Global Body Posture and Plantar Pressure Distribution in Individuals With and Without Temporomandibular Disorder: A Preliminary Study

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Abstract

Objective: The aim of this study was to evaluate body posture and the distribution of plantar pressure at physiologic rest of the mandible and during maximal intercuspal positions in subjects with and without temporomandibular disorder (TMD).

Methods: Fifty-one subjects were assessed by the Diagnostic Criteria for Research on Temporomandibular Disorders and divided into a symptomatic group (21) and an asymptomatic group (30). Postural analysis for both groups was conducted using photogrammetry (SAPo version 0.68; University of São Paulo, São Paulo, Brazil). The distribution of plantar pressures was evaluated by means of baropodometry (Footwork software), at physiologic rest and maximal intercuspal positions.

Results: Of 18 angular measurements, 3 (17%) were statistically different between the groups in photogrammetric evaluation. The symptomatic group showed more pronounced cervical distance ($P = .0002$), valgus of the right calcaneus ($P = .0122$), and lower pelvic tilt ($P = .0124$). The baropodometry results showed the TMD subjects presented significantly higher rearfoot and lower forefoot distribution than those in the asymptomatic group. No differences were verified in maximal intercuspal position in the between-group analysis and between the 2 mandibular positions in the within-group analysis.

Conclusions: Subjects with and without TMD presented with global body posture misalignment. Postural changes were more pronounced in the subjects with TMD. In addition, symptomatic subjects presented with abnormal plantar pressure distribution, suggesting that TMD may have an influence on the postural system. (J Manipulative Physiol Ther 2014;37:407-414)

Key Indexing Terms: *Temporomandibular Disorder; Posture; Photogrammetry*

Temporomandibular disorder (TMD) is characterized by functional and structural changes, the most frequent symptoms being temporomandibular joint and/or masticatory muscles pain, functional limitations, deviations, and sounds during mandibular movements. The etiology of TMD is multifactorial involving a combination of psychological, structural, and postural aspects.[1-4]

Alterations in the postural alignment are commonly found in individuals with TMD, mainly related to the head, cervical column, and shoulder posture.[5-8] Postural changes in a muscle segment could lead to the lengthening or shortening of adjacent muscles, which cause tension in the muscular chain.[9] Forward head posture may lead to a sequence of changes in the cranio-cervico-mandibular system, such as more posterior mandibular condyle position and compression of the retrodiscal region; reduction of C0-C1 functional space; increase of the posterior dental contacts; cervical and masticatory muscles unbalance; and, consequently, change of stomatognathic functions.[4,10-12]

The neuron-anatomical and biomechanical interaction among jaw, head, and neck in individuals with TMD has been demonstrated by some authors.[5-8] On the other hand, in more

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recent studies, this association was not evidenced.[9,13-16] Such divergence may be attributed to methodological variability of the studies, thus limiting their comparisons.[17]

Functional relation of the masticatory and lower limbs muscles by means of the muscular chains has been demonstrated.[18-20] Some authors have verified increase of the electromyographic activity in the peroneus longus and gastrocnemius muscles during simulated malocclusion[18] and decrease of the sternocleidomastoid, erector spinal, and soleus muscle activity with occlusal splint.[19] Electrical activity changes of the masticatory muscles at mandibular rest and in the maximal intercuspal position with the induced plantar arch modification were also demonstrated.[20]

It is theorized that the muscular and articular proprioception of the cranio-cervico-mandibular complex can interfere in the postural system. The potential role of the mandibular position change on the weight distribution in the anterior, posterior, left, and right quadrants of the foot in normal individuals was demonstrated by Yoshino et al.[21] Ries and Bérzin[22] have showed the influence of the TMD in the postural control.

Considering the relation between the postural and the stomatognathic systems, it is possible that the presence of TMD may have a relationship with the body posture as a whole and, consequently, the plantar pressure distribution. Therefore, the purpose of this study was to evaluate body posture and plantar pressure distribution in subjects during physiologic rest of the mandibular position and in the maximal intercuspal position, in individuals with and without TMD.

Methods

Asymptomatic subjects were recruited by means of electronic and printed media, and subjects with symptoms of TMD were recruited from the Occlusion Clinics of Federal University of Santa Maria (UFSM), Brazil. Of 208 individuals interviewed, 51 were selected for the study. Next, they were distributed into 2 groups: symptomatic (those with TMD) and asymptomatic (those without TMD). Inclusion criteria for the symptomatic group (SG) were both sexes, age from 18 to 35 years, presence of signals, and symptoms of TMD for a period over 6 months. For the asymptomatic group (AG), they were both sexes, age from 18 to 35 years, and absence of pain in the shoulder and cervical region, facial pain, and/or headache; bruxism habit; noises; and limitation in the mandibular function.

To confirm the TMD diagnosis, the volunteers underwent the clinical examination of Research Diagnostic Criteria for Temporomandibular Disorder (RDC/TMD), by a trained examiner.[2]

Exclusion criteria for both groups included presence of neuropsychomotor or systemic or rheumatologic diseases and to be or have been undergone to physical therapy, speech therapy, or orthodontics treatment (for less than 6 months); pain complaint in the lower limbs; labyrinth diseases; squint; trauma or malformation in the cervical and facial regions; and use of analgesic, anti-inflammatory, or muscular relaxants or antidepressive medicine.

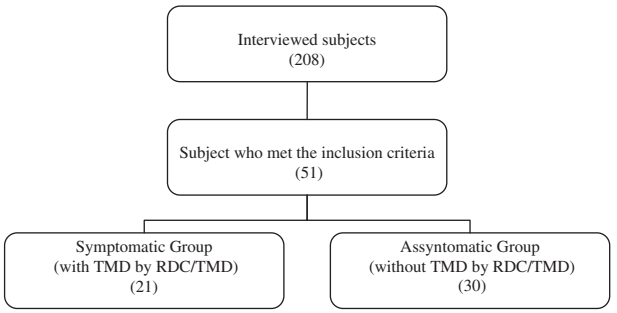

Fig 1. *Flow diagram of subjects in this study. RDC/TMD, Research Diagnostic Criteria for Temporomandibular Disorder; TMD, temporomandibular disorder.*

The SG was composed of 21 individuals (20 women and 1 man, mean age of 25 ± 5 years old) with RDC/TMD combined diagnoses of myofascial pain and arthralgia. Thirty individuals (28 women and 2 men with mean age of 22 ± 5 years old) without TMD, that is, asymptomatic according the RDC instrument, were included in the AG (Fig 1).

The study was approved by the Ethics on Research Committee of the UFSM, Brazil, under protocol number CAAE 0048.0.243.000-08. All subjects were properly informed and signed the consent term.

Photogrammetric Evaluation

The posture evaluation was conducted by the software SAPo version 0.68 (University of São Paulo, São Paulo, Brazil)[23] for the photogrammetric analysis. All subjects were photographed in swimsuit and barefoot, keeping their usual body posture with opened eyes glancing to the horizon line. A digital camera (Sony Cybershot 4.1 megapixels; Sony, Shenzhen, China) was positioned in a 1-m-height tripod (VT 131; Vanguard; Guangzhou, China) and 3 m from the subject. For the image calibration in the software, a plumb line was suspended in the roof beside the volunteer. The photographs were taken in anterior, left lateral, and posterior views. It was used a demarked base with 10 × 40 × 20 cm of dimensions with the foot outline drawn in an eraser rug. It was turned 90°, and the volunteer returned to position over this to change the image's view.

Anatomical points were marked in the voluntary's skin with styrofoam balls with double-face tape, according to the SAPo version 0.68 protocol[23] (Fig 2), by 2 trained examiners.

The quantification of the angles among the anatomical points was conduct by 2 trained physical therapists, who were blind regarding the subject's group and followed the SAPo version 0.68 protocol and its conventions.[23]

The head position was also evaluated by the horizontal distance from the middle cervical region to a vertical line