Correlation Between Severity of Temporomandibular Disorder, Pain Intensity, and Pressure Pain Threshold

Carolina Marciela Herpich, PT,[a] Cid André Fidelis de Paula Gomes, PT, PhD,[b] Almir Vieira Dibai-Filho, PT, PhD,[c] Fabiano Politti, PT, PhD,[b] Cesário da Silva Souza, PT, PhD,[d] and Daniela Aparecida Biasotto-Gonzalez, PT, PhD[b]

Abstract

Objective: The aim of the present study was to correlate the severity of temporomandibular disorder (TMD) with the pressure pain threshold over the temporomandibular joint and masticatory muscles.

Methods: A blind, cross-sectional study was conducted involving 60 women ages 18 to 40 years with a diagnosis of myogenous TMD. Evaluations were performed using the Fonseca Anamnestic Index (FAI), the visual analogue scale, and algometry over the temporomandibular joint and masticatory muscles. Spearman's correlation coefficients (r_s) were calculated to measure the association between TMD severity, pain intensity, and the pressure pain threshold.

Results: A moderate, significant, and negative correlation was found between TMD severity and the pressure pain threshold over the left masseter muscle ($r_s = –0.276$; $P = .034$). No significant correlations were found for the other variables analyzed ($P = .124$-$.985$).

Conclusions: Temporomandibular disorder measured using the FAI was associated to the pressure pain threshold over the masseter muscle. The significant and negative association found between the score of the FAI and the pressure pain threshold over the masseter muscle demonstrated that patients with more severe signs and symptoms of TMD had a lower pressure pain threshold. (J Manipulative Physiol Ther 2018;41:47-51)

Key Indexing Terms: *Temporomandibular Joint Disorders; Pain Measurement; Myofascial Pain Syndromes*

Introduction

Temporomandibular disorder (TMD) is a clinical condition often characterized by the presence of pain, especially in the temporomandibular joint (TMJ) and masticatory muscles. Other symptoms include limited or deviated mandibular movements and joint sounds.[1,2] Because of its multifactorial etiology, TMD is a complex condition that requires diverse evaluative approaches to measure the magnitude and repercussions of the various signs and symptoms.[2,3]

Studies throughout the world have investigated the use of different assessment tools for the evaluation of individuals with TMD. Herpich et al[4] conducted a systematic review of the literature and found that the most commonly employed tools are questionnaires, patient history indices, clinical indices, and diagnostic criteria. Ribeiro-Rotta et al[5] conducted a systematic review focused on the use of computed tomography and magnetic nuclear resonance for the evaluation of joint disorders in patients with TMD. Berni et al[6] established surface electromyography of the masticatory muscles at rest as a complementary evaluative measure for TMD. Dibai-Filho et al[7] and Rodrigues-Bigaton et al,[8] respectively, concluded that infrared thermography does not have sufficient accuracy for the diagnosis of myofascial pain and arthralgia in patients with TMD. For the diagnosis of TMD, the

[a] Postgraduate Program in Rehabilitation Sciences, Nove de Julho University, São Paulo, SP, Brazil.
[b] Department of Physical Therapy, Nove de Julho University, São Paulo, SP, Brazil.
[c] Department of Physical Education, Federal University of Maranhão, São Luís, MA, Brazil.
[d] Department of Physical Therapy, Tiradentes University Center, Maceió, AL, Brazil.
Corresponding author: Cid André Fidelis de Paula Gomes, PT, PhD, Department of Physical Therapy, Universidade Nove de Julho, Av. Dr. Adolfo Pinto, 109, Água Branca, CEP 05001-100, São Paulo, SP, Brazil. Tel.: +55 11970941936. (e-mail: *cid.andre@gmail.com*).
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Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) developed by Dworkin and LeResch[9] is the internationally accepted gold standard.

In countries where Portuguese is spoken, especially Brazil, use of the Fonseca Anamnestic Index (FAI) is common in the clinical setting and research for the determination of the severity of TMD. de Oliveira et al[10] employed the FAI to identify the prevalence of signs and symptoms of TMD in Brazilian university students. Likewise, Nomura et al[11] conducted a prevalence study involving undergraduate students of a dental school in Brazil. Bonjardim et al[12] and de Santis et al[13] employed the FAI on children and adolescents.

According to Bevilaqua-Grossi et al,[14] not only should the frequency of signs and symptoms of TMD be emphasized but also the severity of symptoms and their relationship to clinical signs. Considering the findings of the study cited, the justification for the present investigation is the determination of the relationship between the FAI score and the clinical measures commonly used for the investigation of pain in individuals with TMD because, so far, this relationship has not yet been established in the literature. Thus, the aim of this study was to measure correlation of the severity of TMD with pain intensity and the pressure pain threshold over the TMJ and masticatory muscles, presuming the hypothesis of a significant association between the variables tested.

Methods

Study Design and Ethical Considerations

A blind, cross-sectional study was conducted. One physiotherapist was in charge of the recruitment of participants and diagnosis of TMD, as well as the evaluation of pain intensity and the determination of the pressure pain threshold. Another physiotherapist was in charge of evaluating the severity of TMD with the use of the FAI. A third researcher was in charge of data processing and analysis. Volunteers were recruited from communities in the city of São Paulo (SP, Brazil) through verbal invitations as well as dissemination of information through flyers, the radio, and the Internet. All participants signed a statement of informed consent. This study received approval from the Nove de Julho University institutional review board (number 18032013.4.0000.5511).

Sample

The sample size was determined with the aid of the Ene program, version 3.0 (Autonomous University of Barcelona, Barcelona, Spain) and was calculated on the basis of the findings of a study by Zou et al.[15] The detection of a moderate association (r = 0.50) among the variables was considered for calculation of the sample size. Considering an 80% statistical power and 5% alpha, a minimum requirement of 30 volunteers was determined, and the number was doubled to 60 to increase statistical power.

Table 1. *Diagnosis of Temporomandibular Disorder of 60 Patients Analyzed on the Basis of RDC/TMD*

Diagnosis	Number
Ia	39
Ib	21
IIa	25
IIb	15
IIc	6
IIIa	13
IIIb	0
IIIc	0

Ia, myofascial pain; *Ib,* myofascial pain with limited opening; *IIa,* disk displacement with reduction; *IIb,* disk displacement without reduction; *IIc,* disk displacement without reduction without limited opening; *IIIa,* arthralgia; *IIIb:* osteoarthritis; *IIIc,* osteoarthrosis; *RDC/TMD*, Research Diagnostic Criteria for Temporomandibular Disorders.

Using the RDC/TMD,[9] female participants with a diagnosis of either myofascial pain (Ia) or myofascial pain with limited mouth opening (Ib) and pain and/or fatigue in the masticatory muscles during functional activities for a period of more than 6 months were included in the study. Individuals with diagnoses concurrent with that of myofascial pain, such as disk displacement and/or arthralgia, were also included (Table 1). The following were the exclusion criteria: age less than 18 years or more than 40 years; current orthodontic, physiotherapeutic, or medical (analgesic, anti-inflammatory agent, or muscle relaxant) treatment; missing teeth or use of complete/partial dentures; occlusal splint use; history of trauma to the face or to the TMJ; history of luxation or subluxation of the TMJ; and a diagnosis of either osteoarthritis (IIIb) or osteoarthrosis (IIIc) with the use of the RDC/TMD.[16]

Fonseca Anamnestic Index

The FAI was developed in Portuguese by Fonseca[17] for the evaluation of severity of TMD. This index is composed of 10 questions, each with 3 response options: "yes" (10 points), "sometimes" (5 points), and "no" (0 points).[18,19] Thus, the total score (sum of the points of all questions) allows for classification of TMD severity: 0 to 15 points = absence of TMD; 20 to 45 points = mild TMD; 50 to 65 points = moderate TMD; and 70 to 100 points = severe TMD. Only volunteers with TMD (score of 20-100 points) were included in the present study.

Visual Analogue Scale

The VAS is widely employed for the quantification of pain intensity and consists of a 100-mm line with "no pain" printed at 1 end and "worst pain imaginable" printed at the other end.[20] The volunteers in our study were instructed to mark a perpendicular line between the 2 extremes to represent their pain intensity at the time of evaluation.

Table 2. *Median, First, and Third Quartile Values of Variables Analyzed (n = 60)*

Variable	Median	1st Quartile	3rd Quartile
Fonseca Anamnestic Index score	45.00	40.00	60.00
Visual analogue scale score	3.50	3.00	4.50
PPT over right masseter muscle, kg/cm^2	1.46	1.26	1.88
PPT over left masseter muscle, kg/cm^2	1.44	1.09	1.66
PPT over right anterior temporal muscle, kg/cm^2	2.43	1.97	2.87
PPT over left anterior temporal muscle, kg/cm^2	2.35	1.88	2.76
PPT over right TMJ, kg/cm^2	1.42	1.15	1.88
PPT over left TMJ, kg/cm^2	1.52	1.17	1.85

PPT, pressure pain threshold; *TMJ,* temporomandibular joint.

Table 3. *Correlation Among Severity of Temporomandibular Disorder, Pain Intensity, and Pressure Pain Threshold (n = 60)*

Variables	Fonseca Anamnestic Index (Score)
Visual analogue scale score	$r_s = 0.038$; $P = .776$
PPT over right masseter, kg/cm^2	$r_s = –0.203$; $P = .124$
PPT over left masseter, kg/cm^2	$r_s = –0.276$; $P = .034$ [a]
PPT over right anterior temporalis, kg/cm^2	$r_s = 0.002$; $P = .985$
PPT over left anterior temporalis, kg/cm^2	$r_s = –0.101$; $P = .446$
PPT over right TMJ, kg/cm^2	$r_s = –0.028$; $P = .883$
PPT over left TMJ, kg/cm^2	$r_s = 0.077$; $P = .560$

PPT, pressure pain threshold; *TMJ,* temporomandibular joint.
[a] Statistically significant association ($P < .05$).

Algometry

The pressure pain threshold was evaluated using a digital algometer (PTR-300; Instrutherm, São Paulo, SP, Brazil). The volunteer remained seated with the trunk erect, feet on the floor, and hands resting on the thighs. The trained examiner positioned the algometer with a rubber tip measuring 1 cm^2 and applied gradual pressure with a constant velocity of approximately 0.5 kg/cm^2/s controlled by the sound feedback of a digital metronome.[21] The pressure pain threshold was measured bilaterally over the TMJ (precisely in front of the ear canal), the belly of the masseter muscles, and the belly of the anterior temporal muscles. These sites received pressure until the volunteer reported experiencing pain, at which point the value registered on the display of the algometer (in kg/cm^2) was recorded. The pressure pain threshold was measured 3 times at each site, and the mean was considered for the statistical analysis. Algometry has adequate intraexaminer and interexaminer reliability, with intraclass correlation coefficients higher than 0.75.[22]

Statistical Analysis

The Kolmogorov-Smirnov test was used to determine normality of the data. Thus, distribution was found to be non-normal, and Spearman's correlation coefficients (r_s) were calculated to determine the strength of the associations among the variables. The interpretation of the correlations was based on Zou et al,[15] as follows: 0 = no association; 0 ≥ 0.20 = weak; 0.20 ≥ 0.50 = moderate; 0.50 ≥ 0.80 = strong; 0.80 ≥ 1.00 = perfect. All data were processed using the Statistical Package for the Social Sciences, version 17.0 (SPSS Inc., Chicago, Illinois).

Results

Sixty female volunteers with TMD were recruited, and there were no dropouts during the study. Mean and standard deviation (SD) values were 25.16 years (SD = 4.86) for age, 1.70 m (SD = 0.05) for height, 69.35 kg (SD = 6.95) for weight, and 23.99 kg/m^2 (SD = 2.69) for body mass index. Table 1 displays the number of individuals with the different diagnoses based on the RDC/TMD. Table 2 displays the median values of the different variables analyzed. Table 3 presents a description of the correlations among the variables.

Discussion

In the present study, a significant, moderate, and negative association was found between the FAI score and the pressure pain threshold over the masseter muscle, demonstrating that patients with more severe signs and symptoms of TMD have a lower pressure pain threshold. Different investigations have been conducted in recent years to address the strengths and limitations of the FAI. According to Chaves et al,[19] this index has not yet been fully validated and the determination of its diagnostic accuracy requires more well-conducted studies. Correlation studies have been conducted to define the strength of the association between the FAI score and other important variables in clinical practice. Dibai-Filho et al[23] found that individuals with more severe signs and symptoms of TMD have a higher skin temperature over the TMJ. Gomes et al[24] found no significant association between the FAI score and the range of motion of the mandible (vertical movement, lateral excursion, and protrusion).

Tosato et al[25] reported an increase in cortisol, which is a hormone released in situations of stress, concomitant to greater muscle activity and TMD severity. Berni et al[26] conducted a study on women with TMD and found that the FAI offers a high degree of diagnostic accuracy for the identification of myogenous TMD. However, de Santis et al[13] found that this index has a low degree of sensitivity but that it has high specificity when administered to children and adolescents because of difficulties with regard to comprehension in this age group studied as well as the language used in the self-explanatory questions. Last, Campos et al[27] investigated the psychometric properties of

the FAI and recommended the use of a shorter version containing 8 of the original 10 items.

In the present study, a significant association was found between the severity of signs and symptoms of TMD and the pressure pain threshold over the left masseter muscle. This finding has clinical implications and suggests that physiotherapists and other health care professionals who work with such patients could evaluate pain and focus on the clinical management of pain in the masticatory muscles as a possible way to reduce the severity of TMD. This could possibly be accomplished through the use of joint mobilization, spinal manipulation, dry needling,[28] myofascial release,[29] and electrotherapy[30]; however, further studies would be needed to confirm the recommendation of these methods.

Limitations

Because of the higher rate of prevalence of TMD in females, only women were included in this study. Despite the use of the RDC/TMD, which is considered the gold standard for the diagnosis of TMD, no investigation of myofascial trigger points was performed, and algometry of such trigger points was not employed. Moreover, the pressure pain threshold in other masticatory muscles, such as the digastric and pterygoid muscles, was not investigated.

Conclusions

On the basis of the present findings, the severity of TMD measured using the FAI was associated with the pressure pain threshold over the masseter muscle, with greater severity of the disorder denoting a lower pressure pain threshold in this muscle.

Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

Contributorship Information

Concept development (provided idea for the research): C.M.H., C.A.F.P.G., A.V.D.F.
Design (planned the methods to generate the results): C.M.H., C.A.F.P.G., A.V.D.F., D.A.B.G., F.P., C.S.S.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): C.A.F.P.G., D.A.B.G., F.P., C.S.S.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): C.M.H., C.A.F.P.G., D.A.B.G., F.P., C.S.S.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): C.A.F.P.G., A.V.D.F.
Literature search (performed the literature search): C.A.F.P.G., A.V.D.F.
Writing (responsible for writing a substantive part of the manuscript): C.M.H., C.A.F.P.G., A.V.D.F., D.A.B.G., F.P., C.S.S.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): C.A.F.P.G., A.V.D.F.

Practical Applications

- Patients with lower pressure pain thresholds had higher degree of severity of TMD.

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