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Maxillofacial Fractures: Twenty Years of Study in the Department of Maxillofacial Surgery in Kosovo

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ABSTRACT

The aim of this study was to analyze maxillofacial region fractures during the past 20 years in the Department of Maxillofacial Surgery in Prishtina.

Methods: We have analyzed the histories of all patients with trauma who were hospitalized in the Department of Maxillofacial Surgery in Prishtina since the opening of the clinic in 1983 through 2005. Narrowing the subject of our research, we concentrated on fractures of the maxillofacial region treated at the Clinic of Maxillofacial Surgery for the period 2001–2005. We have analyzed those fractures and compared them with the period from 1983 to 2005 only when it was reasonable. **Results:** During this period, 1,945 patients were treated for trauma in the maxillofacial region by the Department of Maxillofacial Surgery. This group included 19.8% females and 80.2% males. The largest age group were those between 20 and 20 years of age. Causes of trauma for both periods were predominantly traffic accidents; however, during the period 2001–2005, interpersonal conflicts were increasingly the cause of fractures. **Conclusion:** Interpersonal conflict as a cause of maxillofacial trauma has risen in recent years. With this increase the methods of treating fractures in this region are also changing.

Key words: fracture, mandible, maxilla.

1. INTRODUCTION

Maxillofacial traumatology includes a wide range of facial injuries to the facial skeletons and jaw, for which a wide spectrum of healing methods are available. Although oral and-maxillofacial trauma can be quite impressive, it is rare that a patient's life is at risk. However, for the family members, the patient's facial physiognomy changes, causing emotional shock even in cases of small facial injuries (1). Maxillofacial region fractures are frequent, and their frequency is high because the face is exposed and unprotected. The main etiological factors of fractures of the maxillofacial region are traffic accidents, interpersonal conflicts, sports, industrial trauma, etc. Thirty years after World War II, fractures caused by traffic accidents dominated in 30-60% of the cases (2). Perkins and Layton (1988) studied etiological factors, and concluded that there had been some changes in the last 20 years (3). In most economically developed countries, a decrease in the number of fractures caused by traffic accidents and an increase in the number of fractures caused by interpersonal conflicts and sports has become apparent (4). These pathologies

occur more in males than in females, with an approximate ratio of 3:1. To some extent, this is in accordance with etiological causes of this pathology. Most of the injured are between ages 8-30 years (5). The most affected bone is the mandible.

The purpose of this paper is to investigate a problem that has not yet been explored in our country in terms of epidemiological and statistical views. In addition, this research aims to provide exact data connected with epidemiological characteristics of this pathology in our region.

2. MATERIALS AND METHODS

The histories of all patients with trauma who were hospitalized in the Maxillofacial Surgery Department in Prishtina from the period since the opening of the clinic in 1983 until 2005 have been examined. This study has not included soft tissue injuries of the maxillofacial region and dental injuries; neither has it included trauma patients treated on an outpatient basis. The main focus of our research is fractures of the maxillofacial region treated at the Clinic of Maxillofacial Surgery during the

period 2001-2005. When it seemed reasonable to do so, the results were compared to fractures from the period 1983 to 2000.

The data obtained are presented in tables and graphs and the corresponding parameters are also presented showing statistical structure, arithmetic mean, standard deviation, range, chi-square test and t-test. Verification of tests has been done with the degree of reliability of 99.7% ($p < 0.01$) and the reliability of 95% ($p < 0.05$).

3. RESULTS

In the Department of Maxillofacial Surgery in Prishtina for the period 1983-2005 a total of 13,098 patients were treated with different pathologies. Those with maxillofacial region injuries constituted 14.8% of all cases. In any year the maxillofacial region fractures were not less than 10%. For the period 1983-2000, this clinic treated 1,597 patients with maxillofacial injuries, while for the period 2001 to 2005, 348 patients or 17.9% were treated.

Research has indicated a significant gender difference in the number of cases with fractures of the maxillofacial region ($X^2 = 126.8, p < 0.01$). Of the 348 patients included in the survey, 69 or 19.8% were females and 279 or 80.2% were males. (Table 1) Relation M:F in our country is 4:1. According to the relation gender-age group we have not earned the distinction of important statistical significance ($X^2 = 3.95, p > 0.05$). The larger structure of the presentation shows the age group from 20 to 29 at 104 or 29.9%, and the age group from 10 to 19 years at 63 or 18.1%. (X^2 test = 107.4, $p < 0.01$). The average age of patients with maxillofacial region fractures treated for the period 2000-2005 was 28.13 years (standard deviation 15.7 years). The youngest patient was 2 years old, and the oldest was 90 years (Table 1).

Age	Gender				Total		Chitest= p=
	F		M		N	%	
	N	%	N	%			
0-9	11	15.9	30	10.8	41	11.8	8.80 p=0.003*
	%	26.8	-	73.2	-	100.0	-
10-19	15	21.7	48	17.2	63	18.1	17.29 p=0.000*
	%	23.8	-	76.2	-	100.0	-
20-29	11	15.9	93	33.3	104	29.9	64.65 p=0.000*
	%	10.6	-	89.4	-	100.0	-
30-39	15	21.7	46	16.5	61	17.5	15.75 p=0.000*
	%	24.6	-	75.4	-	100.0	-
40-49	8	11.6	33	11.8	41	11.8	15.24 p=0.000*
	%	19.5	-	80.5	-	100.0	-
50-59	3	4.3	21	7.5	24	6.9	13.50 p=0.000*
	%	12.5	-	87.5	-	100.0	-
60+	6	8.7	8	2.9	14	4.0	0.29 p=0.53**
	%	42.9	-	57.1	-	100.0	-
Total	69	100.0	279	100.0	348	100.0	126.72 p=0.000*
	%	19.8	-	80.2	-	100.0	-

Chitest = 3.95, p=0.412** according to age and gender

* significant ** nonsignificant

Table 1. Number of patients with fractures of the maxillofacial region treated in the Clinic of Maxillofacial Surgery during the period 2001 - 2005.

Fractures of the maxillofacial region treated at the clinic of Maxillofacial Surgery for the years 2000-2005 according to the seasons did not show a significant difference with statistical

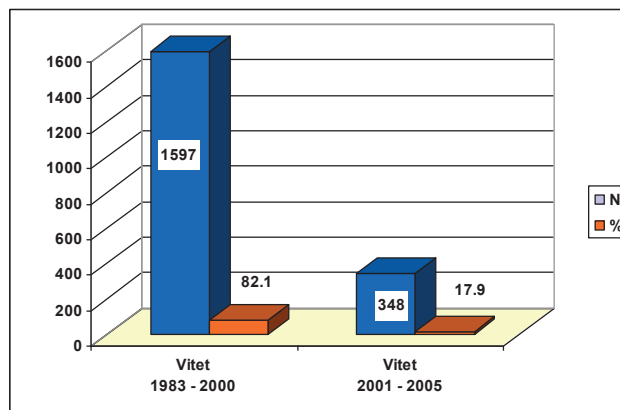


Figure 1. Number of fractures for two periods of time significance (Chi test = 6.3, $p > 0.05$) (Table 2).

Season	N	%	Chitest
Spring	82	23.6	Chitest=6.3 p>0.05
Summer	104	29.9	
Autumn	72	20.7	
Winter	90	25.9	
Total	348	100.0	

Table 2. Fractures of the maxillofacial region for the years 2000-2005, according to the seasons

Of the 348 maxillofacial region fractures for the five-year period of 2001-2005, 114 or 32.8% were caused by traffic accidents; 104 or 29.9% were caused by interpersonal conflicts; 70 or 20.1% were caused by falls; and 12 or 3.4% were a result of work in the fields. In regard to distribution of cases by gender, traffic accidents were similar for both genders (females 33.3% vs. males 32.6%). Interpersonal conflicts and sports related injuries occurred more frequently in males (interpersonal conflicts 21.7% in women vs. 31.9% for males; sports females 5.8% vs. males 8.11%). Falls occurred more frequently among females (29.0% vs. 17.9%) (Table 3).

Etiology	Gender				total	
	F		M		N	%
N	%	N	%			
Traffic accidents	23	33.3	91	32.6	114	32.8
Interpersonal conflicts	15	21.7	89	31.9	104	29.9
Fall	20	29.0	50	17.9	70	20.1
Sport	4	5.8	33	11.8	37	10.6
Field work	3	4.3	9	3.2	12	3.4
Animals	1	1.4	4	1.4	5	1.4
Fire gun	2	2.9	3	1.1	5	1.4
Tooth extraction	1	1.4	-	-	1	0.3
Total	69	100.0	279	100.0	348	100.0

Chitest = 5.201, p=0.158* according to etiology and gender

*significant

Table 3. Maxillofacial fractures by etiology and gender

Falls represented the largest number of maxillofacial injuries in children, ages 0-9 years (43.9% of all cases in this age group).

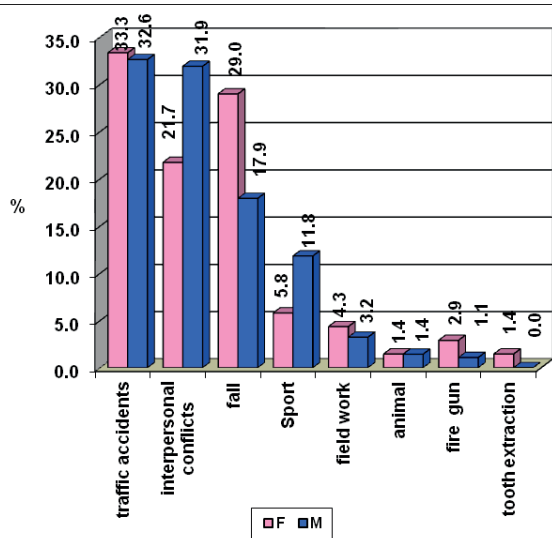


Figure 2. Maxillofacial fractures structure according to etiology and gender

In the 10-19 year old age group fractures were caused mostly by interpersonal conflicts, representing a total of 25 or 39.7%. In the age group 20-29 the major cause of maxillofacial fracture was traffic accidents (61 or 37%) followed by interpersonal conflicts (48 or 29.1%). Similar distribution patterns were found in the 40-59 year old age group, while among those age 60 or older, the most common bone fractures of the maxillofacial region were caused by falls (35.7% of all cases) (Table 4).

For the period 2001-2005 compared to the 1983-2000 pe-

Etiology	age										Total	
	0-9		10-19		20-29		40-59		60+		N	%
	N	%	N	%	N	%	N	%	N	%		
Traffic accidents	12	29.3	16	25.4	61	37.0	21	32.3	4	28.6	114	32.8
Interpersonal conflicts	3	7.3	25	39.7	48	29.1	24	36.9	4	28.6	104	29.9
Fall	18	43.9	10	15.9	28	17.0	9	13.8	5	35.7	70	20.1
Sports	6	14.6	9	14.3	17	10.3	4	6.2	1	7.1	37	10.6
Field work	-	-	1	1.6	6	3.6	5	7.7	-	-	12	3.4
Animal	2	4.9	-	-	2	1.2	1	1.5	-	-	5	1.4
Fire gun	-	-	2	3.2	2	1.2	1	1.5	-	-	5	1.4
Tooth extraction	-	-	-	-	1	0.6	-	-	-	-	1	0.3
Total	41	100.0	63	100.0	165	100.0	65	100.0	14	100.0	348	100.0

Table 4. Maxillofacial fractures according to etiology and age

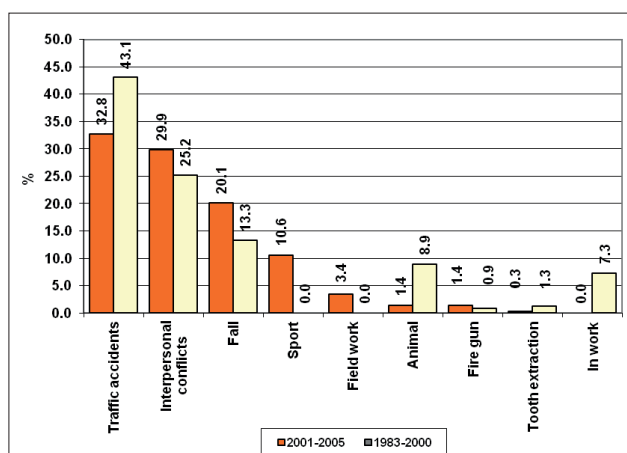


Figure 3. Maxillofacial fractures structure according to etiology and time periods

Affected bone	F		M		Total	
	N	%	N	%	N	%
Mandible	57	82.6	205	73.5	262	75.3
Maxilla	16	23.2	52	18.6	68	19.5
Zygomatic bone	11	15.9	63	22.6	74	21.3
Nasal Bones	2	2.9	8	2.9	10	2.9
Frontal bone	-	-	7	2.5	7	2.0
NOE	-	-	3	1.1	3	0.9
Orbit	1	1.4	3	1.1	4	1.1
Bases of Cranium	-	-	1	0.4	1	0.3
Total	69	100.0	279	100.0	348	100.0

Table 5. Maxillofacial fractures according to the involved bone and sex

Affected bone	Age							Total
	0-9	10-19	20-29	30-39	40-49	50-59	60+	
Mandible	N 34	N 52	N 74	N 47	N 31	N 16	N 8	N 262
	% 82.9	% 82.5	% 71.2	% 77.0	% 75.6	% 66.7	% 57.1	% 75.3
Maxilla	N 7	N 8	N 22	N 14	N 6	N 7	N 4	N 68
	% 17.1	% 12.7	% 21.2	% 23.0	% 14.6	% 29.2	% 28.6	% 19.5
Zygomatic bone	N 3	N 9	N 27	N 12	N 10	N 4	N 9	N 74
	% 7.3	% 14.3	% 26.0	% 19.7	% 24.4	% 16.7	% 64.3	% 21.3
Nasal Bone	N 1	N 3	N 4	N 2	-	-	-	N 10
	% 2.4	% 4.8	% 3.8	% 3.3	-	-	-	% 2.9
Frontal bone	N 2	N 2	N 2	-	-	-	N 1	N 7
	% 4.9	% 3.2	% 1.9	-	-	-	% 7.1	% 2.0
NOE	N -	N 2	N 1	-	-	-	-	N 3
	% -	% 3.2	% 1.0	-	-	-	-	% 0.9
Orbit	N -	N 1	N 2	N 1	-	-	-	N 4
	% -	% 1.6	% 1.9	% 1.6	-	-	-	% 1.1
Basis of cranium	N -	-	-	-	-	-	N 1	N 1
	% -	-	-	-	-	-	% 7.1	% 0.3
Total	N 41	N 63	N 104	N 61	N 41	N 24	N 14	N 348
	% 100.0	% 100.0	% 100.0	% 100.0	% 100.0	% 100.0	% 100.0	% 100.0

Table 6. Maxillofacial fractures according to the involved bone and age group

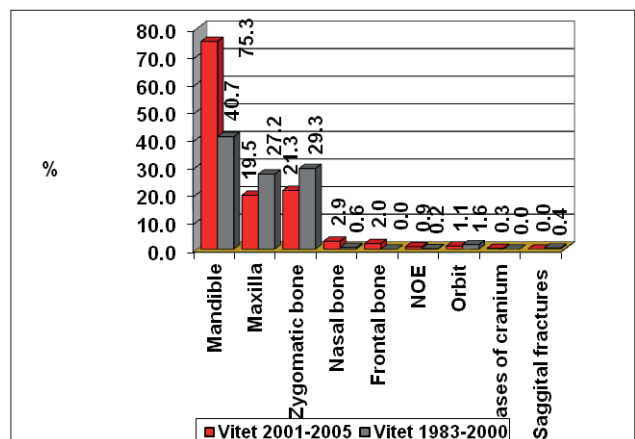


Figure 4. Structure of maxillofacial fractures by bone involved and time periods

riod, a higher incidence of interpersonal conflicts was found (29.9% vs. 25.2%) (Figure 1 and 2).

For the 2001-2005 period, the most broken bone was the mandible, occurring in 262 or 75.3% of all patients. The zygomatic bone was next, occurring 74 times or 21.3%. The maxilla followed with 68 incidences representing 19.5%. (Table 5). In regard to broken bones during time periods, we found a higher

Bone		Traffic accidents	Interpersonal conflicts	Fall	Sports	Field work	Animal	Gun fire	Tooth extraction	Total
		N	%	N	%	N	%	N	%	N
Mandible	N	80	84	26	56	9	3	3	1	262
	%	30.5	32.1	9.9	21.4	3.4	1.1	1.1	0.4	100.0
Maxilla	N	27	17	8	11	2	1	2	-	68
	%	39.7	25.0	11.8	16.2	2.9	1.5	2.9	-	100.0
Zygomatic bone	N	31	18	9	10	3	2	1	-	74
	%	41.9	24.3	12.2	13.5	4.1	2.7	1.4	-	100.0
Nasal bone	N	4	4	1	-	-	-	1	-	10
	%	40.0	40.0	10.0	-	-	-	10.0	-	100.0
Frontal bone	N	2	1	1	2	1	-	-	-	7
	%	28.6	14.3	14.3	28.6	14.3	-	-	-	100.0
NOE	N	1	2	-	-	-	-	-	-	3
	%	33.3	66.7	-	-	-	-	-	-	100.0
Orbit	N	-	1	-	3	-	-	-	-	4
	%	-	25.0	-	75.0	-	-	-	-	100.0
Cranial bases	N	1	-	-	-	-	-	-	-	1
	%	100.0	-	-	-	-	-	-	-	100.0

Table 7. Maxillofacial fractures by bone involved and etiology

Bone		Treatment			Total
		Surgical	Non-surgical	Without treatment	
Mandible	N	77	164	21	262
	%	29.4	62.6	8.0	100.0
Maxilla	N	41	20	7	68
	%	60.3	29.4	10.3	100.0
Zigoma	N	56	7	11	74
	%	75.7	9.5	14.9	100.0
Nasal bones	N	8	2	-	10
	%	80.0	20.0	-	100.0
Frontal bone	N	5	1	1	7
	%	71.4	14.3	14.3	100.0
NOE	N	3	-	-	3
	%	100.0	-	-	100.0
Orbit	N	4	-	-	4
	%	100.0	-	-	100.0
Cranial bases	N	1	-	-	1
	%	100.0	-	-	100.0
Total	N	143	172	33	348
	%	41.1	49.4	9.5	100.0

Table 8. Fractures of the maxillofacial region by involved bone and the method of treatment

incidence of mandible fractures in the period 2001-2005 as compared to the period 1983-2000 (Figure 3). In the 0-59 year old age group, the most commonly broken bone was the mandible. The mandible represented a total of 82.9% of all broken bones in the age group 0-9 years; 82.5% of those 10-19 years old; 77.0% of the 30-39 group; 75.6% of those 40-49 years; and 71.2% of those 20-29 years. In the age group 60 and older the more frequently broken bone was the zygomatic bone in 64.3% of all cases. (Table 6). Of the 262 mandible fractures, the largest number, 84 or 32.1%, were caused as a result of interpersonal conflicts. Traffic accidents were responsible for 80 or 30.5% of the fractures, and sports-related accidents accounted for 56 or 21.4% of the total number of mandible fractures. While fractures of the maxilla were primarily caused as a result of traffic accidents in 27 or

Period injury-treatment	Gender				Total	
	F		M		N	%
	N	%	N	%		
1 day	16	23.2	92	33.0	108	31.0
2 days	14	20.3	57	20.4	71	20.4
3	7	10.1	36	12.9	43	12.4
4	3	4.3	17	6.1	20	5.7
5	3	4.3	6	2.2	9	2.6
6	6	8.7	18	6.5	24	6.9
7	17	24.6	37	13.3	54	15.5
Unknown	3	4.3	16	5.7	19	5.5
Total	69	100.0	279	100.0	348	100.0
Average	3.98		2.86		3.08	
Standard deviation	1.15		0.79		0.93	
Rang	1-7		1-7		1-7	

Table 9. Duration of injury-treatment

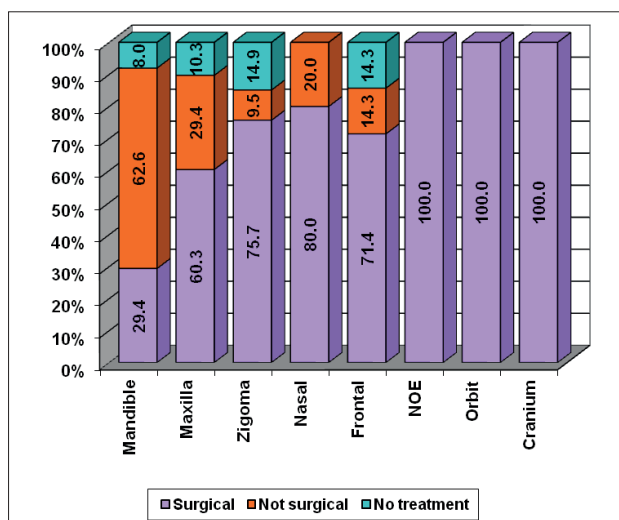


Figure 5. Fractures of the maxillofacial region by involved bone and the method of treatment

39.7%, 17 or 25% were the result of interpersonal conflicts, and injuries in sport accounted for 11 fractures or 16.2%. The main cause of zygomatic bone fractures was also due to traffic accidents (31 or 41.9%); interpersonal conflicts (18 or 24.3%) were second; and sports injuries were third (10 or 13.5%). Nonsurgical treatment was primarily used in mandible fractures (62.6%). It was also used in maxilla fractures (29.4%) and broken nasal bones (20.0%). Surgical methods of treatment were used in all cases of naso-orbito-ethmoid complex, and when orbit and cranial bases were involved. (Table 7,8,9, Figure 4 and 5). In 31% of all cases, the duration of injury-treatment was one day. In 20.4% of the cases, it was two days, and in 15.5% of the cases, it was seven days.

4. DISCUSSION

The occurrences of maxillofacial fractures compared with general human pathology is 32-18 patients in 100,000 hospitalized people (6). In the surgery clinic for the face, jaws and mouth in Zagreb, Croatia, maxillofacial trauma represents 20% of all hospitalized patients, accounting for approximately 500 patients per year (1). In 1983 author J. Dula from Kosovo published data indicating that trauma to the maxillofacial region was present in 23.34% of all cases in comparison with other pathologies in this region. In regard to the seasons, maxillofacial fractures appear with different

variations. For example, during the summer, there is an observed reduction of fractures caused by traffic accidents and an increase in injuries caused by interpersonal conflicts. Variations have been observed even in fractures caused by sports (7). Author Malaria (2005) reports that spring is the dominant season for fractures (8). Al-Khateeb T and Abdullah FM concluded that the month of January dominates in the appearance of the maxillofacial region fractures (9). According to authors from Finland (Risto Kontio, Riita Suuronen, Heikki Ponkkonen, Christian Lindqvist, Pekka Lain 1997), maxillofacial region fractures were more frequent during the months of June, July, and August and weekend days (10). For 30 years following World War II, fractures caused by traffic accidents dominated in 30-60% of all cases (Row-Killey 1968) (11). Perkins and Layton 1988 have studied etiologic factors and observed changes throughout the last 20 years (12). Recent changes in the etiology of maxillofacial trauma were analyzed by the authors Van Beek and Merckx in 1999 (4). Authors from Finland have compared their studies with research conducted by colleagues from Norway, Germany and the UK and have noticed that in more economically developed countries there is a decrease in the number of fractures caused by traffic accidents and an increase in the number caused by interpersonal conflicts and different sports (12). Interpersonal conflicts were etiological causes of maxillofacial fractures in 42% of all cases; traffic represented 26%; and falls accounted for 17%. This study shows that human behavior has become more severe in nature. Assault with a fist as an etiologic agent has increased 7.3%; use of guns has increased 5.7%; bicycle accidents are up 19.3%, while most car accidents have dropped to 31.6%. In Brazil etiologic agents are dominated by traffic accidents at 45%; interpersonal conflicts at 22.6%; fall-injury, 17.9%; sports, 7.8%; and work injuries, 4.5% (13).

In the UAE (Deogratus 2003) interpersonal conflicts dominate with 57.6%, followed by falls at 19.7%, and traffic accidents at a mere 13.7%. In Melbourne, Australia (Shahim FN, Cameron P., 2004) traffic accidents as a cause of maxillofacial fractures dominate at 70% of all cases followed by falls, which account for 15% (14). In China traffic accidents lead the causes of maxillofacial region fractures and are represented in 30.6% of all cases. Falls are in second place at 21.4%, followed by interpersonal conflicts at 15.8% (15). In Pakistan, traffic accidents dominate at 56%; followed by falls, 23%; gunshot injuries, 9%; sports, 5%; interpersonal conflicts, 4%; and animal injuries, 3%. According to these authors, the results may be influenced by geographical circumstances and work (16). In Rome, Italy 37% of maxillofacial fractures are caused by motorcycle accidents, followed by traffic accidents at 27%. In descending order sports are next at 15%, interpersonal conflicts at 11%, and falls at 2% (17).

In 1983 author J. Dula of Kosovo published data that indicated that the etiological factors were falls at 42.97%; interpersonal conflicts at 19.81%; animals at 10.74%, while traffic accidents at that time were only 9.12%. Trauma caused by animals during this period in Kosovo were presented as a fairly high percentage by comparison to today's statistics, which indicate that animals are responsible for only 1.4% of all maxillofacial trauma cases. Also the number of maxillofacial region fractures caused by traffic accidents has increased quite a lot as etiological factors of fractures in this region, from 9.12% to 43.1%, reduced again to 32%. According to this the number of maxillofacial fractures caused by interpersonal conflicts is increasing in Kosovo.

Oikarinen and Lindqvist (1975) studied 729 patients with

polytrauma, 11% of whom had facial fractures. Among them 61% were fractures of the mandible and 46% of the upper jaw, 27% had zygomatic bone fractures, and 19% had nasal bone fractures (18). Author M.H. Motamedi, (2001) from Tehran, Iran showed results indicating that mandible fractures accounted for 72.9% of all facial fractures (19). This was followed by the maxilla, 13.9%; zygomatic bone, 13.5%; zygomatic-orbital complex, 24%; cranial, 2.1%; nasal, 2.1%; and frontal bone, 1.6%. In Tanzania author Deogratus concludes that mandible fractures represent in 70.7% of all maxillofacial fractures.

Yamamoto clinically analyzed 40 patients with isolated fractures of the zygomatic arch, and concluded that surgical intervention is not influenced by the type of fracture or time interval between intervention and injury (20). According to most authors, maxillofacial fractures should be treated with open reduction and fracture repair as soon as possible. Fractures of the orbit may cause aesthetic and functional deformities, and that is why adequate treatment and correct timing is considered very important for good surgical results. Most orbital fractures should be treated in the first week after injury. Authors RM Carr and RH Mathog have conducted research where they analyzed the zygomaticomaxillary fractures and came to the conclusion that these fractures can be treated up to the first 21 days with primary surgery (21). After day 21 osteotomys are needed until four months after injury. After four months bone grafts should be applied.

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