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Comparison of Two Different Photobiostimulation on Pain and Functional Ability in Patients with Myofascial Trigger Points (Levator Scapulae Muscle)

Dheeraj Lamba*

Associate Professor, Department of Physiotherapy, Institute of Health, Jimma University, Jimma, Ethiopia, Africa

**Corresponding e-mail: dheeraj.lamba@gmail.com*

ABSTRACT

Objective: *Myofascial trigger point (MTP) is a characteristic of myofascial pain syndrome (MPS) which is the most common muscle pain disorder. Myofascial pain syndrome is pain arising from one or more trigger points (TP) which are hyperirritable spots in skeletal muscle that are associated with a hypersensitive palpable nodule in taut bands. Aim of the present study is to compare the effectiveness of 780 nm Ga-Al-As LLLT and 904 nm Gallium Arsenide laser therapy on a trigger point in the levator scapulae muscle.* ***Methods:*** *Total of 50 subjects were selected on the basis of the inclusion and exclusion criteria and were recruited randomly to the 3 groups (A, B, C). Group A (experimental group) received 780 nm low-level laser therapy and stretching exercises. Group B (experimental group) received 904 nm low-level laser therapy and stretching exercises. Group C (controlled group) received only stretching exercises.* ***Results:*** *No significant difference in VAS and NDI from 0 to 2nd week in all the 3 groups i.e. Group A, B, and C indicating that rate of improvement in all the 3 groups was the same.* ***Conclusion:*** *Present study does not conclude that stretching is an effective intervention as a significant difference in the rate of improvement was found in the group which received Ga-As laser with stretching. Since the duration over which accumulation of rate of improvement took place was small thus it could not produce any significant difference overall at the end. Hence Ga-As LLLT can be used in adjunct with stretching exercises as cost-effective conservative treatment of MTP in levator scapulae muscle.*

Keywords: Photobiostimulations, Levator scapulae muscle, Therapy

Abbreviations: MTP: Myofascial Trigger Point; MPS: Myofascial Pain Syndrome; TP: Trigger Point; LLLT: Low-Level Laser Therapy; FFI: Foot Function Index; VAS: Visual Analogue Scale

INTRODUCTION

A myofascial trigger point (MTP) is a characteristic of myofascial pain syndrome (MPS) which is the most common muscle pain disorder [1]. MPS is pain arising from one or more trigger points (TP) which are hyperirritable spots in skeletal muscle that are associated with a hypersensitive palpable nodule in taut bands. The spots are painful on compression and can give rise to characteristic referred pain, tenderness, motor dysfunction and autonomic phenomena [2]. Trigger points can arise in virtually any muscle group however the trapezius muscle appears to be the most frequently cited in clinical settings [3]. Four muscles trapezius, levator scapulae, infraspinatus, and scalenus account for 84.7% of TP. Out of these muscles, levator scapulae constitute 19.7% of TP. Common treatments consist of drugs, non-steroidal anti-inflammatory drugs (NSAID) and epidural injection [4-6]. Various physical modalities include intermittent cold and stretch, thermotherapy, massage therapy, post-isometric relaxation, dry needling, trigger point injections, ischemic compression, TENS, ultrasound, and laser and elimination of causative factors [5,6]. Currently used treatments include complementary methods of which Low-level laser therapy (LLLT) is one of the most common methods [4,6] (Figure 1).

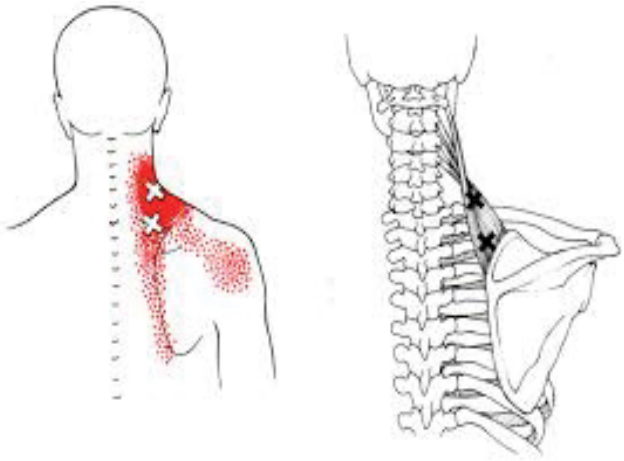

Figure 1 Levator scapulae trigger points

Aim of the Study

To compare the effectiveness of 780 nm Ga-Al-As LLLT and 904 nm gallium arsenide laser therapy on a trigger point in the levator scapulae muscle.

MATERIALS AND METHODS

This section contains information about the subjects, their mode of recruitment, instruments and the procedure used for this study.

Study Design

The experimental study design was used.

Study Set-up

Subjects were recruited from the Outpatient Department of Orthopaedic and Outpatient Department of Physiotherapy, Jimma University Medical Centre, Jimma, Ethiopia, Africa.

Sampling Method

Random sampling method was used.

Study Population

Total of 45 subjects (22 males, 23 female) with myofascial pain in the levator scapulae muscle participated in the study.

Inclusion Criteria

The following criteria were included in the study:

- Both male and female
- Age group 20-50 years
- Palpable taut band in the levator scapulae muscle
- An active trigger point in the levator scapulae

Exclusion Criteria

The following criteria were excluded from the study:

- Fibromyalgia
- Neoplasia

- Neck or shoulder surgery in the past year
- History of disc disease
- Degenerative joint disease
- Fracture or dislocation in the cervical vertebrae
- Cardiac conditions
- Congenital anomalies
- Neurological deficit
- Upper limb amputations
- Diabetic neuropathy
- Systemic disorders such as tuberculosis of the spine or rheumatoid arthritis

Instrumentation

- 780 nm Class 3 B, Ga-Al-As LLLT
- 904 nm Class 3 B, Ga- As LLLT

Outcome Measures

- Visual Analog Scale (VAS)
- Neck Disability Index (NDI)

V.A.S: Visual analogue scale (VAS) has been shown to be an effective and reliable instrument for measuring patient's subjective interpretation of pain. Pain intensity has been measured by subjects using a 0-10 cm scale, in which 0 indicates no pain and 10 indicates the worst pain. VAS provided a reliable, responsive measurement and was easily understood by patients [7].

N.D.I: Neck disability index (NDI) is a questionnaire designed to give information as to how subject neck pain has affected his ability to manage in everyday life. For each section, the total possible score was 5 if the first statement is marked the section score is 0 if the last statement is marked score is 5. If all 10 sections are completed the score is calculated over 50. If any section is missed or not applicable the score is calculated over 45 [8].

Protocol

Based on the inclusion and exclusion criteria, subjects were included in the study and were randomly allocated to 3 groups (A, B, and C). Group A (experimental group) received 780 nm low-level laser therapy and stretching exercises. Group B (experimental group) received 904 nm low-level laser therapy and stretching exercises. Group C (controlled group) received only stretching exercises.

Procedure

Before starting the treatment, the patient's levator scapulae muscle was palpated for the trigger point with the help of pincher grip and flat palpation L.T.R. and jump sign were recorded. In subjects having more than one active trigger point the most hypersensitive point was selected and marked by using a permanent marker. The patients filled the VAS and NDI scale on the 0, 5^{th} and 10^{th} day respectively to check the level of improvement. The approach to develop optimal parameters and dosage has been adopted by the World Association of Laser Therapy (WALT) in their recommendations for treating musculoskeletal disorders with LLLT (www.walt.nu) (Figure 2) [9].

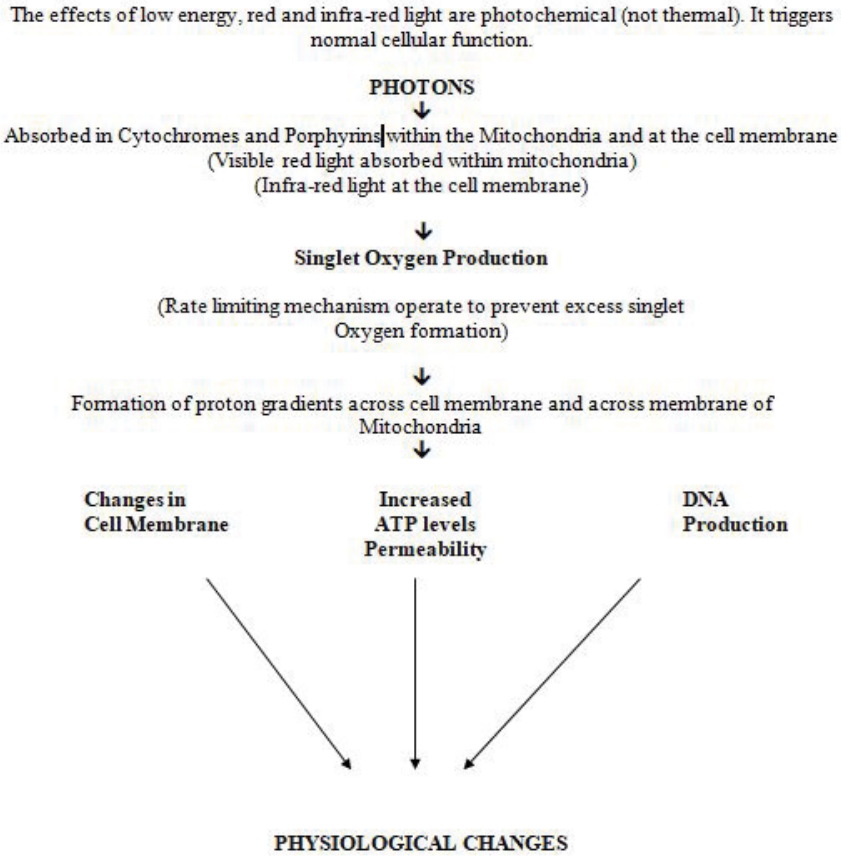

Figure 2 Mechanism of laser

Group A (Experimental Group)

All patients in this group received 780 nm Ga-Al-As low-level laser therapy followed by stretching exercises of levator scapulae muscle. The patient was positioned in prone lying to obscure viewing of laser with the probe in direct contact with the skin at a right angle. The muscle was irradiated with a continuous wave 780 nm laser; therapy which consisted of 2 minutes of irradiation having a mean output of 100 mW and energy density of 10 J/cm^2. The treatment was given daily for 10 days over a period of 2-weeks followed by stretching exercises. To perform the levator scapulae stretching, the patient was instructed to place his left hand behind his head and gently pull it at an angle towards his knees. All the 3 groups were instructed to hold the assigned stretch for 10 seconds and repeat 10 times. The patient was instructed to follow the assigned protocol 3 times per day.

Group B (Experimental Group)

All the patients in this group received 904 nm Ga-As low-level laser therapy followed by stretching exercises for the levator scapulae muscle in the similar way as Group A. The patient was positioned in prone lying to obscure viewing of laser with the probe in direct contact with the skin at a right angle. The muscle was irradiated with a continuous wave 904 nm laser; therapy which consisted of 2 minutes of irradiation having mean output less than 5 mW and energy density of 5 J/cm^2. The treatment was given daily for 10 days over a period of 2-weeks followed by stretching exercises. Stretching exercises for the levator scapulae muscle was given in a similar way as for Group A (Figure 3).

Group C (Controlled Group)

All subjects received stretching exercises for the levator scapulae muscle as described above.

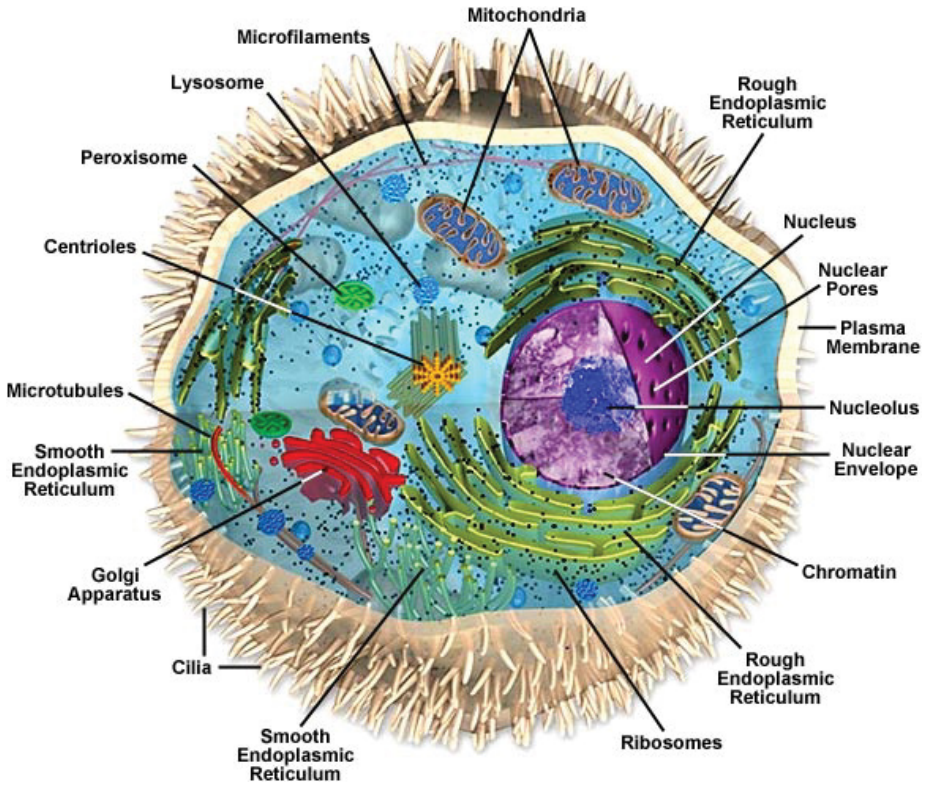

Figure 3 Structure of cell

Data Analysis

Data analysis was done using SPSS software version 21.0. All variables of age, VAS, and NDI were analyzed using one-way ANOVA between Groups A, B and C. Analysis of variance was used to determine the VAS and NDI at 0, 1 and 2-week between the Groups A, B and C. Variables of VAS and NDI were analyzed using one-way ANOVA between 0, 5th and 10th day within the Group A, B, and C. Post-hoc test was done for pairwise comparison of the variables of VAS and NDI between 0, 5th and 10th day within the Group A, B and C. Level of significance was set as 0.05.

RESULTS

Analysis of age between Groups A, B, and C using one-way ANOVA showed significant difference ($p<0.05$) (Table 1).

Table 1 Comparison of age, between Groups A, B and C

Variables	F-value	p-value
Age	6.461	*0.037

Analysis of variance for VAS and NDI at 0, 1st and 2nd week showed no significant difference between the groups ($p>0.05$) (Table 2).

Table 2 Comparison between VAS and NDI at 0 day, 5th day and 10th day between the groups

Variables	Days	F-value	p-value
VAS	0	0.274	0.766
	5	0.139	0.575
	10	0.242	0.385
NDI	0	1.761	0.391
	5	1.295	0.295
	10	2.014	0.154

Variables of VAS and NDI using one-way ANOVA between 0, 5th and 10th day showed a significant difference within the Group A and Group B but there was no significant difference between Group C ($p<0.05$) (Table 3).

Table 3 Comparison of VAS and NDI within Group A, B and Cone 0, 5th and 10th day

Variables	F-value	p-value
VAS A	3.191	*0.052
VAS B	4.909	*0.012
VAS C	1.941	0.169
NDI A	4.031	*0.003
NDI B	2.379	*0.041
NDI C	4.365	0.072

Post-hoc analysis using LSD showed a significant difference between 0, 5th and 10th day within the 3 groups ($p<0.05$) (Table 4).

Table 4 Comparison of rate of improvement in VAS and NDI within Group A, B, and C from 0 day to 10th day

Variables	Days	Mean Difference	Standard Error	p-value
VAS A	0-5th day	0.750	0.7573	0.231
	5th-10th day	1.150	0.7573	0.147
	0-10th day	1.900	0.7573	*0.014
VAS B	0-5th day	0.450	0.4560	*0.039
	5th-10th day	0.950	0.4560	*0.031
	0-10th day	1.400	0.4560	*0.004
VAS C	0-5th day	0.650	0.5605	0.257
	5th-10th day	0.450	0.5605	0.424
	0-10th day	1.100	0.5605	*0.007
NDI A	0-5th day	0.102	0.6365	0.124
	5th-10th day	0.119	0.6365	0.079
	0-10th day	0.220	0.6365	*0.004
NDI B	0-5th day	0.073	0.6803	0.286
	5th-10th day	0.103	0.6803	0.092
	0-10th day	0.176	0.6803	*0.004
NDI C	0-5th day	0.085	0.5763	0.143
	5th-10th day	0.064	0.5763	0.254
	0-10th day	0.149	0.5763	*0.019

Results showed no significant difference in VAS and NDI from 0-2 week in all the 3 groups i.e. Group A, B, and C indicating that rate of improvement in all the 3 groups was the same. Hence, concluding a minimal contribution of therapeutic modalities for pain relief and increasing functional ability. On analyzing the data within the groups, Group A, B, and C, VAS and NDI showed significant results in all the 3 groups i.e. Group A, B, and C

- Group A (Ga-Al-As+Stretching) showed no significant improvement in VAS and NDI score from 0th to 5th day and 5th to 10th day, but significant improvement was seen from 0th to 10th day
- Group B (Ga-As+Stretching) VAS score showed significant improvement from 0th to 5th day and 5th to 10th day and from 0th to 10th day but NDI showed only significant improvement from 0th to 10th day
- Group C showed significant improvement in VAS and NDI score from 0th to10th day

DISCUSSION

The implication of the present study is that no significant difference was found in VAS and NDI from 0-2 week between the 3 groups i.e. Group A (Ga-Al-As+stretching) Group B (Ga-As+stretching) and Group C (stretching alone). When analyzing the results within the groups, Group B i.e. (Ga-As+stretching) showed significant results from the 0-2 week of the treatment period. The findings substantiate the previous findings of Synder-Mackler, et al., demonstrating a reduction in pain due to increase in the latency of the superficial radial nerve in healthy subjects that correspond to a decrease in sensory in nerve conduction velocity after application of LLLT [10-13]. Walker, et

al., suggested that this type of laser may affect serotonin metabolism [14,15], because of a large increase in urinary excretion of 5 hydroxyindoleactic acid (5 HIAA) and better oxygenation of tissue resulting from increased local circulation hence leading to reduction of pain [6,10]. According to the literature, a minimum of 3 treatments have been suggested for assessing the efficacy of laser treatment and a 10 session course has been recommended for those patients who seem to benefit from the treatment. The slight carryover effect noted in the present study i.e. from 1st to 2nd week of Group B was augmented to the point of statistically significance when a 10 session paradigm is used.

Similarly, analyzing within the group, Group A i.e. Ga-As with stretching showed significant improvement from the 0-2 week which could be due to decrease in muscle spasm, increase in ATP production and other possible mechanisms predicted effects on endomorphin level gate control of pain given by Melzack and Wall [16,17]. Gur, et al., advocated that significant and clinically useful effects in the management of chronic neck pain related to MPS are due to a reduction in local tenderness [6,18]. In support of this Fernendo Sornano in his study on LBP suggested that the therapy with Ga-As diode laser can release pain in 70-90% of the cases [19]. Similarly, Sarac, et al., found significant improvement in patients when treated with Ga-As laser with respect to parameters such as pain, functional ability and (quality of life) which is in accordance to the present study [17,20,21].

Findings of the Group C are supported as stretching exercises form the basis of exercise treatment of myofascial pain by addressing the muscle tightness, shortening that is closely associated with pain in this disorder and permits gradual restoration of normal activity [2]. A controlled, blind study by Hanten, et al., compared the effects of 5 day home program of muscle stretching exercises and self-massage with an active ROM program for neck and back myofascial pain [22]. The stretching program showed significantly more improvement than subjects in active ROM concluding that stretching of the affected muscle is believed to be an integral part of Trigger therapy (TP) [1,5].

Limitation of the Study

Pressure Algometer was not used to quantify the tenderness in MTrP. The established validity of pressure algometer in the present study would have compared the Pressure pain threshold (PPT) of subjects with myofascial trigger points in the levator scapulae muscle with adjacent non-trigger point sites in the same subjects.

CONCLUSION

Result of the present study does not conclude that stretching is an effective intervention as a significant difference in the rate of improvement was found in the group which received Ga-As laser with stretching. Since the duration over which accumulation of rate of improvement took place was small thus it could not produce any significant difference overall at the end. Hence Ga-As LLLT can be used in adjunct with stretching exercises as a cost-effective conservative treatment of MTP in levator scapulae muscle.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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