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ORIGINAL ARTICLE

Gerilim tipi baş ağrısı olan bireylerde temporomandibular gevşetme ve miyofasial gevşetme tekniklerinin yaşam kalitesi, depresyon ve baş ağrısı üzerine etkisi

The effect of temporomandibular release and myofascial release techniques on quality of life, depression, and headache in ındividuals with tension-type headache

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Öz

Amaç: Gerilim tipi baş ağrısı (GTBA) toplumda sıklıkla görülmektedir. Çalışmamızın amacı GTBA olan bireylerde temporomandibular eklem (TME) Yumuşak Doku Teknikleri (TME-YDT) ve miyofasial gevşetme (MFG) tekniklerinin etkinliğini incelemektir.

Yöntem: Uluslararası Baş Ağrısı Derneğinin Baş ağrısı sınıflandırması (ICHD-3)'na göre 18-65 yaşları arası GTBA tanısı alan 73 gönüllü birey dahil edildi. Bireyler randomizasyon metoduna göre Grup 1; TME-YDT, Grup 2; MFG Grubu ve Grup 3; Kontrol Grubu olmak üzere 3'e ayrıldı. Baş ağrısı, Headache Impact Test-6(HIT-6) ile; TMED Fonseca Ölçeği ile; Temporomandibular EHA cetvel yardımı ile; servikal EHA gonyometre ile; yaşam kalitesi, SF-36 Yaşam Kalite Ölçeği ile; depresyon, Beck Depresyon Ölçeği (BDÖ) ile; Anksiyete, Beck Anksiyete Ölçeği (BAÖ) ile değerlendirildi. Değerlendirmeler tedavi öncesi ve 4 haftalık tedavi sonunda yapıldı. Grup 1'e TME- YDT (anterior kaudal glide, masseter ve medial pterygoid kaslarına yumuşak doku mobilizasyonu), Temporal ve Suboksipital kaslara miyofasial gevşetme tekniği uygulandı. Grup 2'ye grup 1'e yapılan uygulamalara ek olarak Trapez, Rhomboid, Levator Scapula ve Sternocleidomasteideus kaslarına ve derin posterior servikal fasya gevşetme teknikleri uygulandı.

Bulgular: Hem TME hem de MFG gruplarının FONSECA ve HIT6 total skorlarında meydana gelen değişimin kontrol grubuna göre anlamlı şekilde yüksek olduğu görüldü($p<0,05$).

Sonuç: GTBA tedavisinde TME yumuşak doku tekniklerinin miyofasial teknikler kadar etkili olduğu bulundu.

Anahtar kelimeler: Yaşam kalitesi, Gerilim tipi baş ağrısı,Temporamandibular eklem, Anksiyete, Normal eklem hareketi.

Abstract

***Purpose**: Tension-type headache (TTH) is commonly observed in the community. The aim of our study is to investigate the effectiveness of Temporomandibular Joint Soft Tissue Techniques (TMD-STT) and Myofascial Release (MFR) techniques in individuals with TTH.*

***Methods:** Seventy-three voluntary individuals between the ages of 18-65 diagnosed with TTH according to the International Classification of Headache Disorders (ICHD-3) were included. Participants were divided into three groups based on randomization: Group 1; TMD-STT, Group 2; MFR Group, and Group 3; Control Group. Headache was assessed using the Headache Impact Test-6 (HIT-6); TMJ with the Fonseca Scale; Temporomandibular Range of Motion with a goniometer; quality of life with the SF-36 Quality of Life Scale; depression with the Beck Depression Scale (BDS); and anxiety with the Beck Anxiety Scale (BAS). Evaluations were conducted before treatment and at the end of 4 weeks. Group 1 received TMD-STT (soft tissue mobilization to anterior caudal glide, masseter, and medial pterygoid muscles) and Myofascial Release technique to temporal and suboccipital muscles. In addition to the applications in Group 1, Group 2 received deep posterior cervical fascia relaxation techniques for Trapezius, Rhomboid, Levator Scapula, and Sternocleidomastoid muscles.*

***Results:** Significant improvement in FONSECA and HIT-6 total scores was observed in both TMD-STT and MFR groups compared to the control group ($p<0.05$).*

***Conclusion:** TMD soft tissue techniques were found to be as effective as myofascial techniques in the treatment of TTH.*

***Keywords:** Quality of life, Tension-type headache, Temporomandibular joint, Anxiety, Normal joint movement.*

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INTRODUCTION

One of the most common complaints in society is headaches, significantly affecting the quality of life for individuals. The rate of individuals experiencing a headache at least once in their lifetime is over 90% in society (93% for men and 99% for women). Headaches are fundamentally classified into two main groups: "primary type headaches and secondary type headaches".[1] Among headaches, tension-type headache (TTH) is defined as a primary type of headache,[2] with a lifetime prevalence of 46% in adults.[3] Studies in the literature have reported that temporomandibular joint dysfunction (TMJD) and headaches are "comorbid diseases," suggesting that the presence of one will increase the symptoms of the other, and if both disorders occur, symptoms start earlier than expected.[4,5]

Literature studies have proven that TMJD affects headaches, jaw stiffness, and functionality in jaw movements. However, TMJD increases with stress and has been reported to cause significant difficulties in performing daily activities.[3] In this context, various studies have shown a strong correlation between pain during mandibular movements, headaches, joint sounds, pain in the temporomandibular area, sleep quality impairment, depression, and anxiety.[5,6]

Additionally, from a diagnostic perspective, the International Classification of Headache Disorders has listed the relationship between TMJD and headaches under item 11.7, where headaches are attributed to temporomandibular disorders.[3] As mentioned above, studies have already shown the relationship between temporomandibular dysfunction and tension-type headache (TTH).[7]

The literature includes studies demonstrating the effectiveness of manipulative treatment methods for tension-type headaches,[8–10] osteopathic,[11] and craniosacral therapy methods.[12,13] However, no studies have been found examining the effectiveness of manipulative treatment methods for the temporomandibular joint in alleviating TTH. Based on these data, the main aim and hypothesis of our study are to examine the effects of Temporomandibular Joint Soft Tissue Techniques (TMJ-STT) and myofascial release techniques (MRT) on the quality of life, depression, and headache in individuals with tension-type headache. Our secondary purpose is to compare the effectiveness of Temporomandibular Joint Soft Tissue Techniques (TMJ-STT) alone and Temporomandibular Joint Soft Tissue Techniques (TMJ-STT)+Myofascial Release Technique (MRT) in individuals with TTH.

METHODS

The study received approval from the institutional review board of Alanya Alaaddin Keykubat University's ethical committee (No:10354421-2021/07-08). The trial was registered on www.ClinicalTrials.gov (identifier:NCT05058573). We adhered to the CONSORT reporting guidelines for pilot and feasibility studies.

Individuals

Fifty volunteers aged 18-65 years who met the inclusion criteria were included in this study.

Inclusion and exclusion criteria and search strategy

The inclusion criteria were as follows: (1) Being diagnosed with Tension-Type Headache (TTH) by a neurology specialist according to the International Classification of Headache Disorders (ICHD-3) criteria,[14] (2) Being able to read and understand Turkish, (3) Not receiving medical treatment in the previous 1 year.

The exclusion criteria were as follows: (1) Having received physical therapy for TMJD in the previous 6 months, (2) Having neurological disorders, (3) Having congenital disease, (4) Depression, (5) Having mental problems, (6) Having a history of cervical or cranial surgery, (7) Having received corticosteroid therapy within the previous year, (8) History of facial trauma (those with a history of facial paralysis), advanced level cervical disc herniation (protrusion and sequestered disc), ankylosing spondylitis, rheumatoid arthritis, or systemic diseases such as fibromyalgia, (9) Having communication problems.

Sample size

According to the conducted power analysis, it was observed that the effect size obtained in the reference study is at a strong level (d=1.524). Considering that a lower level of effect size could also be obtained (f=0.4), the power analysis

results indicate that with a minimum of 66 participants (at least 22 participants for each group), a power of 80% can be achieved at a 95% confidence level. To account for the possibility of participants dropping out of the study, 25 voluntary individuals were included in each group. In the referenced randomized clinical trial study, a total of 30 women diagnosed with Tension-Type Headache (GTBA) were selected using a simple non-probability sampling method.[1]

Design

According to the power analysis conducted prior to the study, it was determined that the inclusion of 66 individuals would be sufficient. However, 87 individuals presenting with headaches and diagnosed with Tension-Type Headache were evaluated at the clinic. Six individuals were excluded from the study as they did not meet the inclusion criteria. The 81 individuals included in the study were randomly divided into 3 groups using the SPSS computer random number generator: Group-1 (n=27) TMJ Soft Tissue Techniques (TMJ-STT) group; Group-2 (n=27) MRT Group including in TMJ-STT; Group-3 (n=27) was planned as the control group receiving only traditional medical treatment. However, a total of 8 individuals were excluded from the study during the course of the study due to their irregular participation. Our study concluded with the participation of a total of 73 individuals (Figure 1).

The patients included in Group 1 and Group 2 received a total of 8 sessions of manual therapy, 2 sessions per week, for 4 weeks. Individuals included in Group 3 were first evaluated and then regularly asked to continue the medical treatment recommended by the physician. Individuals were re-evaluated 4 weeks later.

Recruitment

After the approval of Alanya Alaaddin Keykubat University Non-Interventional Clinical Research Ethics Committee (Date: 14.04.2021, Number: 10354421-2021/07-08), the research was carried out in accordance with the "Helsinki Declaration".

Manipulative techniques

TMJ soft tissue techniques

For the TMJ Soft Tissue Technique (TMJ-STT), the individual laid supine on the treatment bed. The therapist was positioned at the patient's head-side, facing the patient. The therapist placed her thumb on the upper posterior surface of the teeth and her fingers along the line of the mandible. Caudal anterior gliding, one of the soft tissue release techniques, was applied to the temporomandibular joint. Soft tissue mobilization was performed to the medial pterygoid and masseter muscles. The suboccipital myofascial release technique was applied while the patient was lying in the supine position. The therapist completely relaxed the patient's head and applied cranial pull while her 4th and 5th fingers were in the semi-flexion position. While the patient was lying back, their head was flexed slightly to the right and myofascial release technique was applied to the temporal muscle. The therapist held the fascia steady with one hand, while applying gentle pushes in the caudal direction with the other. Right and left bilateral application was made (Figure 2).

Myofascial release technique

The patient lay face down on the treatment bed. The upper trapezius release technique was applied unilaterally while the patient was lying face down. The myofascial release technique was applied to M. Trapezius M. Rhomboideus, M. Levator Scapulae, and M. Sternocleidomastoid muscles for 3-5 minutes. The deep posterior cervical fascia release technique, was applied while the patient was in the supine position. The therapist completely released the head weight. While all four fingers were in the semi-flexion position, a slight pull was applied from the base of the occiput to the cranial. The deep posterior cervical fascia was relaxed by gently pressing the fingers along the superior direction. The treatment was applied for 20 minutes in both groups (Figure 2).

Measures and data collection

Data collection was conducted from April 2021 to August 2021.

Outcome measures

Cervical region joint movement

Evaluation of the joint range of motion of the cervical region was performed using a "universal goniometer". The Kendall Mc-CREARY mean value of joint range of motion (ROM) was used for measurements. Head flexion-extension and lateral flexion and rotation movements were shown to the patients, in this order. They were then asked to perform these movements and the measurements were recorded.[15]

TMJ range of motion

The maximum amount of mouth opening (M-MO), the maximum amount of assisted mouth opening (A-MO), the amount of painless active mouth opening (P-MO), and the right and left movements of the lower jaw (laterotrusion) were measured using a ruler (mm). Mouth opening was evaluated based on the mean reference values determined by Walker et al. (43.5+-6.1 mm).[15]

TMJ dysfunction classification

The Fonseca Questionnaire was administered to classify TMJD. This questionnaire, developed by Fonseca et al. in the early 1990s, consists of 10 items.[3] There are 3 answer options for each question: 10 points for "yes", 5 points for "sometimes", 0 points for "no". The scores of all items are summed and the severity of temporomandibular joint dysfunction is determined, where 0-15 points indicate no TMJD, 20-40 points indicate mild-TMJD, 45-60 points indicate moderate-TMJD, and 70-100 points indicate severe-TMJD.[14,16]

Depression

Beck Depression Inventory (BDI)

The Beck Depression Inventory, consisting of 21 items, was used to evaluate the psychological status of the individuals.[4,5] Each question consists of 4 options and the individual is asked to choose the one reflecting their mood best. Each item is scored between 0 and 3. High scores reflect poor results. According to the total score obtained, 0-9 points indicate minimal depression, 10-16 points indicate mild depression, 17-29 points indicate moderate depression, and 30-63 points indicate severe depression.[8]

Anxiety

Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory is an assessment tool that provides information about whether individuals have anxiety symptoms.[6,7] The subjects were asked to answer questions about how much symptoms bothered them when they were anxious or stressed in the previous week. The BAI consists of 21 four-point Likert type items, where 0-points indicates none; 1-point indicates mild- "didn't affect me much"; 2-points indicate moderate- "it wasn't pleasant but I endured", and 3-points indicate severe- "I had a hard time holding on". A range of 8-15 points is expressed as "mild anxiety symptoms", 16-25 points as "moderate anxiety symptoms", and 26-63 points as "severe anxiety symptoms".[17]

Headache

The Headache Impact Test-6 (HIT-6) was used to evaluate the headache symptoms of the patients[18,19]. The HIT-6 consists of 6 items regarding headache severity, the extent of restriction at school, work, or social activities due to headache, psychological status, and changes in cognitive status. The patients were asked to answer 6 questions by choosing the most appropriate option: "always, often, sometimes, rarely, and never", where "always" is 13 points, "often" is 11 points, "sometimes" is 10 points, "rarely" is 8 points, and "never" is 6 points. The total score ranges from 36 to 78, where grade 1 is no influence≤49; Grade 2 is 50-55 points, moderate exposure; Grade 3 is 56-59 points, a significant influence; and, Grade 4 is severe influence, ≥60 points.[20,21]

General quality of life assessment

The 36-Item Short Form Health Survey (SF-36), developed by Ware et al., was used to evaluate the general quality of life of the patients.[22,23] The SF-36 is a questionnaire consisting of 36 items to obtain information about the physical pain, physical state, emotional state, and general health of individuals The general quality of life scale includes 8 sub-parameters, namely, mental health, energy state, bodily pain, physical function, limitation due to physical problems, limitation due to emotional problems, social function, and general health status. The total score ranges from 0 to 100 points. High scores indicate that the individual is in good health.[24]

Statistical analysis

Data were analyzed with SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk, NY: IBM Corp) package program. Continuous variables are expressed as mean ± standard deviation, median (25th and 75th percentiles), and min-max values. Categorical variables are expressed as numbers and percentages. The conformity of the data to the normal distribution was examined using the Shapiro Wilk test. In independent group analysis, One Way Analysis of Variance (post hoc: Tukey test) was used when parametric test assumptions were met. When parametric test assumptions were not met, Kruskal Wallis Analysis of Variance (post hoc: Mann Whitney U test with Bonferroni correction) was used. When the parametric test assumptions were met in comparing the

differences between the measurements, the t-test was used in the dependent groups and the Wilcoxon Paired-Sample Test was used when parametric test assumptions were not met. The Chi-square test was used to examine the differences between categorical variables. $p<0.05$ was considered statistically significant.[9]

RESULTS

In our study, 87 individuals aged 18-65 years presenting with headaches and diagnosed with Tension-Type Headache were evaluated at the clinic. Six individuals were excluded from the study as they did not meet the inclusion criteria. The 81 individuals included in the study were randomly divided into 3 groups using the SPSS computer random number generator: Group-1 (n=27) TMJ Soft Tissue Techniques (TMJ-STT) group; Group-2 (n=27) MRT Group including in TMJ- STT; Group-3 (n=27) was planned as the control group receiving only traditional medical treatment. However, a total of 8 individuals were excluded from the study during the course of the study due to their irregular participation. Our study concluded with the participation of a total of 73 individuals (Figure 1).

The results of the passive assessment of the maximum mouth opening amount (M-MO) and painless active mouth opening amount (P-MO) before and after treatment did not show a significant difference among the three groups. When the changes in Group 1 and Group 2 were examined over the 4 weeks before and after treatment, a statistically significant increase was observed in both the maximum mouth opening amount (M-MO) and the passive assisted mouth opening amount (P-MO) ($p<0.05$). No change was observed in Group 3 ($p>0.05$) (Table 2). When the changes in the

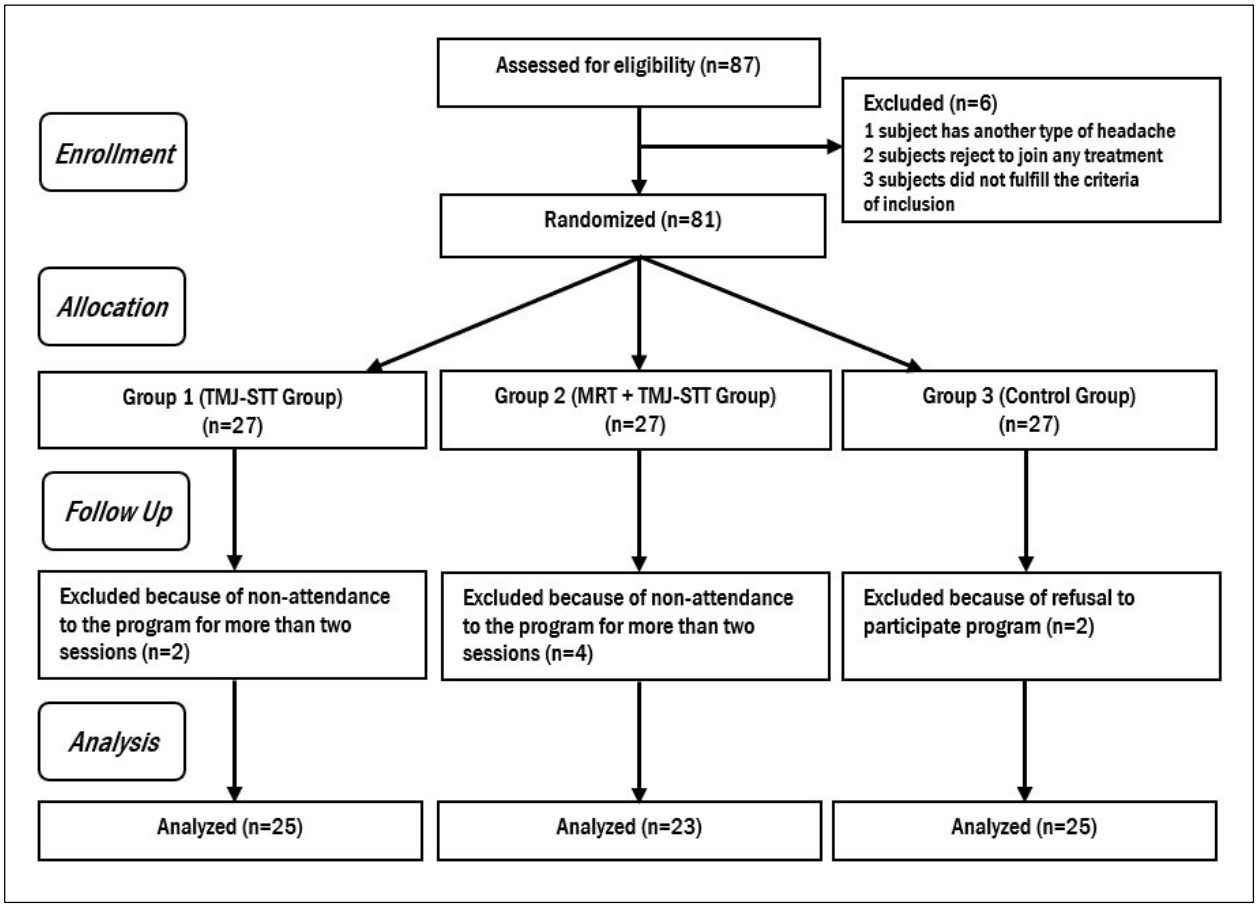

Figure 1. Flowchart according to consort statement for the report of randomized trials.

Temporomandibular Joint Soft Tissue Techniques	
Caudal Anterior Glide	
Medial Pterygoid Soft Tissue Mobilization	
M. Masseterius Soft Myofascial Release	
M. Temporalis Soft Myofascial Release	
Mm. Suboccipitalis Myofascial Release	
Soft Tissue Techniques	
Deep Posterior Cervical Fascial Release	
M. Trapezius, M. Levator Scapulae, M. Rhomboideus Myofascial Release	

Figure 2. Manipulative techniques.

assisted mouth opening amount before and after treatment were examined, it was determined that there was a significant increase only in Group 1 ($p<0.05$). No change was observed in Group 2 and Group 3 (Table 2).

When the right and left laterotrusion movements were examined, a significant difference was found between the three groups only after the treatment ($p<0.05$). The right laterotrusion values of Group 1 and Group 2 were significantly higher than the values of Group 3 ($p<0.05$). It was observed that the change in left laterotrusion movement in Group 1 was higher than that in both Group 2 and Group 3 ($p<0.05$). It was determined that right laterotrusion movements significantly increased in both Group 1 and Group 2 after 4 weeks of treatment ($p<0.05$), while there was no change in Group 3 ($p>0.05$) (Table 2).

There was no significant difference among the three groups in terms of cervical flexion, extension, lateral flexion, and rotation angles, both before and after treatment (Table 2). When the changes before treatment and after 4 weeks of treatment were examined, a significant increase was observed in cervical flexion in both Group 1 and Group 2 ($p<0.05$). No change was observed in Group 3. No statistically significant change was observed in any group in terms of cervical extension. A significant increase was found in the right lateral flexion and right rotation angles of Group 1 ($p<0.05$). There was no change in the lateral flexion angles of Group 2 and Group 3 ($p>0.05$). No change was observed in the rotation angles of Group 2 and Group 3 ($p>0.05$) (Table 2).

There was no significant difference among the three groups in Fonseca, HIT-6, BDI, BAI, and SF-36 scores both before and after treatment ($p>0.05$). When the changes before and after treatment were examined, it was observed that there was a statistically significant decrease in Fonseca, HIT-6, BDI, and BAI scores in both Group 1 and Group 2 ($p<0.05$), while no change was observed in any of these scores in Group 3 ($p>0.05$) (Table 3).

When the difference values of the three groups before and after treatment were compared, it was determined that the change in M-MO and right rotation values in Group 1 was significantly higher than in Group 3 ($p<0.05$) (Table 4). It was observed that the change in P-MO, right laterotrusion, and cervical flexion values in Group 2 was significantly higher than in Group 3 ($p<0.05$) (Table 4). The change in Fonseca total, HIT-6 total, BDI total, and BAI total scores in both Group 1 and Group 2 was found to be significantly higher than in Group 3 ($p<0.05$) (Table 4).

DISCUSSION

Our study aims to compare the effects of Temporomandibular Joint (TMJ) relaxation techniques (Group 1), TMJ + Myofascial relaxation techniques (Group 2), and Medical Treatment (Group 3) on cervical joint range of motion, mouth opening, quality of life, Fonseca impact scale, depression, anxiety, and headache in individuals with Tension-Type Headache (TTH). Results showed improvements in quality of life, joint range of motion, headache, depression, and anxiety symptoms in Group 1 and Group 2 compared to Group 3 both before and after treatment. Inter-group analyses demonstrated significant improvements in P-MO, right lateral trusion, and cervical flexion values in Group 2 compared to Group 3. Positive effects were found in M-MO and right rotation values in Group 1 compared to Group 3. Positive changes were observed in Fonseca total value, headache (HIT6), depression (BDI), and anxiety (BAI) values in both Group 1 and Group 2. The data confirm the hypothesis that manipulative-myofascial relaxation techniques positively affect the quality of life, depression, and headache in individuals with TTH. Similarly, De Sousa and De Matos (2014) investigated the impact of myofascial relaxation techniques on cervical range of motion in TTH.[25] They found significant improvement in all cervical movements and reported a significant difference in pre- and post-treatment values.[25,26] On the other hand, Lopez and colleagues (2014) explored the efficacy of two different manual therapy applications. The first group received suboccipital soft tissue inhibition, the second group received occiput-atlas manipulation, the third group received a combination of the two treatments, and the control group received no treatment. They observed an increase in cranioservical flexion in the intervention groups after treatment. They noted greater improvement in occiput-atlas manipulation and suggested that the combination of suboccipital inhibition and occiput-atlas manipulation group

showed better improvement than suboccipital inhibition alone.[27]

In our study, as well as in the mentioned study above, it is observed that soft tissue techniques applied to the suboccipital region are effective. However, in a meta-analysis study investigating the effectiveness of physical therapy methods applied to the suboccipital region in patients with Tension-Type Headache (TTH), six randomized controlled trials were conducted with a total of 505 participants. The Suboccipital Soft Tissue Inhibition Technique (SIT) + Occiput-Atlas-Axis Global Manipulation (OAA) was found to be more effective than SIT in increasing cranioservical extension after 4 weeks of treatment. However, the combination therapy of SIT+OAA may be more effective in the short term (4 weeks), showing no significant difference in the long term (8 weeks).[10] Therefore, the long-term results of our study are needed. In a study conducted by Memmedova to examine the relationship between Temporomandibular Joint Disorder (TMJD) and Tension-Type Headache (TTH) using the Fonseca questionnaire, a higher Fonseca score was reported in individuals with TTH.[28] Looking at the research, it has been observed that headaches and comorbid disorders of TMJD trigger each other.[29] They found that oral problems were more commonly observed in individuals with TTH.[22] In our study, we assessed the presence of TMJD in patients presenting with TTH and the effectiveness of treatments only with the FONSECA questionnaire.[23] According to FONSECA, we do not have information

Table 1. Comparison of features such as bruxism, chewing direction, previous operations, medication use, and cigarette use among the groups.

		Group 1 (N=25)	Group 2 (N=23)	Group 3 (N=25)	
		n (%)	n (%)	n (%)	p
Bruxism history	None	16 (64)	9 (39.13)	14 (56)	0.301 (a)
	Present at night	5 (20)	7 (30.43)	8 (32)	
	Present during the day	1 (4)	5 (21.74)	1 (4)	
	Present both night and day	3 (12)	2 (8.7)	2 (8)	
Chewing direction	Right	6 (24)	4 (17.39)	6 (24)	0.509 (a)
	Left	0 (0)	2 (8.7)	1 (4)	
	Bilateral	19 (76)	17 (73.91)	18 (72)	
Dominant chewing direction	Right	22 (88)	14 (60.87)	19 (76)	0.271 (a)
	Left	2 (8)	7 (30.43)	5 (20)	
	Bilateral	1 (4)	2 (8.7)	1 (4)	
Previous operations	None	22 (88)	19 (82.61)	18 (72)	0.347 (a)
	Present	3 (12)	4 (17.39)	7 (28)	
Medication use	No	14 (56)	13 (56.52)	18 (72)	0.422 (a)
	Yes	11 (44)	10 (43.48)	7 (28)	
Cigarette use	No	18 (72)	18 (78.26)	17 (68)	0.726 (a)
	Yes	7 (28)	5 (21.74)	8 (32)	
Orthodontic treatment history	No	24 (96)	20 (86.96)	23 (92)	0.514 (a)
	Yes	1 (4)	3 (13.04)	2 (8)	
Coexisting diseases	Diabetes	3 (12)	3 (13.04)	2 (8)	0.488 (a)
	Hypertension	- (0)	- (0)	3 (12)	
	Hyperlipidemia	1 (4)	1 (4.35)	1 (4)	
	Other	6 (24)	6 (26.09)	4 (16)	
	None	15 (60)	13 (56.52)	15 (60)	

(a): Chi-Square test.

Table 2. Comparison of maximum mouth opening, active mouth opening, passive opening, laterotrusion right-left, cervical range of motion data' before and after treatment and between groups.

		Group 1	Group 2	Group 3	
		X±SD	X±SD	X±SD	p
Max mouth opening BT		41.08±3.83	37.91±6.63	41.16±4.12	0.052 (b)
Max mouth opening AT		42.60±3.66	39.70±6.67	41.44±3.95	0.126 (c)
	p (BT-AT)	0.003* (e)	0.007* (d)	0.059 (d)	
Active mouth opening BT		34.76±3.43	31.26±6.35	31.76±3.50	0.034* (b)α
Active mouth opening AT		35.72±3.51	33.57±6.54	32.16±3.54	0.021* (b)α
	p (BT-AT)	0.144 (d)	0.017* (d)	0.072 (e)	
Passive mouth opening BT		43.64±3.65	41.61±6.52	43.68±4.28	0.315 (b)
Passive mouth opening AT		44.80±3.56	42.35±6.52	43.88±4.08	0.287 (b)
	p (BT-AT)	0.020* (d)	0.260 (e)	0.140 (e)	
Laterotrusion Right-BT		9.44±2.02	9.17±2.74	8.56±2.36	0.414 (c)
Laterotrusion Right-AT		10.80±2.24	10.52±2.27	8.36±2.41	0.001* (c)α,β
	p (BT-AT)	0.019* (e)	0.028* (d)	0.157 (e)	
Laterotrusion Left- BT		8.88±2.54	8.57±2.57	8.16±2.37	0.595 (c)
Laterotrusion Left- AT		9.76±2.20	9.43±2.02	8.08±2.27	0.009* (b)α
	p (BT-AT)	0.04* (d)	0.191 (d)	0.705 (e)	
Cervical flexion BT		55.2±6.20	51.74±7.01	52.2±8.55	0.243 (b)
Cervical flexion AT		56.2±6.17	53.26±7.48	52.2±8.55	0.203 (b)
	p (BT-AT)	0.025* (e)	0.038* (e)	1.00 (e)	
Cervical extension BT		39.00±6.12	39.35±8.02	39.8±7.57	0.938 (b)
Cervical extension AT		40.20±4.89	40.00±7.39	39.8±7.57	0.978 (b)
	p (BT-AT)	0.107 (e)	0.603 (e)	1.00 (e)	
Right cervical lateral flexion BT		34.2±4.72	36.74±4.67	34.8±6.37	0.197 (b)
Right cervical lateral flexion AT		36.6±4.73	37.39±4.49	34.8±6.37	0.294 (b)
	p (BT-AT)	0.035* (e)	0.579 (e)	1.00 (e)	
Left cervical lateral flexion BT		32.60±4.11	33.26±4.91	33.00±6.12	0.890 (b)
Left cervical lateral flexion AT		33.60±4.45	33.91±4.99	33.00±6.12	0.930 (b)
	p (BT-AT)	0.260 (e)	0.435 (e)	1.00 (e)	
Right rotation BT		47.60±5.02	49.57±5.82	50.00±4.79	0.197 (b)
Right rotation AT		50.20±4.20	50.00±5.64	50.00±4.79	0.981 (b)
	p (BT-AT)	0.038* (e)	0.48 (e)	1.00 (e)	
Left rotation BT		45.40±6.44	45.87±5.36	47.40±5.23	0.427 (b)
Left rotation AT		45.40±5.39	45.87±5.15	46.80±4.97	0.645 (b)
	p (BT-AT)	0.903 (e)	1.00 (e)	0.18 (e)	

*p<0.05. BT: Before treatment. AT: After treatment. (b): Kruskal-Wallis test. (c): One-way ANOVA. (d): t test in dependent groups. (e): Wilcoxon Signed Rank test. α: Significant difference between Group 1 and Group 3. β: Significant difference between Group 2 and Group 3.

about whether TMJD is myogenic or arthralgic. Therefore, we cannot say that every patient with TTH has TMJD. However, based on the literature, it has been indicated that manual therapy methods applied to the cervical region in individuals with TMJD increase mouth opening.[30] Based on this, we believe that the increase in mouth opening measurements in this study is due to the relaxation of the jaw joint and neck muscles caused by the manual techniques applied to TMJ, providing relaxation in TMJ.

There are studies in the literature measuring the effects of Osteopathic Manipulative Therapy (OMTh) and Craniosacral therapies on pain in Tension-Type Headache (TTH). Deodato et al.[11] investigated the effects of osteopathic manipulative therapy

Table 3. Comparison of Fonseca, HIT6, BDS, BAS Parameters before and after treatment and between the groups.

	Group 1	Group 2	Group 3	
	X±SD	X±SD	X±SD	p
Fonseca Questionnaire BT	41.2±20.38	52.83±25.80	44.00±18.20	0.161 (c)
Fonseca Questionnaire AT	32.8±15.55	38.26±24.20	46.60±23.13	0.076 (c)
p (BT-AT)	0.024* (e)	0.001* (e)	0.001* (e)	
The Headache Impact Test-6 (HIT-6) BT	62.48±7.33	63.30±8.75	63.96±7.97	0.840 (b)
The Headache Impact Test-6 (HIT-6) AT	53.92±7.14	51.87±7.94	63.76±9.06	<0.001* (c) α,β
p (BT-AT)	<0.001 (d)	<0.001 (d)	0.892 (d)	
Beck Depression Scale BT	14.84±9.36	14.04±7.92	13.40±10.83	0.742 (b)
Beck Depression Scale AT	9.36±7.63	9.35±8.20	14.68±12.30	0.089 (b)
p (BT-AT)	0.0001* (d)	0.001* (d)	0.195 (d)	
Beck Anxiety Scale BT	19.76±10.87	20.96±13.55	15.12±9.85	0.194 (b)
Beck Anxiety Scale AT	12.20±9.89	12.87±11.24	15.00±11.43	0.592 (b)
p (BT-AT)	0.001* (e)	0.001* (e)	0.917 (d)	
SF-36 General Health Score BT	55.60±20.22	50.87±20.37	57.40±21.37	0.535 (c)
SF-36 General Health Score AT	53.60±17.59	53.04±19.87	56.40±19.01	0.799 (b)
p (BT-AT)	0.482 (d)	0.508 (d)	0.451 (d)	

*p<0.05. BT: Before treatment. AT: After treatment. (b): Kruskal-Wallis test. (c): One-way ANOVA. α: Significant difference between Group 1 and Group 3. β: Significant difference between Group 2 and Group 3. SF-36: The 36-Item Short Form Health Survey.

Table 4. Comparison of the differences (before and after treatment) between the groups.

		Group 1	Group 2	Group 3	
		X±SD	X±SD	X±SD	p
Mouth opening	Maximum	-1.52±2.29	-1.78±2.86	-0.28±0.84	0.02* (b)α
	Active	-0.96±3.18	-2.30±4.28	-0.40±1.08	0.04* (b)β
	Passive	-1.16±2.32	-0.74±3.09	-1.60±7.01	0.313 (b)
Laterotrusion	Right	-1.36±2.51	-1.35±2.74	0.20±0.71	0.008* (b)β
	Left	-0.88±2.03	-0.87±3.09	0.08±0.70	0.072 (b)
Cervical flexion		-1.00±2.04	-1.52±3.17	0.00±0.00	0.049* (b)β
Cervical extension		-1.20±3.62	-0.65±4.60	0.00±0.00	0.343 (b)
Cervical lateral flexion	Right	-2.40±5.42	-0.65±4.84	0.00±0.00	0.126 (b)
	Left	-1.00±4.33	-0.65±4.60	0.00±0.00	0.599 (b)
Cervical rotation	Right	-2.60±5.61	-0.43±2.98	0.00±0.00	0.018* (b)α
	Left	0±6.61	0.00±3.69	0.60±2.20	0.695 (b)
Fonseca Questionnaire		8.40±17.06	14.57±18.02	-2.60±8.55	<0.001 (b)α,β
Headache Impact Test-6 (HIT-6)		8.56±8.66	11.43±10.02	0.20±7.27	<0.001 (c)α,β
Beck Depression Scale (BDS)		5.48±6.29	4.70±5.68	-1.28±4.80	<0.001 (c)α,β
Beck Anxiety Scale (BAS)		7.56±10.48	8.09±9.66	0.12±5.68	0.002* (b)α,β
The 36-Item Short Form Health Survey (SF-36)					
Physical Function		-1.40±10.05	-3.91±19.71	3.00±11.81	0.123 (b)
Physical Role Change		-13.00±38.94	-32.30±38.43	-9.00±38.11	0.053 (b)
Emotional Role Change		-18.68±46.24	-28.98±40.59	-2.66±44.01	0.056 (b)
Energy		-7.40±20.62	-11.52±18.12	-0.40±19.89	0.145 (c)
Mental Health		-5.28±20.16	-9.22±15.51	-6.56±20.42	0.47 (b)
Social Functioning		-42.50±16.44	-11.96±21.15	0.50±16.72	0.167 (b)
Pain		-12.80±23.21	-19.78±20.43	-6.90±18.52	0.063 (b)
General Health Perception		2.00±13.99	-2.17±15.51	1.00±17.91	0.295 (b)

*p<0.05. α: Significant difference between Group 1 and Group 3. β: Significant difference between Group 2 and Group 3.

on chronic tension-type headache and forward head posture They included 10 individuals in the OMTh group and 10 individuals in the control group. As a result, they found that OMTh was effective in terms of both pain duration, intensity, and head posture.[11] In a systematic review and meta-analysis study investigating the effects of craniosacral therapies on headaches, 735 studies were examined, and ultimately, four studies were included. The study suggests that craniosacral therapy has clinically insignificant effects on pain intensity but does not observe any significant effects on disability or headache outcomes.[31] A study examining the effects of TMJ and cervical region treatment on pain and functional improvement in individuals with TTH has been found in the literature. They found that both TMJ and cervical region treatment groups showed a significant decrease in HIT6 scores before and after treatment.[32] Choi et al.[18] investigated the effects of temporomandibular disorder treatment on headache and quality of life in individuals with TTH. The study reported that the group treated with TMJ+cervical manual therapy showed more reduction in HIT6 scores compared to the cervical manual therapy and conservative treatment group. The application of cervical manual therapy along with temporomandibular joint treatment to individuals with TTH resulted in a decrease in pain frequency and intensity, along with an increase in quality of life.[18] In this study, parallel to the literature, although no significant difference was observed in SF-36 values between groups, improvement was observed in all parameters in both groups undergoing manual therapy in intra-group evaluations.[26,33] We believe that this is the most important factor in increasing the quality of life, especially with the reduction of headaches. In a study conducted with military firefighters, a painful TMJD was found to be associated with daytime bruxism and anxiety. They also indicated that painless TMJDs are a risk factor for the development of anxiety and daytime bruxism tension-type headaches.[34] Manual therapy (suboccipital soft tissue techniques and articular techniques) was investigated for its effect on anxiety and depression in individuals diagnosed with TTH aged 18-65. They stated that manual therapy techniques reduced depression and anxiety symptoms.[26]

In conclusion, the study supports that TMJ release and myofascial release techniques are effective interventions in improving the quality of life, reducing depression and anxiety, and relieving headaches in individuals with TTH. The difference between our study and the literature is that TMJ applications are being tested for the first time in individuals diagnosed with TTH.

Limitations

Despite providing valuable date there are several limitations that sould be pointed. First, the treatment program is relatively short aslittle as 4 weeks. Second, since it is difficult to reach the patient due to the pandemic and the patients, it was challenging to include patients for the active participation. Third, both evaluation and treatment were applied by the same physiotherapist which could lead to a potential bias. Future studies evaluating long-term results with larger sample sizes are emergently needed and.

Conclusion

In conclusion, we think that both TMJ and MRT applications are effective in the treatment of TTH while MRT techniques and TMJ techniques in combined with appropriate exercise regimens could be performed for individuals with TTH who are under the conventional pain treatment.

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REFERENCES

1. Hosseinifar M, Bazghandi R, Azimi Z, Khodadadi Bohlouli B. Effectiveness of Neck

Myofascial Release Techniques and Exercise Therapy on Pain Intensity and Disability in Patients with Chronic Tension-Type Headache. Glob J Health Sci. 2016;9:47.
2. Crystal SC, Robbins MS. Epidemiology of tension-type headache. Current Pain and Headache Reports. 2010;14:.449-454.
3. Kamonseki DH, Lopes EP, van der Meer HA, Calixtre LB. Effectiveness of manual therapy in patients with tension-type headache. A systematic review and meta-analysis. Disabil Rehabil. 2022;44:1780-1789.
4. Otman S., Demirel H. SA. Tedavi Hareketlerinde Temel Değerlendirme Prensipleri. Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yüksekokulu Yayınları. 1995
5. Özdinç S, Ata H, Selçuk H, Can HB, Sermenli N, Turan FN. Temporomandibular joint disorder determined by Fonseca anamnestic index and associated factors in 18- to 27-year-old university students. Cranio - Journal of Craniomandibular and Sleep Practice. 2020;38:327-332.
6. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An Inventory for Measuring Depression The difficulties inherent in obtaining.
7. Hisli N. Beck Depresyon Envanterinin Üniversite Öğrencileri İçin Geçerliği, Güvenirliği. Psikoloji Dergisi.1989:7;3-13
8. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An Inventory for Measuring Depression. Archives of general psychiatry.1961:4;561-571.
9. Herranz-Gómez A, García-Pascual I, Montero-Iniesta P, La Touche R, Paris-Alemany A. Effectiveness of exercise and manual therapy as treatment for patients with migraine, tension-type headache or cervicogenic headache: An umbrella and mapping review with meta-meta-analysis. Applied Sciences. 2021;11:6856.
10. Jiang W, Li Z, Wei N, Chang W, Chen W, Sui HJ. Effectiveness of physical therapy on the suboccipital area of patients with tension-type headache: A meta-analysis of randomized controlled trials. Medicine (United States). 2019;98:e15487.
11. Deodato M, Guolo F, Monticco A, Fornari M, Manganotti P, Granato A. Osteopathic manipulative therapy in patients with chronic tension-type headache: A pilot study. Journal of the American Osteopathic Association. 2019:119;682-687.
12. Carrasco-Uribarren A, Mamud-Meroni L, Tarcaya GE, Jiménez-Del-Barrio S, Cabanillas-Barea S, Ceballos-Laita L. Clinical Effectiveness of Craniosacral Therapy in Patients with Headache Disorders: A Systematic Review and Meta-analysis. Pain Management Nursing 2023:7-14.
13. Muñoz-Gómez E, Inglés M, Aguilar-Rodríguez M, Mollà-Casanova S, Sempere-Rubio N, Serra-Añó P, et al. Effect of a Craniosacral Therapy Protocol in People with Migraine: A Randomized Controlled Trial. J Clin Med. 2022;11:759.
14. Olesen J. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders Cephalalgia. 2018:38;1-211.
15. Fernandes G, Franco AL, Gonçalves DA, Speciali JG, Bigal ME, Camparis CM. Temporomandibular disorders, sleep bruxism, and primary headaches are mutually associated. J Orofac Pain. 2013:27;14-20.
16. A.M. B, M. FFR, S. KK, W. F, J. DDDDA, O. M del del M, et al. Comments. Journal of Manual and Manipulative Therapy. 2015;18.
17. Ulusoy M, Sahin NH, Erkmen H. Turkish version of the Beck Anxiety Inventory psychometricproperties. Journal of Cognitive Psychotherapy.1998:12.2:163
18. Choi W, Woo J, Lee S, Lee S. Effects of treatment of temporomandibular disorders on headache, quality of life, and neck function in patients with tension-type headaches: a randomized controlled study. Physical Therapy Rehabilitation Science. 2020;9;215-221.
19. AGGARWAL AGJKPradnya. Role of myofascial release technique on mobility and function in temporomandibular joint disorder patients with neck pain. Journal of Dental Research & Review,. 2020:7;84-87.
20. Yang M, Rendas-Baum R, Varon SF, Kosinski M. Validation of the Headache Impact Test (HIT-6TM) across episodic and chronic migraine. Cephalalgia. 2011;31;357-361.
21. Yalinay Dikmen P, Bozdağ M, Güneş M, Koşak S, Taşdelen B, Uluduz D, et al. Reliability and validity of turkish version of headache impact test (Hit-6) in patients with migraine. Noropsikiyatri Arsivi. 2021;58;300.
22. Caspersen N, Hirsvang JR, Kroell L, Jadidi F, Baad-Hansen L, Svensson P, et al. Is there a relation between tension-type headache, temporomandibular disorders and sleep? Pain Res Treat. 2013:2013;845684.
23. Viegas RG de S, Bussadori SK, Vicente IVR dos S, Teixeira VP, Bozzella MA, Gonçalves MLL, et al. Evaluation of primary headache associated with temporomandibular dysfunction in adolescents from Santos, SP, Brazil: an observational study. J Phys Ther Sci. 2018:30;1372-1376.
24. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (Sf-36): I. conceptual framework and item selection. Med Care. 1992;30;473-483.
25. De Sousa RC, De Matos LKBL. The myofascial release and the treatment of tension headache

induced by trigger points. Manual Therapy, Posturology Rehabilitation Journal. 2014:12;73-77.
26. Espí-López GV, López-Bueno L, Vicente-Herrero MT, Martinez-Arnau FM, Monzani L. Efficacy of manual therapy on anxiety and depression in patients with tension-type headache. A randomized controlled clinical trial. International Journal of Osteopathic Medicine. 2016;22;11-20.
27. Espí-López G V., Gómez-Conesa A, Gómez AA, Martínez JB, Pascual-Vaca ÁO, Blanco CR. Treatment of tension-type headache with articulatory and suboccipital soft tissue therapy: A double-blind, randomized, placebo-controlled clinical trial. J Bodyw Mov Ther. 2014:18;576-585.
28. Memmedova F, Emre U, Yalın OÖ, Doğan OC. Evaluation of temporomandibular joint disorder in headache patients. Neurological Sciences. 2021:42;1-7.
29. Raju PS, Reddy S V, Venkat R, Sachin G, Seela BS. A Study to Evaluate the Effectiveness of Continuous Ultrasound Therapy in Healing of Pressure Sores-A Prospective Randomized Clinical Trial. Indian Journal of Physiotherapy and Occupational Therapy - An International Journal. 2017;11:136.
30. Ghodrati M, Mosallanezhad Z, Shati M, Noroozi M, Moghadam AN, Rostami M, et al. Adding Temporomandibular joint treatments to routine physiotherapy for patients with non-specific chronic neck pain: A randomized clinical study. J Bodyw Mov Ther. 2020:24;202-212.
31. Carrasco-Uribarren A, Mamud-Meroni L, Tarcaya GE, Jiménez-Del-Barrio S, Cabanillas-Barea S, Ceballos-Laita L. Clinical Effectiveness of Craniosacral Therapy in Patients with Headache Disorders: A Systematic Review and Meta-analysis. Pain Management Nursing. 2024:25;21-28.
32. Kwon SH, Chung EJ, Lee J, Kim SW, Lee BH. The effect of hamstring relaxation program on headache, pressure pain threshold, and range of motion in patients with tension headache: A randomized controlled trial. Int J Environ Res Public Health. 2021:18;10137.
33. Muñoz-Gómez E, Inglés M, Aguilar-Rodríguez M, Mollà-Casanova S, Sempere-Rubio N, Serra-Añó P, et al. Effect of a Craniosacral Therapy Protocol in People with Migraine: A Randomized Controlled Trial. J Clin Med. 2022:11;759.
34. Wagner B de A, Moreira Filho PF, Bernardo VG. Association of bruxism and anxiety symptoms among military firefighters with frequent episodic tension type headache and temporomandibular disorders. Arq Neuropsiquiatr. 2019:77;478-484.