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Relationship between oral parafunctional/nutritive sucking habits and temporomandibular joint dysfunction in primary dentition

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Summary. The aim of this study was to evaluate the relationship between nutritive and parafunctional habits and the presence of temporomandibular dysfunction (TMD) in children with primary dentition.

Methods. Ninety nine children, aged 3–5 years, were examined to check for the presence or absence of signs and symptoms of TMD (headache, preauricular pain, earache, masticatory muscle tenderness, deviation on opening, occlusal interference and asymmetric movement of the mandible), oral parafunctions (bruxism, nail biting, finger/thumb sucking, speech alteration, mouth breathing, pacifier and atypical swallowing) and nutritive habits (breast- or bottle-feeding) through interview and clinical examination. The results were submitted to descriptive statistical analysis and Fisher's exact test.

Results. The results showed that only atypical swallowing was positively related to TMD ($P < 0{\cdot}0001$); other oral parafunctional and nutritive habits were not related to TMD.

Conclusions. It was concluded that parafunctional habits, with the exception of atypical swallowing, and feeding methods were not determinants for the presence of signs and/or symptoms of TMD in the sample of children included in the study.

Introduction

Sucking is a fundamental behaviour in the newborn infant. It appears in the neonate in two different modes depending on whether it is nutritive or non-nutritive. Oral habits (bruxism, nail biting, non-nutritive sucking etc.) are common in children [1–10], but those that persist may have profound effects on orofacial structures [10,11]. They may also play a role in the aetiology of temporomandibular joint dysfunction (TMD) [4], which is a collective term embracing a number of clinical conditions involving the temporomandibular joint (TMJ), masticatory muscles and/or associated structures [12]. Temporomandibular joint dysfunction has generally been presumed to be a condition affecting adults; however, epidemiological studies have reported signs and symptoms in children to be as frequent as in adults [13–16]. Trauma [17], emotional status [18,19], malocclusion [20–23] and oral parafunctions [3,24,25] are known aetiologic factors for TMD [26–28]. Temporomandibular joint sounds [29], impaired movement of the mandible [4,30], limitation in mouth opening, preauricular pain, facial pain, headaches and jaw tenderness on function are the signs and symptoms that have been most commonly reported [2,3,26,27,31].

The relationship between oral parafunctional habits and TMD, if it exists, seems to be controversial and unclear [6,18,24,25]. Some studies have linked bruxism and oral parafunctional habits to disturbances and diseases of the temporomandibular joint [3,24–28,32,33]. The relation between

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nutritive sucking habits (breast- and bottle-feeding) and signs and symptoms of TMD has not been studied. As the primary dentition can be a factor which influences the establishment of the permanent dentition, and because regular examination of children provides an opportunity to intercept a development of disorders of the stomatognathic system, the aim of this study was to investigate the relationship between oral parafunctional and nutritive sucking habits and signs and symptoms of TMD in young children.

Methods

Sample

The sample of children included in the study was made up of 99 children of both genders (58 boys and 41 girls), aged 3–5 years (average 4·2 years), from Piracicaba, Brazil. Written and verbal consent were obtained from each child's parents/guardians after they had been informed about the procedures, possible discomforts and risks, as well as the potential benefits. The research was approved by the Ethics Committee of the Dental School of Piracicaba, State University of Campinas, Brazil. Children with systemic diseases, uncooperative behaviour, or with a history of trauma, dental pain or orthodontic treatment were excluded.

Examinations

All parents/guardians were interviewed using a structured anamnesis questionnaire, as the children included were too young to understand sufficiently to provide reliable answers. The questionnaire included qualitative (yes or no) and quantitative (frequently, occasional or never) aspects of oral parafunctional habits (bruxism, nail biting, speech alterations, mouth breathing, pacifier and finger/thumb sucking), nutritive sucking habits, and symptoms of TMD. Signs of TMD were evaluated through clinical examination, and atypical swallowing through observation. Two examiners from the Department of Paediatric Dentistry at the Dental School of Piracicaba held a series of preliminary sessions to standardize the data collection technique and methodology.

Bottle-feeding for 1 year or more and breastfeeding over a period of at least 6 months were regarded as bottle feeding and breastfeeding, respectively. The following symptoms of TMD were recorded: headache, earache, preauricular pain, ear noises, neck tenderness and clicking. Only headaches and earaches of unknown aetiology were considered. To be included they had to have been manifested frequently (more than once a week), as had symptomatic manifestations.

Clinical examination comprised the evaluation of dental conditions, premature tooth loss, occlusal characteristics such as molar canine relationship, crossbite, midline deviation in habitual clenching, overbite and overjet and mandibular movements. These details are not considered further in this paper but form the basis for a further report. Most of the children ($n = 88$) had all primary teeth, without variations that could compromise arch dimensions. Eight children presented with advanced dental caries but without complaint of pain. Restorations with plastic materials or stainless steel crowns or extractions were indicated for these children. Three children had premature loss of one or more anterior and/or posterior teeth. Atypical swallowing was considered to occur when lip activity produced strong tension in the perioral musculature, and/or the tip of the tongue was placed or pushed against the anterior teeth during swallowing.

Parents were asked to determine the presence and frequency of bruxism: more than once a week was considered as positive. The presence of bruxofacets in the primary teeth (several showing wear in dentin) was used only to confirm that reported.

Clinical signs were recorded as reported previously by Bonjardim *et al*. [34], as follows:

- Mandibular deviation on opening, to the left or right [35], by measuring the lower midline distance between the lower and upper central incisors, in relation to the upper midline;
- Occlusal interference, between the centric relation to the intercuspal position;
- Condyle motion in opening and closing movements (symmetric/asymmetric), with the index and middle fingers on the temporomandibular joints;
- TMJ and muscle tenderness (anterior and posterior portions of temporal, superficial portions of masseter and the medial pterygoid muscles) – by bilateral palpation with a standard pressure of approximately 500 g [36]. The child was asked about the difference in sensitivity between the right and left sides, and the palpebral reflex, caused by pain, was also observed (eyelid reaction); and

- TMJ sounds were recorded as evidently audible, during opening and closing, using the index finger.

Groups

The children were distributed in four groups:

- With at least one clinical sign and one symptom of TMD;
- With at least one clinical sign of TMD;
- With at least one symptom of TMD; and
- Without any clinical sign or symptom of TMD.

Statistical analysis

The results were submitted to descriptive statistical analysis. Groups with signs and/or symptoms of TMD were aggregated and Fisher's exact test was applied to relate TMD to different types of oral parafunctions and nutritive sucking habits.

Results

Thirty-four children (34·34%) of the 99 children presented at least one sign and/or one symptom of temporomandibular dysfunction. The most prevalent symptom was frequent headache (7·07%) followed by preauricular pain (4·04%), earache (3·03%) and difficulty in swallowing (3·03%). The most prevalent sign was mandibular deviation during opening and closing (18·18%) followed by occlusal interferences (7·07%), asymmetric condylar movement (5·05%) and TMJ sounds (3·03%) (Table 1).

Table 2 shows the frequency and relationship between oral parafunctional, nutritive sucking habits and signs and/or symptoms of TMD in the sample studied. There was a significant relationship between atypical swallowing and the presence of signs and symptoms of TMD ($P < 0·0001$); however, there was no relation with bruxism, nail biting, speech alterations and mouth breathing ($P > 0·05$), or with nutritive and non-nutritive sucking habits.

Table 1. Frequency of signs and symptoms of temporomandibular dysfunction ($n = 99$).

Mandibular deviation	18·18%
Occlusal interferences	7·07%
Asymmetric condylar movement	5·05%
TMJ sounds	3·03%
Headache	7·07%
Pre-auricular pain	4·04%
Earache	3·03%

Discussion

Cross-sectional and longitudinal studies have revealed that signs and symptoms of temporomandibular dysfunction occur in children as often as they do in adults [31]. In this study, 34·3% of the sample presented at least one sign and/or symptom of TMD. This value is much lower than those found in the Egermark-Eriksson's study [34], where there was a prevalence of 46·7% in children ranging from 7 to 15 years old. It is also lower than Akeel and Al Jasser's results [37], where there was a prevalence of 41% in children aged 8, 14, and 18 years old. The smaller prevalence could be partly related to the fact that most signs and symptoms in young children are characterized as mild and therefore harder to detect,

Table 2. Frequency and relation between oral parafunctional and nutritive sucking habits and temporomandibular dysfunction.

	n (%)	Bruxism	Speech alterations	Nail biting	Atypical swallowing	Mouth breathing	Breast feeding	Bottle feeding	Finger/thumb sucking	Pacifier
Only symptoms	8 (8·08)	4 (4·04)	0	2 (2·02)	3 (3·03)	2 (2·02)	4 (4·04)	6 (6·06)	1 (1·01)	2 (2·02)
Only signs	18 (18·80)	4 (4·04)	1 (1·01)	4 (4·04)	6 (6·06)	5 (5·05)	11 (11·11)	16 (16·16)	0	10 (10·10)
Signs and symptoms	8 (8·08)	5 (5·05)	2 (2·02)	2 (2·02)	2 (2·02)	5 (5·05)	5 (5·05)	7 (7·7)	0	3 (3·03)
TMD children	34 (34·34)	13 (13·13)	3 (3·03)	8 (8·08)	11* (11·11)	12 (12·12)	20 (20·20)	29 (29·29)	1 (1·01)	15 (15·15)
None	65 (66·66)	19 (19·19)	13 (13·13)	10 (10·10)	18* (18·18)	25 (25·25)	37 (37·37)	59 (59·60)	10 (10·10)	23 (23·23)
Total sample	99 (100)	32 (32·32)	16 (16·16)	18 (18·18)	29 (29·29)	37 (37·37)	57 (57·58)	88 (88·89)	11 (11·11)	38 (38·38)

*$P < 0·0001$.

and severe dysfunction is rare [38]. Various signs and symptoms have been used to define temporomandibular conditions in children; but it is not yet clear whether these represent normal variation, preclinical features or manifestations of a disease state [39].

The frequency of bruxism (32·32%, Table 2) observed here was higher than in the other studies reported [2,6,7,24]; Alamoud [18] found the prevalence to be 8·4% in children of the same age range. As in other studies [4,40], bruxism was not significantly related to signs and symptoms of TMD. Gavish *et al*. [40] found no relation between the presence of bruxism and muscle sensitivity to palpation in adolescent girls; in the study carried out by Alamoudi [18] there was no relation between attrition, symptoms of TMD and deviation on opening. In contrast, Widmalm *et al*. [24] and Widmalm *et al*. [25] have reported a significant association between bruxism and most of the TMD signs and symptoms in children of a similar age to those included here, but these studies were conducted through a clinical examination and interview with the children, without the parents.

In the present study information was obtained by interviewing the children and evaluating the questionnaires answered by the parents. As bruxism may occur during sleep, children will be unaware of this habit [27]. Similarly, parafunctions like thumb sucking and nail biting may not be revealed during interview with the child because of embarrassment. As a result, the occurrence of parafunction can be under-reported [27]. Thus, obtaining data from the parents is important for the validity of the study.

Past studies have indicated different techniques to record bruxism [41,42]. One is the evaluation of the dental attrition, either from direct visual observations in the mouth [43], from occlusal appliances [44] or from dental study casts [45]; however, it is difficult to be sure if wear is solely a consequence of a parafunctional or a functional habit. This is especially so in primary teeth, as occlusal surfaces may wear physiologically [4]. The reliability of this technique is therefore controversial. Attrition has been considered as an objective method of recording the prevalence of bruxism (grinding and clenching), but it may also not indicate the current level of bruxism. Subjects who have bruxed in the past may exhibit wear facets, even if the habit no longer exists, while subjects who have only recently begun to show bruxism may not show signs of attrition. Thus, bruxism in the present sample was assessed by parental report and/or severe wear involving dentine.

Kritsinelli and Shim [13] showed that bruxism and thumb/finger sucking were significantly related to TMJ dysfunction in the primary and mixed dentitions. Magnusson *et al*. [46] stated that the positive correlation found in their study, which included up to three evaluations during a 10-year period, indicated the existence of a causal relationship between parafunctions and signs of TMJ dysfunction. Vanderas [27] evaluated children aged 6–10 years who had not experienced unpleasant life events (calm group) and a second group who had experienced one or more unpleasant life events (not calm group). The author found a statistically significant correlation between TMJ dysfunction and oral parafunction, such as grinding, clenching and lip/cheek biting in the calm group. These parafunctions were considered the primary aetiological factors of signs and symptoms of TMD. In the not calm group, the origin of signs and symptoms was attributed to muscle tension or to another unknown aetiological factor. Widmalm *et al*. [24] stated that most symptoms of TMJ dysfunction were associated with parafunctions, primarily with bruxism, but also with thumb sucking and fingernail biting in 4–6-year-old African-American and Caucasian children.

The existence of bruxism and other parafunctions in children without TMJ dysfunction in both dentitions, however, suggests that these parafunctions are not 'necessary' but are 'sufficient', as reported previously by Vanderas [26]. In this context 'necessary' was taken to mean that the factor must be present for the disease to occur, whereas 'sufficient' indic--ates that the disease may occur if the factor is present (but that presence of the factor does not always result in the disease). Temporomandibular joint dysfunction also has a close relationship with the frequency, duration and intensity of oral parafunctions [26]. Rugh and Solberg [47] showed that the bruxist behaviour is not always similar in the subjects and also shows variations from night to night in the same subject. The fact that some children with TMJ dysfunction had not shown bruxism or other parafunctional habits has led to general agreement that the aetiology of TMJ dysfunction generally agreed is multifactorial [4,24,26].

In this study the use of a pacifier was the most frequent parafunction (38·38%), followed by bruxism. Alamoud [18] observed that nail biting and finger sucking were not related to TMD, but he did not

include pacifiers among the variables studied. In agreement with this, we did not find any significant relationship between the use of a pacifier, nail biting or finger sucking and the signs and symptoms of TMD. Similar results were found by Nilner [2] in children aged 7–14 years. These parafunctions were common in children and were not related to signs and symptoms of TMD in the study performed by Bernal and Tsamtsouris in 3–5-year-old children [4]. These authors attributed their results to changes in the TMJ that occur at this age [17]; however, Widmalm *et al*. [24] and Widmalm *et al*. [25] observed an association between finger sucking and nail biting and some signs and symptoms including pain on chewing, headache and neck pain. Similar results were reported by Sari and Sonmez [33], where finger/thumb sucking and nail biting were significantly related with TMJ dysfunction in children with a mixed dentition.

Speech alterations and mouth breathing were not related to signs and symptoms of TMD in this study; whereas atypical swallowing showed a highly significant relationship ($P < 0{\cdot}0001$). Bianchini [48], in a study of 51 adult patients with temporomandibular joint dysfunction, did not find any similar association between atypical swallowing and speech alterations and TMD; however, similar results were obtained by Willianson *et al*. [49], who found that abnormal swallowing patterns were present in 19 out of 25 adult patients with TMD, whereas only nine out of 25 control subjects had a swallowing pattern. Willianson *et al*. [49] suggested that the swallowing pattern may represent an effort to avoid stimulus to the joints and, consequently, pain. A correlation between facial pain and abnormal swallow patterns was also reported by Goldstein *et al*. [50], who reported that this was a cause of hyperactivity of the digastric muscle.

Milk flows differently from the bottle than it does from the breast, requiring the nursing baby to use specific, different muscular patterns for each type of feeding. Bottle-feeding may cause less varied physiological activity, which could impede harmonious maxillo-facial development. Electromyographic activity of the masseter muscle in bottle-fed babies is significantly reduced when compared with that in breast-fed babies [51]. If the need to suck is not satisfied during regular feeding, it may be fulfilled by a sucking habit [22]. It may be considered that prolonged bottle-feeding might determine atypical swallowing, as the child may compromise the infantile to adult swallowing transition, characterized by decreased use of perioral muscles. This may underlie development of the positive association between atypical swallowing and the presence of signs and/or symptoms of TMD in the children included in the present study. Thus, swallowing evaluation in children assumes greater importance because it is a physiological function of the masticatory system and dysfunction may result in severe problems in orofacial structures.

Bottle- and breast-feeding were not determinant factors of the presence of signs and symptoms of TMD in this study; however, from a functional point of view, as well as for other reasons, it seems preferable to prolong breast-feeding for at least 6–9 months [52]. Breastfeeding requires a significant effort from the masticatory muscles and leads directly or indirectly to the growth of the bones into which the muscles are inserted [51].

No relationships between nutritive and parafunctional habits and different signs and symptoms of temporomandibular dysfunction were observed in this study, except for that to atypical swallowing. In accordance with Vanderas [26] the susceptibility of the masticatory system may differ from individual to individual and the same aetiologic factor may result in different signs of TMD in different individuals. Moreover, causality is extremely difficult to establish [24]. Although the growing child has a great ability to tolerate changes in the masticatory structures [53], individual functional characteristics, such as atypical swallowing, other parafunctional habits and occlusal factors should be identified so that any necessary intervention may be made at the appropriate time. The question of whether or not the interventions will also prevent development of TMD or even reduce TMD signs and symptoms in these patients remains open to discussion, as the cause of mandibular dysfunction is so obviously multifactorial.

On the basis of the results observed in this study, it can be suggested that atypical swallowing may increase the probability of the child developing the signs and symptoms of TMD, but longitudinal research into the effects of this variable on the signs and symptoms of TMD are needed to confirm this assertion; however, it is important to recognize the paediatric patient with a predisposition towards disorder of the stomatognathic system. Each of the possible aetiologic factors and their interactions should be evaluated thoroughly.

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Résumé. Cette étude a eu pour objectif d'évaluer la relation entre les habitudes parafonctionnelles et nutritives et la présence de dysfonction temporo-mandibulaire (TMD) chez des enfants en denture temporaire.
Méthodes. Quatre-vingt dix-neuf enfants âgés de 3 à 5 ans ont été examinés afin de vérifier la présence ou l'absence de signes et symptômes de TMD (maux de tête, douleur pré-tragienne, douleurs auriculaires, tendreté des muscles masticateurs, déviation à l'ouverture buccale, interférence occlusale et mouvement asymétrique de la mandibule), parafonctions orales (bruxisme, onychophagie, succion du pouce ou d'un autre doigt, trouble du langage, respiration buccale, tétine, déglutition atypique) et habitudes nutritionnelles (sein ou biberon) à travers un entretien et un examen clinique. Les résultats ont été soumis à une analyse statistique descriptive et au test exact de Fisher.
Résultats. Les résultats ont montré que seule la déglutition atypique était positivement liée au TMD ($p < 0{,}0001$). Les autres parafonctions et habitudes nutritives n'étaient pas reliées au TMD.
Conclusions. Il en a été conclu que les habitudes de parafonction, à l'exception de la déglutition atypique, et les méthodes de nutrition n'étaient pas des déterminants à la présence de signes ou symptômes de TMD au sein de l'échantillon d'enfants inclus dans l'étude.

Zusammenfassung. Ziel dieser Studie war es, die Relation zwischen Ernährungsgewohnheiten und Parafuktionen einerseits und temporomandibulärer Dysfunktion (TMD) andererseits bei Kindern im Milchgebiss zu untersuchen.
Methoden. Neunundneunzig Kinder im alter von 3 bis 5 Jahren wurden untersucht auf das Vorliegen von Zeichen und Symptomen von TMD (Kopfschmerz, präaurikulärer Schmerz, Ohrschmerz, Dehnbarkeit der Masseters, Seitenabweichung bei Mundöffnung, okklusale Interferenzen und assymmetrische Unterkieferbewegungen) orale parafunktionen (Zähneknirschen, Nagelkauen, Lutschen, Sprechstörungen, Mundatmung, Schnuller, atypisches Schlucken, Ernährungsgewohnheiten (Stillen oder Saugerflaschengebrauch) durch Befragung und klinische Untersuchung. Die Ergebnisse wurden durch deskriptive Statistik und den Fishers Test statistisch untersucht.
Ergebnisse. Nur atypisches Schlucken war positiv mit TMD korreliert ($p < 0.0001$); andere parafunktionelle oder ernährungsbezogene Parameter zeigten keine Korrelation zu TMD.
Schlussfolgerungen. Mit Ausnahme des atypischen Schluckens waren in der hier untersuchten Stichprobe Parameter nicht mit TMD assouziiert.

Resumen. El objetivo de este estudio fue evaluar la relación entre hábitos nutritivos, parafuncionales y la presencia de disfunción temporomandibular (DTM) en niños con dentición primaria.
Métodos. Se examinaron 99 niños entre 3 y 5 años para comprobar, mediante interrogatorio y examen clínico la presencia o ausencia de signos y síntomas de DTM (dolor de cabeza, dolor pre-auricular, dolor de oído, sensibilidad del músculo masetero, desviación a la abertura, interferencia oclusal y movimiento asimétrico de la mandíbula), parafunciones orales (bruxismo, mordedura de uñas, chupeteo de dedo/pulgar, alteración al habla, respiración bucal, chupete, deglución atípica y hábitos nutritivos (lactancia materna o con el biberón) Los resultados se sometieron a análisis de estadística descriptiva y Test Exacto de Fischer.
Resultados. Los resultados mostraron que sólo la deglución atípica estaba relacionada positivamente a DTM ($p < 0{,}0001$); otras parafunciones orales y hábitos nutritivos no estaban relacionados con la DTM.
Conclusiones. se concluyó que los hábitos parafuncionales, con excepción de la deglución atípica y los métodos de alimentación no eran determinantes para la presencia de signos y/o síntomas de DTM en la muestra de niños incluidos en este estudio.

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