

EFFECTS OF BURST TENS OVER UPPER TRAPEZIUS TRIGGER POINTS- A PILOT DOSIMETRY STUDY

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ABSTRACT:

Background: Myofascial pain is one of the most common examples of musculoskeletal pain arising from myofascial trigger point (MTrP). MTrP is very frequent in trapezius muscle. Common causes of upper trapezius MTrP are prolonged uncomfortable position of upper limb and neck, carrying heavy loads and physically demanding work. Upper trapezius MTrPs are also the causative factor of chronic tension type headache, mechanical neck pain and shoulder pain. Stress and anxiety are the predisposing factors for the MTrP formation.

Transcutaneous Electrical Nerve Stimulation (TENS) is a method of electrical stimulation which primarily aims to provide a degree of symptomatic pain relief by exciting sensory nerves and thereby stimulating either the pain gate mechanism and/or the opioid system.

Objectives: To find the duration of Burst TENS to dissolve the upper trapezius myofascial trigger points.

Study design: Pilot experimental study.

Outcome measures: The outcome measures include Pain Pressure Algometer and Universal Goniometer.

Materials and Methods: Participants (n=10) of both sex with myofascial trigger points present over bilateral upper trapezius muscle, between the ages of 18 to 30 years were included in this study. They were treated with burst type TENS for a duration of 5 days.

Statistical analysis: The pre and post data was analyzed using student t-test.

Result: The Pain Pressure Threshold (PPT) and Cervical lateral flexion Range of motion (ROM) was measured before the treatment, after completion of 5 days treatment and with 15 days of follow up. The data collected was analysed using student t test. The ROM of cervical lateral flexion was measured before and after the course of treatment. Student t test showed significant increase in the ROM on mean cervical lateral flexion ($p < 0.05$). 15 Days follow up done where 9 out of 10 patients turned in and 1 patient dropped out. The mean PPT values of post treatment and 15 days follow-up showed no changes signifies improved pain status even after 15 days.

Conclusion: Based on the results of this study, five sessions of burst type TENS had hypoalgesic effects for mechanical stimuli by increasing Referred Pressure Pain Threshold (RPPT) over MTrPs in bilateral upper trapezius muscle and in 15 days follow-up there is no change in pain sensitivity of MTrPs. There was also improvement in bilateral cervical lateral flexion range of motion, although in 15 days follow-up the range of motion decreased then post treatment state. This signifies the effectiveness of Burst TENS over MTrP over duration of 5 days and this can be the ultimate dosimetry as a non invasive, cost effective and speedy recovery method of treating MTrP.

Key words: MTrPs, Upper Trapezius, Burst-TENS

Background:

Myofascial pain is one of the leading musculoskeletal conditions characterized by presence of myofascial trigger point (MTrP). Which is hyperirritable spot located within a taut band of a skeletal muscle which is painful on compression or stretch and can give rise to a typical referred pain pattern as well as autonomic phenomena which was suggesting aberrant action potential generation. Further pathological findings associated with sustained hyper-contraction/activity are consisted with metabolic stress and ATP depletion.¹

The signs and symptoms related to MTrP are head neck pain, muscle stiffness, restriction of movement, dizziness, sweating, insomnia, limitation in daily activities with a very high recurrence rate, and they may persist for long periods.² Moreover, the MTrPs never disappear completely if it is not treated effectively. The presence of active trigger points in a muscle may cause sensory, motor or autonomic symptoms.^{3,4}

Local ischemia or hypoxia has been proved to be a reason for taut band formation. The prolonged ischemia/hypoxia also leads to muscle injury resulting in the release of potassium, bradykinins, cytokines, ATP, and substance P which might stimulate nociceptors in the muscle. The end result is the tenderness and pain observed with myofascial trigger points accompanied by calcitonin gene-related peptide (CGRP).^{5,6} Furthermore, a decrease in pH can also cause an increase in acetylcholine release and to activate acid sensing ion channels ASIC3.⁶ Focal neck muscle tenderness (Latent trigger point) was prevalent in 45% of male and 54% of female air force personal with an average age of 19 years.⁷

An observational study conducted in Netherlands on patient's age between 18 to 66 years, with unilateral non-traumatic shoulder pain, concluded that upper trapezius active MTrP were found in 42 subjects and upper trapezius latent MTrP were found in 27 subjects among 104 subjects.⁸

A large variety of both manual and non-manual interventions exists for the deactivation of trigger points. Non-manual intervention may include botulism toxin injections, dry needling, acupuncture, and ethyl chloride spray. Manual approaches may include muscle energy technique (MET), strain-counterstrain (SCS), myofascial release,¹³ proprioceptive neuromuscular facilitation (PNF), and ischemic compression^{10,9} Kinesiotaping.¹² There are various treatment modalities used for treating myofascial pain which includes application of ice

or hot, ultrasonic therapy,⁹ laser, diathermy, transcutaneous electrical therapy.^{10,11} In addition postural and ergonomic education, exercises are also needed improvement.¹⁴

Sandberg et al reported an increase of blood flow in the muscle after the application of a burst-TENS (pulse width 180; burst frequency, 2Hz). A single session single blind randomised control trial Study suggests that a burst-type TENS will (pulse width 200 μ s, pulse frequency 100Hz, and a burst frequency of 2Hz) produce immediate mild hypoanalgesic effect for mechanical stimuli by increasing the Referred pressure pain threshold (RRPT) over latent MTrPs in the upper trapezius muscle and it proves that TENS has influence on MTrP pathogenesis. Contractions induced by the application of burst-TENS could normalize endplate acetylcholine secretion and reduce algogenic substances found within the MTrP area. In addition, muscle contractions (twitches) induced by TENS may increase local blood flow of the MTrP area, leading to a “washout” of these inflammatory mediators for 15 minutes for a single session. One of the limitation mentioned in their study was that they only assessed the immediate hypoanalgesic effect and recommended to investigate the long term effect of TENS.¹⁵

Therefore, we investigated the effect of burst-type TENS by application of 5 sessions, on pain pressure threshold and cervical contra lateral flexion range of motion. This study aimed to improve pain and cervical lateral flexion ROM in people suffering with trigger points in their bilateral upper trapezius muscle.

METHODS

Participants:

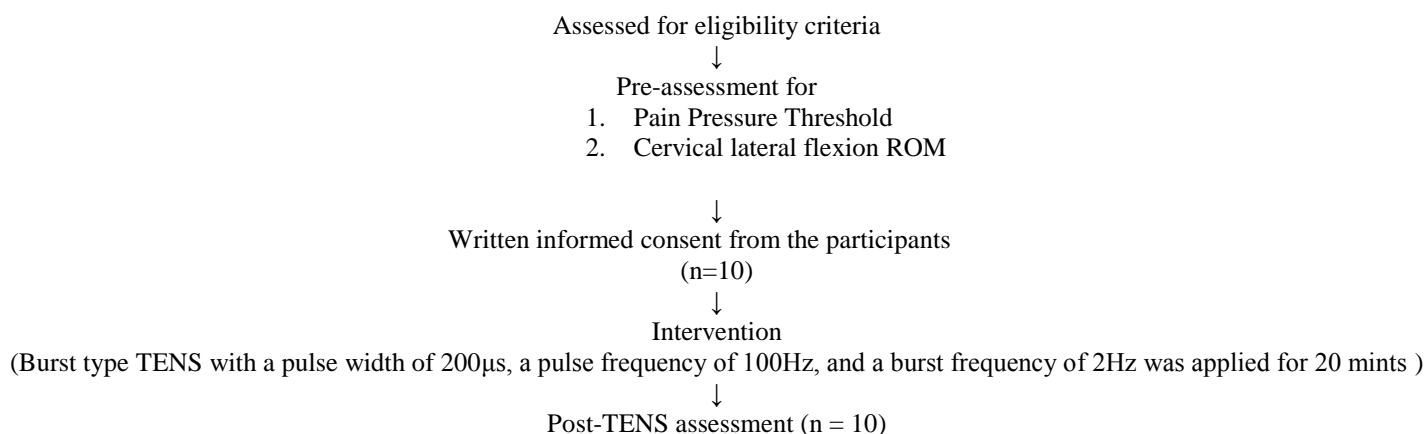
10 participants (n=10) of both sex within the age group of 18-30 years were included in the current study. Subjects were included if there was a diagnosis of bilateral latent or active MTrP over right and left upper trapezius. MTrP diagnosis was assessed by an experienced physiotherapist. The inclusion criteria for selecting subjects were the presence of a palpable taut band in a skeletal muscle, the presence of palpable taut band, a local twitch response provoked by snapping palpation of the taut band and reproduction of referred pain response to compression. The exclusion criteria was any history of surgery in head-neck region or any trauma in neck region, any facial neuralgia, headache; MTrP therapy in the neck within the previous 3 months, history of fibromyalgia. This study was approved by the Institutional Human Research Ethics Committee of Nopany Institute of Healthcare Studies.

Interventions

The subjects were diagnosed and after inclusion they were treated with burst-TENS with a pulse width of 200 μ s, a pulse frequency of 100Hz, and a burst frequency of 2Hz was applied for 20 mints in a comfortable intensity which is able to produce visible contractions of upper trapezius muscle. The treatment was done using TENS major delux dual channel table- 101D, Bhogilal(Fig .1). The active electrode, a pen stimulator electrode was placed over the MTrP and ground electrode was placed over the deltoid insertion.



Figure 1: application of burst TENS over upper trapezius MTrPs



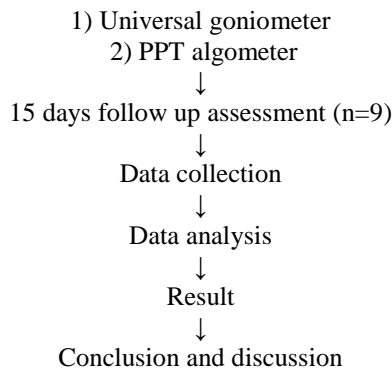


Figure 2: flow chart of methodology

Outcome Measures: In this study, the outcome measures were used as universal goniometer to measure cervical ROM and Pain pressure threshold algometer to measure pain pressure threshold. Outcomes were obtained before the intervention, after 5 days of treatment and as 15 days of follow up period,

Cervical spine lateral flexion ROM:

For the measurement of cervical lateral flexion ROM, universal goniometer was used which is sufficiently reliable for measuring cervical range of motion (ICC 0.75). The subjects were in sitting position, with the thoracic and lumbar spine well supported by back of chair. The fulcrum of the goniometer was placed over C7 spinous process with the cervical spine in 0 degree of flexion, extension, and rotation. Stationary arm was positioned with the spinous process of the thoracic vertebrae and movable arm was positioned with the dorsal midline of the head. The subject was instructed to do active cervical lateral flexion to either direction /side and then ROM was measured in degrees.¹⁷

Pain pressure algometry

The pain pressure threshold (PPT) was measured using an electronic algometer over potential trigger point on the body. The examiner identified a trigger point by palpating and exerting vertical pressure on the skin. Previous investigations have examined the characteristics of PPT algometry and found it to be reliable, however many algometers only display the maximum force function, and application of force has not been thoroughly investigated. It was identified pain pressure algometers maximum force reading is reliable and valid.¹⁸

Statistical analysis :

The primary analysis consisted of the use of descriptive statistics for calculating mean and standard deviation. Student t test was used to compare the difference between pre intervention, 5 days post intervention and after 15 days follow up period. It was used to compare the difference in pain pressure threshold and cervical ROM.

The level of significance was set at $p < 0.05$ and the analysis were performed using SPSS version 19.

RESULTS:

The PPT was measured before the treatment, after completion of 5 days treatment and at 15 days follow up period. The data collected was analysed using student t test.

Pre intervention mean value of PPT was 19.70 ± 3.68 and Post intervention was 35.7 ± 3.68 which shows significant improvement ($p < 0.05$). The cervical lateral flexion ROM of right (Rt) and left (Lt) side was measured before and after the course of treatment. It has also significantly improved ($p < 0.05$) their bilateral cervical lateral flexion ROM (mean Rt Pre ROM 31.40 ± 7.11 and mean Rt Post ROM 48.30 ± 7.11 , mean Lt Pre ROM 30.90 ± 8.39 and Lt Post ROM 49.00 ± 8.39).

Table 1: Pre and post treatment PPT and ROM

	N	Mean	Std. Dev	t	df	p
Pre test PPT	10	19.70	3.68	-13.74	8	<0.05
Post test PPT	10	35.7				
Rt Pre ROM	10	31.40	7.11	-7.52	8	<0.05
Rt Post ROM	10	48.30				
Lt Pre ROM	10	30.90	8.39	-6.83	8	<0.05
Lt Post ROM	10	49.00				

At the 15 Days follow up 1 patient dropped out. The mean PPT values of post treatment and 15 days follow-up showed insignificant ($p > 0.05$) result, that signifies no changes in pain status even after 15 days. But it is also seen that 1 out of 9 patients turned up with increased pain as per PPT.

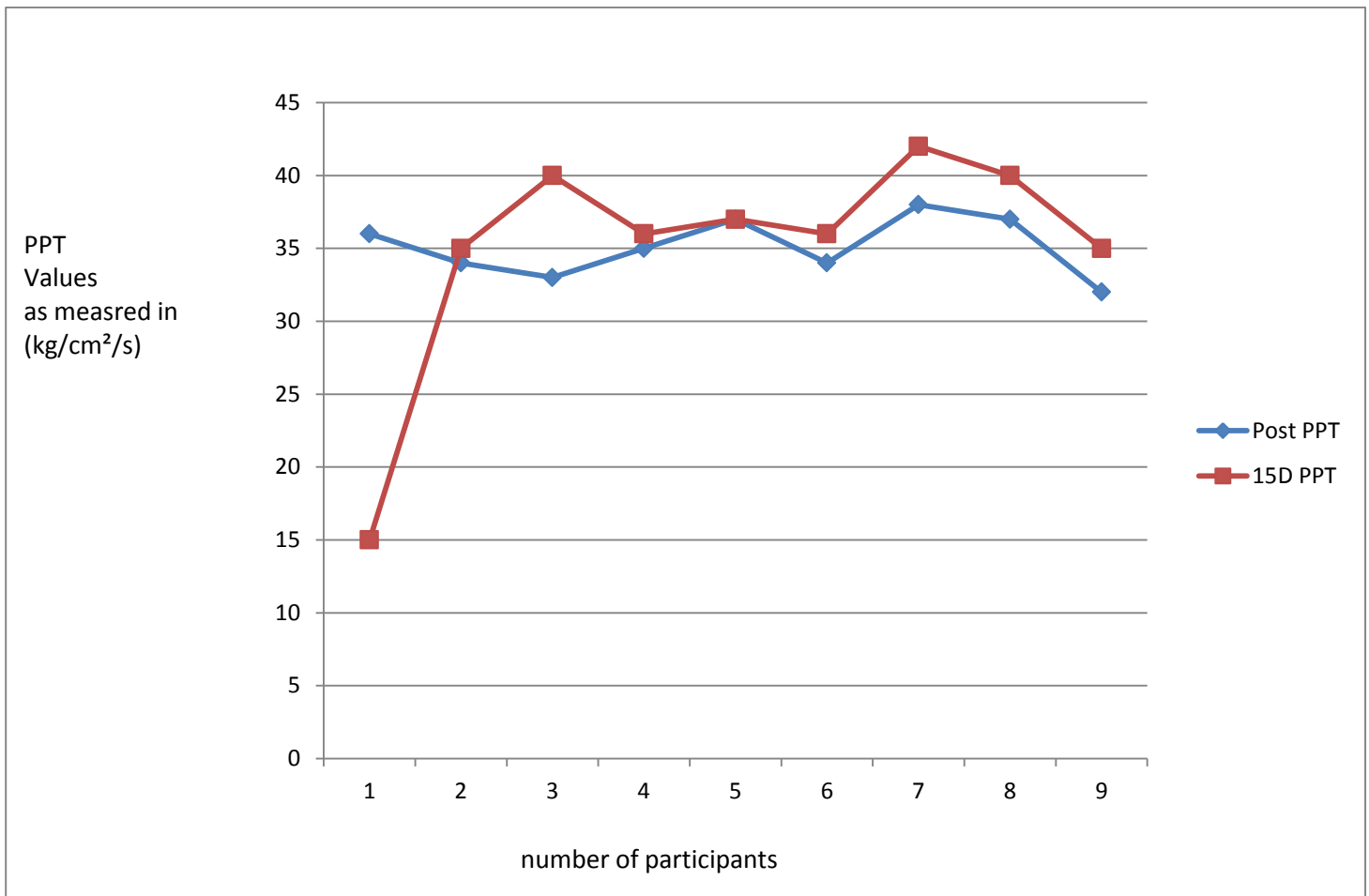


Figure 3: Comparison of Post treatment and 15 days post follow up PPT value

The ROM has been found significantly ($p < 0.05$) decreased after 15 days of follow-up than the post treatment state.

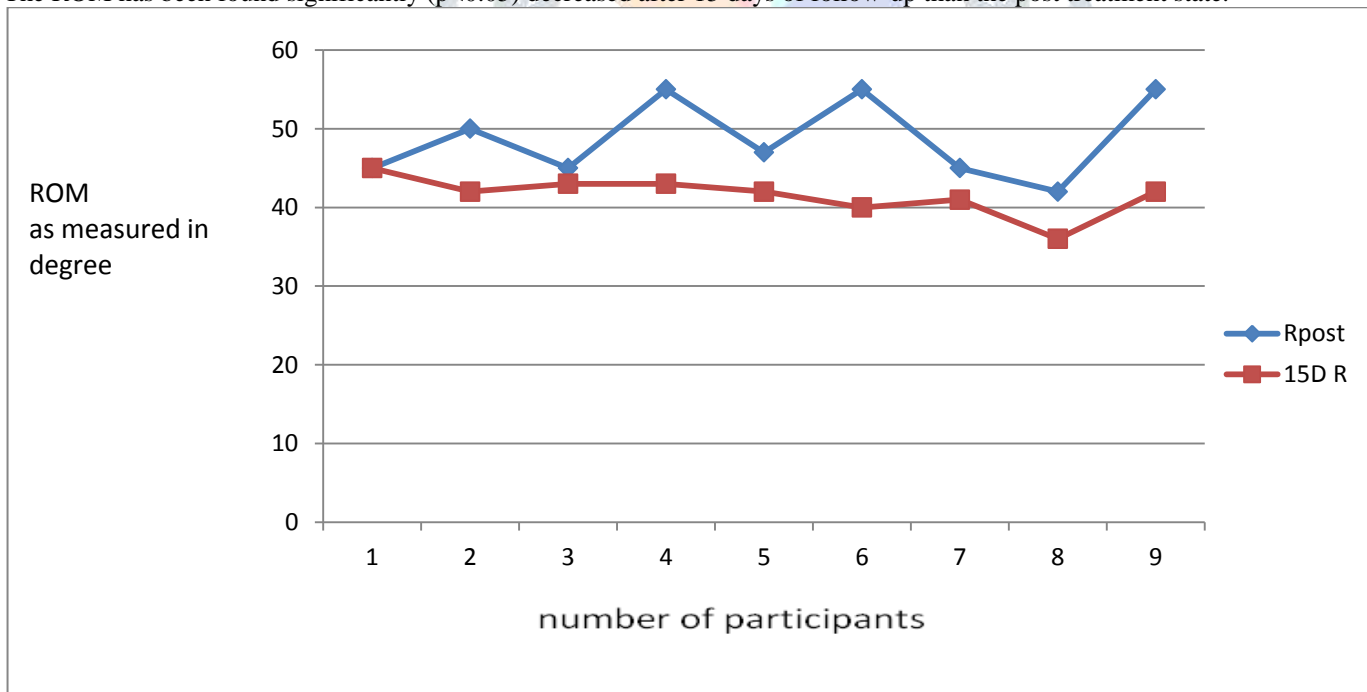


Figure 4: Comparison of Rt side post treatment and 15 days post follow up ROM

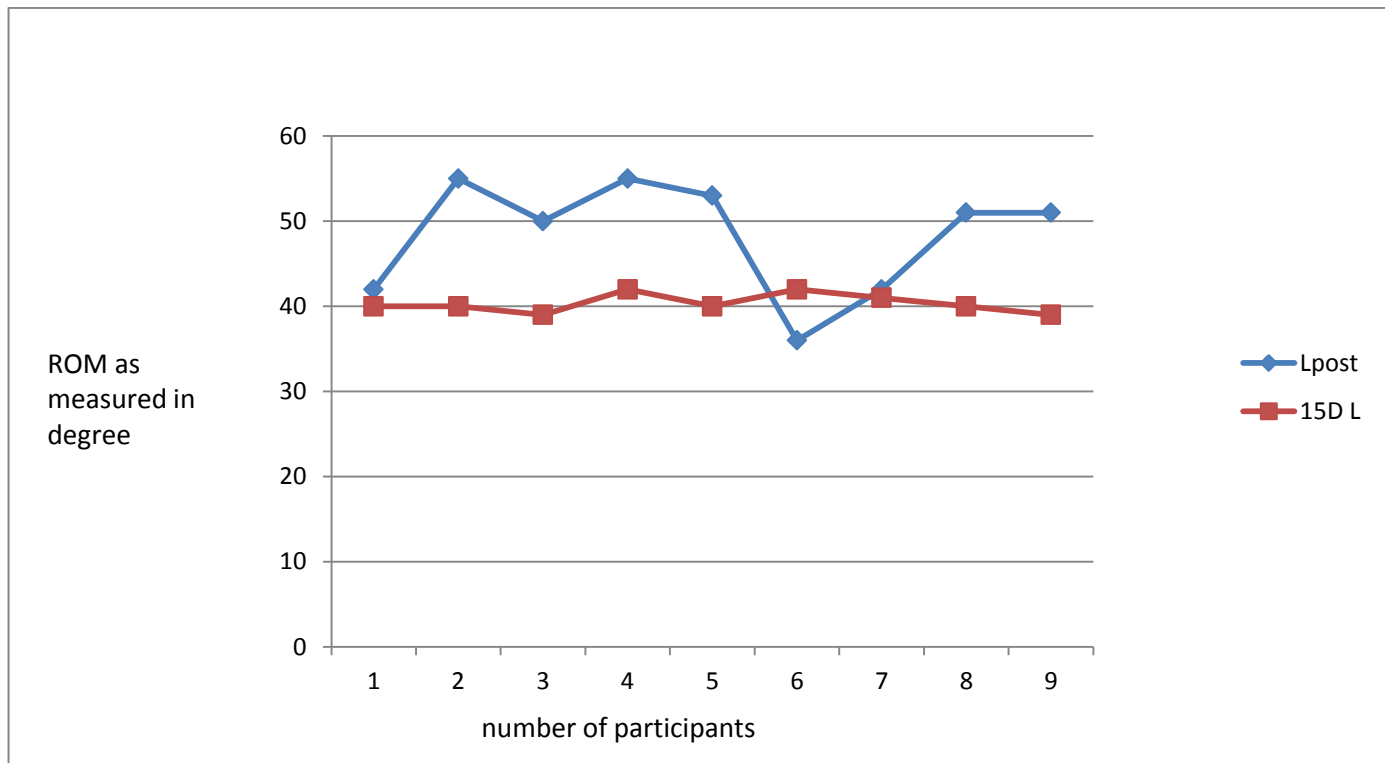


Figure 5: Comparison of Lt side post treatment and 15 days post follow up ROM

Discussion :

In people suffering with upper trapezius trigger points, we found that five days application of burst-type TENS has significantly improved ($p < 0.05$) their pain sensitivity. As we have also followed-up our participants after 15 days, we found there is no changes in PPT but ROM decreased. This signifies that after withdrawal of the treatment there is no changes in pain level as this might be due to complete dislodge of the trigger point nodule. It has also been noted that there is a minor decrease in ROM which might be due to lack of home exercise program which supposed to be incorporate with our treatment protocol.

We applied Burst TENS on the tender trigger points of the neck muscles, and our results showed significant improvements in pain and ROM among the individuals. These results are in tune with those of previous studies that examined this therapy. Angel I et al. applied Burst type TENS on myofascial trigger point over upper trapezius muscle and showed significant improvement in ROM and pain sensitivity. Further this study only assessed the immediate hypoalgesic effect. They did not follow the long term efficacy for the same thus there was a greater need of deciding a suitable treatment parameter.⁹

TrPs are defined as tender spots in discrete taut bands of hardened muscle that produce local and referred pain with other symptoms. A TrPs is composed of numerous so called contraction knots. An individual contraction knot appears as a segment of a muscle with extremely contracted sarcomere and an increase diameter.¹ The result of our current intervention proves that application of burst type of TENS over a period of 5 days having an analgesic effect and increased ROM on upper trapezius trigger points.

A study conducted by Margareta et al (2007) over upper trapezius muscle blood flow following TENS. They applied 2Hz TENS with a pulse duration of 180 microseconds (Burst Mode). Two 40 60 mm electrodes were used to stimulate the muscle. Treatment was given for 15 minutes of duration. They had concluded that skin blood flow quickly and significantly increases by application of this current. They also suggested that skin blood flow remains significantly high than the baseline level by 30% for 15 minutes post stimulation.¹⁹ Result of our study also correlates where burst type of TENS was applied for 20 mins. There was a significant improvement in cervical lateral flexion ROM. This is due to improved muscle blood flow and post contraction relaxation phase. Post exercise hyperaemia is a well known phenomenon after both static and dynamic contraction. It is generally believed that exercise hyperaemia is a local phenomenon including myogenic, metabolic and endothelium mediated control. The muscle pump accumulation of local metabolic vasodilator substance and flow induced vasodilatation produced by local release of relaxing factors derived from the endothelium were suggested as potential mechanisms for the observed vasodilatation following by burst mode TENS.²⁰

Hye Rim Suh et al In their study of High-Frequency Transcutaneous Electrical Nerve Stimulation for Dental Professionals for their work related musculoskeletal disorder found a significant improvement in pain by application of single session of treatment. They have postulated that TENS increased the local blood flow in muscles, improved tissue oxygenation, and suppressed sympathetic tone in small arterioles these changes aided muscle relaxation.²¹ In our current investigation also there was a significant improvement in ROM due to vasodilatation effect.

A three group comparison study was conducted over management of myofascial pain of upper trapezius. Over their comparison of Ultrasound, laser and ischemic compression, laser showed their superior efficacy than other techniques.²² The outcome measures they used were VAS and Tenderness grading scale, but our study is one of its first kind of study where we used Pain pressure threshold algometry as a outcome measure which is a highly reliable to measure trigger point pain.

Efficacy of Dry needling and Ischemic compression with Muscle energy technique also been investigated as a suitable treatment parameter for upper trapezius myofascial trigger point.²³ Although dry needling is a invasive procedure compared with our investigation which is a non invasive and safe to use with a minimum treatment duration with complete recovery.

Conclusion:

Based on the results of this study, five days session of burst type TENS had hypoalgesic effects for mechanical stimuli by increasing RPPT over MTrPs in bilateral upper trapezius muscle and in 15 days follow-up there is no such change in pain sensitivity of MTrPs compared to post treatment result. There was also improvement in cervical lateral flexion ROM, though in 15 days follow-up the ROM decreased then post treatment state but this might be due to small sample size measured using student t test where there was a chance of type II error. This signifies the effectiveness of Burst TENS over MTrP over duration of 5 days and this can be the ultimate dosimetry as a non invasive, cost effective and speedy recovery method of treating MTrP. Further study is needed to see combined efficacy of another treatment protocol to gain more faster recovery. Also there is a need to include home based exercise program to see the improvement in ROM of post follow up days.

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