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Orofacial trauma patterns in children victims of violence and abuse

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Abstract: Due to its epidemiological features and to the alarming consequences in dental disability, child abuse represents a real dental health problem. The aim of this study was to identify potential orofacial trauma patterns associated with child abuse and violence. Materials and method. 591 children in possession of a legal medicine certificate issued by the Institute of Legal Medicine Iași were enrolled in a statistical analysis. On hand of statistical tests, various epidemiological correlations regarding the pathogenic pathways and types of traumatic injuries were established. Results and discussion. The trauma patterns that can be identified throughout a complete general and oro-dental examination performed by a trained DMD or a forensic dentist are multiple. They are significantly associated with multiple factors like age or sex – as a basis of optimal prevention. Conclusions. Through their frequency, polymorphism and potential dental and aesthetic disabilities, the orofacial trauma patterns should be a subject of concern for all parties involved. Optimal prevention and treatment are crucial for the future physical and psychological development of the child.

Key Words: child abuse, forensic dentistry, soft tissue injuries, orofacial injuries.

Children represent a vulnerable population segment as to craniofacial and dental-periodontal trauma risk. This risk is caused mainly by their ludic activities; nevertheless, the especially important etiopathogenic aspects are related to non-ludic multifactor accidents, violence acts against children, negligence [1] and, last but not least, a potentially unfavourable morphopathological background often present (for instance: malpositions or malocclusions, frequently associated with an orthodontic or prosthetic therapeutical method applied prior to the trauma, and with a complicated post-trauma evolution [2]) in traumatic diatheses.

In this context, different etiological models have been considered, nuanced by epidemiologic aspects often relevant and materialized in multiform injury patterns – by their incidence, recognizable as serious public health problems [3,4] –, all of them making up the vast clinical context of the abused child. Therefore, the notion of child abuse is superordinated to a generous defining context, collecting all pathological types in which a child is subject to a treatment considered unacceptable, in certain population tributary to a specific culture, at a certain time [5].

Taking into account the multiple valencies or oral-facial trauma in abused children, the purpose of the present study was the identification, particularization and correlative epidemiological analysis of the injury types of oral and dental-periodontal traumas in a population segment of children who benefitted from forensic medical

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reports issued by the Forensics Institute of Iaşi, between January 16th 2007 and September 30th 2008. Such a study proves to be the more opportune, the more frequently the literature of the field often evokes the adverse character of the statistical epidemiologic data as to the oral dental-periodontal pathology of the abused and/or neglected child [6].

MATERIALS AND METHOD

The study started with the evaluation of 5,400 forensic medical reports issued by the Forensics Institute of Iaşi between January 16th 2007 and September 30th 2008, of which 591 were pediatric cases (Table 1). In these latter cases, distribution on genders was of 77.2% male subjects and 22.8% female subjects, respectively (Fig. 1). The chronological age limits for males and females ranged between 0 and 18 years, and between 2 and 18 years, respectively, with a total repartition on habitual environments of 57.19% for the urban environment, and of 42.81%, respectively, for the rural one (Fig. 2).

Table 1. Experimental batch

Patients with Legal Medicine Certificate (16. 01. 2007 – 30. 09. 2008)	Number	%
Adults	4809	89.1%
Children	591	10.9%
Children with oral trauma	320	54.1%
Children with other trauma	271	45.9%
Total group (16. 01. 2007 – 30. 09. 2008)	**5400**	

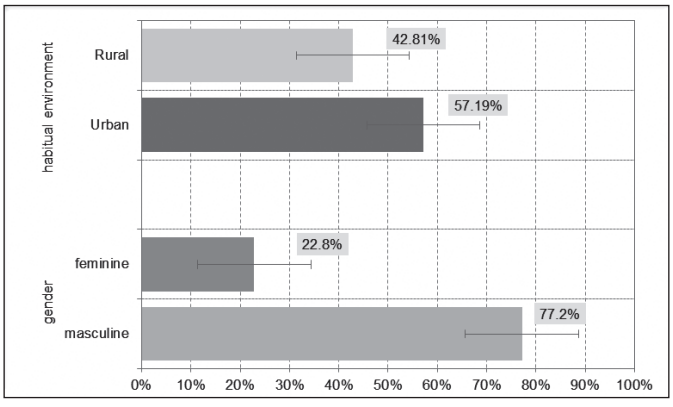

Figure 1. Case repartition on gender and habitual environment.

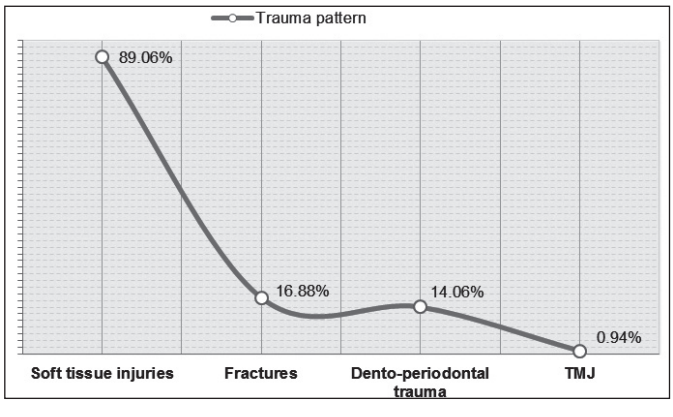

Figure 2. Distribution of cases as a function of injury type.

The aforementioned statistical methods helped in the successful and comparative assessment of: 1) the injury mechanism and its statistical association with the habitual environment, gender and age of subjects, and 2) the injury pattern and its statistical association with the habitual environment, gender and age of subjects. Consecutively, the reference parameter calculated during the tests (representing the level of test significance) was compared with p=0.05, a value corresponding to a 95% reliability, with significant values for the calculated p <0.05.

Data are expressed as mean±SD, median and interquartile range, or as percent frequency, as appropriate. Comparisons among groups were made by the p value of the linear trend (1-way analysis of variance or chi-square test), while comparisons among patients were made by the paired t test (normally distributed data) or by the Wilcoxon signed rank test (non-normally distributed data). The correlations between variables were investigated by Pearson product moment correlation coefficient or by Spearman rank correlation coefficient, as appropriate. Statistical significance was defined at p values below 0.05. The obtained data were analysed using a SPSS V.20.0. software (SPSS for Windows, standard statistical package, version 20.0, Chicago, Illinois).

RESULTS AND DISCUSSION

According to Table 1, in 54.1% of the studied cases, the injuries were localized in the oral-maxillofacial area (OMF); this percent is close to the 53.6% value reported by Calvacanti [7] and the 59% one reported by Cairns *et al.* [8], and lower than the one reported by Naidoo [9] in 2000 (67%) or than the 66.2% value reported by Jeesee [10]. In a retrospective study performed on a batch of 1,248 abused children in Minnesota USA, da Fonseca ascertains a 37.5% prevalence of oral-facial lesions, emphasizing that the percent was double in physically-abused children, reaching 75.5% [11].

The results obtained showed a preponderant presence of lesions in males (77.2%), which agrees with the values reported by other authors [7,8,9,12], while the studies performed by Jeesse [10], da Fonseca [11], Needleman HL [13] revealed an equal distribution of injuries between the two genders. A higher frequency of the oral-maxillofacial injuries (57.19%) was also noticed in subjects from the urban environment (Fig. 1).

An alarming frequency of oral-maxillofacial and dental-periodontal trauma cases produced by physical abuse was ascertained (84.69%), in comparison to other cases (car accidents – 12.5%, or sexual abuse – 2.81%). Therefore, physical abuse has major consequences in the oral-maxillofacial area, those considered in the present study involving mainly soft tissue injuries (89.06%), dental-periodontal trauma (14.06%), fractures of the facial skeleton and mandible (16.88%) and lesions of the temporo-mandibular joint (TMJ) (0.94%) (Fig. 2).

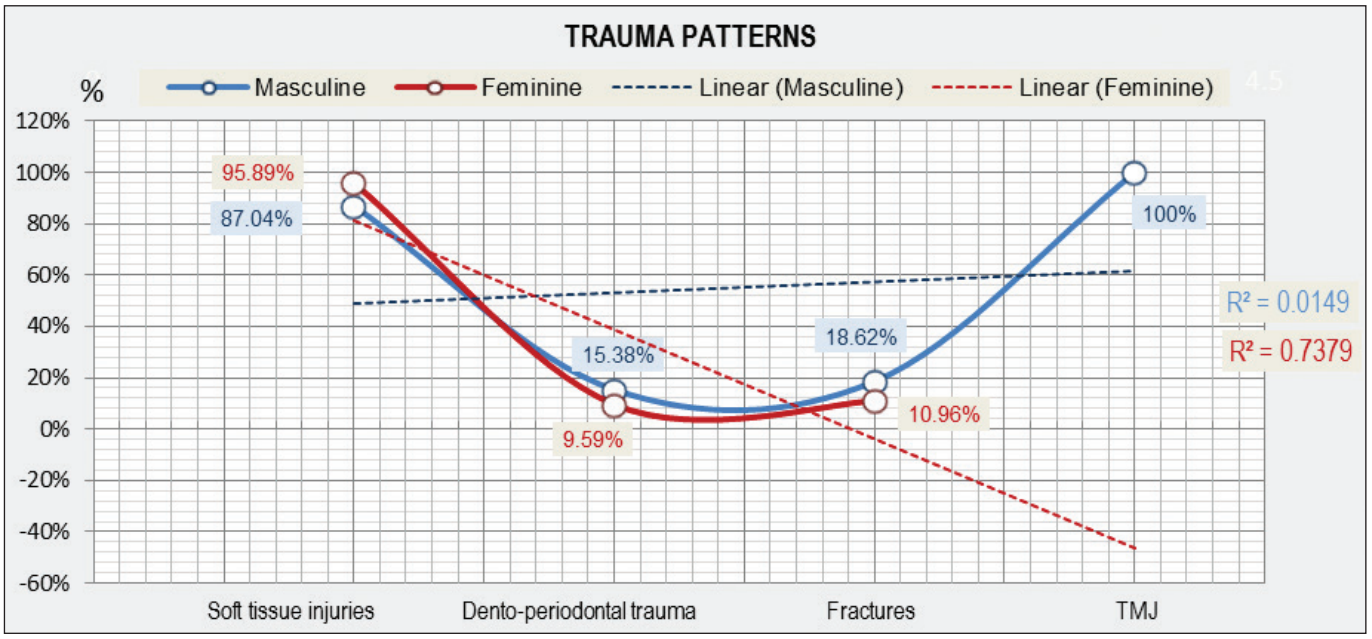

Figure 3. Distribution of cases as a function of injury type and sex of children.

As to the soft tissue injuries, their analysis as a function of sex revealed their presence in 95.89% of girls and in 87.04% of boys, respectively (Fig. 3), and also that the mean age of patients with this type of injuries was of 14.9 years ± 3.7DS, a significantly lower value than the age of the patients with no such type of injuries (F=5.98, p=0.0149, 95%CI).

Analysis of the soft tissue lesions considered in the study revealed the prevalence of ecchymoses (45.94%), followed closely by excoriations (32.8%) and wounds (27.81%). According to a study done by Legano L. and col. in 2009 [14], ecchymoses are the most common form of injury found in physical abuse cases. A study developed in the UK on a batch of abused children with chronological ages between 0 and 16 years reports that facial ecchymoses were present in 65% of the cases with oral-facial signs of abuse, followed by ecchymoses of the head (18%) and neck (12%) [8]. The data available in the specialized literature quote the face (cheeks, eyes, mouth, ears, mandible, etc.) as one of the most frequent places of ecchymoses associated with non-accidental traumas [13, 15, 16]. The other types of clinical entities included in the category of soft tissue injuries - even if present in much lower but not negligible percents - were represented by: contusions (17.19%), hematomas (5.31%) and burns (0.94%) (Table 2).

Table 2. Case distribution as a function of the type of soft tissue injuries

SOFT TISSUE TRAUMA	Cases (n=320)	%
Escoriations	105	32.81%
Hematomes	17	5.31%
Contusions	55	17.19%
Wounds	89	27.81%
Burns	3	0.94%
Ecchimoses	147	45.94%

Most frequently met were the cases with 2 or 3 injuries of the soft tissues (53.44%, respectively 30.31%). Evaluation of the odds and risk parameters expressing such type of injuries indicates a 3.47 times higher risk (table 3) in girls, comparatively with boys (OR=3.47, p=0.033, 95%CI). In cases of fractures and dental-periodontal traumatisms, the risk of their occurrence was significantly higher in boys, the chance of manifestation being 1.7 times higher for fractures ($\chi 2$=3.57, p=0.021) and 1.86 times higher, respectively, for dental-alveolar traumatisms ($\chi 2$=5.36, p=0.018). All TMJ cases were present in boys (100%) (Fig. 4).

The present study evidenced a 14.06% frequency of dental-periodontal traumas in the studied children, which reveals the importance of the participation of the pediatric dentist, and of the dentist generally, in the detection and reporting of these cases to specialty forums. Specialized literature reports the presence in variable percents (2.6% - 28%) [7, 9, 10, 16] of intraoral and/or dental-periodontal injuries, while mentioning that many of the intraoral injuries may be overlooked either by the presence of much more obvious neighbouring injuries,

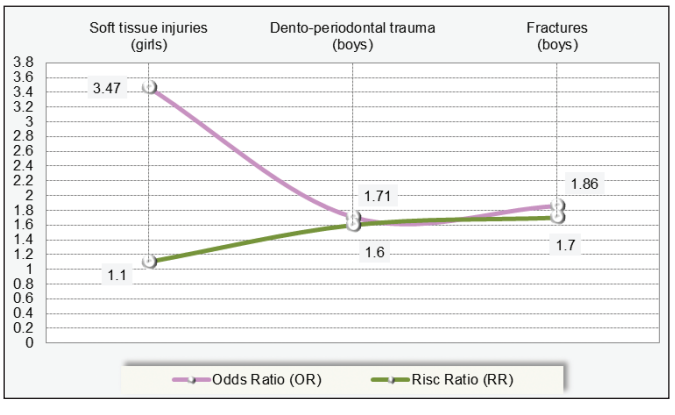

Figure 4. Estimation of odds and risk parameters as a function of injury type.

Table 3. Estimation of odds and risk parameters as a function of lesion type and sex of the children

	Odds Ratio (OR)	Relative Risk Ratio (RR)	RR(95%CI)		Chi (χ^2)	Signif. Level p(95%CI)
			Inferior Limit	Superior Limit		
Soft tissue lesions (girls)	3.47	1.1	1.03	1.18	4.53	0.033
Fractures (boys)	1.71	1.6	1.29	3.44	3.57	0.021
Dental-periodontal traumatisms (boys)	1.86	1.7	1.54	3.82	5.36	0.018
ATM(100% boys)	-	-	-	-	-	-

or because the general practitioner having consulted the child was not familiar with intraoral examination (once known that the cases in which a dentist may participate in the consultation are extremely few).

Analysis of the forensic medical reports of children with dental-periodontal traumas revealed that tooth luxations were found in 6.88% of the cases, coronary (penetrating and non-penetrating) fractures - in 7.1% of the cases, while dental avulsions reached values of 2.8%, and radicular fractures reached values of 2.19% (Fig. 5).

According to a study done by Malecz [17] in 1979, 32% of the cases of abused children had fractured teeth, while the study of Calvacanti [7] reports a much lower ratio of dental fractures, namely 5.2%, which was actually the only dental injury entity found by the author. In the present study, the ratio of children with fractured teeth amounts to 9.28%, which does not reflect the real situation, as numerous cases of abuse are not reported to the Forensics Institute or to specialty forums.

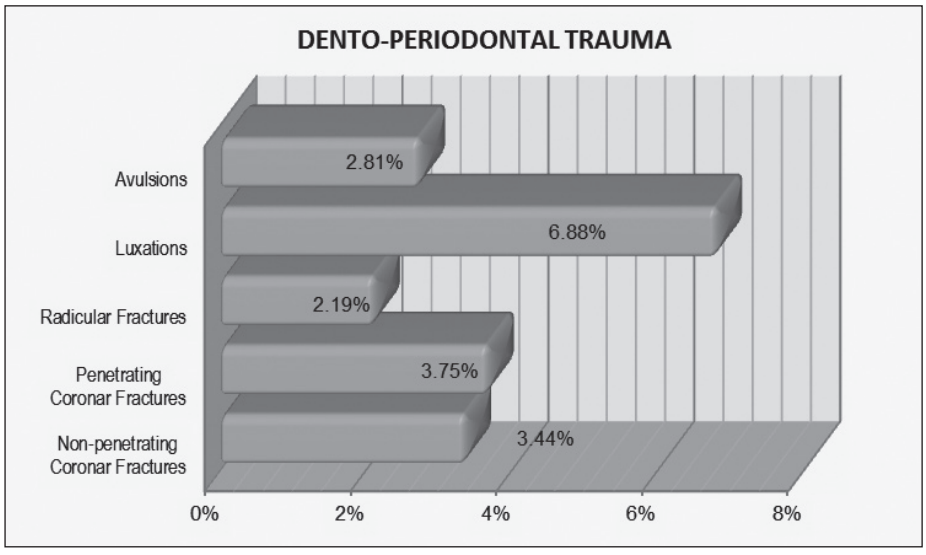

Figure 5. Case distribution as a function of the presence of dental-periodontal traumatisms.

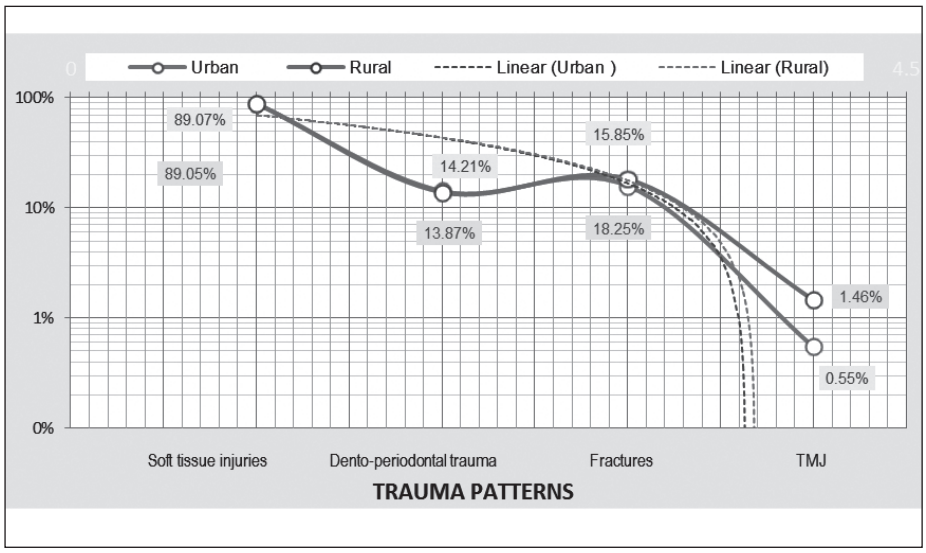

Figure 6. Case distribution as a function of lesion type ans children's habitual environment.

As to the topography of dental fractures, they were localized mainly in the upper incisors (80.55%), which is very close to the 84.6% value reported by Calvacanti [7], the second position being occupied by lower incisor fractures, with a much lower percent (5.55%).

As to the distribution of dental-periodontal traumas on habitual environments, the urban environment records a slightly higher frequency of dental-periodontal traumas (14.21%) among the total number of traumas, comparatively with the rural environment, where only 13.87% of the total traumas are of dental-periodontal type (Fig. 6).

A comparative analysis of lesion type as a function of the habitual environment in the here considered cases demonstrates the absence of a significant association between these two variables ($\chi 2$=1.68,

Table 4. Cox adjusted hazard ratio

Variables	β	S.E.	Wald	Sig. p-value	Exp(β) HR	95% CI for EXP(β)	
						Lower	Upper
Age (years)	0.620	0.008	5.889	0.015	5.451	1.984	7.437
Male sex	0.893	0.049	4.939	0.026	2.867	2.607	6.632
Habitual environment	0.048	0.035	1.949	0.163	1.049	0.981	1.123
Type of lesion	0.752	0.019	0.897	0.034	3.018	2.981	5.058

* CI, confidence interval; df, degrees of freedom; HR, hazard ratio; SE, standard error.

p=0.591, 95%CI), an aspect also evidenced by the close values of the frequency of cases registered in the urban and rural medium (Fig. 6).

Analysis of the dental-periodontal traumatisms as a function of sex evidenced their presence in higher ratios in males (15.38%), comparatively with females (9.59%), similarly with the cases of temporo-madibulary lesions (TMJ) (Fig. 3).

The clinical forms of oral-maxillo-facial traumas here analyzed included simple and/or double mandible fractures (4.37%), facial skeleton fractures (5%), as well as nasal pyramid fractures (9.38%), all these clinical forms being mentioned, in various ratios, again as consequences of child abuse, by other authors [9,15-17]. A higher presence of fractures was ascertained in females, alongwith a relatively high percent of cases – 83.12% - evidencing no fractures associated with the other types of injuries.

The diversity of traumatic OMF injuries here analyzed included a very low percent (0.94%) of injuries of the temporomandibular joint (TMJ).

The Cox-proportional hazard regression model was applied for evaluating the association of the independent predicting factors (age, male sex, habitual environment, type of lesion) with the mechanism having produced the oro-maxillo-facial trauma (the agression).

The Backward Stepwise (Wald) method, involving a gradual elimination of the factors evidencing no significant association with the aggressive mechanism, was also applied, which led to the best multivariate model (Hosmer-Lemeshow tests – $\chi 2 = 5.48$, df=5, p=0.629, 95%CI). The contribution of covariables (age, male sex, habitual environment, type of lesion) - which explains the dependent variable (the aggression) - was evaluated with Wald test, with a p value<0.05 considered as significant.

In multifactorial analysis, the predictors that maintained a significant association with the mechanism causing aggression were: age, male sex and type of lesion. An one-unit increase of age increases the risk that the trauma mechanism should be represented by a 5.4 times higher aggression (HR=5.4, p=0.015, 95% CI), while the male sex evidences a 2.8 times higher risk, comparatively with that recorded in female children (HR=2.8, p=0.026, 95% CI). The risk estimated for a possible fracture-type clinical form of the oro-maxillo-facial trauma in the case of an aggression is 3.01 times higher, comparatively with other trauma mechanisms (HR=3.018, p=0.034) (Table 4).

Thus, it appears that a minute intra- and extraoral examination is mandatory in all cases of suspected/ definite abuse.

All pediatric dentists should know how to recognize the signs and symptoms of child physical abuse and the legal procedures for reporting them to the authorities, as an early recognition of such problems facilitates the implementation of effective intervention measures with short-, medium- and long-term benefits.

CONCLUSIONS

The subjects forming the experimental batch considered in the present study offer a sound statistical evidence for the most serious public oral health issue represented by traumatic oral-facial injuries in children. In such a context, child abuse and violence become problems of interdisciplinary interest, given that the prevention, diagnosis and therapy of these pathological entities necessarily require interdisciplinary participation from the part of: child social protection services, law enforcing institutions, forensic physicians (and forensic odontologists), pediatric dentists or multidisciplinary dental teams.

The main factor calling for this multimodal therapy of oral-facial traumas in children is the major risk for long-term dental or aesthetic disability the little patient is exposed to. Unfortunately, the elaborated therapeutical difficulty and specific characteristics of this pathology recommend – besides a correct diagnosis and evaluation of each patient in part – prevention as a key factor in approaching cases of child abuse and violence.

Hence, it is essential that the dentists – who have the first contact with the patient - should be prepared to identify correctly, from an etiological perspective, any potential traumatic injury deriving from abuse and violence, to report any suspicious case – frequently detected during an objective examination inconsistent with patient's anamnesis – to the competent state institutions in charge and to send the patient to a forensic institution. An efficient collaboration between the dentist and child protection services is also one of the key elements of prevention, essentially based on a specific and well-established education system.

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