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Original Article

Artigo Original

Influence of generalized joint hypermobility on temporomandibular joint and dental occlusion: a cross-sectional study

Influência da hipermobilidade articular generalizada sobre a articulação temporomandibular e a oclusão dentária: estudo transversal

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Keywords

Joint Instability
Temporomandibular Joint
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ABSTRACT

Purpose: To evaluate the dental occlusion and temporomandibular joint in women with and without generalized joint hypermobility. **Methods:** Generalized joint hypermobility was assessed by the Beighton score. Individuals were divided into two groups: with and without hypermobility. The Research Diagnostic Criteria for Temporomandibular Disorders was used to evaluate the temporomandibular joint. Dental occlusion was assessed according to Angle classification, overjet and overbite measures, presence of open bite or crossbite, pattern of disocclusion, and occlusal interference. **Results:** Forty-three women participated voluntarily in the study: 17 in the group with hypermobility and 26 in the group without hypermobility. The frequencies of joint noise and deviation during mouth opening were greater in the hypermobility group (52.9% vs. 38.5% and 76.5% vs. 50%, respectively), but without statistical significance. None of the volunteers presented ideal occlusion and no significant difference was found in Angle Class between the groups. The hypermobility group presented a higher percentage of changes in occlusion (29.4% of overbite, 47.1% of overjet, and 17.6% of crossbite), with crossbite showing statistical difference between the groups. **Conclusion**: Hypermobility does not influence occlusion and range of mandibular motion in the women assessed. Nevertheless, the higher percentage of articular noise and uncorrected deviation during mouth opening shown by the group with hypermobility, even without statistical difference, may constitute evidence of correlation between hypermobility and temporomandibular disorder.

Descritores

Instabilidade Articular
Articulação Temporomandibular
Oclusão Dental
Má Oclusão
Mulheres

RESUMO

Objetivo: Avaliar a oclusão dentária e a articulação temporomandibular de mulheres com e sem hipermobilidade articular generalizada. **Método:** A hipermobilidade foi avaliada pelo Escore de Beighton, e as voluntárias foram distribuídas, conforme o escore obtido, em dois grupos: com e sem hipermobilidade. A articulação temporomandibular foi avaliada por meio do instrumento Critérios de Diagnóstico para Pesquisa de Desordens Temporomandibulares, e a avaliação oclusal compreendeu a classificação de Angle, presença de sobremordida, sobressaliência e mordida cruzada, padrão de desoclusão e interferências oclusais. **Resultados:** 43 mulheres participaram voluntariamente da pesquisa, 17 no grupo com hipermobilidade e 26 no grupo sem hipermobilidade. A frequência de ruídos articulares e de desvio na abertura da boca foi maior no grupo com hipermobilidade (52,9% versus 38,5% e 76,5% versus 50%, respectivamente), sem diferença significativa. Quanto à oclusão, nenhuma voluntária apresentou uma oclusão ideal e não se verificou diferença significativa na Classe de Angle entre os grupos. As alterações na oclusão obtiveram percentual maior no grupo com hipermobilidade (29,4% de sobremordida, 47,1% de sobressaliência e 17,6% de mordida cruzada), sendo que a mordida cruzada apresentou diferença estatística entre os grupos. **Conclusão:** A hipermobilidade não influenciou a oclusão e as amplitudes de movimentos mandibulares nas mulheres avaliadas. Contudo, o maior percentual de ruídos articulares e de desvio não corrigido apresentado pelo grupo com hipermobilidade, mesmo sem diferença entre os grupos, pode constituir um indício de relação entre hipermobilidade e disfunção temporomandibular.

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INTRODUCTION

Generalized joint hypermobility (GJH) is an extreme variation of normal articular mobility in most of the joints. It is considered a benign, non-pathologic phenomenon[1-3]. GJH is characterized by increased joint mobility during active and passive movements. It occurs owing to changes in the collagen that composes the conjunctive tissues of the body[3,4].

This structural defect in collagen leads to alteration of the ligaments, making them lax and increasing joint mobility[1]. As a result, ligament laxity provides low afferent regulation to muscle stretch receptors, reducing proprioception and joint stability. Moreover, it is known that the components present in the connective tissue, such as collagen, fibrils, elastin, and proteoglycans, act together and provide mechanical and proprioceptive properties to the articular capsule, ligaments, and tendons[5].

It is believed that GJH decreases markedly during childhood and more slowly during adulthood. Regarding gender, women generally exhibit a wider range of motion compared to that of men. With respect to ethnicity, Asians present more mobility than Africans, who, in turn, are more mobile than Caucasians[3,4,6].

Considering the characteristics of GJH, it is suggested that such manifestation affect all articulations, including the temporomandibular joint (TMJ). Several studies report GJH as a risk factor for the development of signs and symptoms of temporomandibular joint dysfunction (TMD)[7-10]. Due to ligament laxity and, consequently, to impaired proprioception, it is believed that the TMJ be overloaded, resulting in degenerative changes that can be observed in internal derangements and articular inflammation[9-11].

In addition to GJH, oromyofacial disorders may also disrupt the function of the TMJ or be manifested as a result of TMD. Nociceptive stimuli arising from occlusion and/or TMJ can cause muscular compensatory behaviors, such as changes in the appearance, posture and mobility of lips, tongue, jaw and cheeks, and in the functions of the stomatognathic system[12].

Although GJH is often addressed in research involving TMJ, there are few studies investigating occlusion in these patients[11]. The relationship between occlusion and GJH can be attributed to the fact that joints and bones participate in the fragility of the conjunctive tissue present in GJH[5].

Dental occlusion is a complex formed by the mandible, maxilla, TMJ, and the elevator and depressor muscles of the jaw[13]. Normal occlusion is characterized by the harmony of this complex[14], and maintaining occlusal balance is essential to the proper functioning of the masticatory system[15].

Malocclusion is defined as an abnormal relationship between the teeth and the dental arch, which assume an undesirable contact with the elements of the opposite arch[13]. It also comprises all deviations in the normal alignment of the teeth, maxilla, and mandible, such as poor individual position of teeth and osteodental discrepancy[16].

The movement pattern and position of the mandible are determined by dental occlusion. Thus occlusal instability may trigger an overload of the masticatory system and damage the TMJ[17].

Traditionally, dental occlusion is considered a possible determinant factor in the etiology of TMD[18]; however, results from a large longitudinal study[19], conducted with 7008 individuals aged 20 to 79 years, show no correlation between occlusal factors and TMD symptoms, with normal occlusion presenting similar prevalence for individuals with and without TMD.

Based on what has been previously exposed, the present study suggests the hypothesis that the presence of GJH can influence the dental occlusion and TMJ of women. The evaluation of these variables by comparing women with and without GJH is proposed to investigate this hypothesis.

METHODS

This is an observational, cross-sectional, controlled, quantitative study conducted at the Orofacial Motricity Laboratory of the Speech-language Pathology Service (SAF-UFSM) and at the Outpatient Clinic of Prosthodontics and Occlusion of the Odontology Course of the Federal University of Santa Maria - UFSM, Santa Maria, Rio Grande do Sul state, Brazil.

This study was part of the Cranio-cervico-mandibular System project, with multifactorial diagnostic and therapeutic approach, which was approved by the Research Ethics Committee of the aforementioned institution under the protocol no. 23081.019091/2008-65, according to the resolution no.196/1996.

Inclusion criteria were as follows: female gender, considering that women present greater range of mandibular motion than men[3,4,6]; age range between 18 and 35 years; no complaint of TMJ pain; and the signing of an Informed Consent Form.

The following exclusion criteria were considered: dental losses (more than two teeth - except third molar); use of dental prostheses; signs of psychomotor impairment; malformations, tumors, surgery, or trauma in the head and neck; previous or current speech-language therapy and/or physiotherapy treatment in the area of orofacial motricity; TMJ pain symptoms; and oral breathing.

Data collection occurred according to the flowchart presented in Figure 1.

The presence of GJH in the volunteer participants was assessed by a physiotherapist according to the criteria by Carter and Wilkinson, modified by Beighton (Beighton score)[6]. This instrument assesses some joints in the body bilaterally through five tests (Figure 2)[10], assigning one point for each positive outcome. The scale score ranges from zero to nine points (0-9), with a score ≥ 4 points indicating GJH. Based on this score, the volunteer participants were divided into two groups: group with GJH - study group (SG) and group without GJH - control group (CG).

Clinical examination was conducted according to the Axis I protocol of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[20]. This test allows evaluation of the presence of pain on palpation and in the jaw movements, joint mobility (opening, right and left lateral excursions, and protrusion), presence of mandibular deviation, and verification of joint noise during mandibular motion. It also allows for the generation of TMD diagnoses (myofascial pain, disc displacement and/or arthralgia, osteoarthrosis, and osteoarthritis).

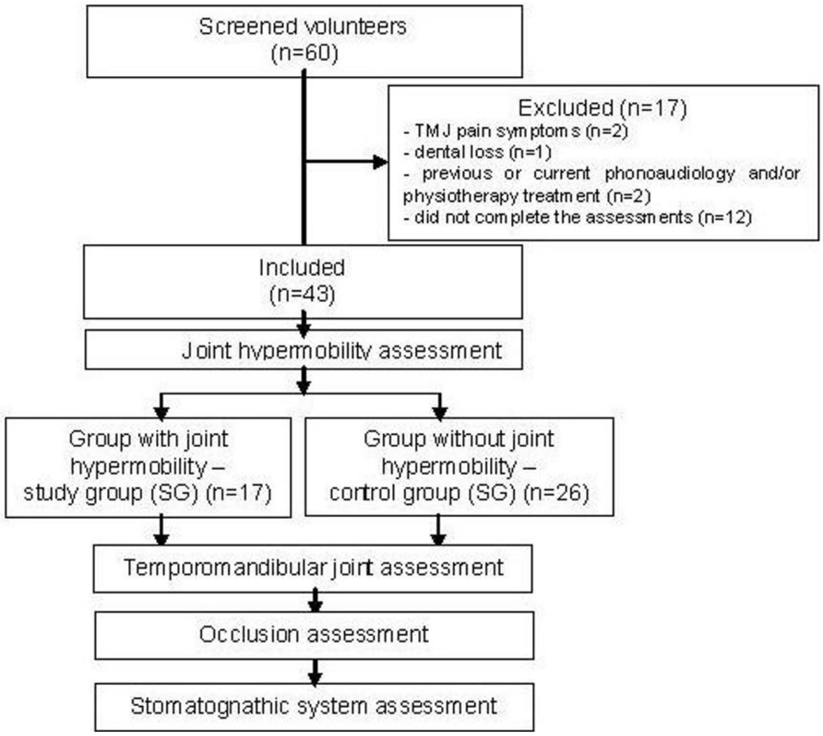

Figure 1. Flowchart of data collection

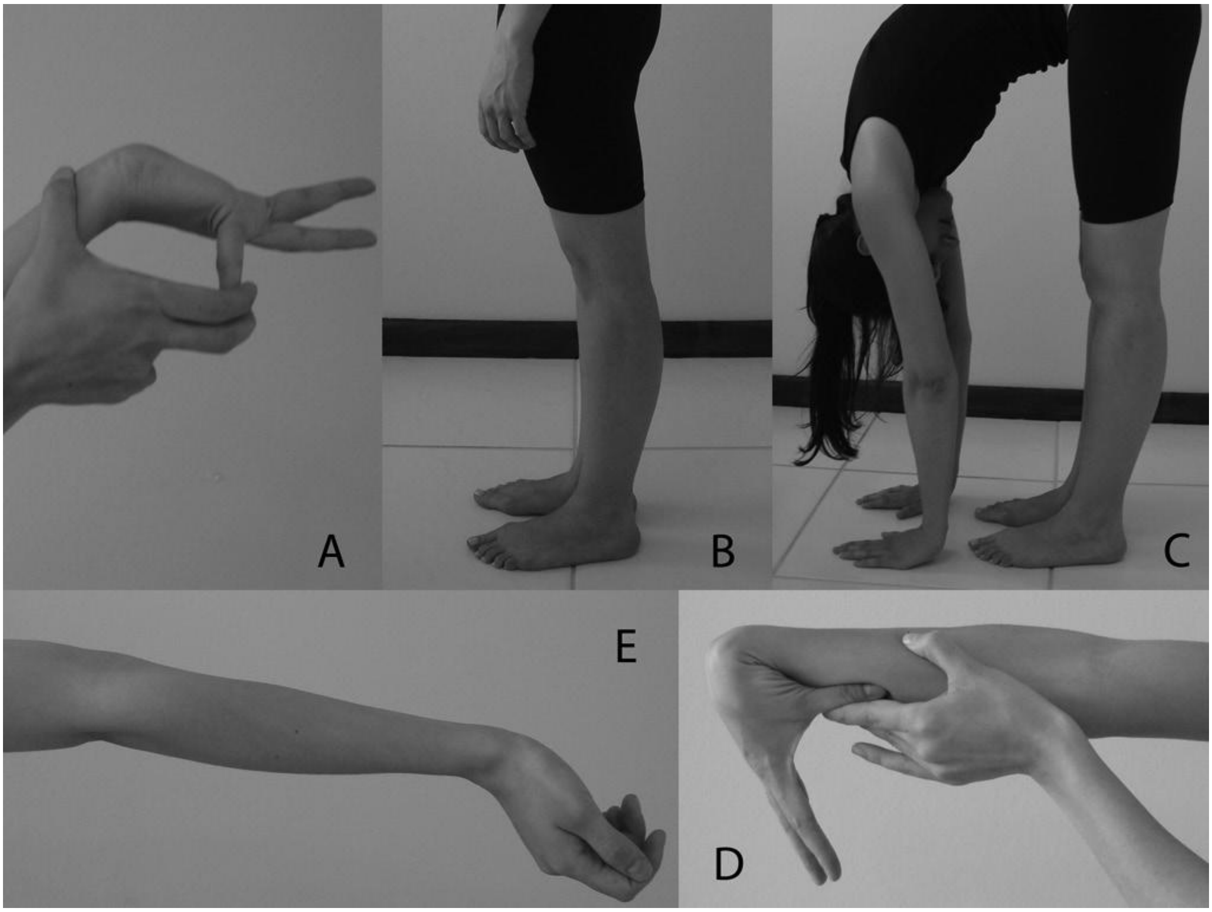

Figure 2. Beighton score. A) passive dorsiflexion of the fifth finger, so that it is parallel with the flexor aspect of the forearm; B) ability to hyperextend the knee beyond 10º; C) forward flexion of trunk, so that the individual is able to place their palms on the floor with knees fully extended; D) passive thumb dorsiflexion to the flexor aspect of the forearm; E) ability to hyperextend the elbow beyond 10º. Source: Pasinato et al.[10]

The instrument was applied by a trained physiotherapist aiming at evaluating the aspects that could be influenced by GJH, such as opening pattern, range of mandibular motion, and the presence of joint noise. For the assessment of occlusion, which was conducted by faculty members of the Odontology Course of UFSM, performance of orthodontic and/or occlusal treatment was questioned and the Angle classification, presence of overbite, overjet and crossbite, pattern of disocclusion, and occlusal interferences were verified.

The study participants were evaluated while sitting in a dental chair with 110° inclination, first with respect to the molar key of occlusion, which was characterized as ideal occlusion and Class I, II, or III malocclusions[21,22].

The overbite and overjet measures were also verified with the teeth occluded. Overbite was characterized when the tips of the upper incisors and canines covered more than a third of the crown length of the lower incisors. Overjet was measured horizontally from the lower incisor to its antagonist, and it was considered when this value was greater than two millimeters. Crossbite was classified as absent or present[18,22-24].

To characterize the pattern of disocclusion and occlusal interferences, participants were requested to perform mandibular protrusion and lateral excursions, and the contact spots were marked[19].

Statistical analyses were performed using the software Statistica 9.0 for Windows. The Student's t test, Chi-square test, and Fisher's exact test were used to determine differences between the groups. Statistical significance level of 5% (p=0.05) was adopted for all analyses.

RESULTS

Sixty volunteer participants were interviewed to conduct this research, but only 43 fulfilled the inclusion criteria and completed the assessments. Participants were divided into two groups according to their Beighton scores: group without generalized joint hypermobility (GJH) – control group (CG), composed of 26 women (60.5%) aged 23.3±4.9 years; and group with GJH – study group (SG), comprising 17 women (39.5%) aged 23.5±4.4 years.

Table 1 shows the measures for range of mandibular motion evaluated according to the Axis I protocol of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) instrument. No significant difference was found for values between the groups.

The other variables concerning TMJ assessment are presented in Table 2. Higher percentages of uncorrected lateral deviation and articular noise were observed in the SG, but no statistically significant differences were found between the groups.

No statistical difference was observed regarding the frequency of orthodontic and/or occlusal treatment between the groups (50% *vs*. 52.9%, for the CG and SG, respectively), as well as for treatment time (2.8 years in both groups).

Table 3 shows the Angle classification of dental occlusion, in which no significant difference was found between groups. There were no statistically significant differences between groups with respect to pattern of disocclusion and occlusal interferences during mandibular movements, with 53.9% and 70.6% of participants not presenting occlusal interferences in the CG and SG, respectively (Figure 3).

Table 1. Mean and standard deviation of range of mandibular motion in the control (CG) and study (SG) groups

Range of mandibular motion	CG		SG		p
	Mean (mm)	SD	Mean (mm)	SD	
Maximal opening without assistance	49.5	5.5	49.9	4.3	0.50
Maximal opening with assistance	51.5	5.5	51.7	4.5	0.62
Right lateral excursion	9.4	2.2	10.5	2.2	0.21
Left lateral excursion	8.9	1.8	9.0	3.1	0.64
Protrusion	5.8	2.0	5.8	1.9	0.95

Caption: CG = control group (without generalized joint hypermobility); SG = study group (with generalized joint hypermobility); SD = standard deviation. Student's t-test

Table 2. Mouth opening pattern and articular noise in the control (CG) and study (SG) groups

	Corrected lateral deviation n (%)	Uncorrected lateral deviation n (%)	p	Articular noise n (%)	p
CG	10 (38.5)	3 (11.5)	0.56	10 (38.5)	0.08
SG	6 (35.3)	7 (41.2)		9 (52.9)	

Caption: CG = control group (without generalized joint hypermobility); SG = study group (with generalized joint hypermobility). Chi-square test (categories were reclassified for the test application)

Table 3. Distribution of the occlusion classification between the control (CG) and study (SG) groups

	Class I n (%)	Class II n (%)	Class III n (%)	Total n (%)	p
CG	21 (80.8)	2 (7.7)	3 (11.5)	26 (100)	0.47
SG	11 (64.8)	3 (17.6)	3 (17.6)	17 (100)	

Caption: CG = control group (without generalized joint hypermobility); SG = study group (with generalized joint hypermobility). Chi-square test

Table 4. Frequency, mean, and standard deviation of vertical, horizontal, and transversal occlusal changes in the control (CG) and study (SG) groups

	Overbite		Overjet		Crossbite
	n (%)	M±SD (mm)	n (%)	M±SD (mm)	n (%)
CG	3 (11.5)	3.1±1.6	9 (34.6)	2.9±1.2	0 (0.0)
SG	5 (29.4)	3.9±0.9	8 (47.1)	3.0±0.9	3 (17.6)
p	0.14	0.78	0.41	0.06	0.05*

Caption: CG = control group (without generalized joint hypermobility); SG = study group (with generalized joint hypermobility); M: mean; SD = standard deviation. Student's t-test to compare means between the groups. Chi-square test for the frequencies of overbite and overjet
*Statistically significant (Fisher's exact test)

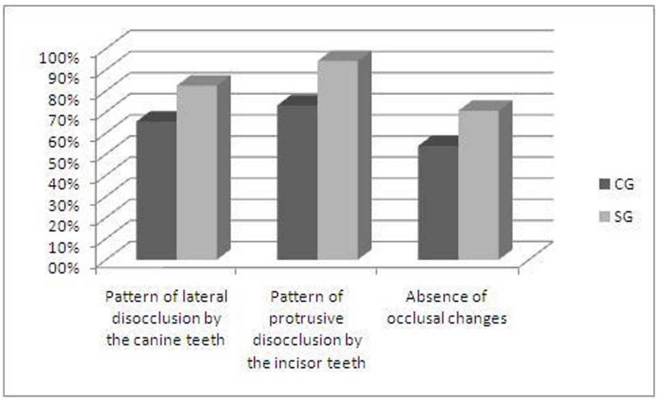

Figure 3. Evaluation of the patterns of disocclusion of participants. CG: control group (without generalized joint hypermobility); SG: study group (with generalized joint hypermobility)

Most of the volunteer participants presented adequate Angle class I and pattern of disocclusion; however, they showed other characteristics for malocclusion diagnosis such as vertical (overbite), horizontal (overbite), and transverse (crossbite) changes. Overbite and overjet were observed in both groups, with higher means and percentages in the SG, but no significant differences. Crossbite was observed only in the SG, with significantly higher frequency compared with that of the CG (Table 4).

DISCUSSION

Normal values for range of mandibular motion were observed in the women investigated in this study during TMJ assessment[25], with no statistically significant differences between the control (CG) and study (SG) groups. This result corroborates that of a recent study[10], conducted with 34 women in the same age range (from 18 to 35 years), which also reported no difference in the range of mandibular motion of participants.

Still with respect to TMJ assessment, the volunteers from both groups presented articular noise in the mandible movements and deviation during mouth opening; however, noise and uncorrected lateral deviation were more frequently found in the SG. These signs indicate a possible reduction of proprioception, that is, afferent regulation to muscle stretch receptors owing to ligament laxity. This aspect should be carefully observed in patients with generalized joint hypermobility (GJH), considering that reduction in proprioception can cause hyper-translation of the condyles, generating articular noise and, possibly, internal derangements and joint inflammation[9-11]. This topic has been addressed in previous studies[7-10] that reported GJH as a risk factor for the development of TMD signs and symptoms.

Regarding the correlation between occlusion and GJH, it is assumed that the joints and bones participate in the fragility of the connective tissue present in GJH[5,26].

A study[11] investigated occlusion in individuals with GJH and found higher percentages of Angle Class II and crossbite in comparison with the control group. Contrary to that research, in this study, most of the volunteer participants presented Angle Class I malocclusion; however, slightly higher percentages of Classes II and III were found in the SG, but with no significant difference compared with the CG. In addition to the classification proposed by Angle, some authors consider that ideal occlusion should include pattern of lateral disocclusion by the canines, pattern of protrusive disocclusion by the incisors, absence of occlusal interferences during mandibular motion[15], and normal overbite and overjet. According to these criteria, none of the volunteer participants of both groups presented ideal occlusion in this study, although half of them had already undergone previous orthodontic and/or occlusal treatment.

Few occlusal interferences were found in the study participants. These interferences in protrusive movements are undesirable because they may result in morphological changes in the TMJ internal structure in relation to the configuration, position, and function of the articular disk[27].

The occlusal assessment showed higher frequency of crossbite in the SG, but only in three volunteers. This finding should be interpreted cautiously, considering that this alteration may have occurred due to the absence or recurrence of previous orthodontic and/or occlusal treatment.

Crossbite must be treated early to avoid negative long-term effects on the growth and development of facial teeth and bones[28], in addition to being a risk factor for the development of TMD symptoms[11]. A study found higher frequency of crossbite in patients with disk displacement and increased overjet and decreased overbite in patients with osteoarthrosis[29].

In the present research, overbite and overjet were observed in both groups, with a slight increase in the SG, but with no significant difference. Increased overbite and overjet would be responsible for increasing the load on the masticatory muscles; however, the direct association between TMD and abnormal occlusion remains controversial. Researchers[18] investigated 103 individuals with and without TMD and did not find a correlation between TMD and the presence of occlusal changes.

The presence of joint noise in the volunteer participants of this study seems to have occurred owing to occlusal changes, but no association between these variables was found. Although the participants of both groups did not differ with regard to occlusion, investigation of the presence of GJH should to be included in the assessment of health professionals considering that it can be very simply performed. Knowledge on the influence of GJH collaborates with clinical practice, because articular instability can hinder the maintenance of orthodontic and myofunctional therapeutic results. Physiotherapy can minimize the effects of ligament laxity through muscle strengthening, enhancing neuromuscular coordination and restoring joint stability.

The clinical practice shows that orthodontic treatment is longer and more recurrent in patients with GJH. Nevertheless, it was not possible to conduct this analysis objectively because of the variability of methods and duration of treatment. Because of such limitations, the findings of this survey indicate a need for further studies to elucidate them, particularly regarding the monitoring of therapeutic outcomes in these patients.

Other limitations of this study regard the fact that it did not use a specific method to evaluate occlusion. Such an instrument should be validated and include all aspects related to occlusion (molar key; presence of transverse, horizontal, and vertical changes; pattern of disocclusion; occlusal interferences). Also, previous orthodontic and/or occlusal treatment may have been a confounding factor in this assessment and it should be an exclusion criterion in further research.

CONCLUSION

Under the experimental conditions of this study, we conclude that generalized joint hypermobility (GJH) did not influence dental occlusion and range of mandibular motion in the women assessed.

In the Angle class assessment, both groups showed predominance of Class I, although none of the volunteers presented ideal occlusion. Vertical, horizontal, and transversal changes were observed in both groups. The higher percentage of articular noise and uncorrected deviation verified in the study group, even without statistical difference, may constitute evidence of the correlation between GJH and temporomandibular disorder.

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Author contributions

LC was responsible for the research, collection and analysis of data, and writing of the manuscript; ABP and TSM were responsible for the collection and analysis of data; AMTS contributed to the speech and language pathology aspects of the study and revision of the manuscript; ECRC was the study advisor and contributed to the writing of the manuscript.