RISK FACTORS AND PREDICTORS OF CROSSBITE AT CHILDREN

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RISK FACTORS AND PREDICTORS OF CROSSBITE AT CHILDREN (Abstract). **Aim:** was to determine the etiological risk factors and predictors of crossbite' treatment at children. **Material and methods:** 270 cases with crossbites and 255 controls with other malocclusions were uniformly evaluated. The crossbites cases were divided in group I (anterior crossbite), group II (posterior crossbite) and group III (anterior and posterior crossbites) and were compared between them per Angle Class malocclusions, dysfunctional and dental causes, associations with other discrepancies, as well by need and types of treatment. Binary logistic regression was used to find risk factors and predictors. **Results:** The mean age of cases was 10.25±2.770 years. There were found significant differences between the groups of crossbites cases ($p<0.05$). There were identified risk factors (non-attrition of deciduous teeth, Angle Class II malocclusion and permanent teeth extraction) and protective factors of the crossbite (the tooth decay of deciduous teeth, eruption anomalies and tongue-thrust swallowing). There were found predictors for early corrective treatment (sucking habit, non-attrition and buds crowding) with a precision of 78.5%; for normal treatment (mouth breathing and buds crowding) with a precision of 71.5%; for late treatment (Angle Class III malocclusion, dental crowding and TMJ disorders) with a precision of 83.0%; for maxillary expansion (eruption anomalies and buds crowding) with a precision of 77.0%; for oral associated surgery (macrodontia and TMJ disorders) with a precision of 75.9% (HL test, $p>0.05$). **Conclusion:** The risk factors were dental furthermore; the predictors of treatment were adequate with dentition, etiology and disorders at age identification, suggesting the contribution of practitioners in intercepting this orthodontic emergency. **Keywords:** CROSSBITE, RISK FACTORS, TREATMENT, PREDICTOR FACTORS, CHILDREN.

Crossbite (CB) is the only malocclusion that requires emergency treatment as soon as possible, before maxillary discrepancies occur. The maxillary teeth positions are lingual to the mandibular teeth in centric occlusion. It can vary in clinical forms from one single tooth to all, and can be anterior or/and posterior and unilateral or/and bilateral (1, 2). Abnormal labiolingual relationship between upper and lower incisors is called anterior CB and between maxillary and mandibular canines, bicuspids or molars it is defined as posterior CB. The frequency found in population varies between 2.2-23 %, depending on the age, the racial group and types of CB studied (3, 4, 5).

CB can be a feature of some genetic and endocrine syndromes, but, usually it appears isolated (non-syndromic). CB etiopathogenesis is still unknown. Several forms of CB were associated with muscle and mandibular functional changes (6, 7), with delayed dental maturation (8), with temporomandibular joint (TMJ) disorders (9, 10), with craniomandibular asymmetry (11, 12, 13), or with leg length inequality (14). Previous study has not been reached a unanimous conclusion on the cause and effect relationship of CB. Many studies have focused on the CB treatment with various orthodontic appliances, but authors was not specified a causal therapy (3, 5). Also, predict factors CB' treatments are almost nonexistent in previous study.

Our study is based on the hypothesis that CB may occur due to determinants cause factors. The detection and early removal can be prevented future severe skeletal discrepancies. Correctives treatment options depend by development stage and of child at the moment of orthodontic intervention. Objects of our study were be to compare two samples of children and adolescents with same characteristics, with/without CB, with orthodontic treatment, to assess the mean age for detecting of malocclusions, etiological causes, oral status, need and types of CB' treatment. The aim of this study was to establish the possible risk factors for etiological causes of CB types and the accuracy of predictive factors for treatment options.

MATERIAL AND METHODS

Samples

This retrospective and case-control study was conducted for 525 orthodontic patients (217 - 41.3% males and 308 - 58.7% females) aged between 6-18 years old, at the Orthodontics Clinic from "St. Spiridon" University Emergency Hospital Iasi, Romania, between January 2009 and April 2013. The ethical approval was attained from the institute's ethical committee. 270 (51.4%) patients with CB were included as case samples and were divided in three groups, to the anomaly's location by group I with anterior CB (n=175 - 33.3%), group II with posterior CB (n=46 - 8.8%) and group III with anterior with posterior CB (n=49 - 9.3%). Patients with endocrine and genetic syndromes or clefts palate were excluded. The diagnosis was established by clinical and complementary exams (plaster cast, panoramic radiographs and lateral cephalometric radiography). All cases received orthodontic treatment. The control sample consisted in 255 (48.6%) patients without CB, being diagnosed with other malocclusions throughout the visit at the orthodontic office, in order to be compared with the case samples. The informed consent was acquired from all of the patients' parents.

Studied parameters

The data were collected from orthodontic records for both samples were uniformly evaluated per socially (age and gender) and oral status parameters (dentition stages and Angle Class malocclusion). The groups of CB cases were compared between them, introducing etiological parameters (dysfunctional and dental), associations with crowding, overbite, mandibular lateral deviation, jaw discrepancies and TMJ disorders, as well by need and types of treatment.

The skeletal discrepancies were established on lateral cephalometric radiography by measuring the angles between the points A Down, Nasion, B Down (ANB) in: Class I=ANB 2-4°, Class II=ANB>4° and Class III=ANB<2° (15). The treatment need was defined by the discrepancy of the teeth between retruded contact position and intercuspal position, using guidelines of Dental Health Components of the Index of

Orthodontic Treatment Need classifying them in moderate need (≤1 mm discrepancy), urgent need (with >1 mm but ≤ 2 mm discrepancy) and very urgent need (>2 mm discrepancy) (16).

Statistical methods

Statistical analysis was performed using the SPSS 16.0 package (SPSS Inc., Chicago, IL) for Windows. The data were characterized through descriptive statistics and cross tables; we used the chi-squared test to compare the variables between cases-controls and between the three groups of CB cases, in order to find the significant differences. The risk and prediction factors that were significant on binary analysis were brought into a forward stepwise binary logistic regression model (B) and the independent factors were determined. In order to select the most suitable model, the Hosmer-Lemeshow goodness-of-fit test (HL test) was used and a p value >0.05 was considered as good fit. Any association between the factors was tested using correlation, to eliminate the multicollinearity problems. The entire statistical analyses were conducted at 5% level of significance and p value <0.05 was regarded as significant.

RESULTS

The study included 525 orthodontic patients, 270 (51.4%) cases with a mean age of 10.96±3.225 years (males 10.82±3.079 years and females 11.06±3.331 years) and 255 (48.6%) controls with a mean age of 10.25±2.770 years (males 10.08±2.818 years and females 10.36±2.739 years). Their baseline characters were similar for both samples (tab. I). There were no significant differences between cases and controls in gender, dentition stages and Angle Class malocclusions (p>0.05).

TABLE I

Baseline characteristics of cases and controls

Characteristics	**Cases** (n=270)		**Controls** (n=255)		Chi-square	p value
	n	%	n	%		
Gender					0.005	0.943
Males	112	41.5	105	41.2		
Females	158	58.5	150	58.8		
Dentition stages					3.744	0.154
Early mixed dentition	66	24.4	78	30.6		
Late mixed dentition	107	39.6	103	40.4		
Young dentition	97	36.0	74	29.0		
Angle malocclusions					0.262	0.877
Class I	190	70.4	184	72.2		
Class II	39	14.4	36	14.1		
Class III	41	15.2	35	13.7		

Group I of CB cases consisted of 175 (64.8%) patients with a mean age of 10.71±2.926 years (males 10.53±2.864 years and females 10.85±2.984 years), group II of 46 (17.0%) patients with a mean age of 10.91±3.693 years (males 11.15±3.760 years and females 10.73± 3.705 years) furthermore, group III of 49 (18.1%) patients with a mean age of 11.90±3.653 years (males 12.08±3.095 years and females 11.83±3.873 years). The groups of CB cases were compared using multiple parameters (tab. II).

TABLE II
Statistically significant differences between groups of cases

Parameters	Cases (n=270)		Group I (n=175)		Group II (n=46)		Group III (n=49)		p value
	n	%	n	%	n	%	n	%	
Angle malocclusions									0.000
Class I	190	70.4	138	78.9	30	65.2	22	44.9	
Class II	39	14.4	18	10.3	15	32.6	6	12.2	
Class III	41	15.2	19	10.9	1	2.2	21	42.9	
Dysfunctional causes									0.022
Vicious oral habits	10	3.8	6	3.4	3	6.6	1	2	
Tongue-thrust swallowing	10	3.7	1	0.6	5	10.9	4	8.2	
Mouth breathing	34	12.6	20	11.4	8	17.4	6	12.2	
Dental causes									
Changes of the tooth axle	129	47.8	94	53.7	14	30.4	21	42.9	0.014
Permanent teeth extraction	3	1.1	0	0.0	1	2.2	2	4.1	0.041
Buds crowding									0.000
Canine	106	39.3	67	38.3	22	47.8	17	34.7	
Three molars	38	14.0	16	9.1	4	8.7	18	36.8	
Overbite									0.000
Reduced (<2 mm)	28	10.4	11	6.3	10	21.7	7	14.3	
Excessive (>2 mm)	88	32.6	48	27.4	22	47.8	18	36.7	
Mandibular deviation	122	45.2	56	32.0	25	54.3	41	83.7	0.000
Skeletal discrepancy									0.000
Class I	129	47.8	105	60.0	18	39.1	6	12.2	
Class II	55	20.4	27	15.4	21	45.7	7	14.3	
Class III	86	31.9	43	24.6	7	15.2	36	73.5	
TMJ disorders	87	32.2	33	18.9	24	52.2	30	61.2	0.000
Treatment need									0.026
Moderate	50	18.5	35	20.0	13	28.3	2	4.1	
Urgent	175	64.8	114	65.1	24	52.2	37	75.5	
Very urgent	45	16.7	26	14.9	9	19.6	10	20.4	
Treatment types									0.000
Expansion	169	62.6	95	54.3	32	69.6	42	85.7	
Oral surgical	122	45.2	72	41.1	21	45.7	29	59.2	

Through the binary logistic regression model, we found statistically significant etiological risk factors, with an internal precision accuracy of 66.3% for all CB (HL test, p=0.890), of 66.5% for anterior CB (HL test, p=0.811), of 85.7% for posterior CB (HL test, p=0.994) and of 83.2% (HL test, p=0.449) for anterior with posterior CB. Value odds ratio (OR) <1.00 corresponds to protective factors (tab. III).

We found significant predictors for the precocious corrective treatment with a precision of 78.5% (HL test, p=0.708), for normal corrective treatment with a precision of 71.5% (HL test, p=0.821) and for late corrective treatment with a precision of 83.0% (HL test, p=0.485), as well as for alternative methods of correction (overall percentage 77.0%, HL test, p=0.992 for maxillary expansion and 75.9%, HL test, p=0.102 for oral surgical) (tab. IV).

TABLE III

Binary logistic regression analysis of risk factors

Parameters	B	Wald statistic	p value	OR	95% Confidence Interval for OR	
					Lower bound	Upper bound
All CB						
Tooth decay	-2.691	12.698	0.000	0.068	0.015	0.298
Eruption anomalies	-1.183	18.674	0.000	0.306	0.179	0.524
Non-attrition	1.002	4.175	0.041	2.725	1.042	7.128
Anterior CB						
Tongue-thrust swallowing	-2.821	7.305	0.007	0.060	0.008	0.461
Tooth decay	-2.460	10.644	0.001	0.085	0.019	0.374
Eruption anomalies	-1.365	17.866	0.000	0.256	0.136	0.481
Posterior CB						
Angle Class II	1.146	8.920	0.003	3.147	1.483	6.678
Non-attrition	1.847	7.912	0.005	6.341	1.751	22.968
Anterior with posterior CB						
Non-attrition	1.866	8.150	0.004	6.461	1.795	23.259
Permanent teeth extraction	2.997	5.110	0.024	20.033	1.490	269.371

TABLE IV

Binary logistic regression analysis of predictor factors

Parameters	B	Wald statistic	p value	OR	95% Confidence Interval for OR	
					Lower bound	Upper bound
Precocious treatment						
Sucking habit	2.342	3.723	0.054	10.397	0.964	112.168
Non-attrition	1.689	10.259	0.001	5.416	1.926	15.228
Buds crowding	0.904	5.671	0.017	2.469	1.173	5.193
Normal treatment						
Mouth breathing	0.881	4.451	0.035	2.413	1.065	5.469
Buds crowding	2.069	32.417	0.000	7.918	3.884	16.143
Late treatment						
Angle Class III	1.998	16.779	0.000	7.376	2.835	19.191
Dental crowding	1.572	11.922	0.001	4.818	1.974	11.764
TMJ disorders	2.288	30.224	0.000	9.855	4.359	22.280
Maxillary expansion						
Eruption anomalies	1.337	4.867	0.027	3.809	1.161	12.497
Buds crowding	2.335	52.212	0.000	10.329	5.483	19.459
Oral surgical associate						
Macrodontia	2.870	30.782	0.000	17.639	6.399	48.618
TMJ disorders	1.374	18.962	0.000	3.951	2.129	7.332

DISCUSSION

Early detection of a malocclusion and finding the cause-treatment relationship represents a necessity for practitioners, especially in emergency situations.

Complex analysis of types of CB in children compared with other malocclusions in order to establish the etiological risk factors and predictors of orthodontic treatment was investigated in this study. There were selected samples with same characteristics to avoid statistical errors. Patients without syndromes and clefts palate were selected, in order to avoid introducing additional variables, such as such as growth deficiencies, general skeletal and jaw development. The CB cases were divided into three groups and studied by comparisons. Types of CB presented highly significant differences, which explain the separate study of the clinical forms of CB by other authors (3, 5). We used multiple variables from clinical and complementary exams, which is an enhanced method against previous studies (17, 18).

The effects we pursued were focused on the relationship between age detection of malocclusions, cause, effect and therapy. According to the average age of the studied patients, the detection of CB was done in the period of late mixed and permanent dentitions, for both sexes. Identified at the early mixed dentition, CB benefit from a technique, which is simple, non-invasive, quick (3-6 months), and with minimal cost (19, 20, 21) Detected at the adolescent patient, the nature of intervention must be different, as a complex orthodontic and surgical treatment, for a longer time (2-3 years) and with a maximal cost (22, 23, 24).

Our binary logistic regression model found only dental causes as risk factors for the CB occurrence (non-attrition of deciduous teeth, Angle Class II malocclusion and permanent teeth extraction), which may be easily intercepted by practitioners. In addition, there were identified protective factors of the CB' (the tooth decay of deciduous teeth, eruption anomalies and tongue-thrust swallowing), which were not investigated by previous studies.

Predictors for corrective treatment options of CB were different according to the nature of the intervention. The buds teeth crowding and eruption anomalies were indicated for maxillary expansion in precocious and normal treatment. Macrodontia and TMJ disorders were indicated for oral surgical associated procedures in late treatments. In addition, sucking habit and mouth breathing were predictors for treatment in mixed dentition as well as dental crowding and Angle Class III malocclusion for treatment in young permanent dentition. These predictors were not identified in previous studies, dealing with predict factors for future mandibular growth of children with anterior CB (25).

CONCLUSIONS

Our case-control study revealed the following results: the mean age of malocclusions' detection was late; the groups of CB cases were highly significant different; etiological risk factors were only dental; protective factors of CB were identified; predictors of treatment were adequate to the dentition, etiology and disorders.

The study suggests the necessity of dental practitioners' involvement in intercepting this occlusal disorder. Similar further studies can be extended on other malocclusions that affect the young population's dental and facial esthetics.

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NEWS

PROTECTIVE EFFECTS OF PIOGLITAZONE AND/OR LIRAGLUTIDE ON PANCREATIC B-CELLS IN DB/DB MICE: COMPARISON OF THEIR EFFECTS BETWEEN IN AN EARLY AND ADVANCED STAGE OF DIABETES

Diabetes is a major health problem for developed and for developing countries and is considered the 21st century epidemic. The global prevalence of diabetes mellitus for all age groups was estimated to be 2.8% in 2000 and is projected to rise to 4.4% in 2030. Diabetes mellitus is a chronic disease caused by inherited and/ or acquired deficiency in production of insulin by pancreas, or by ineffectiveness of the insulin produced. Failure to maintain a normal level of glucose concentration in the blood can result in micro- and macrovascular complications. In type II diabetes insulin secretion is decrease due to pancreatic damage by "β-cell glucose toxicity" with beta cells mass affection and decrease proliferation of these. It is know that there is a statistically significant relationship between appropriate long-term blood glucose control and reduction of diabetic complications, so maintenance of strict glycemic control is necessary but this requires the preservation of β-cell function. Some anti-diabetic drugs, like thiazolidines and glucagon like peptide-1 receptor agonist possess a protective effect upon β-cells. The researchers was revealed that in obese type 2 diabetes model mice exhibiting significant hyperglycemia, compensatory hypertrophy of the islets can be seen in the early stage of diabetes but the capacity of such compensation is markedly attenuated in the advanced stage. The aim of this study was to compare the protective effects of pioglitazone and/or liraglutide on pancreatic β-cells between in an early and advanced stage of diabetes. The experiment was carried out for a period of 2 weeks with 20 diabetic rats that were divided into four groups of five rats each (group 1-4). Group 1 received Pioglitazone, group 2 – Liraglutide, group 3 - Pioglitazone and Liraglutide combination, group 4 – vehicle. During the entire period of experiment was determinate and monitored the body weight, food intake, insulin plasma concentration, cell apoptosis and proliferation in pancreatic islets. The results of this study showed that the food intake was significantly decreased just in an early stage, after 1 week of treatment, by Liraglutide and Liraglutide-Pioglitazone treatment and body weight gain was suppressed by Liraglutide and was significantly accelerated by Pioglitazone. Fasting blood glucose levels were significantly lower after Liraglutide and Pioglitazone treatment in early stage and it was enhanced by combination treatment. Plasma insulin levels in an advanced stage was lower than those in early stage. Liraglutide and Liraglutide-Pioglitazone treatments significantly reduced plasma glucagon concentrations compared with other groups in an early stage, but not in an advanced stage. After the evaluation of β-cell ratio and mass for all 4 groups in early and advanced stage it was showed that in an early stage, β-cell mass was increased in Pioglitazone and Liraglutide-treated mice, and the most significant effect was observed in the associated drugs group. In an advanced stage, on the other hand, the effect of these drugs on β-cell mass have not significant changes. In conclusion, protective effects of pioglitazone and/or liraglutide on pancreatic β-cells were more powerful in an early stage of diabetes compared to those in an advanced stage. (Kimura T, Kaneto H, Shimoda M et al. Protective effects of pioglitazone and/or liraglutide on pancreatic β-cells in db/db mice: Comparison of their effects between in an early and advanced stage of diabetes. *Mol Cell Endocrinol:* 2015; 400: 78-79).

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