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Original Scientific Paper

PATTERNS OF FACIAL FRACTURES AND ASSOCIATED SOFT TISSUE INJURIES: A RETROSPECTIVE STUDY ON 1007 PATIENTS

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SUMMARY – Background: Knowing the severity of a pathology in a population helps to both establish a rapid diagnosis and to prepare medical staff to provide adequate and complete treatment. The aim of this study was to determine the patterns of maxillofacial fractures and their associated soft tissue injuries in order to identify the specific types of maxillofacial fractures with the highest incidence of associated soft tissue injuries.

Methods: A 10-year retrospective evaluation of maxillofacial trauma was performed on 1007 patients. All 1007 patients were clinically and paraclinically confirmed to have facial skeletal injuries.

Results: The highest incidence of maxillofacial fractures was found in the mandible (62.16%), the mandibular angle being the most frequently involved (28.84%). Most of the fractures were complete (97.82%), displaced (87.98%) and closed (86.30%). Hematoma was the most common associated soft tissue injury (44.79%). In mandibular trauma, the incidence of hematoma and laceration was the highest in angle and simultaneous multiple fracture lines (p=0.002). In the midface, hematoma was more frequently associated with non-comminuted zygomatic bone fractures (p=0.003), while laceration was associated with multiple underlying fracture lines (p=0.002).

Conclusions: Patients presenting with hematomas will most frequently have an underlying single closed fracture line, while patients with lacerations will most frequently present underlying multiple and displaced fractures.

Key words: *maxillo-facial fractures; trauma; soft tissue injuries; facial trauma; facial fractures*

Introduction

Maxillo-facial injuries are currently continuously increasing worldwide[1]. The complexity of the cases varies greatly in the literature, depending on the etiology of the trauma, the kinetic energy of the wounding agent, the type of fracture, the number and trajectory of the fracture lines, the associated overlying soft tissue injuries, as well as on the possible association of ocular, intracranial, cerebral, abdominal, thoracic or limb injuries[2]. Therefore, correct diagnosis and sequential therapeutic management of this pathology are frequently challenging and require a multidisciplinary approach[3]. Post-traumatic facial soft tissue injuries vary from simple ecchymoses and emphysema to hematomas or significant tissue laceration that may conceal or hinder the identification of underlying fracture lines at first consultation, particularly for less experienced clini-

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cians who sometimes omit additional imaging of the traumatized patient based on the clinical evaluation[4]. Incomplete diagnosis and a late inadequate therapeutic approach can have major aesthetic, cosmetic and functional effects in case of maxillo-facial fractures[5]. Impairment of physiognomy can have major consequences on the social, professional and cultural integration of an individual[6]. Psychological disorders such as post-traumatic stress syndrome and depression frequently occur in these cases, amplifying the difficulty of subsequent treatment[7]. Knowing the severity and patterns of maxillo-facial trauma in a population as well as the interrelationship between associated soft tissue injuries and the potential type of underlying fractures helps to both rapidly establish a diagnosis and prepare the medical staff to apply adequate and complete treatment[8]. Currently, there is no consensus regarding this aspect in the literature, with specialists having divergent opinions worldwide[9]. In this context, we believe that determining the type of fracture and associated soft tissue injuries is absolutely necessary for the rapid establishment of a clinical diagnosis in a specialized clinic, in order to perform proper triage and proper imaging of the patient. Under these conditions, the chances of a maxillo-facial fracture being overlooked will decrease[8].

The aim of this study was to determine the severity, type and pattern of maxillofacial fractures and their associated soft tissue injuries to help clinicians quickly establish a correct diagnosis and treatment for this pathology.

Patients and methods

This study was conducted on patients hospitalized and treated in a Romanian tertiary university clinic for oral and maxillofacial surgery between January 1, 2008 and January 1, 2013. It should be noted that the patients treated for maxillofacial trauma in the host center of the study come from a wide geographical area in Eastern Europe.

The study was approved by the Ethics Committee of Oradea University (IRB no. 17893/19.04.2018). All patients included in the study signed informed consent at the time of admission to the clinic, by which they agreed to the use of their anonymized medical data for scientific purposes. In patients under the age of 18, the informed consent was signed by the parent or their legal guardian. This study was approved by the Territorial Ethics Commission and was therefore performed in accordance with the ethical standards laid down in the 1975 Declaration of Helsinki and its later amendments, as revised in 1983.

The data were extracted from the patients' medical records, and the following variables on the severity of the fractures were analyzed: the degree of bone involvement, the topographic location of the fracture in the viscerocranium, the degree of bone displacement, the relationship of the fracture focus with the external environment and the type of associated soft tissue injuries. Hematoma, excoriation and laceration were included as the types of associated lesions. We did not consider swelling as a stand-alone type of associated soft tissue injury in this study. Swelling as part of the pathophysiology of facial trauma is present in the majority of facial fractures, due to which we decided not to include this parameter in our statistical analysis, as its relevance is low in this context.

The study inclusion criteria were: presence of at least one fracture line in the maxillo-facial region, a history of an acute trauma episode, time since trauma less than 48 hours, paraclinical examinations (radiographic or computed tomographic examination) confirming the clinical diagnosis of fracture and showing its location and pattern, the treatment of the fracture having been performed in the study host institution and signing of informed consent by which the patient agreed to the use of their medical data for scientific purposes. All patients included in this study were older than 10 years of age. Children under the age of 10 are treated in the pediatric surgery service in our region.

Exclusion criteria: patients without any fracture lines in the maxilla-facial region, fracture of a different etiology than trauma, time since trauma more than 48 hours, absence of complementary imaging examinations in the patient's clinical sheet, treatment performed in a clinic other than the study host institution, absence of complete data referring to all variables monitored in each patient, presence of factors favoring the development of fractures such as bisphosphonate treatment, osteopathies and osteoradionecrosis and the patient's refusal to sign an informed consent for the use of their medical data for scientific purposes.

To prevent bias, all observation sheets were checked twice by both the author who collected the data and a member of the statistical team.

The size of the study was determined by the period of time in which the data were collected, namely 10 years.

Data were collated in electronic format using Microsoft Excel. Descriptive statistics of the evaluated cases was performed with two-decimal percentage accuracy.

The statistical analysis and the statistical correlations between variables were performed using MedCalc Statistical Software version 19.2 (MedCalc Software bvba, Ostend, Belgium;53 https://www.medcalc.org; 2020).

Continuous variables were expressed as mean and standard deviation, and nominal variables were expressed as frequency and percentage. The frequencies of a nominal variable among the categories of another nominal variable were compared using the chi-square test. The comparison of a continuous nominal variable between two groups was performed using a T test for independent variables. After applying the Bonferroni correction, the new threshold for statistical significance was $p<0.05$.

Results

The study inclusion criteria were met by 1007 patients, of which 626 (62.16%) had strictly mandibular fractures, 301 (29.89%) had strictly midface fractures, and 80 (7.94%) had mandibular and midface fractures.

1099 fracture lines were identified in the mandibles. The most frequent location of the fracture lines

Table 1. Distribution of the type of associated soft tissue injuries depending on the degree of bone involvement, displacement and the relationship with the external environment of the fracture

		Degree of bone involvement		Total	Relationship with external environment		Total	Degree of bone displacement		Total
		incomplete	complete		closed	open		with	without	
Hematoma	Absent	4	552	556	472	84	556	511	45	556
		18.2%	56.0%	55.2%	54.3%	60.9%	55.2%	57.7%	37.2%	55.2%
	Present	18	433	451	397	54	451	375	76	451
		81.8%	44.0%	44.8%	45.7%	39.1%	44.8%	42.3%	62.8%	44.8%
Total		22	985	1007	869	138	1007	886	121	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=				0,001			0,178			0,003
Laceration	Absent	9	771	780	677	103	780	694	86	780
		40.9%	78.4%	77.5%	78.0%	74.6%	77.5%	78.4%	71.1%	77.5%
	Present	13	213	226	191	35	226	191	35	226
		59.1%	21.6%	22.5%	22.0%	25.4%	22.5%	21.6%	28.9%	22.5%
Total		22	984	1006	868	138	1006	885	121	1006
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=				0,002			0,442			0,004
Escoriation	Absent	8	703	711	617	94	711	632	79	711
		36.4%	71.4%	70.6%	71.0%	68.1%	70.6%	71.3%	65.3%	70.6%
	Present	14	282	296	252	44	296	254	42	296
		63.6%	28.6%	29.4%	29.0%	31.9%	29.4%	28.7%	34.7%	29.4%
Total		22	985	1007	869	138	1007	886	121	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=				0,001			0,555			0,207

Table 2. Correlation of the type of associated soft tissue injury, the degree of bone displacement and the relationship with the external environment of the fracture with the topographic location of mandibular fractures

	Mandibular fracture site										Total
	Absent	Median	Para median	Body	Angle	Ramus	Sub condylar	Coronoid	Alveolar Process	Multiple	
Hematoma No	59	6	19	42	114	4	43	1	1	267	556
	19.6%	75.0%	55.9%	59.2%	83.8%	66.7%	62.3%	20.0%	12.5%	72.4%	55.2%
Hematoma Yes	242	2	15	29	22	2	26	4	7	102	451
	80.4%	25.0%	44.1%	40.8%	16.2%	33.3%	37.7%	80.0%	87.5%	27.6%	44.8%
Total	301	8	34	71	136	6	69	5	8	369	1007
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002											
Laceration No	199	7	24	59	122	3	55	4	2	305	780
	66.3%	87.5%	70.6%	83.1%	89.7%	50.0%	79.7%	80.0%	25.0%	82.7%	77.5%
Laceration Yes	101	1	10	12	14	3	14	1	6	64	226
	33.7%	12.5%	29.4%	16.9%	10.3%	50.0%	20.3%	20.0%	75.0%	17.3%	22.5%
Total	300	8	34	71	136	6	69	5	8	369	1006
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002											
Excoriation No	168	6	21	50	117	4	54	3	2	286	711
	55.8%	75.0%	61.8%	70.4%	86.0%	66.7%	78.3%	60.0%	25.0%	77.5%	70.6%
Excoriation Yes	133	2	13	21	19	2	15	2	6	83	296
	44.2%	25.0%	38.2%	29.6%	14.0%	33.3%	21.7%	40.0%	75.0%	22.5%	29.4%
Total	301	8	34	71	136	6	69	5	8	369	1007
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002											
Displacement Yes	245	7	29	63	129	5	58	4	7	339	886
	81.4%	87.5%	85.3%	88.7%	94.9%	83.3%	84.1%	80.0%	87.5%	91.9%	88.0%
Displacement No	56	1	5	8	7	1	11	1	1	30	121
	18.6%	12.5%	14.7%	11.3%	5.1%	16.7%	15.9%	20.0%	12.5%	8.1%	12.0%
Total	301	8	34	71	136	6	69	5	8	369	1007
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.003											
Fracture site Closed	297	0	4	7	133	6	69	5	7	341	869
	98.7%	0.0%	11.8%	9.9%	97.8%	100.0%	100.0%	100.0%	87.5%	92.4%	86.3%
Fracture site Open	4	8	30	64	3	0	0	0	1	28	138
	1.3%	100.0%	88.2%	90.1%	2.2%	0.0%	0.0%	0.0%	12.5%	7.6%	13.7%
Total	301	8	34	71	136	6	69	5	8	369	1007
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.004											

Table 3. Correlation of the type of associated soft tissue injury, the degree of bone displacement and the relationship with the external environment of the fracture with the topographic location of midface fractures

		Midface fracture site										Total
		Absent	Le Fort I	Le Fort II	Le Fort III	Zygomatic	Nasal Bones	Alveolar Process	Orbit	Anterior Sinus Wall	Multiple	
Hematoma	No	486	2	2	1	37	13	4	0	0	11	556
		77.6%	50.0%	22.2%	20.0%	21.5%	22.8%	14.8%	0.0%	0.0%	10.9%	55.2%
	Yes	140	2	7	4	135	44	23	5	1	90	451
		22.4%	50.0%	77.8%	80.0%	78.5%	77.2%	85.2%	100.0%	100.0%	89.1%	44.8%
	Total	626	4	9	5	172	57	27	5	1	101	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.003												
Laceration	No	541	2	7	3	132	30	13	3	0	49	780
		86.4%	50.0%	77.8%	60.0%	77.2%	52.6%	48.1%	60.0%	0.0%	48.5%	77.5%
	Yes	85	2	2	2	39	27	14	2	1	52	226
		13.6%	50.0%	22.2%	40.0%	22.8%	47.4%	51.9%	40.0%	100.0%	51.5%	22.5%
	Total	626	4	9	5	171	57	27	5	1	101	1006
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002												
Escoriation	No	514	2	6	3	119	26	10	2	0	29	711
		82.1%	50.0%	66.7%	60.0%	69.2%	45.6%	37.0%	40.0%	0.0%	28.7%	70.6%
	Yes	112	2	3	2	53	31	17	3	1	72	296
		17.9%	50.0%	33.3%	40.0%	30.8%	54.4%	63.0%	60.0%	100.0%	71.3%	29.4%
	Total	626	4	9	5	172	57	27	5	1	101	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002												
Displacement	Yes	579	3	8	4	136	41	24	3	0	88	886
		92.5%	75.0%	88.9%	80.0%	79.1%	71.9%	88.9%	60.0%	0.0%	87.1%	88.0%
	No	47	1	1	1	36	16	3	2	1	13	121
		7.5%	25.0%	11.1%	20.0%	20.9%	28.1%	11.1%	40.0%	100.0%	12.9%	12.0%
		626	4	9	5	172	57	27	5	1	101	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.001												
Fracture site	Closed	498	4	8	3	171	57	23	5	1	99	869
		79.6%	100.0%	88.9%	60.0%	99.4%	100.0%	85.2%	100.0%	100.0%	98.0%	86.3%
	Open	128	0	1	2	1	0	4	0	0	2	138
		20.4%	0.0%	11.1%	40.0%	0.6%	0.0%	14.8%	0.0%	0.0%	2.0%	13.7%
		626	4	9	5	172	57	27	5	1	101	1007
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
P=0.002												

was the mandibular angle, n=317 (28.84%), followed by mandibular body fractures, n=267 (24.29%), subcondylar fractures, n=242 (22.02%), paramedian, n=191 (17.38%), median, n=35 (3.18%), ramus, n=22 (2.00%), coronoid process, n=13 (1.18%) and alveolar process fractures, n=12 (1.09%).

In the midface, the highest incidence was of zygomatic bone fractures, n=172 (45.14%), followed by multiple/comminuted fractures, n=101 (26.51%), nasal bone fractures, n=57 (14.96%), alveolar process fractures, n=27 (7.09%), Le Fort II, n=9 (2.36%), orbital, n=5 (1.31%), Le Fort III, n=5 (1.31%), Le Fort I, n=4 (1.05%), and anterior maxillary sinus wall fractures, n=1 (0.26%).

The majority of the patients had complete line fractures, n=985 (97.82%), while those with incomplete fractures represented a small proportion, n=22 (2.18%). Maxillofacial fractures with displaced bone fragments were predominant, n=886 (87.98%), non-displaced fractures being less frequent, n=121 (12.02%). Of all patients, 869 (86.30%) had closed fractures, while 138 (13.70%) had open fractures communicating with the external environment.

Hematoma was the most frequent associated soft tissue injury, being present in 451 patients (44.79%), followed by excoriations, n=296 (29.34%), and lacerations, n=226 (22.44%).

Dental injuries were present in only 90 patients (8.9%). The most frequent was the coronal fracture, n=31 (34.4%), followed by dental avulsion, n=25 (27.7%), dental luxation, n=23 (25.5%), and radicular fracture, n=11 (12.2%).

Associated soft tissue injuries had higher incidence in complete and displaced fractures. The correlation of associated lesions with the degree of bone involvement was analyzed: hematoma, p=0.001, laceration, p=0.002, excoriation, p=0.001. The correlation of associated injuries with the degree of displacement was also calculated: hematoma, p=0.003, laceration, p=0.004 and excoriation p=0.207. The correlations between the relationship with the external environment of the fracture focus and the incidence of associated injuries can be seen in Table 1.

Examining the correlation between the topographic location of the mandibular fracture lines and the incidence of the type of associated soft tissue injury, we identified the fact that the highest incidence of associated lesions was in the case of angle, body and simultaneous multiple fracture lines (p=0.002) (Table 2).

Table 2 also shows that bone fragment displacement more frequently occurred in angle and simultaneous multiple fracture lines (p=0.003). It can be seen that the opening of the fracture focus had the highest incidence in paramedian and body fractures (p=0.004).

It can be observed that hematomas had the highest incidence in zygomatic bone fractures, p=0.003, while lacerations and excoriations had the highest incidence in multiple midface fracture lines, p=0.002 (Table 3). This table also shows the fact that bone displacement was more frequent in zygomatic bone, nasal bones and multiple midface fractures (p=0.001). The opening of the fracture focus was more frequent in alveolar process fractures, p=0.002.

Discussion

The mandible was the most fractured bone in this study, a result supported by other studies[2,3,8]. This is explained by its prominence that makes it more exposed to injuries compared with other bones[5-8]. Contrary to our results, other authors reported a predominance of midface fractures[10-12]. The incidence of the topographic location of maxillo-facial fracture lines depends on a number of factors such as: the etiology of the trauma, the type, form and consistency of the wounding agent, its kinetic energy and speed, the surface impact and the position of the head at the time of the impact[8-12]. Regarding this, the literature reports the fact that injury due to a blow with a fist more frequently results in mandibular fractures or zygomatic bone disjunction, while road traffic accidents and firearm or explosive injuries predominantly lead to midface, comminuted or panfacial fractures[3-6,10-12]. The high incidence of maxillofacial injuries by fist blows, as well as the legislative norms that forbid possession of firearms in our geographical area can explain the great number of mandibular fractures registered in this study[13]. In the midface, zygomatic bone fractures had the highest incidence in the present study. This fact can be explained by its prominence in the facial contour as well as its role as an impact absorber at this level[2-6,9,14,15]. Another factor that explains the results obtained is the aggressor's and victim's behavioral instinct in the case of interpersonal violence[14,15]. The aggressor will aim to damage the facial appearance of the victim, tending to target the facial bones, while the victim will be often tempted to turn the head at the moment of the impact in order to protect their eyes and midface structures[3,9,15]. Contrary to our results, other authors reported the highest incidence for midface frac-

tures in the nasal bones[12,16] or the orbital bone[4,8,17]. Nasal bones fractures are frequent, their biomechanical resistance to trauma being reduced[12,16]. The interrelationship between orbital fractures and zygomatic bone fractures is well known, the zygomatic bone being part of 2 of the 4 orbital walls[1-5]. In this context, these two categories mostly overlap; authors may include orbital fractures in the category of zygomatic bone fractures and vice versa[13]. For example, in this study, frontozygomatic fracture was included in the category of zygomatic bone fractures. In this context, the differences between our results and those of other authors are understandable.

The mandibular angle was the most frequently fractured area, a result confirmed by other authors[18,19]. Biomechanically, the mandibular angle is an area of minimum resistance to trauma[2,3,18,19]. From an anatomical point of view, the thin cortical bone at this level and the possible presence of an impacted wisdom tooth in the bone decrease the resistance of the mandibular angle to trauma[18,19]. The high incidence of mandibular angle fractures can also be due to the fact that the mandible can fracture by a direct mechanism, secondary to the lateral action of a direct wounding agent[2,3,18,19]. Additionally, the mandible can fracture by an indirect flexion mechanism, due to its arched shape, secondary to the action of a wounding agent in the paramedian or contralateral lateral region[2,3,18,19]. Contrary to our results, some authors reported the highest incidence of mandibular fractures in the paramedian[9,20] or subcondylar region[21,22]. The multitude of mechanisms that can cause mandibular fractures, as well as the wide range of factors contributing to the development of the fracture lines in a given topographic location, can explain the divergent reports found in the literature[18-22]. This is why we believe that determining the type of maxillofacial fractures in each anatomical area is essential for early diagnosis and adequate management.

The majority of the fractures in this study were complete, which is in accordance with the findings reported in the literature[1-5,9-15,18-23]. Incomplete fractures mainly occur in the mandible, secondary to low kinetic energy wounding agents[18-23]. Their action is insufficient to cause total fracture of both cortical bones[18-23]. Nevertheless, their incidence is low[18-23]. In the midface, where the cortical bones are poorly represented due to paranasal sinus pneumatization and to the presence of nasal fossae, incomplete fractures occur rarely, as the bones fracture in their entire thickness even secondary to low kinetic energy injuries[1-7].

The high frequency of displaced fractures in this study is also supported by other authors[1-4,10-12,23]. In the mandible, displacement of the fractured fragments occurs frequently through the action of the mandibular elevator and depressor muscles insertions at this level[18-23]. The increased number of mandibular fractures in the current study explains this result. In our study, the displacement of the fracture fragments most frequently occurred in case of angle and multiple fracture lines, a result also found in the studies of other authors[22,23]. The unequal distribution of mandibular elevator and depressor muscle insertions in the fractured fragments in these cases explains this result[18-23]. Secondary displacement is rare in the midface, as significant muscle traction forces is present only in the pterygoid processes[1-4]. However, the fractured fragments are easily displaced primarily, through the direct action of wounding agents due to the thin midface cortical bone[1-8]. The most frequent fragment displacement in the midface was observed in the case of zygomatic or comminuted fractures, which is in accordance with findings reported in the literature[24,25].

Closed fractures were predominant in this study, a result also confirmed by other authors[2-4,16,17]. Closed fractures most frequently occur following injuries with low kinetic energy, which is insufficient to cause significant overlying soft tissue lesions in order to expose the bone fragments to the exterior environment[2-4,16,17]. In contrast, in areas of military conflict or in studies on patients with panfacial fractures secondary to high kinetic energy agents, open fractures are predominant[10,11,25]. In our study, the opening of the fracture focus had the highest incidence in case of alveolar processes and paramedian and mandibular body fractures. Mucoperiosteal adherence to the bone is a factor that predisposes to intraoral opening of the fracture focus through the injury itself in these cases[1-4,16-20,22-24].

In this study, hematoma was the soft tissue injury with the highest incidence, a result also reported in the studies of other authors[12,18]. However, some studies report the highest incidence of lacerations[2,4,6,16,23] or excoriations[15]. The increased incidence of hematomas in this study emphasizes the fact that most of the injuries were induced by blunt objects with low kinetic energy[16,17]. Lacerations more frequently occur following high kinetic energy impacts[10,11,26]. This has been demonstrated in studies conducted on patients with maxillofacial fractures caused by firearms, explosives or road traffic accidents, cases in which the incidence

of lacerations is clearly dominant[10,11,24]. This fact can also be observed in our findings, as the association between lacerations and multiple displaced fractures was statistically significant. This result also is confirmed by other studies that recommend that clinicians should take into account the mechanism of trauma when examining a patient suspected of having facial fractures[2-10,11,16,23,24]. Thus, the presence of a hematoma can hide a single or double fracture, while a laceration can hide a multiple or comminuted fracture[23,24].

Additionally, lacerations can occur following bone fragment displacement, which directly induces open wounds of the adherent covering tissues[2-6,10,11]. In this study, the predominance of open fractures in the alveolar process, mandibular body and paramedian mandibular region, where the adherent covering mucoperiosteum is easily lacerated as a result of bone fragment displacement, supports the above. This study also showed a strong association between zygomatic bone fracture and hematoma. This finding has also been reported in the literature[12,18].

In the current study, the number of associated dental injuries was lower, which is in contradiction with the results of other authors[12,17]. The presence and the type of dental injuries depend on the patient's dento-periodontal status, the direction of action of the wounding agent, the position of the head and on whether the mouth was closed or open at the time of the impact[12,17]. Data related to dento-periodontal status might not have been accurately recorded, which is a limitation of the current study. The aim of this study achieved, however; the type of maxillofacial fractures, as well as their interrelationship with the type of associated overlying injuries was accurately determined in a significant group of patients.

A limitation of this study was the fact that zygomatic fractures in the midface are frequently combined with orbital fractures, thus being difficult to evaluate retrospectively. Therefore, it cannot be known with certainty whether the type of fracture was correctly diagnosed and topographically classified at the time of presentation. This limitation may be overcome by conducting a prospective clinical study in the future.

Conclusions

The mandible is the most commonly fractured bone of the viscerocranium, the angle being the most frequently involved topographic location. The zygomatic bone is the most fractured bone of the midface. Clinicians should expect that, among patients with a confirmed fracture in the facial skeleton, those with soft tissue hematomas will most frequently have an underlying single fracture line, while patients with lacerations will most frequently present underlying multiple and displaced fractures. The clinical approach to diagnosis and the need for proper imaging of maxillo-facial trauma should should be considered in this context.

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Sažetak

OBILJEŽJA FRAKTURA KOSTIJU LICA I VEZANE OZLJEDE MEKOG TKIVA: RETROSPEKTIVNA STUDIJA NA 1007 PACIJENATA

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Pozadina: Poznavanje težine dane patologije u populaciji pomaže u bržem postavljanju dijagnoze i pripremanju medicinskog osoblja na pružanje adekvatnog i kompletnog liječenja. Cilj ove studije bio je odrediti karakteristike maksilofacijalnih fraktura i vezanih ozljeda mekog tkiva kako bi se odredile vrste maksilofacijalnih fraktura s najvišom pojavnosti vezanih ozljeda mekog tkiva.

Metode: Provedena je retrospektivna analiza maksilofacijalnih trauma na 1007 pacijenata u razdoblju od 10 godina. Kod svih 1007 pacijenata je klinički i paraklinički potvrđeno prisustvo ozljeda facijalnog skeleta.

Rezultati: Najviša pojavnost maksilofacijalnih fraktura nađena je u mandibuli (62,16%), pri čemu je kut mandibule bio najčešće zahvaćen (28,84%). Većina je fraktura bila potpuna (97,82%), dislocirana (87,98%) i zatvorena (86,30%). Hematomi su bila najčešća vezana ozljeda mekog tkiva (44,79%). U mandibularnim traumama je pojavnost hematoma i laceracija bila najviša u kutnim prijelomima i kod simultanih višestrukih linija prijeloma (p=0,002). U srednjem licu, hematomi su bili češći u ne-kominutivnim zigomatičnim frakturama (p=0,003), dok su laceracije bile povezane s višestrukim frakturnim linijama (p=0,002).

Zaključci: Pacijenti s hematomima će najčešće imati jednu zatvorenu liniju frakture, dok će pacijenti s laceracijama najčešće imati višestruke i dislocirane frakture.

Ključne riječi: *maksilofacijalne frakture; trauma; ozljeda mekog tkiva; trauma lica; frakture kostiju lica*