ORIGINAL ARTICLE

EFFECTIVENESS OF MANUAL THERAPY, PHYSICAL THERAPY IN CONJUNCTION WITH PATIENT EDUCATION FOR TEMPOROMANDIBULAR DISORDERS: A RANDOMIZED CONTROLLED STUDY

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Background: Temporomandibular joint (TMJ) disorders represent a significant health concern affecting a substantial portion of the population worldwide. The management of TMJ disorders often involves a multifaceted approach including physiotherapy techniques, manual exercise interventions, patient education, and medication therapy. The purpose of this research is to examine the "Effectiveness of manual therapy, and physical therapy in conjunction with patient education for temporomandibular disorders". **Methods:** Forty patients with TMDS were randomized into two groups: one for home physical therapy and the other for manual therapy plus physical therapy. Patient education and counseling were done in both groups. the patient had assessments both before and after. **Results:** The study made a comparison of two groups: one received physical therapy only (n=20) and the other group received a combination of physical and manual therapy (n=20). There were no significant differences between the two groups in terms of age, gender distribution, or the affected side of the face (p>0.05). **Conclusion:** For TMJ issues, physical therapy patient education is a useful therapeutic method. Moreover, combining these modalities with manual therapy improves results beyond what would be achieved with just these modalities alone.

Keywords: TMDS; Manual therapy; Patient education; Home physical therapy; Maximal mouth opening

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INTRODUCTION

The term TMD, which stands for temporomandibular disorders, encompasses a variety of clinical problems that affect the muscles involved in chewing, the temporomandibular joint (TMJ), and the structures associated with it. According to published research, the most prevalent type of temporomandibular dysfunction (TMD) is myofascial pain in the masticatory muscles. TMD stands as the primary culprit behind chronic pain in the orofacial region, making it the most prevalent cause. Research indicates a reported prevalence of 10–15% for this condition, with women and individuals aged 35-44 years exhibiting the highest rates.[4] In affluent nations, TMD continues to pose a serious public health concern as it is one of the leading causes of chronic orofacial discomfort that significantly lowers quality of life.[2]

Pain represents the most prevalent symptom of TMDs impacting regions like the face, eyes, and/or throat, often leading to neck stiffness and headaches, along with affecting mouth opening and difficulty in chewing. Sleep issues are frequently observed in TMD patients, with around 90% experiencing low sleep quality.[3] The causation of TMD is diverse. A suggested hypothesis related to the progression of TMD highlights the link between functional stress and the capability of masticatory muscles to withstand this stress. Oral behaviors, Prolonged strain, such as tooth clenching, and bruxism could trigger pain and dysfunction in individuals with limited musculoskeletal capacity.[4] TMDS management involves physical therapy, manual therapy, occlusal appliances, pharmacotherapy, trigger-point injections, acupuncture, behavioral modification, self-care management, and biofeedback, with patient education and counseling adequate for most patients.[9] These exercises may reduce inflammation, decrease and regulate muscle activity, and encourage tissue regeneration and repair in order to alleviate musculoskeletal discomfort and return function to normal.[13]

There were some differences found when MT for TMJ was compared to other therapy. Up to

the 3-month follow-up, there was a considerable rise in MMO and a significant decrease in pain in the cervical area as compared to MT.[14] There were no discernible changes between the botulinum toxin injection and manual pressure therapy on the craniocervical coordination centers throughout the follow-up, except for laterotrusion movements, which improved more following MT treatment.[11] The trigger point relaxation technique, which involves applying gradual pressure on the trigger point based on patient tolerance, is a key component of manual therapy.[1] Conservative/manual therapy is recommended for the initial treatment of TMD due to its effectiveness in reducing pain, and comfort, and restoring normal function. Manual treatment includes guided mandibular motions, MRP, spray and stretch, passive or active stretching exercises, moderate isometric tension against resistance exercises, and mobilization of the temporomandibular joint and soft tissues of painful muscles.[12] For the treatment of TMD, a persistent musculoskeletal pain problem, physical therapy (PT) is advised. Exercises that encourage patient coping and self-management are part of a typical physical therapy program. According to a meta-analysis by Feine and Lund, the majority of PT treatments, reduced symptoms, and the effectiveness of the treatments rose with the length of the patient.[8]

Counseling educates patients about their disorder's causes and management techniques. It recommends mastication, a soft diet, reduced caffeine intake, proper hydration, postural adjustments, and controlling muscle hyperactivity. Self-care management has proven effective in 60% to 90% of myofascial pain patients and should be a core part of the initial treatment plan. [(9)] Patient education is crucial in TMD treatment plans, with various methods varying treatment outcomes. Combining video or leaflet explanations with oral explanations improves compliance and satisfaction with self-exercise programs. Conservative, cost-effective treatments like counseling and self-management-based therapies can also be beneficial. There is a scarcity of studies investigating the impact of patient education and counseling on modifying OBs in TMD patients.[10]

Research on manual therapy for myofascial pain has been limited due to methodological issues, such as combining it with other treatments, lack of a control group, and different diagnostic criteria. Therefore, considering the level of productivity of patient education and manual therapy This paper aims to conduct randomized clinical trials to examine the Effectiveness of manual therapy in combination with physiotherapy treatment and patient education for temporomandibular disorders.

MATERIAL AND METHODS

Approval for this study was obtained from the Ethics Committee of Bahria University, Pakistan. All participants were fully informed about the study and provided their consent to participate. The study specifically enrolled individuals who presented with pain in the TMJ region during mandibular movements. The subjects were diagnosed by a dentist who possessed expertise in TMD. The diagnosis was made using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) which is a set of standardized criteria used for the diagnosis and classification of temporomandibular disorders (TMD).[14] It was developed by an international consortium of researchers and clinicians to provide a consistent framework for assessing TMD signs and symptoms in research settings. In the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), the dual-axis system consists of Axis I, which focuses on physical examination findings like pain and range of motion, and Axis II, which involves self-report measures to assess psychosocial factors such as depression and anxiety that may affect TMD symptoms and treatment outcomes. The first axis is divided into four groups.

Group I: muscle disorders: myofascial pain (Ia), myofascial pain with limited mouth opening (Ib)

Group II: disc displacement disorders: with reduction (IIa) without reduction with limited mouth opening (IIB) without limited mouth opening (IIC)

Group III: joint disorders: osteoarthritis, rheumatoid arthritis, and arthralgia (III)

Group IV: Other Disorders - This category encompasses conditions that do not fit into the previous three groups or have overlapping features. Examples include congenital anomalies and neoplasms. (IV)

Inclusion criteria:

Categories Ia, Ib, IIa of RDC/TMD

Age range 25 to 55 years

Both male and female

Patients having pain not related to acute trauma or infection

Exclusion Criteria

Patients with categories IIb, III, and IV of RDC/TMD

Patients with psychological disorder

Patients with a history of trauma to TMJ

Patients with a history of Surgery to TMJ

Participants were sorted into treatment groups and provided with individual identification numbers to safeguard their identities and group memberships. Prior to group allocation, a physical therapist who was unaware of the groupings conducted baseline measurements and explained physical therapy to all participants. Following four weeks, the therapist

carried out final assessments without access to the baseline data or any participation in recruitment, or group assignment.

In this study, a total of 20 individuals (9 males and 11 females) with the age range of 20 to 55 years were selected to undergo HPT and patient education exclusively. This treatment approach involved providing them with knowledge about the underlying causes of pain, a soft diet, reduced caffeine intake, proper hydration, postural adjustments, controlling muscle hyperactivity, teaching breathing exercises, and relaxation techniques, and guiding them on mandibular exercises. In contrast, the second group, consisting of 20 individuals (7 males, 13 females age range of 25 to 55 years), received manual therapy in conjunction with home physical therapy and patient education (MTeHPT). This combined therapy included mobilization of soft tissues, TMJ mobilization and stabilization, coordination exercises, mobilization of the cervical spine, and techniques for post-isometric relaxation and stretching. Both groups underwent manual therapy sessions three times a week for a duration of six weeks. Each session lasted for 30 minutes and was tailored to meet the specific needs of each participant. Furthermore, both groups were instructed to continue HPT for six weeks, regardless of whether they experienced pain relief.[14]

The assessment of pain intensity is a critical factor in making informed decisions about therapy. It provides valuable diagnostic information. One convenient and efficient method is to have patients rate their pain intensity on a scale of 0 to 10. This can be achieved using a visual analogue scale, where the pain intensity is represented by a length measurement (e.g., 10 cm: 0-10). The range of 0 to 10 has been consistently reliable, with 0 denoting the absence of pain and 10 signifying the maximum bearable pain.

The initial measurement focused on pain intensity during rest, which was then followed by the assessment of stress-induced pain. Pain at rest was specifically defined as the level of pain experienced without any external stressors, and it was measured while the mandible was in a neutral resting position without any contact between the upper and lower teeth.

Pain intensity with stress/ function of both jaws while chewing was evaluated by instructing participants to chew gum using both sides of their jaws for one minute, and then indicate their level of pain on a visual analog scale (VAS).

VAS scores were measured at baseline and the end of the last treatment session. Pain-free mouth opening to the maximum extent defined as “the maximum distance that the participants could open their mouths without experiencing pain”.

The greatest distance between the upper and lower incisors was gauged using a digital caliper at the beginning of the treatment and again at the conclusion of the fourth week. The maximum mouth opening range was measured several times, with the highest value recorded as the maximum mouth opening at the beginning and end of the treatment.

Descriptively, simple frequencies and percentages were computed for categorical variable like gender and effected side of face. Normality of continuous variables was assessed using the Shapiro-Wilk test and Kolmogorove-Smirnov. For normally distributed data like age, means and standard deviations were presented as measures of central tendency and dispersion, respectively. Non-normally distributed data were summarized using the median and interquartile range (IQR).

VAS and MMO pain were compared over ti me within each treatment group and between groups using MANOVA tests. Bonferroni test was used for p ost hoc analysis. For normally distributed variables, the independent sample t-test was employed. Non-normally distributed variables were analyzed using the Mann- Whitney U test. Furthermore, Difference of categorical variables between two groups was explored using chi-square test. Reliability was checked using Cronbach's alpha coefficient. The significance threshold was set at a p-value of 0.05 or less, accompanied by a 95% Confidence Interval. All statistical analyses were executed using SPSS Software, specifically version 27.0.1, developed by IBM.

RESULTS

The baseline characteristics of the study population are summarized in Table 1. The study made a comparison of two groups: one received physical therapy only (n=20) and the other group received a combination of physical and manual therapy (n=20).

There were no significant differences between the two groups in terms of age, gender distribution, or the affected side of the face (p>0.05). The median age was similar in both groups, with 37.25 years (SD=8.31) in the physical therapy only group and 37.90 years (SD= 7.40) in the physical plus manual therapy group (p=0.785). The gender distribution was also similar, with 11(55%) female and 9(45%) male in the physical therapy only group while in the physical plus manual therapy group 13(65%) female and 7(35%) male (p=0.519). No significant difference observed in the involvement of sides of face (p=0.780). Comparing baseline pain scores, there were no significant differences between the two groups in terms of VAS at rest (p=.687), VAS during function (p=.324), or MMO (Maximum Mouth Opening pain-free) (p=0.841).

Table 2 and Figure 1 summarizes the effect of treatment on pain at rest in the study groups. The baseline VAS (Visual Analog Scale) scores for pain at rest in both treatment groups was: 7.00 (IQR 2) in the physical therapy only group and 8.00 (IQR 2) in the physical plus manual therapy group. After the intervention, the VAS score significantly decreased in both groups. In the physical therapy only group, the median VAS score decreased to 4.00 (IQR 2), while in the physical plus manual therapy group, the median VAS score decreased to 4.00 (IQR 2). The difference in VAS score from baseline to after intervention was statistically significant in both groups (p<0.001). Also, there was a significant interaction effect between time and treatment type (p=0.001), indicating that the change in pain at rest over time differed between the two treatment groups. However, there was no difference between the two groups in terms of VAS score after intervention with 4.00±2 vs. 4.00±2 (p=0.062), indicating that the type of treatment did not significantly affect the reduction in pain at rest. MCS for VAS at rest was -42.9% and -50% in the Physical therapy only and Physical plus manual therapy groups, respectively.

Table 3 and Figure 2 presents the effect of treatment on pain during function in the study group. At baseline, the VAS (Visual Analog Scale) score for pain during function in both treatment groups was: 7.00 (IQR 1) in the physical therapy only group and 8.50 (IQR 1) in the physical plus manual therapy group. After the intervention, the VAS score significantly decreased in both groups. In the physical therapy only group, the median VAS score decreased to 4.00 (IQR 1), while in the physical plus manual therapy group, the median VAS score decreased to 4.50 (IQR 1). However, this change in VAS score from baseline to after intervention was not statistically significant in (p=.267). Contrast to VAS at rest, the two treatment groups showed significant difference (p=0.001), indicating that the type of treatment significantly lead to reduction in pain during function. The interaction effect between time and treatment type was not significant (p=0.710). MCS for VAS at function was -42.87% and -52.9 % in the Physical therapy only and Physical plus manual therapy groups, respectively.

Table 4 illustrates the effect of treatment on pain-free maximum mouth opening (MMO) in the study groups.At baseline, the MMO was similar in both treatment groups: 32.00 (IQR 2.5) in the physical therapy only group and 32.00 (IQR 3) in the physical plus manual therapy group. After the intervention, the MMO significantly increased in both groups. In the physical therapy only group, the median MMO increased to 38.00 (IQR 2), while in the physical plus manual therapy group, the median MMO increased to 40.00 (IQR 2.5). The change in MMO from baseline to after intervention was statistically significant in both groups (p<0.001). The comparison of MMO between the two treatment groups showed no significant difference (p=0.067), pointing that the type of treatment did not significantly cause the improvement in MMO. The interaction effect between time and treatment type was also significant (p<0.001), indicating that the change in MMO over time differed between the two treatment groups. In the physical therapy only group, the SDD for MMO was 2.244, while in the physical plus manual therapy group, it was 3.547 showing clinical effectiveness of treatment.

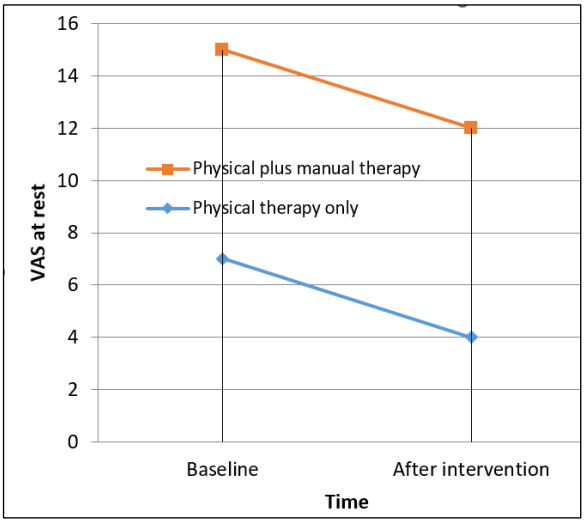

Figure-1: VAS score at rest before and after treatment

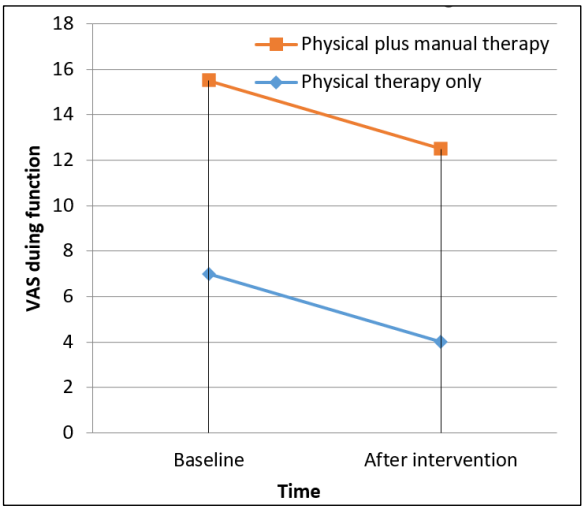

Figure-2: VAS score during function before and after treatment

Table-1: Baseline characteristics of the study population.

	Groups			*p*-value
	Physical therapy only (n=20)		Physical plus manual therapy (n=20)	
	Median/mean±IQR/SD, Count (%)		Median/mean+IQR/SD, Count (%)	
Age[a]	37.25±8.31		37.90±7.40	.785
Gender	Female	11(55%)	13(65%)	.519
	Male	9(45%)	7(35%)	
Effected side of face	Right	5(25%)	7(35%)	.780
	Left	10(50%)	9(45%)	
	Both	5(25%)	4(20%)	
VAS at rest	7.00±2		8.00±1	.687
VAS during function	7.00±1		8.50±1	.324
MMO (mm)	32±2.5		32±3	.841

n:sample size, VAS: visual analog score, MMO: Maximum mouth opening pain free. a=independent sample t test. b=chi-square test. c=Mann-Whitney U test. d=MANOVA.

Table-2: Effect of treatment on pain at rest

Outcome variable		Baseline	After intervention	MCS[b]	*p*-value[a]		
Treatment groups		Median±IQR	Median+IQR		Time	Treatment type	Time*Treatment
VAS at rest	Physical therapy only	7.00±2	4±2	-42.9	<.001	.062	.001
	Physical plus manual therapy	8.00±1	4±2	-50			

a=MANOVA. b=Mean change score

Table-3: Effect of treatment on pain during function

Outcome variable		Baseline	After intervention		*p*-value		
Treatment groups		Median±IQR	Median±IQR	MCS[b]	Time	Treatment type	Time*Treatment
VAS during function	Physical therapy only	7.00±1	4.00±1	-42.87	.267	.001	.710
	Physical plus manual therapy	8.50±1	4.50±1	-52.9			

a=MANOVA. b=Mean change score

Table-4: Effect of treatment on pain free Maximum mouth opening

Outcome variable	Treatment groups	Baseline	After intervention		*p*-value		
		Median+IQR	Median+IQR	SDD[b]	Time	Treatment type	Time*Treatment
MMO	Physical therapy only	32+2.5	38+2	2.244	<.001	.067	<.001
	Physical plus manual therapy	32+3	40+2.5	3.547			

a=MANOVA. b=smallest detectable difference

DISCUSSION

This study aimed to assess the short-term efficacy of HPT and patient education alone versus the combination of MT and HPT in patients with TMD. The MTeHPT group demonstrated a greater reduction in VAS scores and improvement in pain-free MMO compared to the HPT group. These findings highlight the clinical effectiveness of MT-HPT treatment.

Soft tissue therapy, along with self-therapy and behavioral therapy, is the initial recommended approach for patients experiencing pain and limited joint function. According to a comprehensive analysis of randomized controlled trials (RCTs), soft tissue therapy targeted at the masticatory muscles proves to be more efficacious than botulinum toxin injections. Nevertheless, there exists conflicting evidence regarding the effectiveness of manual therapy (MT) in individuals with temporomandibular disorders (TMDs), necessitating additional RCTs to assess specific treatment modalities.[7] Dworkin *et al*. have highlighted the significance of patient education, particularly in terms of self-care, as a potent tool for the rehabilitation and treatment of temporomandibular disorders (TMD). By emphasizing patient responsibilities and addressing psychosocial factors such as coping strategies and locus of control, a considerable number of TMD patients can derive substantial benefits from this approach.[8] Ensuring the restoration of physiological mandibular movement is a critical aspect of TMD management. Clinical trials investigating TMD have consistently highlighted pain-free maximum mouth opening (MMO) as a reliable indicator of treatment outcomes (Carmeli *et al.,* 2001; Blanco *et al.,* 2006; Cuccia *et al*., 2010).[14] A thorough evaluation found that using both passive and vigorous oral exercises reduced TMD11) symptoms. It is possible to improve mandibular motions and increase mouth opening by performing passive and active stretching exercises, isometric tension exercises, and relaxation activities. In the treatment of TMD, exercise and patient education are also beneficial.[5] In the realm of regional musculoskeletal disorders, exercise therapy stands as the fundamental component of rehabilitation, providing the necessary groundwork for optimal recovery. From a biomechanical perspective, when the head is extended forward, it pushes the

mandibular condyle against the retro discal tissue, leading to swelling, pain, and disc degeneration.[1]

The study compared the effects of physical therapy alone and a combination of physical and manual therapy on patients with facial pain. The baseline characteristics showed no significant differences between the groups in terms of age, gender, or the affected side of the face. The baseline Visual Analog Scale (VAS) scores for pain at rest were 7.00 for the physical therapy only group and 8.00 for the physical plus manual therapy group. Post-intervention, both groups exhibited significant reductions in VAS scores, with the median score dropping to 4.00 in both groups. Pain during function showed a slightly different scenario, with the physical therapy only group having a median VAS score of 7.00 and the physical plus manual therapy group having a higher median score of 8.50. Both groups showed significant reductions in VAS scores, with the physical plus manual therapy group showing a more pronounced reduction in pain. The treatment type significantly impacted the reduction in pain during function, but the difference in improvement over time was not statistically significant.

In terms of maximum mouth opening (MMO), both treatments led to significant improvements. The physical therapy only group improved to 38.00 mm and the physical plus manual therapy group to 40.00 mm, respectively. However, the difference in MMO improvement was not statistically significant. The interaction effect between time and treatment type was significant, indicating that the rate of improvement in MMO differed between the two treatments.

As per the study findings, patients who underwent 12 MT sessions with a physical therapist, attending three sessions per week, experienced positive effects on their recovery process. The therapist diligently assessed signs and symptoms throughout each phase and provided appropriate instructions, leading to a noticeable reduction in symptoms. Our study revealed a significant increase in pain-free MMO and decreases in pain intensity over time in both groups. Interestingly, the MTeHPT group demonstrated a significantly greater enhancement in pain-free MMO compared to the HPT group.

Limitations:

- Short evaluation period
- Lack of compliance assessment with recommended treatments

Myofascial pain was observed in the subjects, some of whom had limited opening and/or anterior disc displacement with reduction.

CONCLUSION

In the context of TMD treatment, the combination of manual therapy and physical therapy plus patient education surpasses the efficacy of home physical therapy patient education alone in the short term. This integrated approach is especially effective in alleviating pain and improving pain-free maximum mouth opening.

AUTHORS' CONTRIBUTION

SUS: Conceptualization of the study, data collection. SS: Data analysis. SM: Write-up, literature search. SY: Literature search. HJ: Proofreading, data collection. KS: Data analysis, write-up.

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