A COMPARISON ON EFFICACY OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND THERAPEUTIC ULTRASOUND IN TREATMENT OF MYOFASCIAL TRIGGER POINTS

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Date Submitted: September 11, 2015
Date Revised: January 16, 2016
Date Accepted: January 18, 2016

ABSTRACT

OBJECTIVE: To compare the effects of transcutaneous electrical nerve stimulation (TENS) versus therapeutic ultrasound (US) on pain intensity and cervical range of motion (ROM) in patients with upper trapezius myofascial trigger points.

METHODS: Sixty-four patients, selected from Institute of Physical Medicine & Rehabilitation and Rabia Moon Trust Hospital were divided into two groups. Group-A was treated with TENS and upper trapezius stretching while group-B was treated with US and upper trapezius stretching. Both groups received 12 sessions of treatment, 6 times a week for two weeks. Pre and post-treatment evaluation of pain intensity and cervical ROM was made through numerical pain rating scale (NPRS) and goniometer.

RESULTS: Mean pre & post-treatment pain intensity score (PIS), was 5.16±1.09 & 2.62 ± 1.23 in Group-A ($p<0.01$) and 5.87±1.21 & 0.84±1.01 in Group-B ($p<0.05$). Mean pre & post-treatment left lateral flexion (LLF) was 32.01±8.00 & 37.09±6.62 in Group-A ($p<0.01$) and 31.71±6.76 & 40.12±4.52 in Group-B ($p<0.01$). Mean pre & post-treatment right lateral flexion (RLF), was 30.87±7.15 & 36.01±6.92 in Group-A and 32.09±6.54 & 40.81±4.78 in Group-B ($p<0.01$). Mean change in PIS was 2.54±0.14 & 5.03±0.2 in Group-A & Group-B respectively ($p<0.05$). Mean change in LLF, was 5.08±1.38 & 8.41±2.24 in Group-A & Group-B respectively ($p <0.05$). Mean change in RLF, was 5.14±0.23 & 8.72±1.76 in Group-A & Group-B respectively ($p <0.05$).

CONCLUSION: Both therapeutic ultrasound and TENS resulted in significant improvement in pain intensity and cervical ROM, in patients having upper trapezius trigger points. Ultrasound was clinically more effective as compared to TENS.

KEY WORDS: Myofascial pain syndromes (Non-MeSH), trapezius muscle (Non-MeSH), trigger points (MeSH), Transcutaeous Electrical Nerve Stimulation (MeSH), Ultrasonography (MeSH).

THIS ARTICLE MAY BE CITED AS: Amjad F, Shahid HA, Batool S, Ahmad A, Ahmed I. A comparison on efficacy of transcutaneous electrical nerve stimulation and therapeutic ultrasound in treatment of myofascial trigger points. Khyber Med Univ J 2016; 8(1): 3-6.

INTRODUCTION

Musculoskeletal pain affects about 85% of the general population among which neck pain is a common complaint.[1] In general population, the estimated lifetime occurrence of neck pain is 45-54%. Up to 50% of women and 30% of men experience neck pain during their lifetime. Almost 14% of the patients are at risk of their neck pain becoming chronic.[2] About 54% chronic pains of head and neck are due to myofascial trigger points (MTrPs).[3] Simons and Travell clinically described MTrPs as "A hyperirritable spot associated with a hypersensitive palpable nodule in the taut band of skeletal muscle or their fascia." Trigger points may cause referred and local pain, reduced joint range of motion (ROM) and sometimes autonomic disturbance.[4]

Myofascial pain syndrome (MPS) is a painful condition of musculoskeletal system usually results from MTrP formation.[5] The existence of at least one active trigger point (TrP) is required for clinical diagnosis of MPS.[6] Myofascial pain is frequently seen in neck muscles particularly in the upper trapezius muscle (34.7%) which results in pain at neck and shoulder region.[3] Studies conducted in America at various pain clinics revealed 85% incidence of MPS[7] and specified that it is more prevalent in women (65%) than in men (37%).[3] MPS was diagnosed in 36% of 431 patients with pain in Thiland.[7] The prevalence of MPS is increasing in the recent years due to altered physical stresses and changing nature of work i.e desk jobs which imposes high mental and physical pressure on the users.[8] Poor posture, stress, sleep disorders, fatigue, genetics, aging, nutritional deficiencies, anemia and endocrine imbalances may also contribute to myofascial pain.[9]

Although MTrPs are common, they are frequently ignored and inadequately treated. There are many treatment options for MPS and by eradicating the MTrPs one may get rid of the pain. Management is usually symptomatic and the goal of therapy is to deactivate the TrP, relief the pain and release the taut band.[10]

Several therapeutic techniques are used for decreasing trigger point pain; including ischemic compression, spray and stretch, muscle energy techniques, transverse friction massage, ultrasound therapy, thermotherapy, dry needling, laser therapy, transcutaneous electrical nerve stimulation (TENS) and TrP injections with saline, local anesthetic or steroids.[1] TENS and US are non-invasive treatment techniques commonly used in clinical settings. TENS is a type of electro-analgesia, acting on the basis of pain gate theory[11] while therapeutic ultrasound provides analgesic effects and increases tissue extensibility by using high-frequency acoustic energy.[10]

Extensive research has been done regarding treatment of myofascial pain but there is still a gap in research regarding most effective treatment strategies being used. Therefore; the rational of this study was to fill this gap and to investigate and compare the therapeutic effects of commonly used TENS and US in patients having upper trapezius myofascial trigger points.

METHODS

The current study is a comparative study, in which a sample of 64 male and female patients aged between 20-50 years and having MTrPs in their upper trapezius muscle was included. Diagnosis was established on the basis of criteria explained by Travell and Simon (1999) for MPS.[4] The presence of five major (spontaneous pain, palpable taut band, localized sharp tenderness, referred pain, decreased ROM) and at least one out of three minor signs (pain on pressure, local twitch response (LTR), decrease in pain by muscle stretching or Trp injection) was considered to be essential for diagnosis of MPS.[10,12,4]

After taking approval from institutional review board of Dow University of Health Sciences (DUHS), the sample was recruited from Physiotherapy department of Institute of Physical Medicine and Rehabilitation (IPM&R), DUHS and Medical Institute of Neurology and Rehabilitation (MINAR), Rabia Moon Trust Hospital through non-probability purposive sampling. Informed consent was taken from the patients and they were equally assigned into two groups in an alternative manner. Each group contained 32 patients. All patients have completed the study.

Group 'A' was treated with TENS (enraf- nonius endomed 182 device) for 20 minutes (symmetric, biphasic rectangular pulses of duration 100 microseconds with a frequency of 50 Hz and an intensity according to the patient's tolerable limit).[11] The negative electrode was placed on active myofascial trigger point of upper trapezius muscle and the positive electrode on upper trapezius insersional site i.e. proximal to acromion process.[11,13] Group 'B' was treated with therapeutic ultrasound (enraf- nonius sonopuls 190 device) for 7 minutes on continuous mode with intensity of 1.5watt/cm2 and frequency 1MHz.[12,10] A conductive gel was applied on the myofascial trigger point and ultrasound probe was then rotated in circular manner over it. As a common therapy, both groups received sustained passive stretching of upper trapezius muscle i.e. flexion, contra-lateral side bending and ipsilateral rotation of cervical spine, in supine position. The stretch was sustained for 30 seconds with 3-5 repetitions per session.[14] Both groups received free of cost treatment of 12 sessions, 6 days a week for consecutive 2 weeks. Pre and post treatment evaluation of cervical range of motion and pain intensity was made through numerical pain rating scale (NPRS) 15 and goniometer 16 in terms of differences in their scores. No treatment complications were noted.

Data was analyzed on SPSS version 16. For quantitative data, the statistical results were expressed as mean ± S.D. A parametric independent sample t-test was applied to find out the significance of changes in score between the groups (Inter-group analysis). While the significance of interventions used within each group (Intra-group analysis) was tested statistically by a parametric paired sample t-test. The level of significance was set at $P<0.05$.

RESULTS

A sample of 64 patients, based on the selection criteria was alternatively and equally assigned into two groups. No patient was dropped out from the study. There was higher proportion of females (39) compared to the males (25). TENS group included 20 females and 12 males with mean age of 32±1 years while ultrasound group included 19 females and 13 males with mean age of 37±9.9 years.

Parametric paired sample t-test was used to perform intra-group analysis which showed statistically significant results ($p<0.05$) in NPRS and goniometer readings. (Table I and II)

For inter group analysis a parametric independent sample t-test was used. Post treatment p-value showed statistical significant result ($P<0.05$) in both goniometry and NPRS scales. (Table III)

Regarding post treatment pain intensity, the mean and S.D of ultrasound group is less than that of TENS group, showing more pain reduction in ultrasound group. While concerning cervical ROM, the mean and S.D of ultrasound group is greater than that of TENS group which demonstrates that cervical ROM is also more improved in ultrasound group.

TABLE I: PRE AND POST EFFECTS ON MEAN IN TENS GROUP

Parameters	Pre-treatment (Mean ± S.D)	Post-treatment (Mean ± S.D)	P-value (95% C.I)
Pain intensity	5.16 ± 1.09	2.62 ± 1.23	0.00 (2.90-3.59)
Left lateral flexion	32.01 ± 8.00	37.09 ± 6.62	0.00 (3.62-7.00)
Right lateral flexion	30.87 ± 7.15	36.01 ± 6.92	0.01 (2.93-6.00)

S.D = Standard deviation, CI: Confidence interval

TABLE II: PRE AND POST EFFECTS ON MEAN IN US GROUP

Parameters	Pre-treatment (Mean ± S.D)	Post-treatment (Mean ± S.D)	P-value (95% C.I)
Pain intensity	5.87 ± 1.21	0.84 ± 1.01	0.001 (4.64-5.41)
Left lateral flexion	31.71 ± 6.76	40.12 ± 4.52	0.00 (6.74-10.06)
Right lateral flexion	32.09 ± 6.54	40.81 ± 4.78	0.00 (7.16-10.27)

S.D = Standard deviation

TABLE III: CHANGES BETWEEN TENS AND US GROUP

Parameters	TENS Group (Mean ± S.D)	US Group (Mean ± S.D)	P-value (95% C.I)
Pain intensity	2.54 ± 0.14	5.03 ± 0.2	0.00 (1.21-2.34)
Left lateral flexion	5.08 ± 1.38	8.41 ± 2.24	0.036 (0.19-5.87)
Right lateral flexion	5.14 ± 0.23	8.72 ± 1.76	0.015 (0.74-6.69)

TENS= Transcutaneous Electrical Nerve Stimulation, US= Ultrasound

DISCUSSION

This study compared the effectiveness of therapeutic ultrasound against TENS in the treatment of myofascial trigger points of upper trapezius muscle. The results showed that both modalities have reduced the trigger point pain intensity scored on NPRS and increased the cervical side bending movement measured through the goniometer. But the therapeutic ultrasound was appeared to be more effective than TENS in order to obtain the better results.

Regarding parameters used for ultrasound therapy the present study corresponds with the study of Pillay.[17] He compared the continuous and pulsed waveforms of ultrasound with 1.5w/cm2 intensity and 1MHz frequency applied for six minutes. Both types of ultrasonic waveforms were found to be effective for MPS treatment but the pulsed ultrasound gave immediate and sustained results. In the present study, continuous waveform of ultrasound was used and the number of treatment sessions i.e. four sessions within three weeks does not correspond to the present study.

Similarly, Esenyel et al. (2000)[18] treated patients with MPS using ultrasound at 1MHz frequency and 1.5w/cm2 intensity for 6 minutes at each session but with the pulsed waveform. This conventional form of ultrasound was found to be as effective as trigger point injections, when combined with stretching exercise. This research study strongly relates to the present study as the method of conventional ultrasound with almost same parameters along with trapezius stretching was used. Ultrasound is a non-invasive technique and give the impression to be a complications free treatment in contrast to injection which can cause nerve damage and infection that can appear during or after injection.[19] Esenyel et al. therefore; suggested that for treatment of MPS, conventional ultrasound along with stretching should be offered to patients especially to those who prefer non-invasive therapy and avoid injections.[18]

On the contrary, in an RCT Unalan[20] found that trigger point injections are superior to conventional ultrasound and high power pain threshold ultrasound (HPPTUS), while both techniques of ultrasound (conventional and HPPTUS) were declared to be equally effective for patients with chronic MPS.

The current study closely resembles to the study of Ardic et al. (2002)[13] in which group 'A' received TENS and stretching, group 'B' received EMS and stretching while group 'C' received only stretching. Pain intensity, pain threshold and range of motion were assessed before treatment, than after two weeks and later after three months through visual analog scale, algometry and goniometry. Outcome measures and number of treatment sessions of present study were similar to Ardic study except that no follow up was done in the present study. The TENS group of both studies (which closely resembles from all expects) showed significant decrease in pain intensity and increase in cervical range of motion.

A study conducted in India by Jerald (2006)[11] was similar to the current study in terms of TENS parameters used, study duration and results. In that study TENS was compared with electrical muscle stimulation (EMS) for treating MTrPs of upper trapezius muscle and TENS was proved to be more beneficial. However, in that study stretching was not applied. Hence, cervical ROM was not measured while pain threshold was assessed which also showed superior effects in TENS group compared to EMS group.

Jaeger and Reeves described that TrP sensitivity and pain intensity can be reduced through passive stretching.[21] A double blind placebo controlled study by Dunder (2010)[12] on effectiveness of ultrasound supports the above statement because both groups of Dunder study (US treatment group and placebo US group) showed significant improvements in CROM which could be the result of daily stretching and isometric exercises.

In the treatment of MPS, although the main concern is to provide pain relief on TrP yet the importance of postural correction, exercise and elimination of aggravating factors cannot be overlooked.[5] The effectiveness related to some other outcomes like disability or functional limitation was not examined in the present study. The results of this study showed that clinicians can efficiently deal with the neck and shoulder pains related to TrPs through ultrasound followed by stretching exercise.

CONCLUSION

Therapeutic ultrasound group showed significant improvement in pain intensity and cervical range of motion as compared to the TENS group, in patients having upper trapezius trigger points assessed through NPRS and goniometry. Thus ultrasound has proved to be statistically more significant and clinically effective intervention in comparison to TENS among the patients between 20-50 years of age. Further studies are needed to evaluate the long term effects of ultrasound in patients having upper trapezius myofascial trigger points.

ACKNOWLEDGEMENT

First and foremost sincere thanks to ALMIGHTY for this great opportunity and blessings that He has showered upon for the successful completion of this study. Sincere gratitude to every person for their direct or indirect help especially to the management of IPM&R, Dow University of Health Sciences and MINAR, Rabia Moon Trust for providing us with the privilege to carry out this study in their distinguished institutions. Finally, to all the patients who participated in this study, without them this work would not be possible.

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CONFLICT OF INTEREST

Authors declared no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

FA: Concept & study design, acquisition analysis and interpretation of data, drafting the manuscript, final approval of the version to be published

HAS: Drafting the manuscript, final approval of the version to be published

SB, AA: Acquisition analysis and interpretation of data, final approval of the version to be published

IA: Critical revision, drafting the manuscript, final approval of the version to be published,

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.