DR. CLAUDIA LÚCIA PIMENTA FERREIRA (Orcid ID : 0000-0002-4376-9368)

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Masticatory behavior and chewing difficulties in young adults with temporomandibular disorders

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Author names and affiliations

Claudia Lúcia Pimenta Ferreira, PhD[a*]

Chiarella Sforza MD, PhD[b]

Francesca M.E. Rusconi, DDS[c]

Paula Midori Castelo, PhD[d]

Silvana Bommarito PhD[e]

[a]Post Doctoral Fellow – Department of Biomedical Sciences for Health, Functional Anatomy Research Center (FARC), Università degli Studi di Milano, Milano, Italy

*Present address: Department of Speach Therapy, School of Medicine, Universidade Federal de São Paulo, São Paulo, SP, Brazil (Present address)

[b]Professor – Department of Biomedical Sciences for Health, Functional Anatomy Research Center (FARC), Università degli Studi di Milano, Milano, Italy

[c]Researcher – Department of Biomedical Sciences for Health, Functional Anatomy Research Center (FARC), Università degli Studi di Milano, Milano, Italy

[d]Professor – Department of Pharmaceutical Sciences, Universidade Federal de São Paulo, São Paulo, SP, Brazil

[e]Professor – Department of Speach Therapy, Escola Paulista de Medicina, Universidade Federal de São Paulo, São Paulo, SP, Brazil

Corresponding Author

Prof. Silvana Bommarito

Depto. de Fonoaudiologia, Universidade Federal de São Paulo (UNIFESP)

Rua Botucatu, 802, São Paulo – SP, Brasil. CEP: 04023-900

TEL. +5511 5576-4531

E-MAIL: bomarito@terra.com.br

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Authors' contributions:

Claudia Lúcia Pimenta Ferreira: conception and design of the study; acquisition of data; analysis and interpretation of data; drafting the manuscript; final approval of the version to be submitted.

Chiarella Sforza: conception and design of the study; analysis and interpretation of data; revising the manuscript critically for important intellectual content; final approval of the version to be submitted.

Francesca Maria Emilia Rusconi: acquisition of data; final approval of the version to be submitted.

Paula Midori Castelo: statistical analysis and interpretation of data; revising the manuscript critically for important intellectual content; final approval of the version to be submitted.

Silvana Bommarito: analysis and interpretation of data; revising the manuscript critically for important intellectual content; final approval of the version to be submitted.

Abstract

Background: Difficulties and limitations on masticatory function are among the main reasons why patients with temporomandibular disorder (TMD) seek care.

Objective: to evaluate the masticatory behavior and perception of chewing difficulties in adults with mild TMD of recent onset, considering the presence of malocclusion.

Methods: 81 young adults were divided into groups according to the presence of TMD and malocclusion: Non TMD Normal Occlusion (n=18), Non TMD Malocclusion (n=22), TMD Normal Occlusion (n=18), and TMD Malocclusion (n=23). TMD was assessed using the TMD Research Diagnostic Criteria and volunteers also answered questionnaires regarding their perception about jaw functional limitation and difficulty to chew foods of different textures. Masticatory and swallowing behaviors were assessed using the Orofacial Myofunctional Evaluation with Scores (OMES) protocol. Chewing time and chewing frequency taken to ingest the test-food were also obtained. Two-way-ANOVA was used to analyze the *TMD*, *occlusion* and *TMD*occlusion* interaction effects.

Results: *TMD* effect was observed on vertical jaw mobility and jaw function limitation total scores, meaning that groups differed in the perception of opening limitation and mandibular limitation according to TMD status with a medium effect size. Also, more changes in chewing function (OMES-Chewing score) and higher chewing frequency was observed in the presence of TMD ($p<0.05$). *Occlusion* effect was only observed on OMES-Swallowing score and no *TMD*occlusion* interaction effect was observed.

Conclusion: Changes in chewing behavior, frequency and perception of mandibular limitation was observed in the presence of TMD, pointing out the importance of functional evaluation when planning and establishing a treatment plan.

Keywords: Temporomandibular Joint Dysfunction, Dental Occlusion, Self-Perception, Eating Behavior, Mastication

1. Introduction

Given the variety of diagnoses and degrees of severity of temporomandibular disorder (TMD), it is possible that, at some point in its clinical manifestation, the masticatory function is also impaired[1-4]. In fact, in most cases of TMD the difficulties and limitations of masticatory function are among the main reported or observed signs and symptoms[2-4].

To better understand chewing complaints, self-assessment questionnaires have been proposed and used, presenting questions about mandibular function and intake of food of different type, texture and consistency.[1-10] The clinical evaluation of the stomatognathic system is also an important part of the myofunctional orofacial analysis, which aims to detail the masticatory behavior and complement the diagnosis[8,11]. According to our clinical experience and to the results found in previous studies, it is possible to expected that patients with TMD may present changes or alterations in the various aspects of the masticatory function, which differ in terms of frequency and severity[8,11].

In an overview, these patients may have a perception of reduced masticatory ability or greater difficulty to chew[2-4,8], unilateral mastication, changes in rhythm, pattern and strength, incoordination and limitation of mandibular movements, a longer time to chew[2,3,11,12], worse efficiency or masticatory performance[1], less accurate recruitment of temporal and masseters muscles on the working and balancing sides[8,13], besides kinematic alterations and less stability of the masticatory cycles[14,15].

TMDs are a heterogeneous group of disorders affecting the masticatory system[10], which may be divided in myofascial pain, disc displacement with/without reduction, and arthralgia or osteoarthritis subgroups[4]. Patients with moderate to severe long lasting disorders reported greater difficulty in chewing foods of different textures than asymptomatic ones, especially considering those with higher consistency[8], and when comparing the various diagnostic subgroups, patients with

disc displacement (with or without reduction) reported greater difficulties in chewing than those with myofascial pain[4]. To the best of our knowledge, no study directly investigated how much chewing may be impaired in TMD cases with mild-to-moderate symptomatology, by applying validated and standardized protocols.

Although the symptoms may vary, they affect to a greater or lesser degree the choice, the intake and the pleasure of the food, so that the majority of TMD patients end up modifying their diet in function of this problem[16,17]. As food texture can affect several aspects of the masticatory process[18-20], the evaluation of the perception of patients with TMD symptoms associated or not with occlusal alterations may help understanding how the disorder changes their chewing behavior.

Regarding to the influence of occlusal changes on mastication, if on one hand a reduction in the efficiency or masticatory performance in patients with malocclusions has been evidenced[21,22], on the other, studies have shown that masticatory performance and ability were only partially dependent[1] or were not related to malocclusion[23]. Using specific subjective tests that evaluate chewing with questionnaires, patients with occlusal alterations also noticed difficulties in chewing harder foods[21], as well as patients with malocclusions seemed to overestimate their ability to chew, reporting no difficulties[22]. Thus, it is possible to question whether the changes in chewing function in the presence of TMD could be maximized/influenced by the association with occlusal changes[24-27].

The question that led to this investigation was whether changes in chewing behavior and, consequently, the ingestion of certain foods may be detectable even in patients with mild symptoms and recent TMD onset, with and without occlusal alterations. This information would bring us the possibility of an early diagnosis of the first functional changes related to TMD. Applying questionnaires to track the changes in masticatory function would allow to screen and detect individual functional alterations, providing personalized treatments, and avoiding that these modifications aggravate or perpetuate the TMD symptomatology. The objective of this study was to analyze the masticatory behavior and the perception of difficulties in food processing of young adults with mild symptoms and recent onset TMD, as well as the influence of occlusal changes on these variables.

2. Methods

The study was carried out between the years 2013-2014 at the Università degli Studi di Milano, Italy, in accordance with the ethical standards of the institutional research committee (process number 2013/CS_CPF; Dept Biomedical Sciences, Univ. Milano) and with the 1964 Helsinki declaration and its later amendments. All subjects were informed about the study and signed the Informed Consent Form.

2.1. Participants

This crossectional study included 81 subjects, aged 18-41 years (52 females), who were divided into 4 groups according to the TMD diagnosis and to their occlusal condition (normal or malocclusion): No TMD Normocclusion (n = 18), No TMD Malocclusion (n = 22), TMD Normocclusion (n = 18), TMD Malocclusion (n = 23).

For the sample selection all volunteers answered a validated questionnaire to detect the presence and to measure the severity of signs and symptoms of TMD (ProTMDmulti-part II questionnaire)[28], and were evaluated and classified according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD - Axis I)[29]. Then they answered the questionnaires regarding Jaw Functional Limitation Scale (JFLS)[5] and perception about the difficulty of chewing various foods[3]. Further, they underwent myofunctional orofacial evaluation according to the OMES protocol[30], and an analysis of their occlusal conditions.

The inclusion criteria for the following groups were:

- No TMD Normocclusion: absence of dental caries and periodontal disease, normal occlusion, and being asymptomatic for TMD, in other words, not presenting characteristic signs and symptoms of the condition and also not presenting any classification of TMD on clinical examination (RDC / TMD - Axis I)[29];
- No TMD Malocclusion: presenting malocclusion and being asymptomatic for TMD, as detailed above;

- TMD Normocclusion: absence of dental caries and periodontal disease, normal occlusion, and presenting mild severity of signs and symptoms of TMD according to ProTMDmulti-part II[28], as well as TMD classified as disc displacement (IIa or IIb groups), whether or not associated to the classification of myogenic pain (group Ia) and/or arthralgia (group IIIa) according to the RDC/TMD – Axis I[29]. The symptoms should be of recent (less than 6 months) onset;

- TMD Malocclusion: presenting malocclusion and signs and symptoms of TMD as detailed above.

For all the studied groups, the exclusion criteria were: pathologies of the neck and stomatognathic system; presence of caries and periodontal disease; history of orthodontic, speech or physical treatments in the last three years; central or peripheral neurological disorders; chronic diseases such as hypertension, diabetes, cancer; history of surgeries and/or tumors or trauma in the head and neck regions; being pregnant. Subjects who were taking analgesic, steroid, anti-inflammatory or psychotropic drugs, or those who underwent any type of TMD treatment (for ex., occlusal splints) were excluded.

2.2. Experimental settings

2.2.1. TMD Classification

The differential diagnosis and the characterization of the sample regarding TMD classification were based on the results of the clinical examination, since no imaging tests were used. The subjects were evaluated sitting in a dental chair.

A dentist specialist in TMD diagnosis performed the morphological and functional evaluation of occlusion, as well as muscles and temporomandibular joints palpation and diagnosis of TMD, according to the RDC/TMD - Axis I protocol[29].

The criteria for a normal occlusion were: presence of anteroposterior Angle Class I relationship of the lower and upper first molars; a minimum of 28 permanent teeth, overjet and overbite between 2 and 4 mm, absence of open bite, absence of unilateral posterior crossbite, low-moderate right-left asymmetry of dental arches in mesiodistal relationships, and low-moderate asymmetry of the midline[31].

The criteria for the classification of the malocclusion were based on Angle's classification (1899): subjects who presented one or more of the following conditions were considered as having

malocclusion: Angle Class II or III molar relationship, increased overjet (incisors with overjet greater than 4 mm), increased overbite (incisors overbite greater than 4 mm), anterior and/or posterior crossbite, anterior and/or posterior open bite; absence of dental elements[31-35].

2.2.2. Perception of the subjects regarding the limitation of the mandibular function

The Jaw Functional Limitation Scale (JFLS) protocol was used, which has three subscales: Chewing; Jaw Vertical Mobility; Emotional and Verbal Expression, as previously described[5]. The subjects were asked to indicate the degree of limitation of the jaw during the last month, by means of an 11-point scale, in which 0 (zero) indicated the absence of limitation and 10 the maximum limitation, that is, if activity was limited by the high degree of difficulty. The JFLS score ranges from 1 to 200 points (higher scores indicate worse mandibular function).

2.2.3. Subjects' perception regarding their chewing difficulties

The subjects were instructed to judge the degree of difficulty in chewing 9 foods of different consistencies and textures (bread, steak, rice and beans, apple, pasta, boiled potato, peanut, barbecue meat, chicken in sauce) by means of a scale of 10 points, in which 1 indicated the lowest difficulty to chew and 10 the highest difficulty[3]. The degree of difficulty to chew was obtained by the sum of the scores attributed by the subject to each food. The score ranges from 9 to 90 points (higher scores indicate greater difficulty in chewing). The test required subjects to think about the difficulties imposed by foods according to their current condition.

2.2.4. Orofacial myofunctional evaluation

The myofunctional orofacial status was evaluated according to the Orofacial Myofunctional Evaluation with Scores - OMES[30], validated for adults; according to a previously described methodology[30], the evaluation was first performed by visual inspection and complemented by analyzing recorded videos (Sony Handycam video Hi8/ccd-TRV 138). The total protocol score ranges from 32 (the worse orofacial myofunctional status) to 103 (the best myofunctional status).

According to the protocol, the evaluation of chewing comprised the following items: food bite, masticatory type, presence of other behaviors and signs of alterations, and total time for food intake. Specifically for chewing evaluation, subjects were instructed to chew a chocolate-flavored

cookie (Bono® - Nestlé, Brazil) in their usual way; they were free to divide it into how many portions they judged necessary. The total time spent to eat the cookie was measured using a digital timer (Q&Q Stop Watch HS43, Japan CBN Corp.). The grinding time of each portion was initiated when the food began to be chewed and stopped when the subject swallowed the bolus of the portion. The total time for the consumption of the cookie was calculated by the sum of the time spent for the ingestion of each portion. During the grinding of each portion, the number of chewing strokes was also counted. The masticatory frequency was calculated by dividing the total number of chewing strokes by the total time spent chewing the cookie. The percentages for the classification of the masticatory type was calculated by the sum of the numbers of strokes in each side with respect to the total number of strokes[8].

For the evaluation of the swallowing function, a glass of water and a cookie were offered to the subjects. They were instructed to place the usual amount into the mouth and then scores were assigned for the following items: lip behavior, tongue behavior, other behaviors and signs of alterations, and swallowing efficiency for liquid and solid consistencies[30].

2.3. Data Analysis

Data were statistically analyzed using SPSS 24.0 software (IBM Corp., NY, USA), considering an alpha level of 5%, by one of the authors (PMC, Applied Statistics Specialist). The exploratory statistics consisted of means, standard deviation, medians and quartiles. Normality was tested by the Kolmogorov-Smirnov test and Quantile-quantile-plot (QQ-plot) analysis.

A general linear model – Two way ANOVA – was used to test the effects of DTM and occlusion and the interaction between these factors in the observed variance of the variables under study. The effect size (partial *Eta* squared) and the power of the test for each model were also obtained and the results of Levene equality of variances test were evaluated as ANOVA's premise.

To assess the size of the differences, *Eta* partial squared statistics was interpreted as follows: values larger than 0.01 were considered small, larger than 0.06 as medium, and larger than 0.14 as large[36].

3. Results

The sample characteristics and the measures of chewing difficulties and jaw function limitation are described in Table 1. A total of 91 subjects were included, being 41 classified as presenting TMD - disc displacement (IIa); 10 subjects also presented pain complaints (myalgia and/or arthralgia).

The perception of the subjects regarding the difficulty to chew different kind of foods did not differ considering the presence of TMD and malocclusion. On the other hand, a significant *TMD* effect was observed on Jaw Vertical Mobility subscale (Two-way ANOVA: p=0.001; *Eta* partial squared =0.125; power=0.91) and Jaw Function Limitation total score (Two-way ANOVA: p=0.015; *Eta* partial squared =0.074; power=0.69), while the effects of *occlusion* and *TMD*occlusion* were not significant (p>0.05), meaning that groups differed in the perception of opening limitation and mandibular limitation according to TMD status with a medium effect size.

Table 2 shows the characteristics of the chewing and swallowing evaluation according to OMES protocol; in addition, the total chewing time and chewing frequency taken to ingest the test-food are described. TMD groups showed lower scores in OMES Chewing domain than the groups without TMD, which means that this group of volunteers showed more changes in masticatory behavior with a significant *TMD* effect and medium effect size (Two-way ANOVA: p=0.017; *Eta* partial squared=0.072; power=0.67). A significant *TMD* effect was also observed in chewing frequency, with TMD groups showing higher chewing frequency than the groups without TMD (Two-way ANOVA: p=0.042; *Eta* partial squared=0.053; power=0.53), although with a small size of the difference. No significant difference was observed in the time required to ingest the test-food (chewing time).

A significant *occlusion* effect was observed in Swallowing OMES domain (Two-way ANOVA: p=0.014; *Eta* partial squared=0.076; power=0.70), with groups of Malocclusion showing smaller scores (greater changes in swallowing function). There was no significant *TMD*occlusion* interaction effect in any of the performed analyses, meaning that the effects of these factors were independent.

4. Discussion

The main results showed that in patients with mild symptoms, the presence of TMD of recent onset seemed to impact in some degree both the perception of mandibular functioning and some clinical parameters of chewing behavior. The focus of this study was to perform an analysis of masticatory behavior in patients with mild TMD. However, considering that some authors report that chewing may be influenced by occlusal factors[21,22], occlusion was another factor considered in the statistical analysis and interpretation.

4.1. Perception of chewing difficulties and jaw limitation

The masticatory function can be described in terms of the objective analysis of food fragmentation, or subjectively, from the subjects' perception about chewing issues[37]. These two aspects allow us to describe the masticatory behavior, which in patients with TMD may vary according to the type and severity of the dysfunction and the possible limitations during mandibular movements[8,11].

Generally, individuals with poor masticatory function are more selective and report changes in the choice of food they usually ingest considering the difficulty in chewing different kinds of foods; since the symptoms vary, they also affect the intake and pleasure for food, with most patients with painful TMD modifying their diet, with consequent negative effects on their nutritional status[4,16,17,21]. By using structured questionnaires, it is possible to understand eating behavior and assess whether the subject avoids certain types of food because of its texture and consistency[38].

It has been reported that avoidance behaviors may contribute to the progression of TMD[39]. In this study, considering that most individuals presented only mild symptomatology (only 10 individuals presented symptoms of joint/muscle pain) and an impact on jaw mobility was observed, this finding shows the importance of the early identification of functional alterations to promote preventive actions, favoring a better quality of the masticatory function.

In a previous study, the masticatory capacity score was correlated with temporomandibular joint pain and mouth opening ability, but not with temporomandibular joint noise and muscle sensitivity[2]. Therefore, it is important to consider the inclusion of masticatory ability evaluation in the clinical routine of TMD patients[2] and differentiate the clinical findings among the different TMD diagnosis, considering the presence or absence of pain symptoms.

A prospective study[10] observed that changes in joint structure from normal condition to disc displacements and degenerative disease may not be perceived by patients as relevant in terms of jaw pain, function, and disability. For this reason, the data obtained with the application of the JFLS protocol were particularly useful to demonstrate which conditions of mandibular limitation were more prominent in these patients recently affected by the disorder, which agrees with the findings of the clinical evaluation (OMES). Indeed, in order to bite and grind larger and more consistent foods, respectively, greater vertical movement[20], bite force and lateral excursion of the jaw are required[40]. As described by Le Révérend et al.[19], modifying food textures, even within the same "food family", would influence masticatory behavior.

Therefore, for rehabilitation and self-management treatment of TMD, the type of food to be chosen should be considered[4], allowing those functional condition more suited to each patient and avoiding overload of the stomatognathic structures. In this sense, it should be considered that a light diet should be recommend together with detailed information about its composition in nutrients and how to prepare certain foods (such as meat, vegetables, and bread) in order to help the patients avoid greater changes in their diets[16]. However, dietary and nutritional guidance in TMD has been highlighted as an area of difficulty in TMD management[41].

4.2 Orofacial myofunctional findings

Patients with moderate to severe TMD may have altered orofacial motor control, which includes but doesn't limit chewing aspects[8]. The results of this study seem to confirm this tendency, since those patients with mild TMD symptomatology showed some changes in masticatory behavior but not major myofunctional alterations, as observed using the OMES protocol. This understanding is important in directing therapeutic strategies that are more appropriate to the type and severity of TMD and the myofunctional changes present in each case.

In healthy subjects, different muscle groups and elemental motor functions are recruited in different ways during food intake, even when the physical characteristics of food are similar[19]. It is also possible that depending on the individual biomechanics and the severity of TMD, there may be greater or lesser compensations during the masticatory process, which result, for example, in the need to keep the grinding on one side or increasing the number of chewing cycles to ingest the food. The latter could be a hypothesis for the finding of increased masticatory frequency in TMD groups, i.e., individuals with TMD required more chewing cycles to ingest the test-food, which could be interpreted as a strategy to maintain homeostasis and complete the chewing task, as

reported Shimada et al.[9], even considering that the observed effect size was small. In contrast, previous studies found no difference between TMD individuals and control ones regarding masticatory frequency[8,42].

Corroborating previous studies[22,23,43], the present study did not observe a significant effect of occlusion on masticatory parameters, neither an interaction between TMD and occlusion, which means that both factors are independent in the influence on mastication. The etiological importance of occlusal changes in both masticatory behavior and TMD development should be viewed with caution, since muscular resistance to overload may be more important than the presence of certain types of malocclusions[44]. At the same time, major changes in the number of occlusal contacts and dental absences seems to have a great impact on masticatory performance[1,21,23,37]. In this study, all subjects had all teeth and did not present major (skeletal) malocclusions, which may be the reason why no significant occlusion effect was observed on masticatory objective and subjective parameters.

According to Gameiro et al.[22], patients with malocclusion are probably unaware of their reduced masticatory capacity, thus swallowing larger food particles. Coherently, in the present study, occlusion had an effect on swallowing, but not on mandibular limitation judgments and difficulty in chewing. It should also be considered that the same occlusal features may derive from different causes, or even develop at different times. This, in turn, may cause different patient adaptations to the altered condition, and, therefore, there is a need for clinical evaluation to associate morphology with function. Thereby, it is suggested to be aware of some indicative signs of possible future imbalances in milder cases, which may, in turn, be a risk to health and functional balance of the stomatognathic system.

The results showing reduction of the vertical mobility score and total JFLS score, as well as more changes in masticatory behavior and increased masticatory frequency, may be an indicative of impairments on masticatory function associated to mild symptoms of TMD of recent onset. That's why the restoration of the masticatory ability is important in the treatment of TMD[2].

Among the limitations of this study it is possible to mention that no imaging procedure was used to characterize the joint status, which could validate the diagnosis, showing a joint disc impairment. Another limitation may be related to how we characterized occlusal alterations. Perhaps if the number of contacts and occlusal interferences had been considered, the effect of the occlusal condition on masticatory behavior could emerge and justify some changes in this process. Furthermore, almost all results showed medium effect size, the power of the test found was lower than the desirable (0.80 or greater); this indicates that the sample was smaller than the

needed, thus limiting the generalization of results.

Although the cross-sectional design of this study does not allow us to establish if the characteristics found developed before or after the onset of TMD, such an in depth characterization of the masticatory behavior is important for a more precise description of the masticatory process and how much it is influenced by the TMD in the presence or absence of occlusal changes. This may be useful for diagnosing functional changes that may maintain or aggravate TMD symptoms, and for establishing an early functional intervention plan.

5. Conclusion

The presence of mild and recent onset TMD influenced the patients' chewing behavior, which was reflected in their perception of mandibular limitation, as well as in the clinical parameters of the mastication. Although occlusion did not influence the masticatory behavior, they may have an effect on swallowing.

Ethical approval: All procedures were noninvasive and not painful, and were made in accordance with the ethical standards of the institutional research committee (process number 2013/CS_CPF Dept biomedical sciences Univ Milano) and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

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Table 1. Sample characteristics according to demographic data and measures of chewing difficulties and Jaw Functional Limitation Scale (JFLS): a Two-way ANOVA analysis

	n	Sex	Age (years)	Chewing difficulties score	JFLS Mastication score	JFLS Vertical Jaw Mobility score	JFLS Emotional and verbal expression score	JFLS total score
		male/female	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
No TMD Normocclusion	18	7/11	21.61 (4.95)	17.89 (9.62)	4.78 (6.30)	3.50 (6.30)	1.78 (4.37)	10.06 (16.14)
No TMD Malocclusion	22	9/13	21.00 (2.69)	15.56 (6.11)	2.77 (4.03)	2.50 (4.19)	1.05 (2.95)	6.32 (8.74)
TMD Normocclusion	18	3/15	20.50 (2.53)	19.06 (8.29)	6.72 (7.09)	9.67 (8.49)	2.06 (3.62)	18.44 (15.17)
TMD Malocclusion	23	10/13	21.00 (3.07)	19.26 (10.54)	6.30 (7.84)	6.43 (7.69)	1.39 (2.62)	14.13 (16.78)
TMD effect		p-value	0.466	0.097	0.062	**0.001**	0.682	**0.015**
Occlusion effect		p-value	0.942	0.329	0.405	0.169	0.359	0.221
*TMD*occlusion interaction effect*		p-value	0.466	0.281	0.585	0.466	0.964	0.930
F[†]		-	0.324	1.787	1.606	4.328	0.340	2.557
Eta partial squared[†]		-	0.012	0.065	0.059	0.144	0.013	0.091
Power[†]		-	0.112	0.448	0.407	0.851	0.113	0.609

[†] Two-way ANOVA corrected model

SD, standard deviation

P values in bold are significant ($p < 0.05$)

Table 2. Total chewing time and frequency and measures of swallowing and chewing functions according to Orofacial Myofunctional Evaluation with scores (OMES protocol): a Two-way ANOVA analysis

		n	OMES Swallowing	OMES Chewing	Chewing time (s)	Chewing frequency (cycles/s)
No TMD Normocclusion	***Mean (SD)***	18	14.17 (0.92)	9.17 (0.86)	31.23 (9.29)	1.22 (0.20)
No TMD Malocclusion	***Mean (SD)***	22	13.59 (1.47)	9.41 (0.80)	31.37 (7.47)	1.30 (0.18)
TMD Normocclusion	***Mean (SD)***	18	14.11 (0.83)	8.50 (1.20)	33.94 (11.51)	1.42 (0.51)
TMD Malocclusion	***Mean (SD)***	23	13.43 (1.04)	8.96 (1.19)	32.70 (7.96)	1.39 (0.25)
TMD effect	p-value	-	0.672	**0.017**	0.321	**0.042**
Occlusion effect	p-value	-	**0.014**	0.132	0.788	0.744
*TMD*occlusion interaction effect*	p-value	-	0.840	0.643	0.736	0.390
F[†]	-	-	2.205	2.740	0.368	1.597
Eta partial squared[†]	-	-	0.079	0.096	0.014	0.059
Power[†]	-	-	0.539	0.643	0.119	0.404

[†] Two-way ANOVA corrected model

SD, standard deviation

P values in bold are significant ($p < 0.05$)