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Physiotherapy in hypomobility of temporomandibular joints

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Abstract: Introduction: Temporomandibular disorders (TMD) are the second most common cause of chronic pain in the human musculoskeletal system. The triad of symptoms of TMD includes: pain within the temporomandibular joint (TMJ), limitation of its mobility and crepitations. The aim of the study was to present the methods of physiotherapy and to assess its effectiveness in patients with hypomobility of temporomandibular joints.
Material and Methods: 44 patients (40.2 ± 10.6 years) were examined for signs of TMD using the Manual Functional Analysis of masticatory system (MFA) questionnaire due to DC/TMD. In the above group, 20 patients showed hypomobility of TMJs and myofascial pain. They underwent a 3-week physiotherapy consisting of manual therapy and exercises. In the study group, linear measurements of TMJs mobility and palpation of selected masticatory muscles were performed. Pain was assessed before and after 3 weeks of therapy according to Numerical Rating Scale (NRS). Statistical processing of the data was done with STATISTICA 13 and was conducted considering significance at a p-value <0.05.
Results: Significant improvement in TMJ's mobility, which increased on average by 6.6 mm ($p = 0.0005$) and reducing of pain, a decrease of 3 points on average on the NRS Scale ($p = 0.00002$) were achieved.
Conclusions: The applied physiotherapy algorithm, including manual therapy and exercises of masticatory muscles, is effective in the case of improvement TMJ's range of motion and reduction of pain in patients with hypomobility of TMJ's.

Keywords: temporomandibular joint disorders, hypomobility of temporomandibular joints, physiotherapy, rehabilitation.

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Introduction

Temporomandibular disorders (TMD) are the second most common cause of chronic pain in the human musculoskeletal system, after chronic low back pain [1]. They are defined as a variety of pathologies that concern the structures of the masticatory system. Characteristic symptoms of these disorders are:

1. pain of the temporomandibular joints (TMJ) and masticatory muscles, which may be acute or chronic;
2. functional disorders of TMJ e.g. limitation of movement, jaw's deviation during mouth opening;
3. crepitation and clicking sounds of TMJ.

The above three symptoms are called triad of signs and symptoms of temporomandibular disorders [2].

Dysfunctions in TMJ's area also give symptoms such as: tinnitus and tension type headaches [3]. These symptoms lead to decrease in the quality of life such as: difficulties in performing activities of daily living (food intake, swallowing, breathing, verbal and emotional communication) and active participation in social life [1]. As a result, TMD become a social problem associated with high economic costs resulting from treatment and absence from work [4].

The occurrence of symptoms of TMD in the population is determined at the level of 8–15%, more often in women than men. The risk of developing symptoms of TMD increases with age and usually affects people between the age of 35 and 45 [5]. Recent studies on the Polish society have shown that this problem concerned 56.9% in the case of muscular symptoms and the second most common (48.9%) kind of TMD are disc's dislocation [6].

The contemporary interdisciplinary approach to the problems of temporomandibular joint dysfunctions includes: dental treatment, orthodontic treatment, rehabilitation, pharmacotherapy and patient's education. The medical team consists of a dentist, orthodontist, physiotherapist, psychologist and speech therapist. Physiotherapy as a non-invasive method of TMD's treatment plays an important role in comprehensive therapy of the patient and helps to reduce the symptoms and increase the quality of life [7].

The aim of this study was to present and evaluate the effectiveness of physiotherapeutic treatment, including manual therapy, exercises and patient's education in the case of TMD limitation of temporomandibular joint movement.

Material and Methods

The study group was isolated from 44 patients (40.2 ± 10.6 years) who underwent stomatognathic physiotherapy and consisted of 20 women (38.9 ± 10.9 years) with TMD, where the main symptoms were limited mobility and pain in the area of temporomandibular joints.

All subjects were provided with an explanation of the study and gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki.

Patients were examined before and after 3 weeks of therapy by the same physiotherapist experienced in rehabilitation of TMD. The assessment of the degree of temporomandibular joint dysfunction was made using the Manual Functional Analysis of masticatory system, based on Diagnostic Criteria of Temporomandibular Disorders (DC/TMD) [8] and palpation of the head and neck muscles according to Festa. The research card consisted of an interview and a physical examination questionnaire, which included:

1) assessment of the temporomandibular joint mobility;
2) joint surface examination through dynamic resistance tests;
3) joint capsule and ligaments assessment through static resistance tests;
4) examination of the occurrence of crepitation in the temporomandibular joints.

On the other hand, the questionnaire of palpation of head and neck muscles according to Festa consisted in subjective assessment of pain intensity by the patient in the 11-points Numerical Rating Scale (NRS). The palpation examination was carried out according to the protocol in reference points for given muscles. For the purposes of this study includes: temporal muscles (muscular 3 points: anterior, medial and posterior bellies), masseter muscles (muscular 3 points: inferior part of superficial belly, anterior part of superficial bell and deep belly), sternocleidomastoid muscles and trapezius muscles, which were examined symmetrically.

Inclusion criteria

1. Patients with a diagnosis of hypomobility of temporomandibular joints (TMJ) according to questionnaire of Manual Functional Analysis of masticatory system, based on Diagnostic Criteria of Temporomandibular Disorders (DC/TMD).
2. Subjects with a diagnosis of myofascial pain according to palpation of masticatory and neck muscle by Festa. The results above 5 points on Numerical Rating Scale (NRS) and the occurrence of pain on palpation of at least two muscles from eight muscles were classified as orofacial pain.
3. Subjects with TMD and myofascial pain that was not related to active inflammation, infection or acute trauma for at least 6 months.
4. Consent to participate in the study.

Exclusion criteria

Subjects were excluded from the study when they had the following symptoms: no diagnosis of TMD, hypermobility of TMJs, rheumatic and inflammatory diseases, acute trauma or injuries of face, head or cervical spine, neurological disorders, taking medication that could affect the musculoskeletal system, a history of temporomandibular disorders treatment within last three months, pregnancy, no consent to participate in the study.

Outcome variables

To assess the effectiveness of physiotherapy maximum mouth opening and assessment of pain intensity were performed twice on first therapy and after 3 weeks. Maximum mouth opening was measured by a millimeter ruler. The patient was asked to open his mouth as widely as possible. In the case of pain associated with mouth opening, patient was requested to open his/her mouth until pain occurred. The distance between the front upper incisors and the front lower incisors was measured. The highest measurement out of three was considered as the result.

Pain intensity was assessed in a neutral, resting position of mandible without contact with opposite dental arches and without tension of masticatory muscles. Numerical Rating Scale (NRS) is 11 points scale, which was used to record pain scores in our research, has been recommended as a valid and the most accurate in measuring orofacial pain reproducibility in patients with TMD [9]. Patients were asked to determine their current pain, ranging from 0 “no pain” to 10 “the worst imaginable pain”.

Interventions

After baseline examination, the first session of physiotherapy started. This study was blinded, the physiotherapist, who examined and carried out rehabilitation not involved in data analysis and did not know about research at the time of final assessment. The therapeutic session lasted 45 minutes and was performed 3 times a week for 3 weeks. Physiotherapeutic treatment included manual therapy, soft tissue mobilization and exercises, adapted individually to the needs of each patient. Table 1 presents a procedure of physiotherapeutic treatment. The patients were also instructed on how to do exercises at home. The home physical therapy consisted of relaxation techniques, increasing range of motion exercises such as passive mandible’s abduction, breathing exercises, posture correction exercises (especially directed at cervical spine). Moreover, patients received education concerning of the etiology of the temporomandibular disorders, ergonomics and reducing stress.

Table 1. A protocol for physiotherapeutic management used in a group of patients with hypomobility of temporomandibular joints and pain.

Technique	Body area and instruction	Therapeutic purpose
Mobilization of TMJ on both sides longitudinally caudally	Extraoral technique with prolonged traction	Mobilization of abduction with icreasing the range of motion
Mobilization of TMJ unilaterally longitudinally caudally	Intraoral technique with prolonged traction	
Longitudinal caudal movement with repetitive depression and elevation of mandibular	Intraoral technique	
Mobilization of TMJ laterally	Intraoral technique performed in the range of lateral jaw movement by 1–2 mm	Mobilization of latero- and mediotrusion
Mobilization of TMJ medially	Extraoral technique	
Poisometric relaxation (PIR)	Adductors of mandible	Relaxing tense muscles and reducing pain
Trigger point therapy and masticatory muscle stretching	masseter muscles, temporal muscles	
Stretching the neck muscles combined with trigger point therapy	Sternocleidomastoid muscle, trapezius muscle, Suboccipital muscles	
Exercises of abduction of mandibular (autotherapy)	Tongue in a vertical position behind the upper incisors, fingers on TMJs on both sides, opening the mouth and closing. In the case of lateral deviation of the mandible, place the tongue on the opposite side (more on the right incisor or the left incisor)	Coordination of mandible movements
Chewing exercises	Index finger laid on chin, making protrusion, depression, elevation	
Lateral motion exercises	Index fingers on the sides of the lower jaw, static lateral movements, especially in the direction of limited movement	

Statistical analysis

Statistical processing of the data was done with STATISTICA 13 and was conducted considering significance at a p-value <0.05. Continuous variables were presented as mean +/– standard deviation or median. The Shapiro–Wilk test were used to check normal distribution. To assess the progress of rehabilitation applied the Wilcoxon's signed-rank test to compare the results before and after therapy.

Results

All patients completed the 3-week physiotherapy without adverse effects, interventions other specialists and drug therapy.

The mean mouth opening movement before therapy was 38.9+/–8.1 mm. As a result of physiotherapeutic treatment, an average mouth opening movement improve of 6.6 mm. Table 2 shows the exact data. The effects obtained during physiotherapy were statistically significant (p = 0.0005), as demonstrated by Wilcoxon's signed-rank test. All patients managed to improve. The best result achieved in this group is the increase in the mobility of the mandible by 27 mm.

Table 2. Comparison of the mean temporomandibular joints' abduction before and after 3-week physiotherapy.

Abduction	Mean	Median	Min.	Max.	sd	p (Wilcoxon matched-pairs test)
before	38.9	40.0	20.0	55.0	8.1	p = 0.00054
after	45.5	45.0	38.0	52.0	3.6	

Analysis of the subjective pain perception at the NRS scale showed that orofacial pain is a common phenomenon among patients with hypomobility of TMJs. All patients reported pain in the palpation of masticatory muscles. The mean pain intensity before therapy was the highest in palpation of masseter muscles and sternocleidomastoid muscles. Regardless, NRS scores significantly decreased after physiotherapy (the Wilcoxon's signed-rank test, p = 0.00002). For all muscles, it was a decrease in pain by an average of 3 points on the NRS scale. Fig. 1 presents the distribution of subjective mean pain intensity of selected masticatory and neck muscles before and after physiotherapy.

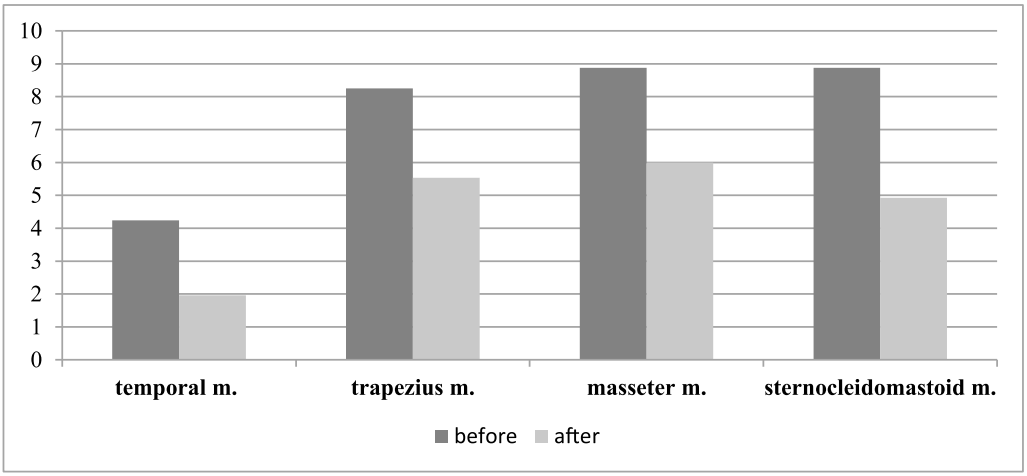

Fig. 1. Average pain intensity on the Numerical Rating Scale for selected masticatory muscles before and after 3-week physiotherapy (p = 0.00002, Wilcoxon matched-pairs test).

Discussion

There is no doubt that conducting physiotherapy in the case of patients with temporomandibular disorders is important. Crucial seems to be the standardization of the naming and physiotherapeutic methods used in the treatment of patients with temporomandibular joint dysfunctions and the creation of a comprehensive treatment protocols.

As the most frequently mentioned interventions are: isometric exercises, resistance exercises and mobilizations of temporomandibular joints [10]. Kraaijenga *et al.* [11] point out that there is no difference between exercises and mobilizations. Both increase the range of motion of TMJs. There is also lack of difference between using devices for passive movement that increase range of motion and mobilization. In both cases, satisfactory results were obtained. Other studies emphasize that muscle strengthening exercises are more effective than using muscle relaxation techniques or lack of physiotherapeutic intervention. Positive effect achieves by exercises, in the case of reducing pain and improving the range of TMJ's movement, last much longer than the effects of muscle relaxation, which follow quickly, but are short-term [12, 13]. In the case of limitations in mouth opening, it was shown that the exercises performed by the patient are more effective than splinting and increasing the range of TMJ's abduction [14, 15]. Therefore, an important aspect is patient education and learning how to do the exercises correctly.

The next physiotherapeutic intervention is manual therapy, including joint, myofascial and neuromobilisation techniques of the craniomandibular area [7]. Tuncer

et al. [15] prove that the use of manual therapy combined with exercises increases the painless range of mouth opening and reduces myofascial pain better than the exercises itself. There were also compared the effects of fascial manipulation (Facial Manipulation by Stecco) and the botulinum toxin in the treatment of facial pain, assessing them as identical [16].

Many authors emphasize the comprehensive approach to manual therapy of the craniomandibular region, including interventions in the cervical spine. Physiotherapy of the cervical spine (mobilization of the intervertebral joints, stretching of the neck muscles, stabilization of deep neck flexors) increase the painless mouth opening and reduce the pain in patients with TMD. It has been observed that manual therapy of the cervical spine affects the increase in the mouth opening [17–20]. Armijo-Olivo *et al.* [7] prove manual therapy can increase the range of TMJ's movement, reduce pain, improve proprioception, stimulate blood circulation and gain the production of synovial fluid. It can be used in any type of temporomandibular dysfunction, both of joint and muscular origin as well as in mixed forms. The combination of manual therapy techniques focuses on TMJ's and cervical spine with exercises and patient education give the best results [21, 22].

The effectiveness of manual therapy of temporomandibular area is confirmed by von Piekartz's research [23, 24]. The application of physiotherapy allow to reduce pain in the cervical spine and headaches and to achieve long-lasting effects compared to therapy directed only on cervical spine dysfunctions. The authors recommend the study of temporomandibular joints in the case of the above-mentioned disorders, especially when interventions oriented on the cervical spine are insufficient.

In the treatment of temporomandibular joint dysfunctions, an important role is played by proper patient preparing for manual therapy. Essential treatment concerns on reducing pain. One of the analgesic treatments that can be used in patients with TMD is TENS therapy (transcutaneous electrical nerve stimulation). It is a safe and non-invasive method of reducing pain through electrical stimulation using surface electrodes placed above pain areas [25]. Laser therapy (LLLT — low level laser therapy), the aim of which is analgesic, anti-inflammatory and edema reduction, directed to the temporomandibular region is effective in reducing pain [26]. Ultrasounds through thermal action on tissues, increase local blood flow, reduce inflammation and pain, can be safely used in the case of temporomandibular joint dysfunctions [27].

The effectiveness of physiotherapeutic procedures is presented in the aspect of reducing pain and improving the range of movement of the temporomandibular joints. Paco *et al.* [28] evaluated the physiotherapeutic intervention in the treatment of TMD as an effective action to reduce pain and improve the range of motion. In addition, they emphasized the effectiveness of physiotherapy in the treatment of pain — an average pain reduction was 1.74 points in the 11-point NPRS (Numeric Pain Rating Scale).

Our own observations of the results of therapy, confirm the effectiveness of physiotherapy. Among patients with orofacial pain, who have been subjected to physiotherapy, pain reduced average by 3 points on the NRS scale. In addition, for the most painful muscles (masseter m., trapezius m. and sternocleidomastoid m.), pain relieved after therapy (on average 4–6 points on the NRS scale). Moreover, in the case of temporal muscles, pain was eliminated.

While in the case of the improvement of TMJ's mobility, Kalamir *et al.* [29], compare the effects of stomatognathic physiotherapy and indicate that in patients who received physiotherapy the range of motion improved on average from 5 to 9 mm. Similar results were obtained in our own study. Detailed analysis in the group of patients with hypomobility of TMJs indicated an increase in the range of motion, average by 6.6 mm. The above results suggest that physiotherapeutic intervention is effective in the case of limited mobility. Furthermore, our results confirm the thesis of other authors regarding positive changes in the field of motion after the application of physiotherapy.

Our study has some strengths and limitations. The group was homogeneous in a diagnosis of TMD and thanks to this the proposed interventions could be checked for their effectiveness in the case of TMJ's hypomobility and orofacial pain. On the other hand, the intervention lasted only 3 weeks (nine sessions) and only 20 subjects took part in the study. Further research, on a larger group of patients, is necessary for evaluating the long-term effects of physiotherapy for hypomobility of TMJs and patient's compliance level as well.

Conclusions

In conclusion, comprehensive physiotherapeutic approach, including manual therapy, exercises and patient's education, allow to increase the range of temporomandibular joints' movement and reduce pain in the case of patients with myofascial pain and limited mobility of temporomandibular joints.

Conflict of interest

None declared.

Contribution statement

J.B. and M.K.M. conceived the idea of the research and designed it. J.B. carried out the literature research. M.K.M. performed clinical study J.B. and M.K.M. analyzed the data. J.B. wrote the paper. J.B., M.K.M. and M.P. revised the manuscript for final submission.

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