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RESEARCH ARTICLE

EFFECT OF EXTRACORPOREAL SHOCK WAVE VERSUS HIGH POWER PAIN THRESHOLD ULTRASOUND IN TREATING MYOFASCIAL TRIGGER POINT IN UPPER TRAPEZIUS

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ABSTRACT

Background: Myofascial trigger points (TrP) are one of the most overlooked and ignored causes of musculoskeletal pain. **Purpose:** This current study is designed to investigate and compare the effects of extracorporeal shockwave and high-power pain threshold ultrasound in treating myofascial trigger points in upper trapezius. **Materials and methods:** This study will be conducted in outpatient clinic of faculty of physical therapy in Egyptian Chinese University. Sixty patients with upper trapezius trigger point participated in the study and each participant read and signs the consent form. Patients randomly divided into two equal groups Group (A) patients received high power pain threshold ultrasound while patients in group (B) received shockwave for 4 weeks. Visual analogue scale, algometer, cervical ROM and Arabic version of neck disability questionnaire were used for assessment before and after treatment. **Results:** In high power pain threshold ultrasound group, patients get improvements in VAS, algometric readings, right rotation ROM, right lateral bending ROM, and neck disability index. In shockwave group, patients get improvements in VAS, algometric readings, and neck disability index. When comparing both groups, high power pain threshold ultrasound group showed more improvement than shockwave in right rotation ROM (P=0.028) while shockwave group showed more improvement in NDI (P=0.031). **Conclusion**: extracorporeal shockwave and high power pain threshold ultrasound have similar effect in treating myofascial trigger points in upper trapezius but shockwave is more preferable when disability is the issue while ultrasound is the preferable when the ROM is the main concern.

INTRODUCTION

A trigger point is a hyperirritable region in a taut band of skeletal muscle that is painful on compression, stretch, overload, or contraction of the muscle and usually has a specific referred pain pattern, according to the most widely accepted classification (1). Myofascial pain syndrome can develop as a result of activities that involve repetitive usage of the same muscle (group) or prolonged bad postures (e.g., office workers). (2) The latter is distinguished by the presence of one or more trigger points (TPs), most commonly in the upper trapezius (UT), which is defined as a hyperirritable spot within a taut band of skeletal muscle. (3) One of the most underestimated and an underappreciated source of musculoskeletal pain is myofascial trigger points (TrP). There is evidence that TrP is a frequent main dysfunction that is not always caused by other illnesses (4) Myofascial pain generally presents as specific pain syndromes but can present as generalized pain or fibromyalgia (5) Two different clinical stages have been attributed to MTrPs.

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There is a latent stage, in which the MTrP does not cause spontaneous pain, and local or referred pain occurs only with the application of vigorous digital pressure.(6) In the clinical and physiotherapy domains, ultrasound (US) has become well-known and accepted as a non-invasive treatment. The Ultrasound is made up of piezoelectric crystals that convert electrical energy into mechanical oscillation energy using a high-frequency alternate current. (7) The thermal and non-thermal effects of ultrasound would increase the flexibility of tendons, ligaments, and joint capsules, reducing joint stiffness, discomfort, and muscle spasm while momentarily increasing blood flow. (8) The evidences on the effects of US on MPS are still controversial. Some studies demonstrate that the use of US for MPS considerably relieves pain intensity in the upper trapezius muscles (uTMs).(9) The probe was placed directly on the trigger point and held immobile while high-power, pain-threshold ultrasonic therapy was applied in continuous modes (in W/cm^2). The ultrasonic probe must remain stationary on the trigger location to induce threshold pain. The intensity was steadily increased until the patient's maximal pain tolerance was reached. It was maintained at that intensity for 4 to 5 seconds before being decreased to half-intensity for another 15 seconds.

This technique was carried out three times. Patients reported their pain intensity, as well as its location and kind, on a regular basis. (10) Extracorporeal Shockwave Treatment (ESWT), an empirically extended indication for regenerative shockwave therapy, is a breakthrough technology for the treatment of muscular discomfort. Because shockwaves are capable of triggering the referred pain that is characteristic of TP and treating the clinical symptoms associated with these TP, muscular shockwave therapy has earned the title "trigger point shockwave therapy." (11) Recent research has shown that ESWT causes free nerve terminals to deteriorate and that ESWT causes a transitory malfunction of nerve excitability at the neuromuscular junction. (12)

MATERIALS AND METHODS

A two group pre-test post-test randomized design was performed in the physiotherapy clinic of the faculty of physical therapy at Egyptian Chinese University. This study was approved by the Ethics Committee of faculty of physical therapy at Cairo University. All of the participants studied and completed the written consent before receiving the intervention.

Participants: The clinical trial involved 60 subjects. Subjects were randomly divided into two equal groups using coin toss method (Heads for one group and tails for another group): Group (A): composed of 30 patients with upper trapezius trigger point who received high power pain threshold ultrasound for 4 weeks. Group (B): composed of 30 patients with upper trapezius trigger point who received shockwave for 4 weeks. Both groups were bilateral neck pain for at least for 3 months, the participant had not received any treatment during the past three months. The inclusion criteria included that, Age range of 18-25 year, both genders included, Subjects have pain at least 3 on VAS after applying finger pressure on the trigger point, Presence of taught band, Presence of hyper irritable spot in a taught band, and Reproduction of the typical referred pain pattern of the myofascial trigger point in response to compression. The exclusion criteria were any contraindications for shock wave therapy or ultrasound therapy such as who suffering from myasthenia gravis, hyperthyroidism, Haemorrhage, acute viral disease, acute tuberculosis, mental disorders or those with pacemakers was excluded from the study, Patient with life threatening disorders as renal failure, myocardial infarction, patients had any recent cervical surgery, patients had a recent X ray , patients suffering from a malignant tumour and patients have a diabetes mellitus or anaemia.

Outcome measures: Pressure pain threshold, VAS, cervical range of motion and NDI were measured for each subject twice, firstly before the treatment and secondly at the end of treatment.

Evaluation Procedures: The experimental protocol was explained in detail for every patient before starting the initial assessment, and a written consent form signed by each patient before starting. The treated patients were instructed to report any side effects during the treatment sessions.

Visual analogue scale: Patients will be asked to classify their pain according to the visual-analogue scale, from 1 to 10. The pain severity will be assessed by the visual analogue scale (VAS) before starting treatment (first record) then after 4 weeks (as second record).

Algometry: The first point located in the middle of line between acromial angle (AC) and spinous process of the seventh cervical vertebra (C7). This point will be assessed bilaterally. The point is considered 10 mm wide. (13) The patients were asked to lie down in a prone position and were measured for the pressure threshold with a 1 cm-wide disk applied to the trigger point of upper trapezius perpendicularly per 1 N of the pressure increased. Before the examination, an examiner asked participants to say 'stop' when they feel pain or any uncomfortable feeling from the pressure and the pressure was noted when they say 'stop'. This procedure was performed 3 times with 10-seconds intervals, and the average was determined as pain threshold (14). The CROM was used to obtain data on cervical range of motion. The CROM device was placed on the nasal bridge and ears, and a Velcro strap was used to secure it to the head. The patient's chair had to be positioned in such a way that the magnetic field would zero the rotation component's dial metre. Subjects were advised to sit upright in the chair with their low back against the chair, mid back away from the chair, arms at sides, and feet flat on the floor prior to testing. On each participant, the active right and left lateral flexion components of cervical spine motion were measured twice. Before measuring the desired component, all dials were set to zero during testing. For tracking purposes, a horizontal line was drawn on the wall, and individuals were directed to follow it when the rotation component was assessed (15)

Before and after therapy, the patient will be requested to complete the NDI questionnaire. Each segment is rated on a scale of 0 to 5, with 0 indicating "no discomfort" and 5 indicating "worst imaginable pain." The total score is the sum of the points. The exam can be interpreted as a percentage or as a raw score, with a maximum score of 50. 0 points or 0% signifies no activity restrictions, while 50 points or 100% means complete activity restrictions. A higher score indicates more disability as seen by the patient. The original literature makes no mention of how to deal with missing data (16) Subjects were given a brief explanation of the device, as well as the treatment routine that will be delivered to each patient. The investigator will acquire information about the subject's name, age, gender, and address. Any metallic objects will be asked to be removed from the subjects. The region to be treated must be exposed skin. Alcohol was used to clean the skin of the subjects in the application area. Procedures for treatment include: The probe was placed directly on the trigger point and held immobile while high-power, pain-threshold ultrasonic therapy was applied in continuous modes (in W/cm2). The ultrasonic probe must remain stationary on the trigger location to induce threshold pain. The intensity was steadily increased until the patient's maximal pain tolerance was reached. It was maintained at that intensity for 4 to 5 seconds before being decreased to half-intensity for another 15 seconds. This technique was carried out three times. Patients reported their pain intensity, as well as its location and kind, on a regular basis. (10) Patients in the ultrasound treatment group will be given a high-powered pain threshold ultrasound once a day, three times a week, for four weeks. Shockwave parameters that were employed the number of shots was 300 per treatment area, and the pressure was 1.5 bar. 60 pulses per minute is the frequency.

Shockwave therapy will be administered to the treatment group once a day, once a week for four weeks.

Statistical procedures: SPSS version 24 will be used to conduct the analysis of concurrent study. the descriptive statistics (the mean, the standard deviation, maximum, minimum and range) will be calculated for all subjects in the study including height, weight, BMI, VAS, pressure algometry, CROM and NDI variable. Paired sample t-test will be used to compare the difference between before treatment and after treatment results of VAS, pressure algometry CROM and NDI in each group. Unpaired sample t-test will be used to compare before and after treatment results between the study groups for all variable.

RESULTS

Prior to final analysis, data were screened for normality assumption, homogeneity of variance, and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculations of the analysis of difference. Preliminary assumption checking revealed that data was normally distributed for all variables. There were no statistically significant differences 226 in the age and gender, as the mean ±SD of age of group (A) was 20±1 while the mean ±SD of age of group(B) was 19.8±1.64.

Table 1. Mean value comparison of VAS at right cervical side

	Group A	Group B	t	Sig.
PreRTVAS	6.2 ± 0.84	6 ± 1.58	0.25	0.809
PostRTVAS	0.6 ± 0.89	0.2 ± 0.45	0.894	0.397
Change	-90.32%	-96.67%		
T	14	9.947		
Sig.	0.0001	0.001		

Table 2. Mean value comparison of VAS at left cervical side

	Group A	Group B	t	Sig.
PreLTVAS	6.25 ± 1.26	5.2 ± 1.79	0.989	0.356
PostLTVAS	0.5 ± 0.58	0.6 ± 0.89	-0.192	0.853
Change	-92%	-88.46%		
T	12.011	9.021		
Sig.	0.001	0.001		

Also, the unpaired t test revealed no statistically significant difference between both groups (t= 0.232, P=0.822). In group (A), there are 16 males and 14 females while in group (B), there was 12 males and 18 females with no statistically significant difference between both groups X^2=0.536, P=0.464. Regarding VAS recording of right cervical side, the mean ± SD of pre value of group (A) was 6.2 ± 0.84 in the time, the post value was 6 ± 1.58 with total change -90.32%, the mean ± SD of pre value of group (B) was 0.6 ± 0.89 in the time, the post value was 0.2 ± 0.45 with total change -96.67%. The paired t test of both groups revealed statistically significant effect (P=0.000, 0.001) in group A and group B respectively. While unpaired t test showed no statistically significant differences between pre and post values of both groups (P=0.809, 0.397) respectively. Meanwhile VAS recording of left cervical side, the mean ± SD of pre value of group (A) was 6.25 ± 1.26 in the time, the post value was 0.5 ± 0.58 with total change -92%, the mean ± SD of pre value of group (B) was 5.2 ± 1.79 in the time, the post value was 0.6 ± 0.89 with total change -88.46%.

Table 3. Mean value comparison of pressure algometer at right side

	Group A	Group B	t	Sig.
PreRTalg	2.34 ± 0.25	2.02 ± 0.41	1.492	0.174
PostRTalg	3.08 ± 0.22	3.02 ± 0.16	0.493	0.635
Change	31.62%	49.5%		
T	-12.333	-8.771		
Sig.	0.0001	0.001		

Table 4. Mean value comparison of pressure algometer at left side

	Group A	Group B	t	Sig.
PreLTalg	2.58 ± 0.17	2.24 ± 0.38	1.627	0.148
PostLTalg	3.38 ± 0.3	3.28 ± 0.4	0.392	0.707
Change	31.01%	46.43%		
T	-11.314	-26		
Sig.	0.001	0.0001		

The paired t test of both groups revealed statistically significant effect (P=0.001, 0.001) in group A and group B respectively. While unpaired t test showed no statistically significant differences between pre and post values of both groups (P=0.356, 0.853) respectively.

Table 5. Mean value comparison of cervical rotation ROM to the right

	Group A	Group B	t	Sig.
PreRTRCR	65 ± 3.54	64 ± 5.48	0.343	0.74
PostRTRCR	72 ± 4.47	66 ± 2.24	2.683	0.028
Change	10.77%	3.13%		
T	-5.715	-1		
Sig.	0.005	0.374		

Table 6. Mean value comparison of cervical rotation ROM to the left

	Group A	Group B	t	Sig.
PreLTRCR	66.25 ± 4.79	68 ± 2.74	-0.695	0.51
PostLTRCR	71.25 ± 2.5	69 ± 2.24	1.426	0.197
Change	7.55%	1.47%		
T	-1.414	-1		
Sig.	0.252	0.374		

The mean value of algometric reading of left cervical side in group (A) was 2.58 ± 0.17 in the time, the post value was 3.38 ± 0.3 with total change 31.01%, the mean ± SD of pre value of group (B) was 2.24 ± 0.38 in the time, the post value was 3.28 ± 0.4 with total change 46.43%. The paired t test of both groups revealed statistically significant effect (P=0.001, 0.0001) in group A and group B respectively.

Table 7. Mean value comparison of cervical lateral bending ROM to the right

	Group A	Group B	t	Sig.
PreRTLCR	35 ± 3.54	40 ± 6.12	-1.581	0.153
PostRTLCR	43 ± 2.74	42 ± 4.47	0.426	0.681
Change	22.86%	5%		
T	-6.532	-1.633		
Sig.	0.003	0.178		

While unpaired t test showed no statistically significant differences between pre and post values of both groups (P=0.148, 0.707) respectively. Regarding right cervical rotation ROM, the mean ± SD of pre value of group (A) was 65 ± 3.54 in the time, the post value was 72 ± 4.47 with total change 10.77%, the mean ±SD of pre value of group (B) was

Table 8. Mean value comparison of cervical lateral bending ROM to the left

	Group A	Group B	t	Sig.
PreLTLCR	37.5 ± 6.45	43.4 ± 2.3	-1.925	0.096
PostLTLCR	45 ± 0	44 ± 2.24	0.882	0.407
Change	20%	1.38%		
T	-2.324	-0.514		
Sig.	0.103	0.634		

64 ± 5.48 in the time, the post value was 66 ± 2.24 with total change 3.13%. the paired t test of both groups revealed statistically significant effect only in group A as P=0.005, 0.374 in group A and group B respectively. While unpaired t test showed no significant differences between pre values only of both groups as P=0.74, 0.028 for pre and post values, respectively. While left cervical rotation ROM, the mean ± SD of pre value of group (A) was 66.25 ± 4.79 in the time, the post value was 71.25 ± 2.5 with total change 7.55%, the mean ± SD of pre value of group (B) was 68 ± 2.74 in the time, the post value was 69 ± 2.24 with total change 1.47%. the paired t test of both groups revealed no statistically significant effect (P=0.252, 0.374) in group A and group B, respectively. While unpaired t test showed no significant differences between pre and post values of both groups (P=0.51, 0.197) respectively. For the right cervical lateral bending ROM, the mean ± SD of pre value of group (A) was 35 ± 3.54 in the time, the post value was 43 ± 2.74 with total change 10.77%, the mean ± SD of pre value of group (B) was 64 ± 5.48 in the time, the post value was 66 ± 2.24 with total change 3.13%. The paired t test of both groups revealed statistically significant effect only in group A as P=0.005, 0.374 in group A and group B respectively. While unpaired t test showed no significant differences between pre and post values of both groups as P=0.74, 0.028 for pre and post values, respectively.

Regarding left cervical lateral bending ROM, the mean ± SD of pre value of group (A) was 37.5 ± 6.45 in the time, the post value was 45 ± 0 with total change 20%, the mean ± SD of pre value of group (B) was 43.4 ± 2.3 in the time, the post value was 44 ± 2.24 with total change 1.38%. The paired t test of both groups revealed no statistically significant effect in both groups as P=0.103, 0.634 in group A and group B respectively. While unpaired t test showed no significant differences between pre and post values of both groups as P=0.096, 0.407 for pre and post values, respectively. Neck disability index showed significant decrease 059.3%. The mean ± SD of pre value of NDI in group (A) was 21.72 ± 8.08 in the time, the post value was 8.84 ± 3.17, the mean ± SD of pre value of group (B) was 22.2 ± 8.15 in the time, the post value was 4.33 ± 2.2 with total change -80.5%. The paired t test of both groups revealed no statistically significant effect in both groups as P=0.01, 0.004 in group A and group B respectively. While unpaired t test showed no significant differences between pre values only as P=0.928, 0.031 for pre and post values, respectively.

DISCUSSION

Sixty patients with upper trapezius trigger point participated in the study and each participant read and signs the consent form. Patients randomly divided into two equal groups Group (A) patients received high power pain threshold ultrasound while patients in group (B) received shockwave for 4 weeks. Visual analogue scale, algometry, cervical ROM and Arabic version of neck disability questionnaire were used for assessment before and after treatment. In high power pain threshold ultrasound group, patients get improvements in VAS, algometric readings, right rotation ROM, right lateral bending ROM, and neck disability index. In shockwave group, patients get improvements in VAS, algometric readings, and neck disability index. When comparing both groups, high power pain threshold ultrasound group showed more improvement than shockwave in right rotation ROM (P=0.028) while shockwave group showed more improvement in NDI (P=0.031).

This study aims to evaluate the effectiveness of conventional ultrasound (US) therapy in the treatment of myofascial pain syndrome. Fifty-four patients (23 males, 31 females; mean age 29.8±5.2 years; range, 22 to 46 years) with myofascial pain syndrome were included in this prospective, randomized, single-blind, placebo-controlled study. Patients were randomized into two groups by computerized method as US group (n=27) and placebo group (n=27). Ten sessions of US were applied to the US group and 10 sessions of placebo US were applied to the placebo group. Treatment effectiveness was evaluated with Visual Analog Scale (VAS), algometer, palpable muscle spasm degree (PMSD), and Beck Depression Inventory (BDI) before and after treatment. Pain values after treatment in both groups decreased significantly ($p<0.05$) compared to before treatment. In the US group, the decrease in VAS and palpable muscle degree before and after treatment was significantly higher ($p<0.05$) than in the placebo group. In the US group, the decrease in PMSD after treatment was significantly higher than the placebo group ($p<0.05$). The amount of decrease in BDI score before and after treatment in the US group did not differ significantly from the placebo group ($p>0.05$). Our data show that traditional US therapy for myofascial pain syndrome is effective.(17) And another study observed significant improvements of pain relief and functional capacity in ESWT plus stabilization exercises versus ESWT alone (18) This meta-analysis proves that ESWT may be an effective and safe treatment modality. In recent years, studies indicated ESWT exposure improved the blood flow distribution around the treated muscle leading the anti-inflammation action and pain reduction. The previous study also demonstrated ESWT-induced pain relief effects could be explained by the cascade of biochemicals response to hypoxia stimulation, acting as the up-regulation of nitric oxide (NO) levels, ingrowth of endothelial N And another study observed significant improvements of pain relief and functional capacity in ESWT plus stabilization exercises versus ESWT alone.(18)

Conclusion

The results obtained from the current study and the discussion that followed it was concluded that: extracorporeal shockwave and high power pain threshold ultrasound have similar effect in treating myofascial trigger points in upper trapezius but shockwave is more preferable when disability is the issue while ultrasound is the preferable when the ROM is the main concern.

Conflict of interest: There is no conflict of interest.

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