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Original Article

Effectiveness of a Home Exercise Program in Combination with Ultrasound Therapy for Temporomandibular Joint Disorders

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Abstract. [Purpose] This study compared the effectiveness of home exercise alone versus home exercise combined with ultrasound for patients with temporomandibular joint disorders. [Subjects and Methods] This study enrolled 23 female and 15 male patients who were divided randomly into two groups. The home exercise group performed a home exercise program consisting of an exercise program and patient education, and the home exercise combined with ultrasound group received ultrasound therapy in addition to the home exercise program. Pain intensity was evaluated using a visual analogue scale. Pain free maximum mouth opening was evaluated at baseline and 2 weeks after the treatment. [Results] There was no difference between the two groups in baseline values. After the treatment, the visual analogue scale decreased and pain free maximum mouth opening scores improved significantly in each group. Additionally, both values were higher in the home exercise combined with ultrasound group than in the home exercise group. [Conclusion] The combination of home exercise combined with ultrasound appears to be more effective at providing pain relief and increasing mouth opening than does home exercise alone for patients with temporomandibular joint disorders.
Key words: Temporomandibular joint disorders, Ultrasound therapy, Home exercise

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INTRODUCTION

Temporomandibular disorders (TMD) include conditions affecting the masticatory musculature, temporomandibular joint (TMJ), and associated structures[1)]. TMD affects more than 25% of the general population[2)]. The most common signs and symptoms of TMD are joint sounds, limited mouth opening, and muscle and joint tenderness. A number of studies have examined physical therapy for TMJ dysfunction and pain, including massage, electrotherapy, active exercise, and manipulation therapy[3)]. Physical therapy reduces pain and inflammation and improves mouth function[4)]. Suggested behavioural treatments and patient education include self-awareness of the aggravating factors and lifestyle modification[5)].

The relaxing effect of ultrasound (US) therapy on bone, tendon (ligament), and muscle tissue has been shown experimentally[6)]. However, US treatment alone has been reported to have no significant effect on TMJ disorders in a few trials, and there is insufficient evidence regarding its effect on TMD[7)]. To our knowledge, no studies have compared the combination of US and home exercise therapy (HE+US) versus home exercise (HE) therapy alone. Therefore, we investigated the effectiveness of HE and HE+US on pain and on pain-free maximum mouth opening (MMO) in patients with TMD.

SUBJECTS AND METHODS

Initially, the study enrolled 44 patients complaining of pain in the TMJ region during mandibular movements. Category 1A and 1B unilateral TMD were diagnosed according to the Research Diagnostic Criteria for TMD used by Department of Physical Medicine and Rehabilitation[8)].

The local ethics committee of Harran University approved this study. Informed consent was obtained from all patients before treatment. Subjects with a history of trauma to the TMJ or upper back, inflammatory disorders or other rheumatic diseases, neurological and psychiatric disorders,

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other problems related to the masticatory system, or a history of TMD drug use or physiotherapy treatment within the last 3 months were excluded. Following a detailed physical examination, a standard evaluation form was completed for each patient. Demographic information was recorded, such as age, sex, occupation, education level, pain duration, and affected side.

A complete blood count, erythrocyte sedimentation rate, and routine biochemical tests were performed. In both groups, disc displacement was assessed based on the physical examination and X-ray and magnetic resonance imaging (MRI) at the initial visit.

Patients were allocated randomly to the HE or HE+US group. The HE group received only HE, which involved patient education and exercise therapy. The patients were informed about techniques for dealing with TMJ pain through lifestyle changes, coping mechanisms, and ergonomic regulation. They were given an exercise program consisting of slow active and passive mouth opening and closing exercises, isometric mouth exercises, mouth stretching exercises, and resistive mouth exercises, with each exercise to be performed for 6 seconds with 10 repetitions.

The exercises were performed twice a day for 4 weeks. The HE+US patients received US to the TMJ region, in five sessions per week for 4 weeks in addition to the HE program. US (3 minutes, 0.8–1 Watt/cm^2) was applied to the TMJ region and masticatory muscles.

In each group, the outcome measurements were made at baseline and 2 weeks after the treatment. Subjectively perceived TMJ pain was assessed using visual analogue scale (VAS) (0–100 mm), and mouth opening was assessed as pain-free maximum mouth opening (MMO)[9].

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS 15.0, Chicago, IL, USA). The normal distribution of the data was assessed using the Kolmogoro-Smirnov test, histograms, and q-q graphics. The groups were compared with the independent two-sample t-tests and the Mann-Whitney U-test for quantitative variables and with χ^2 tests for qualitative variables. Within-group comparisons were performed using the dependent two-sample t-tests and the Wilcoxon test. Data are described as frequency (percentage), mean ± standard deviation, or median (25–75th percentiles). A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

Initially, 50 consecutive patients who were seen in our Physical Medicine and Rehabilitation outpatient clinic were considered for this study.

At the initial visit, six patients refused treatment, and the remaining 44 patients were randomised into the two groups according to the sequence of allocation. As four patients in the HE group and two in the HE+US group did not attend follow-up appointments, the study was completed with 38 patients (Fig. 1).

Patient characteristics are summarised in Table 1. There was no difference in these characteristics between the two groups. The baseline VAS scores and pain-free MMO values are shown in Table 2. No differences in the baseline VAS scores and pain-free MMO were found between the two groups (both $p > 0.05$). After treatment, the VAS score and pain-free MMO improved in both groups (Table 2). The VAS score decreased more and pain-free MMO increased more in the HE+US group than in the HE group after treatment (both $p < 0.05$).

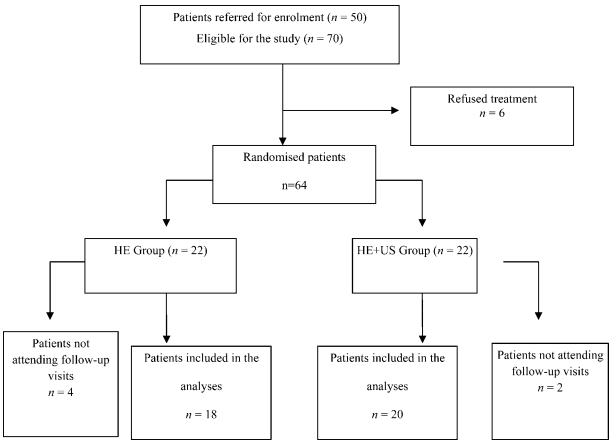

Fig. 1. Flow diagram of the study process, outlining patient selection

Table 1. Patient characteristics

	HE Group n =18	HE+US Group n= 20
Age (years)	29 ± 10	27 ± 11
Gender (male/female)	7 / 11	8 / 12
BMI (kg/m^2)	24.9 (20.4–29.6)	25.6 (21.6–29.4)
Duration of pain (months)	3.9 (1–6)	4.1 (1–6)
Affected side (right/left)	6 / 12	10 / 10
Education (years)	8.6 (5–18)	7.8 (5–16)
Occupation (n)		
Housewife	8	9
Worker	3	4
Official	4	5
Other	3	1
Unemployed	0	1

HE, home exercise; HE+US, home exercise plus ultrasound; BMI, body mass index

DISCUSSION

The results of this study showed that the VAS scores of both groups decreased after treatment, and the decrease in the VAS scores was greater in the HE+US group than in the HE group. Furthermore, the pain-free MMO in both groups increased after treatment and the increase was also greater in the HE+US group.

Structural, behavioural, psychological, and environmental factors play an important role in the aetiology of TMD.

Table 2. Comparison of the clinical findings between the treatment groups

Variables		HE Group n =18	HE+US Group n= 20
VAS (mm) (baseline)	Baseline	40 (28–60)	42 (30–58)
	Post-treatment	26 (16–44)	18 (14–36)
Δ VAS (mm)*		14	24
Pain-free MMO (mm)	Baseline	28 (22–30)	28 (21–31)
	Post-treatment	36 (34–40)	42 (38–46)
Δ Pain-free MMO (mm)*		8	14

Values are expressed as the median (25–75th percentiles).
VAS, visual analogue scale; MMO, maximum mouth opening; HE, home exercise; HE+US, home exercise plus ultrasound
*$p<0.05$

Therefore, the treatment of patients with TMD should be considered from multiple perspectives[10]. A combination of drugs, physical therapy, patient education, occlusal splints, US, and surgery treatments is used in the treatment of TMD[1]. Of these, physiotherapy alone and HE+US combination therapy is often chosen because they are simple, non-invasive, and inexpensive compared with the other treatments available for TMD pain and dysfunction.

A systematic review demonstrated that the use of active and passive oral exercises decreased symptoms related to TMD[11]. Passive and active stretching exercises, isometric tension, and relaxation exercises are effective at increasing mouth opening and improving mandibular movements. Exercise and patient education are also beneficial in the treatment of TMD.

Another study found that a patient education program was more effective than an occlusal splint for relieving the pain of patients with TMD[12].

Several authors have suggested posture exercises in the treatment of TMD. In our study, the patients were instructed in posture and in active/passive oral exercises to treat their TMD. Improvement in the VAS and pain-free MMO was observed after treatment in the HE group, demonstrating that HE therapy is effective at relieving the symptoms of patients with TMD.

Electrophysiological modalities, such as shortwave diathermy, US, laser, and transcutaneous electrical nerve stimulation (TENS), are commonly used in clinical practice. US is used to reduce inflammation, promote muscular relaxation, and increase blood flow. It has an analgesic effect on bone and tendons which is elicited by increasing the temperature in these tissues compared with surrounding tissue.

Gray et al. evaluated the effectiveness of short-wave diathermy, US, and laser treatments for patients with TMD found that no method was superior to the others, but that these modalities were significantly better than placebo treatment[13]. In another study, US alone had no significant effect on TMJ disorders in trials, and evidence regarding the effect of US on TMD is lacking[7]. Our study demonstrated that a combination of US and HE therapies was superior to HE therapy alone.

In conclusion, adding US to an HE program may better improve the symptoms of patients with TMD. Further longitudinal studies are warranted to evaluate the long-term effects of US treatment.

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