



**EFFECTIVENESS OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION
AND LOW-LEVEL LASER THERAPY ON HEMIPLEGIC SHOULDER PAIN: A
COMPARATIVE STUDY**

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ABSTRACT

Introduction: Hemiplegic shoulder pain is present at rest, during passive or active movement on the hemiplegic side after stroke with no direct relation to trauma or injury. It affects daily activities, poor recovery of arm function, quality of life and can increase duration of hospitalization. Muscle weakness after stroke is believed to be a primary reason for hemiplegic shoulder pain other factors such as subluxation, weakness in the rotator cuff muscles or tear, rotator cuff and deltoid tendinopathy and bicipital and supraspinatus tendon tenderness. Transcutaneous electrical nerve stimulation (TENS) is used in patients with hemiplegic shoulder pain and found remarkable reduction of pain and improved range of motion. Low level LASER therapy (LLLT) has been shown to reduce inflammation, edema, induce analgesia, and promote healing in a range of musculoskeletal pathologies. The effect is photochemical not thermal, the light triggers biochemical changes within the cells which can promote healing and fibroblastic stimulation and can enhance recovery of structural pathologies in hemiplegic shoulder pain. **Aim and objective:** aim of the study is to compare the effectiveness of transcutaneous electrical nerve stimulation and low-level LASER therapy on pain, disability and upper limb function in subjects with hemiplegic shoulder pain. **Methods:** 66 subjects who were diagnosed with hemiplegic shoulder pain were selected from the outpatient department of GSL Medical College and General Hospital, Rajahmahendravaram. The study was conducted during the period between July 2020 and June 2021. Prospective Study Design. Four times a week for four weeks. **Results:** all 66 subjects completed the entire study program as defined by 4week in the outpatient department basis. To observe the intervention impact before and after the intervention in the groups, analysis is carried out by using paired t-test. **Conclusion:** Transcutaneous electrical nerve stimulation is effective in reducing pain, disability and upper limb function in hemiplegic shoulder pain however low-level LASER therapy is more effective when compared with transcutaneous electrical nerve stimulation.

KEYWORDS: Stroke, Hemiplegic Shoulder Pain, Low Level LASER Therapy, SPADI and FMA-UE.

INTRODUCTION

Hemiplegic Shoulder Pain (HSP) is one of the most common complications after Hemiplegia, with an Incidence rate range from 34% to 84% and 75% of patients complain of pain at some point of time in the first 12 months following Stroke.^[1] Hemiplegic Shoulder Pain has repercussions on motor Rehabilitation and the Psychological equilibrium of the patient makes it more redoubtable.^[2]

Hemiplegic Shoulder Pain is usually diagnosed based on subject, medical history and clinical symptoms found in routine physical examination, because of poor specificity and sensitivity it is difficult to precisely localize and determine the exact location and extent of the injury that caused the pain.^[3] Musculoskeletal ultrasound and magnetic resonance imaging are used to diagnose the

lesion of the soft tissue damage in Hemiplegic Shoulder.^[4]

Hemiplegic shoulder pain delay Rehabilitation and functional independence, as the painful joint may hinder improvement of motor function.^[5] Studies reported that shoulder muscles cannot contract effectively against gravity and external forces during movement, the humeral head can't be held in a proper position, soft tissue around the shoulder may gradually stretched and torn, resulting in Hemiplegic Shoulder Pain.^[6] Hemiplegic Shoulder Pain is associated with reduced pinch grip and shoulder shrug strength, with abnormal muscle tone, but most importantly with sensory inattention and sensory loss.^[7] Subjects with Hemiplegic shoulder pain lose mobility around the shoulder.

RATIONAL OF STUDY

Numerous interventions have been suggested for management of Hemiplegic shoulder pain such as oral medications and Physiotherapy but Transcutaneous Electrical Nerve Stimulation and Low-Level LASER Therapy are said to be effective individually in treatment of Hemiplegic Shoulder Pain. Finding a right modality for the management of shoulder pain in stroke subjects reduces length of hospital stay and promotes recovery of upper limb function among Stroke survivors. This study compares between the effectiveness Transcutaneous Electrical Nerve Stimulation and Low-Level LASER Therapy on Pain, Disability and Upper Limb Function in hemiplegic shoulder pain.

AIM AND OBJECTIVE

Aim of the study was to compare the effectiveness of Transcutaneous Electrical Nerve Stimulation and Low-Level LASER Therapy in treatment of Hemiplegic Shoulder Pain. The main objective of the study is to determine the effect of transcutaneous electrical nerve stimulation and low level LASER therapy on pain, disability and upper limb function.

METHODOLOGY

A Prospective study Design was conducted during the period between July 2020 and June 2021 (1 year) 4 sessions a week for 4 weeks. 70 subjects who were diagnosed with hemiplegic shoulder pain were selected from the Out Patient Department of Physiotherapy, GSL Medical College and General Hospital, Rajahmahendravaram. A total of 66 subjects met the inclusion criteria and were taken by Simple Random Sampling. All the subjects were explained the purpose of the study and given the subject information sheet. The participants were requested to provide their consent for participation in the study. All the participants' signed the informed consent. All the eligible participants were randomized into two groups Low Level LASER Therapy and Transcutaneous Electrical Nerve Stimulation.

Data analysis

All Statistical analysis was done by using SPSS version 21.0 version for this purpose the data was entered into Microsoft Excel 2007. Descriptive statistical data was presented in the form of mean \pm standard deviation and mean differences and percentages were calculated and graphical representation. Within the groups Paired student "t" test was performed to assess the statistical difference within the groups for SPADI for shoulder pain, disability and FMA-UE for function. Between the Groups Independent students t-test was performed to assess the statistical significant difference in mean value between the groups for SPADI for shoulder pain, disability and FMA-UE for function of arm.

Ethical clearance

Ethical clearance taken from Ethical Committee of GSL Medical College & General Hospital Rajahmundry and informed consent was taken from the study subjects

before doing the study.

Conflict of interest No conflict of interest.

Funding No external funding was done for this study.

RESULTS

Protocol For group A

LOW LEVEL LASER THERAPY (LLLT)

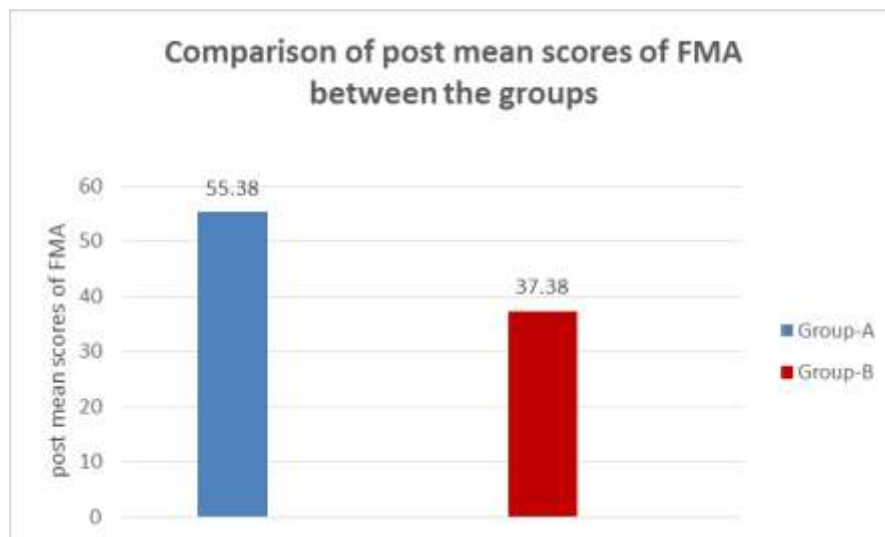
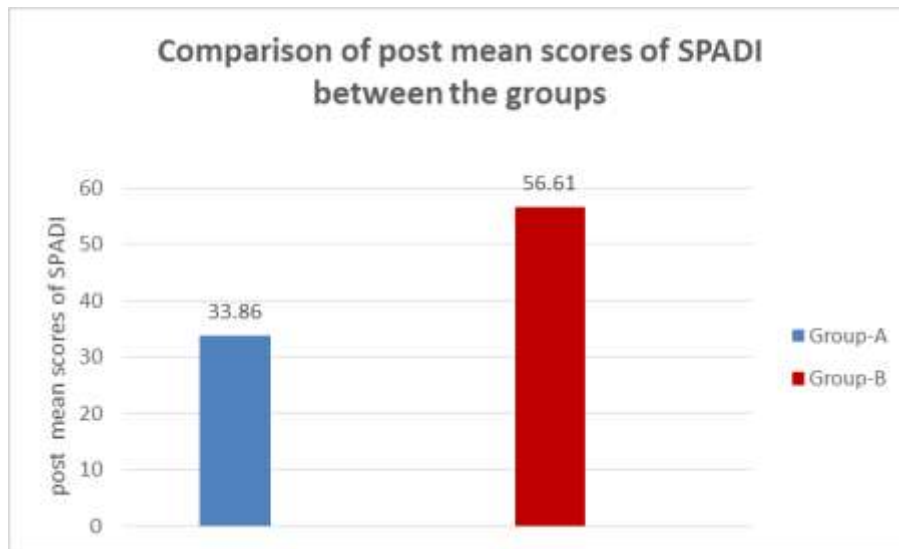
The subjects were required to sit on a chair in a comfortable position; the Low-Level LASER Therapy was applied around the affected shoulder. The device was a GA-AI-AS LASER with a wavelength 810nm and 30mW of power. The duration of the treatment point is 3J and the total dose per session is 15J, which are the most painful points on the shoulder joint found in clinical examination. The LASER was held perpendicular to the body surface with contact to skin without pressure. Wearing appropriate spectacles will protect the eyes against the LASER beam. The treatment lasted for 4 times a week for 4 weeks each treatment session lasted for 20minutes.

Protocol for group B

TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS)

Transcutaneous Electrical Nerve Stimulation with a frequency of 100Hz and pulse width 100 μ s used and the surface electrodes were placed near the motor points of the Supraspinatus and medial and posterior bundle of deltoid. The studies postulated that Supraspinatus and deltoid of shoulder coordinated to stabilize the Humerus in the Glenoid Fossa therefore stimulation of These muscles contribute to activation of both muscles. The amplitude was adjusted to cause minimal discomfort without any discernible muscle contraction.

Each treatment session of Transcutaneous Electrical Nerve Stimulation (TENS) lasted for 20 minutes. After the completion of each session of intervention both the groups were given conventional physiotherapy which includes Sensorimotor Training, Manual Therapy, Stretching, Muscular Strengthening And Patient Education. The subjects attended 16 physiotherapy sessions in 4 weeks, 4 sessions a week, 30 minutes per every session.



GROUP-A LOW LEVEL LASER THERAPY (LLLT)

S.no	SPADI		FMA-UE	
	PRE	POST	PRE	POST
1.	70	30	30	60
2.	60	30	28	54
3.	75	34	30	60
4.	48	20	20	30
5.	82	40	33	55
6.	64	32	30	60
7.	53	30	30	60
8.	68	33	30	58
9.	85	50	30	54
10.	78	48	30	60
11.	57	24	27	57
12.	72	36	28	46
13.	89	46	30	60
14.	55	30	35	55
15.	63	28	28	60
16.	76	37	40	58
17.	81	40	30	54
18.	45	30	30	60
19.	72	38	38	58

20.	58	30	29	56
21.	68	31	30	54
22.	77	31	30	58
23.	86	39	33	60
24.	61	24	50	40
25.	92	31	23	53
26.	56	22	30	60
27.	71	42	34	56
28.	88	40	31	53
29.	90	40	28	42
30.	54	30	30	60

GROUP-B TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS)

S.no	SPADI		FMA-UE	
	PRE	POST	PRE	POST
1.	63	58	32	40
2.	74	68	30	38
3.	58	48	33	40
4.	68	65	26	32
5.	68	60	31	39
6.	58	55	34	45
7.	82	68	30	35
8.	66	58	26	32
9.	75	60	24	30
10.	54	48	30	38
11.	62	60	28	37
12.	72	65	32	41
13.	48	45	30	38
14.	67	60	28	35
15.	71	64	31	40
16.	56	54	34	40
17.	73	65	28	33
18.	64	55	22	35
19.	50	45	30	47
20.	65	58	33	42
21.	57	50	36	45
22.	70	65	30	40
23.	66	60	35	42
24.	53	46	20	28
25.	86	63	32	40
26.	48	44	24	35
27.	85	60	33	40
28.	58	50	27	35
29.	68	62	30	40
30.	53	46	20	28
31.	58	50	22	29

DISCUSSION

The present study determined to compare the effectiveness of Transcutaneous Electrical Nerve Stimulation and Low-Level LASER Therapy in treatment on Hemiplegic Shoulder Pain. In this study Subjects were assessed for shoulder Pain and upper limb function at the baseline and at the end of the intervention using SPADI for shoulder pain, disability and FMA-UE for the upper limb motor function.

TENS is a feasible unit for treatment of pain it is a non-opioid modality for treating pain it provides low dose electrical current which stimulate vibration receptors when applied on painful area it reduces the transmission of pain stimuli to the brain which increases the secretions of endogenous endorphins, reducing pain, as such useful in management of both acute and chronic pain.

According to Gross AR et al, Low Level LASER Therapy produces a better pain relief and accelerates healing. The mechanisms by which LASER produce

analgesic effects are thought to be release of endogenous opioids, elevating pain thresholds and modifying the release of noxious mediators like bradykinin and histamine, pain modulation through changes in nerve conduction velocity.^[33] In the healing process LASER acts through anti-inflammatory effects in reducing prostaglandin levels which helps in reducing edema, swelling, and inflammation around the structures and repair the damaged tissue.^[34]

In present study both (Group-A) low level LASER therapy and (Group-B) TENS showed statically significant difference within the group from pre-test to post-test values ($P < 0.000^*$) on reducing Pain, Disability and upper limb function in subjects with Hemiplegic Shoulder Pain. Thus, low level LASER was better than TENS for reducing hemiplegic shoulder pain.

So, this suggests that LLLT and TENS are effective in reducing Hemiplegic Shoulder Pain. LLLT causes biomechanical changes within the cell and cellular photoreceptors triggers chemical changes, it is based on stimulation emission of radiation, and this effectiveness might contribute to the reduction of pain and enhance upper limb function.

CONCLUSION

The present study concludes that after four weeks of Interventions both groups (TENS & LLLT) can effectively improve hemiplegic shoulder pain. However Low-Level LASER Therapy is superior compared to Transcutaneous Electrical Nerve Stimulation on improving SPADI and FMA-UE hence Low Level LASER Therapy is a useful adjunct treatment in Hemiplegic Shoulder Pain.

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