EFFICACY OF BIOFEEDBACK ELECTRO – STIMULATION TECHNOLOGY ON LATENT TRIGGER POINTS OF UPPER TRAPEZIUS MUSCLE IN YOUNG ASYMPTOMATIC INDIVIDUALS

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INTRODUCTION

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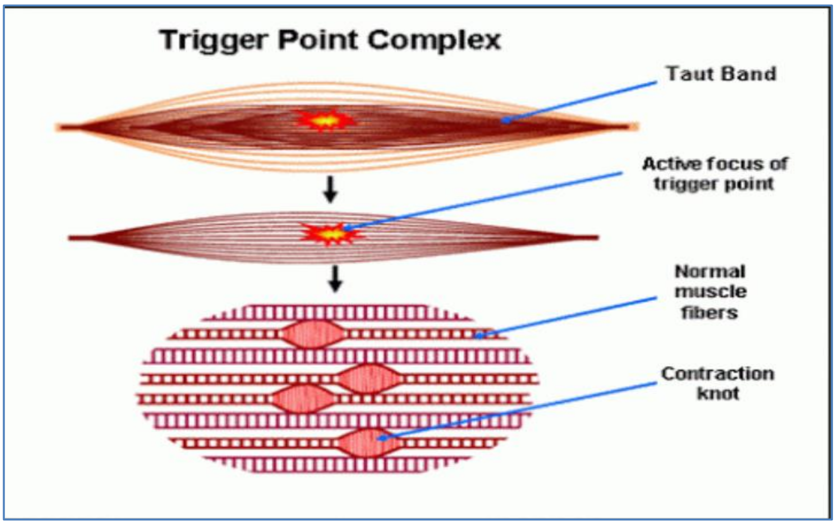
The neck is a very important part of the body. It has many important functions. One of the most important roles of the neck is that, it supports the head allowing precise movement and position. All the vital nerve centres are in the head allowing controlled vision, vestibular balance, auditory direction and olfactory nerves. Somatosensory inputs from the neck activated by changes in head orientation can also influence the distribution of postural tone in the trunk and limbs. Vestibular inputs that are activated by a change in head orientation alter the distribution of postural tone in the neck and limbs. Thus it is seen that along with mobility, the neck also plays an important role in the stability of the body. The neck also houses arteries that supplies blood to the brain from the heart. The neck atop the cervical spine must be supported in the appropriate position to allow for specific motion to accomplish its function. [24]

Neck pain is a common musculoskeletal condition with a lifetime incidence rate between 22% and 70% [1]. The neck is very fragile and can move in all sorts of directions because of its sensory organs like eyes, ears and nose. Stress, posture and excess computer use can stiffen the neck. The result is reduced blood supply to the brain and its subsequent malfunction. That causes poor wellbeing, reduction in energy level and bear down of the immune system. Neck pain is multifactorial. Any excessive physical strain may cause micro trauma in the muscle & connective tissue. Another common problem occurring due to decreased mobility or pain in the neck is trigger points in the muscles surrounding the neck.

A myofascial trigger point (mTrP) is a site of increased irritability in a tissue that demonstrates a hypersensitive reaction to mechanical stimulation such as pressure or traction and triggers an additional (pathological) physiological reaction. [5]

Compared to the surrounding area, the myofascial trigger point is particularly sensitive, over excitable, tender area within a cord-like shortened skeletal muscle fibre bundle (taut band), which is frequently as a thickened section. Pain, strange sensations& autonomic phenomenon can be caused with mechanical stimulation like pressure, traction or needling. Myofascial pain syndrome refers to all the symptoms caused by mTrPs. [5]



An active mTrP is a myofascial trigger point which is already symptomatic at rest and/or during psychological strain (spontaneous activity) and feels tender as well as sensory, motor function and/or autonomic phenomena in its related transfer zones. [5]

A latent mTrP is not symptomatic at rest and/or during physiological strain but still demonstrates localised tenderness as well as causing regional sensory, motor function and/or autonomic phenomena in its related transfer zones. A latent mTrP can turn into an active mTrP [5]. A latent trigger point may have all the other clinical characteristics of an active trigger point and always have a taut band that increases muscle tension and restricts range of motion (Simons et al.) [7]. Hence it is necessary to treat the latent trigger points. Some authors contend when pressure is applied to a trigger point, a jump sign is obtained [6, 7].

Another common observation is that among all the neck muscles the trapezius is most likely to have trigger points. Any overuse injury such as using a computer, hand held electronic devices, repetitive strain from lifting, poor posture, muscle tensing due to stress, traumas & injuries, prolonged bed rest & sitting causes shortening of muscles creating spasm and trigger points in the trapezius muscle[3]. Jull et al. found that patients with neck pain put higher demands on their superficial neck muscles than do healthy people, to compensate for weakness of the deep muscles. Poor postural patterns eventually result in chronic pain symptoms, which have shown to be predictably caused by limited range of motion or shortening or lengthening of muscles. The neck and shoulder often require to perform static work as the hands perform skilled task. Working with the shoulder flexed or abducted increases the activity in upper trapezius, cervical and thoracic erector spinae muscles. [11]

The principle muscle to carry the load of the cervical spine is the trapezius muscle [2].One of the major roles of the trapezius is stabilization. Trapezius along with other shoulder muscles functions to stabilize& move the shoulder girdle. Overall these muscles move and stabilize the scapula & thus provide maximal mobility to the hand while providing a firm base on which the arm, forearm & hand function [8].

Another role of the upper trapezius is that it is an anti-gravity muscle. The upper trapezius along with the other scapular muscles supports the shoulder girdle against the downward pull of gravity. The upper trapezius and upper serratus anterior form one segment of a force couple that drives the scapula in elevation of arm [10]. The trapezius belongs predominantly to the shoulder region, however, when the upper extremity is fixated, the trapezius can produce extension of the head and neck. Acting unilaterally, the upper trapezius can produce ipsilateral flexion and contralateral rotation of head and neck [9].

Janda defined postural muscle as one that responds to dysfunction by tightening and this can lead to restricted range of motion of the neck. In upper extremity, a typical pattern of tightening can be seen in upper trapezius, levator scapulae and pectoralis muscles with weakening of deep neck flexors and lower scapular stabilizers. The upper trapezius has a tendency to develop tightness, whereas the middle and lower trapezius tend to develop inhibitory weakness [11]. The constant use of the trapezius muscle in movements of the cervical spine and during stabilization of the shoulder girdle causes shortening of the muscle. Shortened muscle length along with the patient not able to complete the full cervical range of motion on a daily basis might cause adaptive changes in the muscle length with a habitual forward head posture. The length/tension relationship of a muscle will adapt to a new resting length of the muscle. The head posture will further affect the cervical range of motion in individuals.

Some of the modalities commonly used in the physiotherapeutic management of myofascial trigger points include ultrasound, laser. Electrical nerve stimulation and electrical muscle stimulation is also used to treat trigger points. Some of them include TENS, interferential current, strong surge faradic current. They have also been found to give effects in the treatment of myofascial trigger points [12.23] Biofeedback electro stimulation is a newly developed technique in the treatment of trigger points. It has been claimed that the electro-stimulation forms a somatic feedback between the device which prevents neurological habituation and accommodation, for more effective pain relief. The mechanism behind the effectiveness of biofeedback electro-stimulation technology – When the device is placed in contact with the tissue, it applies a high voltage damped sinusoidal wave form. The passing of the pulsed sinusoidal wave form causes the electrical properties of the tissue to change resulting in changes in the next applied signal. Hence the term biofeedback.

The purpose of the study is to determine the effectiveness of Biofeedback electro stimulation technology on the latent trigger points of the upper trapezius muscle.

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REVIEW OF LITERATURE

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Prevalence of latent myofascial trigger points and diagnostic criteria of the triceps surae and upper trapezius: a cross sectional study

Physiotherapy, December 2013, Vol 99(4):278-284.Rob Grieve, Sue Barnett et al conducted a study of 220 healthy subjects, from the university of health sciences and established the prevalence of latent mTrPs to be 20% - 23%. The pain pressure threshold was assessed in the subjects. [30]

Myofascial pain syndrome of head and neck: a review of clinical characteristics of 164 patients.

Oral surgery, oral medicine, and oral pathology December 1985 Vol 60(6th edition):615-623. James R Friction et all conducted a review of the clinical characteristics of 164 patients whose chief complaints led to the diagnosis of myofascial pain syndrome. The study revealed that these patients had tenderness at points in firm bands of skeletal muscles that were consistent with past reports; specific patterns of pain referral associated with each trigger point; frequent emotional, postural and behavioural contributing factors; and frequent associated symptoms and concomitant diagnoses.[29]

Pathophysiologic and Electrophysiologic mechanisms of Myofascial Trigger Points

Archives of Physical and Medical Rehabilitation 1998;79:863-72 Hong C – Z, Simons DG. The objective of the study was to review clinical and basic science studies on myofascial trigger points to facilitate a better understanding of the mechanism of a myofascial trigger point. Data was sourced from English literature in the last 15 years regarding scientific investigations on myofascial trigger points in either humans or animals. It was concluded that the pathogenesis of a myofascial trigger point appears to be related to integrative mechanisms in the spinal cord in response to sensitized nerve fibres associated with abnormal endplates.[31]

Reliability and Validity of a pressure algometer.

Alogometers are devices that can be used to identify the pressure and/or force eliciting a pain-pressure threshold. It has been noted in pain-pressure threshold studies that the rate at which manual force is applied should be consistent to provide the greatest reliability. The purpose of the study was to test the reliability and construct validity of an algometer. In conclusion of the study, with previous familiarization and practice, an investigator may have high reliability in the rate of force application. The device itself was also highly correlated with readings from a force plate and, therefore, may be considered valid [26].

Measurement of cervical range of motion with a measuring tape

A study by Hsieh and Yeung evaluated the intratester reliability of two different clinicians who used a tape measure to examine the cervical motions in 34 subjects. It indicated that intratester reliability ranged from 0.78 to 0.95. The authors concluded that the tape measure method ‘ is a reliable means for clinicians to assess neck range of motion’.

Efficacy of Avazzia Best Microcurrent Stimulation Device for Pain and Symptoms Associated with Pain

The purpose of this survey was to examine patient perceptions of the effectiveness and safety of treatment with Avazzia Biofeedback Electro- Stimulation Technology (BEST) microcurrent devices for relief and alleviation of pain. A total of 41 people took part in the survey. Participants reported effectiveness in pain reduction (97%), improved range of movement (100%) and improved ability to return to daily activities (94%) after using Best devices for treatment. In addition, 56% reported using less or significantly less medicine after using the therapy

Conclusion – Respondents perceived the Avazzia BEST devices as effective and safe treatment for alleviation of pain. The devices can be used to provide patients with a safe, non-invasive, non-pharmacological treatment for pain.

HYPOTHESIS

HYPOTHESIS

NULL HYPOTHESIS (H_0)

There is no difference in the efficacy of biofeedback electro-stimulation technology when compared to sham electro-stimulation on latent trigger points of upper trapezius muscle.

ALTERNATE HYPOTHESIS (H_1)

There is a difference in the efficacy of biofeedback electro-stimulation technology when compared to sham electro-stimulation on latent trigger points of upper trapezius muscle.

AIM AND OBJECTIVES

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AIM

To study the efficacy biofeedback electro-stimulation technology on upper trapezius latent trigger points

OBJECTIVES

1. To determine the effect of biofeedback electro-stimulation technology on the pain pressure threshold, cervical range of motion (contralateral side flexion and ipsilateral rotation) and upper trapezius muscle length on upper trapezius latent trigger points.
2. To compare the effect of biofeedback electro-stimulation technology with sham electro-stimulation technology on contralateral cervical lateral flexion, ipsilateral rotation, trapezius muscle length and pain pressure threshold on upper trapezius latent trigger points.

METHODOLOGY

STUDY DESIGN: Experimental Study

DURATION OF STUDY: 1 year

SAMPLE SIZE: 60

STUDY SUBJECTS:

Inclusion Criteria:

Males/females having latent trigger points on upper trapezius muscle in the age group of 18 – 30 years.

Exclusion Criteria:

1. PIVD in cervical spine
2. Cervical fractures
3. Neurological symptoms in upper extremity
4. Analgesic drugs taken in last 24 hours
5. Active trigger points

MATERIALS AND TOOLS USED –

1. Pressure Algometer
2. Measure tape
3. Avazzia micro-current biofeedback electro stimulation technology device
4. Anthropometer
5. Pen

PROCEDURE

- A sample of 60 subjects who fulfil the inclusion criteria with latent trigger points on upper trapezius was included in the trial.
- They were randomly assigned to the two groups. Group A receiving biofeedback electro – stimulation technology and Group B receiving sham biofeedback electro – stimulation technology.
- The instrument was checked well for its functioning.
- They were checked for contraindications and thermal sensations were assessed. The part to be treated was well exposed and skin was cleaned.

  Limitations or Contraindications

  · Those with cardiac pacemakers

  · Those with cardiac fibrillation

  · Intoxicated individuals

  · Personal intolerance

  · People suffering from severe mental disorders

  · Pregnant women

  · People with organ transplants
- The trial was explained & a written consent was taken from all subjects.
- Cervical range of motion was measured using measuring tape in sitting position for the affected and unaffected side.
- Pain pressure threshold was measured using a pressure algometer. [14,15,26]
- Trapezius muscle length was measured using an anthropometer.

CERVICAL SIDE FLEXION

IN NEUTRAL POSITION **AT END OF RANGE OF MOTION**

CERVICAL ROTATION

IN NEUTRAL POSITION **AT END RANGE OF MOTION**

Pain pressure threshold was measured using a pressure Algometer places perpendicular over the trigger point. The pressure was applied and the weight at which patient first experienced pain was recorded

Trapezius muscle length was measured using an anthropometer between the mastoid process and acromioclavicular joint in maximum stretched position of the upper trapezius muscle of the affected side with subject in supine lying.

The subjects were randomly assigned to 2 groups, each consisting of 30 subjects

The subjects in the first group were treated using biofeedback electro stimulation technology (BEST). The procedure for applying BEST is as follows

1. Attach Y-electrode lead wire to the accessory port at the side of device.
2. Slide the switch on the side of the device to the ON position.
3. RELAX mode will light up.
4. Press MODE button once.
5. DEEP STIMULATE mode will light up.
6. Place Y-electrode on neck area.
7. Press the [+] button to increase the intensity level until the patient feels a comfortable prickling sensation.
8. Roll Y-electrode (in any direction) on and around neck area looking for "sticky" / friction areas.
9. If an area is "sticky", roll Y electrode (in any direction) on that area until it rolls smoothly.
10. Go along the length of the trapezius (shoulder) region and look for "sticky" / friction areas.
11. Roll Y electrode (in any direction) on that region until it rolls smoothly.
12. Once all "sticky" areas have been smoothed out, slide the switch on the side of the device to the OFF position.
13. Place two (2) adhesive pads on the area which had most friction / most "sticky".
14. Attach the adhesive pads lead wire to the accessory port at the side of device.

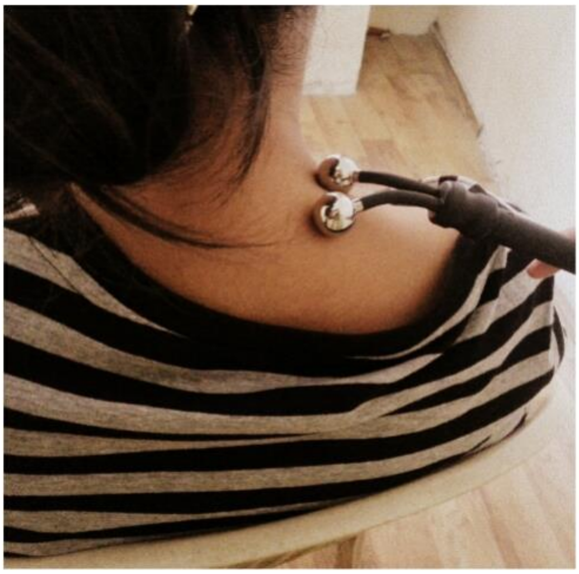
14. Slide the switch on the side of the device to the ON position.

16. RELAX mode will light up.
17. Press MODE button twice.
18. RSI mode will light up.
19. Press the [+] button to increase the intensity level until the patient feels a comfortable prickling sensation.
20. Leave the adhesive pads on for about 20 minutes.
21. Decrease the intensity level if the patient complains that the intensity is high during treatment.

22. Slide the switch on the side of the device to the OFF position.

23. Remove the adhesive pads and place it on its plastic sheet.

Subjects in the second group were given sham treatment where they were treated in a similar fashion but with the machine in the OFF mode

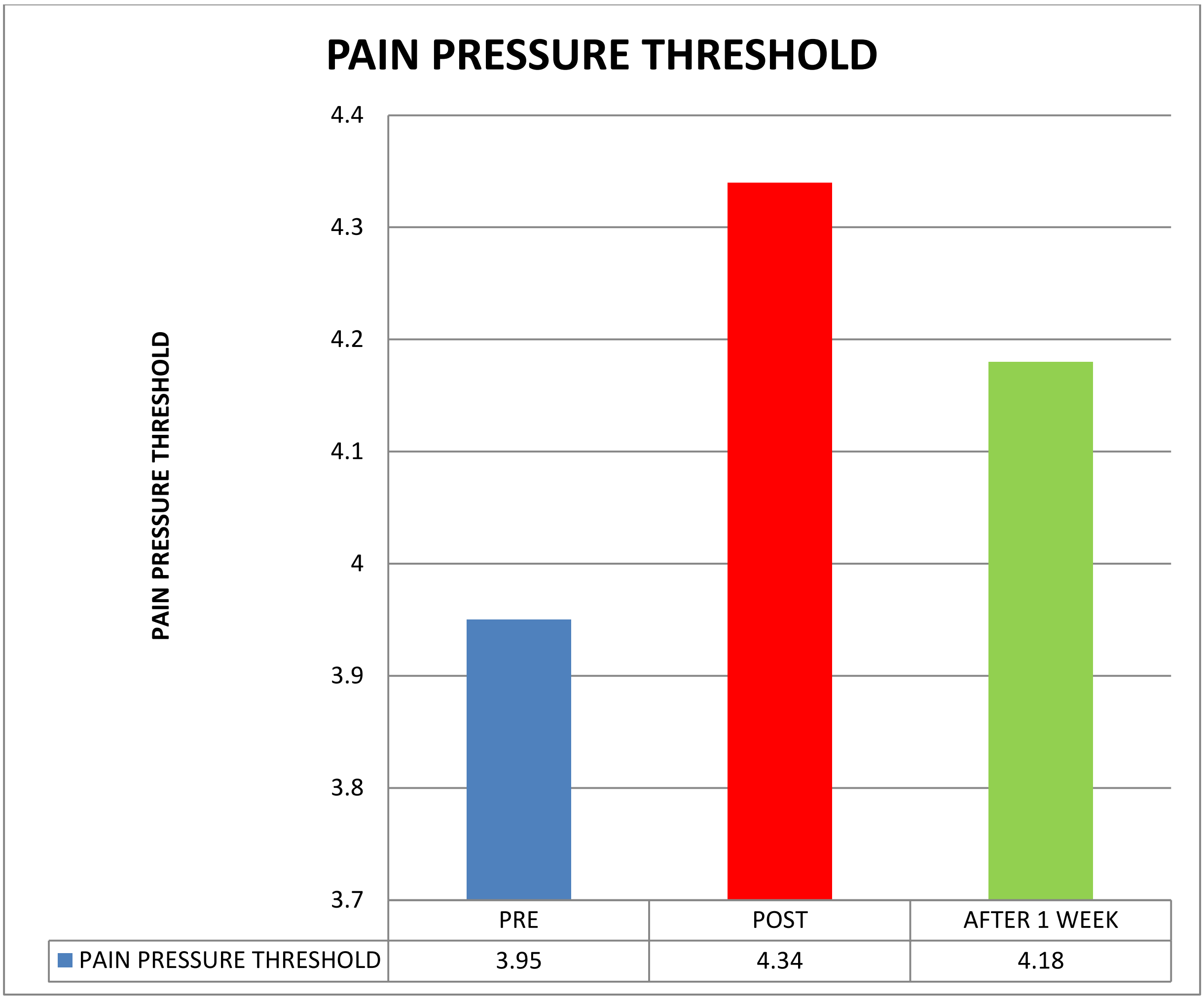


DATA ANALYSIS AND RESULTS

DATA ANALYSIS AND RESULTS

Graph 1

Pain pressure threshold: Bar diagram showing mean measures of Pain Pressure Threshold pre-treatment, post treatment and post1 week retention for Treatment Group.



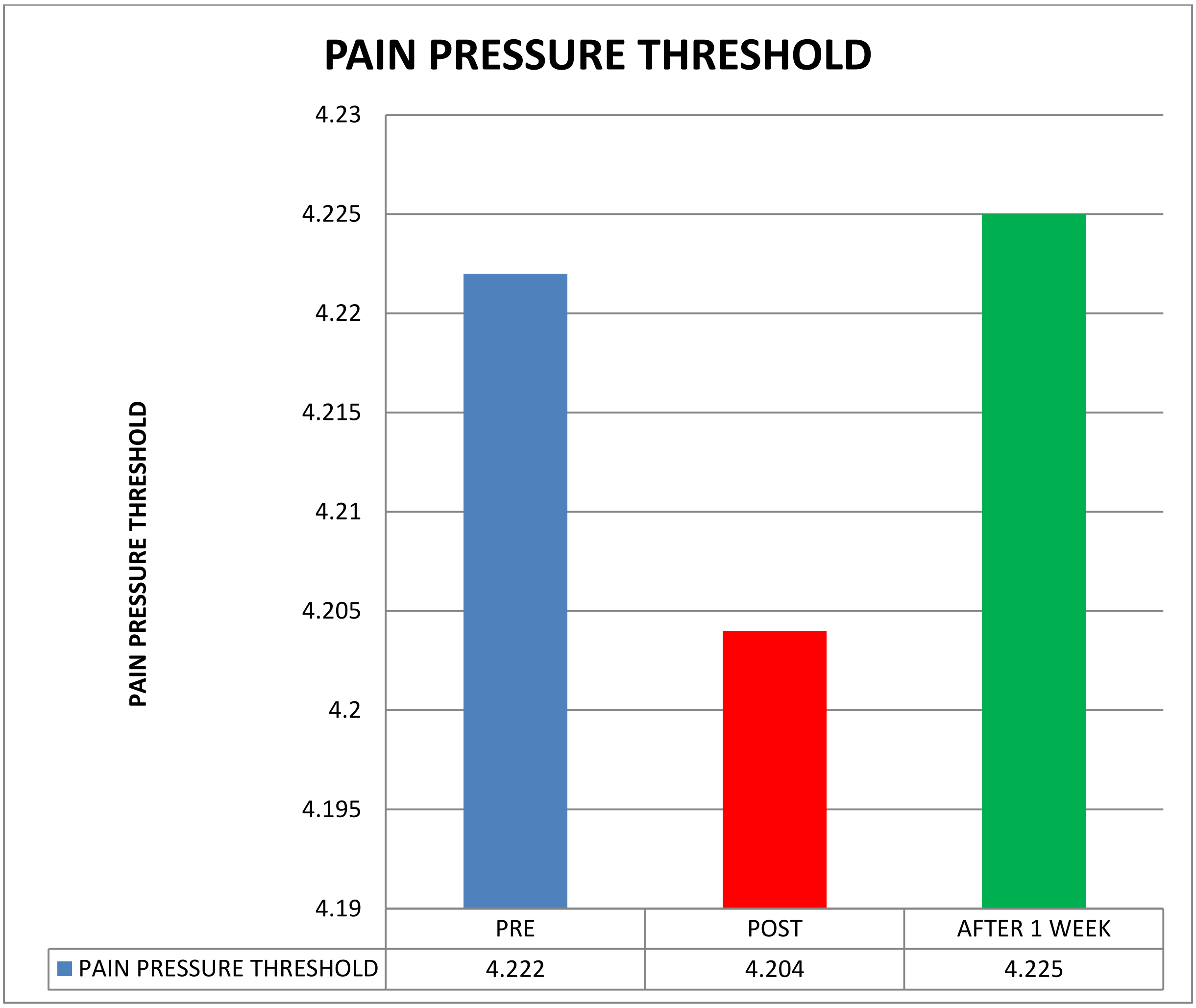
GROUP	MEAN (KG)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	3.948	0.4603	0.08404
POST	4.344	0.4346	0.07935
POST 1 WEEK	4.183	0.4718	0.08614

COMPARISON	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL		Q	P VALUE
		FROM	TO		
PRE VS POST	-0.3957	-0.4625	-0.3288	20.143	<0.001
PRE VS POST 1 WEEK	-0.2347	-0.3015	-0.1678	11.946	<0.001
POST VS POST 1 WEEKS	0.1610	0.09415	0.2279	8.196	<0.001

Since the P value for the repeated measure ANOVA is less than 0.05 for pain pressure threshold, there was a statistically significant improvement in the pain pressure threshold post the treatment as well as in the post 1 week retention period.

Graph 2

Pain pressure threshold: Bar diagram showing mean measures of Pain Pressure Threshold pre-treatment, post treatment and post 1 week retention for Sham Treatment Group.



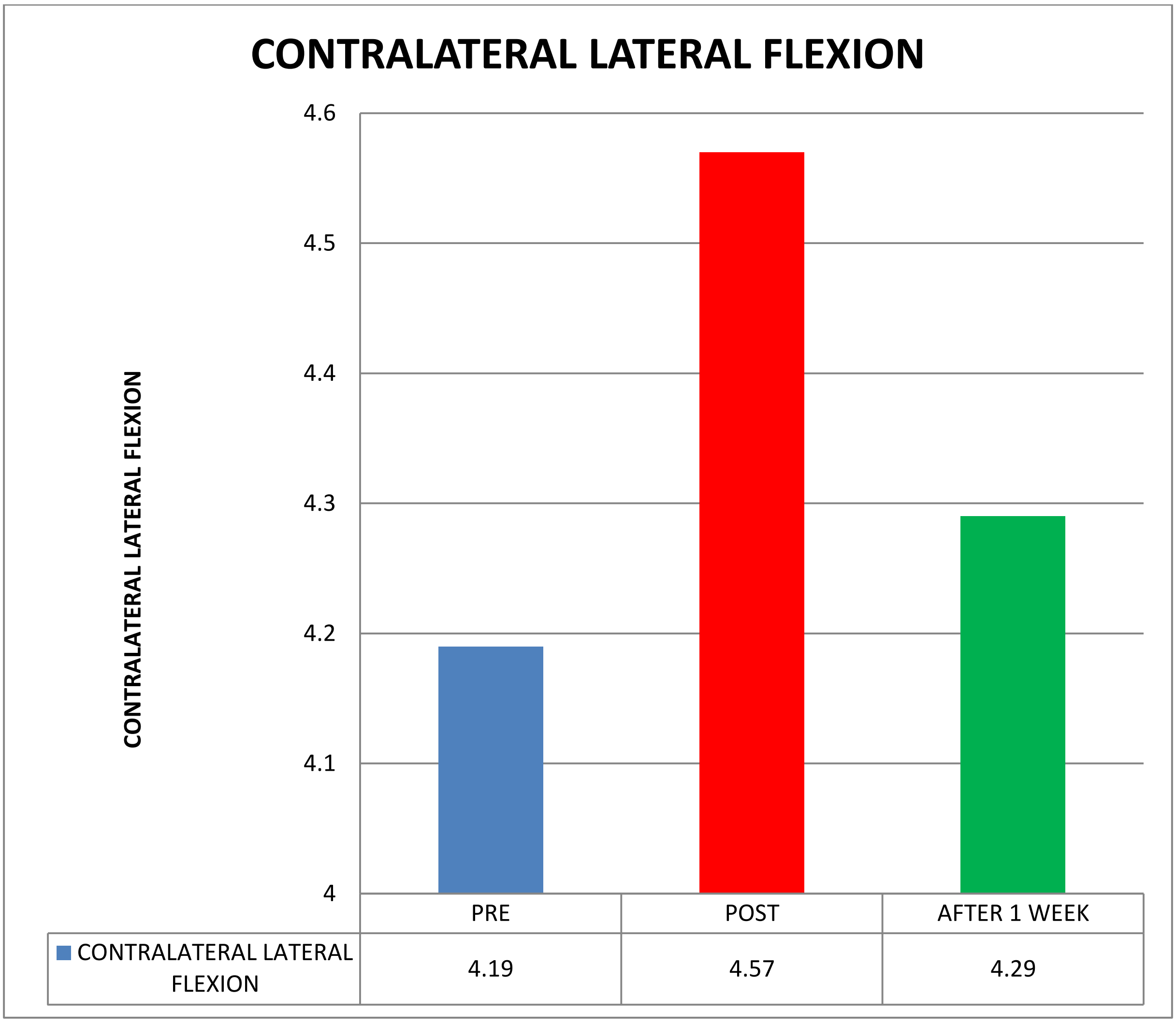
GROUP	MEAN (KG)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	4.222	0.3569	0.06516
POST	4.205	0.3880	0.07083
POST 1 WEEK	4.226	0.3543	0.06469

COMPARISON	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL		Q	P VALUE
		FROM	**TO**		
PRE VS POST	0.01733	-0.038430	-0.07310	1.058	>0.05
PRE VS POST 1 WEEK	-0.003667	-0.059430	-0.05310	0.2238	>0.05
POST VS POST 1 WEEK	-0.02100	-0.976770	0.03477	1.282	>0.05

Since the p value for the repeated measure ANOVA is 0.6282 (greater than 0.05) for pain pressure threshold there was no statistically significant improvement in the pain pressure threshold post the treatment as well as in the post 1 week retention period

Graph 3

Contralateral Lateral Flexion: Bar diagram showing mean measures of Contralateral Lateral Flexion pre-treatment, post treatment and post 1 week retention for Treatment Group.



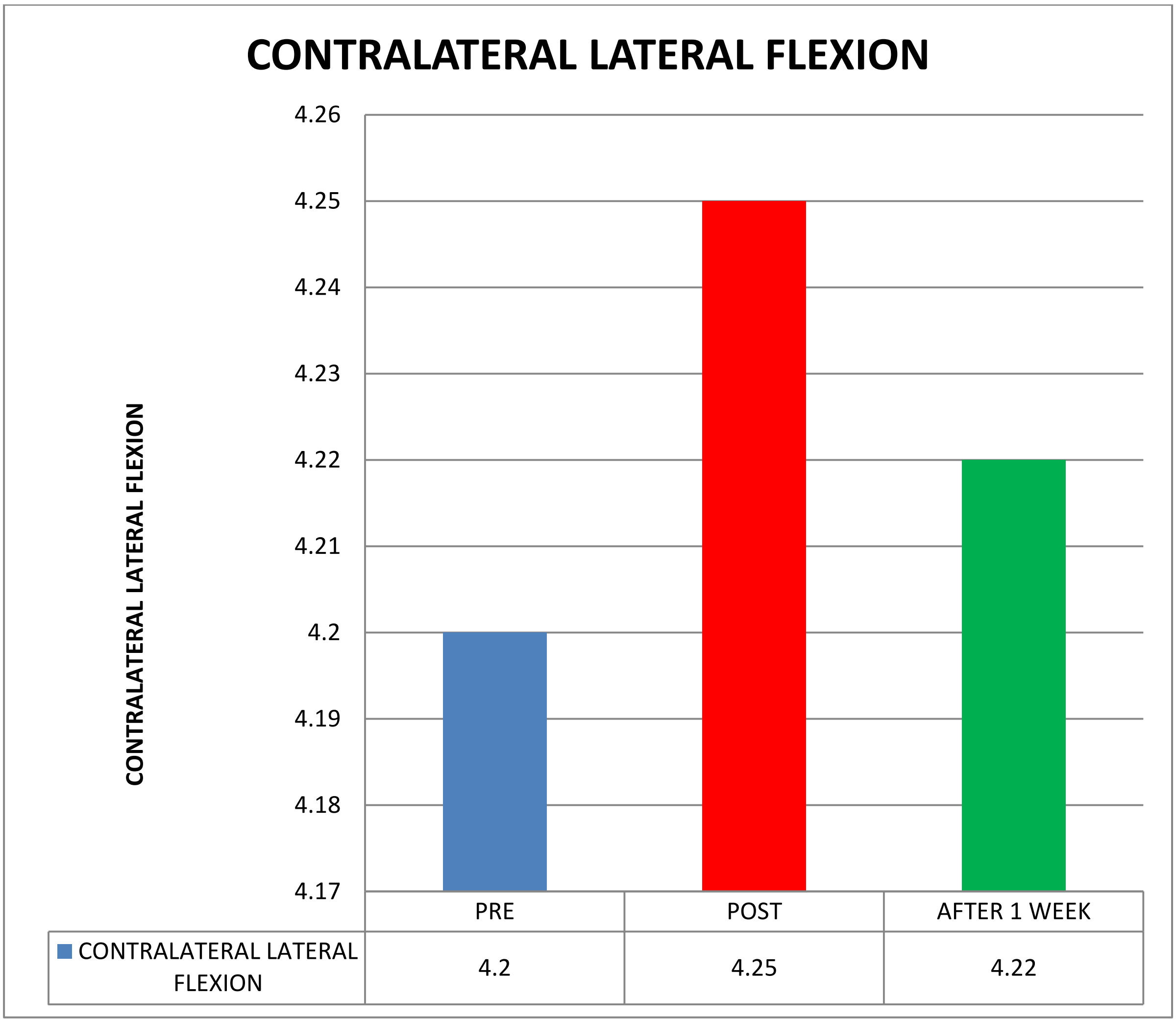
GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	4.191	0.3262	0.05955
POST	4.575	0.3090	0.05641
POST 1 WEEK	4.291	0.3015	0.05504

COMPARISON	RANK SUM DIFFERENCE	P VALUE
PRE VS POST	-46.000	P<0.001
PRE VS POST 1 WEEK	-15.500	P<0.05 ns
POST VS POST 1 WEEK	30.500	P<0.001

Since the P value for Friedman's test is < than 0.05, there was a statistically significant improvement in the contralateral lateral flexion post the treatment, however in the post 1 week retention period, there was no statistically significant difference.

Graph 4

Contralateral Lateral Flexion: Bar diagram showing mean measures of Contralateral Lateral Flexion pre-treatment, post treatment and post 1 week retention for Sham Treatment Group.



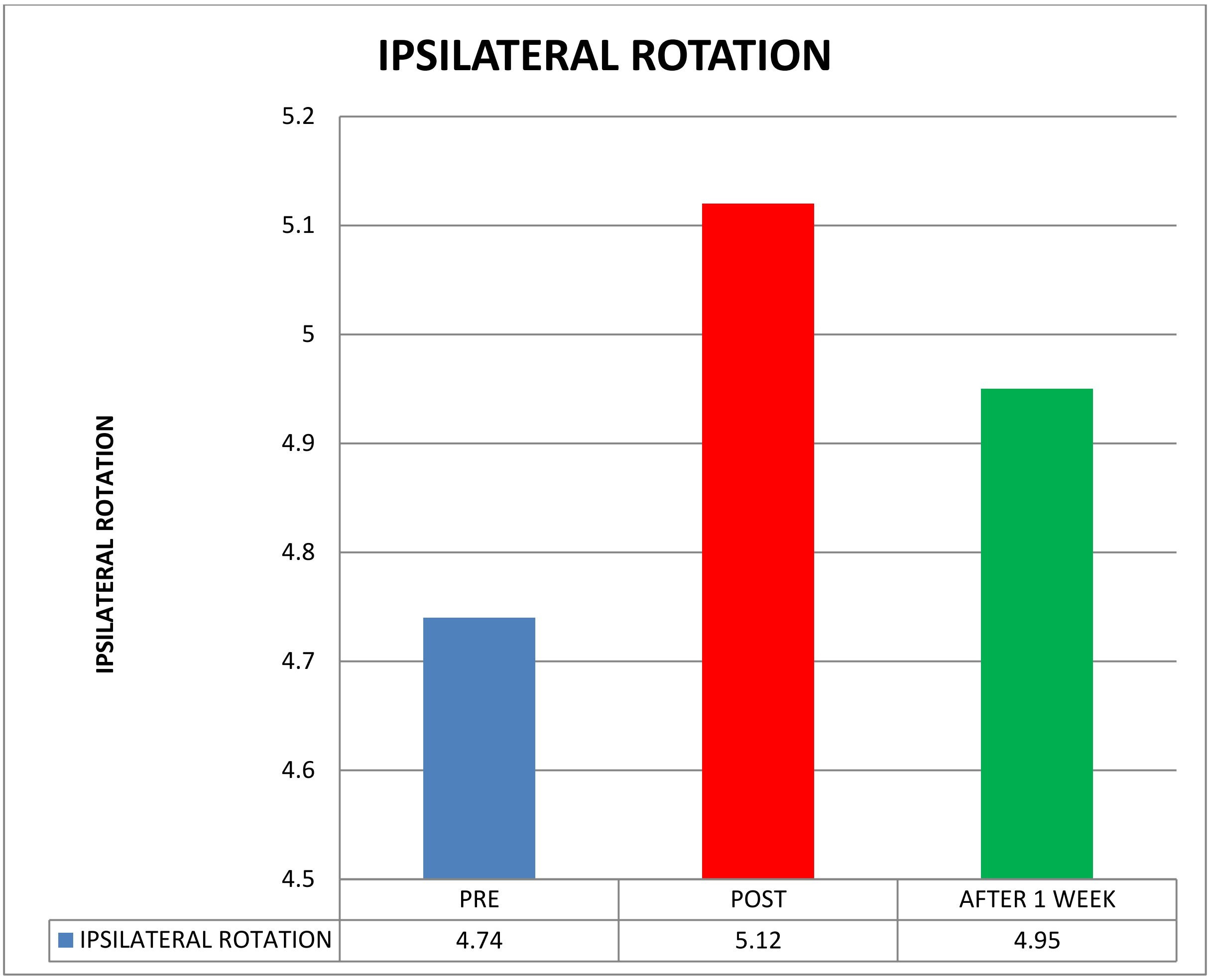
GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	4.208	0.2942	0.05372
POST	4.25	0.3411	0.06228
POST 1 WEEK	4.225	0.3557	0.06494

COMPARISON	RANK SUM DIFFERENCE	P VALUE
PRE VS POST	-8.000	>0.05 ns
PRE VS POST 1 WEEK	-4.000	>0.05 ns
POST VS POST 1 WEEK	4.000	>0.05 ns

Since P value for the Friedman's test is 0.1269 (greater than 0.05) for left lateral flexion, there was no statistically significant improvement in the contralateral lateral flexion post the treatment as well as in the post 1 week retention period.

Graph 5

Ipsilateral Rotation: Bar diagram showing mean measures of Ipsilateral Rotation pre-treatment, post treatment and post 1 week retention for Treatment Group.



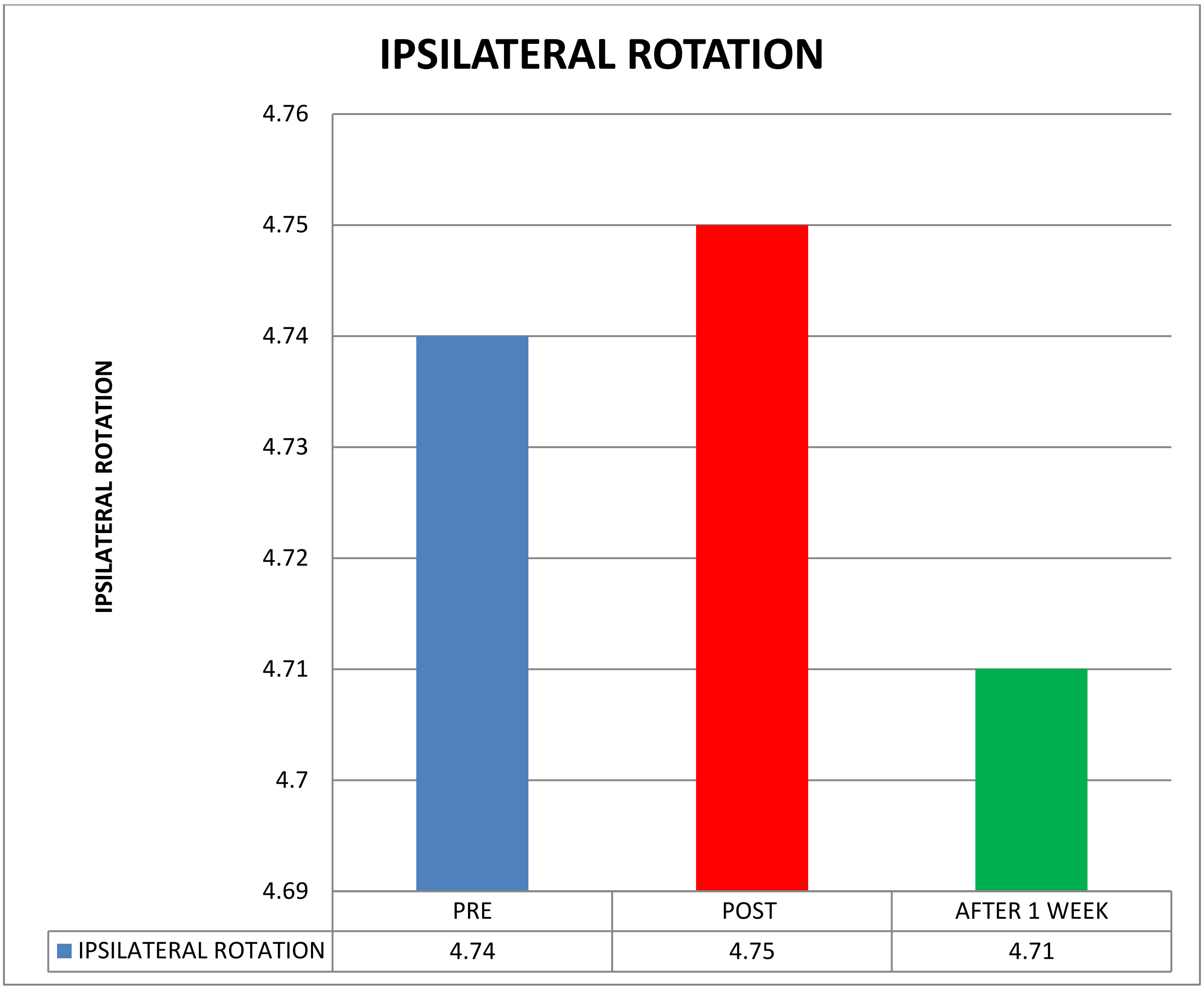
GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	4.741	0.4073	0.07436
POST	5.125	0.3980	0.07266
POST 1 WEEK	4.95	0.3851	0.07030

COMPARISON	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL		Q	P VALUE
		FROM	TO		
PRE VS POST	-0.3833	-0.4925	-0.2742	11.951	<0.001
POST VS POST 1 WEEK	-0.2083	-0.3175	-0.09917	6.495	<0.001
POST VS POST 1 WEEK	0.1750	0.06583	0.2842	5.456	<0.001

Since the P value for the repeated measures ANOVA is less than 0.05 for ipsilateral rotation, there was a statistically significant improvement in the ipsilateral rotation post the treatment as well as in the post 1 week retention period.

Graph 6

Ipsilateral Rotation: Bar diagram showing mean measures of Ipsilateral Rotation pre-treatment, post treatment and post 1 week retention for Sham Treatment Group.



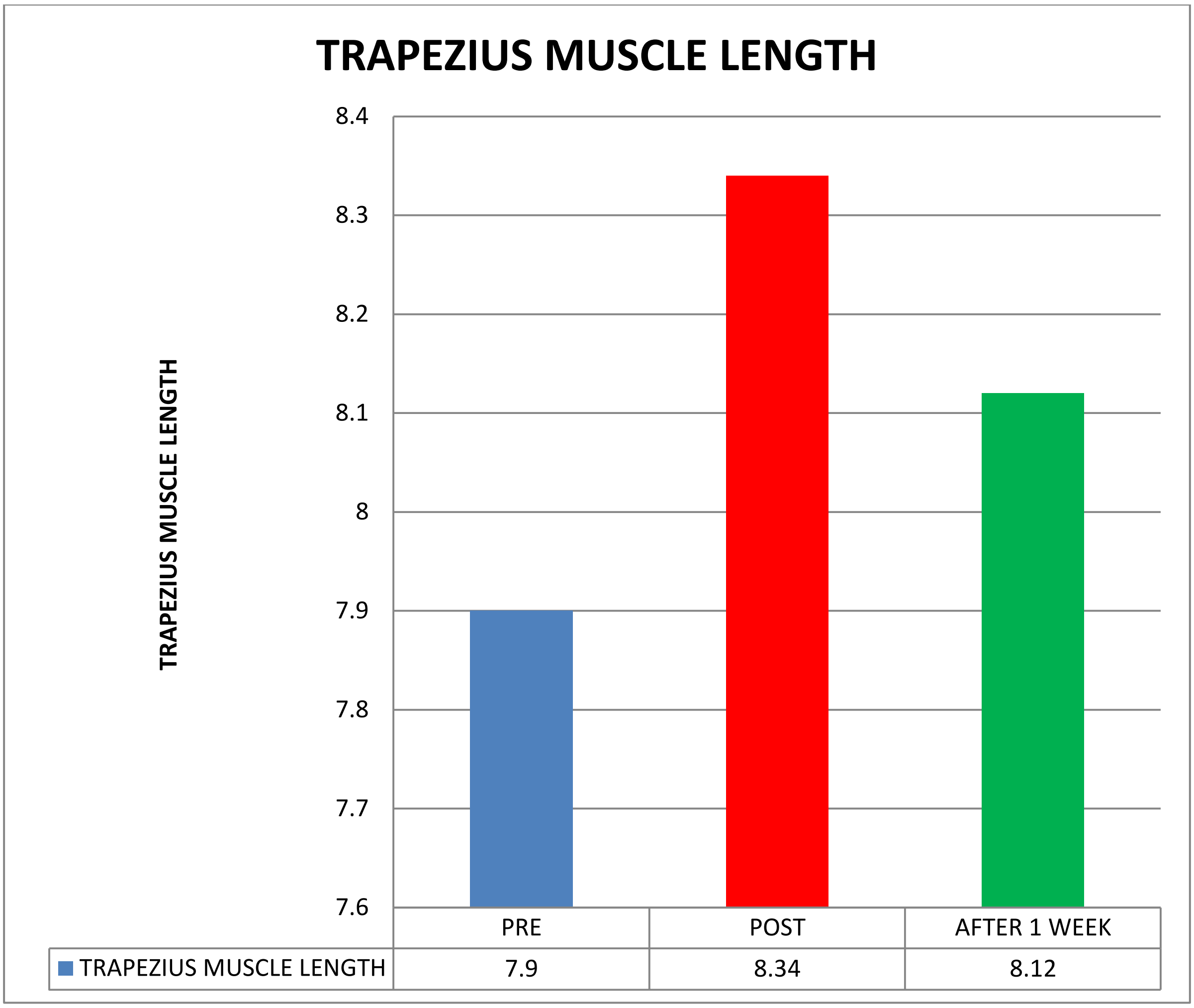
GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	4.741	0.3379	0.06169
POST	4.758	0.3182	0.05809
POST 1 WEEK	4.716	0.3457	0.06312

COMPARISON	RANK SUM DIFFERENCE	P VALUE
PRE VS POST	-3.000	>0.05
PRE VS POST1 WEEK	4.500	>0.05
POST VS POST 1 WEEK	7.500	>0.05

Since the P value for the Friedman's test is 0.1211 (greater than 0.05) for right rotation, there was no statistically significant improvement in the ipsilateral rotation post the treatment as well as in the post 1 week retention period.

Graph 7

Trapezius muscle length: Bar diagram showing mean measures of Trapezius muscle length pre-treatment, post treatment and post 1 week retention for Treatment Group



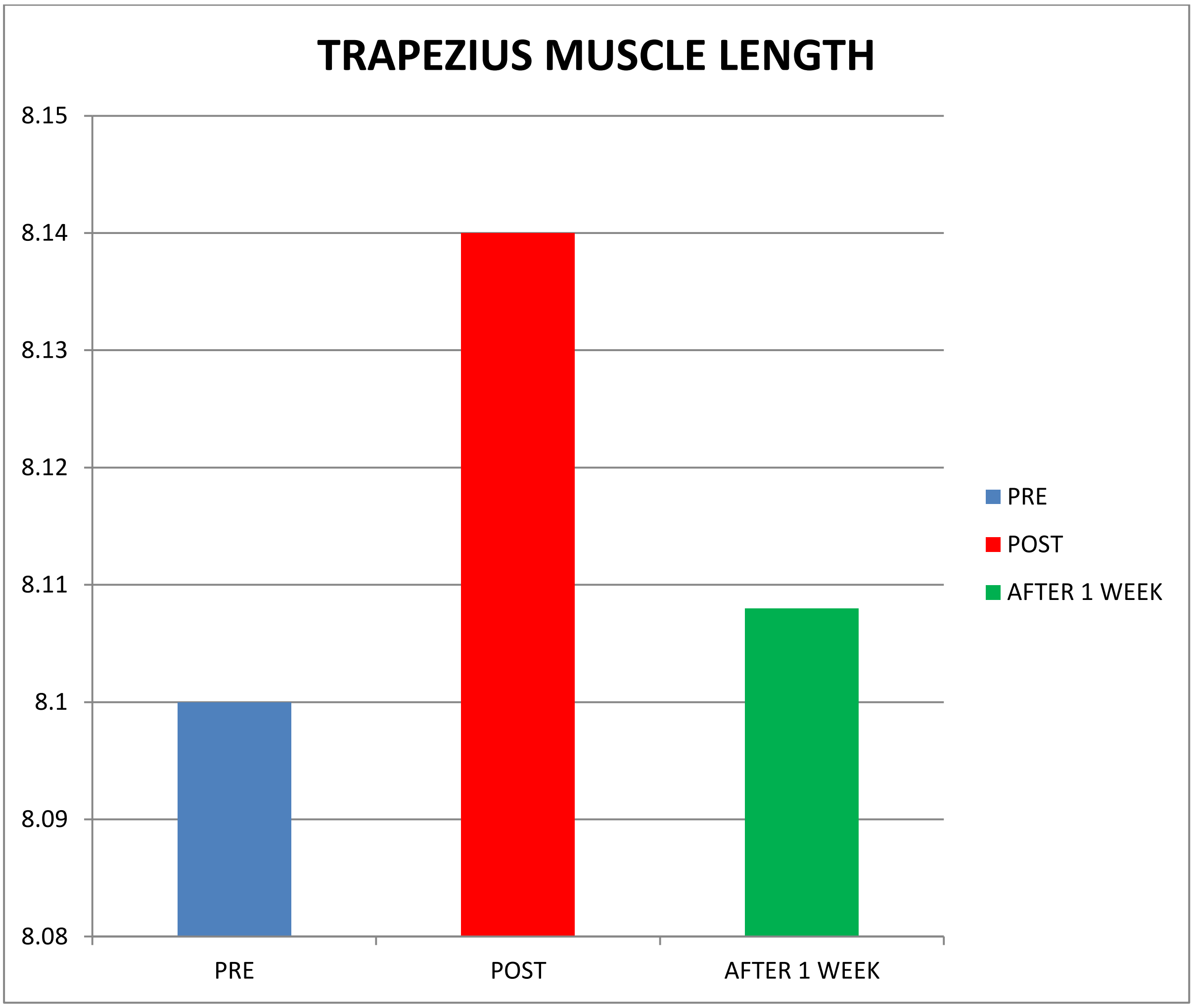
GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	7.908	0.4890	0.08928
POST	8.34	0.5084	0.09283
POST 1 WEEK	8.125	0.5561	0.1015

COMPARISON	RANK SUM DIFFERENCE	P VALUE
PRE VS POST	-50.500	<0.001
PRE VS POST 1 WEEK	-27.500	<0.01
POST VS POST 1 WEEK	23.000	<0.01

Since the P value for the Friedman's statistic test is less than 0.05, there is a statistically significant improvement in the trapezius muscle length post the treatment as well as in the post 1 week retention period.

Graph 8

Trapezius muscle length: Bar diagram showing mean measures of Trapezius muscle length pre-treatment, post treatment and post 1 week retention for Sham Treatment Group.



GROUP	MEAN (in)	STANDARD DEVIATION	STANDARD ERROR OF MEAN
PRE	8.1	0.3862	0.07051
POST	8.141	0.3922	0.07160
POST 1 WEEK	8.103	0.3637	0.06642

COMPARISON	RANK SUM DIFFERENCE	P VALUE
PRE VS POST	-7.500	>0.05
PRE VS POST 1 WEEK	-1.500	>0.05
POST VS POST 1 WEEK	6.000	>0.05

Since the P value for the Friedman's statistic test is 0.1225 (greater than 0.05) for trapezius muscle length, there is no statistically significant improvement in the trapezius muscle length post the treatment as well as in the post 1 week retention period.

RESULTS

1. There was a statistically significant improvement in pain pressure threshold, trapezius muscle length and cervical ROM (ipsilateral rotation and contralateral side flexion) in the group receiving biofeedback electro stimulation technology.
2. There was no statistically significant difference in pain pressure threshold, trapezius muscle length and cervical ROM (ipsilateral rotation and contralateral side flexion) in the group receiving sham biofeedback electro stimulation technology.

DISCUSSION

DISCUSSION

The purpose of the study was to evaluate the effects of biofeedback electro-stimulation technology on latent trigger points on upper trapezius muscle. A total of 60 subjects were included in the study. They were randomly assigned to the two groups, each consisting of 30 subjects. Group A consisting of subjects who received biofeedback electro-stimulation and Group B consisting of subjects who received sham treatment. All the participants had latent trigger points on upper trapezius muscle. They were asymptomatic as regards to any active trigger points in upper trapezius and any neurological involvement of the upper extremity. Both the groups were homogenous in terms of age , pain pressure threshold , muscle length , contralateral lateral flexion , ipsilateral rotation.

When within group analysis of Group B (sham treatment) was done, it was found that there was no statistically significant improvement in the pain pressure threshold, trapezius muscle length and cervical ranges on the latent trigger points of the upper trapezius muscle.

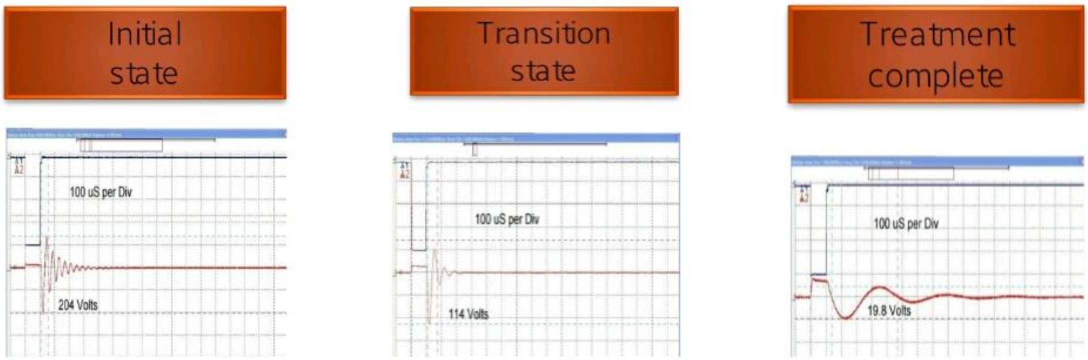
When within group analysis of Group A (treatment group) was done, it was found that there was statistically significant improvement in pain pressure threshold, trapezius length, cervical ranges (contralateral side flexion, ipsilateral rotation) on the latent trigger points of the upper trapezius muscle.

Simon's theory proposed that, the palpable band around the trigger point is due to increase in free ions of calcium. The abnormally increased calcium may cause uncontrolled shortening activity and increased metabolism. The muscle fibre shortening also impairs local circulation, which causes a loss of oxygen and nutrient supply to the region. This completes a vicious cycle; thus, an energy crisis occurs, and taut band forms. [27] Because of the sustained muscle contraction, muscle goes into fatigue and lactic acid accumulates. Because of reduced blood flow, lactic acid does not get washed off and it irritates the local nerve endings, resulting in pain. Pain impulses travel into the central nervous system at different rates depending on what nerve fibre is stimulated. Thin myelinated A-delta fibres conduct noxious sensation quickly and very thin, unmyelinated C fibres more slowly. Most pain sensation is delivered to the central nervous system by C-fibres. Interestingly, 70% of the peripheral nervous system is composed of these small-calibre, pain transmitting fibres. Furthermore, most of the peripheral autonomic activity utilizes slow C-fibres.

In our study, biofeedback electro-stimulation was used to treat the patients with latent trigger points. The normal physiological responses to electrical current include creating a muscle contraction through nerve or muscle stimulation, stimulating sensory nerves to help in treating pain. The type and extent of physiological response is dependent on type of tissue stimulated, nature of electrical current applied. As electricity moves through the body's conductive medium, changes in the physiologic functioning can occur at various levels – cellular, tissue, segmental and systemic. Effects at cellular level are excitation of nerve cells, changes in cell membrane permeability, protein synthesis stimulation of fibroblast and osteoblasts and modification of microcirculation. The effects that occur at the tissue level are skeletal muscle contraction and tissue regeneration. This helps to heal the micro-trauma caused due to the trigger points. Effects occurring at the segmental level are modification of joint mobility, muscle pumping action to change circulation and lymphatic activity, increased movement of charged proteins into the lymphatic channels. Electrically induced muscle contractions pull joint through limited range. Continued contraction of muscle group over extended time results in joint and muscle tissue modification and lengthening.

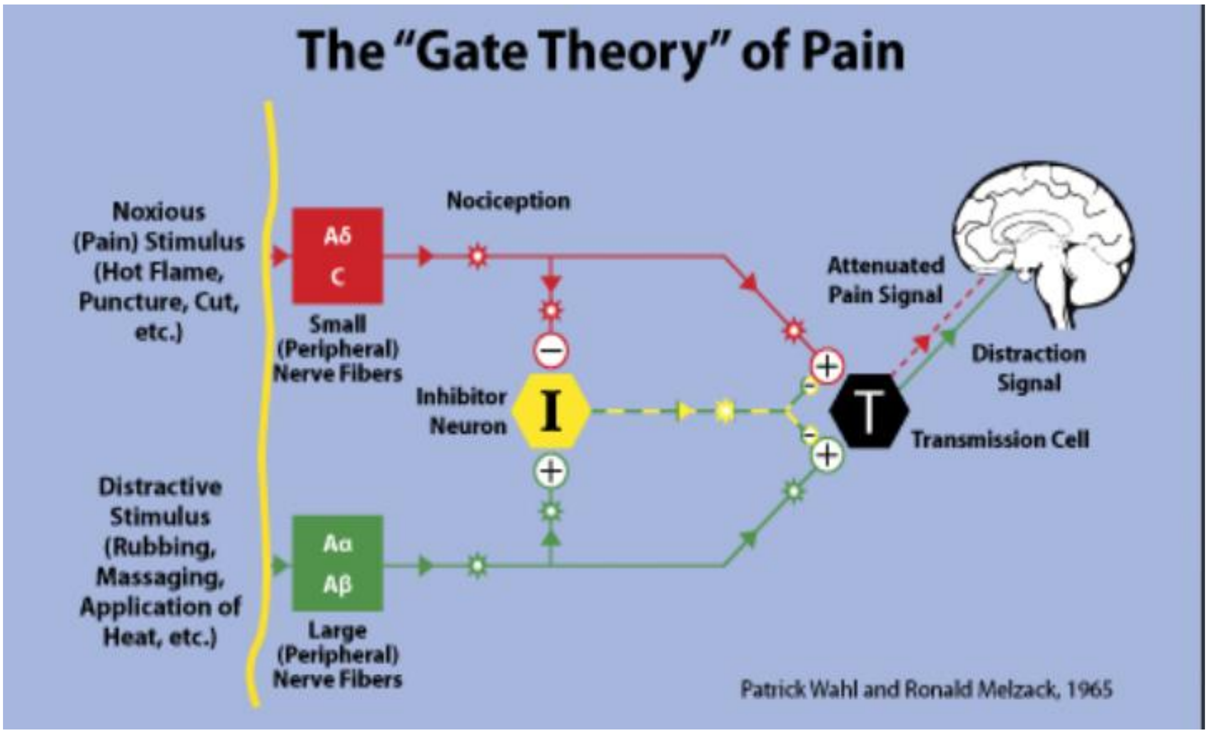
The anti – inflammatory effects of electrostimulation technology are – facilitation, oscillo/torsion repair, enhancement of filtration/ diffusion process, pH normalization, cAMP formation, cell membrane repair, influence on metabolism, sustained depolarization, immune system support, increase in blood flow

Biofeedback electro-stimulation technology works on the pain gate and opiod theory mechanism. Most conventional TENS technology works based on the "pain gate" theory. However, acupuncture TENS works on opiod theory. That is, they apply sufficient electrical charge to the "A" and "B" fibres of the nervous system to saturate them and thereby block the communication of pain to the brain. Often, when the stimulation is removed, the pain returns in a short period of time. Note the signals are monophasic-square wave in nature with voltage from 0 to 30 volts. BEST (Biofeedback Electro Stimulation Technology) is based on a completely different operating theory. BEST devices generate electrical impulses that are physiologically similar to neurological impulses observed in the "C" nerve fibres embedded in tissues and consist of 85% of all nerves found in the body and to "fast" pain blocking A fibres. A BEST device communicates with the neuro-endocrine system through direct touch to the skin, sending a signal through the epidermis and dermis into underlying fascia planes and is transmitted through connective tissue to the C and A nerve fibres. The differences between biofeedback electro-stimulation and transcutaneous electrical nerve stimulation are that biofeedback electro-stimulation technology are high intensity, burst pulses, low intensity currents with a voltage range between 0-450 volts and amperage range between 6-10 microamperes, frequency range of 1-1000 Hz. They are damped asymmetrical biphasic sinusoidal waveforms, the signalling always varies based upon change in impedance of the tissue. The device forms a somatic biofeedback between the device and the tissue. Somatic feedback prevents neurological habituation and accommodation for more effective pain management.



BEST is a non-invasive microcurrent system that transcutaneously communicates with the internal peripheral nervous system for the purpose if therapeutic intervention.[19] The devices stimulate the neuro-endocrine system through direct touch to the skin. The electrodes can detect (via biofeedback) impedance of skin by 'sticking' (dramatic increase in friction) to acupuncture points when gliding the instrument over the skin[20,21] These sticky areas may be injured or diseased tissue or may be associated with an organ or corresponding body system. By placing the electrodes at a correct spot for treatment, equilibrium between tissues and organs is restored, and the redox (reduction-oxidation) potential of the body is recharged. Whereas, TENS constitutes low intensity, long duration pulses, voltage ranging between 0-40 volts, amperage ranging between 3 – 10 miliampere, frequency range of 1 – 100 Hz. They are square waveforms, monophasic or biphasic symmetrical or asymmetrical. There is no biofeedback in TENS. There is neurological habituation and accommodation, which severely limits effectiveness of pain management with TENS.

Under normal physiological circumstances, the brain generates pain sensations by processing incoming noxious information arising from stimuli such as tissue damage. If noxious information is to reach the brain it must pass through a metaphorical **pain gate,** which is located in lower levels of CNS. In physiological terms, the gate is formed by excitatory and inhibitory synapses regulating the flow of neural information through the CNS. This pain gate is opened by noxious events in the periphery, it can be closed by activation of mechanoreceptors through rubbing the skin. This generates activity in large diameter Aβ afferents which inhibits the onward transmission of noxious information. This closing of the pain gate results in less noxious information reaching the brain, which results in a reduction in the sensation of pain. The neuronal circuitry involved is segmental in its organization. The aim of biofeedback electro-stimulation is to activate Aβ fibres using electrical currents



If the nociceptive information is allowed through the gate then this traffic will continue up the lateral spinothalamic tract of the spinal cord to the thalamus, and from here to the cerebral cortex. As this stimulus passes through the brainstem, it may cause an interaction between the periaqueductal area of grey matter (PAG) and the raphe nucleus in the mid-brain. These nuclei form part of the descending pain suppression system and their descending neurons can release an endogenous opiate substance into the substantia gelatinosa at a spinal cord level. The chemical nature of this endogenous opiate, which may be β endorphin or encephalin, is such as to cause inhibition of transmission in the nociceptive circuit synapses. This is achieved by blocking the release of the chemical transmitter (substance P) in the pain circuit. Consequently, if physiotherapeutic agents are applied which cause stimuli to flow along nociceptive fibres, this effect could be achieved. C-fibres have a high threshold of excitement. The force of voltage required to activate C-fibres is many times higher than for A-fibres. Because the device generates a unique, high amplitude voltage impulse, it is expected that it is capable of stimulating small-diameter nerve fibres in general and the C-fibres in particular. The aim of biofeedback electro-stimulation is to activate the descending pain inhibitory pathways, by the release of β endorphins and encephalins and thus reduce pain at a spinal level.[28] Thus when the adhesive electrodes are applied with the RSI(repetitive strain injury) mode, the descending inhibitory pathways are activated and there is release of β endorphins and encephalins thus reducing pain. BEST consists of short duration pulses of high voltage amplitude (20-650 volts) and very low duty cycle. In order for pain to reduce via the opiate theory, the current should be high voltage, pulsed, high duration current. Descending pain–control pathways – the nociceptors can be highly activated without an individual experiencing pain. For example, when athletes or soldiers are injured or wounded but feel partially no pain in the heat of action. Neural pathways descend from the central structures of the nervous system and diminish the pain signals travelling up the ascending pathways from the body to the brain.

The probable mechanism by which the biofeedback electro-stimulation works is that it stimulates the body's natural release of nitric oxide, endorphins and neuropeptides into the blood stream. Nitric oxide causes vascular dilation and thereby increases blood circulation. Endorphins are the body's natural pain management chemicals. [16,17]. Neuropeptides are the body's regulatory elements that promote accelerated healing.[18]

No unwanted side effects have been experienced from or BEST treatment in over twenty years of use in Russia and Europe. The impulses sent by the device are similar to the body's own nerve impulses and are quite safe, even for children. The only absolute contraindication is for people with cardiac pacemakers.

In our study it was noted that though biofeedback electro-stimulation technology is more effective than sham biofeedback electro-stimulation technology, the improvement was reverted back in the one week retention period.

Scope of further study – Studies should be done to compare the effects of biofeedback electro–stimulation technology with burst TENS, acupuncture TENS and conventional TENS since the previous study was survey/ questionnaire based. Studies should be done to evaluate the effectiveness of biofeedback electro-stimulation technology on active myofascial trigger points.

CONCLUSION

CONCLUSION

- There was a statistically significant effectiveness noted by the application of biofeedback electro stimulation technology on upper trapezius latent myofascial trigger points on the pain pressure threshold, contralateral cervical lateral flexion, ipsilateral cervical rotation, and upper trapezius muscle length in young asymptomatic individuals.
- Biofeedback electro-stimulation technology is more effective than the placebo treatment group which did not show any statistically significant effectiveness on the pain pressure threshold, contralateral cervical lateral flexion; ipsilateral cervical rotation and upper trapezius muscle length on upper trapezius latent myofascial trigger points in young asymptomatic individuals.

REFERENCES

REFERENCES

1. Sharon M.H. Tsang, Grace P.Y. Szeto, Raymond Y.W. Lee. Normal kinematics of the neck: The interplay between the cervical and thoracic spines. Manual Therapy 18(2013)431-437
2. Siegfried Mense, David GS, muscle pain understanding its nature,diagnosis and treatment, Philadelphia: Lipincort Williams & Wilkins 2000
3. Jan Lucas Having, manual therapy physical therapy or continued care by a general practitioner for patients with neckpain. ARCT, Annals of internal medicine 2002;136:10:713-72.
4. Goran M. Hagg, The work overload on upper trapezius muscle European Journal of Applied Physiology. 2000 Oct; 83(2-3) : 159-165
5. Domnik Irnich, Roland Gautschi, Nicolas Behrens, Myofacial Trigger points Comprehensive Diagnosis and treatment. 2013 . Edition 1: 5-7
6. Gross Hander SL, Strtas NE, Toomey TC, Gray WF, Chronic neck and shoulder pain focussing on myofascial origins , Post grad Med 1985; 77:149-158
7. Simon D.G Travel, J & Simons L.S (1999); Myofacial pain And dysfunction: The trigger point manual – vol 1, Upper half of body, 2nd ed Baltimore: Williams and Wilkins
8. Pratt NE: Clinical Musculoskeletal Anatomy, Philadelphia, JB Lippincott, 1991. – management of common musculoskeletal disorders (4th edition) – kesler 135
9. Porterfield J, Derosa C: Mechanical Neck Pain: Perspectives in functional anatomy. Philadelphia, WB Saunders, 1995
10. Norkin CC, Levangie PK: Joint structure and function: A comprehensive analysis, 2nd edition, Philadelphia, FA Davis 1992. - management of common musculoskeletal disorders (4th edition) – kesler 135
11. Janda V: muscle & motor control in cervicogenic disorders: assessment and management. In: Grant R ed: physical therapy for cervical & thoracic spine, 2nd ed. Edinburgh, Churchill Living Stone, 1994: 195-216. management of common musculoskeletal disorders (4th edition) – kesler 135
12. Hsurb, Tse-Chioh, Cheng, Pao-tsai,Kuan, Ta-Shen,Hong: The immediate effectiveness of electrical nerve stimulation & electrical muscle stimulation in

Myofacial Trigger points. American Journal of Physical Medicine & Rehabilitation Nov/Dec 1997. Vol 76. Issue 6. Pp471-476

13. Joseph A Balogan, Oladehinde K. Aberecoje, Inter and Intratester Reliability of Measuring Neck Motions with Tape Measure and Myrin GRAVITY.- Reference goniometer, JOSPT, Jan 1989:248
14. Ohrbach R, Gale EN. Pain pressure thresholds in normal muscles: reliability, measurement effects and topographic differences. Pain 1989;37:257-63
15. Ohrbach R, Gale EN. Pain pressure thresholds, clinical assessment, anddifferential diagnosis: reliability and validity in patients with myofascial pain. Pain 1989;157-69
16. “Human bodies make their own morphine” Christine Dell’Amore, National Geographic news. Publishes April 26,2010
17. Anette Kjellgren,2003, The experience of floatation REST(restricted environmental stimulation technique), subjective stress and pain, Goteborg University Sweden, Kjellgren A Sundequist U et al.. “effects of floatation – REST on muscle tension pain” Pain Reseach and management 6940:181-9
18. Wolcott LE, Wheeler PC, Hardwicke HM and Rowley BA(1969). Accelerated healing of skin ulcer by electrotherapy: preliminary clinical results. Southern medical journal 62(7): 795-801. PMID 5306004.
19. Boecker h,Sprenger T, Spilker ME, Henriksen G, Koppenhoefer M, Wagner KJ, Valet M, Berthele A, Tolle TR(Feb 2008). The runner’s high: opioidergic mechanisms in the human brain. Cerebral cortex(new York, N.Y. : 1991) 18(11): 2523 – 31.
20. Johnson C (1999-06-04) acupuncture works on endorphins. News in science, ABC Science Online. Australian Broadcasting Corporation. Retrieved 2008 – 10-15
21. Reichmanis M,Marino AA and Becker RO (1975). Electrical correlates of acupuncture points. IEEE transactions on Biomedical Engineering @@ (Nov;22(6)): 533-5
22. Comparison of effectiveness of 2 different Extracorporeal Short wave Diathermy regimens in the treatment of patients with myofascial pain syndrome. Archives of Rheumatology.
23. Chuen-Ru Hou, Li-Chen et al. immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger point sensitivity. Archives of physical medicine and rehabilitation, October 2002, Vol.83(10): 1406-1414, doi: 10.1053
24. Rene Cailliet, M.D. Pain series. Neck & Arm. Edition – 3. Pg 2-3

25. Cesar Fernandes- de – las – Penas et al. Referred pain from myofascial trigger points in head and neck –shoulder muscles reproduces head pain features in children with chronic tension type headache. The Journal of Headache and Pain. February 2011, Vol 12, Issue 1, pp 35-43
26. Kisner AM, Sands WA, Stone MH. Reliability and validity of a pressure algometer. J Strength Cond Res. 2009 Jan,23(1); 312-4
27. Chang – Zern Hong, David G Simons. Pathophysiology and electrophysiologic mechanisms of myofascial trigger points. Arch Phys Med Rehabilitation. Vol 79,July 1998.
28. Tim Watson, electro-therapy evidence – based practice, 12th edition, transcutaneous electrical nerve stimulation, pg 255.
29. James R Friction, Ralf Siegert. Oral surgery, oral medicine, oral pathology December 1985 Vol 60(6th edition):615-623c
30. Rob Greive, Sue Barnett. The prevalence of latent myofascial trigger points and diagnostic criteria of the triceps surae and upper trapezius: a cross sectional study. Journal of Physiotherapy, December 2013, Vol.99(4): 278-284, doi:10.1016
31. Pathophysiologic and Electrophysiologic mechanisms of Myofascial Trigger Points.Archives of Physical and Medical Rehabilitation 1998;79:863-72 Hong C – Z, Simons DG