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Prevalence of temporomandibular disorder and its relation with plantar pressures in university students of health-related courses

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ABSTRACT

Background: The temporomandibular disorders (TMD) are changes that occur at the structures that compose the temporomandibular joint. Changes in the temporomandibular complex provoke adaptations throughout the muscular system, which generate postural alterations, modifying the body biomechanics and interfering with their body alignment. **Objective:** To verify the prevalence of TMD in university students, and to analyze the plantar pressures of subjects with and without TMD. **Methods:** This research was approved by the Ethics Committee with number: 2.407.595. The 68 students of physiotherapy and dentistry courses were evaluated through the "Research Diagnostic Criteria for Temporomandibular Disorders" and through baropodometry. Plantar pressures of students were compared using the Mann-Whitney test. **Results:** 71% of the university students presented some type of TMD. Most subjects with TMD presented their pressure center located in the hindfoot contralateral to the disorder. **Conclusion:** There was no significant difference ($p \geq 0.05$) between the plantar pressures of the students with and without TMD.

Keywords: Temporomandibular Joint; Temporomandibular Joint Disorders; Posture.

INTRODUCTION

Temporomandibular Joint (TMJ) is part of the stomatognathic system and is located bilaterally between the skull and mandible in the individuals. It is considered the most active joint of the human body, composed of internal and external structures that allows it to perform complex movements. Several functions of the human body, such as chewing, phonation, swallowing and posture, are directly related to the stability and correct functioning of the TMJ[1,2]. The changes that occur in the level of the structures that compose the TMJ generate the Temporomandibular Disorders (TMD)[3], which encompasses conditions such as myofascial, sensory or joint changes[4,5]. TMD is considered a complex disorder in which the joint, teeth, nerves, masticatory muscles, ligaments, or even these combined structures may be involved in their clinical manifestations[6]. It is a condition of multifactorial etiology, in which there is an interrelation between psycho-behavioral, occlusal and neuromuscular factors[7]. It presents prevalence between 3 and 15% of the population, and among orofacial pain, it is the second most found disorder in the population[8], and women are more likely to have TMD[9]. The symptoms of TMD include orofacial pain, headache, ear pain, joint pain, and also some signs as muscle and TMJ sensitivity. Limited or uncoordinated movement, jaw deviation during opening of the mouth, noise or cracking of the joint, teething wear and dislocation are also frequent in patients with TMD due to the presence of parafunctional habits[10].

Currently, for the diagnosis of TMD, the "Research Diagnostic Criteria for Temporomandibular Disorders" (RDC/TMD), published by Dworkin and Leresche (1992)[11], stands out and it is considered the best structured evaluation tool available in the literature, gold standard and reference in TMD surveys, allowing standardization for data collection and comparison of findings from different studies[12]. The changes in the TMJ cause adaptations throughout the musculoskeletal system, generating postural alterations, modifying the body biomechanics of the subject, and interfering in their body alignment[13]. Some published studies show correlations between TMD and type of occlusion, head anterioration, craniofacial dimensions and postural imbalance[14-16]. Therefore, changes in TMJ may interfere with body alignment and vice versa[13]. Baropodometry is an examination performed on a platform composed of sensors, and allows us to perform a postural evaluation, assessing the distribution disorders and plantar pressure, and it is considered as a reliable technological tool for analysis of lower limbs and choice of appropriate

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treatment[17]. In view of the above, the aim of this study was to verify the prevalence of TMD and to analyze and compare the plantar pressures of university students with and without TMD.

METHODS

Descriptive cross-sectional study, in which were included students of both sexes from the Physiotherapy and Dentistry courses of the Center for Health Sciences of the Universidade Estadual do Norte do Paraná, Jacarezinho, Paraná, Brazil. 76 students agreed to participate in the study. Based on the exclusion criteria, 68 students remained in the study. The exclusion criteria were: subjects under orthodontic treatment, TMD treatment, pregnant or breastfeeding. The participants were informed about the study procedures, and after explanation and solving doubts, they signed the Informed Consent Form (ICF). In cases of minors, the students signed the assent term and the ICF was sent to the person responsible to authorize participation in the research. The project was approved by the Committee of Ethics and Research with Human Beings, with number: 2.407.595.

After signing the ICF, all students were evaluated in a single moment by a single evaluator. For the diagnosis of TMD, the RDC/TMD was used, which consists of two axes: the axis 1 is aimed at the physical diagnosis of muscle or joint disorders of the TMJ, including joint sounds, muscle and joint palpation, joint amplitude measurement, and axis 2 that evaluates behavioral, psychological and psychosocial factors through a self-administered questionnaire[11]. The possible diagnoses that RDC/TMD provides for TMD are myofascial pain, myofascial pain with opening limitation, disc displacement with or without reduction, disc displacement without reduction and with opening limitation, osteoarthritis, osteoarthrosis and arthralgia[11]. As determined by the questionnaire to verify the presence of clicks, noises or pain in the TMJ, the palpation was performed[11]. For measurements of mandibular movements and deviations during the RDC/TMD evaluation, was used the Digital Westerns PRO® Pachymeter, and to perform the pressures was used the Wagner Pain Test™ FPK/FPN Algometer. Pressure algometry consists of a technique that quantifies the physiology of the nociceptive system, aims to estimate the subject's ability to perceive and tolerate pain through physical stimuli[18]. On the same day, after the RDC/TMD evaluation, it was performed the evaluation of the plantar pressures through the FootWork Arkipelago® baropodometer (Arkipelago Ind. Com. Ltda, São Paulo (SP), Brazil), allowing the observation of postural alteration, weight discharge and center of gravity of the participants. The participant was advised to climb on the platform, stripped of shoes and socks, in a standing position, and remain static, with feet parallel and apart at hip height, upper limbs relaxed and head in neutral position with physiological mandibular position, looking forward to a fixed point at 1 meter distance. Three static evaluations were performed for a greater reliability, with duration of 20 seconds each, and for analysis was used the average of the 3 evaluations[19].

Statistical Analysis

Statistical analysis was conducted by the BioEstat 5.3 software. The shapiro-wilk normality test was performed, and the data were considered non-normal, being expressed as median and interquartile range. The non-parametric Mann-Whitney test was used to compare plantar pressures between the two groups, subjects with TMD and no TMD. The statistical significance adopted was $p \leq 0.05$.

RESULTS

The median age of the 68 volunteers was 20 [17-31] years, with 57 females and 11 males. Regarding the clinical diagnosis of signs and symptoms of TMD, shown in Figure 1, a large part of the sample presented TMD.

Of the 71% who were diagnosed with TMD, the vast majority had arthralgic-type TMD (in the joint), followed by mixed (myofascial and arthralgic), as we can see in the Figure 2.

Table 1 shows the distribution of the plantar pressures between the foot regions of subjects with and without TMD. According to statistical analysis performed through the Mann-Whitney test to compare the plantar pressures of university students with TMD and without TMD, there was no significant difference ($p>0.05$).

Table 2 shows that the majority of the subjects with TMD had both sides affected, being classified as lateral. It also has

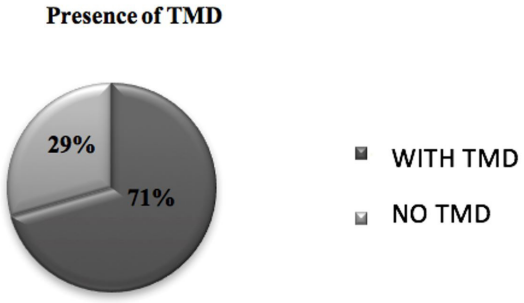

Figure 1. Analysis of the students who had Temporomandibular Disorder.

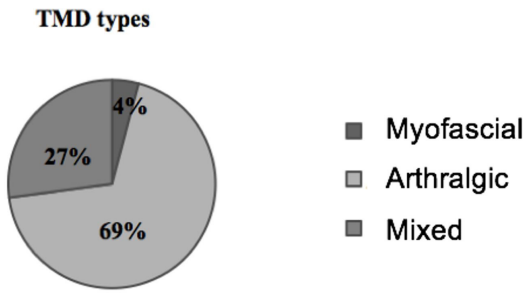

Figure 2. Analysis of the classification of Temporomandibular Disorder types found.

Table 1. Plantar pressures

DISTRIBUTION OF PLANTAR PRESSURES (%)				
	RF	LF	RH	LH
With TMD	20.91±5.82	19.54±6.03	29.08±6.81	30.24±7.42
No TMD	21.25±4.72	18.28±2.77	29.94±6.53	30.50±5.67
Value of p	0.845	0.813	0.962	0.518

Note: RF: Right Forefoot; LF: Left Forefoot; RH: Right Hindfoot; LH: Left Hindfoot. TMD: Temporomandibular Disorder. Mann-Whitney test between groups, *p: ≤0.05.

Table 2. Localization of the plantar pressure center in subjects who presented Temporomandibular Disorder

Center of pressure	Right TMD %	Left TMD %	Bilateral TMD %
RF	0	0	6
LF	14	13	12
RH	29	62	30
LH	57	25	52
TOTAL	100	100	100

Note: TMD: Temporomandibular Disorder; RF: Right Forefoot; LF: Left Forefoot; RH: Right Hindfoot; LH: Left Hindfoot.

the values percentile in relation to the center of pressure of the subjects evaluated, showing the plantar region that had the largest weight discharge. Most subjects with TMD had their plantar pressure center in the left hindfoot region, and most subjects without TMD had their plantar pressure center in the right hindfoot region.

DISCUSSION

The perception of signs and symptoms is extremely important for an early diagnosis of a TMD. For the TMD evaluation in this study, the RDC/TMD diagnostic was used. Currently, this diagnostic criterion allows standardization for data collection and comparison of findings from different studies, being considered as a reference standard in TMD researches[11,12]. In the present study, 71% of university students evaluated showed signs and symptoms of TMD. Jesus et al.[20], evaluated 832 university students, and 69.23% presented TMD, which corroborates our results. In another study performed with university students, Bonjardim et al.[21], evaluated 196 university students and reported that 50% of them had signs and symptoms of TMD. Generally, this high prevalence of TMD in university students is related to the emotional stress, since it is known that psychological factors are considered as risk factors for TMD [22]. The arthralgic TMD was the most found among the university students evaluated (69%), followed by mixed type (27%). These results corroborate the results of Ferreira et al.[22], in which in which 153 university students were evaluated and the most prevalent form of TMD was the arthralgic type with 78%, followed by mixed type with 22%. It is believed that mixed TMD occurs due to the chronification of pain that causes secondary pain sensitization, responsible for allodynia and secondary hyperalgesia; in addition, other forms of TMD may also arise when a TMD is not treated, causing perpetuation of the cycle of dysfunction and pain[22].

There were no significant differences (p> 0.05) in plantar pressures between university students with and without TMD. However, in a study carried out by Souza et al.[19], evaluated 51 subjects also through RDC/TMD and baropodometer, and the results showed a significant difference in plantar pressures while in mandibular rest position between subjects with and without TMD, which differs from the present study. According to the same author, the postural imbalances found in TMD patients, such as pelvic retroversion, reflected a more posterior localized plantar pressure distribution, concluding that TMD could interfere with the distribution of plantar pressures[19]. The results found in this study may have differed from that found by Souza et al.[19] because the author excluded cases of arthrogenetic TMD, whereas in the present study, all types of TMD were included. According to the study results of Ferrario et al.[23], in which a force platform was used, it was observed that changes in the plantar pressure center were not influenced by TMD. According to the same author, the postural adjustments performed by the neuromuscular mechanism of the subjects with TMD may not be detectable[23], which may explain the results of this study.

Due to pain or discomfort of the patient, TMD can lead to adaptations in body structures to correct areas of musculoskeletal tension and minimize pain, and postural deviations may occur due to such adaptations[24]. Altered cranio-cervical posture such as cervical spine rectification and head anterioration have been established in subjects with TMD[2]. Such postural changes may interfere with the location of the center of gravity of the body of these subjects. Thus, these subjects may have their plantar pressure center located anteriorly, which may explain the fact that only the university students who showed signs and symptoms of TMD presented a plantar pressure center in the forefoot (10.29%), whereas no university student without TMD performed greater weight discharge in the forefoot. In relation to the plantar pressure center, it can be observed that the majority of subjects performed the largest weight discharge and had their plantar pressure center located in the lower limb contralateral to the TMD side, most of them in the hindfoot region. In addition to postural changes related to the posture of the head, shoulders and cervical spine[2], subjects with TMD may also present changes in the pelvis and knee, as well as presenting greater plantar pressure in the hindfoot[25], which was observed in this study. In subjects with TMD, the head tends to be inclined and turned to the side where the painful process exists[26]. This could affect the center of gravity of them, and consequently change the location of the plantar pressure center. In the case of university students who presented TMD, the majority had a plantar pressure center in the lower limb

contralateral to the TMD. However, these changes may be related or independent. In the study of Bastos et al.[27], in which 14 university women were evaluated, the presence of TMD and postural alterations of the lower limbs was related, so it was concluded that TMD are related to postural alterations of lower limbs. Many studies correlate TMD with postural changes, but few relate to alterations in the lower limbs through plantar pressures using baropodometer as in the present study.

CONCLUSION

The majority of university students evaluated showed signs and symptoms of TMD, mostly of the arthralgic type. Through the evaluation of baropodometry, it can concluded that there were no significant differences between the plantar pressures of the university students who presented and did not present TMD. In addition, there is a need to take into account the entire body posture of the subject with TMD. Some limitations encountered to perform this study include the small size of the sample, due to the availability of university students for evaluation, and the scarcity of studies using baropodometry in patients with TMD. Further studies are suggested with larger samples that evaluate, apart from body posture, the distribution of plantar pressures in subjects presenting TMD, distinguishing them by different age groups, gender, different diagnoses and severity of TMD.

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AUTHORS CONTRIBUTIONS

ABBO: evaluations and data collection, manuscript and article writing; CCA: article review; TTDA: methods and statistical analysis; NMF: literature review; JKMS: study guidance and article editing.

CONFLICTS OF INTERESTS

The authors declare that there was no conflict of interests.

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