

Erosive Tooth Wear, Presence of Parafunctional Habits and Tooth Injuries—Occurrence in a Group of Children and Adolescents Exposed to Domestic Violence

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Objectives: To compare the prevalence of parafunctional habits, erosive tooth wear and occurrence of tooth injuries among children being under the care of Social Welfare Centre and children treated in the Department of Children's Dentistry of the Medical University of Warsaw. **Study design:** The study contains environmental and medical interviews, record-based analysis and clinical examination. Parafunctional habits were rated on the base of dental interviews and clinical examinations. The occlusal surfaces were evaluated by visual examination using modified tooth wear index (TWI). Tooth injuries were reported from a medical interview labeled using Andreasen classification. The consent of the bioethics committee and guardians of children participated in the study was obtained. **Results:** The study involved 782 patients, including 404 children from dysfunctional families (average age $11,4 \pm 3,7$) and 378 from ordinary families-control group ($8,53 \pm 3,92$). In the study group we observed higher prevalence of erosive tooth wear (44,66% vs 18,02% $p=0,000$), dental trauma (9,4% vs 3,44% $p=0,001$) and a presence of parafunctional habits (67,8% vs 20,4 % $p=0,000$). **Conclusion:** The occurrence of parafunctional habits, erosive tooth wear and tooth injuries may be an indicator of domestic violence and a component of maltreated child syndrome.

Keywords: child abuse, domestic violence, tooth injures, erosive tooth wear, parafunctional habits

INTRODUCTION

Dental professionals have regular contact with children and their families, some of which have no other contact with healthcare services¹. In the pathogenesis and treatment of many everyday grievances and illnesses encountered in dental practice, the influence of violence is often ignored although the signs of physical abuse can commonly be seen in the orofacial region. Dental professionals are therefore in a good position to recognize and report suspicious cases of abuse and neglect in order to safeguard and promote children's welfare. Research has shown that dentists feel unprepared to take on such a role and are unsure what to do if they suspect that a child has been abused²⁻⁶. Child abuse is defined as those acts or omissions of care that deprive a child of the opportunity to fully develop his or her unique potentials as a person either physically, socially or emotionally⁷. World Health Organization (WHO)⁸ classified abuse into four types: physical, sexual, psychological and neglect. Among the social groups, children represent the most vulnerable group to be abused and neglected. Regarding the types of violence against children, studies show the prevalence of neglect (physical, medical and emotional) in relation to others^{9,10}. The signs of violence, such as physical injury, self-mutilation, cigarette marks are easily accessible for assessment during the examination and do not generate any doubts about the diagnosis. Children with fresh signs of physical abuse are rarely brought to the dentist. Therefore, we should be conscious of other signs of violence. Experiencing or witnessing violence also affects

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the child's psyche and behavior. Many authors state that the effects of long-term experience of stressful situations may manifest themselves in the oral cavity¹¹. Children with long-term stress might develop parafunctional habits such as biting, chewing various objects (e.g. pencil) which can lead to tooth abrasion, lateral mandibular shift, clenching affecting the masticatory muscles leading to bruxism and painful temporomandibular disorders (TMDS)^{12,13}. Other problems found: Abrasion, abfraction, attrition and erosion. Erosive factors cause "softening" of the tooth surface, which results in the loss of mineral substances. The hard tissues deprived of mineral substances have a reduced resistance to mechanical factors. Pathological tooth wear in the mechanism of attrition, abrasion or abfraction can then evolve faster^{14,15}. Considering the frequent co-occurrence of above-mentioned processes and the mixed nature of non-carcinogenic lesions it is difficult to diagnose and treat them properly. Our study does not differentiate between erosion/abrasion/attrition. These processes are collectively named as "erosive tooth wear"- a terminology introduced by Lussi in 2006¹⁶. The consequences of the prolonged loss of hard tissues may result in the loss of vertical dimension, secondary orthodontic problems, esthetics and functional problems. It should be remembered that any pathological processes taking place in the oral cavity have a negative impact on the overall health of the patient.

Knowledge of psychological consequences of experiencing violence is essential to fully understand this complex problem. Doctors must be sensitive to more subtle effects of experiencing domestic violence—dental neglect, behavioral disorders and psychosomatic symptoms (changes in the mucous membranes, tooth wear, bruxism). These symptoms should be analyzed with other ones—family interview, long-term observation, dental neglect etc. which might enhance the certainty of potential violence giving the clinician the tools to intervene.

MATERIALS AND METHOD

The study involved children and youth aged 2-17 remaining under the protection of Social Welfare Centers/Family Support Centers (n=404, study group) and patients visiting the Pediatric Dentistry Department of Warsaw Medical University (n=378, control group). The legal guardians of all children participating in the study signed a Consent Form. Written consent was also obtained from participants over 16 years old. The children who refused to participate in the research, even with parental consent, were not included in the research. Special care was taken to protect the children's privacy. The project was approved by the Ethics Committee of Warsaw Medical University no. KB/14/2017. Chronic diseases in the history and habitual use of drugs were excluding factors. The study was carried out in 2017-2019 and contains environmental and medical interviews, record-based analysis of proteges of social welfare centers/family support centers and clinical examinations. The interviews and analysis of children's files provided information about the socio-economic status of the family and type of violence experienced. During the interview all respondents, their parents/legal guardians/guardians from the social welfare centre were asked about the occurrence of parafunctions (night grinding and clenching, onychophagia, parafunctional biting habits, headaches, pain or tenderness of masticatory muscles, pain

and movement limitation of temporomandibular joint). Dental examination was based on the criteria for classification of clinical conditions of the WHO¹⁷. Extra and intraoral examination to evaluate the condition of TMJ was performed: temporomandibular joint (during active opening and closing and during active deviation to the left and right) and muscles (during clench and relax) palpation. Particular attention was paid to the symptoms associated with overloading of the stomatognathic system, i.e. soreness and masticatory muscle tenderness, clicking, popping or grating sound coming from the TMJ. Clinical examination was performed using the basic dental set (mirror and probe- 2WHO 621) in conditions with access to shadeless lamp and drying. During the examination, special attention was paid to the dental symptoms, i.e. dental wear and tear, and the type of tooth wear was analysed in detail. The study did not differentiate between erosion/abrasion/attrition. The presence of non-cariogenic lesions was diagnosed on the surfaces of all teeth present in the oral cavity in permanent (except the second and third molars) and deciduous dentition. The occlusal surfaces of the first four molars and premolars and the labial, incisal, lingual and palatal surfaces of the six upper and lower anterior teeth were evaluated using the following criteria: 0- no wear into dentin, 1- dentin just visible (including cupping) or dentin exposed, 2- dentin exposure greater than 1/3 of surface, 3- exposure of pulp or secondary dentin. In the assessment of tooth wear modified tooth wear index (TWI)^{18,19} was used. Tooth injuries were obtained from a medical interview and during oral examination. The criteria for the diagnosis of dental trauma were assessed according to the method used by Andreasen *et al.*²⁰ No radiographs were taken. The legal guardian of a child and a psychologist were present during examination. Statistical analysis using STATISTICA 13.3 program for Mann-Whitney U test, Student's *t*-test and Chi-squared test analysis was performed. Statistical significance was established at level of $p \leq 0,05$ value.

RESULTS

The study involved a total of 782 children and youth (aged 2-17), including 404 children from dysfunctional families (11.4 ± 3.7 years) and 378 from normative families in the control group (8.53 ± 3.92 years). Eighty-three parents/caregivers refused to sign a consent form, nine children did not accept to undergo oral examination. Characteristics of the examined groups and family socioeconomic data are presented in Table 1.

Children under the care of social intuitions and the type of existing problem in the examined families (type of experienced abuse, drugs and/or alcohol use) are presented in Table 2.

In the examined group of patients (study group, control group) various parafunctions and resulting dysfunctions were observed (Table. 3).

In the study group dental trauma was noted in 9.4% (n=38) patients, while in the control group in 3.44% (n=13) [$p=0.001$]. The number of injured teeth in the study group was 67 (1.91 ± 1.22) and in the control group 21 (1.17 ± 0.38), [$p < 0.001$]. In the control group injuries involved only permanent incisors, while in the study primary dentition group (n=7, 18.42%) and lateral teeth were also involved. Presence of tooth injuries depending of a group of teeth in permanent dentition is presented on the diagram (Figure 1). Injuries in primary dentition occurred mostly in incisors

Table 1. Characteristics of the examined groups.

Parameters	Study group		Control group		
	N	%	N	%	
Sex	Boys	173	42,8%	194	51,0%
	Girls	231	57%	184	48,7%
Dentition	Primary	44	11,39%	108	29%
	Mixed	167	41,34%	174	46%
	Permanent	191	47,28%	96	25%
Age of parents					
	20-29	92	22,77%	44	11,64%
	30-39	207	51,24%	192	50,79%
	>40	105	25,99%	142	37,57%
Parent's education level					
	basic education	172	42,57%	18	4,76%
	secondary education	194	48,02%	86	22,75%
	higher education	38	9,41%	274	72,49%
Family economic status					
	Low	244	60,4%	19	5,03%
	Average	144	35,64%	102	26,98%
	Good	16	3,96%	74	19,58%
	High	0	0	90	23,81%

Table 2. Family and children situation of the examined groups.

Parameters	Study group		Control group	
	N	%	N	%
Social welfare center	404	100%	0	0,0%
Superintendent	141	34,9%	0	0,0%
Blue Card	62	15,35%	0	0,0%
Large family	91	22,52%	21	5,6%
Single-parent family	225	55,69%	3	0,8%
Foster home	138	34,16%	0	0,0%
Orphanage	8	1,98%	0	0,0%
Emergency medical services	36	8,91%	0	0,0%
Alcohol at home	237	58,17%	0	0,0%
Drugs at home	36	8,91%	0	0,0%
Frequent visits to the police station	31	7,67%	0	0,0%
Sexual violence	14	3,47%	0	0,0%
Physical violence	89	22,03%	0	0,0%
Mental violence (brawls, curses, being a witness to domestic violence etc.)	266	65,84%	0	0%
Dysfunctional family	404	100%	0	0%

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Table 3. The occurrence of parafunctional habits among study and control group.

Indicators/variable measured	Study group		Control group		p-value
	N	%	N	%	
Parafunctional habits	274	67,8%	111	29,4%	0,000 *
Mouth breathing	94	23,3%	1	0,3%	0,000 *
Visceral swallowing pattern	32	7,9%	1	0,3%	0,000 *
Chewing disorders	21	5,2%	0	0,0%	0,000 *
Speech impairment (stammering)	130	32,2%	6	1,6%	0,000 *
Lisp	118	29,2%	0	0,0%	0,000 *
Language delay	3	0,7%	0	0,0%	0,093
Teeth grinding (during sleep)	138	34,2%	14	3,7%	0,000 *
Teeth clenching (during sleep)	158	39,1%	16	4,2%	0,000 *
Nail-biting	191	47,3%	24	6,3%	0,000 *
Soreness and masticatory muscle tenderness	8	2,0%	35	9,3%	0,000 *
Clicking sounds or grating sensation	11	2,7%	28	7,4%	0,003 *

* statistically significant

Table 4. Presence and intensity of erosive tooth wear.

Tooth wear	Study group	Control group	P-value
Occurrence of tooth wear (TWI)	44,66%	18,02%	0,000
Primary dentition	58,79%	18,7%	0,000 *
1°	43,51%	56,98%	0,000 *
2°	20,94%	30,01%	0,000 *
3°	35,55%	13%	0,000 *
Permanent dentition	39,56%	17,47%	0,000 *
1°	69,28%	83,31%	0,000 *
2°	23,75%	7,5%	0,000 *
3°	6,97%	1,93%	0,000 *

* statistically significant

Figure 1. Presence of tooth injuries depending of a group of teeth among permanent dentition.

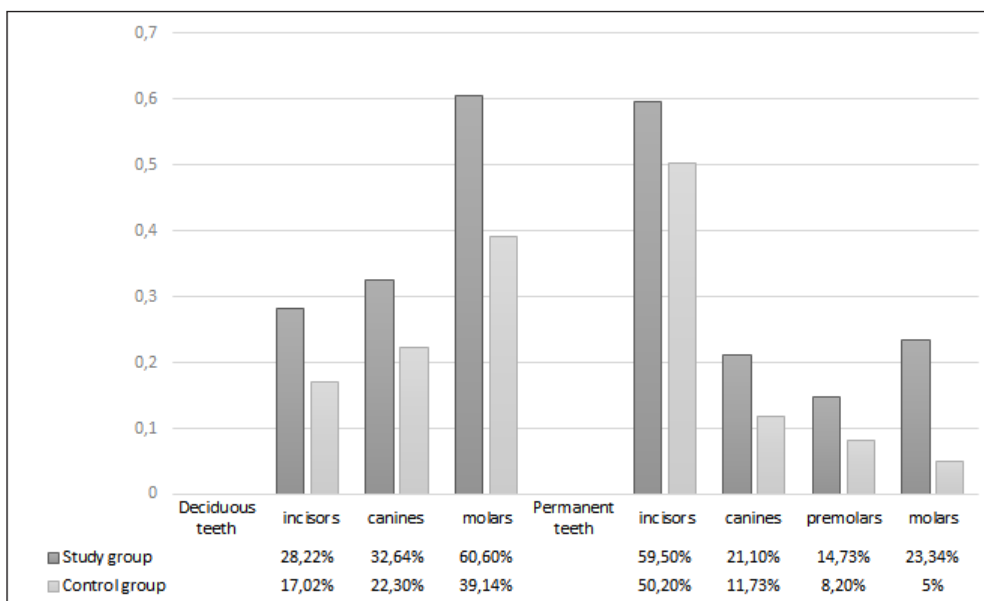
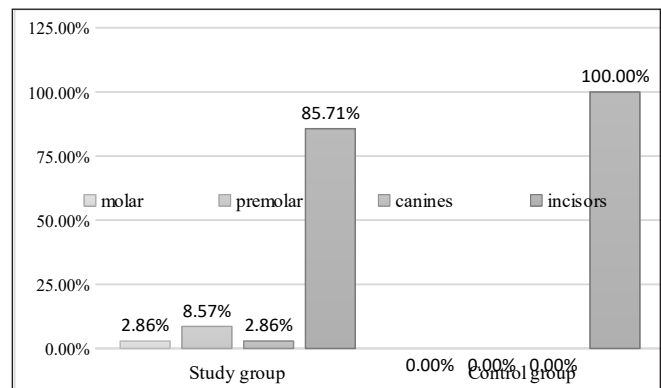


Figure 2. Presence of erosive tooth wear depending of a group of teeth.

(n=5, 71.43%). In two cases (n=2, 28.57%) were observed in molar teeth. In the study group injuries, classified according to Andreasen classification, were as follows: enamel infraction (n=4, 10.81%), enamel fracture (n=29, 43.28%), enamel-dentin fracture (n=13, 19.40%), complicated crown fracture (n=8, 11.94%), subluxation (n=6, 8.96%), lateral luxation (n=2, 2.99%), intrusion (n=2, 2.99%), avulsion (n=3, 4.48%), soft tissue injuries (e.g. friction) and abrasion of mucosa and gingiva (n=5). In the control group injuries involved permanent dentition (only incisors) and were determined according to Andreasen's classification as: enamel infraction (n=9, 42.86%), enamel fracture (n=8, 38.10%) and enamel-dentin fracture (n=4, 19.05%).

Presence and intensity of tooth wear in the study and control group for primary and permanent dentition are presented in Table 4. The difference between the occurrence of tooth wear was statistically significant, both in primary and permanent dentitions. Tooth wear were much more frequent in the study group (44,66% vs 18,02%, p=0,000). Intensity of tooth wear lesions were significantly higher in the study group (Table 4). (Figure 2) In permanent dentition erosive tooth wear affected mostly the incisors and molars, in primary dentition – molars and canines.

DISCUSSION

Child abuse includes not only physical and sexual abuse but also neglect and witnessing domestic violence. Oro-facial trauma occurs in about 50% of cases of child abuse²¹⁻²³. According to Becker *et al* who examined 260 documented cases of child abuse; 61% of these injuries were to the face, 33% head injuries and 6% were in the oral cavity²⁴. Therefore, careful intraoral and perioral examination is necessary in all cases of suspected abuse^{22,24-26}. Abused children are seldom brought to the hospital or to the dentist in case of an oral or head and neck injury. In a medical interview the information about the circumstances of the injury is scanty or misleading. In diagnosing some of the child's somatic disorders, doctors often ignore the fact that many of the symptoms can be the result of the violence against the child. It is estimated that up to 30% of children aged <6 years sustain accidental dental trauma, with the peak age of 3 years^{27,28}. Oral injuries in case of child abuse commonly coexists with dental neglect, severe caries, parafunctional habits, tooth wear and mucous lesions²⁹. Becker *et al* reported that most frequent intraoral injury in cases of child abuse were in 43% contusions and ecchymosis, 28,5% were abrasions and lacerations of oral mucosa and 28,5% were dental trauma²⁴. Valencia-Rojas *et al* also noticed the higher prevalence of tooth trauma among children who are abused (physical and sexual abuse) and neglected³⁰. Our study confirmed those observations—dental injuries were more frequent observed among children experiencing or witnessing domestic violence (9.4% vs 3.44%, p=0.001). Injuries were also observed in premolars and molars, both in permanent and deciduous dentition in the study group. Other oral injuries described in the literature are lacerations to lips or mucosa, dental intrusions, extrusions³¹. Tooth injuries and microfracture may cause tooth discoloration. The etiology of brownish/grey/reddish discoloration of the teeth is difficult to come up with a proper diagnosis³². It is often difficult to determine the boundary between an accident and the result of the child's abuse³³⁻³⁶. The interesting research presented by Sudeshni³⁷ stated

that 67% of children treated in the hospital had head, neck and mouth injuries (fractured teeth, avulsed teeth, laceration to the lip, frenulum, tongue and jaw fractures). Problems detecting intraoral injuries in case of child abuse may arise from the fact that dental professionals are rarely involved in the assessment of suspected child abuse and neglect³⁸. Studies describing the occurrence of tooth injuries among children from abusive families are mostly based on retrospective dental record analysis making it difficult for dentists to distinguish the accidental injury from intentional one.

Fakhruddin *et al* reported that children suffering from untreated dental trauma experienced more difficulties in chewing and experienced poor social interaction³⁹. Some authorities believe that the oral cavity may be a central focus for physical abuse because of its significance in communication and nutrition⁴⁰. Pathological tooth wear (44,66% vs 18,02%, p=0,000), clenching (during sleep) (39,1% vs 4,2%, p=0,000) and grinding (during sleep) (34,2% vs 3,7% p=0,000) habits were statistically more often represented in the study group. Both in primary and permanent dentition, erosive tooth wear was more frequent and the lesions were more severe. The prevalence of stage 3 of TWI among abused and neglected children were for primary teeth 35,55% vs 13% (p=0,000) and for permanent dentition 6,97% vs 1,93% (p=0,000). According to Shwartz, stress was a significant cause for clenching and grinding behavior resulting in pain, muscle tenderness, limited range of mandible movement⁴¹. Stress is also the main cause of increased neuromuscular tension. The stomatognathic system, overloaded with a strong stress, tries to react to suppressed aggression by performing a non-intended motor activity⁴². The results of Sgobbi de Faria and Berzin's research provide very convincing arguments for the existence of a direct link between strong emotional stress and increased activity and tension of masticatory muscles. The authors of these studies stated unequivocally that muscular tension measured during stressful situations was significantly higher⁴³. Authors report several factors directly related to erosive tooth wear in children, such as socio-economic aspects, gastroesophageal reflux or vomiting, and intake of some medications, as well as behavioral factors⁴⁴.

Many authors report that violence experienced in the early stages of life has the strongest negative effects on personality disorders, speech development disorders or psycho-physical development of the child. In the research speech fluency disorders (stuttering, lack of developed speech, lisp) was also noted (20,63% vs 1,6%, p=0,000). In 90% of cases, speech fluidity disorders occur in the pre-school period⁴⁵. The etiology of speech disorders is attributed to anxiety or a severe stressful situation⁴⁶. Psycho-physical factors causing speech disorders include, for example, psychological trauma, prolonged stress, anxiety, increased tension and anxiety. Lack of fluency in speech can be perpetuated by various social reactions, e.g. criticism, brawls between parents, violence against a child or excessive demands of parents^{45,47}. The American Academy of Child and Adolescent Psychiatry observations are in line with the results of our study. This organization has proved that child abuse experience can manifest itself with unique clinical patterns: losing interest in activities which normally gave joy or pleasure, a regression to thumb-sucking, bed wetting or other age-in appropriate behaviors including loss of talking skills and

severe concentration problems interfering with learning or social activities, and those abnormal reactions and behaviors are part of the post-traumatic stress disorder (PTSD)⁴⁸.

The prevalence of tooth wear is increasing among children and adolescents around the world. In the study conducted in 1993 it was reported that 52% of 5-year-olds had dental wear of their primary incisors with 25% showing dentinal or pulpal involvement. In the group of 11–14-year-olds, 28% were found to have dental wear of their upper incisors. Primary dentition due to reduced thickness of the enamel and its greater solubility in acid is more susceptible to erosion⁴⁹. Recent studies have revealed a wide variation in erosion prevalence among countries, ranging from 0.6% to 98.4%⁵⁰⁻⁵⁶. In our study the prevalence of tooth wear was around 44,66% in the study group and 18,02% in the control group (p=0,000). This disproportion allows to assume that the experience of domestic violence may be a risk factor increasing the likelihood of erosive tooth wear presence. As far as the authors are aware, despite the knowledge of that, the domestic violence has a psychological influence on health and development of child, there is no evidence in the literature that excessive tooth wear, occurrence of parafunctional habits is related to child abuse and neglect. This is the first study in which the correlation between tooth wear and child abuse and neglect is established this way. This study aims to sensitize dentists to the problem of child abuse and neglect.

CONCLUSIONS

The occurrence of parafunctions and erosive tooth wear, apart from severe carious diseases, hygiene negligence, mucosal lesions, dental injuries and behavioral disorders may be an indicator of domestic violence and a component of maltreated child syndrome.

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Conflicts of interest

THERE ARE NO CONFLICTS OF INTEREST.

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