

ASSOCIATION AMONG STOMATOGNATHIC FUNCTIONS, DENTAL OCCLUSION AND TEMPOROMANDIBULAR DISORDER SIGNS IN ASYMPTOMATIC WOMEN

Associação entre funções estomatognáticas, oclusão dentária e sinais de disfunção temporomandibular em mulheres assintomáticas

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ABSTRACT

Purpose: to investigate the association between stomatognathic functions of mastication and deglutition, dental occlusion and signs of temporomandibular disorders in asymptomatic women. **Methods:** the stomatognathic functions were assessed by the miofuncional orofacial exam; the dental occlusion exam included: Angle classification; measures of overjet and overbite; presence of openbite and crossbite; and the temporomandibular joint was examined by Axis I of the Research Diagnostic Criteria for Temporomandibular Disorders. **Results:** 43 women with a mean age of 23.7 years were assessed. The miofuncional orofacial exam demonstrated changes in the mastication pattern (30.2%), atypical contractions during mastication (18.6%) and deglutition (58.1%). Regarding dental occlusion, Class I malocclusion (74.4%) was predominant, but no volunteer had an ideal occlusion. The evaluation of the temporomandibular joint showed range of motion within normal, presence of opening deviation (60.5%) and temporomandibular disorders diagnosis (16.3%). A significant association was found between presence of joint noises and diagnosis of temporomandibular disorders, joint noises and atypical deglutition contractions, mouth opening pattern and atypical contractions during mastication, and there was no association between occlusal Class Angle, mastication pattern and temporomandibular disorders. **Conclusion:** asymptomatic volunteers showed changes in stomatognathic functions as atypical contractions during deglutition and mastication, which were associated with the presence of joint noises and mouth opening pattern. These findings can be attributed to imbalances and lack of coordination of the muscles involved in these functions. No volunteer had ideal occlusion and no associations were found with this condition.

KEYWORDS: Stomatognathic System; Dental Occlusion; Temporomandibular Joint Disorders; Temporomandibular Joint

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■ INTRODUCTION

The stomatognathic system is a functional unit consisted of static structures that correspond to the hyoid bone, maxillary and mandibular dental arches, maxilla, mandible and cranial bones – linked by the temporomandibular joint (TMJ) and by dynamic structures, i.e., a neuromuscular unit that provides the mobilization of the static parts. This system is responsible for sucking, chewing, swallowing, breathing and speech functions¹⁻⁴.

The TMJ along with the jaw, maxilla, teeth and chewing muscles form a complex known as dental occlusion. A normal occlusion is characterized by a complex harmony and a normal position of dental inclined planes, which in accordance with their bone bases and muscle forces, exhibit contact points and correct axial inclinations⁵.

The occlusion has a close relationship with stomatognathic functions and, despite occlusal deviations is inherent to the characteristics of the human being, it does not mean that the occlusion is comfortable and promotes an efficient chewing⁶. Furthermore, occlusion determines the movement pattern and the mandible position, and the occlusal instability may be a reason for the chewing system overload and may also bring damages to TMJ⁷.

Nociceptive stimuli from the occlusion and/or TMJ may generate compensatory behaviors such as myofascial orofacial disorders, including temporomandibular joint dysfunction (TMD)⁸.

A study⁷ that investigated the occlusal stability on TMD patients found a correlation between the activity of chewing muscles and the jaw movement, i.e., the asymmetry in the chewing muscles activity can result in an abnormal jaw movement, inducing to TMD occurrence.

Also, the occlusal interference and instability may increase the functional load on TMJ altering the muscle coordination between right and left sides⁹ and causing morphological changes in the TMJ internal structure related to the configuration, location and function of the articular disc¹⁰.

Considering the exposed above, the aim of this research was to study the association between chewing and swallowing stomatognathic functions, the dental occlusion and TMD signs in asymptomatic women.

■ METHODS

This research consisted of an observational, cross-sectional study with a quantitative approach. The research was conducted at the Orofacial Motricity Laboratory at Speech Therapy Service (SAF-UFSM) (Santa Maria, RS), and it was part of the Project Cranio-cervico-mandibular System: diagnosis and multifactorial therapeutic approach, with the approval of Santa Maria Federal University Research Ethics Committee (UFSM) protocol number 23081.019091/2008-65, as per resolution 196/1996.

The research was published on print and electronic media at UFSM site (www.ufsm.br). Academic UFSM and women in dental care at UFSM Prosthodontics and Occlusion Clinic were

invited to participate voluntarily, to stomatognathic functions, dental occlusion and TMJ evaluations.

The participant's selection included an interview, taking in account the research inclusion and exclusion criteria. Women aged between 18 and 35 years old, who signed the Consent Instrument Form were included.

It was excluded those having tooth loss (more than two teeth – excepting third molar); dentures use; psychomotor impairment signs; malformations, tumors, surgery or head and neck traumas; speech therapy and physical therapy in the orofacial motion prior or current; painful symptoms in the TMJ and mouth breathers.

The stomatognathic system was evaluated by a speech therapist with expertise in the orofacial motion area, through myofunctional orofacial examination, according to MBGR protocol¹¹.

For the mastication evaluation, a loaf of bread was offered. The volunteers were instructed to chew and swallow usually, and the test was repeated three times. After, it was carried out the liquid swallowing, supplied in a 200-mL disposable cup.

Mastication and swallowing functions were recorded on video, and the recordings were analyzed by three speech therapists, considering the following aspects regarding mastication: incision, crushing, chewing pattern, lip closure and atypical muscle contractions; as for the swallowing: lip closure, lip posture, food contention, atypical muscle contractions and coordination.

Occlusion was evaluated by UFSM Dentistry academics and included: Angle classification; horizontal and vertical overjet and overbite measures; openbite and crossbite presence, malocclusion pattern and occlusal interferences¹²⁻¹⁵. In this evaluation the performance of previous orthodontic treatments was also investigated.

The volunteers were firstly assessed with occluded teeth, and as for the molar key, they were classified as: ideal occlusion, malocclusion Class I, II or III. Horizontal and vertical overjet and overbite measures were verified with occluded teeth. The normal vertical overjet was defined when the upper incisors and canines tip covered at most one third of the jaw incisors crown length. If this distance was surpassed it was considered an overbite. The horizontal overjet was horizontally measured from the lower incisor to its antagonist, and the value considered normal was between 1-2 millimeters. Higher values were considered overbite. The cross-evaluation, i.e., the crossbite was classified as absent or present.

In order to evaluate the malocclusion pattern and occlusal interferences, the volunteers should

perform protrusion and lateralization movements and the contact points were registered.

The TMJ evaluation was carried out by a trained physiotherapist through the Diagnostic Criteria for Research temporomandibular disorders (RDC/TMD) Instrument¹⁶. From this instrument, jaw movement amplitudes, the presence of joint noises, mouth opening pattern and TMD diagnosis can be evaluated.

The results of the chewing and swallowing evaluations were compared to verify the agreement degree among observers, through the Kappa coefficient. These results were interpreted as follows: poor agreement ($K < 0$), light agreement ($K = 0-0.20$), weak agreement ($K = 0.21-0.40$), moderate agreement ($K = 0.41$ to 0.60), substantial agreement ($K = 0.60-0.80$) and excellent agreement ($K > 0.80$)¹⁷.

The remaining analyzes were performed using the Statistic software, version 9.0 for Windows, and Chi-square and Fisher tests were used to assess the variables association: chewing pattern, chewing and swallowing atypical contractions, Angle Class, overjet, overbite, crossbite, orthodontic treatment, TMD diagnosis, articular noises and opening pattern. A level of 5% was determined significant.

■ RESULTS

Forty three women, aged between 23.7 ± 4.8 years old, voluntarily participated in this study.

When analyzing chewing and swallowing through myofunctional orofacial examination, it was observed that all participants had incision aspects, grinding, lip closure, lip posture, food containment and coordination considered normal.

Among the volunteers assessed, mastication pattern changes were observed, as well as the presence of atypical contractions in chewing and swallowing, the latter being found in most volunteers. Results also showed that there was a poor level of agreement between judges on this point (Table 1).

Regarding the occlusion, half of the women studied (51.1%) underwent previous orthodontic treatments and there was no association between this and the other variables.

Table 2 shows the assessment of dental occlusion characteristics of the volunteers in the study, where normality characteristics were predominant. No volunteer showed a completely normal occlusion.

Table 1 – Frequency of conditions found in orofacial myofunctional examination and concordance coefficient between judges

Aspect	Condition	n (%)	Kappa*
Mastication pattern	Normal	30 (69.8)	0.34
	Changed	13 (30.2)	
Chewing atypical contractions	Absent	35 (81.4)	0.17
	Present	8 (18.6)	
Swallowing atypical contractions	Absent	18 (41.9)	0.22
	Present	25 (58.1)	

* Kappa coefficient

Table 2 – Frequency of conditions found in dental occlusion assessment (n=43)

Aspect	Condition	n (%)
Angle classification	Class I	32 (74.4)
	Class II	5 (11.6)
	Class III	6 (14.0)
Overjet	Normal	26 (60.5)
	Overjet	17 (39.5)
Overbite	Normal	35 (81.4)
	Overbite	8 (18.6)
Cross alteration	Absent	40 (93.0)
	Bite Crossed	3 (7.0)
Lateral malocclusion pattern	Canines	29 (67.4)
	Other	14 (32.6)
Protrusive malocclusion pattern	Incisors	35 (81.4)
	Other	8 (18.6)
Occlusion interferences	Absent	26 (60.5)
	Present	17 (39.5)

The TMJ evaluation through RDC/TMD instrument observed amplitude values within the normal range of movement. The mean and standard deviation of the active opening was 42.5 ± 6.6 mm, passive opening 51.6 ± 5.1 mm, right and left lateral deviations, respectively, 9.8 ± 2.2 mm and 9.0 ± 2.3 mm, and 5.8 ± 1.9 mm in the protrusion.

Although asymptomatic, the TMD diagnosis was found in 16.3% of the volunteers (disc displacement and osteoarthritis), 60.5% had mouth opening deviation and 41.9% had noise during joint movements (Table 3).

Table 3 – Conditions found in temporomandibular joint assessment

Aspect	Condition	n (%)
TMD	Without diagnoses	36 (83.7)
	Disc displacement	4 (9.3)
	Osteoarthritis	3 (7.0)
Opening	Straight	17 (39.5)
	Diverted	26 (60.5)
	Absent	25 (58.1)
Noises	Click	14 (32.6)
	Crepitus	4 (9.3)

TMD: temporomandibular disorder

The association between chewing pattern, chewing and swallowing atypical contractions, Angle Class, overjet, overbite, TMD diagnosis, opening pattern and noise was analyzed. Results showed that there was significant association between TMD and joint noises; joint noises and atypical swallowing

contractions; opening pattern and chewing atypical contractions (Table 4). There was no association between variables related to the Angle Occlusal Class, chewing pattern and temporomandibular dysfunction (Table 5).

Table 4 – Association between noises, mouth opening pattern, temporomandibular disorders, swallowing and chewing atypical contractions.

	Without noises n (%)	With noises n (%)	Total n (%)	p
Without TMD	24 (55.8)	12 (27.9)	43 (100)	0.01*
With TMD	0 (0.0)	7 (16.3)		
Without SAC	14 (32.6)	4 (9.3)	43 (100)	0.02**
With SAC	11 (25.5)	14 (32.6)		

	Opening straight n (%)	Opening Diverted n (%)	Total n (%)	p
Without CAC	11 (25.6)	24 (55.8)	43 (100)	0.02**
With CAC	6 (14.0)	2 (4.6)		

TMD: temporomandibular disorder, SAC: swallowing atypical contractions, CAC: chewing atypical contractions. * Fisher Test. **Chi-square test.

Table 5 – Association between angle classes, mastication pattern and temporomandibular disorder

	Class I n (%)	Class II n (%)	Class III n (%)	p*
Normal mastication	24 (55.8)	3 (7.0)	3 (7.0)	0.20
Altered mastication	8 (18.6)	2 (4.6)	3 (7.0)	
Without TMD	27 (62.8)	4 (9.4)	5 (11.6)	0.84
With TMD	5 (11.6)	1 (2.3)	1 (2.3)	

TMD: temporomandibular disorder *Chi-square test.

■ DISCUSSION

This research aimed to investigate the association between chewing and swallowing stomatognathic functions, dental occlusion and TMD signs in asymptomatic women.

Aspects related to mastication were normal, except for the pattern and the presence of atypical contractions. Regarding the mastication pattern, one third of the volunteers were abnormal, i.e., using predominantly a specific side during the chewing cycle.

Although some studies have shown that healthy individuals may present a unilateral predominance, the chewing normal physiology is characterized by

unilateral cycles with periodic alternation of food on the two sides of the dental arch¹⁸.

The alternating bilateral pattern is essential in preventing myofunctional disorders, periodontal problems and TMD, contributing as well to the maxillary bones development, arches maintenance, occlusion stability, TMJ stability, and muscular and functional balance of the stomatognathic system¹⁹⁻²¹.

A research⁹ that aimed to evaluate the chewing function of a group of TMD patients (n=20) compared to a control group (n=10) found that the higher the number of occlusal interferences and TMD severity, the longer the chewing time and a lower mastication type score, that is, farther from the normal physiological pattern.

Orofacial myofunctional assessment demonstrated in this study the presence of chewing and swallowing atypical contractions. A recent study on women with TMD²² justified the changes in the chewing muscle recruitment as a compensatory mechanism for pain symptoms relief. Besides pain, the authors also suggested that the excessive oral muscles involvement in individuals with TMD serves to counteract the tongue thrust force, which aims to prevent the food to escape from the oral cavity during swallowing. In the present research, pain does not justify atypical contractions, once the volunteers were asymptomatic.

The exaggerated participation of the orbicular and chin muscles during swallowing may be influenced by discrepancies of bone bases, when these do not allow a normal labial occlusion. Such actions take place to ensure the lip sealing during swallowing, being observed mainly as a Class II malocclusion with overjet, due to the great anterior posterior distance between maxilla and mandible²⁰. In the present study, only five of the 43 women had occlusal Class II, and 17 had overjet, which may explain the lack of association between this variable and the myofunctional assessment, once that occlusal interference was small in magnitude.

For the swallowing process in a normal manner, it is necessary the balance between perioral and masticatory muscles and tongue. Any disruption of this balance may lead to atypical swallowing, which may act as etiologic factors of malocclusion, once the bone is a highly plastic tissue, able of shaping to the muscle pressures. Therefore, atypical swallowing may determine any type of malocclusion²³.

Even with the a high percentage of atypical swallowing contractions, volunteers of this study showed characteristics of normal occlusion, but the ideal occlusion was not found in any of them.

Results of epidemiological studies in Brazil point out a high rate of malocclusion, ranging from 13 to 90.09%. However, these data should be viewed with caution, once, in Latin America, malocclusions researches are scarce, of regional characteristics, and do not follow a uniform methodology¹⁴.

The relationship between occlusion and TMD has also been discussed^{7,9,10,13,24}, since dental occlusion determines the movement pattern and the jaw position. Additionally, the occlusal instability may be a reason for the chewing system overload and also leading to damages to TMJ⁷.

Occlusal interferences were observed in volunteers during jaw movements. This condition must be considered detrimental, as the interferences in lateralization may increase the functional load on TMJ, due to a change in muscle coordination between

right and left sides, and in the jaw stability during mastication⁹.

On the other hand, interferences in protrusive movements may cause morphologic alterations in the TMJ internal structure in relation to the configuration, position and function of the articular disc¹⁰. Although, in this study, no significant association was found between TMD signs and dental occlusion, the presence of mouth opening deviation may indicate the influence of occlusal interferences in this condition.

One study²⁵ evaluated the occlusal variables to differentiate patients with disc displacement and osteoarthritis (n=381) on normal asymptomatic adults (n=98). By multiple logistic regression analysis, patients with disc displacement had more crossbite, and patients with osteoarthritis showed bigger overjet and smaller overbite.

TMD diagnosis was found in a low percentage of volunteers due to painful symptoms, which is typical of myogenic TMD diagnosis, has been exclusion criteria in this study. Therefore, only disc displacement and osteoarthritis diagnostics were detected through the RDC/TMD instrument, from the presence of noise during TMJ movements. This fact justifies the significant association between TMD diagnosis and the presence of noises. It should be emphasized that the disc displacement diagnosis can only be confirmed by magnetic resonance image²⁶ and, a recent study regarding RDC instrument sensitivity and specificity, showed low levels on these conditions, recommending imaging tests for a more accurate diagnosis²⁷.

Another TMD sign observed in most of the volunteers was the mouth opening deviation, which may occur due to pathological changes, joint inflammation, lack of occlusal guides, as well as imbalance of chewing muscles^{26,28}. It is possible that this imbalance may also be responsible for the association between the opening pattern and atypical contractions during chewing.

As for the evaluation of TMJ range of movement, the mean values were within the normal range found in literature²⁹, except for the protrusion movement, whose mean value observed was slightly below the reference levels (≥ 7 mm).

The limitations of this study may be related to the myofunctional assessment protocol, which had poor agreement between judges, and the fact that a previous orthodontic treatment was not an exclusion criterion.

The relevance of this study is based on the need for an interdisciplinary approach of speech therapists, dentists and physiotherapists in the assessment and therapeutic intervention of the cranio-cervico-mandibular system. Subsequent

studies with larger samples and providing a deeper understanding of this system for all professionals involved, may contribute to a more comprehensive clinical practice and with more definitive results.

■ CONCLUSION

The asymptomatic volunteers of this study showed some changes of stomatognathic functions,

mainly, atypical contractions during swallowing and chewing, which were associated with the presence of joint noises and mouth opening pattern. These findings can be attributed to imbalances and lack of coordination of the muscles involved in these functions. Regarding dental occlusion, no volunteer had an ideal occlusion and no associations were found with this assessment.

RESUMO

Objetivo: verificar a associação entre funções estomatognáticas de mastigação e deglutição, oclusão dentária e sinais de disfunção temporomandibular em mulheres assintomáticas. **Métodos:** as funções estomatognáticas foram avaliadas pelo exame miofuncional orofacial; o exame da oclusão dentária compreendeu: classificação de Angle; medidas de sobrepasso horizontal e vertical; presença de mordida aberta e cruzada; e a avaliação da articulação temporomandibular foi realizada pelo instrumento Critérios de Diagnóstico para Pesquisa de Desordens Temporomandibulares. **Resultados:** foram avaliadas 43 mulheres com idade média de 23,7 anos. O exame miofuncional orofacial demonstrou alterações no padrão de mastigação (30,2%) e contrações atípicas na mastigação (18,6%) e deglutição (58,1%). Quanto à oclusão dentária, houve predomínio de classe I de Angle (74,4%), porém nenhuma voluntária apresentou uma oclusão ideal. A avaliação da articulação temporomandibular apresentou amplitude de movimento dentro da normalidade, presença de desvio na abertura da boca (60,5%) e diagnóstico de disfunção temporomandibular (16,3%). Houve associação significativa entre presença de ruídos articulares e diagnóstico de disfunção temporomandibular e contrações atípicas na deglutição; padrão de abertura e contrações atípicas na mastigação; e não houve associação entre a Classe Oclusal de Angle, padrão de mastigação e disfunção temporomandibular. **Conclusão:** voluntárias assintomáticas apresentaram alterações das funções estomatognáticas, como contrações atípicas durante a deglutição e mastigação, as quais foram associadas com a presença de ruídos articulares e padrão de abertura da boca. Tais achados podem ser atribuídos a desequilíbrios e inco-ordenação dos músculos envolvidos nessas funções. Nenhuma voluntária apresentou oclusão ideal e não foram encontradas associações com esta condição.

DESCRITORES: Sistema Estomatognático; Oclusão Dentária; Transtornos da Articulação Temporomandibular; Articulação Temporomandibular

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