



# The pain ratio before and after the application of physiotherapy for dysfunction of temporomandibular joint

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## ABSTRACT

**Introduction:** Physiotherapy, a non-invasive method of conservative treatment, that includes manual therapy, exercises and physical procedures, is used in the treatment of temporomandibular dysfunction and polyarticular laxity. It has been proven that physiotherapy focused on temporomandibular dysfunction is an essential element of treatment that leads to a reduction in pain, an improvement in temporomandibular joint (TMJ) function, and an improvement in quality of life. Physiotherapy treatment aims to alleviate the symptoms and try to restore the normal function of the masticatory system, for which various techniques can be used. The aim of the study was to determine the type, intensity, and frequency of TMJ dysfunction pain before and after physiotherapy.

**Methods:** The study was conducted in a private practice in Munich, Germany. All subjects who met the criteria for inclusion in the study completed a standardized questionnaire on TMJ dysfunction (TMJ disorder [TMJ/TMD] Questionnaire). The questionnaire was used to obtain data on the type and location of pain, duration of pain, and other symptoms related to the TMJ. The anamnestic data of the respondents who came to the doctor's office with the symptoms mentioned were examined, and the orthodontic or dental findings were analyzed.

**Results:** The analysis showed that before treatment some of the joints were affected in 28 subjects, while after treatment the joints were affected in 19 subjects. After treatment a significant decrease in affected TMJ was observed ( $\chi^2 = 9.516$ ,  $p = 0.008$ ). Ear pain occurred in 17 (54.84%) subjects before treatment, and in 5 (16.13%) after treatment. A significant reduction was observed at the  $p = 0.003$  level. Pain around the eyes occurred in 9 (29.03%) of the respondents before treatment, and after treatment in 2 (6.45%) of the respondents. Facial pain was reported in 16.13% of the anamnestic data before the treatment, and it was not reported in any of the respondents after treatment. There was also a significant reduction in the occurrence of tinnitus ( $p = 0.004$ ). The occurrence of headaches also decreased after treatment ( $p < 0.001$ ). Ear pressure was present before treatment in 45.16% of cases, and after treatment in 22.58% of cases, so there was no significant decrease.

**Conclusion:** Physiotherapy for people with TMJ dysfunction contributed significantly in reducing pain and alleviating other TMD symptoms.

**Keywords:** Temporomandibular joint dysfunction; physiotherapy; quality of life; pain management; pain measurement

## INTRODUCTION

The temporomandibular joint (TMJ) is considered the most complex structure in the human body. It performs rotational and translational movements due to the double articulation of the temporal bone condyles. This joint is susceptible to functional or pathological changes, that lead to disorders such as temporomandibular dysfunction (1). The treatment of temporomandibular dysfunction (TMD) can be divided into non-invasive, minimally invasive, and invasive methods. Replacement of the TMJ is reserved for severely damaged joints in the final stages of the disease,

when all other more conservative treatment methods have failed (2). Physiotherapy, a non-invasive method of conservative treatment, that includes manual therapy, exercises, and physical procedures, is used in the treatment of TMD as well as of polyarticular laxity. Physiotherapy targeting TMD has been shown to be an essential element of treatment leading to pain reduction, improved TMJ function and improved quality of life (3). To minimize the effects caused by TMD, physiotherapy becomes a fundamental and integral part of the treatment. Physiotherapy treatment aims to alleviate the symptoms and try to restore the normal function of the masticatory system, for which different techniques can be used. Devices such as laser, ultrasound and cathode current are useful in the treatment. However, manual therapy through muscle stretching exercises, joint mobilization, and exercises to stabilize the cervical spine

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segment can also be included in the physiotherapy process. Physiotherapy is effective and improves physical function in people with TMD (1). In addition, it is important to emphasize the effectiveness of combining cervical therapy and orofacial treatment in patients with cervicogenic headaches associated with signs and symptoms of TMD (4). Temporomandibular dysfunction can be contributing factor to cervicogenic headaches partly due to the influence of TMJ dysfunction on the cervical spine (5). Physiotherapy of the cervical spine (mobilization of the intervertebral joints, stretching of the neck muscles, stabilization of the deep neck flexors) increases pain-free mouth opening and reduces pain in patients with TMD (6). There is a significant percentage of TMD cases in patients with cervicogenic headaches and also a significant reduction in cervical symptoms after specific treatment of TMD, even over a long period of time. However, a lot of studies have not found a consistent relationship between craniocervical posture and TMD. The authors also add that changes in head and neck posture are abnormalities that are found equally in individuals with and without TMD. An anterior head posture leads to posterior rotation of the skull and mandible, and there is a tendency to pull the mandibular condyle posteriorly, resulting in a posterior position (7). Physiotherapy is particularly important in the treatment of the pain syndrome associated with functional disorders of the TMJ. In people with long-lasting dysfunction of the masticatory muscles, palpation can localize trigger points, i.e., thickenings in the form of nodules the size of a grain of rice or a pea (8). One of the roles of physiotherapists is health promotion, and therefore, they are in an ideal position to influence the health of an individual. Nevertheless, the treatment goals for people suffering from TMD are similar to those for other musculoskeletal conditions. The goals are best achieved with a well-established program that focuses not only on treating the physical impairments, but also on reducing or eliminating the effects of any contributing factors (9). Kinesitherapy involves active exercises and relaxation exercises as well as post-isometric muscle relaxation which should be an integral part of the therapy. After the previous education, it is recommended that patients perform the exercises in front of a mirror in 2-3 sets of 15-20 repetitions. Performing exercises with one's own hand/finger resistance, opening/closing the mouth in full range of motion should become a daily routine to maintain proper muscle tone and joint function (10). The exercises used in TMD treatment aim to reduce pain, improve coordination of the masticatory muscles, reduce muscle spasms and hyperactivity, restore original muscle length, strengthen the muscles involved and stimulate tissue regeneration (11). During the exercises, the TMJ must not crack, and the movement range of the joint must not exceed the physiological and painful limit. Therefore, the exercises are designed to act directly on the position of the TMJ and correct the general posture of the body depending on the postural defect. The most common alterations in the area of the head, neck and shoulders are protraction of the head, cervical hyperlordosis, elevation, and internal rotation of the shoulders. To restore the correct posture, it is necessary to reduce the tension in the tonic muscles. It is necessary to strengthen the muscles, because muscle atrophy can occur (12). Massage can be an effective method of treating

myofascial pain. Such therapy is clinically useful because it improves the patient's subjective and objective health status and is easy to monitor (13). One of the many non-invasive procedures used to treat these disorders is massage. By applying rubbing techniques or transverse massage to the muscle fibers, improvement of circulation is achieved, mobility is improved, and muscle tension is reduced. Trigger point massage is another non-invasive procedure that supports treatment of this group of patients. Pressure on the trigger point is a technique that lasts about 15-60 s and uses an ischemic mechanism. The therapist palpates the painful point – the place where the sarcomeres are damaged, they usually occur due to overuse. Deactivation of the trigger points, i.e., a significant reduction in pain sensations, directly leads to relaxation of the soft tissues. In the case of TMJ dysfunction, it is important to relax trigger points for overactive muscles that surround the joint, but also for muscles that act synergistically, such as the trapezius muscle or the sternocleidomastoid muscle (10). Massage reduces sensitivity after exertion and tissue swelling. The short-term analgesic effect is caused by the activation of the pain threshold mechanism, which switches off the pain signals that reach the central nervous system through larger and faster conducting nerve fibers that are activated. The descending mechanism of pain suppression makes it possible to achieve long-lasting analgesic effect. In addition, massage has good psychological effects, reduces stress and anxiety, and improves the patient's mood. Massage reduces tension headaches, masticatory, and temporal muscle pain and helps to restore muscular balance between the right and left masticatory muscles. There is also an improvement in the functional movements of the masticatory organ (13). The masticatory muscle massage is performed while the lower jaw is at rest for about 3-5 minutes. The treatment is carried out by a physiotherapist or the patient themselves - so-called self-massage. The masticatory muscles, the temporal muscles, the posterior belly of the digastric muscles, and the medial pterygoid and lateral pterygoid muscles are treated. Massage of the masticatory muscle in combination with massage of the medial pterygoid muscle is performed intraorally using a thumb pad. Access to the massage of the lateral pterygoid muscle is possible in the vestibule of the oral cavity behind the upper eighth tooth, where circular movements of the thumb are performed (12). A gum massage can also have a relaxing effect, especially when the teeth are tense. It improves blood circulation and thus helps to heal irritations on the sensitive tooth neck more quickly. Massages outside the mouth are useful for the entire face and neck area. With all massages, the therapist must be careful to feel the pressure, so that the massage does not lead to more pain. If the pain increases, the pressure must be reduced. Heat therapy is an important factor when it comes to healing tension. However, the heat can aggravate the inflammation, which is why other treatment methods should be used in such cases. Finally, teeth chattering in winter is due to the muscles shortening as a result of the cold. The body tries to counteract the hypothermia with a "waving" movement by generating heat through movement. In case of craniomandibular dysfunction, masticatory muscles are put under great strain by the clenching and scraping of the teeth or by misalignment of the jaws. The muscles keep the jawbone stable in the skull

bones. If the muscle is no longer stable, the jaw slips, is pushed in the wrong direction and puts further strain on the muscle. A red-light lamp, a heating pad, or a relaxing fango pack are used for heat therapy. A heat plaster can help to relax the throat and neck muscles. Depending on the manufacturer and active ingredient, they last up to 12 hours and are well tolerated by most people. Warming creams are also a good way to improve blood circulation in the muscles. Healing mud is not only good for muscles and other tissues, but also full of minerals that penetrate the skin and have a beneficial effect on soft tissue. Electrotherapy – depending on the need, electrotherapy is used to relieve the pain and tension in the muscles (transcutaneous electrical nerve stimulation - [TENS], hyaluronidase iontophoresis) and to increase muscle strength in people with hypermobility (electrostimulation) (12). TENS is a variant of muscle stimulation in which the nerves are specifically stimulated with a stimulation current (14).

With this in mind, the survey was designed to investigate the presence of symptoms before and after the rehabilitation in people with TMJ dysfunction, the pain ratio before and after rehabilitation, and to identify the effective therapy modalities.

## METHODS

The research was conducted in a private practice “Physiotherapie Süd – West” in Munich, Germany in the period from May 31, 2022, to March 27, 2023. The study involved 31 male and female subjects with symptoms of TMJ dysfunction in the chronic phase (tinnitus, facial pain, neck pain, tension in the masticatory muscles, difficulty opening the mouth, etc.) and who were over 18 years of age. Study is approved by management of practice, and performed according to 1964 Helsinki declaration and its later amendments. Before enrolling in the study all respondents were informed in detail about the research plan and procedure, and only those respondents who gave their consent to voluntarily participate in the study were included. All subjects who met the criteria for inclusion in the study completed a standardized questionnaire on TMJ dysfunction (TMJ disorder [TMJ/TMD] Questionnaire) (15). The questionnaire was primarily translated from English to Bosnian, and then from Bosnian to German by a court interpreter as all respondents were from German-speaking countries. Questionnaire was used to collect data on the type and location of pain, the duration of pain, and other symptoms associated with the TMJ. In addition, the anamnestic data of the respondents who came to the doctor’s office with the symptoms mentioned were examined, and the dental findings were analysed. The physiotherapy program of TMJ includes the use of canines, medical massage, ultrasound and kinesiotherapy over 3 weeks with a total of 6 treatments. The treatment lasts 40 minutes. Before the actual therapy, a physiotherapeutic assessment of the condition of the muscles and mobility in the TMJ was carried out, and the subjects were informed about the risk factors that lead to dysfunction of the TMJ. Massage and pressure on trigger points of the myofascial muscles support faster muscle relaxation. Kinesiotherapy was also performed through exercises, counseling of the subjects, manual stretching of the craniomandibular muscles, and

manual stretching of the muscles in the clavicle area. The study was designed as prospective, interventional research using a descriptive-analytical method. The results of the descriptive statistical risk analysis are presented with the following parameters: mean value and standard deviation. The Chi-square test ( $\chi^2$ ) was used to investigate the existence of a difference between the expected and observed values in one or more categories in the contingency tables. In cases where more than 20% of cells were found to have a value  $<5$  in the expected values, Fisher’s exact test was used. Comparison of mean values between two groups was performed using the t-test. Statistical significance was set at a probability level  $p < 0.05$ .

## RESULTS

Table 1 shows that before treatment some joints were affected in 28 subjects, while after treatment the joints were affected in 19 subjects. After treatment a significant reduction in affected TMJ was found ( $\chi^2 = 9.516$ ,  $p = 0.008$ ).

Tables 2 and 3 show the presence of symptoms before and after physiotherapy treatment. Subjective hearing loss was neither present before nor after treatment. 45.16% of respondents had dizziness before treatment and only 12.90% of respondents had it after treatment. A significant reduction in the frequency of dizziness was found ( $p = 0.011$ ). There was also a maximum reduction in nausea and upset stomach ( $p = 0.002$ ). Before treatment tinnitus was present in 61.29% of respondents, and after in 22.58% of respondents. A significant decrease in the frequency of tinnitus was observed ( $p = 0.004$ ). The frequency of headaches was also significantly reduced after treatment ( $p < 0.001$ ). 45.16% of respondents had pressure in the ear before treatment, and 22.58% of the respondents after treatment. No significant reduction was found. One respondent experienced tongue pain before treatment, but it was no longer present after treatment.

Tables 4 and 5 show other, specific symptoms or diagnosis that were present before and after physiotherapy and that rarely occur.

Table 6 shows the most helpful methods in the treatment of TMJ dysfunction. Here, 83.9% of respondents cited a massage as the most effective method, and 41.9% of respondents cited exercises as the most effective.

Figure 1 shows type of pain before and after physiotherapy treatment. Before treatment, none of the subjects were pain-free and 67.7% of them had severe pain. The spread of pain was present in 51.60% of the respondents. After treatment, there was a reversal, 35.50% of the respondents had no longer pain at all, and 45.20% of the respondents had superficial pain. Only 9.70% of the subjects had deep pain, and not a single subject had spreading pain.

**TABLE 1.** Affected temporomandibular joints before and after physiotherapy treatment

Affected joint	Before treatment	After treatment	Chi-square	p-value
Right joint	6	10	9.516	0.008
Left joint	5	6		
Both joints	17	3		

**TABLE 2.** Presence of symptoms before and after physiotherapy treatment

Presence of symptoms	Before treatment (%)	After treatment (%)	Fisher's exact <i>p</i>
<b>Pain in TMJ</b>			
No pain	1 (3.23)	13 (41.94)	0.0005
Presence of pain	30 (96.77)	18 (58.06)	
<b>Ear pain</b>			
No pain	14 (45.16)	26 (83.87)	0.003
Presence of pain	17 (54.84)	5 (16.13)	
<b>Pain around the eyes</b>			
No pain	22 (70.97)	29 (93.55)	0.042
Presence of pain	9 (29.03)	2 (6.45)	
<b>Lower jaw pain</b>			
No pain	11 (35.48)	24 (77.42)	0.002
Presence of pain	20 (64.52)	7 (22.58)	
<b>Upper jaw pain</b>			
No pain	1 (3.23)	14 (45.16)	<0.001
Presence of pain	30 (96.77)	17 (54.84)	
<b>Neck pain</b>			
No pain	2 (6.45)	26 (83.87)	<0.0001
Presence of pain	29 (93.55)	5 (16.13)	
<b>Shoulder pain</b>			
No pain	5 (16.13)	23 (74.19)	<0.001
Presence of pain	26 (83.87)	8 (25.81)	
<b>Forehead pain</b>			
No pain	23 (74.19)	31 (100.00)	0.0046
Presence of pain	8 (25.81)	0 (0.00)	
<b>Facial pain</b>			
No pain	26 (83.87)	31 (100.00)	0.052
Presence of pain	5 (16.13)	0 (0.00)	
<b>Sound of "crunching" in TMJ</b>			
Not present	5 (16.13)	24 (77.42)	<0.001
Present	26 (83.87)	7 (22.58)	

TMJ: Temporomandibular joint

**TABLE 3.** Presence of symptoms before and after physiotherapy treatment

Presence of symptoms	Before treatment (%)	After treatment (%)	Fisher's exact <i>p</i>
<b>Subjective hearing loss</b>			
No pain	31 (100.00)	31 (100.00)	-
Presence of pain	0 (0.00)	0 (0.00)	
<b>Dizziness</b>			
Not present	17 (54.84)	27 (87.10)	0.011
Present	14 (45.16)	4 (12.90)	
<b>Upset stomach - nausea</b>			
Not present	22 (70.97)	31 (100.00)	0.002
Present	9 (29.03)	0 (0.00)	
<b>Ringing in the ears (tinnitus)</b>			
No pain	12 (38.71)	24 (77.42)	0.004
Presence of pain	19 (61.29)	7 (22.58)	
<b>Headache</b>			
No pain	10 (32.26)	29 (93.55)	<0.001
Presence of pain	21 (67.74)	2 (6.45)	
<b>Pressure in the ears</b>			
No pain	17 (54.84)	24 (77.42)	0.106
Presence of pain	14 (45.16)	7 (22.58)	
<b>Tongue pain</b>			
No pain	30 (96.77)	31 (100.00)	0.998
Presence of pain	1 (3.23)	0 (0.00)	

Figure 2 shows ratio of pain intensity before and after the physiotherapy treatment. Observed from the average, the

average pain intensity before treatment was  $4.88 \pm 1.62$ , while it was  $1.71 \pm 0.56$  after treatment. A significant



**TABLE 4.** Presence of other symptoms before physiotherapy treatment

Other symptoms	N	%
Migraine	2	6.5
Fibromyalgia	1	3.2
Depression	1	3.2

**TABLE 5.** Presence of other symptoms after physiotherapy treatment

Other symptoms	N	%
Fibromyalgia	1	3.2
Depression	1	3.2

**TABLE 6.** The most helpful methods during physiotherapy treatment

Helpful methods in physiotherapy	N	%
Kinesiotherapy	11	35.5
Fango	11	35.5
Ultrasound	10	32.3
Massage	26	83.9
Exercises	13	41.9

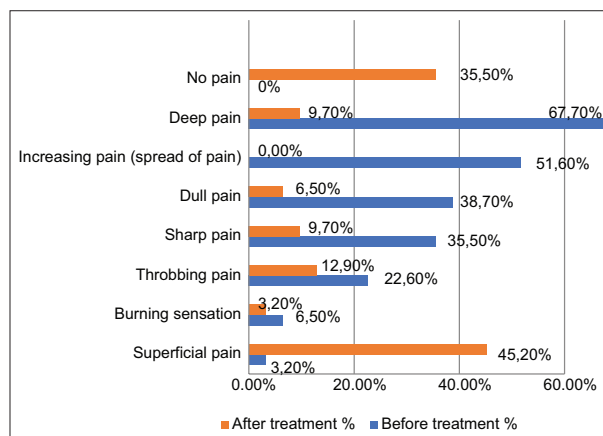
reduction in pain in respondents was observed after treatment ( $t = -10.315, p < 0.001$ ).

**DISCUSSION**

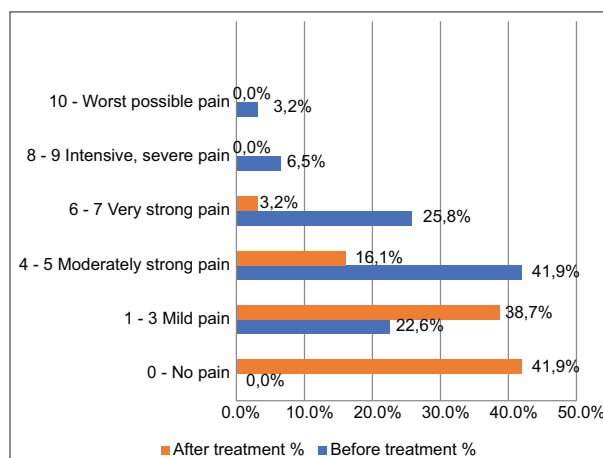
Based on previous research and the literature cited in this paper, it can be concluded that more and more people are experiencing pain in the TMJ, and that the main cause is emotional disturbance or stress, and the resulting bruxism. The aim of the study was to determine the effects of physiotherapy because in addition to the pain in the TMJ, the symptoms usually spread to the cervical spine, and tinnitus, headaches, pressure in the ear, dizziness, and tension in the cervicomandibular muscles occur. The physiotherapy lasted 3 weeks.

A similar study was conducted by Byra et al. who investigated the degree of TMJ hypomobility and the effectiveness of physiotherapy in 44 subjects ( $40.2 \pm 10.6$  years). In the indicated group, 20 respondents had TMJ hypomobility and myofascial pain. The subjects underwent 3 weeks of physiotherapy consisting of manual therapy and exercises. Linear measurements of TMJ mobility and palpation of selected masticatory muscles were performed in the study group. The pain was assessed before and after 3-week therapy using a numerical rating scale (NRS). Byra et al. results showed that a significant improvement was achieved in TMJ mobility, which increased by an average of 6.6 mm ( $p = 0.0005$ ), as well as reduction in pain by an average of 3 points on the NRS scale ( $p = 0.00002$ ). Applied physiotherapy algorithm, including manual therapy and exercises for the masticatory muscles, is effective in improving the range of motion of TMJ and reducing pain in people with TMJ hypomobility (16).

In correlation with our results, it was concluded that in our study, the TMJ pain was present in 28 respondents before treatment, while after treatment, affected joints were present in 19 respondents. A significant decrease in the pain in the affected TMJ was found after the treatment ( $\chi^2 = 9.516, p = 0.008$ ), which is consistent with the results of Joanna and associates.



**FIGURE 1.** Analysis of type of pain before and after physiotherapy treatment.



**FIGURE 2.** Ratio of pain intensity before and after the physiotherapy treatment.

A clinical study conducted by Delgado de la Serna et al. investigated the effects of adding cervicomandibular manual therapy to an exercise program (physiotherapy) and training on clinical outcomes in people with tinnitus associated with temporomandibular dysfunction (TMD). Respondents with tinnitus attributable to temporomandibular dysfunction were divided into two groups; one group received physiotherapy and manual therapy, the other group received only physiotherapy. All subjects participated in six physiotherapy sessions for 1 month, which included craniocervical and TMJ exercises, massage, and patient education. Respondents in the manual therapy group also had cervicomandibular manual therapy applied to TMJ and the cervical and masticatory muscles. Primary outcomes included TMJ pain intensity and tinnitus severity. Secondary outcomes included tinnitus-related disability, temporomandibular dysfunction-related disability, self-rated quality of life, depression symptoms, pressure pain thresholds, and mandibular range of motion. Respondents were assessed at the baseline, 1 week, 3, and 6 months after the intervention. This clinical study showed that the use of cervicomandibular manual therapy in combination with exercises and training led to better results than the use of exercises/training alone in people with tinnitus due to TMD (17).

In physiotherapy process for people with TMJ dysfunction, the treatment in our study was similar to that in the study

by Delgado de la Serna et al. The respondents mentioned massage as the method that helped them the most, with this method being mentioned by 26 (83.9%) respondents. Thirteen (41.9%) respondents indicated exercise as better method, and kinesitherapy and fango were chosen by 11 (35.5%) respondents. 10 (32.3%) respondents indicated that the ultrasound was helpful in the treatment. In correlation of our study with the research by Delgado de la Serna et al., it can be concluded that in both studies, the exercises and education of the respondents had a positive influence on the physiotherapeutic process.

Ferendiuk et al. investigated the effects of emotional stress in the treatment of TMJ dysfunction. The study included 100 respondents of both genders aged of 20-35 years, who had been diagnosed with pain due to TMJ dysfunction followed by high muscle tension treated with relaxation massage. All respondents underwent a physical examination, a special functional examination of the masticatory system, and an assessment of psycho-emotional factors and stress, based on a survey created for their own needs. The test results after the relaxation therapy showed a significant reduction in the intensity of myofascial pain in all respondents. Progressive muscle relaxation can be used successfully as a supportive therapy for people with TMJ dysfunction (18).

In the assessment of the pain condition in our study, the onset of symptomatology was severe emotional distress in most of respondents, i.e., 21 (67.7%) respondents. Due to the emotional disturbance, the respondents complained of the following symptoms: pain in the left and right ear, pain around the eyes, ringing in the ears or tinnitus, headache, and pressure in the ear. Ear pain occurred before treatment in 17 (54.84%) respondents, and after treatment in 5 (16.13%) respondents. A significant decrease was found at the level  $p = 0.003$ . Pain around the eyes occurred in 9 (29.03%) respondents, and after treatment in 2 (6.45%) respondents. Fascial pain occurred in 16.13% cases before treatment and after treatment, it was not found in any of the respondents. A significant decrease in the occurrence of tinnitus was also observed ( $p = 0.004$ ). After treatment the frequency of headaches also decreased ( $p < 0.001$ ). 45.16% of the respondents had pressure in the ear before treatment, and 22.58% of the respondents had it after treatment, so it can be said that no significant decrease was found. Our study as well as the study by Ferendiuk et al. proved that the main cause of temporomandibular dysfunction symptoms is emotional disturbance or stress. In both studies, there was a positive result in the treatment of muscle tension.

Based on the literature review, Zhang et al. investigated the effects of exercise therapy and occlusal splint therapy on pain and mobility of TMJ in people with painful TMJ dysfunction. The quality of the study was assessed using the Physiotherapy Evidence Database Scale. Six studies were included (498 patients: 251 occlusal splint therapy, 247 therapy exercises). The results showed that exercise therapy was not proven better at relieving pain in patients with painful TMJ than occlusal splint therapy ( $p = 0.08$ ) (19).

When correlating the results of Zhang et al. with our study, a significant reduction of TMD joint effect was found after treatment ( $\chi^2 = 9.516$ ,  $p = 0.008$ ). However, during our study, 45.16% of the respondents had ear pressure, and after treatment, it was found in 22.58% of the respondents.

No significant reduction was found. The impact of physiotherapy on the complete or partial inability to open the mouth also showed no improvement or change in any of the subjects in our study. One respondent was completely unable to open his mouth before and after the application of physiotherapy, while two respondents were partially unable to open their mouths before therapy, and this condition did not change after therapy. The respondent who was completely unable to open his mouth was referred for surgical treatment after physiotherapy treatment.

In a randomized study, Gomes et al. investigated the effects of massage therapy, conventional occlusal splint therapy, and silicone occlusal splint therapy on the electromyographic activity of the masticatory and anterior temporal muscles and the intensity of signs and symptoms in respondents with severe TMD and bruxism during sleep. The respondents with severe TMD and bruxism during sleep were divided into four treatment groups: (1) massage group, (2) conventional occlusal splint group, (3) massage + conventional occlusal splint group, and (4) silicone occlusal splint group. Groups 2, 3, and 4 wore an occlusal splint for 4 weeks. Groups 1 and 3 had three massage sessions per week for 4 weeks. Group 3 showed greater progress in TMD intensity compared to other groups. Massage therapy and the use of an occlusal splint had no significant effect on the electromyographic activity of the masticatory or anterior temporal muscle. However, the combination of these therapies resulted in the reduction of signs and symptoms intensity in individuals with severe TMD and bruxism during sleep (20).

Our research findings are similar to those of Gomes et al. as both studies found the positive effects of massage on reducing symptoms of temporomandibular dysfunction. The results of our study show that out of 31 respondents, 26 (83.9%) reported that massage as a therapeutic treatment helped to alleviate their symptoms.

## CONCLUSION

The presence of symptoms in individuals with TMJ dysfunction was significantly reduced after rehabilitation, with the exception of ear pressure symptom for which no significant statistical reduction was found. When the pain was analyzed before and after rehabilitation, a significant rebound in pain intensity was found. After treatment, mild pain was present more frequently as a percentage than after rehabilitation. This is an effective indicator that the percentage of maximum severe pain, intense severe pain, and very strong pain was reduced to mild pain. Of the treatment modalities, massage and kinesitherapy exercises had the highest efficiency in reducing pain and other symptoms of TMJ dysfunction.

## DECLARATION OF INTERESTS

Authors declare no conflict of interest.

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