Manual Therapy, Posturology & Rehabilitation Journal
formerly REVISTA TERAPIA MANUAL

RESEARCH ARTICLE

https://doi.org/10.17784/mtprehabjournal.2019.17.756

Temporomandibular dysfunction in patients with a history of stroke.

Mariana Altvater Ramos[1], Beatriz Garcia Moura[1], Camila Costa Araujo[1], Tiago Tsunoda Del Antonio[1], Joyce Karla Machado da Silva[1]

ABSTRACT
Background: The temporomandibular joint (TMJ) is certainly one of the most complex joints in the human body. The American Academy of Orofacial Pain defines temporomandibular joint disorder (TMD) as a set of disorders involving the masticatory muscles, the TMJ, and associated structures. It is pointed as the main cause of non-dental pain in the orofacial region, including head, face and related structures. The most common TMD symptoms involve joint, chewing and face pain. There may also be crackling when opening and closing the mouth, earache, tinnitus, dizziness, dislocations, limitation of movement and painful tenderness to palpation. Stroke causes sequelae in subjects that include motor disorders, speech or language disorders, and swallowing disorders. Approximately 50% of patients with hemiparesis after stroke are known to have facial control deficiency, weakened orofacial and mandibular functions. **Objective:** To evaluate patients with a history of stroke, seeking a possible relationship with TMD, the pain associated with this change, and the limitations of range of motion related to the presence of hemibody spasticity in patients post stroke. **Methods:** The sample consisted of 19 patients of both genders, aged 55 to 70 years, who had suffered stroke. It was used the RDC/TMD for TMD diagnosis, Pressure Pain Threshold test, Ashworth scale, and Sanny Fleximeter® for cervical ROM evaluation, being the statistical analysis performed by the software Bioestat version 5.3. **Results:** TMD was diagnosed in 81.8% of the sample, and of these, 45.4% had a diagnosis of disc displacement with reduction. **Conclusion:** There was an increase in the muscle tone and the pressure pain threshold, and a decrease in cervical spine ROM, related to the affected side and diagnosed with this disorder, observing that the muscle alterations caused by stroke may be predisposing factors to patients, to the development of muscle TMD or even joint TMD.

Keywords: Temporomandibular Joint; Stroke; Temporomandibular Joint Disorders.

INTRODUCTION

The temporomandibular joint (TMJ) is certainly one of the most complex joints in the human body. It is linked to physiological functions, and is responsible for performing movements such as elevation, depression, protrusion, and laterality movements of the jaw. It is responsible for performing functional actions such as chewing, swallowing and speaking[(1)]. The American Academy of Orofacial Pain defines temporomandibular disorders (TMD) as a set of disorders involving the masticatory muscles, the TMJ, and associated structures. It is pointed as the main cause of non-dental pain in the orofacial region, including head, face and related structures[(2)]. The etiology of TMD is multifactorial, but some factors can be highlighted, such as macro and micro trauma in TMJ, functional or structural muscle damage, parafunctional habits and psychosocial problems[(3)]. Other authors mention that the nerve connections between the cervical region, skull and jaw suggest that postural changes are related to the genesis and perpetuation of TMD[(4,5)]. The most common TMD symptoms involve joint, chewing and face pain. There may also be crackling when opening and closing the mouth, earache, tinnitus, dizziness, dislocations, limitation of movement and painful tenderness to palpation[(5)]. Stroke causes sequelae in subjects that include motor disorders, speech or language disorders, and swallowing disorders[(6)].

Approximately 50% of patients with hemiparesis after stroke are known to have facial control deficiency, weakened orofacial and mandibular functions. Swallowing abnormalities are often observed in patients who are recovering from stroke, which may result in altered eating habits and patterns, contributing to an impaired physical condition. Postural changes may influence mandibular position, which may lead to changes in proprioceptive and periodontal entry, affecting movement patterns and postural stability. Postural and movement defects in the craniocervical regions and impairments in their control may be the main reasons for the decline in stomatognathic system function, including the TMJ, muscles, and the onset of swallowing problems[(7)]. These changes may influence body biomechanics, including orofacial

Corresponding author: Mariana Altvater Ramos. Address: Alameda Padre Magno, n° 841 – Nova Jacarezinho. Jacarezinho – Paraná, Brasil. CEP: 86400-000. Universidade Estadual do Norte do Paraná – Campus de Jacarezinho. Centro de Ciências da Saúde – CCS E-mail: m.altvater@hotmail.com. Tel: (43) 999192337.

[1] Universidade Estadual do Norte do Paraná, Jacarezinho, PR, Brasil.

Financial support: nothing to declare.

Submission date 26 May 2019; Acceptance date 08 July 2019; Publication date 13 December 2019

and cervical biomechanics reflecting on muscle adaptations that cause postural changes. This study aimed to evaluate patients with a history of stroke, and to verify the incidence of TMD, limitations of range of motion and pain threshold related to the presence of hemodynamic spasticity in these patients.

METHODS

There was a selection at the "Clínica de Fisioterapia e Reabilitação Professor Alfredo Franco Ayub" from the "Universidade Estadual do Norte do Paraná (UENP) - Jacarezinho, Paraná" of 19 patients of both genders, aged 55 to 70 years, who had suffered stroke. Inclusion criteria were: result of at least 19 points in the Mini Mental State Examination (MMSE) according to education and having suffered stroke for more than 3 months. Exclusion criteria were: refusal to participate in the study, ischemic or hemorrhagic stroke that presented muscle hypotonia, and edentulous patients without the use of dental prosthesis. The patients were instructed and, after having doubts about the study, signed the free and informed consent form. The project was approved by the Human Research Ethics Committee, under number: 1.747.985. After signing and analyzing the inclusion and exclusion criteria, 11 patients underwent the "MMSE"[8] for results of different cognitive parameters. Then it was performed the RDC/TMD (Research Diagnostic Criteria for Temporomandibular Disorders) by a single physiotherapist evaluator. The questionnaire with questions about the patient's history and physical examination form (axis I) was used generating possible diagnoses of myofascial pain, disc dislocation, arthralgia and degenerative diseases. For measurements of mandibular movement and the amount of the midline deviation, it was used a small caliper with sliding jaw of Sanny®. Digital palpation was performed to check and observe for pain and presence of noises or crackles in the TMJs as established by the RDC/TMD form[9]. Palpation pressures were performed with the Algometer Wagner PAIN TEST™ FPK/FPN. Algometry quantifies through physical mechanical pressure stimulus, the subject's ability to perceive and tolerate pain to a mechanical stimulus[10].

Pressure Pain Threshold Test (PPT) was performed with the aid of the Algometer Wagner PAIN TEST™ FPK/FPN, also by a single evaluator. The points used bilaterally were: TMJ, Anterior Temporal Muscles, Sternocleidomastoid, Masseter, Upper Trapezius, and the Achilles Tendon used as a pressure reference and considered as an extratrigeminal point. It was used an initial pressure of 0.5kgf to a maximum of 5kgf[11]. The patient should report the pressure at which the sensation became painful and uncomfortable, which was recorded by the evaluator. To assess and classify the degree of stroke spasticity, the modified "Ashworth Scale" was used[12]. The Sanny® Fleximeter was used to assess the range of motion (ROM) of the cervical region of patients. It was considered the measurement system developed by Kapandji and Marques[13-14], being considered within normal range the values of 0-65° of cervical flexion, 0-50° of cervical extension, 0-40° of right and left lateral flexion and 0-55º of cervical rotation.

Statistical analysis was performed by Bioestat software version 5.3, by means, standard deviation and percentages. Shapiro-Wilk test was initially applied to verify the normality of general data, such as the TMD/stroke ratio. Regarding the PPT between the homolateral and contralateral sides, the nonparametric Wilcoxon test was applied. A value of $p \leq 0.05$ was considered statistically significant.

RESULTS

Of the total sample of 11 subjects evaluated, 81.8% (n = 9) presented signs and symptoms related to TMD, 18.2% (n = 2) did not fit the diagnosis. According to the RDC/TMD, of the 81.8% with TMD, 45.4% (n = 5) were diagnosed with reduced disc displacement, as described in Figure 1.

Through medical records, it was found that 71.43% had post-stroke involvement in the right hemibody and 28.57% in the left hemibody. Regarding the relationship between the presence of TMD on the side affected by stroke, 55.6% of the sample had TMD on the affected side, as shown in Table 1.

Regarding the degree of spasticity assessed by the Ashworth scale, 55.6% of the sample had Grade 0 (no increase in muscle tone), and 44.4% showed some increase in muscle tone, as shown in Table 2.

The values found in the fleximeter evaluation showed that all 100% of the patients had decreased amplitude of any of the

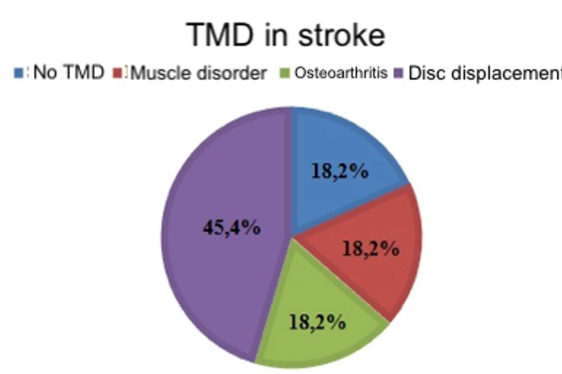

Figure 1. Incidence and diagnosis of temporomandibular dysfunction according to RDC/TMD in Stroke Patients. Note: TMD= Temporomandibular disorder.

Table 1. TMD relationship with the side affected by the stroke.

Relation TMD and stroke	PERCENTIL (%)
Homolateral	55.6
Bilateral	22.2
Muscle Character	22.2

Note: The muscular character does not present specificity for the affected side of the TMD, and the diagnosis is generally given.

Table 2. Classification of increased level of muscle tone according to Ashworth scale.

Ashworth	PERCENTIL (%)
Degree 0	55.6
Degree 1	11.1
Degree 1+	0
Degree 2	11.1
Degree 3	22.2
Degree 4	0

Table 3. Patients who present decreased range of motion of the cervical spine shown as a percentage.

Movement	PERCENTIL (%)
Flexion	77.7
Extension	100
Homolateral flexion to the lesion*	55.5
Contralateral flexion to the lesion*	66.6
Homolateral rotation to the lesion	88.8
Contralateral rotation to the lesion	33.3

Note: * Referring to the side of the hemibody affected by the stroke

Table 4. Comparison of pressure exerted by pressure pain threshold through algometry between homolateral and contralateral sides of the stroke represented in Kgf.

	Homolateral	Contralateral	P
TMJ	1.77(1.29)	2.47(0.96)	0.01*
Masseter	1.78(1.27)	2.66(1.48)	0.01*
Temporal	1.86(0.56)	2.46(1.01)	0.09
ECOM	1.43(0.47)	2.38(1.58)	0.17
Trapezius	2.98(1.59)	3.28(1.67)	0.67
Achilles tendon	5.00(0.00)	5.00(0.00)	

Note: TMJ= temporomandibular joint; ECOM= sternocleidomastoid; p≤0.05

cervical spine movements evaluated, 88.8% in the homolateral rotation of the side affected by the stroke, and 100% in the cervical extension, according to Table 3.

The PPT test showed that there was a significant difference in the TMJ and Masseter muscle points, demonstrating a decrease in the pressure pain threshold at these points on the side affected by the stroke, as shown in Table 4. At the other points there were no significant differences, and at the Achilles tendon point chosen for pain parameters none of the patients reported pain at the maximum level of pressure exerted.

DISCUSSION

The TMD according to the American Academy of Orofacial Pain (AAOP) encompasses several problems involving the masticatory muscles, TMJ and associated structures, usually reported by muscle and joint signs and symptoms such as pain, mouth opening limitation, asymmetrical mandibular movements and joint sounds. TMD pain is musculoskeletal, i.e., of muscular, joint or mixed origin[2]. In the present study, 45.4% of the sample were diagnosed with TMD signs and symptoms belonging to Group II of the RDC/TMD exam, called reduced disk displacement and considered one of the most frequent causes of TMJ disorders. Reduced disc displacement indicates that the articular disc has been displaced from the normal position, and that it reduces its structural relationship with the condyle when mandibular translation with the mouth opening occurs and produces a joint sound described as a popping sound. It also has reciprocal cracking heard during the closing movement of the mouth before occlusion of the teeth. It may or may not be a painful condition. As it becomes chronic, or as the disc becomes progressively more dislocated, it may interfere with the opening movement of the mouth[15,16]. Disc displacement is a common condition in the population and due to study limitation it cannot be stated that the displacement occurred after stroke.

Degenerative bone changes in TMJ are characterized by osteophytes, erosion and condylar sclerosis, joint eminence and mandibular fossa, either alone or in combination[17]. These changes are considered signs of osteoarthritis and were found in 18.2% of the population evaluated. Degenerative TMJ conditions usually affect individuals older than 50 years, usually due to physiological reasons or overload due to parafunctional habits and/or joint cavity lubrication problems. For the same reason mentioned above, in relation to disc displacement, the subjects in the present study are older than 55 years, which could indicate the presence of degenerative changes reported as TMJ crackling when opening and closing the mouth even before the stroke event. Pain is a common symptom among TMD patients, and may be joint or muscular[18]. A sample of 18.2% showed a positive association between the presence of myofascial pain and the occurrence of mouth opening limitation.

Central nervous system (CNS) injuries resulting from stroke present spasticity as the main consequence, one of the main causes of functional loss. It manifests itself in muscle hyperactivity generating pain and disability, impairing musculoskeletal functions that imply limitations in activities of daily living[19]. The presence of muscle tone causes the disc to assume a more anteromedial position, allowed by its insertions and its own morphology. A feature of this functional relationship is that the condyle moves across the disc in some degree when movement begins, which does not occur in a normal joint. During movement the increased intra-articular pressure may prevent the articular surfaces from sliding smoothly over one another. The disc may become stuck or slightly agglomerated, causing an abrupt movement of the condyle over the disc relative to normal disc-condyle positioning, causing a snap. Once the snap has occurred, the normal disc-condyle relationship is reestablished and this relationship is maintained until the end of the opening movement[20]. This highlights the findings of the study, as 44.4% of the sample showed a significant increase in the Ashworth Scale on the side affected by stroke and diagnosed with TMD.

Studies prove through anatomical evidence the interaction between mandibular movements with cervical joints and muscles, which justifies the study of cervical ROM in TMD[21,22]. Changes in mobility in stroke patients, in addition to changes in muscle strength and tone, are related to changes in the postural control mechanism[23]. The limitation of trunk mobility in these patients causes a body imbalance, tending to an asymmetrical posture, with lower weight distribution and smaller movements to the affected side[24]. This confirms the findings in the present study, since the sample showed a decrease in range of motion of 88.8% for rotation of the hemiparetic side. Secondary changes in the initial presentation of stroke have been attributed to neurological and biomechanical changes including hypertonia, excessive muscle coactivation, muscle weakness, contracture, and increased muscle stiffness. Increased muscle tone of the flexors of the neck and upper body may result in shortening of the flexors, which results in mechanical failure of their actions, consequently altering body alignment and range of motion[24]. In the sample population, 66.6% of the individuals presented decreased mobility of contralateral lateral-flexors and 55.5% of homolateral lateral-flexors. It was observed that 100% of the sample had decreased ROM when performing cervical extension. According to Lau et al[25], The anterior head posture is often related to neck pain due to the overload of the posterior cervical muscles performed in an attempt to maintain the balance of the head over the spine. This posture may also be related to TMD, by changing the position of the mandibular condyle, which in turn overloads the temporomandibular joints[26-29].

Chesterton et al.[30] conducted studies between the PPT of healthy men and women, and women had a significantly lower threshold. Silva et al.[32] conducted a study of subjects with signs and symptoms compatible with TMD compared to a control group, in which the symptomatic group had a significantly lower pressure pain threshold (PPT) compared to the control group. In the present study, a significant low pain threshold in the TMJ and masseter in the side affected by the stroke was also found in patients with TMD diagnosis. No significant difference was found between the other points evaluated, when compared to the compromised side and healthy side, possibly because the population (22.2%) had the diagnosis of bilateral or muscular TMD (22.2%), which makes it necessary for future studies and better statements, a larger sample population.

CONCLUSION

The present study demonstrated a significant presence of TMD in the post-stroke patients evaluated, and most of them had a diagnosis of reduced disc displacement, with the limitation that the presence of TMD signs and symptoms before stroke was not questioned because it is a cross-sectional study. A considerable percentage had increased muscle tone, decreased pressure pain threshold and decreased range of motion of the cervical spine, related to the side affected and diagnosed with this dysfunction. It is then observed that the muscle changes caused by stroke may be predisposing factors to patients to the development of muscle or even joint TMD. Further studies are needed, as the TMD associated with stroke is scarce in the literature.

AUTHOR'S CONTRIBUTIONS

MAR and BGM performed the data collection and elaborated the study; TTDA performed the statistical analysis; CCA and JKMS performed the critical intelectual proof reading of the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

nothing to declare.

REFERENCES

1. Sartoretto SC, Dal Bello Y, Della Bona A. Evidências científicas para o diagnóstico e tratamento da DTM e a relação com a oclusão e a ortodontia. Revista da Faculdade de Odontologia-UPF, 2012;17(3).
2. De Leeuw R. (2010). Dor orofacial: guia de avaliação, diagnóstico e tratamento. São Paulo: Quintessence, 2010;315.
3. da Costa LMR, Schimit EFD, Souza C, Neto ESW, da Silva LDS, Candotti CT, Loss JF. Effect of the Pilates method on women with temporomandibular disorders: A study protocol for a randomized controlled trial. Journal of bodywork and movement therapies, 2016;20(1):110-114.
4. Souza JA. Postura e disfunção temporomandibular: avaliação fotogramétrica, baropodométrica e eletromiográfica.2010.
5. Carrara SV, Conti PCR, Barbosa JS. Termo do 1º consenso em disfunção temporomandibular e dor orofacial. Dental Press J Orthod, 2010;15(3):114-20.
6. Schelp AO, Cola PC, Gatto AR, Salva RG, Carvalho LR. Incidência de disfagia orofaríngea após acidente vascular encefálico em hospital público de referência. Arq. Neuropsiquiatria. 2004;62(2-B):503-506.
7. Oh DW, Kang TW, Kim SJ. Effect of stomatognathic alignment exercise on temporomandibular joint function and swallowing function of stroke patients with limited mouth opening. Journal of physical therapy science, 2013;25(10):1325-1329.
8. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. Journal of psychiatric research, 1975;12(3):189-198.
9. Dworkin SF, Leresche L. Research Diagnostic Criteria for Temporomandibular Disorders. Research Diagnostic Criteria for Temporomandibular Disorders RDC/DTM, J Craniomand Disord 1992. Revisão:2010.
10. Piovesan EJ, Tatsui CE, Kowacs PA, Lange MC, Pacheco C, Werneck LC; Utilização da Algometria de Pressão na Determinação dos Limiares de Percepção Dolorosa Trigeminal em Voluntários Sadios. Arq Neuropsiquiatr 2001;59(1):92-96.
11. da Costa DRA, de Lima Ferreira AP, Pereira TAB, Porporatti AL, Conti PCR, Costa YM, Bonjardim LR. Neck disability is associated with masticatory myofascial pain and regional muscle sensitivity. Archives of oral biology, 2015;60(5):745-752.
12. Bohannon RW, Smith MB. A confiabilidade interavaliadores do Modified Ashworth Scale, de espasticidade muscular. Phys Ther, 1987;67:207.
13. Kapandji IA. Fisiologia articular: esquemas comentados de mecânica vertebral: tronco e coluna vertebral. 5.ed. São Paulo: Pan-Americana;2000.

14. Marques AP. Manual de Goniometria. 2.ed. São Paulo: Manole;2003.
15. Okeson JP. Tratamento das Desordens Temporomandibulares e Oclusão 7:Tratamento das Desordens Temporomandibulares e Oclusão. Elsevier Health Sciences.
16. Katzberg RW, Westesson PL, Tallents RH, Drake CM. Anatomic disorders of the temporomandibular joint disc in asymptomatic subjects. J Oral Rehabil, 1999;26(5):357-63.
17. Campos MIG, Campos PSF, Cangussu MCT, Guimaraes RC, Lines SRP. Analysis of magnetic resonance imaging characteristics and pain in temporomandibular joint with and without degenerative changes of condyle. Int J Oral Maxillofac Surg, 2008;37:529-34.
18. Ash MM, Ramfjord SP, Schmioseroer J. Oclusão. 2.ed.S.P.:Santos. 2001.
19. Zilli F, de Lima CBA, Kohler MC. (2014). Neuroplasticidade na reabilitação de pacientes acometidos por AVC espástico. Revista de Terapia Ocupacional da Universidade de São Paulo, 2014;25(3):317-22.
20. Maciel RN. ATM e dores crânio faciais–Fisiopatologia basica. SP: Santos;2003.
21. Eriksson PO, Häggman-Henrikson B, Nordh E, Zafar H. Co-ordinated mandibular and head-neck movements during rhythmic jaw activities in man. J Dent Res, 2000;79(6):1378-84.
22. Cuccia A, Caradonna C. The relationship between the stomatognathic system and body posture. Clinics, 2009;64(1):61-6.
23. Menoita EC, Sousa LM, Pão-Alvo I, Marques-Vieira C. Reabilitar a pessoa idosa com AVC: Contributos para um envelhecer resiliente. Loures: Lusociência; 2012.
24. Schuster RC. Correlação entre Disfunções Motoras e Respiratórias no AVC. Rev Neurocienc. 2011;19(4):587-88.
25. Ryerson S, Levit K. Functional Movement Reeducation. New York: Churchill Livingstone. 1997.
26. Lau KT, Cheung KY, Chan KB, Chan MH, Lo KY, Chiu TT. Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability. Man Ther. 2010;15(5):457-62.
27. Corrêa EC, Bérzin F. Temporomandibular disorder and dysfunctional breathing. Braz J Oral Sci. 2004;3(10):498-502.
28. Silveira MC, Sígolo C, Quintal M, Sakano E, Tessitore A. Proposta de documentação fotográfica em motricidade oral. Rev CEFAC. 2006;8(4):485-92.
29. Jensen K, Andersen HØ, Olesen J, Lindblom U. (1986). Pressure-pain threshold in human temporal region. Evaluation of a new pressure algometer. Pain, 1986;25(3):313-323.
30. Cherstento LS, Barlas P, Foster NE, Baxter GD. Wrigth CC. Gender differences in pressure pain threshold in healthy humans. Pain, 2003;101(3):259-66.
31. Silva RS, Conti PC, Lauris JR, Da Silva RO, Pegoraro LF. Pressure pain threshold in the detection of masticatory myofascial pain: na algometer-based study. Jorofac pain, 2005;19(4):318-24.