Maxillofacial injuries sustained during soccer: incidence, severity and risk factors

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Abstract – A very popular sport worldwide, soccer generates a great number of maxillofacial injuries, mainly fractures, resulting in esthetic or functional problems. The aim of this retrospective study was to contribute to the knowledge of soccer-related maxillofacial injuries, and call attention to the risk factors that favor these injuries. A total of 108 patients, who attended hospital because of maxillofacial injuries during soccer within a period of 8 years, were included in this study. The relationship of the patients with soccer, the type, the site, the severity, the mechanism of the injuries and the applied treatment were analyzed. The injured were all males, and were principally amateurs. Around 89.8% of the patients suffered maxillofacial fractures while 10.2% presented only soft tissue injuries; 13.9% had multiple fractures; 50% of the maxillofacial fractures concerned the zygomatic complex and 38.2% the mandible where the majority occurred at the angle. The prevailing mechanism was the direct impact of players. Head to head impact outnumbered. Elbow to head impact caused contusions of the temporomandibular joint. Kick to head impact was the main cause of multiple fractures. The treatment of fractures was mainly surgical (68.2%). These findings support the fact that maxillofacial injuries sustained during soccer tend to be severe, demanding surgical treatment. The mandibular angle is in danger due to the usual existence of impacted and semi-impacted third molars. There should be a preventive intervention on the above contributors, and mainly coaches and sports physicians should be properly informed about the specificity of the maxillofacial injuries.

Soccer is an old team sport with worldwide appeal and socioeconomic impact. It is considered to be a high-risk game, especially as it concerns the maxillofacial area (1-7), based on the fact that the main acts of the game (kick and header) are aggressive, repeated, and can cause various injuries (8, 9). It is estimated that, nowadays, there are 120 million participants and the number is increasing rapidly (10); therefore, maxillofacial injuries increase in frequency as well, affecting soccer in both human and financial terms.

The implementation of preventive programs to diminish sport-related morbidity is mainly based upon retrospective studies. Regarding soccer-related maxillofacial injuries, existing studies are limited (2, 4, 11, 12), so subsequently any recent recording of the incidence, severity and underlying mechanisms shall promote the establishment of more effective preventive measures and treatments. The present study was undertaken to outline the specificities of maxillofacial injuries sustained during soccer and underline the importance of the appropriate preventive measures.

Material and methods

During a period of 8 years, 173 patients who suffered from sport-related maxillofacial injuries were treated in our department. Of them, 108 were injured playing soccer. Ninety-seven patients suffered 110 maxillofacial fractures and 11 only orofacial soft tissue injuries. The age of the patients ranged from 14 to 52 years (average 33 years) and they were all male. The parameters studied were the relationship of the patients with soccer (professional-amateurs), the type, site, severity, mechanism of injury and the applied treatment.

Results

The 108 patients represented 62.43% of all injured athletes admitted to the Oral and Maxillofacial Department. The incidence of injuries was higher in people of the third decade. Of the injured, 103 were amateur soccer players.

A total of 110 maxillofacial fractures were recorded. Fifty-five of those (50%) concerned the zygomatic complex, 42 (38.2%) the mandible, and a small percentage concerned the alveolar process, the nasal bones and the middle third of the face (Le Fort II) (Table 1). Fifteen of the patients (13.9%) had multiple fractures (Table 2). Analyzing the distribution of the mandibular fractures, it was noted that the majority occurred at the angle (50%) (Fig.1). Soccer-related soft tissue injuries were reported by 10.2% of the patients. More

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Table	1.	Site	of	the	fractures

	Fractures				
Site	п	%			
Zygomatic complex	55	50			
Mandible	42	38.2			
Alveolar process	6	5.45			
Nasal bones	6	5.45			
Le Fort II	1	0.9			

Table 2. Multiple maxillofacial fractures (13.9%)

Multiple fractures	Patients
Double mandibular fracture	9
Nasal bones fracture + zygomatic fracture	3
Bimaxillary fracture	1
Triple mandibular fracture	1
Nasal bones fracture + fracture of alveolar process	1



Fig. 1. Distribution of mandibular fractures.

specifically, eight lacerations – four labial, two mental, one nasal and one in suborbital region – and three contusions of the temporomandibular joint (TMJ) were noted.

Concerning the mechanism of fractures (Table 3), 92.79% of those were attributed to direct impact of players. Head to head impact caused 42.27% of the fractures, while the fractures caused by kick from another player were mainly multiple. On the other hand, a small percentage (7.21%) occurred due to impact against equipment and ground (indirect impact). In

Table 3. Mechanism of fractures

		Patients		
Mechanism	Cause	n	%	
Direct impact with player	Head-head impact	41	42.27	
	Elbow-head impact	20	20.6	
	Kick from other player	15	15.5	
	Knee-head impact	10	10.3	
	Fist from other player	4	4.12	
Indirect impact				
Impact against equipment	Hit by the ball	3	3.09	
	Hit on the goalpost	1	1.03	
Impact against ground	Fall on the ground	3	3.09	

particular, the impact against ground was responsible for the unique bimaxillary fracture, which however was the most severe. The relationship between the mechanism and the type of injury is shown in Table 4. All soft tissue injuries were caused by direct mechanism.

Regarding the treatment of fractures (Table 5), at the zygomatic complex the majority was treated surgically (83.6%), whereas cases with no functional or esthetic problems (16.4%) were only observed. Osteosynthesis was applied in 66.7% of mandibular fractures and intermaxillary fixation (IMF) in 23.8%. An arch bar fixation was used for the fractures of the alveolar process. Two cases of nasal bone fractures were treated with surgical manipulation with nasal packing and splinting.

The lacerations were carefully debrided and sutured. In TMJ contusions, soft diet, non-steroidal anti-inflammatory drugs and avoidance of wide mouth opening for 15 days were recommended. All patients recovered satisfactorily.

Discussion

In Greece, as well as in Italy (5, 13), United Kingdom (4), France (3), and Finland (14), soccer is the most popular sport, and it is widespread to every age group and all skill levels. However, the rules of the game are not strictly followed and there is a lack of proper training that may lead to an increase in injuries. Recently, there has been a proportionate increase in maxillofacial injuries in European countries (13–15) contrary to a decrease in injuries in Japan, probably due to proper guidance and training (1).

In general, the accident-prone age is the third decade of life, in accordance with many European reports (2, 3, 15–18). This is consistent with the high activity level of people of that age, the aggressive attitude of the players, and the greater surface of the exposed human body (11, 14, 17, 18). On the contrary, there is an extremely low frequency of injuries at ages under 12, which can be explained by the smaller body mass that does not correspond to an appreciable potential for injury (12). In Japan, on the other hand, the highest rate of injuries appears during the second decade of life, probably because this nation customarily shows an early interest in sports compared with western countries (1, 19).

As regards sex, males predominate in the majority of studies (2–4, 13, 17, 19), although female soccer teams have appeared lately. However, the rate of maxillofacial injuries is minimum or zero compared to that of males (3, 5, 14).

The number of injured amateur athletes was disproportionately higher than that of professionals. The assumption that they could not cope with the game and adjust to the rules, probably owing to the lack of proper training and supervision, may be an explanation (20).

The ratio of hard to soft tissue injuries (10:1) and the percentage of multiple fractures support the fact that maxillofacial injuries sustained during soccer may be more severe than previously recognized (5, 11, 19, 21).

In this series of injuries, the most frequently recorded trauma was a fracture of the zygomatic complex,

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Table 4. Relationship between mechanism and type of maxillofacial injury

	Type of injury									
		Fractures								
Type of impact	Zygoma	Mandible	DM/TM	Le Fort II + mandible	Nasal	AP	Laceration	TMJ contusion	Nasal + zygoma	Nasal + AP
Head-head $(n = 47)$	28	6	1/-		2	1	2		2 labial 1 suborbital 1 mental	
Elbow-head $(n = 25)$	11	3	2/-			4				3
Kick $(n = 23)$	3	4	5/1					1	1 nasal	
Knee-head $(n = 10)$	9	1								
Fist $(n = 7)$		4							2 labial	
									1 mental	
Fall $(n = 4)$				1			1			
Hit by the ball $(n = 3)$ Hit on goalpost $(n = 2)$	1	2	1/-							
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DM, double mandibular; TM, triple mandibular; AP, alveolar process; TMJ, temporomandibular joint. n = total number of injuries (number of fracture lines + number of lacerations).

Table 5. Treatment of maxillofacial fractures

	Treatment, n (%)							
Site of fracture	Surgery	IMF	Arch bar fixation	Conservative				
Zygomatic complex Mandible	46 (83.6) 28 (66.7)	10 (23.8)		9 (16.4) 4 (9.5)				
Alveolar process Nasal bones Le Fort II	1 (16.6) 1 (100)		6 (100)	5 (83.4)				

according to references in the United Kingdom (16), Australia (11), Ireland (15), Italy (13), and Japan (1). This injury occurred either at the zygomatic body where esthetic problems are mainly caused, or usually at the zygomatic arch where functional problems mainly appear as a result of mouth restriction. Regarding injuries of the mandible, the angle is most commonly fractured, because the bone is weak at this region due to the usual existence of impacted and semi-impacted third molars (22, 23).

The prevalent mechanism of soccer-related maxillofacial injuries was head to head impact (42.27%). Headers principally caused fractures of the zygomatic complex, a considerable number of mandibular fractures, and most of the orofacial lacerations. Elbow to head impact was responsible for the majority of fractures of the alveolar process (66.7%) and all the injuries of TMJ. The latter is in conjunction with another study (24). It is noteworthy that multiple fractures were caused by kick, while the most severe injury (Le Fort II) occurred indirectly because of a fall on the ground.

Treatment was determined by the severity and site of injury, and was based on the quick and most effective recovery of athletes. 83.6% of zygomatic complex fractures were treated surgically; 33.3% of mandibular fractures were treated conservatively either by close follow-up of the occlusion and the appropriate instructions (soft diet, non-intense movements for 15 days) or by IMF with elastics for 14 days, although in most cases

(66.7%) osteosynthesis was preferred (25). The reduction and fixation of the cortical bone plate with the teeth on an arch bar is required in cases of alveolar fractures, in order to achieve maximal occlusion. Regarding the soft tissues, the lip lacerations require precise alignment during the suturing of the vermillion border, the syncheleia and the philtrum. Moreover, TMJ contusions require follow-up, because these injuries can result in lifelong disorders.

Conclusions

In conclusion, it is obvious that maxillofacial injuries sustained during soccer tend to be common and severe (26), demanding surgical management, increased cost of hospitalization and frequently long-lasting absence from activities of normal life. Hence, based on the relevant literature, there is considerable scope for preventive intervention on associated factors of the game and decrease of the undesirable consequences. Besides the general basic rules for every sport (proper organized fields, training, guidance, up to date adjustment of the rules) (1, 5, 8, 13, 27), the following suggestions could also be helpful: (i) removal of the impacted third molars (28); (ii) onlay of nasal shields extending to the zygoma (29, 30); (iii) penalization of the hit by elbow, which has already been suggested by the Soccer Federation (15); (iv) use of a custom-made mouthguard, so that the impact can be spread equally at the jawbones (6, 7, 24, 31-34). Of course, these suggestions would be subject to revision as experience is gained.

It should also be emphasized that coaches and sports physicians are not properly informed about the specificity of the maxillofacial injuries (20, 31, 35). They need to possess a basic understanding of these injuries in order to maximize safe participation for their athletes.

The recording of soccer-related maxillofacial injuries is of great importance, as it is necessary for the authorities to depend on a reliable database in order to take measures such as the compulsory use of equipment or the modification of rules.

References

- 1. Delilbasi C, Yamazawa M, Nomura K, Iida S, Kogo M. Maxillofacial fractures sustained during sports played with ball. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004;97:23–7.
- Sane J, Lindqvist C, Konito R. Sports-related maxillofacial fractures in a hospital material. Int J Oral Maxillofac Surg 1988;17:122–4.
- Maladiere E, Bado F, Meninguad J-P, Guilbert F, Bertrand JC. Aetiology and incidence of facial fractures sustained during sports: a prospective study of 140 patients. Int J Oral Maxillofac Surg 2001;30:291–5.
- Hill CM, Burford K, Martin A, Thomas DW. A one-year review of maxillofacial sports injuries treated at an accident and emergency department. Br J Oral Maxillofac Surg 1998;36:44– 7.
- Frenguelli A, Ruscito P, Bicciolo G, Rizzo S, Massarelli M. Head and neck trauma in sporting activities. Review of 208 cases. J Craniomaxillofac Surg 1991;19:178–81.
- Levin L, Friedlander LD, Geiger SB. Dental and oral trauma and mouthguard use during sport activities in Israel. Dent Traumatol 2003;19:237–42.
- Yamada T, Sawaki Y, Tomida S, Ueda M. Oral injury and mouthguard usage by athletes in Japan. Endod Dent Traumatol 1998;14:84–7.
- Broglio SP, Ju Y-Y, Broglio MD, Sell TC. The efficacy of soccer headgear. J Athl Train 2003;38:220–4.
- Kirkendall DT, Garrett WE. Heading in soccer: integral skill or grounds for cognitive dysfunction? J Athl Train 2001;36:328– 33.
- Putukian M. Heading in soccer: is it safe? Curr Sports Med Rep 2004;3:9–14.
- Lim LH, Moore MH, Trott JA, David DJ. Sports related facial fractures: a review of 137 patients. Aust N Z J Surg 1993;63:784–9.
- McFadyen JA, Shulman JD. Orofacial injuries in youth soccer. Pediatr Dent 1999;2:192–6.
- Cerulli G, Carboni A, Mercurio A, Perugini M, Becelli R. Soccer-related craniomaxillofacial injuries. J Craniofac Surg 2002;13:627–30.
- Sane J, Ylipaavalniemi P. Maxillofacial and dental soccer injuries in Finland. Br J Oral Maxillofac Surg 1987;25:383–90.
- Carroll SM, Jawad MA, West M, O'Connor TPF. One hundred and ten sports related facial fractures. Br J Sport Med 1995;29:194–5.
- Hill CM, Crosher FM, Mason DA. Dental and facial injuries following sports accidents: a study of 130 patients. Br J Oral Maxillofac Surg 1985;23:268–74.
- Emshoff R, Schoning H, Rothler G, Waldhart E. Trends in the incidence and cause of sport-related mandibular fractures: a retrospective analysis. J Oral Maxillofac Surg 1997;55:585–92.

- Gassner R, Tuli T, Hachl O, Rudisch A, Ulmer H. Craniomaxillofacial trauma: a 10 year review of 9543 cases with 21067 injuries. J Craniomaxillofac Surg 2003;31:51–61.
- Tanaka N, Hayashi S, Amagasa T, Kohama G-I. Maxillofacial fractures sustained during sports. J Oral Maxillofac Surg 1996;54:715–9.
- Tesini DA, Soporowski NJ. Epidemiology of orofacial sportsrelated injuries. Dent Clin North Am 2000;44:1–18.
- Echlin P, Mckeag DB. Maxillofacial injuries in sport. Curr Sports Med Rep 2004;3:25–32.
- Schwimmer A, Stern R, Kritchman D. Impacted third molars: a contributing factor in mandibular fractures in contact sports. Am J Sports Med 1983;11:262–6.
- 23. Yamada T, Sawaki Y, Tohnai I, Takeuchiu M, Ueda M. A study of sports-related mandibular angle fracture: relation to the position of the third molars. Scand Med Sci Sports 1998;8:116–9.
- Lephart SM, Fu FH. Emergency treatment of athletic injuries. Dent Clin North Am 1991;35:707–16.
- Paoli JR, Fabie L, Dodart L, Lauwers F, Boutault F, Fabie M. Mandibular fractures in sports. Retrospective study of 48 cases. Rev Stomatol Chir Maxillofac 1999;100:306–10.
- 26. Mihalik JP, Myers JB, Sell TC, Anish EJ. Maxillofacial fractures and dental trauma in a high school soccer goalkeeper: a case report. J Athl Train 2005;40:116–9.
- 27. Injuries in youth soccer: a subject review. American Academy of Pediatrics. Committee on Sports Medicine and Fitness. Pediatrics 2000;105:659–61.
- Laskin DM. Giving your patients a sporting chance. J Oral Maxillofac Surg 1997;55:113.
- Demas PN. Surgical management of sports-related traumatic injuries. Dent Clin North Am 2000;44:137–59.
- Heise M, Eufinger H, Rarreck T. Individualized facial protection after fracture management of the nasal bone and zygomatic arch in professional soccer players. Mund Kiefer Gesichtschir 2001;5:320–2.
- Takeda T, Ishigami K, Hoshina S, Ogawa T, Handa J, Nakajima K et al. Can mouthguards prevent mandibular bone fractures and concussions? A laboratory study with an artificial skull model. Dent Traumatol 2005;21:134–40.
- Gardiner DM, Ranalli DN. Attitudinal factors influencing mouthguard utilization. Dent Clin North Am 2000;44:3–65.
- Tompson BD. Protection of the head and neck. Dent Clin North Am 1982;26:659–67.
- Ranalli DN, Demas PN. Orofacial injuries from sport: preventive measures for sports medicine. Sports Med 2002;32:409–18.
- 35. Onyeaso CO, Adegbesan OA. Knowledge and attitudes of coaches of secondary school athletes in Ibadan, Nigeria regarding oro-facial injuries and mouthguard use by the athletes. Dent Traumatol 2003;19:204–8.

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