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Review

Maxillofacial trauma scoring systems

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ABSTRACT

The changing complexity of maxillofacial fractures in recent years has created a situation where classical systems of classification of maxillofacial injuries fall short of defining trauma particularly that observed with high-velocity collisions where more than one region of the maxillofacial skeleton is affected. Trauma scoring systems designed specifically for the maxillofacial region are aimed to provide a more accurate assessment of the injury, its prognosis, the possible treatment outcomes, economics, length of hospital stay, and triage. The evolution and logic of such systems along with their merits and demerits are discussed. The author also proposes a new system to aid users in quickly and methodically choosing the system best suited to their needs without having to study a plethora of literature available in order to isolate their choice.

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Introduction

The measurement of injury severity has been a widely discussed and commonly practiced methodology for quite some time now. It is a useful tool to determine the possible prognosis, treatment outcomes in trauma patients, assessing the cost of injuries and also in incidents involving triage. A number of methods have been developed to characterise injuries in a patient, including scales, indices, graphs, and scores. The measurement can be carried out at the pre-hospital level and/or at the trauma-unit level. The criteria involved in such methods can be grouped into anatomical, physiological, or a combination of both. Such systems, however, were not focused primarily or solely on the maxillofacial region and in certain circumstances even underscored the importance of such injuries. Time has seen the evolution of trauma scoring systems specific to the maxillofacial region. Such systems are the need of the hour as a growing incidence of high-velocity collisions leading to severely comminuted injuries does not predispose the clinician to categorise them into traditional classification systems. The existence of specific maxillofacial trauma scoring can aid the clinician in the classification as well as assessment of such injuries.

The evolution and logic of the current maxillofacial trauma scoring systems available along with their merits and demerits are discussed.

Cooter David score

The oldest proposed trauma score system, Cooter David score, pertaining to the maxillofacial region was first presented in 1989;

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this fracture coding system was simple, reproducible, and meaningful and it documented the overall degree of craniofacial bony disruption [1].

An alpha numeric system/map was presented which divided the craniofacial region into 10 bilateral major anatomic zones. Each major zone was further subdivided into minor zones, which were assigned an expanded alpha code. A numerical score of bony disruption was used to code the fracture severity.

It is the only system to have incorporated a cranial component in the severity scoring.

However, it relied on the users placing their own grades (0–3) on various minor zones of the facial skeleton depending on the fracture pattern. In order to ensure calculation of a score percentage, the maximum sum of fractures for each individual major zone was limited to no more than 5 [2].

Despite being an innovative model, this particular limitation of minor zone scoring leads to numerical compression and can possibly underscore fractures.

Overall, the numerical compression of scoring which in fact is a result of the scoring pattern described gives a somewhat "tight fit" to the user. In addition, while the inclusion of a cranial component is a hallmark of this scoring system, it also might contribute to an understating or, in fact, underscoring of the maxillofacial region, which is our primary concern. However, the inclusion of a cranial component cannot be criticised as it is so often observed in association with injuries of the maxillofacial skeleton and also, due to its critical effect on the overall well-being and prognosis of the patient, it is also true that, from a purely numerical standpoint, it does tend to distract the user from the maxillofacial region.

Facial injury severity scale

The facial injury severity scale was presented in 2006 by Bagheri et al. The scale is designed as a numeric value composed of the sum of individual fractures and fracture patterns in a patient [3]. It utilises a point system dividing the face into horizontal thirds namely mandible, mid-face, and upper face for bony injuries. The combined lengths for all facial lacerations are also included. The authors themselves emphasised that the FISS is not designed primarily for use by the treating maxillofacial surgeon [3]. It incorporates the length of facial lacerations but does not include the mechanism, depth, or severity of the same. It can be of assistance to the trauma team in assessing the extent of facial injuries in a patient. It is not an indicator of treatment modality. It does not classify the mandibular angle, parasymphysis, orbital floor, or medial wall. The fixed weights of the scoring scale do not seem to differentiate between displaced, undisplaced, comminuted, or grossly comminuted fractures with tissue loss [2]. The FISS, however, provides a strong correlation with the cost of treatment involved and the length of hospital stay for a given severity of an injury. The authors claim this scale to have a relatively easy method of calculation along with research applications (Table 1).

Table 1
Facial injury severity scale.

Mandible	
Dentoalveolar	1 point
Each fracture of body/ramus/symphysis	2 points
Each fracture of condyle/coronoid	1 point
Mid-face	
Each midfacial fracture is assigned one point unless part of a complex fracture	
Dentoalveolar	1 point
Le Fort I[a]	2 points
Le Fort II[a]	4 points
Le Fort III[a]	6 points
Naso-orbital Ethmoid	3 points
Zygomaticomaxillary Complex	1 point
Nasal	1 point
Facial Laceration	
Over 10 cm long	1 point

[a] Unilateral Le Fort fractures are assigned half the numerical value.

Maxillofacial injury severity score

The injury severity score (ISS) allows just one injury per body region to be scored, which affected sensitivity in the assessment of maxillofacial injury severity [4].

The ISS was modified to new injury severity score [5] but still remained inconclusive for the evaluation of maxillofacial injuries.

In 2006, Zhang et al. presented the maxillofacial injury severity score (MFISS) which limits the evaluation of injuries to the maxillofacial region regardless of other bodily injuries that may be present in the patient. The MFISS utilises the abbreviated injury scale (AIS). The AIS was first published in 1969 followed by major updates in 1976, 1980, 1985, 1990, 1998, 2005, and 2008. The MFISS is designed for selecting the three highest maxillofacial injury severity scores according to the AIS-90 standard and then combine them with the ISSs for three maxillofacial functional parameters: malocclusion (MO), limited mouth opening (LMO) and facial deformity (FD) [4].

The following formula is applied:

$$\mathrm{MFISS} = (\mathrm{A1} + \mathrm{A2} + \mathrm{A3}) \times (\mathrm{MO} + \mathrm{LMO} + \mathrm{FD})$$

A1, A2, and A3 are the three highest maxillofacial AIS scores and MO, LMO, and FD are the maxillofacial functional parameter scores (Table 2).

It has been noted that mandibular fracture scored a higher value in MFISS evaluation compared to maxillary or zygomatic arch fracture, which is coherent with other studies as well [6–10].

There is a high significant correlation between MFISS and hospital stay days as well as with medical resource consumption [4].

The deficiency of AIS in categorising the consequences of maxillofacial trauma in terms of capturing more severely displaced or comminuted fractures is inherited by the MFISS as half of its indices are derived from the AIS itself.

The MFISS fails to account for frontal bone and orbital fractures and also does not account for all patterns of facial trauma [2].

Functional parameters such as limited mouth opening and malocclusion cannot be obtained retrospectively. Due to the limitations mentioned, one is usually left with a best option scenario where the clinician has to choose from the variables that best describe the actual clinical situation s/he is dealing with. It is also unclear as to how a simplistic product derived from multiplying physiological parameters with anatomical scores holds significance clinically.

Facial fracture severity score

The facial fracture severity score (FFSS) was presented by Catapano et al. in 2010 [11]. It was derived from numerical grades assigned for injuries at 41 different maxillofacial anatomic sites individually graded from 0 to 3 depending upon the presence of fracture, degree of displacement, and bone loss [1,2,12]. A similarity can be drawn between the FFSS and the Cooter David Score as both these systems assign numerical grades on different anatomical sites on the face depending on the fracture pattern. The group decided not to limit their scores, and the scale could produce a maximum score of 123 by adding the sum of the individual scores for different fracture patterns [2,11]. Ahmad et al. in 2012 found the FFSS model to be the most intuitive and easy to use by means of