



The Difference in Severity of Temporomandibular Joint Disorders Before and After Jaw Exercises

¹⁾ Ricca Chairunnisa, ²⁾ Hubban Nasution, ³⁾ Uma Maheswari

^{1,2,3} Universitas Sumatera Utara, Indonesia

*Email: umabala94@gmail.com

*Correspondence: ¹⁾ Uma Maheswari

DOI:

10.59141/comserva.v3i10.1199

ABSTRAK

The temporomandibular joint is part of the stomatognathic system, where interference with one component of the stomatognathic system will interfere with other components causing an imbalance of function. One such disorder is temporomandibular. Temporomandibular disorders have signs, symptoms, and severity that can be eliminated through jaw exercises. This study had the goal of evaluating and comparing the severity of TMD symptoms between students before and after engaging in jaw exercises. In this purposive sampling study, researchers used questionnaires based on the Helkimo Anamnestic Index. 30 respondents who complained of temporomandibular disorder were asked to fill out a questionnaire through a Google form. Patients with TMD were inferred based on the total score of all questions with paired T-test statistical results. The results showed that there was a difference in severity before and after jaw exercise in 24 (80%) patients. There was a difference in the severity of temporomandibular joint disorders before and after jaw exercise by patients with $p\text{-value} = 0.0001$ ($p < 0.005$).

Keywords: Temporomandibular Disorders, Temporomandibular Disorder severity, Jaw Exercise, Helkimo Anamnestic Index

INTRODUCTION

The temporomandibular joint (TMJ) is one of the most complex joints in the body. The temporomandibular joint is formed by the mandibular condyle which is located in the mandibular fossa of the temporal bone. These two bones are separated from the articulation directly by the articular disc. By definition, a complex joint requires at least three bones, but a TMJ consists of only two bones. Functionally, the articular disc serves as unossified bone allowing for complex joint movement. The craniomandibular articulation is a complex joint because the articular disc is the third bone (David & Elavarasi, 2016) (Achmad et al., 2021).

Temporomandibular disorder (TMD) is a collection of symptoms involving the jaw joint and muscles in the orofacial area (Sayed et al., 2021). TMD are disorders that involve the temporomandibular joint, the masticatory muscles, and various tissue structures (Prosthodontics, 1999). TMD has several etiological factors (Hegde et al., 2011) (Kaur & Datta, 2013). TMJ and the masticatory system are complex, requiring a thorough understanding of structural, vascular, and neurological anatomy and physiology to manage TMJ (Problems, 2015). Changes in any combination of teeth, periodontal ligaments, TMJ, or masticatory muscles can ultimately lead to TMD. The multifactorial etiology includes initiation factors (trauma, excessive chewing load, and bad oral habits), predisposing

factors (systemic, genetic, structural, malocclusion, psychology), and perpetuation factors (metabolic factors, muscle tension) (Kaur & Datta, 2013) (Liang et al., 2023).

The prevalence of TMD among Faculty of Dentistry, University of North Sumatra students was 64.3% based on the results of interviews and 83.5% based on the results of clinical examinations. "The prevalence of respondents who have parafunctional habits and experience TMD is 69.9%" based on the interview results and 96.8% based on the results of clinical examination. The sign of temporomandibular joint disorder that most respondents had was a TMD of 81.7% (Castelo et al., 2005) (Hupp et al., 2017).

TMD is characterized by the main symptoms of pain in the chewing muscles and TMJ, joint sounds such as clicking (tapping joints) and crepitus, as well as limitation and deviation of jaw movement (Harrison et al., 2014). The most common symptom of a very common TMD is pain, which is usually localized in the masticatory muscles and pre-auricular area and is exacerbated by chewing, speaking, and other activities involving the jaw (Jerolimov, 2009). Patients with this disorder often experience temporomandibular joint dysfunction, limitations or asymmetries in opening the mouth, discomfort to palpation, sound joints, such as clicking (clicking), popping joints (popping), gnashing joints (gratings) and crackles; headache; and neck pain and stiffness (Achmad et al., 2013) (Rikmasari, 2013).

Physical therapy is a combination of measures that support the definitive treatment of STM disorders. Physical therapy has an important role to play in the success of treatment. Physical therapy is divided into 2 categories, namely modality and manual techniques. Modality techniques are physical therapy that uses tools. Modality techniques include heat therapy, cold therapy, ultrasound, phonophoresis, iontophoresis, transcutaneous electrical nerve stimulation (TENS), acupuncture, and laser. Manual technique is a practical therapy provided by physical therapists to reduce pain and dysfunction. Manual techniques are divided into three categories, namely soft tissue mobilization, joint mobilization, and muscle conditioning (Tuncer et al., 2013). Jaw exercises are designed to improve muscle coordination, relax tense muscles, increase mandibular opening distance, increase muscle strength, restore normal coordination of the TMD complex, stabilize TMD, and ultimately reduce pain (Nicolakis et al., 2000) (Achmad et al., 2021).

Based on the above problems, the researcher wanted to conduct research on differences in the severity of TMD before and after jaw exercises among Faculty of Dentistry, University of North Sumatra students. This study aimed to evaluate and compare the severity of TMD symptoms among students before and after engaging in jaw exercises. Investigate the relationship between parafunctional habits and TMD, taking into account the prevalence and results of clinical examination, to analyze the prevalence of temporomandibular joint disorders, joint sounds, jaw movement limitations, and related symptoms and to assess the effectiveness of physical therapy, especially jaw exercises, in reducing pain, dysfunction, and improving muscle coordination among individuals with TMD.

METHOD

Examination of TMD

Researchers first made observations of students who were still active at the Faculty of Dentistry, North Sumatra. An Ethical Clearance letter from the Health Ethics Commission was permitted to conduct research at the Prosthodontics Department to the Head of the Prosthodontics Department. Researchers look for samples based on inclusion and exclusion criteria.

Inclusion sample criteria are general characteristics of research subjects who meet the research criteria. The inclusion criteria in this study were:

- a. Students who are still active at the Faculty of Dentistry, North Sumatra in 2020.
- b. Students who have TMD
- c. Students who have complete natural teeth up to Molar 2.
- d. Students without systematic disease
- e. Students who are willing to be interviewed, examined, and sign the informed consent as research subjects.

The exclusion sample criteria are the general characteristics of research subjects who do not meet the research criteria. The exclusion criteria in this study were:

- a. There is tooth loss
- b. Students who use fixed orthodontic appliances.
- c. Students who wear gear mock removable or fixed.
- d. Students with a history of trauma to the neck, chin, and face.
- e. Students who have undergone temporomandibular joint disorder treatment.

The sampling technique was purposive sampling. Purposive sampling is sampling based on certain provisions or considerations made by the researcher himself, based on previously known characteristics or characteristics of the population. In this study, sampling was carried out based on predetermined inclusion and exclusion criteria.

The sample size formula in this study I based on the following actions:
$$= \frac{\sigma^2 \cdot [Z\alpha + Z\beta]^2}{(\mu_1 - \mu_2)^2}$$

Information:

n: minimum sample size

Z α : raw Deviat alpha

Z β : raw Deviat beta

μ : Estimated mean of group 1

μ : Group average estimate of 2

σ^2 : Combined variance

Based on the results of the calculations above, the minimum sample size required in this study is 30 people.

Researchers distribute questionnaires to subjects through online communication. Subjects were asked to fill out questionnaires based on Helkimo's anamnestic index that consists of 10 questions such as:

- a. Are you having trouble opening your mouth?
- b. Do you have difficulty moving or using your jaw?
- c. Have you ever felt your muscles stiffen or hurt when chewing?
- d. Do you have frequent headaches?
- e. Have you ever had neck or shoulder pain?
- f. Have you ever had pain?
- g. Are you aware of any sounds in the joint area?
- h. Are you sure that you chew normally?
- i. Do you chew food on only one side?
- j. Do you experience pain around the face in the morning?

Each question has 3 answer choices, namely :

- a. No (Score 0)
- b. Sometimes (Score 1)
- c. Yes (Score 2)
- d. Both sides (Score 3)

Inference the patient has TMD based on the total score of all questions.

- e. Mild STM disorders: Score 4-8
- f. Moderate STM disorders: Score 9-14
- g. Disorders STM severe: Score 15-23

The conclusion from the results of the questionnaire using 10 questions Helkimo's Anamnestic Index is that patients with a score of 0-3 are concluded to have no TMD, while patients with a score of 4-23 are concluded to have TMD (Rani et al., 2017). Subjects declared to have TMD were then instructed to do jaw exercises at home for two weeks. The researcher will demonstrate how to perform jaw exercises through online communication.

The researcher had to conduct this whole research through online communication due to the COVID-19 pandemic, to prevent the spread of this deadliest virus outbreak between researchers and patients.

Implementation of Jaw Exercises

Following are the jaw exercises that the patient should perform:

- a. The patient is instructed to open the jaw in a straight line in front of a mirror. The jaw opening movement should be in a straight line according to the midline of the tooth and using a straight object such as a ruler as a comparison. The patient is instructed to stop opening the jaw when the open groove has begun to tilt and return to the point where the opening of the jaw is still straight. This position is maintained for up to 8 seconds, then repeated for 8 to 10 reps. This exercise is done 3 times a day.
- b. A second exercise is an open jaw with resistance exercise performed by placing a thumb on the bottom of the central part of the patient's chin. The patient is instructed to open the jaw slowly by lowering the jaw while applying Mild, steady pressure to the lower part of the chin with the thumb. Hold your mouth in an open position for 8 seconds, then close your jaw slowly. Repeat this exercise 3 times at home.
- c. Next, the patient is instructed to do tongue-holding exercises on the palate for 8 seconds while slowly opening and closing the jaw. Repeat this exercise 3 times at home (Morales et al., 2013).

Examination of TMD after jaw exercises

After two weeks, a second questionnaire based on the Helkimo's index was administered to the same patient. Data before and after doing jaw exercises was tabulated and data processing was performed. Processing and data analysis were done computerized and presented in tabular form. In this study, to determine the differences in TMD before and after jaw exercises, a paired T-test was used.

RESULTS AND DISCUSSION

The results of the questionnaire before jaw exercise in the first question about difficulty in opening their mouths, 19 people (63.3%) said they did not have difficulties 9 people (30%) said they

sometimes had difficulties and 2 people (6.7%) said yes have difficulties. In the second question about difficulties in moving or using the jaw 16 people (53.3%) stated that there was no difficulty 10 people (33.3%) said that they sometimes had difficulties and 4 (13.3%) stated that they had difficulties. In the third question about having felt stiff muscles or pain when chewing 12 people (40%) said no 11 people (36.7%) said sometimes and 7 people (23.3%) said yes. In the fourth question about headaches 6 people (20%) stated that they did not experience headaches and 14 (46.7%) stated that they sometimes experience headaches and 7 people (23.3%) said yes and 3 people (10%) stated both sides were seriously ill. In the fifth question about pain in the neck or shoulder, 12 people (40%) stated that it did not exist 10 people (33.3%) said sometimes and 8 people (26.7%) said yes. In the sixth question about pain in the ear or its surroundings 18 people (60%) stated that there was no pain and 8 people (26.7%) suffered from pain sometimes and 4 people (13.3%) said yes. In the seventh question about awareness of the presence of sound in the joint area, 5 people (16.7%) said no 9 people (30%) said sometimes and 12 people (40%) said yes and 4 people (13.3%) said both sides hurt badly. In the eighth question, the respondents believed that they chewed normally, 5 people (16.7%) said no 9 people (30%) said sometimes and 16 people (53.3%) said yes. In the ninth question about respondents chewing food on one side only, 9 people (30%) said no 13 people (43.3%) said sometimes and 8 people (26.7%) said yes. In the tenth question regarding pain around the face in the morning, 22 people (73.3%) stated that there was no pain 6 people (20%) said they complained of pain sometimes and 2 people (6.7%) said yes.

Based on the results of the questionnaire after jaw exercise in the first question about difficulties in opening their mouths, 29 people (96.7%) stated that they did not have difficulties and 1 person (3.3%) stated that they sometimes had difficulties. Regarding the second question about the difficulty in moving or using the jaw 27 people (90%) stated that there was no difficulty and 3 people (10%) said that they sometimes had difficulties. In the third question about having felt muscle stiffness or pain when chewing, 21 people (70%) said no 8 people (26.7%) said sometimes and 1 person (3.3%) said yes. In the fourth question about headaches 17 people (56.7%) stated that they did not experience headaches and 8 (26.7%) stated that they sometimes experienced headaches and 5 people (16.7%) said yes. In the fifth question about pain in the neck or shoulder 18 people (60%) stated that it was not there and 12 people (40%) stated it sometimes. In the sixth question about pain in the ear or around it 24 people (80%) stated that there was no pain and 5 people (16.7%) suffered from pain sometimes and 1 person (3.3%) said yes. In the seventh question about awareness of the presence of sound in the joint area, 10 people (33.3%) said no 12 people (40%) said sometimes 6 people (20%) said yes and 2 people (6.7%) said both sides hurt badly. In the eighth question, the respondents believed that they chewed normally, 8 people (26.7%) said no 16 people (53.3%) said sometimes and 6 people (20%) said yes. In the ninth question about respondents chewing food on one side only, 12 people (40%) said no 17 people (56.7%) said sometimes and 1 person (3.3%) said yes. In the tenth question regarding pain around the face in the morning 25 people (83.3%) stated that there was no pain and 5 people (16.7%) stated that they complained of pain sometimes.

In this study, based on the questionnaire before jaw exercise, 18 people (60%) showed mild STM disorders 11 people (36.7%) showed moderate STM disorders and one person (3.3%) showed severe STM disorders. Meanwhile, based on the questionnaire after jaw exercise as many as 13 people (43.3%) showed no STM disorders 15 people (50%) showed mild STM disorders and 2 people (6.7%)

showed moderate STM disorders. %) of 30 respondents had shown significant changes in STM disorders before and after jaw exercises.

Meanwhile, 6 people (20%) of 30 respondents showed no change in STM disorders before and after jaw exercises. This is because respondents were less cooperative and did not send regular video recordings during the two weeks of the study. External factors such as daily activities and busy work can be blamed. In addition, respondents also did not get a significant difference in STM disorders because respondents did not do jaw exercises properly. This is because all jaw training instructions were demonstrated through video recordings and respondents did not receive direct treatment from researchers because of the coronavirus pandemic.

Based on the results of statistical tests using the paired T-test, it was found that there was a significant difference between temporomandibular joint disorders before and after jaw exercise ($p < 0.05$).

Tabel 1. Temporomandibular Joint Disorders Before and After Jaw Exercises

Questions	TMD Before Jaw Exercises								TMD After Jaw Exercises							
	No		Sometimes		Yes		Both sides		No		Sometimes		Yes		Both sides	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1. Are you having trouble opening your mouth?	19	63,3	9	30	2	6,7	-	-	29	96,7	1	3,3	-	-	-	-
2. Do you have difficulty moving or using your jaw?	16	53,3	10	33,3	4	13,3	-	-	27	90	3	10	-	-	-	-
3. Have you ever felt your muscles stiffen or hurt when chewing?	12	40	11	36,7	7	23,3	-	-	21	70	8	26,7	1	3,3	-	-
4. Do you have frequent headaches?	6	20	14	46,7	7	23,3	-	-	17	56,7	8	26,7	5	16,7	-	-
5. Have you ever had neck or shoulder pain?	12	40	10	33,3	8	26,7	-	-	18	60	12	40	-	-	-	-
6. Have you ever had any pain?	18	60	8	26,7	4	13,3	-	-	24	80	5	16,7	1	3,3	-	-
7. Are you aware of any sounds in the joint area?	5	16,7	9	30	12	40	4	13,3	10	33,3	12	40	6	20	2	6,7
8. Are you sure that you chew normally?	5	16,7	9	30	16	53,3	-	-	8	26,7	16	53,3	6	20	-	-
9. Do you chew food	9	30	13	43,3	8	26,7	-	-	12	40	17	56,7	1	3,3	-	-

	on only one side?																
	Do you experience pain around the face in the morning?	22	73,3	6	20	2	6,7	-	-	25	83,3	5	16,7	-	-	-	-

Table 2. Results of Total Score and TMD Before and After Jaw Exercises

No Respondents	Before Jaw Exercises		After Jaw Exercises	
	Total Score	STM disorders	Total Score	STM disorders
1	7	Mild	3	Do not have
2	7	Mild	5	Mild
3	4	Mild	4	Mild
4	4	Mild	3	Do not have
5	6	Mild	3	Do not have
6	7	Mild	7	Mild
7	12	Moderate	6	Mild
8	8	Mild	3	Do not have
9	12	Moderate	6	Mild
10	10	Moderate	4	Mild
11	7	Mild	3	Do not have
12	9	Moderate	9	Moderate
13	13	Moderate	5	Mild
14	6	Mild	6	Mild
15	7	Mild	3	Do not have
16	14	Moderate	5	Mild
17	14	Moderate	5	Mild
18	16	Severe	9	Moderate
19	4	Mild	3	Do not have
20	7	Mild	3	Do not have
21	7	Mild	3	Do not have
22	12	Moderate	6	Mild
23	5	Mild	5	Mild
24	13	Moderate	5	Mild
25	7	Mild	3	Do not have
26	7	Mild	3	Do not have
27	6	Mild	2	Do not have
28	11	Moderate	4	Mild
29	9	Moderate	8	Mild
30	7	Mild	3	Do not have

Table 3. Statistical Results of Differences in Severity of TMD Before and After Jaw Exercises.

Statistical difference in the severity of TMD			
Couple	n		p
Before jaw exercises	30	8.60 ± 3.30	
After jaw exercises	30	4.56 ± 1.88	0.0001 *

Note: * significant (p <0, 05)

Differences in the Severity of Temporomandibular Joint Disorders Before and After Jaw Exercises based on the Helkimo Anamnestic Index.

In this study, differences in the severity of temporomandibular joint disorders before and after were obtained through quasi-experimental (quasi-experimental) one-group pre-test post-test design. Based on the questionnaire, it was found that 13 respondents (43.3%) of respondents with mild disorders with mild disorders after doing jaw exercises for 2 weeks stated that there was no disturbance. 10 people (33.3%) respondents with moderate temporomandibular joint disorders stated that they had mild disturbances after the treatment of jaw exercises at home for 2 weeks. 1 person (3.33%) of respondents who complained of severe temporomandibular joint disorders stated that the level of temporomandibular joint disorders was moderate. Meanwhile, 6 (20%) respondents stated that there was no difference in the severity of the disorder before and after jaw exercises. Based on the statistical results of the paired T-test the severity of temporomandibular joint disorders before and after jaw exercise decreased with a value of $p = 0.0001$ ($p < 0.005$).

Jaw exercises can reduce the severity of temporomandibular joint disorders, the maximum open-mouth exercises performed by respondents at the front mirror stimulate blood circulation to the STM muscles which can overcome the limitations of jaw motion, improve muscle coordination, relax tense muscles, and restore normal muscle length and function. The second exercise, resistance training performed by the respondent, can increase muscle relaxation that works against the main muscles, for example when opening the mouth; the active muscle depressors. With resistance during the opening of the mouth, the levator muscles will relax even more. The third exercise performed by the respondent by holding the tongue against the ceiling can overcome jaw motion and this exercise can eliminate or reduce noise in the joints.

The success or failure of jaw exercise therapy depends on the patient's motivation and cooperation. According to research by Lia Kartika et al. 2007 to get benefits, jaw exercises should be done for 2-3 minutes with a frequency of 2-3 times a day. In most cases, it may take between 2-3 months for satisfactory results both objectively and subjectively to be achieved.

The results of this study are by the study of Nicolakis et al. In 2008 it stated that jaw exercises were useful in the treatment of anterior disc dislocation with reduction and pain. Symptoms that trigger jaw pain and restricted movement can be significantly reduced.¹⁹ Likewise, the results of research by Lia Kartika et al. In 2007 stated that exercise therapy was proven to be very adequate in bringing functional improvements to the masticatory system in patients and satisfactory results could be obtained if jaw exercises were carried out regularly and according to the instructions previously given.²⁰ Moraes AR et al in 2013 recommended the use of jaw exercises in the treatment of temporomandibular joint disorders.¹⁸ However, the results of this study are different from the results of research by Tuncer A et al. In 2013 it stated that jaw exercises alone in the short term cannot reduce pain in the temporomandibular joint, so it must be combined with manual therapy.²¹ In the study of Tuncer A. et al. in 2013, a comparison was made between the group of patients who received manual therapy in practice and the group of patients who did jaw exercise therapy at home, the results were better in the group of manual therapy in practice. This is due to differences in methodology.

In a study where patients who did exercises at home were not noticed by the researcher whether the patients were doing the exercises at home properly or not when in this study, the patients were reminded to do jaw exercises every day and were directed to send videos while they were doing jaw exercises.

Based on the results of the questions in the questionnaire, in the fifth question about pain in the neck or shoulder before jaw exercise 10 people (33.3%) of the respondents complained of pain

sometimes, while after jaw exercise the respondents who complained of pain sometimes increased to 12 people (40%). This is because the respondent who answered yes after the jaw exercise was gone means that there had been an increase in recovery from saying yes to sometimes. The same applies to the seventh question where before the jaw exercise 9 people (30%) of the respondents chose the answer sometimes and after 12 people (40%) of the respondents chose the answer sometimes at the same time who chose yes after the jaw exercise. decreases, it follows from this that the jaw exercise treatment is successful.

Meanwhile, for the eighth question, the respondent's ability to chew normally and choose no and sometimes after jaw exercise increased. This is because after doing jaw exercises the respondents realized that they had not chewed normally all this time. Respondents studied the mistakes they had made so far and answered questions honestly. Likewise, in the ninth question, the respondents answered that sometimes after jaw exercises increased but those who answered yes decreased. This is because, after doing the jaw exercise the respondent was able to chew on both sides and this meant that the jaw exercise had been successful.

The weakness of this study is that researchers cannot monitor the patient directly, so it is possible that the patient's exercise can be wrong, the severity of temporomandibular joint disorders cannot be measured by clinical examination because of the coronavirus pandemic, and the unpredictable honesty of patients.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that: There are differences in the severity of temporomandibular joint disorders before and after jaw exercises, where 24 people (80%) of 30 respondents indicated that there was an improvement in the temporomandibular joint after jaw exercises performed by patients with $p\text{-value} = 0.0001$ ($p < 0.005$). The findings may have implications for the development of targeted and evidence-based interventions to manage TMD, particularly in the context of dental education.

REFERENCES

- Achmad, H., Armedina, R. N., Timokhina, T., Goncharov, V. V, Sitanaya, R., & Riyanti, E. (2021). Literature review: Problems of dental and oral health primary school children. *Indian Journal of Forensic Medicine & Toxicology*, 15(2).
- Achmad, H., Handayani, H., & Singgih, M. F. (2013). Beberapa gejala disfungsi sendi temporomandibula pada anak: Penelitian pada murid SDN 2 Sengkang-Wajo Provinsi Sulawesi Selatan pada tahun 2011-2012 Some symptoms of temporomandibular joint on child: Research at SDN 2 SengkangWajo, Province South Sulawesi in 2011-2012. *Journal of Dentomaxillofacial Science*, 12(1), 11–15.
- Castelo, P. M., Gavião, M. B. D., Pereira, L. J., & Bonjardim, L. R. (2005). Relationship between oral parafunctional/nutritive sucking habits and temporomandibular joint dysfunction in primary dentition. *International Journal of Paediatric Dentistry*, 15(1), 29–36.
- David, C. M., & Elavarasi, P. (2016). Functional anatomy and biomechanics of temporomandibular joint and the far-reaching effects of its disorders. *Journal of Advanced Clinical and Research Insights*, 3(3), 101–106.
- Harrison, A. L., Thorp, J. N., & Ritzline, P. D. (2014). A proposed diagnostic classification of patients with temporomandibular disorders: implications for physical therapists. *Journal of Orthopaedic & Sports Physical Therapy*, 44(3), 182–197.
- Hegde, S., Mahadev, R., Ganapathy, K. S., Sujatha, D., & Patil, B. A. (2011). Prevalence of signs and symptoms of temporomandibular disorders in dental students. *Journal of Indian Academy of Oral Medicine and Radiology*, 23(Suppl 1), S316–S319.
- Hupp, J. R., Tucker, M. R., & Ellis, E. (2017). *Contemporary oral and maxillofacial surgery* (Vol. 262). Mosby.
- Jerolimov, V. (2009). Temporomandibular disorders and orofacial pain. *Rad*, 504, 53–77.
- Kaur, H., & Datta, K. (2013). Prosthodontic management of temporomandibular disorders. *The Journal of Indian Prosthodontic Society*, 13, 400–405.
- Liang, S., Zheng, Z., Li, Y., Yang, Y., Qin, L., Zhao, Z., Wang, L., & Wang, H. (2023). A review of platelet-rich plasma for enteric fistula management. *Frontiers in Bioengineering and Biotechnology*, 11.
- Moraes, A. da R., Sanches, M. L., Ribeiro, E. C., & Guimarães, A. S. (2013). Therapeutic exercises for the control of temporomandibular disorders. *Dental Press Journal of Orthodontics*, 18, 134–139.
- Nicolakis, P., Erdogmus, B., Kopf, A., Djaber-Ansari, A., Piehslinger, E., & Fialka-Moser, V. (2000). Exercise therapy for craniomandibular disorders. *Archives of Physical Medicine and Rehabilitation*, 81(9), 1137–1142.
- Problems, C. A. C. J. (2015). Guideline on acquired temporomandibular disorders in infants, children, and adolescents. *Pediatric Dentistry*, 37(5), 78–84.

Prosthodontics, A. of. (1999). *The glossary of prosthodontic terms*. Mosby.

Rani, S., Pawah, S., Gola, S., & Bakshi, M. (2017). Analysis of Helkimo index for temporomandibular disorder diagnosis in the dental students of Faridabad city: A cross-sectional study. *The Journal of the Indian Prosthodontic Society*, 17(1), 48.

Rikmasari, R. (2013). Penetapan diagnosis gangguan sendi berdasarkan Research Diagnostic Criteria for temporomandibular joint disorders tahun 2010. *Makassar Dental Journal*, 2(4).

Sayed, A. R., Mehta, N., Singh, K., Singh, K., Handa, P., & Sanap, A. A. (2021). Knowledge and Attitude of Dentists towards Physical Therapy for the Management of Temporomandibular Disorders. *Annals of the Romanian Society for Cell Biology*, 25(6), 4918–4927.

Tuncer, A. B., Ergun, N., Tuncer, A. H., & Karahan, S. (2013). Effectiveness of manual therapy and home physical therapy in patients with temporomandibular disorders: A randomized controlled trial. *Journal of Bodywork and Movement Therapies*, 17(3), 302–308.



© 2024 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>).