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Comparative Study of Percutaneous Electrical Nerve Stimulation versus Transcutaneous Electrical Nerve Stimulation on Trigger Points in Levator Scapulae Muscle.

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Keywords

PENS, TENS Myofascial Trigger Point, Range of Motion ,Pressure Algometer

Abstract

Myofascial pain syndrome can be defined as motor, sensory and autonomic symptoms that cause Myofascial trigger points (MTrP). These are hyperirritable areas in skeletal muscle associated with hypersensitive nodule in a taut band. Trigger Points causes shortening of muscles often compress adjacent nerves. This irritates the nerve and disturbs the signal transmission system of nerves. This leads to irregular sensations, causing numbness, tingling, and burning. Present study was undertaken to find out the effectiveness of Percutaneous Electrical Nerve Stimulation (PENS) Vs. Transcutaneous Electrical Nerve Stimulation (TENS) for treating MTrP. Experimental study was conducted with 60 participants fulfilling inclusion and exclusion criteria. Informed consent was taken from the subjects. PENS was administered in Group B and TENS therapy was administered to Group A for a period of 3 weeks, 3 sessions per week. Pre on Day 1 and post on Day 9th assessments were taken by using Pressure Algometer and Range of motion by Universal Goniometer . Vitamin C supplement was recommended prior to the treatment for patients who were treated with PENS for post needle soreness and rapid healing.The outcome of Pressure Algometer and ROM were statistically analyzed. It was found to be effective with P value<0.000.. There was significant decrease in pain recorded in Numerical Pain Rating Scale NPRS and increased in Pain Pressure threshold in patients treated in both the groups. Statistically both the Groups are competent enough to alleviate pain but clinically PENS showed better response in pain depletion and functional mobility compared to TENS .

1. Introduction

Pain syndrome of myofascial is perceived as sensory, motor and involuntary symptoms. Once compressed, associate in nursing MTrP might bring about to characteristics hurting, tenderness, motor dysfunction and involuntary development. It's going to decrease muscle flexibility, manufacture muscle weakness and deform interception. According to pathophysiology, new information about the neurophysiology of MTrP has been flourishing rapidly. Controversialist of MTrP is the need for efficient research investigations. Peripheral nociception and central sensitization are two recent notions of chronic Myofascial pain which interplay amongst each other. Simons had made the hypothesis that prolonged depolarization of post junction membrane and contracture, short sarcomere

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is the result of increased Ach release. Thus, extremely constricted sarcomere of motor endplate is known as "Contraction knot". Chronic sustained sarcomere shortening can lead to increase local energy intake, decrease local circulation of which gives combines effect of local ischemia and hypoxia.[2] Trigger Points have been studied and proved to be the most known cause of musculoskeletal pain. Health workers treating Pain have found nearly 75% of the time, Trigger Points are the main culprit of pain. Muscle tightness caused by Trigger Points weakens the muscle and puts stress on the points where the muscles attach to the bones. This often leads to pain in adjacent joints[3]

Transcutaneous Electrical Nerve Stimulation (TENS): Transcutaneous electrical nerve stimulation (TENS) is a therapeutic modality which uses low voltage electrical current to relief pain. A TENS unit consists of a battery-operated device that releases electrical impulses via electrodes placed on the surface of the skin. The electrodes are placed over or around the nerves where the pain is located or over trigger points.[4] . TENS is mostly used for the symptomatic treatment of acute and non-malignant chronic pain (Woolf and Thompson, 1994). TENS is also used in palliative care to treat pain caused by metastatic bone disease and neoplasm (Thompson and Filshie, 1993). It is also proposed that TENS has antiemetic and tissue-healing effects though it is less often used for such causes.[5] TENS also very effective in the treatment of neck pain. It alleviate pain in patient's spinal level by pain gate mechanism (Hayes et al 1993). Conventional TENS reduces pain through a spinal cord gating mechanism. It stimulates muscle by large diameter A beta and A Gamma fiber which closes the gate to nociceptive (pain) transmission at the spinal cord level via a presynaptic or postsynaptic inhibitory events (Melzack and Wall 1982). Conventional TENS is an approach which activates the larger diameter peripheral nerve fibers to neuromodulate pain via a spinal neurochemical gating mechanism (Howson 1978).[6]

Percutaneous Electrical Nerve Stimulation (PENS): PENS is a modified form of traditional acupuncture in which an electrical current is applied between pairs of acupuncture needles by using a device that controls the frequency and strength of the electrical current which was being delivered. At the time of a standard PENS session, many needle pairs can be stimulated simultaneously, usually for 10-20 minutes, but rarely exceeding thirty minutes.[7]PENS is an analgesic treatment modality where low frequency electrical currents are applied via needles inserted into the affected place. The analgesia is based on Melzack and Wall's Gate Control theory. It is relatively newer physiotherapeutic modality and a novel analgesic therapy used for pain relief. It is a combination of Dry Needling and TENS.[8]

2. Method:

Subjects were recruited after Ethical clearance from the Institution. The study included 60 subjects between the age of 20-40 yrs were assigned into two groups of 30 in each group by simple random method . Group A was treated with TENS and Group B was treated with PENS. All subjects were evaluated for pain by using Pressure Algometer, NPRS and Universal Goniometer. The outcome measures were assessed pretreatment on Day 1 and post treatment on Day 21. Vitamin C supplement was recommended prior to the treatment for patients who were treated with PENS for post needle soreness and rapid healin.The physiotherapy programme was conducted three times a week for three week, total of 9 sessions for 15 mins each .

Inclusion Criteria:

1) Both genders

2) Age 20 to 40 years

3) Presence of Levator Scapulae triggers points

Exclusion Criteria:

1. Patient having needle phobia
2. reluctant patient
3. Patient in anticoagulant therapy / thrombocytopenia
4. limb with lymphedema
5. Abnormal bleeding tendency
6. Compromised immune therapy
7. Diabetes
8. Epilepsy
9. Vascular disease
10. Infection
11. Pregnancy

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Interventions included following techniques:

1. **PENS(Group B) :**In this group, Patient treated with PENS therapy. Patient was in prone lying position with both the arm in abduction and head resting over the hand to relax the muscle that enables easy palpation of the muscle bulk. Head was in neutral position. The needle of 40-50mm was inserted. In this group along with the needle the electrical current was given with the help of alligator electrod

Figure 2- Patient Treated with PENS therapy.

2. **TENS (GROUP A)**: Patients were treated with TENS therapy.Patient was in sitting position with head rested on pillow. The trigger point in Levator Scapulae muscle was marked. Ellectrodes were applied over the triggger point in Levator Scapulae Muscle. Treatment was applied to the trigger point in Levator scapulae muscle with a frequency of 50 Hz lasted for 10 mins of duration.

Figure 4- Patient Treated with TENS

Tables and Graphs:

Table 1: Distribution of patients' Age

Age in years	TENS Group	PENS Group	Total

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21-30	27(90%)	30(100%)	57(95%)
31-40	3(10%)	0(0%)	3(5%)
Total	30(100%)	30(100%)	60(100%)
Mean ± SD	23.93±4.22	22.97±1.10	23.45±3.09

Samples are age matched with P=0.229, Student t test

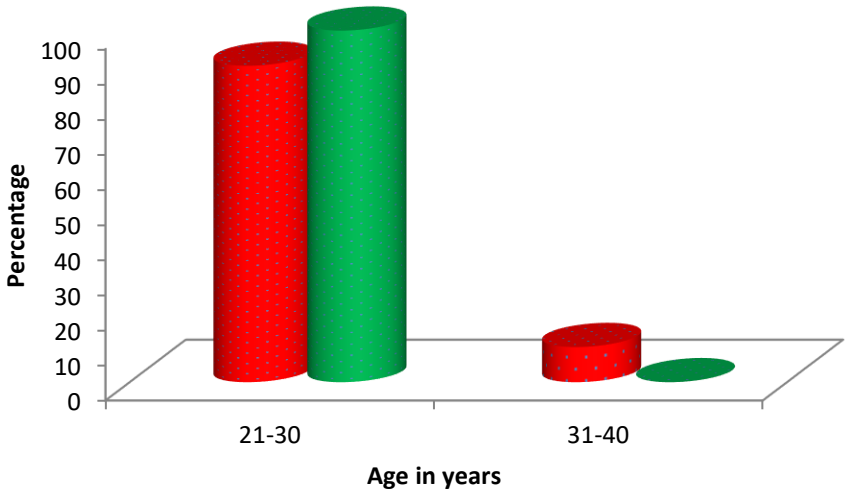

Table 2: Distribution of patients' gender studied

Gender	TENS Group	PENS Group	Total
Female	23(76.7%)	20(66.7%)	43(71.7%)
Male	7(23.3%)	10(33.3%)	17(28.3%)
Total	30(100%)	30(100%)	60(100%)

Simples are gender matched with P=0.390, Chi-Square test,

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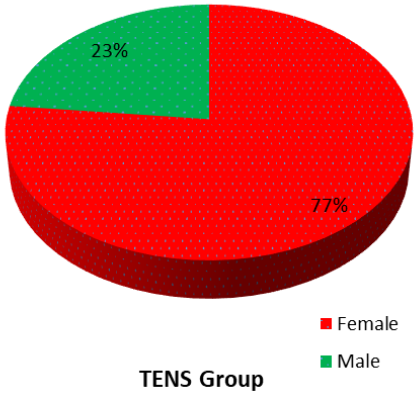

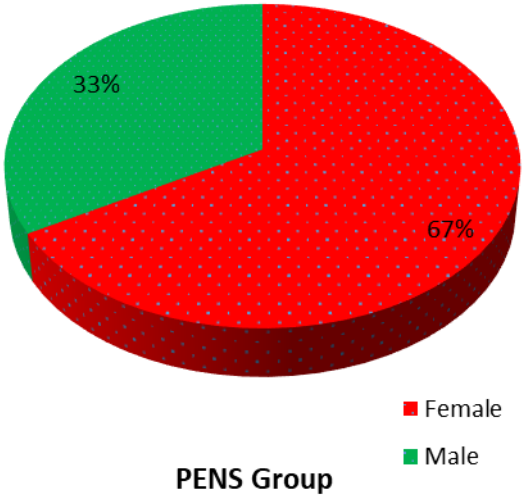

Table 3: Pressure Algometer (in Kgs): Comparative assessment in two groups studied

Pressure Algometer (in Kgs)	TENS Group	PENS Group	Total	P value
Pre on Day 1	1.35±0.32	1.42±0.32	1.38±0.32	0.401
Post on Day 9th	1.91±0.23	2.04±0.53	1.98±0.41	0.222
Difference	-0.567	-0.627	-0.597	-
P values	<0.001**	<0.001**	<0.001**	-

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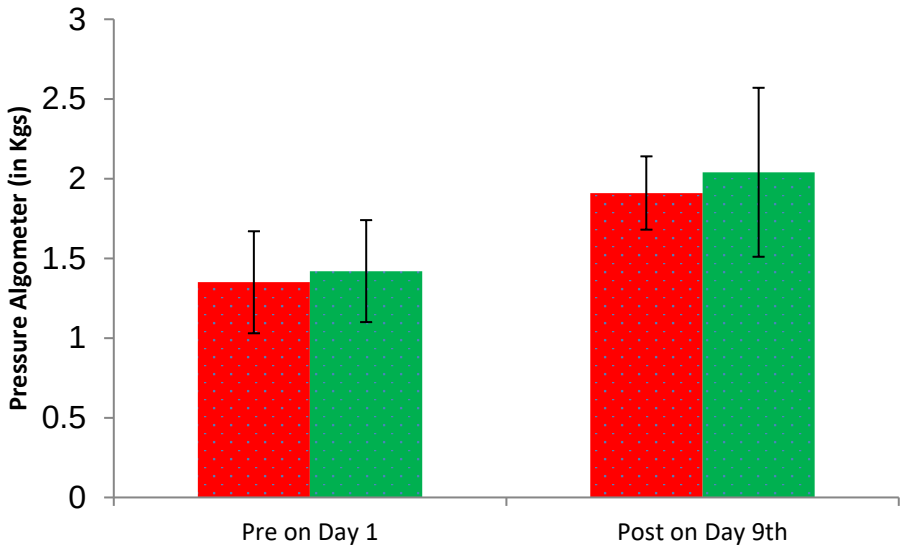

Table 4: Range of Motion (in degrees) - Comparative assessment in two groups studied.

Range of Motion (in degrees)	TENS Group	PENS Group	Total	P value
Flexion				
• Pre	43.13±4.60	40.30±4.31	41.72±4.64	0.017*
• Post	46.07±4.35	49.67±4.29	47.87±4.65	0.002**
• Difference	-2.933	-9.367	-6.150	-
• P value	<0.001**	<0.001**	<0.001**	-
Extension				
• Pre	47.80±3.08	44.77±3.02	46.28±3.39	<0.001**
• Post	48.07±3.00	51.17±3.37	49.62±3.53	<0.001**
• Difference	-0.267	-6.400	-3.333	-
• P value	0.003**	<0.001**	<0.001**	-
Lat. Flxn (L)				
• Pre	36.87±3.43	34.47±3.05	35.67±3.44	0.006**
• Post	39.30±1.51	41.80±1.56	40.55±1.98	<0.001**
• Difference	-2.433	-7.333	-4.883	-
• P value	<0.001**	<0.001**	<0.001**	-

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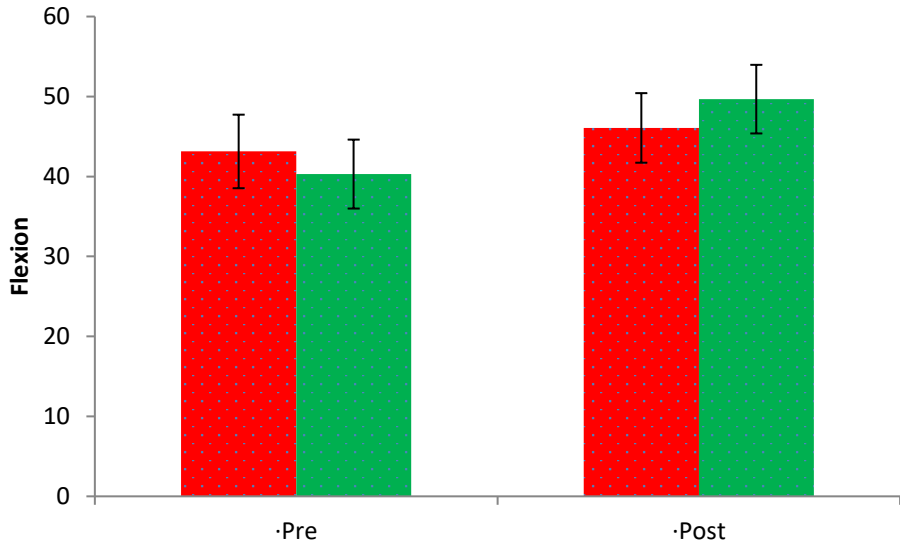
Lat. Flxn (R)				
• Pre	36.83±3.98	34.33±40.00	35.58±4.16	0.018*
• Post	38.87±2.10	42.00±2.38	40.43±2.73	<0.001**
• Difference	-2.033	-7.667	-4.850	-
• P value	0.001**	<0.001**	<0.001**	-
Rotation (L)				
• Pre	43.13±5.69	41.67±4.78	42.40±5.26	0.284
• Post	46.50±3.92	50.93±3.25	48.72±4.21	<0.001**
• Difference	-3.367	-9.267	-6.317	-
• P value	<0.001**	<0.001**	<0.001**	-
Rotation (R)				
• Pre	43.77±6.91	41.33±6.17	42.55±6.61	0.155
• Post	46.47±4.42	49.90±4.35	48.18±4.68	0.004**
• Difference	-2.700	-8.567	-5.633	-
• P value	<0.001**	<0.001**	<0.001**	-

4.A FOR FLEXION:



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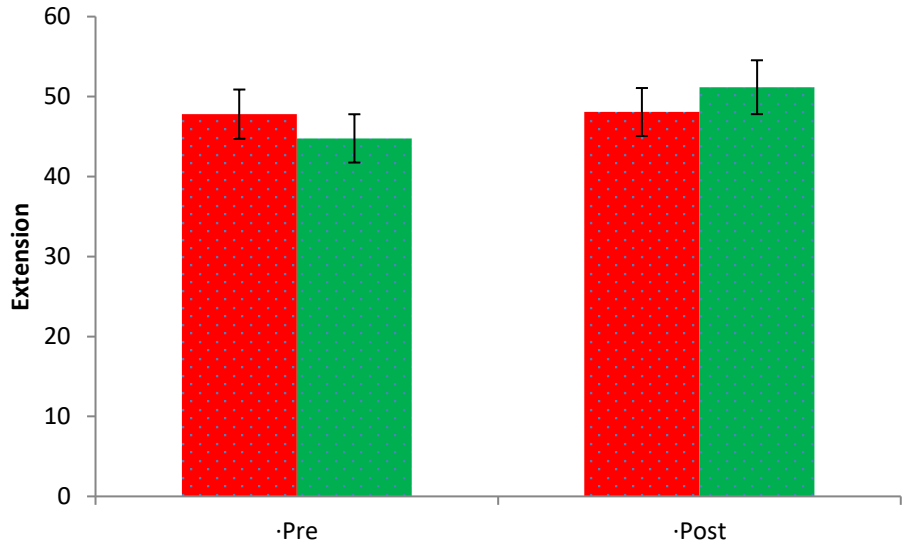
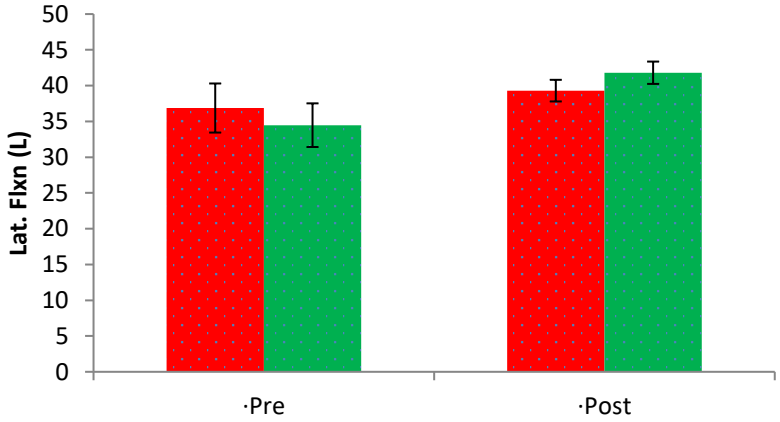
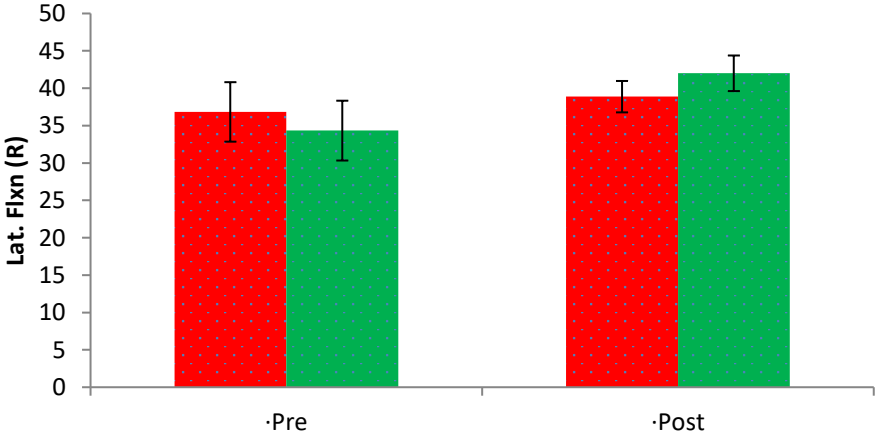
4.B FOR EXTENSION:



4. C FOR LATERAL FLEXION (LEFT):



4. D FOR LATERAL FLEXION (RIGHT):



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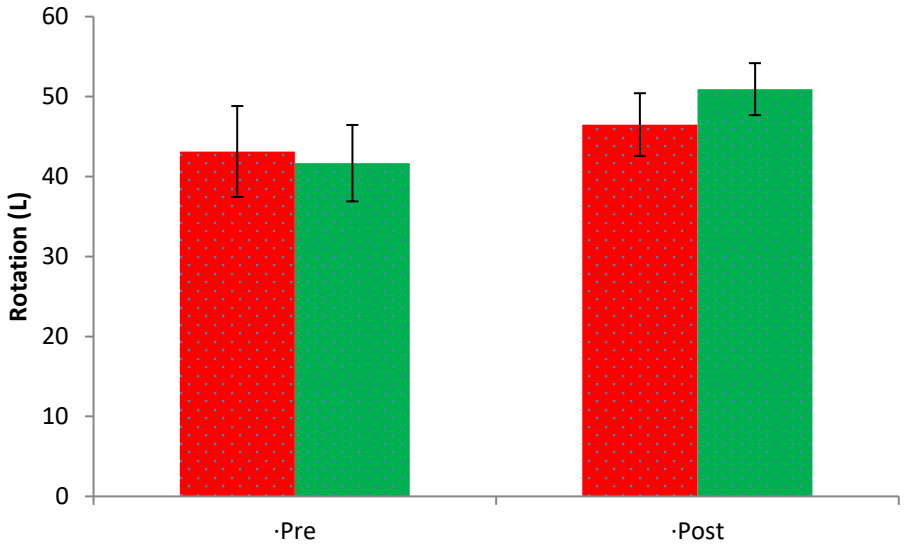
4. E FOR ROTATION (LEFT):



4. F FOR ROTATION (RIGHT):

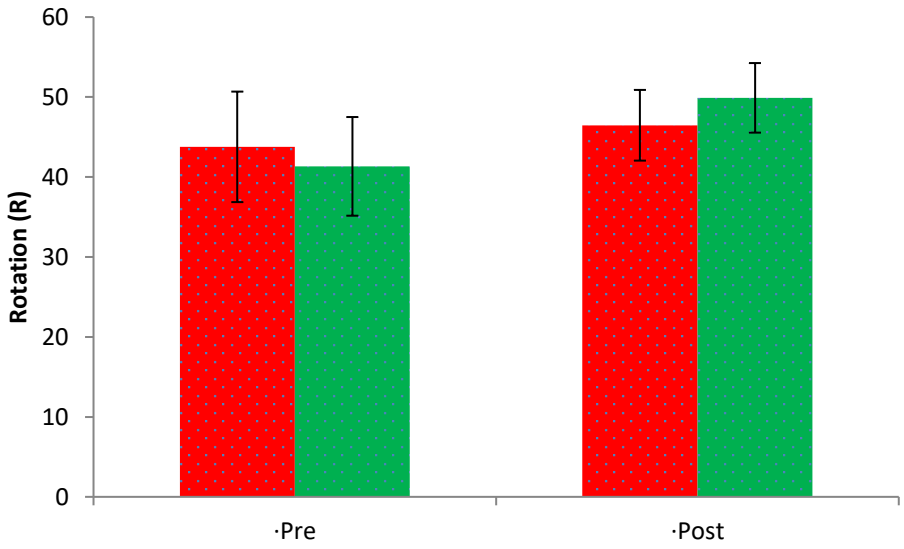


Table 5: NPRS- Distribution in two groups of patients studied

NPRS	Pre	Post	% difference
Tens Group (n=30)			
• 0	0(0%)	3(10%)	10.0%
• 1-3	0(0%)	26(86.7%)	86.7%
• 4-6	14(46.7%)	1(3.3%)	-43.4%

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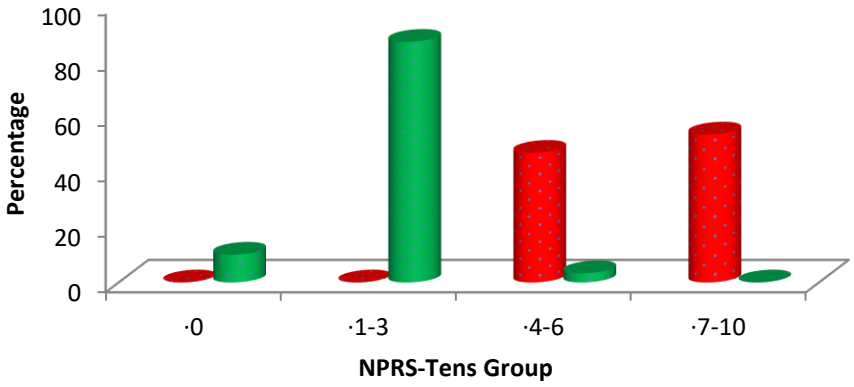
• 7-10	16(53.3%)	0(0%)	-53.3%
Pens Group (n=30)			
• 0	0(0%)	2(6.7%)	6.7%
• 1-3	0(0%)	28(93.3%)	93.3%
• 4-6	9(30%)	0(0%)	-30.0%
• 7-10	21(70%)	0(0%)	-70.0%
P value	0.288	0.671	

Chi-Square/Fisher Exact Test

FOR TENS:



FOR PENS:

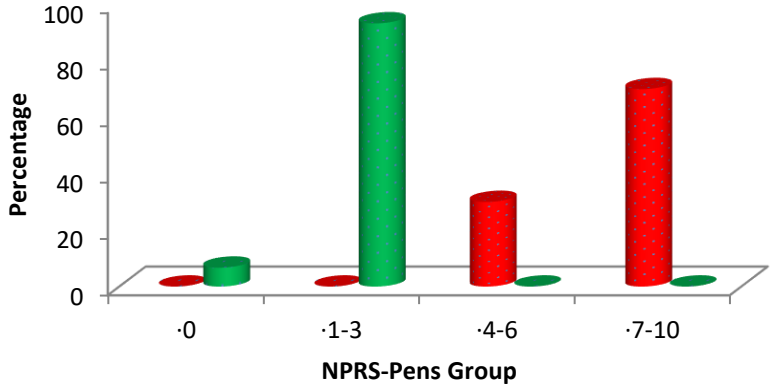


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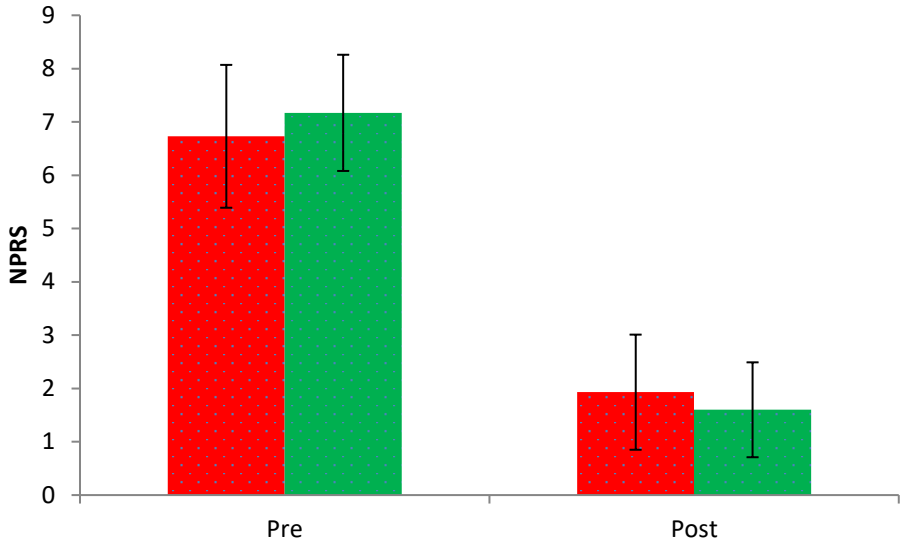
Table 6: NPRS- Comparative assessment in two groups studied

NPRS	TENS Group	PENS Group	Total	P value
Pre	6.73±1.34	7.17±1.09	6.95±1.23	0.173
Post	1.93±1.08	1.60±0.89	1.77±1.00	0.198
Difference	4.800	5.567	5.183	-
P value	<0.001**	<0.001**	<0.001**	-



3. RESULT:

1. Table 1 Graph 1- Represents Age distribution of patients in the study. 21 years to 30 years age group were of 90% in Group A (TENS) and 100% in Group B (PENS) whereas 31 years to 40 years were 10% and 0% respectively in both the Groups.
2. Table 2 Graph 2 – Represents Gender distribution of patients in the study. In Group A (TENS) 76.3% female and 23.3% male were affected where as in Group B (PENS) 66.7% female and 33.3% male were affected.
3. Table 3 Graph 3- Pain thresholds was assessed by Pressure Algometer on Day 1 Pre-treatment and Day 9th post treatment. The mean difference in Group A (TENS) shows -0.567 and Group B treated with PENS shows better improvement by -0.627 and proves p value strongly significant.
   The graph shows better improvement in Group B where the pain threshold increases to 2.5kgs where in Group A shows improvement of 1.7 kgs
4. Table 4.A and Graph 4.A- Flexion Range of Motion was assessed by Goniometer on Day 1 pre-treatment and on Day 9th post treatment. The mean difference in Group A (TENS) shows -2.933 and Group B treated with PENS shows better improvement by -6.150 and proves p values strongly significant.
   The Graph shows better improvement in Group B where Range of Motion in Group B increases to 50° where in Group B shows improvement of 40°.

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5. Table 4.B and Graph 4.B – Extension Range of Motion was assessed by Goniometer on Day 1 pre-treatment and on Day 9th post treatment. The mean difference in Group A (TENS) shows -2.67 and Group B treated with PENS shows better improvement by -6.400 and proves p values strongly significant.
   The graph shows better improvement in Group B where extension ROM increase to 55° where in Group A shows improvement of 45°.
6. Table 4.C and Graph 4.C – Lateral flexion (left) Range of motion was assessed by Goniometer on Day 1 pre-treatment and Day 9th post treatment. The mean difference in Group A (TENS) shows -2.433 and Group B treated with PENS shows better improvement by -7.333 and proves p value strongly significant.
   The graph shows better improvement in Group B where ROM increase to 45° where in Group A shows improvement of 35°.
7. Table 4.D and Graph 4.D- Lateral flexion (Right) ROM was assessed by Goniometer on Day 1 pre-treatment and On Day 9th post treatment. The mean difference in Group A (TENS) was -2.033 and Group B treated with PENS shows better improvement by -7.667 and proves p value strongly significant.
   The Graph shows better improvement in Group B ROM increase to 45° where in Group A shows improvement of 40°.
8. Table 4.E and Graph 4.E- Rotation (Left) ROM was assessed by Goniometer on Day 1 pre-treatment and on Day 9th post treatment. The mean difference in Group A was -3.367 and Group B treated with PENS shows better improvement by -9.267 and proves p value strongly significant.
   The Graph shows better improvement in Group B ROM increases to 55° where in Group A shows improvement of 50°.
9. Table 4.F and Graph 4.F – Rotation (Right) ROM was assessed by Goniometer on Day 1 pre-treatment and on Day 9th post treatment. The mean difference in Group A was -2.700 and Group B treated with PENS shows improvement by -8.567 and proves p values strongly significant.
   The Graph shows better improvement in Group B shows ROM increases to 55° where in Group A shows improvement of 45°.
10. Table 5.A Graph 5.A Represent improvement in patient's pain post treatment in NPRS scale after treating with TENS, 86.7% pain improvement in 1 to 3 range of the scale was noted.
11. Table 5.B Graph 5.B – Represent improvement in patient's pain post treatment in NPRS scale after treating with PENS. 93.3% pain improvement in 1 to 3 ranges of scale was noted.
12. Table 6 Graph 6- NPRS was assessed on Day 1 pre-treatment and on Day 9th post treatment. The mean difference in Group A (TENS) was 4.800 and Group B treated with PENS shows better improvement by 5.567 and proves p value strongly significant.
    The Graph shows better improvement in Group B NPRS decreased to 2.5 where in Group A shows improvement of 8.5.

4. DISCUSSION

Trigger point is a dysfunction which occurs at the point when nerve enters a muscle. Trigger point can develop after an initial injury to muscle fibre. The trigger point leads to pain and stress in the muscle or muscle fibre. It is hyperirritable area in skeletal muscle which is associated with hypersensitive palpable nodule in taught band. Muscle stretch or muscle contraction affected by trigger point leads to intense pain and the body tries to protect itself known as splinting or guarding. The purpose of the study was to compare the TENS and PENS in treatment of Levator Scapulae trigger point in reducing pain and improving cervical ROM. In this study Group B i.e. patient treated with PENS shows better improvement than Group A i.e. patient treated with TENS. Both the groups showed improvement in treating trigger point in Levator scapulae muscle, but Group B showed better improvement than.TENS . TENS and PENS both given at a frequency of 4 Hz for 15 mins showed better improvement on pain alleviation and increase in cervical ROM. TENS therapy t uses electrodes on small, electrodes attached via wires to a battery-operated device. The electrodes are placed over the painful area, and current is passed through the electrodes, stimulating the sensory nerves and creating a tingling sensation which in turn decreases the feeling of pain. Percutaneous electrical nerve stimulation is an analgesic treatment in which low frequency electrical currents are applied through needles inserted into the affected areas. It consists in nerve

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stimulation at the level of the dermatomes corresponding to the area affected by pain . It is relatively newer physiotherapeutic modality and a novel analgesic therapy used for pain relief. It is a combination of Dry Needling and TEN. Yet, when TENS was applied to the area of the trigger point, because of the size of pad of electrode the current spread over the fascia. While in PENS, it is the combined effect of Dry needle with the electrical stimulation. When the needle was inserted it was focused on the trigger point rather than fascia as compared to TENS. Injury caused by needling produces rapid local vasodilatation and increased capillary permeability thus helping in healing and analgesia. Injury potentials are created and can persist and provide stimulation for days until the miniature wound heals. This stimulation leads to production of prostaglandins which increase vascular permeability. Mast cell damage causes the release of histamine and heparin leading to vasodilatation. Pain is alleviated due to improvement in perfusion and relief of muscle spasm causes by local effects of needling and somatovisceral reflexes.[9]

Thus, it can be the reason for PENS to be more effective than TENS in improving ROM and reducing pain in patients with Levator scapulae trigger point.

5. CONCLUSION

Thus, from the above study it can be concluded that both TENS and PENS are effective in increasing Range of Motion and decreasing pain in the management of Active Myofascial trigger point. But Clinically PENS was found to be more effective than TENS in improving Rang of Motion and pain relief.

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