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Can addition of low level laser therapy to conventional physical therapy be beneficial for management of pain and cervical range of motion in patients with trigger point of upper trapezius?

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ABSTRACT

Objective: Trigger points commonly develop in upper trapezius muscle. These might be associated with neck pain arising from trigger points of trapezius. This study was conducted to compare the effectiveness of conventional physical therapy (CPT) with and without low level laser therapy (LLLT) on pain and cervical range of motion (ROM) in patients with trigger point of upper trapezius muscle.

Methodology: An RCT was conducted with a sample size of 62 patients. The study was completed within 9 months after approval of synopsis. Data were collected from Health Care Physiotherapy, Sports, Spine & Rehabilitation Center, Faisalabad (Pakistan). Patients were randomly allocated into two equal groups; 31 patients of Group-1 received low-level laser therapy with CPT, while Group-2 (n=31) patients received CPT as the only treatment protocol. Patients pain level was assessed using Numeric Pain Rating *Scale* (NPRS) and cervical ROM was measured by goniometry at baseline and subsequently at 2nd and 4th week follow-ups.

Results: Results of the study obtained by applying repeated measures ANOVA showed that there was mean reduction in pain scores from day 1 to week 4 in within group analysis of LLLT + CPT Group (Group=1) and within group analysis of CPT Group (Group=2) ($p < 0.05$). Statistically significant improvement was observed in all mean cervical ROMs especially for lateral flexion ROM for both groups in within group analysis ($p < 0.05$). Statistically significant improvement was seen in NPRS score at week four between Group-1 and 2, measured by independent sample t-test with $p < 0.05$. Whereas, independent sample t-test results showed no significant improvement in cervical ROMs at week four between Group-1 and 2 ($p > 0.05$).

Conclusion: Conventional physical therapy and low level laser therapy used in combination are more effective than conventional physical therapy alone in patients of trigger points of upper trapezius.

Key words: Trigger points; Myofascial Pain Syndrome; Cervical ROM; Neck Pain; Low-level laser therapy; Conventional physical therapy; Trapezius muscle; Numeric Pain Rating Scale

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Trigger points are considered as the main reason of pain in about 74% of patients with muscular pain visiting an out-patient department and in 85% of patients hospitalized in pain care center.[1] About 57% of office employees have neck and shoulder pain complaints.[2]

Trigger point is a subjective marker of the myofascial pain syndrome (MPS). Trigger point of any specific area in the muscle has some distinguishing features, e.g. a tender point within a tight band of muscle, the local twitch response (LTR) to physical stimuli, the referral of pain pattern and the regeneration of patient's actual pain.[3]

A cross-sectional study performed on two hundred and twenty four subjects concluded that amongst all the patients of MPS, trigger points were found most common in trapezius muscles (93.75%). Prevalence of active trigger points in trapezius was found to be more on the right side i.e. 82.1% than the left side i.e. 79%. Prevalence of trigger points in other neck muscles e.g. multifidi, levator scapulae and splenius cervicis, were found to be 82.14%, 77.68% and 62.5% respectively.[4]

Simons suggested a hypothesis about production of myofascial trigger points that muscle overloading leads to injury of motor end plate which releases acetylcholine. This raised level of acetylcholine results in development of contraction knot, that causes localized ischemia and hypoxia, which results in more energy requirement. As energy supply is not in proportion to increased energy demand, noxious pain causing substances are released.[5]

There is a variety of therapeutic methods for treating trigger points due to some disease. These procedures may be categorized as invasive or non-invasive methods. Non-invasive therapies include stretching, transcutaneous electrical nerve stimulation (TENS), ultrasound and LASER. Whereas, invasive therapies comprise of local anesthetic injection, dry needling and botulinum toxin injection at trigger points.[6]

Low level laser therapy (LLLT) as a low intensity light therapy which gives thermal not photochemical effects. In LLLT, light is applied in the power range of 10–500 mW. Light with a wavelength of 660 nm-905 nm is used, which lies in the red to near infrared region of the spectrum. These wavelengths have depth of penetration from skin to soft and hard tissues.[7]

The primary objective of the this study was to determine the comparative effectiveness of CPT with or without LLLT on pain and cervical range of motion (ROM) in patients with trigger points of upper trapezius.

METHODOLOGY

This assessor blinded randomized controlled trial was conducted at Health Care Physiotherapy, Sports, Spine & Rehabilitation Center, Faisalabad, Pakistan using non-probability, purposive sampling technique. Sample comprised of patients diagnosed with active upper trapezius trigger points. Age limit was set between 18-55 years.[8] After gaining approval from the ethical committee of The University of Lahore, sample size was calculated by using previous published literature with the help of following formula:[9]

$$n = 2\alpha\, 2[Z1- \alpha/2 + Z\ 1- \beta]/ (\mu1-\mu2)2$$

Sample size of 54 patients was taken (27 in each group).

By adding 20%, dropout rate total sample size taken was 62 (31 in each group).

Patients were divided into two groups by the use of computer

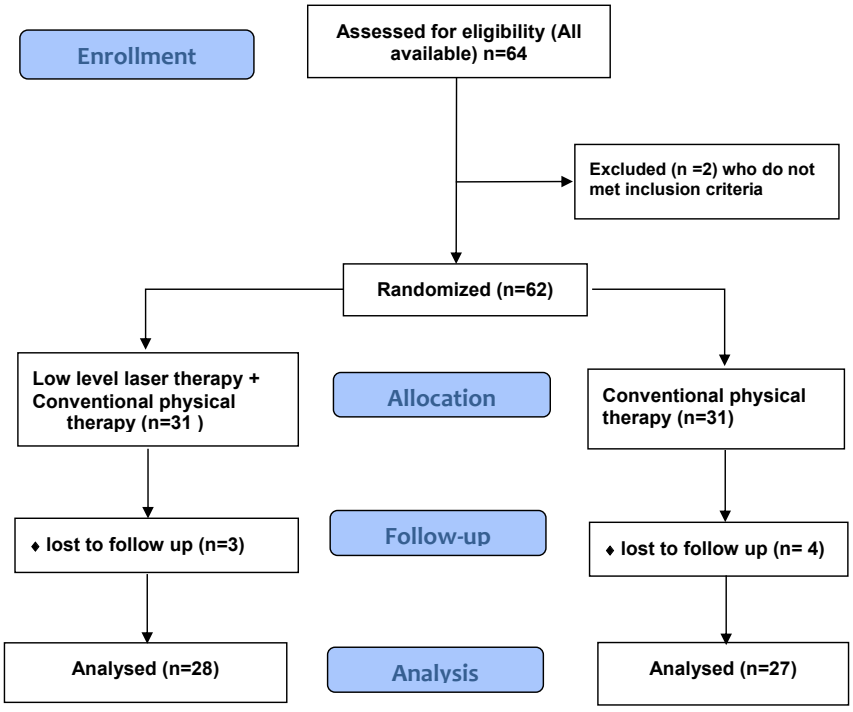

Figure 1: CONSORT Flow Diagram

generated random number table. Consent was taken from all subjects after explaining them the whole procedure of research. Group-1 patients were treated with LLLT + CPT. and Group-2 patients were treated with CPT only. Patients were treated thrice a week on alternate days. Assessment was done by using numerical pain rating scale (NPRS) for measuring pain intensity as the primary objective measure and universal goniometer for measuring cervical ROM as a secondary outcome measure. Measurements were done at day 1, 2 weeks after treatment and 4 weeks after treatment.

Table 1: Inferential statistic for NPRS and ROM showing differences between the groups

Measure	p-value	
	Factor 1	Factor vs treatment group
NPRS	< 0.001	< 0.001
Cervical Flexion ROM	< 0.001	0.757
Cervical Extension ROM	< 0.001	0.756
Cervical Rotation ROM	< 0.001	0.231
Cervical Lateral Flexion ROM	< 0.001	0.002

Statistical Analysis:

Data were analyzed using SPSS version 22. Data presentation was shown in the form of mean ± SD along with p-values. Repeated measures ANOVA was applied for determining within group changes on NPRS and cervical ROM parameters. Comparison of outcome measures between two groups was done using independent sample t-test.

RESULTS

Mean age of patients of the sample was 27.81 ± 7.72 y (Range 18 - 52 y). Out of 62 patients, 12(19.35%) were male while the rest 50(80.65%) were female; out of these 37(59.68%) had radiating pain. 53(85.48%) patients experienced intermittent pain, while the rest of 9(14.52%) patients have had constant pain. 21(33.87%) patients worked for 7-8 h, 17(27.42%) for 9-10 h, 17(27.42%) for 11-12 h. 6(9.68%) for 5-6 h and one patient was working for 3-4 h.

Table 1 shows the inferential statistics for NPRS, which were analyzed using repeated measures ANOVA. Above table shows that there was significant reduction in mean NPRS score across pre-intervention, week 2 and after week 4 measurement in subjects of both groups with $p < 0.05$. Factor vs treatment group shows that there was difference in improvement of both groups ($p < 0.05$).

The above table also shows the inferential statistics for cervical ROM, which were analyzed using repeated measures ANOVA. There was a significant improvement in mean cervical flexion extension and rotation ROM with $p < 0.05$ across pre-intervention, week 2 and after week 4 measurement. Factor vs treatment group p value is more than 0.05 shows that that both groups had equal improvement.

Above table shows that there was significant improvement in in mean cervical Lateral Flexion ROM with p value < 0.05 across pre-intervention, week 2 and after week 4 measurement. Factor vs treatment group ($p < 0.05$) shows that there was difference in improvement of both groups.

Table 2 showing between group comparison for mean change in NPRS and cervical ROM at baseline, follow up at 2 week and follow up at 4 week.

Results demonstrated that no significant difference was observed in NPRS score at baseline and at 4 week follow up between both groups ($p > 0.05$); but

Table 2: Comparison of mean changes in NPRS and cervical ROM at baseline, and at 2 and 4 weeks

Measure	Baseline (Mean ± S.D)			2nd Week follow up (Mean ± S.D)			4th Week follow up (Mean ± S.D)		
	LLLT+ CPT	CPT	Sig 2 – tailed	LLLT+ CPT	CPT	Sig 2 – tailed	LLLT+ CPT	CPT	Sig 2 – tailed
NPRS	4.55 ± .938	4.72 ± 1.222	.518	1.93 ± 1.387	3.00 ± 1.209	.003	.34 ± .769	1.93 ±1.072	.000
Flexion	31.15 ± 8.515	28.14 ± 6.844	.133	35.04 ± 6.714	32.30 ± 5.608	.107	38.07 ± 5.931	35.1 ± 5.632	.063
Extension	26.85 ± 7.521	29.31 ± 5.600	.154	30.14 ± 7.825	32.70 ± 5.326	.163	33.11 ± 9.908	36.04 ±6.537	.203
Lat. Flex	20.79 ± 8.572	20.39 ± 5.398	.834	24.50 ± 11.197	22.58 ± 5.981	.440	28.36 ± 12.443	23.77 ± 6.134	.096
Rotation	35.09 ± 10.026	37.59 ± 9.785	.327	36.86 ± 10.124	41.56 ± 9.512	.082	38.96 ± 10.412	44.63 ± 10.077	.045

significant difference was found in NPRS score at 2nd week follow up between 2 groups ($p < 0.05$).

Results showed that there was no significant difference of cervical flexion, extension, lateral flexion and rotation ROM between both groups at baseline, and at 2 weeks and 4 weeks after intervention ($p > 0.05$). So, the alternate hypothesis is rejected for cervical ROM differences between the groups.

DISCUSSION

Trapezius is a major dynamic stabilizer of the cervical region. It also has a mobility role in the neck area. Characteristic referral patterns arise in the neck, head, jaw and upper extremity due to trigger points present in the upper portion of trapezius. Trigger point formation is explained by the hypothesis that overuse/overload or cumulative micro trauma leads to excitation of motor units. These excited muscle fibers are the target of laser therapy.

Current study shows the comparison of LLLT + CPT with CPT alone in decreasing pain levels, increasing ROM and decreasing disability scores in patients with trigger points of trapezius upper fibers.

Current study demonstrated statistically significant improvement of pain levels within both research groups at two follow-ups recorded. Results of this study propose that there was no significant relief observed in pain levels at day 1. But significant relief was observed between the groups at week 2 and week 4. A $p > 0.05$ at week 2 and week 4 indicates the effectiveness of LLLT + CPT on trigger points at trapezius muscle. Another study had consistent findings with our study. This study evaluated the effect of diode laser in myofascial pain in neck. Results showed significant difference in pain scores between the groups immediately post intervention and 3 months after treatment. However, the study used VAS and McGill Pain Questionnaire for pain measurement instead of NPRS used in our study.[10]

In the present study within group analysis was performed by using repeated measures ANOVA. Results suggest that significant improvement was observed in all four mean cervical ROMs (flexion, extension, side flexion and rotation) for both Group-1 and 2. No significant improvement was seen in cervical ROMs at week four between Group-1 and 2 measured by independent sample t-test.

A study on the treatment of myofascial pain of upper trapezius observed similar results as the present study. This study had three treatment groups: Group 1 received treatment from therapeutic ultrasound, Group 2 from Laser and Group 3 received ischemic compression. Their results also showed within group significant differences in cervical ROM and non-significant difference for cervical ROM in between group analysis done through Chi-square test. Unlike, our study they used inch tape for cervical ROM measurement whereas, present study used universal goniometer for this purpose.[11]

CONCLUSION

The present study reached at the conclusion that conventional physical therapy, with and without low level laser therapy, is effective in patients with trigger points of upper trapezius.

But the combination of the two is more effective in decreasing pain than conventional physical therapy used alone. The effect on cervical range of movements was no significant between the two methods.

Conflict of interest: None declared by the authors

Authors' contribution:

IW - Concept and design of the study, collection, analysis and interpretation of data, manuscript writing

FT: Concept and design of the study, manuscript writing, statistical analysis, revision

AF - Statistical analysis, final approval

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