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Physiotherapeutic rehabilitation of adolescent patients with temporomandibular disorders

MAŁGORZATA PIHUT, ELŻBIETA ZARZECKA-FRANCICA, ANDRZEJ GALA

Prosthodontics and Orthodontics Department, Dental Institute, Jagiellonian University Medical College, Kraków, Poland

Corresponding author: Andrzej Gala, D.D.S., Ph.D.Prosthodontics and Orthodontics Department, Dental Institute, Jagiellonian University Medical College
ul. Montelupich 4, 31-155 Kraków, PolandPhone: +48 12 424 54 00 ext. 230; E-mail: andrzej.gala@uj.edu.pl

Abstract: TMD is a group of pathological changes including increased tension in the masticatory muscles, pain in the muscles and/or the temporomandibular joints, abnormal range of the mandibular movement or the presence of acoustic symptoms in the joints in the form of clicking or popping.

The aim of the project was to compare the effectiveness of two methods of physiotherapeutic rehabilitation, used in adolescent patients with temporomandibular disorders.

Material and Methods: The material consisted of 68 patients, aged 14 to 17, of both sexes, generally healthy, who came to the Dental Prosthetics Department for treatment due to pain in the masticatory muscles. Dental examination and diagnostics revealed Ia in all cases in accordance with RDC/TMD protocol. Manual therapy was performed in group I (34 people) and kinesitherapy with massage was performed in group II (34 people). Patients were allocated randomly to both groups. Contraindications were considered for both methods.

Results: Within the first study, mean values of pain intensity between group I and group II were not significantly different (6.12 and 6.24 respectively). Within the second study significantly lower VAS scores in both groups have been revealed (0.92 and 0.74 respectively). Results of the first and second study differed significantly in both groups. Similar results were obtained for the maximum abduction of the mandible.

Conclusions: The results of the conducted studies indicate a beneficial effect of the assessed physiotherapeutic procedures in terms of functional rehabilitation of adolescent patients with temporomandibular disorders.

Keywords: temporomandibular disorder, physiotherapy, manual therapy, kinesitherapy, adolescent.

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Introduction

Temporomandibular disorders (TMD) is a group of pathological changes including increased tension in the masticatory muscles, pain in the muscles and/or the temporomandibular joints, abnormal range of the mandibular movement, or the presence of acoustic symptoms in the joints in the form of crackles or crepitus. Unfortunately, the number of patients report for prosthetic treatment is systematically increasing, therefore the age of patients decreases along with the occurrence of the pain form [1–4].

Adolescents as a patient with TMD are in a particularly difficult situation due to the unfinished development of the craniofacial skeleton and the frequent inability to use rehabilitation braces, called occlusive splints, which are one of the basic elements of the treatment of dysfunction, and the average time of their use is about a year. Complementary therapy for this group of patients is physiotherapeutic rehabilitation, which aims to restore the functional efficiency of the motor system of the masticatory organ, reduce or eliminate pain in the muscles of mastication and /or temporomandibular joints, restore the correct ranges of mandibular movements and resolve acoustic symptoms in the temporomandibular joints [2, 4–7].

Often the reason of reporting of adolescent patients is the occurrence of pain in the muscles of mastication, as painless symptoms are not noticeable by this group of patients and their caregivers. Many authors [1, 2, 5, 8–12] draw attention to the relationship between muscle pain and occlusive para-functions, significantly prolonging the contractile work of the muscle complex. Muscle pain (myalgia) develops as a result of the lack of refraction and the production of large amounts of lactic acid in the muscles. Christidis *et al.* [4] emphasize that currently there is no developed consensus regarding a uniform therapeutic procedure, which makes the treatment of adolescent patients difficult.

The most commonly used supportive treatment methods include: laser therapy, manual therapy, post-isometric muscle relaxation, sonophoresis and kinesiotherapy. All these methods can be used in adolescent patients [1, 2, 4, 7, 11, 13–19].

The aim of the project was to compare the effectiveness of two methods of physiotherapeutic rehabilitation used in adolescent patients with temporomandibular disorders.

Material and Methods

The research material consisted of 68 patients, aged 14 to 17, of both sexes, who came to the Dental Prosthetics Department for prosthetic treatment due to the occurrence of pain in the masticatory muscles (most often the masseter muscles), which occurred at least 5 weeks before patient came to the Dental Prosthetic Department. The patients

were generally healthy. Based on the basic dental examination and diagnostics in accordance with the RDC/TMD procedure, Ia was diagnosed in all patients [8]. These patients were treated from May 2019 to May 2021. Due to the age of the patients and the unfinished process of the craniofacial skeleton growth, devices like occlusive splints were not used. The patients were divided into two groups of 34 people; where in the first study group manual therapy treatments were used in the area of masticatory muscles, in group II (N 34) kinesiotherapy with massage was used. Patients were allocated randomly to both groups. The treatments were performed by the same person, a physiotherapist with over 15 years of professional experience.

A comparative evaluation of the effectiveness of the applied supportive treatment methods was based on the results of a personal examination, including the analysis of pain intensity, assessed according to the VAS (Visual Analogue Scale) scale and the analysis of the range of mandibular movements (abduction, lateral movements and mandibular extension movement). It should be emphasized that adolescent patients often significantly limit the range of mandibular abduction for a long time due to the fear of pain associated with the maximum abduction of the mandible.

Parents or guardians were helpful in determining the severity of pain in the masticatory muscles, which caused adolescent patients to undergo prosthetic treatment. The mean pain intensity value for the last 7 days was taken into account for each assessment. Myalgia occurred 5 weeks to 4 months prior to treatment.

The criteria for inclusion in the study were: appropriate age of the patients, pain form (Ia) TMD (pain of myofascial origin), good general health and consent by the legal guardian to participate in the research project.

The criteria for exclusion from research was; progression of disease to form IIa, IIb or IIc, (according to RDC/TMD), prolonged absence that occurred as a result of general medical conditions and will to resign from participation in research at any of its stages.

None of them had any trauma in the last 4 years and there was no previous pharmacological and rehabilitation treatment undertaken related to the occurrence of pain.

The method of manual therapy (soft tissue therapy of the myofascial system) is safe and non-invasive for patients of this age and is aimed at reducing excessive tension in the muscles of mastication and elimination of pain, muscle dysfunction and elimination of trigger points. It consists in various types of pressure and massages of soft tissues. It is also manipulation, mobilization and neuromobilization of overloaded tissues. The duration of the procedure was 25 minutes, and the whole series included 10 procedures performed every third day [2–4].

Kinesiotherapy consists in performing slow, controlled relaxation exercises aimed at regaining the full length of the tense muscles, lifting the mandible, and thus achieving a decrease in excessive tension and elimination of pain and restoration of their

proper functioning. Muscle stretching exercises are an important treatment form for myofascial pain. In one series, 5 exercises of lowering and raising the lower jaw were performed, then the rest was 2 minutes and the next series was repeated five times. The total treatment time was 25 minutes. The exercises were performed under the supervision of a physiotherapist and the series consisted of 10 treatments performed every third day [2–4].

Contraindications were considered for both methods, such as acute craniofacial injuries, facial wounds, conditions after surgery or skin inflammation.

Statistical analysis

The results were subjected to statistical analysis using the basic procedures; such as determination of means, standard deviations, medians, etc. Statistical analysis were performed with the use of IBM SPSS Statistics v. 28.0. Basic descriptive statistics were analyzed together with the Shapiro–Wilk (SW) distribution normality test. According to the results of the SW test, the relationships between the groups were calculated using the U-Mann–Whitney test, the T-test and the Wilcoxon test. In the next step, an analysis of the results with repeated measurement was carried out to check whether the results of the conducted tests differ in a statistically significant manner. The level of significance was $\alpha = 0.05$.

Results

Comparison of the results of the physical examination shows a positive effect of the physiotherapeutic procedures carried out in both study groups, as they revealed an improvement in the functioning of the mastication organ, regaining the comfort of eating meals, including a significant decrease in the intensity of pain in the muscles of mastication (Table 1), disappearance of difficulties in chewing food, increasing the range (Table 2) and freedom of movement of the mandible, and a significant reduction in parafunctional activity.

Table 1. Score value on the VAS scale obtained in both studies in group I and II along with the results of the statistical analysis.

VAS (Visual Analogue Scale)							
Exam. I	Group I (n = 34)			Group II (n = 34)			P
	x SD	Min–Max	Median	x SD	Min–Max	Median	
	6.12 1.39	2–8	6	6.24 1.42	2–8	6	p = 0.717
Exam. II	0.92 0.97	1–3	1	0.74 0.86	1–2	0.5	p = 0.507
p	p = 0.000			p = 0.000			

Table 1 shows the mean values of the intensity of muscle pain along with the results of statistical analysis, reported during the assessment of pain by patients from both groups, obtained in two studies, and statistical significance, and they are graphically presented in Fig. 1, 2 and 3.

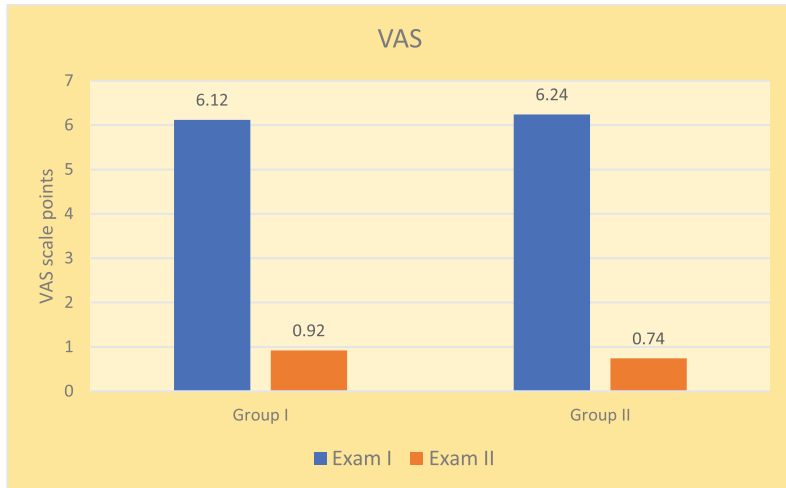


Fig. 1. Graphical representation of the results of the evaluation of the pain intensity of the masticatory muscles obtained in both studies in groups I and II.

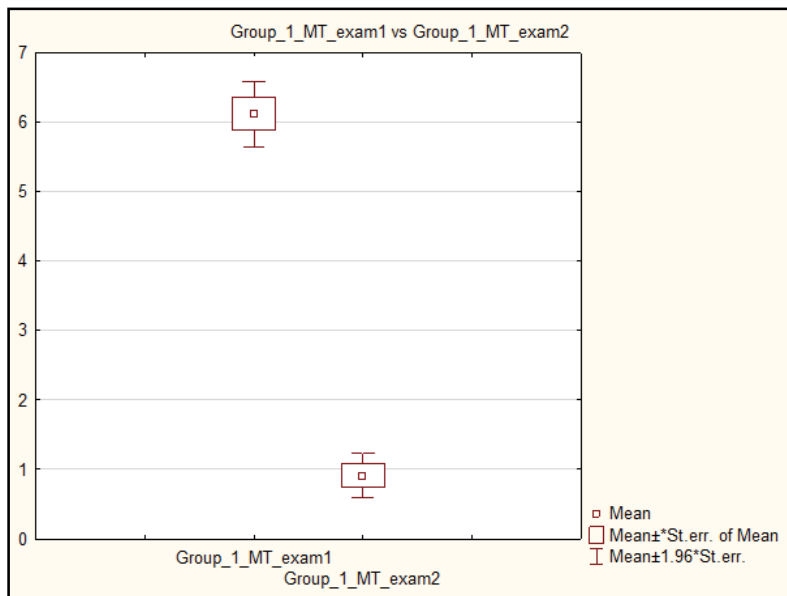


Fig. 2. Diagram of the statistical analysis results for pain intensity of chewing muscles — comparison within group I.

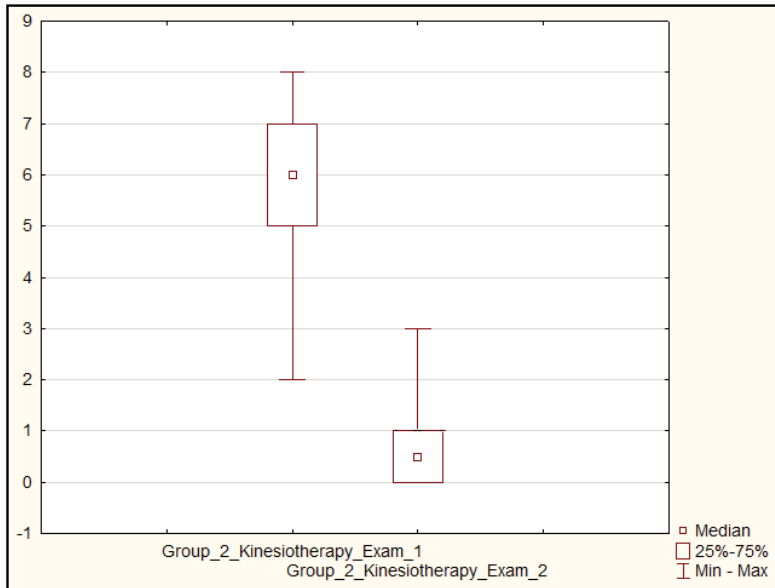


Fig. 3. Diagram of the statistical analysis results for pain intensity of chewing muscles — comparison within group II.

The mean values of pain intensity in the first study were respectively 6.12 in the first group and 6.24 in the second group and these results did not differ statistically significantly ($p = 0.718$), which indicates the homogeneity of the groups in terms of pain symptoms of muscles of mastication before starting physiotherapy treatment. In the second study performed after physiotherapeutic supportive treatment, the mean VAS scores in both groups were significantly lower, as they were 0.92 points for group I and 0.74 for group II.

The comparison of the mean values between the results of the first and second tests differ statistically significantly in both groups, because p is 0.000 for group I and 0.000 for group II. On the other hand, the comparison of the results of study number 2 between the groups did not differ statistically significantly, because $p = 0.508$, which indicates a similar effectiveness of both methods assessed, although the differences in the mean values of pain intensity indicate a greater reduction of pain in the group where muscle exercises were used (by 5.5 points, and in group I the decrease was by 5.2 points).

Table 2 presents the results of the range of lowering the jaw of patients from both groups, obtained in two subsequent studies, with statistical significance, and they are graphically presented in Figures 4, 5, 6.

The mean values of the maximal interincisal distance obtained in the first study in group I 36.32, and in group II — 36.03. The results do not differ statistically significantly because $p = 0.65$ in the first group and 0.68 in the second group. These results

Tab. 2. The values of the mandibular abduction range obtained in both studies in group I and II together with the results of the statistical analysis.

Range of jaw motion							
Exam. I	Group I (n = 34)			Group II (n = 34)			p
	x SD	Min-Max	Median	x SD	Min-Max	Median	
	36.32 2.32	32-42	36	36.03 2.4	38-43	35.5	p = 0.65
Exam. II	41.21 1.67	32-42	41.5	41.38 1.88	38-45	41	p = 0.68
	p = 0.000			p = 0.000			

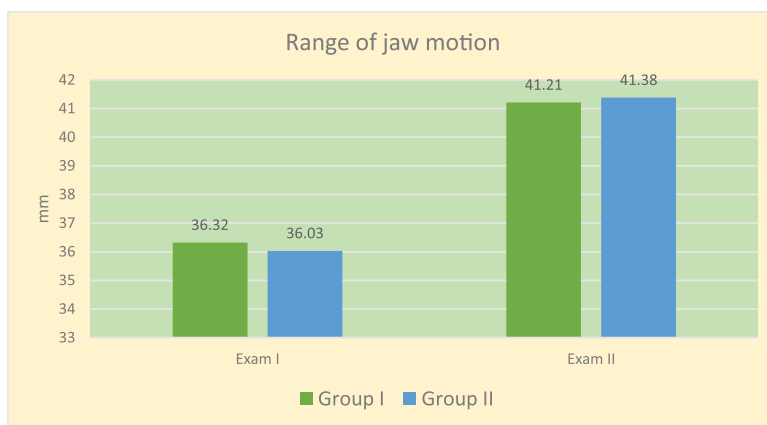


Fig. 4. The mean values of the mandibular abduction range obtained in both studies in groups I and II.

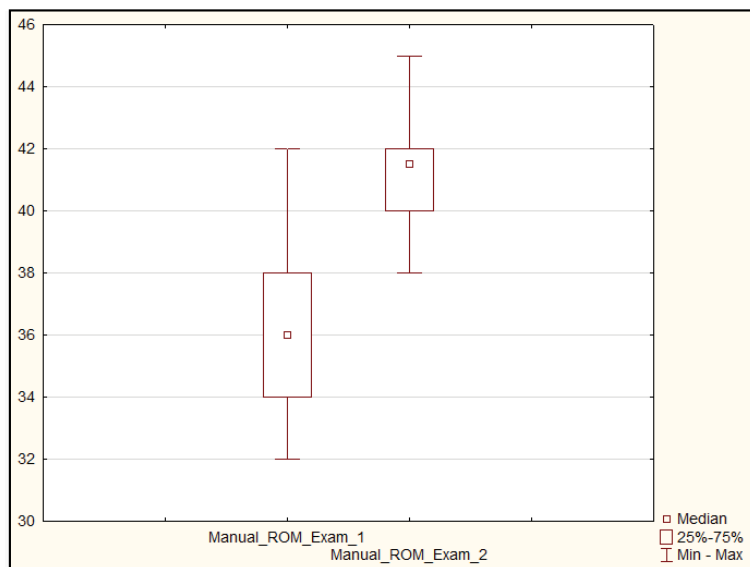


Fig. 5. Diagram of the statistical analysis results in the range of the mandibular motion comparison of muscle pain intensity within group I.

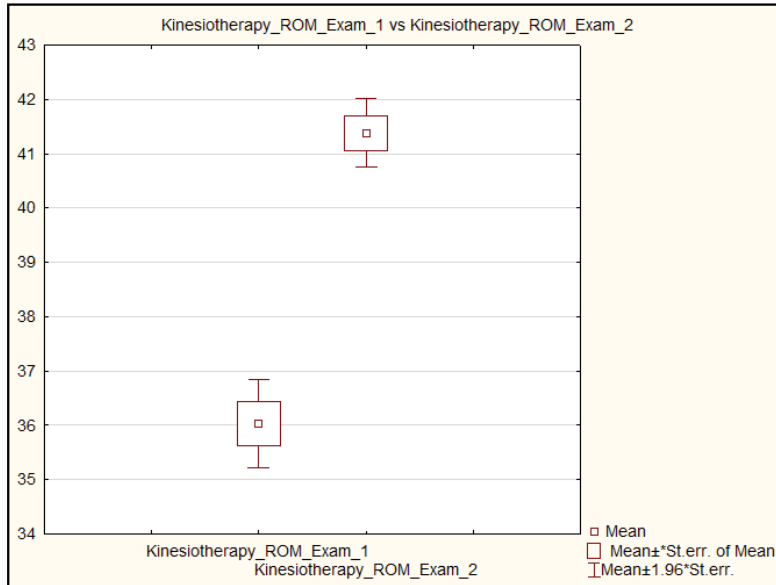


Fig. 6. Diagram of the statistical analysis results in the range of the mandibular motion comparison of muscle pain intensity within group II.

significantly improved under the influence of both assessed methods of physiotherapeutic treatment, as the mean values of the measurement of mandibular abduction in the second study were 41.21 and 41.38 obtaining the value of the physiological range of mandibular abduction.

The comparison of the mean values of the maximal interincisal distance between the first and second examinations within the groups differed statistically significantly because $p = 0.000$ in both groups. These results do not differ in a statistically significant way between the studied groups because p was 0.65 and 0.68 which indicates a similar effectiveness of the applied treatment methods.

Discussion

Prosthetic rehabilitation of adolescent patients treated for temporomandibular disorders is a very difficult task, because adolescents at this age do not yet have fully developed craniofacial skeleton. Application of prosthetic appliances such as occlusive splints for a period of at least one year is not recommended in this group of patients because of age [1, 4, 7, 11, 15].

The results of the conducted research indicate a very beneficial effect of the implemented physiotherapeutic procedures in both groups. The reduction in pain intensity is very high. List *et al.* [20] emphasizes that among adolescent patients treated for TMD there is a predominance of girls with the pain form and the fact

that TMD patients more often reported absence from school due to pain and used painkillers compared to the control group.

The author also emphasized that in the assessment of psychosocial and dental factors, an important role in adolescents with TMD is played by stress, somatic complaints and emotional problems. Wahlund *et al.* [21] assessed the effectiveness of the treatment of the pain form of TMD among adolescents with the use of occlusive splints and relaxation training conducted by a therapist, and the results of their research indicate greater therapeutic efficacy in patients using occlusal splints, but it should be remembered that the unfinished development of the craniofacial skeleton and jaws does not allow freedom in the use of rigid braces, especially in the case of existing malocclusion.

According to Urban *et al.* [22], the most common parafunctions among adolescents include asymmetric chin support (73.68%), lip biting (58.33%) and habitual gum chewing (51.045), and among the signs of TMD, tooth impressions on the tongue, increased tension and pain in the masticatory muscles and a disturbed range of movements of the mandible. It should be emphasized that a very important role should be assigned to prevention and making adolescents aware of the high harmfulness of occlusive para-functions for many elements of the stomatognathic system.

Karamann *et al.* [23] emphasized that among 648 adolescents treated orthodontically due to various malocclusion, most of the respondents had symptoms of TMD and a lower quality of life in this group of respondents. Not many authors define the recommended methods and algorithm for the therapeutic management of pain in TMD.

Fernandes G *et al.* [24] examined the factors predisposing to the development of painful TMD in adolescents, including various elements of the biopsychosocial model. The study group consisted of 1094 adolescents, the occurrence of pain in muscles and/or temporomandibular joints was assessed using RDC/TMD axis I. The role of parafunctional habits was also assessed.

Nilsson, List [25] observed 2,209 adolescents reporting TMD symptoms and impairment of the proper functioning of the masticatory system. 45.1% of the respondents experienced pain during the observation period, and 45.2% of the respondents reported moderate-severe depression. It can be assumed that the occurrence of pain in the muscles of mastication or temporomandibular joints is a very important symptom, indicating the presence of dysfunction in the masticatory organ in minors.

The applied methods of manual therapy and kinesiotherapy carried out under the supervision of a physiotherapist had a very positive effect on the disappearance or significant reduction of the pain in the muscles of mastication and the recovery of the correct parameters of the jaw movements and the comfort of chewing food.

Treatment of adolescent patients with TMD is a difficult task and requires an individual analysis of symptoms and the selection of appropriate rehabilitation meth-

ods. The searching the new rehabilitation methods is a very important clinical aspect in cases where the age of adolescent patients does not allow the use of occlusive splints [26–31].

Conclusions

The analysis of the obtained research results shows that the rehabilitation methods used are similar and highly effective.

- The number of adolescent patients with temporomandibular disorders is increasing, and this is why onset of the coming out of symptoms is steadily decreasing, and they are experiencing more and more of the pain form of TMD.
- Adolescent patients cannot be treated with conventional methods (occlusal splints) because the development of the craniofacial bones is not yet complete, which is why physiotherapeutic treatment is so valuable in the treatment of TMD in this group of patients.

Authors contributions

Małgorzata Pihut — conceived the ideas, analysed the data, draft manuscript; Elżbieta Zarzecka-Francica — collected the data, led the writing, checked all writing; Andrzej Gala — collected the data and analysed, draft manuscript.

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