Risk Indicators for Signs and Symptoms of Temporomandibular Dysfunction in Children

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Objectives: *The aim of this study was to determine the risk indicators for signs and symptoms of temporomandibular dysfunction (TMD) in children between 4 and 12 years of age.* ***Study Design:*** *One hundred six patients were assessed for the following variables:(1) signs and symptoms of TMD (deviation when opening mouth, joint noises, limitation of movement, pain in the mandible or during movement), (2) dentition and occlusal abnormalities, and 3) habits (pacifier sucking, nonnutritive sucking, finger sucking, nail biting, and teeth grinding (bruxing). Multivariate logistic regression was performed with the level of significance set at P < 0.05.* ***Results:*** *The prevalence of at least one sign or symptom of TMD in the present sample was 12.26% (n = 13). Only bruxing (P = 0.01, odds ratio 6.08, CI 1.51–24.51) and posterior crossbite (P = 0.03, odds ratio 5.74, CI, 1.18–27.85) achieved statistical significance in the multivariate regression model and were considered risk indicators for signs and symptoms of TMD.* ***Conclusions:*** *Children with bruxing or clenching habits and those with posterior crossbite have a greater likelihood of developing signs and symptoms of TMD.*

Keywords: *temporomandibular dysfunction, children, habits, malocclusion*
J Clin Pediatr Dent 34(1): 81–86, 2009

INTRODUCTION

The term *temporomandibular dysfunction* (TMD) is a blanket term that includes a series of clinical signs and symptoms affecting the masticatory musculature, temporomandibular joint, and associated structures. Such disorders are considered a subdivision of musculoskeletal pathologies and constitute the main source of orofacial pain of nondental origin.[1] In the past, signs and symptoms of TMD were generally attributed only to adult patients. However, studies carried out in recent years addressing the prevalence of signs and symptoms of dysfunction in young populations have demonstrated an increase in the number of children and adolescents affected.[2–5]

TMD has a multifactorial etiology.[6] A number of etiological theories have been proposed over the years, including parafunctional habits and psychological, hormonal, and occlusal factors (malocclusion).[7–10,5] However, the correlation between risk indicators for TMD remains contradictory, especially in childhood.[11] A current school of thought holds that variables once considered strong risk indicators for signs and symptoms of TMD, such as malocclusion, have a weak correlation, thereby supporting the multifactorial theory as the cause of TMD pain more than occlusal interference and isolated malocclusions.[12]

Clinically, TMD is a relatively common disorder. Thus, the aim of this study was to determine risk indicators for signs and symptoms of TMD in patients between 4 and 12 years of age at a pediatric dentistry clinic of a teaching institution.

MATERIALS AND METHODS

Sample

The sample in this study was made up of 106 children between 4 and 12 years of age in the primary, mixed, and permanent dentitions and under care at the Pediatric Den-

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tistry Clinic between 2000 and 2008 (Table 1). This study was approved by the Research Ethics Committee (process number 0034.0.189.000-08). All procedures were performed in compliance with Resolution 196/96 of the Brazilian Ministry of Health.

Data Collection

The data were collected from an examination form and questionnaire contained in 106 dental charts. The examination form contained data on the morphological and functional exam of the occlusion, qualitative questions (yes or no) for signs and symptoms of TMD, and quantitative questions (until what age, often, occasionally, or never) on nonnutritive habits that were answered by the parents or guardians (Figure 1). The criterion for assessment of TMD in children was the presence of at least one sign or symptom as described by Bonjardim et al (2003).[3] Among them were:

- Deviation during mouth opening (symmetric/asymmetric, synchronized/not synchronized). Any deviation of 2 mm or more was recorded as a sign of TMD.
- Joint noises (clicking or crepitus, evaluated without a stethoscope).
- Movement limitation from pain or mechanical impairment.
- Joint pain during movement from standardized pressure for 2 seconds during palpation.

Table 1. Distribution of Sample According to Gender

	Male	Female
N (number of children)	55	51
Mean age (months)	90	92
Mean age (years)	7.5	7.7
Primary dentition (n)	16	8
Mixed dentition (n)	29	39
Permanent dentition (n)	10	4

Data Analysis

Statistical analysis was performed using the SPSS 9.0 (Chicago, IL, USA) statistical software package. Univariate logistic regression analysis was performed with the dichotomization of the dependent variable presence of at least 1 sign or symptom (yes/no). Among the independent variables (yes/no) considered was the Angle molar relationship (Class II or III). In the primary dentition, a distal terminal plane was considered a malocclusion. A mesial step was

Exam Form
Sings and Symptoms of TMD:
1. Deviation when opening mouth ( ) Yes ( ) No
2. Joint noises ( ) Yes ( ) No
3. Limitation to movement ( ) Yes ( ) No
4. Pain in mandible or during movement ( ) Yes ( ) No

Occlusal characteristics:

Dentition:	( ) primary	( ) mixed		( ) permanent
Mid Line:	( ) coincident	( ) deviated		
Crossbite:	( ) posterior	( ) anterior		
	( ) unilateral	( ) bilateral	( ) right	( ) left
Crowding:	( ) upper	( ) lower		
Overbite:	( ) open	( ) normal	( ) moderate	( ) accentuated
Overjet:	( ) crossbite	( ) normal	( ) moderate	( ) accentuated
Early tooth loss:	( ) yes	( ) no		
Angle's molar classification:	( ) Normal	( ) Class I	( ) Class II – div 1	
	( ) Class II – div. 2	( ) Class III		
Canine relationship:	( ) normocclusion	( ) distocclusion	( ) mesiocclusion	
	( ) crossbite	( ) edge to edge relationship		

Habits

1. Used pacifier ( ) Yes ( ) No	Until what age?_____
2. Used bottle ( ) Yes ( ) No	Until what age?_____
3. Finger sucking ( ) Yes ( ) No	Until what age?_____
4. Nail biting ( ) Yes ( ) No	Until what age?_____
5. Teeth grinding or clenching	( ) Yes ( ) No

Figure 1. Data collection form regarding signs and symptoms of temporomandibular dysfunction, morphological and functional characteristics of occlusion, and nonnutritive habits.

considered a malocclusion only when accompanied by a Class III cuspid relationship. Other variables were the canine relationships (normocclusion, distocclusion, mesiocclusion, crossbite), deviations from the midline, teeth grinding *(*bruxing), nonnutritive sucking habits, early tooth loss, abnormal incisor relationships, posterior crossbites, use of pacifier beyond age 3, finger sucking for more than 6 months, artificial nursing (bottle feeding) for 1 year or more, and nail biting.

Univariate regression was applied for the identification of factors independently associated with the presence of at least 1 sign or symptom of TMD. Variables that achieved a *P*-value of ≤ 0.30 were employed as potential predictors of signs or symptoms of TMD and used as co-variables in the multivariate analysis.[13] Multivariate logistic regression was performed controlling for sex and age, with a significance level of $P < 0.05$. An additional analysis was then performed using "teeth grinding" as the dependent variable (yes/no) to identify possible risk factors for bruxing or clenching.

Table 2. Results of Univariate Logistic Regression in Determining Variables Independently Associated with TMD

	Signs and Symptoms of TMD		P-value
Independent variables	YES	NO	
Gender			
male	5	50	-
female	8	43	
Age			
months	-	-	-
Dentition			
primary	3	21	-
mixed	10	58	
permanent	0	14	
Angle's molar and/or canine classification (II or III) or relationship of primary 2nd molars in distal or mesial relationship			
present	8	37	0.15*
absent	5	56	
Deviation from midline			
present	6	25	0.16*
absent	7	68	
Crowding			
present	5	23	-
absent	8	70	
Tooth grinding			
present	6	15	0.02*
absent	7	78	
Early tooth loss			
present	0	5	-
absent	13	88	
Incisor relationship (open bite, crossbite, overjet, or overbite)			
present	4	38	-
absent	9	55	
Posterior crossbite			
present	6	17	0.01*
absent	7	76	
Pacifier sucking (beyond age 3)			
present	2	14	-
absent	11	79	
Finger sucking (for more than 6 months)			
present	2	6	0.27*
absent	11	87	
Nonnutritive sucking			
present	1	7	-
absent	12	86	
Nonnutritive sucking (beyond age 1)			
present	13	87	-
absent	0	6	
Nail biting			
present	9	25	-
absent	4	68	

Table 3. Results of Multivariate Logistic Regression in Determining Variables Independently Associated with TMD

Independent Variables	Signs and Symptoms OF TMD (Yes)	Odds Ratio	Odds Ratio (Confidence Interval)	P-value
Angle's molar and/or canine classification (II or III) or relationship of primary 2nd molars in distal or mesial relationship				
present	9	1.83	0.49 to 6.89	0.37
absent	4	Ref.		
Deviation from midline				
present	6	1.08	0.21 to 5.62	0.92
absent	7	Ref.		
Tooth grinding				
present	6	6.08	1.51 to 24.51	0.01*
absent	7	Ref.		
Posterior crossbite				
present	6	5.74	1.18 to 27.85	0.03*
absent	7	Ref.		
Finger sucking (for more than 6 months)				
present	2	1.89	0.25 to 14.40	0.53
absent	11	Ref.		

*$p<0.05$

RESULTS

The prevalence of at least 1 sign or symptom of TMD in the present sample was 12.26% (13 patients out of 106). Univariate logistic regression analysis revealed that bruxing, posterior crossbite, midline deviation, finger sucking, Class II or III molar or canine malocclusion, and primary-molar distal step were significantly associated with the presence of at least 1 sign or symptom of TMD ($P \leq 0.30$) (Table 2). However, only bruxing and posterior crossbite achieved statistical significance in the multivariate regression model and were therefore considered risk indicators for the presence of signs and symptoms of TMD ($p<0.05$) (Table 3). Thus, in the present sample, children who reported the habit of grinding their teeth and those with posterior crossbite had a greater likelihood of exhibiting TMD.

An additional analysis was then performed using bruxing as the dependent variable and obeying the same inclusion criteria for multivariate analysis. The presence of at least 1 sign or symptom of TMD ($P = 0.01$) and early tooth loss ($P = 0.02$) were the only variables significantly associated with bruxing in the multivariate analysis. Therefore, children with TMD (odds ratio, 5.42) and early tooth loss (odds ratio, 9.5) had a greater likelihood of exhibiting bruxing (Table 4).

Table 4. Results of Univariate and Multivariate Logistic Regression in Determining Variables Independently Associated with Bruxing

	Bruxing		Univariate analysis	Multvariatei analysis
Independent variables	**YES**	**NO**	***p-value***	***p-value***
Gender				
male	13	42	0.31	-
female	8	43		
Age				
months	-	-	0.44	
Dentition				
primary	5	19	0.99	-
mixed	13	55		
permanent	3	11		
Angle's molar and/or canine classification (II or III) or relationship of primary 2nd molars in distal relationship				
present	11	34	0.31	-
absent	10	51		
Deviation from midline				
present	5	26	0.54	-
absent	16	59		
Crowding				
present	6	22	0.80	-
absent	15	63		
TMD				
present	6	7	0.02*	0.01
absent	15	78		
Early tooth loss				
present	3	2	0.04*	0.02
absent	18	83		
Incisor relationship (open bite, crossbite, overjet, or overbite)				
present	7	35	0.51	-
absent	14	50		
Posterior crossbite				
present	4	20	0.66	-
absent	17	65		
Pacifer sucking (beyond age 3)				
present	2	14	0.43	-
absent	19	71		
Finger sucking (for more than 6 months)				
present	2	6	0.70	-
absent	19	79		
Nonnutritive sucking				
present	1	7	0.59	-
absent	20	78		
Nonnutritive sucking (beyond age 1)				
present	19	81	0.40	-
absent	2	4		
Nail biting				
present	7	22	0.49	-
absent	14	63		

* p <.30 in univariate analysis

DISCUSSION

The prevalence of signs or symptoms of TMD in the present study was close to 12%, with no differences between sexes and no age influence. These data corroborate the literature, as the prevalence of TMD among young individuals is predictably small, and severe dysfunctions are rarely encountered in young children when compared with studies carried out on patients after puberty.[4,14,15] The distribution of TMD in relation to sex and age after puberty suggest a possible link between disease and hormonal dysfunction.[16] In the present study, the absence of these relationships might be explained by the fact that the sample contained only younger children (under 12). Gender differences in the prevalence of TMD are less evident in childhood, become more accentuated between 20 and 40 years of age, and tend to diminish with age.[17]

The risk indicators assessed in this study were chosen based on a search for possible agents triggering pain and dysfunction in childhood. The influence of dentition phase and occlusal factors in the development of TMD remains the subject of speculation. In our study, Angle's molar classification and posterior crossbite were significantly associated with the presence of TMD in the univariate analysis. However, after inserting these variables into the multivariate model, crossbite alone remained a potential predictor of TMD. In a systematic literature review of population-based studies, Gesch *et al* investigated the association of malocclusions and occlusal interferences with TMD symptoms,[18] with the result that such associations are not uniform and that no occlusal pattern was found. However, the literature showed that crossbites in children are associated with functional abnormalities such as decreased masticatory efficiency and bite strength, asymmetric activity of the masticatory muscles, and abnormal musculoskeletal morphology.[19–22] Thus, occlusal factors appear to be involved in some aspect of individual susceptibility to TMD.[23]

The correlation between oral habits and TMD (if any) remains uncertain.[24,25] Many investigations have sought to establish harmful childhood habits as possible etiological factors in the development of TMD.[24,26] In the present study, no significant correlation was found between oral habits and signs and symptoms of TMD. Habits such as nail biting and finger sucking are very common and do not ordinarily affect the balance of the stomatognathic system. However, these habits are often underreported because of embarrassment, and their occurrence may therefore be underestimated.[27] Alamoudi found that nail biting and finger sucking were not associated with TMD.[25] Castelo *et al* also found no association between nail biting, finger sucking, mouth breathing, use of a pacifier, or speech abnormalities and TMD in preschool children, thereby corroborating the results of our study.[5]

Bruxing and clenching are either diurnal or nocturnal parafunctional activities; their occurrence has been observed in as much as 41% of children.[5,28] Few individuals, especially children, are aware of these habits. In this study, the report of grinding or clenching was identified as a predictor of risk for signs and symptoms of TMD. Although bruxing is considered a temporary or fluctuating phenomenon, its association with TMD (like other parafunctional habits) has been reported in the literature.[29] One of the possible mechanisms by which bruxing can influence TMD in children is based on functional overload of the stomatognathic system. The involuntary, forced contact between the occlusal surfaces of the teeth during nonfunctional movements may exceed the

physiological tolerance of the masticatory system, thereby causing pain and dysfunction.[29]

The etiology of bruxism is not yet well defined. However, a multifactorial etiology has been proposed that includes central (patho-physiological and psychological) factors as well as peripheral (morphological) factors that blend with the factors possibly involved in the etiology of TMD. Through parents' reports, Cheifetz *et al* found that bruxism in children was related to anxiety and a family history of this parafunction.[13] Moreover, among younger children, bruxism is considered a consequence of the immaturity of the neuromuscular system. In the present study, early loss of posterior teeth raised the likelihood of an individual's exhibiting grinding habits by approximately 10-fold. This suggests that posterior support may trigger mandibular deviations that influence the habit of grinding or clenching. A number of investigators have reported that factors related to the morphology of the dental arches, anatomy, and occlusion were related to bruxing, especially deviations between the retracted contact and intercuspation positions, which is thought to be the most common cause of this parafunction.[30] In recent years, however, occlusal factors have been contested, as psychological and patho-physiological factors are currently considered the main factors involved in bruxing.[31,32]

Complications stemming from tooth grinding in adults include tooth wear, headaches, TMD, and muscle fatigue. A number of studies have also shown a link between this oral parafunction and TMD in the primary and mixed dentitions.[29] Furthermore, a 20-year longitudinal study showed significant correlations between bruxism and signs and symptoms of TMD as well as an initial report that clenching is a predictor of treatment for this disorder over the 20-year period.[33]

The frequency of harmful habits in childhood is generally high and often overlooked by parents and caregivers. However, it is important to stress that the initial dentition stages have a direct influence on the establishment of the permanent dentition and, for normality to be achieved, it is necessary to provide adequate morphological and functional development by recognizing the abnormalities and parafunctions that can affect the stomatognathic system.

CONCLUSIONS

In the sample evaluated,

- Sucking habits, malocclusion, and length and type of nursing were not associated with the presence of TMD.
- Early tooth loss had an influence on bruxing habits.
- Children with grinding or clenching habits and those with posterior crossbite had a greater likelihood of developing signs and symptoms of TMD.

ACKNOWLEDGEMENTS

The authors thank the Professors of the Pediatric Dentistry Clinic – Lavras University Center (Ricardo Barbosa, Isis Patto and Luciana Tourino) and also the Clinical Supervisor (Johnson Fouseca).

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