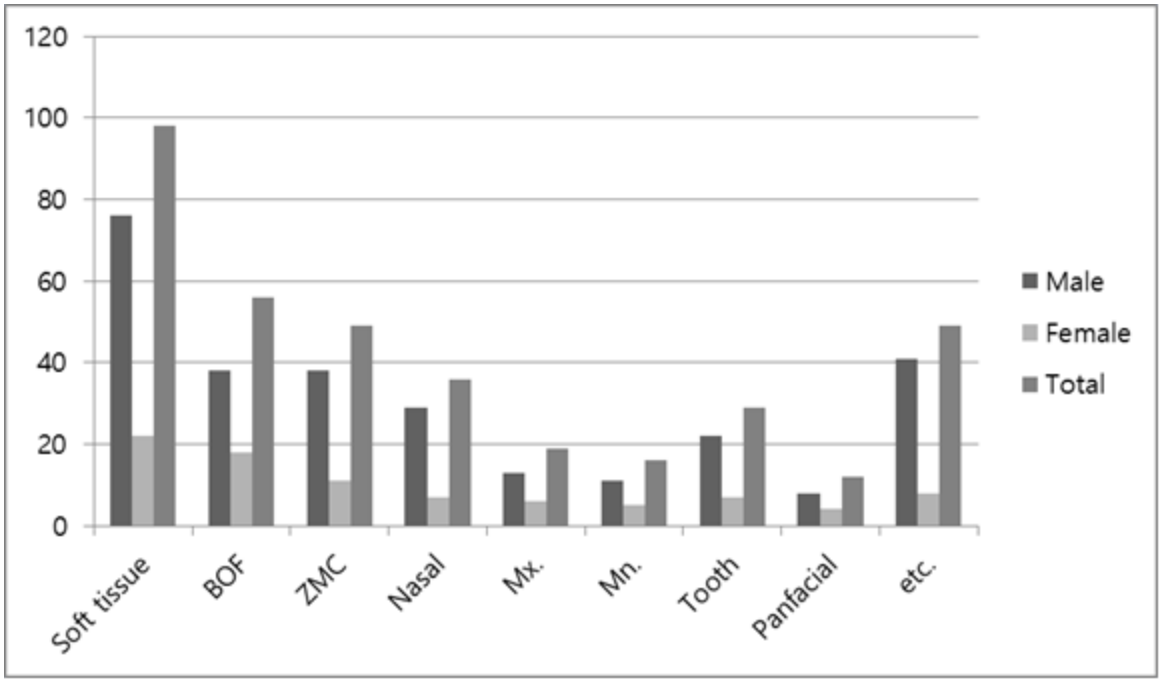


Figure 1

Sex-based distribution of oral and maxillofacial injury sites (n = 188). Soft tissue injuries were the most common overall.

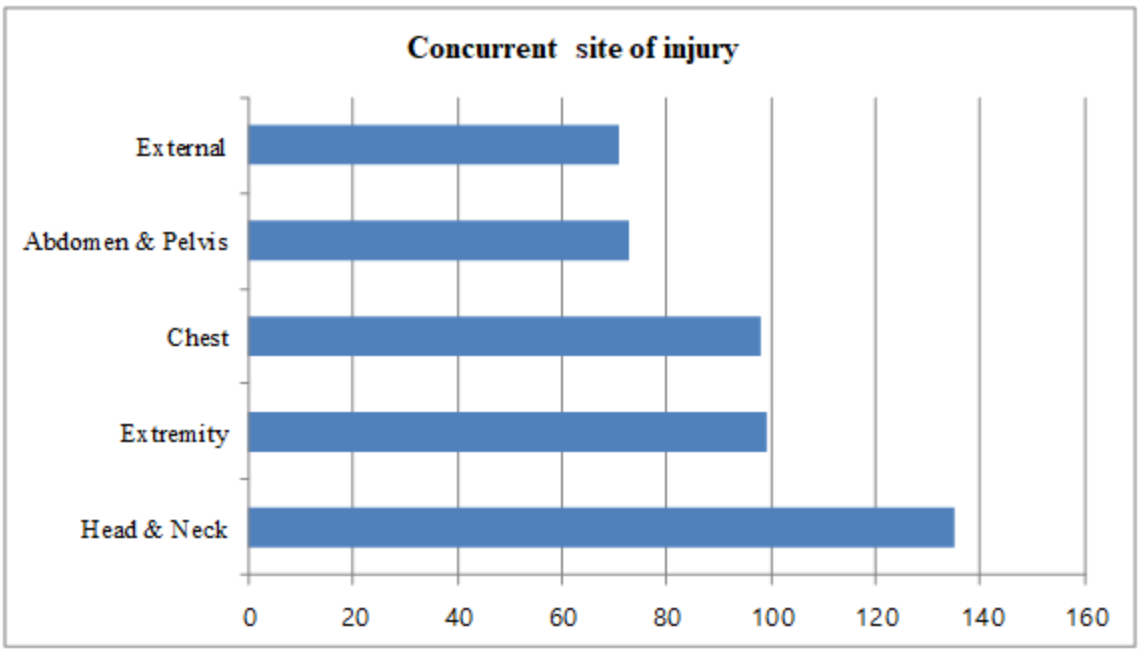


Figure 2

Distribution of concurrent injury sites in major trauma patients with OMF injuries (n = 188. *Patients may have injuries in multiple ISS anatomical regions).

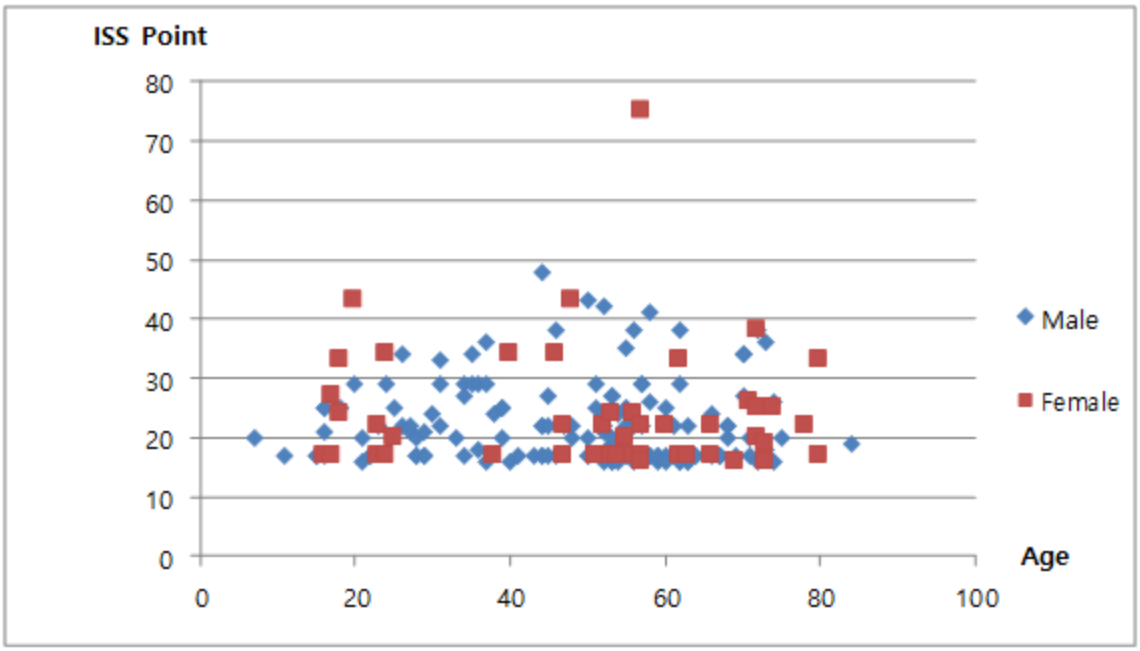


Figure 3

Distribution of ISS scores by sex.