J. Maxillofac. Oral Surg. (Apr–June 2018) 17(2):169–174
https://doi.org/10.1007/s12663-016-0994-3

RESEARCH PAPER

Epidemiology and Risk Factors of Maxillofacial Injuries in Brazil, a 5-year Retrospective Study

Luciana Domingues Conceição[1] · Isadora Augusta da Silveira[1] · Gustavo Giacomelli Nascimento[1,4] · Rafael Guerra Lund[1,4] · Ricardo Henrique Alves da Silva[2] · Fábio Renato Manzolli Leite[3,4]

Received: 1 July 2016 / Accepted: 19 December 2016 / Published online: 23 December 2016

Abstract

Aim The etiology and epidemiology of maxillofacial injuries varies widely in different regions of the world due to socioeconomic status, cultural aspects in addition to road traffic and drug consumption. The aim of this study is to determine major causes and epidemiological characteristics of maxillofacial trauma in a 5-year period.

Materials and methods Reports of corporal trauma (n = 25,632) from 2007 to 2011 in the Department of Forensic Medicine were analyzed as to the presence of maxillofacial injuries. Data were submitted to Chi square test and to multivariate Poisson regression.

Results 3262 reports referred maxillofacial trauma. The majority were men (55.8%), single (68.9%), most of them white (75.7%). The average age was 28.9 years (SD = 8.42), and victims with age between 16 and 30 years old were the most affected (48.0%). Women comprised 44% of total sample, 67.8% (971) were single, 76% (1.076) white and 46% (691) aged between 16 and 30 years old. Middle third injuries were associated after adjustment with females (PR 1.05; 95% CI 1.01–1.11), non-white subjects (PR 1.06; 95% CI 1.01–1.12) and physical aggression (PR 1.07; 95% CI 1.02–1.13). Injuries in the oral region was more prevalent in men (PR 1.24; 95% CI 1.09–1.41), in those aged between 16 and 30 (PR 1.97; 95% CI 1.48–2.61) and in subjects with injuries caused by traffic accident (PR 1.21; 95% CI 1.02–1.44). The presence of injuries in the lower third of face remained associated in the final model only with traffic accident (PR 1.75; 95% CI 1.43–2.15).

Conclusion Health care practitioners must recognize vulnerable population and most prevalent sites of lesion to identify cases of violence.

Keywords Domestic violence · Violence against women · Forensic dentistry · Forensic medicine · Maxillofacial injury

Introduction

The etiology and epidemiology of maxillofacial injuries varies widely in different regions of the world due to socioeconomic status, cultural aspects in addition to road traffic and drug consumption. The risk factors for traumatic dental and facial injury frequently involve aggressiveness and violent attitudes and must always be considered in the development of effective strategies for dental health preservation [1]. In addition, dental and facial trauma can influence people's lives, affecting their appearance, speech, and diet habits [2].

The head and neck region is one of the common sites of interpersonal violence (IPV) [3, 4], and this type of aggression can often leave irreversible marks, bringing harm to the person, both physical and psychic. Likewise,

✉ Fábio Renato Manzolli Leite
fabio.leite@ufpel.edu.br

[1] Department of Restorative Dentistry, Dental School, Federal University of Pelotas, Pelotas, RS, Brazil

[2] Department of Stomatology, Public Health and Forensic Dentistry, School of Dentistry of Ribeirão Preto, University of São Paulo (USP), Ribeirão Prêto, SP, Brazil

[3] Department of Semiology and Clinics, Dental School, Federal University of Pelotas, Pelotas, RS, Brazil

[4] Faculdade de Odontologia de Pelotas – Programa de Pós-Graduação em Odontologia, Rua Gonçalves Chaves, 457 – Centro, Pelotas CEP 96015-560, Brazil

traffic accidents can caused maxillofacial injuries and several concomitant injuries to other body parts [5].

Retrospective data is important to identify, to describe, and to quantify injuries for preventive programs as well as legislative changes in future. In this sense, it is important that police and Department of Forensic Medicine work together with other sectors, like health care, to seek strategies. Epidemiological studies analyzing maxillofacial injuries with 5-year period are rare and most of them showed only fractures or interpersonal violence. The aim of this study is to point out cause, epidemiological characteristics of prevalence and associated factors of maxillofacial trauma from a city of the Southern Brazil during a 5-year period and to delineate comparisons with worldwide patterns and prevent injuries.

Materials and Methods

This cross-sectional and retrospective study was performed on the records of all violence-related forensic reports in the Department of Forensic Medicine, Pelotas, Brazil, from January 2007 to December 2011 (n = 25,632). The institute is a reference for 11 cities with 600,000 inhabitants. All data were collected by two calibrated examiners and recorded in a specific form. A selection was made to include all the records reporting presence of maxillofacial injuries. Injuries were grouped as follow: (1) oral lesions, defined as those involving: (a) teeth and surrounding supportive tissues (periodontium); (b) oral mucosa including gums, alveolar mucosa in edentulous patient, palate and mucosa; (c) jaw bones (upper and lower); (d) lips (mucosa and skin); (e) tongue; (f) perioral soft tissues (extraoral tissues that surround mouth and cover upper and lower jaw); (2) extraoral regions: lower third (masseter, mandible and mentum regions), middle third (infraorbital, zygomatic and nasal regions) and oral (intraoral, lips and perioral soft tissues). This study followed the Declaration of Helsinki on medical protocol and was approved by the Institutional Review Board of the Federal University of Pelotas, Dental School (protocol 88/2009).

Statistical Analysis

Data were analyzed with Stata 12.0 software (StataCorp, College Station, TX, USA) and double typed. Also were submitted to descriptive and bivariate analyzes, Chi square and Chi square for linear trend when appropriate, in order to verify an association between the outcome with the independent variables. After, a multivariate Poisson regression model was performed. For variable selection the stepwise method with backward selection was used. Variables with $P < 0.20$ were included in the fitting model, and estimated their Prevalence Ratio (PR) and their 95% confidence of interval.

Results

In this study from a total of 25,632 victims only 3262 (12.7%) presented maxillofacial traumas. Patients with missing data (n = 648) were excluded from the study, remaining 2614 patients presenting 3348 injuries. Number of cases was similar among the studied years (mean 5.126/year). The majority were men (55.8%), single (68.9%), most of them white (75.7%). The average age was 28.9 years (SD = 8.42), and victims with age between 16 and 30 years old were the most affected (48.0%), followed by ages between 31 and 45 years old (24.6%). Considering women's data, we found that they comprised 44% of total sample, 67,8% (971) were single, 76% (1.076) were white and 46% (691) of the victims were aged between 16 and 30 years old.

The specialized police station for women defense (730; 22.4%) referred most of the affected subjects. Majority of maxillofacial traumas among men and women were due to physical aggressions (2739; 81.8%), traffic accidents (381; 11.4%) and falls (32; 4.9%). About damage caused by lesions, 22 patients (3.3%) presented permanent and irreversible consequences, becoming unable for daily, social and work activities.

Table 1 Lesions distribution in middle third of the face according to gender, age, skin color and cause of injury

	Middle third injuries (%)	
	n	*P* value
Sex		<0.001*
Male	1266 (62.56)	
Female	966 (67.02)	
Age (years)		0.022#
0–15	233 (64.90)	
16–30	971 (62.30)	
31–45	533 (67.07)	
46–60	268 (68.33)	
>60	70 (76.90)	
Skin color		0.024*
White	1613 (63.25)	
Non-white	442 (68.00)	
Cause of injury		0.002*
Physical aggression	1794 (65.50)	
Traffic accident	270 (57.45)	
Firearm	35 (54.32)	

* Chi square test; # Linear trend test

Table 2 Distribution of injuries according to type of injury among men and women

	n	Women (%)	Men (%)
Type of injury			
Bruise	916	451 (31.3)	465 (25.5)*
Edema	788	346 (24.0)	442 (24.3)
Hematoma	122	54 (3.74)	68 (3.74)
Erosion	314	143 (9.9)	171 (9.4)
Fracture	122	26 (1.8)	96 (5.3)*
Wound	290	97 (6.7)	193 (10.6)*
Scar	57	19 (1.3)	38 (2.1)
Total	2609	100	8.1

Pelotas/Brazil, 2014. (n = 3345)

* $P < 0.05$ (Chi square test)

Traumas occurred in all regions of the face in a different proportion, with middle third concentrating most of the them (475, 73.3%), followed by lower third (170, 26.2%) and by oral region (140, 21.6%). Table 1 describes the associations between the presences of traumas and independent variables are listed according to the middle third. For dental traumas, tooth fracture was the most prevalent (94, 34.9%) followed by avulsion (35, 13.0%). With respect to the intraoral soft tissue injuries, buccal (72, 26.8%) and gingival mucosa (27, 10.0%) and tongue (17, 6.4%) were the most affected sites. Table 2 brings data of type of injuries distributed according gender. The statistical analysis demonstrated a significant difference in the prevalence of bruise, which was higher among women, fracture and wound, higher among men.

Table 3 brings information regarding factors associated with injury occurrence in face middle third region according to the exposition variables. Middle third injuries were associated with females, non-white individuals and physical aggression and more prevalent on subjects older than 60-year-old. After adjustment, females (PR 1.05; 95% CI 1.01–1.11), non-white subjects (PR 1.06; 95% CI 1.01–1.12) and physical aggression (PR 1.07; 95% CI 1.02–1.13) still remained positively associated with the main outcome.

Finally, Tables 4 and 5 present the multivariate analysis by the Poisson regression. In the adjusted model, occurrence of injuries in the oral region was more prevalent in men (PR 1.24; 95% CI 1.09–1.41), in those aged between 16 and 30 (PR 1.97; 95% CI 1.48–2.61), 31–45 (PR 1.98; 95% CI 1.47–2.67), 46–60 (PR 2.15; 95% CI 1.57–2.94), and in subjects with injuries caused by traffic accident (PR 1.21; 95% CI 1.02–1.44), physical aggression aggregated with traffic accident (PR 4.09; 95% CI 3.75–4.45) (Table 4). The presence of injuries in the lower third of face remained associated in the final model only with traffic accident (PR 1.75; 95% CI 1.43–2.15) (Table 5).

Discussion

Maxillofacial region is very delicate and includes vital functions, e.g. respiration, mastication, speech, vision and others that may cause death or several damage.

Table 3 Crude (c) and adjusted (a) prevalence ratios (PR) for injuries in the middle third of face according to independent variables

Variables	Middle third			
	PR^c (95% CI)	*P* value	PR^a (95% CI)	*P* value
Sex		**0.009**		**0.043**
Male	1.0		1.0	
Female	1.07 (1.01–1.12)		1.05 (1.01–1.11)	
Age (years)		0.155		0.126
0–15	1.0		1.0	
16–30	0.96 (0.88–1.05)		0.94 (0.87–1.03)	
31–45	1.03 (0.94–1.13)		1.01 (0.92–1.10)	
46–60	0.96 (0.86–1.03)		0.95 (0.86–1.03)	
>60	1.18 (1.03–1.35)		1.18 (1.03–1.35)	
Skin color		**0.035**		**0.048**
White	1.0		1.0	
Non-white	1.07 (1.01–1.14)		1.06 (1.01–1.12)	
Cause of injury		**<0.001**		**0.005**
Physical aggression	1.07 (1.03–1.16)		1.07 (1.02–1.13)	
Traffic accident	0.93 (0.85–1.02)		0.95 (0.87–1.04)	
Firearm	1.0		1.0	

Bold values indicate statistical significant association

Pelotas/Brazil (n=2109)

Table 4 Crude (c) and adjusted (a) prevalence ratios (PR) for injuries in the lower third of face according to independent variables

Variables	Oral region			
	PR[c] (95% CI)	*P* value	PR[a] (95% CI)	*P* value
Sex		**0.001**		**0.001**
Male	1.25 (1.10–1.45)		1.24 (1.09–1.41)	
Female	1.0		1.0	
Age (years)		**0.047**		**0.029**
0–15	1.0		1.0	
16–30	1.80 (1.38–2.35)		1.97 (1.48–2.61)	
31–45	1.78 (1.35–2.35)		1.98 (1.47–2.67)	
46–60	1.98 (1.48–2.65)		2.15 (1.57–2.94)	
>60	0.75 (0.40–1.72)		0.83 (0.43–1.57)	
Skin color		0.336		0.349
White	1.0		1.0	
Non-white	0.92 (0.79–1.08)		0.92 (0.79–1.08)	
Cause of injury		0.069		**0.037**
Physical aggression	1.0		1.0	
Traffic accident	1.24 (1.05–1.46)		1.21 (1.02–1.44)	
Firearm	0.19 (0.10–1.32)		0.21 (0.12–1.50)	
Physical aggression + traffic accident	4.21 (3.90–4.56)		4.09 (3.75–4.45)	
Physical Aggression + firearm	1.12 (0.56–2.23)		1.01 (0.50–2.05)	
Others	0.44 (0.24–0.80)		0.45 (0.25–0.81)	

Bold values indicate statistical significant association

Poisson regression. Pelotas/Brazil, 2014 (n = 3345)

Table 5 Crude (c) and adjusted (a) Prevalence Ratios (PR) for injuries in the lower third of face according to independent variables

Variables	Lower third			
	PR[c] (95% CI)	*P* value	PR[a] (95% CI)	*P* value
Sex		0.884		0.487
Male	0.98 (0.84–1.15)		0.94 (0.79–1.11)	
Female	1.0		1.0	
Age (years)		0.761		0.906
0–15	1.0		1.0	
16–30	1.13 (0.85–1.51)		1.10 (0.83–1.47)	
31–45	1.31 (0.97–1.77)		1.31 (0.97–1.78)	
46–60	1.03 (0.73–1.07)		0.99 (0.69–1.42)	
>60	0.96 (0.53–1.73)		0.88 (0.50–1.56)	
Skin color		0.086		0.466
White	1.0		1.0	
Non-white	0.82 (0.66–1.02)		0.81 (0.65–1.01)	
Cause of injury		**<0.001**		**<0.001**
Physical Aggression	1.0		1.0	
Traffic Accident	1.77 (1.46–2.15)		1.75 (1.43–2.15)	
Firearm	2.60 (1.48–4.56)		1.69 (0.70–4.08)	
Physical aggression + traffic accident	1.45 (0.83–2.49)		1.38 (0.78–2.44)	
Physical aggression + firearm	0.31 (0.14–2.12)		0.31 (0.45–2.14)	
Others	1.56 (1.06–2.31)		1.69 (1.14–2.49)	

Bold values indicate statistical significant association

Poisson regression. Pelotas/Brazil, 2014 (n = 3345)

The comparison of data must consider the variation of geographic region, socioeconomic status, population density and others factors involved. Our study found average age was 28.9 years for men and victims with age between 16 and 30 years old were the most affected the same for women. Others studies showed the same age group, but most of them are related to maxillofacial fractures [6–8]. We believe that this range of age may represents economic active segment, mainly men.

Brasileiro and Passeri [8], in a 5-year prospective study with 1024 patients found that most fractures were caused by traffic accidents (45%), followed by assaults (22.6%). Differences can be explained because they analyzed fractures instead of general maxillofacial lesions and traffic accidents tend to cause more serious injuries such as fractures. Assaults have a pattern of minor injuries that reach more soft tissue and are most commonly caused by punches and kicks explaining our results.

Lee [9], in a 11-year study showed IPV was the main cause of facial fractures. Likewise, IPV is a serious health problem that affects, in the USA, up to 26% of adult women and 16% of adult men [10]. In Brazil, 28.9% of women reported to have suffered any kind of physical or sexual violence [11]. In 2006, the Brazilian government enacted a law under the symbolic name "Maria da Penha Law" on Domestic and Family Violence. In our study, the Police Station for the Defense of Women was the institution that endorsed more victims for forensic medical examination (730; 22.4%), which explains our high number of injuries caused by assault or IPV. Furthermore, it shows that since the creation of the special women's police stations, also in 2006, women began to feel more welcomed in seeking for help in cases of domestic violence. Aroseana et al. [12] observed that 42.2% of adult female victims of assault with facial trauma at The University of Kentucky College documented the episode as IPV or family violence.

IPV has profound health consequences. Abused women are more likely to have physical and psychological problems, including reproductive problems, depression, psychosomatic disorders, and limitations in social functioning [13–15]. In addition, IPV is also associated with loss of productivity and increased use of health care and social services for a long time after the end of the violence episodes [16].

Another interesting finding is that non-white women has more risk of physical aggression and lesions on middle third of face. Others studies showed that middle third of face was commonly involved when maxillofacial region was studied [17, 18]. Our findings can be explained by the fact of assaults against women be perpetrated by her partner and associated with the intention of damaging the women beauty. The middle third is the prominent part of face and more easy to damage by punches and kicks. Le et al. [17] in a retrospective review with patients treated for domestic violence injuries at an inner-city hospital over a 5-year period found the middle third of the face was most commonly involved (69%). Thus, we can assume that women that suffer physical aggressions are at greater risk to have the middle third of the face injured.

Domestic violence against women is one of the types of intimate partner violence (IPV) fastest growing. It is estimated that more than 2.5 million women are assaulted annually worldwide and this number is probably much larger because physical abuse inflicted by family members within households is often hidden [19]. Furthermore, women fear to denunciate the aggressor; and feel lower self-esteem, shame and embarrassment. American Dental Association [20] expanded existing efforts to educate dental professionals to recognize abuse and neglect beyond that of the children alone, to include women, elders, people with developmental disabilities, and encourage training programs on how to report such abuse and neglect to the proper authorities as required by state law, and be it further.

Another finding in our study showed that injuries in lower third is more related to men aged between 16 and 30 old and traffic accidents. This result is in accordance with other studies [21, 22]. Men are more susceptible to traffic accidents because they drive more frequently, have more aggressive behavior compared to women and in many occasions are under alcohol influence [23].

It is important to point that no previously published paper has reported a social marker as a risk factor for oral and maxillofacial trauma in women victims of assaults. What we can see in our report is that women can also be a victim of this social mark of being brown or black. The absence of a forensic dentist in our service may have underestimated the prevalence and severity of maxillofacial injuries.

Conclusion

Our study collaborates with the understanding of etiologic factors and pattern of injuries in head and neck injuries. The presence of a forensic dentist in forensic departments is essential to avoid underreported injuries and public policies against violence are necessary considering the exposed groups at risk. Victims of violence are sometimes reluctant to report the abuse and it is important that health care practitioners are able to identify the most vulnerable population and most prevalent sites of lesion to recognize a case of violence. In addition, professionals should be able to support the victim about the involved ethical and legal aspects and, furthermore, arrange the most adequate clinical care.

Compliance with Ethical Standards

Conflict of interest L. D. Conceição, I. A. da Silveira, G. G. Nascimento, R. G. Lund, R. H. A. da Silva, F. R. M. Leite state that there are no conflicts of interest. No funding supported this study. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 (in its most recently amended version).

References

1. Soriano EP, Caldas AF Jr, Goes OS (2004) Risk factors related to traumatic dental injuries in Brazilian schoolchildren. Dent Traumatol 20(5):246–250
2. Brauer JC (1950) The treatment of children's fractured permanent anterior teeth. J Am Dent Assoc 41(4):399–407
3. Muelleman RL, Lenaghan PA, Pakieser RA (1996) Battered women: injury locations and types. Ann Emerg Med 28(5):486–492
4. Ochs HA, Neuenschwander MC, Dodson TB (1996) Are head, neck and facial injuries markers of domestic violence? J Am Dent Assoc 127(6):757–761
5. Thoren H, Snall J, Salo J, Suominen-Taipale L, Kormi E, Lindqvist C et al (2010) Occurrence and types of associated injuries in patients with fractures of the facial bones. J Oral Maxillofac Surg 68(4):805–810
6. Singh V, Malkunje L, Mohammad S, Singh N, Dhasmana S, Das SK (2012) The maxillofacial injuries: a study. Natl J Maxillofac Surg 3(2):166–171
7. Lee KH, Snape L, Steenberg LJ, Worthington J (2007) Comparison between interpersonal violence and motor vehicle accidents in the aetiology of maxillofacial fractures. ANZ J Surg 77(8):695–698
8. Brasileiro BF, Passeri LA (2006) Epidemiological analysis of maxillofacial fractures in Brazil: a 5-year prospective study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 102(1):28–34
9. Lee KH (2009) Interpersonal violence and facial fractures. J Oral Maxillofac Surg 67(9):1878–1883
10. Centers for Disease C, Prevention (2008) Adverse health conditions and health risk behaviors associated with intimate partner violence–United States, 2005. MMWR Morb Mortal Wkly Rep 57(5):113–117
11. Garcia-Moreno C, Jansen HA, Ellsberg M, Heise L, Watts CH, Health WHOM-cSoWs et al (2006) Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. Lancet 368(9543):1260–1269
12. Arosarena OA, Fritsch TA, Hsueh Y, Aynehchi B, Haug R (2009) Maxillofacial injuries and violence against women. Arch Fac Plast Surg 11(1):48–52
13. Campbell JC (2002) Health consequences of intimate partner violence. Lancet 359(9314):1331–1336
14. McCaw B, Golding JM, Farley M, Minkoff JR (2007) Domestic violence and abuse, health status, and social functioning. Women Health 45(2):1–23
15. Bonomi AE, Thompson RS, Anderson M, Reid RJ, Carrell D, Dimer JA et al (2006) Intimate partner violence and women's physical, mental, and social functioning. Am J Prev Med 30(6):458–466
16. Rivara FP, Anderson ML, Fishman P, Bonomi AE, Reid RJ, Carrell D et al (2007) Healthcare utilization and costs for women with a history of intimate partner violence. Am J Prev Med 32(2):89–96
17. Le BT, Dierks EJ, Ueeck BA, Homer LD, Potter BF (2001) Maxillofacial injuries associated with domestic violence. J Oral Maxillofac Surg 59(11):1277–1283; discussion 83-4
18. Saddki N, Suhaimi AA, Daud R (2010) Maxillofacial injuries associated with intimate partner violence in women. BMC Public Health 10:268
19. Garbin CA, Guimaraes e Queiroz AP, Rovida TA, Garbin AJ (2012) Occurrence of traumatic dental injury in cases of domestic violence. Braz Dent J 23(1):72–76
20. ADA. 99H-1996 (1996) In: Transactions ADA, editor. American Dental Association Chicago, p 684
21. Mallikarjuna SK, Krishnappa P (2009) Prevalence of maxillofacial injuries by motorized two wheeler road traffic accidents in Bangalore city. Dent Traumatol 25(6):599–604
22. Ravindran V, Ravindran Nair KS (2011) Metaanalysis of maxillofacial trauma in the northern districts of kerala: one year prospective study. J Maxillofac Oral Surg 10(4):321–327
23. Banks PBA (2001) Etiology, surgical anatomy and classification. In: Banks PBA (ed) Fractures of the facial skeleton. Elsevier, Philadelphia