Urban-rural differences in oral and maxillofacial trauma

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Abstract: The aim of this research was to assess oral and maxillofacial trauma in urban and rural populations of the same region. The data collected included age, gender, year and month of trauma occurrence, origin (rural and urban), cause of injury, and the type of oral and maxillofacial trauma. Records from 1121 patients with 790 instances of oral and maxillofacial trauma were evaluated. Statistical analysis was performed with the Statistical Package for Social Sciences (SPSS) version 17.0 software and involved descriptive statistics and Pearson's chi-squared test. Male patients were more prone to maxillofacial trauma (n = 537; 68%), and the patients were mostly from urban areas (n = 534; 67.6%). The male-to-female ratio was found to be 2.12:1 (urban zone, 1.72:1; rural zone, 3.49:1). The average age was 25.7 years (SD = 14.1). A traffic accident was the most common cause of oral and maxillofacial trauma (27%). The jaw (18%) was the most commonly fractured bone in the facial skeleton, followed by the zygoma (12.9%). Avulsion (8.5%) was the most common dental trauma. A significant statistical relationship was found between place of origin and gender ($p < 0.001$). Accidents involving animals were more frequent in rural areas ($P < 0.001$). Zygomatic fractures ($p < 0.001$), contusion ($p = 0.003$), and abrasion ($p = 0.051$) were the most common injuries among individuals from rural areas. Nasal fracture ($p = 0.011$) was the most frequent type of trauma in individuals from urban areas. According to these data, it seems reasonable to assume that specific preventive public policy for urban and rural areas must respect the differences of each region.

Descriptors: Facial Injuries; Traumatology; Maxillofacial Injuries; Urban Population; Rural Population.

Introduction

The epidemiology of maxillofacial trauma has been studied worldwide.[1-6] The etiology varies, depending on the age of the patient in question, as well as cultural and socio-economic factors.[1,2,7,8] Among the most common causes are:

- a traffic accident involving a car, motorbike, or bicycle;[1,2,4,7-13]
- day-to-day activities and sports;[5]
- as well as a fall from a height.[6,14,15]

Knowing the etiology of the maxillofacial trauma provides an understanding of people's behavior in a region and the need for adoption of

preventive policies.[16]

Very little research has been done on the prevalence and etiologic factors of maxillofacial trauma in rural areas.[17,18] Studies of the prevalence of tooth injuries in clinical settings other than dental offices, such as hospitals and emergency rooms, are important, since they provide information about the most prevalent types of trauma and the characteristics of the treated population.[19] This should help to improve the treatment, prevention, and prognosis of trauma cases, and to minimize the damage. Knowledge about the most commonly found maxillofacial trauma among the rural Brazilian population is scarce, as is knowledge about the causes of these traumas.

This study presents the results of a 35-month survey on the occurrence and characteristics of oral and maxillofacial trauma in patients (both urban and rural dwellers) admitted to a hospital in the region of Guanhães, MG, Brazil.

Methodology

The Oral and Maxillofacial Surgery Unit of the Public Hospital in Guanhães, in the southeast of Brazil, provides maxillofacial trauma treatment for a large number of people from urban and rural areas of the state of Minas Gerais. It is a reference point for 23 Municipalities (urban areas) and various districts and villages (rural areas), in an area with a population of 238,797 inhabitants and an area of 12,745.1 km^2. This study was based on the data pertaining to those patients who had suffered a maxillofacial trauma between the 1st of January 2005 and the 30th of November 2007, and who had been attended to in the Public Hospital. Data were collected from the patients' medical files by a single trained researcher.

All patients who had been victims of maxillofacial trauma were included in the sample. Variables related to origin were collected (rural or urban), including:

- cause of injury:
  - (i) vehicles, which included accidents involving automobiles, motorcycles, and bicycles;
  - (ii) violence, which included interpersonal violence and the violent use of weapons;
  - (iii) falls;
  - (iv) sports injuries;
  - (v) accidents involving animals; and
  - (vi) accidents at work;
- gender;
- age;
- year and month in which the trauma occurred;
- the type of maxillofacial trauma:
  - fractured jaw,
  - zygomatic fracture,
  - broken nose,
  - two or more facial fractures,
  - facial abrasion,
  - facial laceration,
  - facial contusion,
  - tooth luxation,
  - dental avulsion,
  - broken teeth.

Statistical analysis, which was performed with the Statistical Package for Social Sciences (SPSS) version 17.0 software (SPSS Inc., Chicago, USA), involved evaluating the measures of central tendency and variability and calculating proportions. Pearson's chi-squared test was used to compare factors linked to the occurrence of trauma in both rural and urban individuals.

This research was approved by the Research Ethics Committee of the Public Hospital.

Results

Clinical records of 1121 patients who attended the hospital between January 2005 and November 2007 were evaluated. Of these patients, 790 (70.5%) had experienced a maxillofacial trauma. The majority of these were male (n = 537; 68%) and urban dwellers (n = 534; 67.6%). The male-to-female ratio was found to be 2.12:1 (urban zone, 1.72:1; rural zone, 3.49:1). The average age was 25.7 years (SD = 14.1). For both rural and urban patients, the main etiologic factors of trauma were traffic accidents (27%), practicing sports (20.5%), and violence (19%). The most common types of facial fractures were mandibular fracture (18%) and zygomatic fracture (12.9%). The most common dental trauma was avulsion (8.5%) (Table 1).

Table 1 - Distribution of the frequency of etiology, location of fracture, soft-tissue wounds, and dental trauma among all patients (n = 790).

Etiology	n (%)
Car	59 (7.5)
Motorbike	72 (9.1)
Bicycle	87 (11)
Animal	111 (14.1)
Work	35 (4.4)
Violence	150 (19)
Sport	162 (20.5)
Fall	115 (14.6)
Type of fracture*	
Mandibular	142 (18)
Upper jaw	42 (5.3)
Zygomatic	102 (12.9)
Nose	73 (9.2)
2+ facial bones	34 (4.3)
Soft-tissue wounds*	
Abrasion	442 (55.9)
Laceration	447 (56.6)
Contusion	651 (82.4)
Dental trauma	
Luxation	49 (6.2)
Avulsion	67 (8.5)
Enamel fracture	61 (7.7)
Enamel/dentin fracture	39 (4.9)
Enamel/dentin/pulp	59 (7.5)

*Responses are not mutually exclusive.

A statistically significant association was found between place of origin and gender. The lowest incidence levels of trauma were among female rural dwellers (Table 2).

Car accidents ($p = 0.040$), violence ($p = 0.040$), and practicing sports ($p = 0.030$) caused trauma more frequently in urban areas than in rural areas. Accidents involving animals were more common in rural areas ($p < 0.001$) (Table 3).

Zygomatic fracture ($p < 0.001$), contusion ($p = 0.003$), and abrasion ($p = 0.051$) were the most common types of trauma among rural dwellers. A broken nose was the most common injury among urbanites ($p = 0.011$) (Table 4).

Discussion

This research was carried out between January 2005 and November 2007 in a region of Minas Gerais, in the southeast of Brazil, covering a population of about 238,797 inhabitants. This region includes both rural and urban areas, with 70% of the population younger than 30 years of age. The results of epidemiological investigations vary depending on the demographics of the population studied. Factors such as geographic region, socio-economic status, and temporal factors such as the period of the year and area can influence the causes, types, and frequency of injuries. These factors must be considered when data are compared.[20]

Analysis of the demographic data on maxillofacial trauma in this region indicated that it was most prevalent among men (2.1:1) in both urban (1.72:1) and rural areas (3.49:1). These results agree with data from others regions of the world[9,14] and also within Brazil.[7,11] It is interesting to note that the cultural and socio-economic characteristics of the studied population may influence the rates of facial fractures in women. In regions where women participate directly in social activities and consequently are more susceptible to traffic accidents and urban violence, the ratio of men:women incurring maxillofacial trauma is generally low.[5,11] In rural regions, where few women drive and do outdoor work, the ratio of men:women tends to be higher.[21]

In this research, traffic accidents were the most common cause of maxillofacial trauma. Within the category of traffic accidents, bicycle and motorcycle accidents deserve special attention, since they are prominent in maxillofacial trauma etiology.[22] Traffic accidents are important causes of maxillofacial injuries in both developing[1,2,4,11,23] and developed countries.[9,24] Bicycles and motorcycles are important means of transportation in both urban and rural areas. In rural areas, traveling on horseback is still common, which explains the higher levels of maxillofacial trauma attributed to accidents involving animals.

In this research, we can see that maxillofacial trauma due to violence or practicing sports is

Table 2 - Link between the victim's origin and socio-demographic variables: gender, age (in years), year and month of the trauma.

Variables		Victim's origin					
		Total	Urban		Rural		p-value
			n	%	n	%	
Gender	male	527	338	63.3	199	77.7	< 0.001*
	female	253	196	36.7	57	22.3	
Age	1 – 18	241	171	32.0	70	27.3	0.391 ns
	19 – 28	311	204	38.2	107	41.8	
	29 +	238	159	29.8	79	30.9	
Year	2005	239	149	27.9	90	35.2	0.115 ns
	2006	290	203	38.0	87	34.0	
	2007	261	182	34.1	79	30.8	
Month	Jan – Mar	223	158	29.6	65	25.4	0.195 ns
	Apr – June	197	130	24.3	67	26.2	
	July – Sept	194	137	25.7	57	22.2	
	Oct - Dec	176	109	20.4	67	26.2	

* significant; ns non- significant.

Table 3 - Distribution of frequency and link between the victim's origin and the etiology of the trauma (n = 790).

Types of accidents		Victim's origin					
		Total	Urban		Rural		p-value
			n	%	n	%	
Car accident	Yes	59	47	8.8	12	4.7	0.040*
	No	731	487	91.2	244	95.3	
Motorbike accident	Yes	72	51	9.6	21	8.2	0.538 ns
	No	718	483	90.4	235	91.8	
Bicycle accident	Yes	87	65	12.2	22	8.6	0.133 ns
	No	703	469	87.8	234	914.	
Involving animals	Yes	111	33	6.2	78	30.5	< 0.001*
	No	197	130	24.3	67	26.2	
Work accident	Yes	40	32	6.0	8	3.1	0.085 ns
	No	750	502	94.0	248	96.9	
Violence	Yes	150	112	21.0	38	14.8	0.040*
	No	640	422	79.0	218	85.2	
Sport	Yes	162	121	22.7	41	16.0	0.030*
	No	628	413	77.3	215	84.0	
Fall	Yes	115	79	14.8	36	14.1	0.785 ns
	No	675	455	85.2	220	85.9	

* significant; ns non- significant.

more common in urban areas than in rural areas. Research carried out in urban areas of developed countries confirms that practicing sports is the second most common cause of maxillofacial injuries,[25] while, in developing countries, interpersonal violence is the second most common cause of facial traumas.[22] Educational campaigns should be promoted in both urban and rural areas with the aim

Table 4 - Distribution of frequency and the link between the victim's origin and the type of trauma (n = 790).

Types of trauma		Victim's origin					
		Total	Urban		Rural		p-value
			n	%	n	%	
Mandibular fracture	Yes	142	93	17.4	49	19.1	0.555 ns
	No	648	441	82.6	207	80.9	
Upper jaw fracture	Yes	42	24	4.5	18	7.0	0.137 ns
	No	748	510	95.5	238	93.0	
Zygomatic fracture	Yes	102	53	9.9	49	19.1	< 0.001*
	No	688	481	90.1	201	80.9	
Broken nose	Yes	73	59	11.0	14	5.5	0.011*
	No	717	475	89.0	242	94.5	
Fracture ≥ 2 bones	Yes	34	20	3.7	14	5.5	0.264 ns
	No	756	514	96.3	242	94.5	
Facial abrasion	Yes	442	286	53.6	156	60.9	0.051*
	No	348	248	46.4	100	39.1	
Facial laceration	Yes	447	301	56.4	146	57.0	0.860 ns
	No	343	233	43.6	110	43.0	
Facial contusion	Yes	651	425	79.6	226	88.3	0.003*
	No	139	109	20.4	30	11.7	
Dental luxation	Yes	49	37	6.9	12	4.7	0.222 ns
	No	741	497	93.1	244	95.3	
Dental avulsion	Yes	67	40	7.5	27	10.5	0.149 ns
	No	723	494	92.5	229	89.5	
Broken teeth	Absent	631	431	80.7	200	78.1	0.686 ns
	En†	61	42	7.9	19	7.4	
	En/Dn	39	24	4.5	15	5.9	
	En/Dn/Pl	59	37	6.9	22	8.6	

* significant; ns non-significant; † En: enamel; Dn: dentin; Pl: pulp.

of recommending the use of mouthguards, helmets, and knee-pads and/or elbow pads while practicing sports. Recently, in terms of violence, assault has been found to be the most common etiology of facial trauma in many urban centers in developed countries. Some previous studies[26,27] demonstrated that developed countries have a higher level of interpersonal violence, and this is the leading cause of facial injuries. With the ease of acquiring weapons and increasingly aggressive behavior in urban centers, violence has replaced road accidents as the leading cause of maxillofacial trauma in these regions.[11] Because of legislative changes and preventive measures involving the use of seat belts and air bags, as well as the reduction in driving while under the influence of alcohol, motor vehicle accidents related to facial injuries have tended to decrease in some countries, while interpersonal violence has emerged as the predominant cause of facial trauma. Alcohol and unemployment are also contributing factors.[7,28,29]

The lower jaw was the most prevalent facial bone fractured, followed by the zygomatic complex and the nose. Similar results were found in other research projects carried out in Brazil [7,11,30] and in other countries, such as Turkey,[4] India,[2] Japan,[9] and the UAE.[10] The lower jaw is one of the most frequent targets in fights and is also a frequently fractured bone in motor vehicle accidents.[7] Zygomatic

fracture, contusion, and abrasion were the most common types of trauma among rural dwellers. A broken nose was the most common injury among urbanites. Further studies should be carried out to link each type of injury with the type of accident. It is believed that this difference between rural and urban areas is due to the large number of accidents involving animals in rural areas. Reports with high numbers of traffic accidents tend to contain many jaw injuries, particularly condylar fractures. In studies of significant interpersonal violence, mandibular fractures and zygomatic complex fractures appear to be the most prevalent fracture location.[9] However, no research of this type has been carried out in Brazil as yet.

This research supports the idea that regular epidemiologic evaluations of maxillofacial fractures provide important support for care facilities and research priorities, since factors associated with maxillofacial traumas can be identified. According to these data, it seems reasonable to assume that specific preventive public policy for urban and rural areas must respect the differences of each region.

Conclusion

The prevalence of maxillofacial trauma was high. The male-to-female ratio was higher in rural areas than in urban areas. The most common type of trauma was a fractured lower jaw, followed by a zygomatic fracture. The cause of injury differed greatly between rural and urban areas, with car accidents, violence, and sports accidents being the most common cause in urban areas and accidents involving animals causing most injuries in rural areas. Zygomatic fracture, contusion, and abrasion were the most common types of trauma among rural dwellers. A broken nose was the most common injury among urbanites.

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References

1. Maliska MC, Lima Júnior SM, Gil JN. Analysis of 185 maxillofacial fractures in the state of Santa Catarina, Brazil. Braz Oral Res. 2009 Jul-Sep;23(3):268-74.
2. Gandhi S, Ranganathan LK, Solanki M, Mathew GC, Singh I, Bither S. Pattern of maxillofacial fractures at a tertiary hospital in northern India: a 4-year retrospective study of 718 patients. Dent Traumatol. 2011 Aug;27(4):257-62. doi: 10.1111/j.1600-9657.2011.00996.x. Epub 2011 Jun 3.
3. Díaz JA, Bustos L, Brandt AC, Fernández BE. Dental injuries among children and adolescents aged 1-15 years attending to public hospital in Temuco, Chile. Dent Traumatol. 2010 Jun;26(3):254-61.
4. Erol B, Tanrikulu R, Görgün B. Maxillofacial fractures. Analysis of demographic distribution and treatment in 2901 patients (25-year experience). J Craniomaxillofac Surg. 2004 Oct;32(5):308-13.
5. Gassner R, Tuli T, Hächl O, Rudisch A, Ulmer H. Craniomaxillofacial trauma: a 10 year review of 9,543 cases with 21,067 injuries. J Craniomaxillofac Surg. 2003 Feb;31(1):51-61.
6. Sandalli N, Cildir S, Guler N. Clinical investigation of traumatic injuries in Yeditepe University, Turkey during the last 3 years. Dent Traumatol. 2005 Aug;21(4):188-94.
7. Chrcanovic BR, Abreu MH, Freire-Maia B, Souza LN. Facial fractures in children and adolescents: a retrospective study of 3 years in a hospital in Belo Horizonte, Brazil. Dent Traumatol. 2010 Jun;26(3):262-70. Epub 2010 Apr 23.
8. Santos SE, Marchiori EC, Soares AJ, Asprino L, de Souza Filho FJ, de Moraes M, *et al*. A 9-year retrospective study of dental trauma in Piracicaba and neighboring regions in the State of São Paulo, Brazil. J Oral Maxillofac Surg. 2010 Aug;68(8):1826-32. Epub 2010 May 20.
9. Iida S, Kogo M, Sugiura T, Mima T, Matsuya T. Retrospective analysis of 1502 patients with facial fractures. Int J Oral Maxillofac Surg. 2001 Aug;30(4):286-90.
10. Klenk G, Kovacs A. Etiology and patterns of facial fractures in the United Arab Emirates. J Craniofac Surg. 2003 Jan;14(1):78-84.
11. Brasileiro BF, Passeri LA. Epidemiological analysis of maxillofacial fractures in Brazil: a 5-year prospective study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Jul;102(1):28-34. Epub 2006 Mar 22.
12. Gulinelli JL, Saito CT, Garcia-Júnior IR, Panzarini SR, Poi WR, Sonoda CK, *et al*. Occurrence of tooth injuries in patients treated in hospital environment in the region of Araçatuba, Brazil during a 6-year period. Dent Traumatol. 2008 Dec;24(6):640-4.
13. Zandi M, Khayati A, Lamei A, Zarei H. Maxillofacial injuries in western Iran: a prospective study. Oral Maxillofac Surg.

2011 Jun 10; [Epub ahead of print]. Available from: http://www.springerlink.com/content/4w0t616032621551/.
14. Qudah MA, Bataineh AB. A retrospective study of selected oral and maxillofacial fractures in a group of Jordanian children. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002 Sep;94(3):310-4.
15. Choi SC, Park JH, Pae A, Kim JR. Retrospective study on traumatic dental injuries in preschool children at Kyung Hee Dental Hospital, Seoul, South Korea. Dent Traumatol. 2010 Feb;26(1):70-5.
16. Gomes PP, Passeri LA, Barbosa JR. A retrospective study of 5 years of complex fractures and zygomatic arch zygomatic-orbital state of Sao Paulo, Brazil. J Oral Maxillofac Surg. 2006 Jan;64(1):63-7.
17. Schroeder WA Jr. Maxillofacial trauma in two rural level II trauma centers. Mo Med. 1989 Jan;86(1):35-9.
18. Ugboko VI, Odusanya SA, Fagade OO. Maxillofacial fractures in a semi-urban Nigerian teaching hospital. A review of 442 cases. Int J Oral Maxillofac Surg. 1998 Aug;27(4):286-9.
19. Schatz JP, Joho JP. A retrospective study of dento-alveolar injuries. Endod Dent Traumatol. 1994 Feb;10(1):11-4.
20. Ellis E 3rd, el-Attar A, Moos KF. An analysis of 2,067 cases of zygomatico-orbital fracture. J Oral Maxillofac Surg. 1985 Jun;43(6):417-28.
21. Al Ahmed HE, Jaber MA, Abu Fanas SH, Karas M. The pattern of maxillofacial fractures in Sharjah, United Arab Emirates: a review of 230 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2004 Aug;98(2):166-70.
22. van Beek GJ, Merkx CA. Changes in the pattern of fractures of the maxillofacial skeleton. Int J Oral Maxillofac Surg. 1999 Dec;28(6):424-8.
23. Fasola AO, Nyako EA, Obiechina AE, Arotiba JT. Trends in the characteristics of maxillofacial fractures in Nigeria. J Oral Maxillofacial Surg. 2003 Oct;61(10):1140-3.
24. Iida S, Matsuya T. Paediatric maxillofacial fractures: their etiological characters and fracture patterns. J Craniomaxillofac Surg. 2002 Aug;30(4):237-41.
25. Cheema SA, Amin F. Incidence and causes of maxillofacial skeletal injuries at the Mayo Hospital in Lahore, Pakistan. Br J Oral Maxillofac Surg. 2006 Jun;44(3):232-4.
26. Hächl O, Tuli T, Schwabegger A, Gassner R. Maxillofacial trauma due to work-related accidents. Int J Oral Maxillofac Surg. 2002 Feb;31(1):90-3.
27. Iida S, Hassfeld S, Reuther T, Schweigert H, Haag C, Klein J, *et al*. Maxillofacial fractures resulting from falls. J Craniomaxillofac Surg. 2003 Oct;31(5):278-83.
28. Haug RH, Prather J, Indresano AT. An epidemiologic survey of facial fractures and concomitant injuries. J Oral Maxillofac Surg. 1990 Sep;48(9):926-32.
29. Telfer MR, Jones GM, Shepherd JP. Trends in the aetiology of maxillofacial fractures in the United Kingdom (1977-1987). Br J Oral Maxillofac Surg. 1991 Aug;29(4):250-5.
30. Chrcanovic BR, Freire-Maia B, Souza LN, Araújo VO, Abreu MH. Facial fractures: a 1-year retrospective study in a hospital in Belo Horizonte. Braz Oral Res. 2004 Oct-Dec;18(4):322-8.