# COMBINED EFFECT OF LOW LEVEL LASER AND PHONOPHORESIS ON CLASSICAL AQUPOINTS VERSUS MYOFACIAL TRIGGER POINTS IN NECK PAIN PATIENTS.

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## ABSTRACT

**Background**: Myofascial trigger points and hypersensitive taut bands within the muscles can be a very distressing condition. It's linked to regional muscular spasms, tightened related joints, and a restricted range of motion called meridians represent some organs of the body like heart, kidney, liver, small intestine, large intestine, lung , liver, bladder, pericardium, stomach and spleen. We will select the following four acupoints on the affected side: Shousanli (Large Intestine Meridians, LI 10), Hegu (Large Intestine Meridians, LI 4), Waiguan (Sanjiao Meridians, TE 5), and Houxi (Small Intestine Meridians, SI 3), which are commonly used in the treatment of cervical myofacial pain syndrome ( MPS)..**Purpose:** This study aimed to investigate the combined effect of phonophoresis and low-level laser therapy on both myofacial trigger points and on classical aqupoints in neck pain patients. **Methods:** 60 participants from both genders who had neck pain . They varied in age from 20 to 40 years old. They were divided into four equal groups at random: (A, B, C,D). The four groups will receive therapy on classical acupoints.
The first group, Experimental (A), consisted of 15 volunteers from both genders who had neck pain and will receive LLLT on classical acupoints For one month, they attended three sessions every week. The second group, Experimental (B), consisted of 15 volunteers from both genders who had neck pain were treated with phonophoresis of hydrocortisone 1% in conjunction with diclofenac 1%. They were engaged in three sessions per week for one month. The third group, Experimental (C), consisted of 15 volunteers from both genders, men and women, who had neck pain were treated with Phonophoresis of hydrocortisone 1% in addition to diclofenac 5%. For one month, they attended three sessions every week. The fourth group, Experimental (D), consisted of 15 volunteers from both genders, men and women, who had neck pain were treated with both LLLT and phonophoresis on classical aqupoints. They attended three sessions every week, for one month.

**Keywords: Low level laser, phonophoresis, classical aqupoints, trigger points.**

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## INTRODUCTION

**Classical acupoints:** The 360 classical acupoints called meridians represent some organs of the body like heart, kidney, liver, small intestine, large intestine, lung , liver, bladder, pericardium, stomach and spleen. We will select the following four acupoints on the affected side: Shousanli (Large Intestine Meridians, LI 10), Hegu (Large Intestine Meridians, LI 4), Waiguan (Sanjiao Meridians, TE 5), and Houxi (Small Intestine Meridians, SI 3), which are commonly used in the treatment of cervical myofacial pain syndrome ( MPS).

**Phonophoresis for trigger points:**

Phonophoresis (PH) is the process of increasing skin absorption and penetration of the topical medications to the deep tissues using ultrasound. Topically applied drugs therapeutic effects depend on different factors such as rate, amount of drug penetration, depth of the skin and the potential drug toxic hazards on the tissues (Kasapoğlu.,et al 2019).

**Low Level Laser for trigger points:**

Among the various methods of application techniques in Low Level Laser Therapy (LLLT) (He Ne 632.8 nm visible red or infrared 820-830 nm continuous wave and 904 nm pulsed emission) there are very promising "trigger points" (TPs), i.e., myofascial zones of particular sensibility and of highest projection of focal pain points, due to ischemic conditions. The effect of LLLT and the results obtained after clinical treatment of more than 200 patients (headaches and facial pain, skeletomuscular ailments, myogenic neck pain, shoulder and arm pain, epicondylitis humery, tenosynovitis, cervical and radicular pain to whom

the "trigger points"were better than we had ever expected. According to clinical parameters, it has been observed that the rigidity decreases, the mobility is restored (functional recovery), and the spontaneous or induced pain decrease.

**MATERIALS AND METHODS**

60 participants from both genders who had neck pain . They varied in age from 20 to 40 years old. They were divided into four equal groups at random: (A, B, C,D). The four groups will receive therapy on classical acupoints. The first group, Experimental (A), consisted of 15 volunteers from both genders who had neck pain and will receive LLLT on classical acupoints For one month, they attended three sessions every week. The second group, Experimental (B), consisted of 15 volunteers from both genders who had neck pain were treated with phonophoresis of hydrocortisone 1% in conjunction with diclofenac 1%. They were engaged in three sessions per week for one month.

The third group, Experimental (C), consisted of 15 volunteers from both genders, men and women, who had neck pain were treated with Phonophoresis of hydrocortisone 1% in addition to diclofenac 5%. For one month, they attended three sessions every week.

The fourth group, Experimental (D), consisted of 15 volunteers from both genders, men and women, who had neck pain were treated with both LLLT and phonophoresis on classical aqupoints. They attended three sessions every week, for one month.

**II) Equipment and tools**

**A-Measurement Equipment:**

**1-CROM Device**: It is a technique and process for assessing cervical spine active range of motion (ACROM) that is clinically relevant, reliable, and valid in both healthy and sick patients. Each patient had their cervical AROM assessed in right/left lateral flexion, and right/left rotation**.**

**2-Pressure Algometer:**

The term algometer refers to equipment used to evaluate pain sensitivity. The word algometer may suggest pressure tolerance testing, the greatest amount of pressure that a person can withstand. But it does not represent the first point at which a pressure feeling is perceived as pain. These devices are frequently portable and include a "maximum hold" function that indicates the highest pressure produced in any given application. This device typically feature a 1- $cm^2$ pressure application surface and provides force values in newtons or kilograms of force. It has been observed that the force applied should be perpendicular to the body surface and at a consistent pace to rise at a rate of about 1 kg/ $cm^2$. Applying force at a quicker rate may result in a low false threshold measurement.

**B-Therapeutic Equipment:**

**1-Low Level Laser Therapy :**

It is of the Chinesport diode variety, having two separate outputs. Treatment time is automatically set based on the amount of energy supplied and the region specified.

**2- Phonophoresis:**

It is a Chinesport ultrasonic therapy equipment with an output ultrasound frequency range of 1-3 MHz and a hand piece with a frequency range of 1-3 MHz. Display resolution is 320x240, treatment time of up to 60 minutes, 200 procedures and programmes that may be saved. Included a smart card. Our ultrasonic heads have a non-contact LED indicator that allows you to examine the accuracy of the tissue-emitting head contact, and they are also self-calibrating to eliminate the need for calibration over time.. The SONIC series devices enable the administration of ultrasounds in both continuous and pulsed modes, with varied options for regulating the duty cycle; this substantially lowers the diathermic impact since heat is distributed in the gap between one pulse and the next. Furthermore, pulsed emission has the technological advantage of reducing transducer overheating and allowing the use of greater intensities. Diclofenac gel combined with corticosteroid ointment were used with ultrasound without using or adding other gel, oil or water,figure (3-4).

**A-Evaluative procedures:**

The following procedures were performed for all volunteers in all groups.

**1-Cervical Range of motion measurement :**

**Right and left lateral flexion**

**- Right and left Rotation**

**2-Pressure Algometer device:**

To test pressure pain threshold (PPT) for each trigger points. Each patient was in sitting position, the therapist was standing behind patient, Algometer measuring unit used here was kg/ $cm^2$ and therapist applied pressure perpendicular to trigger points until patient feeling of discomfort and then take the reading.

**B) Therapeutic Procedures :**

**1-Chinesport LLL device**

The patients were in sitting position, bare skin , back was erect and supported. Wavelength 904 nm; pulse duration 200 ns; pulse frequency 1953 Hz; peak power 90 mW; average output 30 mW; power density 22.5 mW $cm^2$; treatment time 600 seconds; energy dosage 18 J per session; spot size 4 $cm^2$; and

treatment frequency 3 times/week for one month were the delivery parameters. The laser probe (head size: 4 $cm^2$) was held constant in skin contact with no pressure applied to the trigger locations in groups of myofacial trigger points and on acupoints locations with groups of classical acupoints patients. Time was distributed on the trigger points classical acupoints equally.

**2- Phonophoresis of hydrocortison 1% + diclofenac 1%.**

Ultrasound equipment (chinesport gadget). Diclofenac gel 1% and hydrocortison 1% were first applied in a circular fashion with a thickness of 2–3 mm for 10 minutes, 3 times per week for one month, ultrasound with a 5-cm-diameter applicator at 1 MHz frequency and 1.5 Wt/ $cm^2$ power was administered to the trigger sites on the trapezius muscle and acupoints sites of classical acupoints.

**3-Phonophoresis of hydrocortison +diclofenac 5%.**

**Data collection**

Data were screened, for normality assumption test and homogeneity of variance. Normality test of data using Shapiro-Wilk test was used, that reflect the data was normally distributed (P>0.05) after removal outliers that detected by box and whiskers plots. Additionally, Levene's test for testing the homogeneity of variance revealed that there was no significant difference (P>0.05). All these findings allowed the researcher to conducted parametric and non-parametric analysis. The data is normally distributed and parametric analysis is done.

**Statistical analysis**

The statistical analysis was conducted by using statistical SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL). Numerical data are expressed as mean and standard deviation for patient's age, CROM and pressure algometer variables. One-way analysis of variance (ANOVA) test used to compare among 4 groups for patients age. Mixed design 4 x 2 MANOVA-test was used, the first independent variable (between subject factors) was the tested group with 4 levels (group A, group B, group C, and group D). The second independent variable (within subject factor) was measuring periods with 2 levels (pre- and post- treatment) for dependents variables CROM (right rotation, left rotation, Right side bending, left side bending) and pressure algometer (Trp1, Trp2, Trp3, and Trp4). Bonferroni correction test was used to compare between pairwise within and between groups of the tested variables which P-value was significant from MANOVA test. All statistical analyses were significant at probability ($P \leq 0.05$).

**RESULTS AND DISCUSSION**

In the current study, a total of 60 patients participated and they were randomly distributed into 4 groups (15 patients/group). No significant difference in age (P=0.275; P>0.05) among groups A, B, C, and D (Table 1) in classical acupoints.

Multiple pairwise comparison tests (time effect) for CROM variables within each group for classical acupoints revealed there were non-significantly (P>0.05) increased in right rotation (Table 1) at post-treatment compared to pre-treatment within group A (P=0.973), group B (P=0.514), group C (P=0.391), and group D (P=0.070). The left rotation (Table 2) significantly (P<0.05) increased within group D (P=0.026) at post-treatment compared to pre-treatment, but there were non-significantly (P>0.05) increased in left rotation at post-treatment within group A (P=1.000), group B (P=0.574), and group C (P=0.117). There were significantly (P<0.05) increased in right and left side bending (Table 2) at post-treatment compared to pre-treatment within group D (P=0.008 and P=0.036, respectively), but non-significantly (P>0.05) increased was observed in right and left side bending within group A (P=0.688 and P=0.826, respectively), group B (P=0.369 and P=0.635, respectively), and group C (P=0.372 and P=0.488, respectively). These significant and non-significant differences in CROM at post-treatment due to time effect are favorable of group D which received combined laser and phonophoresis treatment. Moreover, the patients in Group D who received the combined phonophoresis and laser treatment improved higher right rotation, left rotation, right side bending, and left side bending (5.53, 6.52, 11.65, and 11.21%, respectively) followed by patients in Group C (2.65, 4.48, 4.15, and 3.86%, respectively) who received the laser treatment only, patients in Group B (1.90, 1.52, 3.45, and 2.53%, respectively) who received phonophoresis hydrocortisone + 5% diclofenac treatment and then those in Group A (0.10, 0.00, 1.73, and 1.12%, respectively) who received phonophoresis hydrocortisone + 1% diclofenac treatment.

Multiple pairwise comparison tests (group effect) for CROM variables among groups A, B, C, and D for classical acupoints (Table 1) showed no significant differences (P>0.05) at pre-treatment in right rotation (P=0.054), left rotation (P=0.057), right side bending (P=0.054), and left side bending (P=0.395). Moreover, no significant differences (P>0.05) among 4 groups at post-treatment in right rotation (P=0.092), left rotation (P=0.138), and left side bending (P=0.100). But, there was significant difference (P<0.05) in right side

bending (P=0.004) at post-treatment among groups A, B, C, and D.

**Table 1:** Within and between group comparisons for CROM variables in classical acupoints

| Variables | Items | Groups (Mean ±SD) | | | | *P*-value |
|---|---|---|---|---|---|---|
| | | Group A (n=15) | Group B (n=15) | Group C (n=15) | Group D (n=15) | |
| **Age (year)** | | 30.07 ±6.55 | 28.93 ±5.77 | 33.40 ±6.16 | 30.00 ±7.46 | 0.275 |
| **Right rotation** | Pre-treatment | 69.00 ±5.15 | 66.73 ±4.93 | 62.67 ±5.13 | 63.80 ±5.04 | 0.054 |
| | Post-treatment | 69.07 ±5.14 | 68.00 ±5.00 | 64.33 ±6.67 | 67.33 ±5.05 | 0.092 |
| | MD (change) | 0.07 | 1.27 | 1.66 | 3.53 | |
| | Improvement % | 0.10% | 1.27% | 2.65% | 5.53% | |
| | *P*-value | 0.973 | 0.514 | 0.391 | 0.070 | |
| **Left rotation** | Pre-treatment | 68.93 ±3.53 | 65.67 ±5.62 | 62.47 ±3.88 | 61.33 ±5.46 | 0.057 |
| | Post-treatment | 68.93 ±4.00 | 66.67 ±5.91 | 65.27 ±4.92 | 65.33 ±4.89 | 0.138 |
| | MD (change) | 0.00 | 1.00 | 2.80 | 4.00 | |
| | Improvement % | 0.00% | 1.52% | 4.48% | 6.52% | |
| | *P*-value | 1.000 | 0.574 | 0.117 | 0.026* | |
| **Right side bending** | Pre-treatment | 34.67 ±2.84 | 36.47 ±2.94 | 32.07 ±4.30 | 34.33 ±5.87 | 0.054 |
| | Post-treatment | 35.27 ±2.71 | 37.73 ±2.84 | 33.40 ±4.68 | 38.33 ±5.06 | 0.004* |
| | MD (change) | 0.60 | 1.26 | 1.33 | 4.00 | |
| | Improvement % | 1.73% | 3.45% | 4.15% | 11.65% | |
| | *P*-value | 0.688 | 0.396 | 0.372 | 0.008* | |
| **Left side bending** | Pre-treatment | 35.80 ±3.42 | 34.40 ±5.15 | 32.67 ±4.10 | 34.53 ±6.09 | 0.395 |
| | Post-treatment | 36.20 ±3.85 | 35.27 ±5.97 | 33.93 ±5.81 | 38.40 ±4.68 | 0.100 |
| | MD (change) | 0.40 | 0.86 | 1.26 | 3.87 | |
| | Improvement % | 1.12% | 2.53% | 3.86% | 11.21% | |
| | *P*-value | 0.826 | 0.635 | 0.488 | 0.036* | |

Group A: received phonophoresis hydrocortisone + diclofenac 1% treatment; Group B: received phonophoresis hydrocortisone + diclofenac 5% treatment; Group C: received laser treatment only; Group D: received combined laser and phonophoresis treatment.
Data are expressed as mean ±standard deviation MD: Mean difference
P-value: probability value S: significant * Significant (P<0.05)
NS: non-significant

Multiple pairwise comparison tests (time effect) for pressure algometer variables within each group for classical acupoints revealed there were non-significantly (P>0.05) increased in Trp1, Trp2, and Trp3 (Table 2) at post-treatment compared to pre-treatment within group A (P=0.874, P=0.524, and P=0.734, respectively), group B (P=0.484, P=0.340, and P=0.440, respectively), group C (P=0.154, P=0.373, and P=0.371, respectively), and group D (P=0.058, P=0.425, and P=0.859, respectively). The Trp4 (Table 2) significantly (P<0.05) increased within group D (P=0.005) at post-treatment compared to pre-treatment, but there were non-significantly (P>0.05) increased in Trp4 at post-treatment within group A (P=0.951), group B (P=0.479), and group C (P=0.150). These significant and non-significant differences in pressure algometer at post-treatment due to time effect are favorable of group D which received combined laser and phonophoresis treatment. Moreover, the patients in Group D who received the combined phonophoresis and laser treatment improved higher Trp1, Prp2, Trp3, and Trp4 (23.81, 18.13, 21.26, and 55.42%, respectively) followed by patients in Group C (15.46, 10.44, 10.33, and 13.96%, respectively) who received the laser treatment only, patients in Group B (6.38, 9.43, 8.46, and 7.89%, respectively) who received phonophoresis hydrocortisone + 5% diclofenac treatment and then those in Group A (1.44, 7.22, 3.61, and 1.09%, respectively) who received phonophoresis hydrocortisone + 1% diclofenac treatment.

Multiple pairwise comparison tests (group effect) for CROM variables among groups A, B, C, and D for classical acupoints (Table 2) showed no significant differences (P>0.05) at pre-treatment in Trp1 (P=0.071), Trp2 (P=0.250), Trp3 (P=0.609), and Trp4 (P=0.089). Moreover, no significant differences (P>0.05) among 4 groups at post-treatment in Trp1 (P=0.129), Trp2 (P=0.425), and Trp3 (P=0.859). But, there was significant difference (P<0.05) in Trp3 (P=0.017) at post-treatment among groups A, B, C, and D.

**Table 2:** Within and between group comparisons for pressure algometer variables in classical acupoints

| Variables | Items | Groups (Mean ±SD) | | | | *P*-value |
|---|---|---|---|---|---|---|
| | | Group A (n=15) | Group B (n=15) | Group C (n=15) | Group D (n=15) | |
| **Trp1** | Pre-treatment | 2.08 ±0.47 | 2.35 ±0.65 | 1.94 ±0.62 | 1.68 ±0.46 | 0.071 |
| | Post-treatment | 2.05 ±0.48 | 2.50 ±0.77 | 2.24 ±0.47 | 2.08 ±0.55 | 0.129 |
| | MD (change) | 0.03 | 0.15 | 0.30 | 0.40 | |
| | Improvement % | 1.44% | 6.38% | 15.46% | 23.81% | |
| | *P*-value | 0.874 | 0.484 | 0.154 | 0.058 | |
| **Trp2** | Pre-treatment | 1.94 ±0.54 | 2.12 ±0.70 | 1.82 ±0.51 | 1.71 ±0.44 | 0.250 |
| | Post-treatment | 2.08 ±0.57 | 2.32 ±0.75 | 2.01 ±0.52 | 2.02 ±0.41 | 0.425 |
| | MD (change) | 0.14 | 0.20 | 0.19 | 0.31 | |
| | Improvement % | 7.22% | 9.43% | 10.44% | 18.13% | |
| | *P*-value | 0.524 | 0.340 | 0.373 | 0.136 | |
| **Trp3** | Pre-treatment | 1.94 ±0.60 | 2.01 ±0.57 | 1.84 ±0.67 | 1.74 ±0.48 | 0.609 |
| | Post-treatment | 2.01 ±0.61 | 2.18 ±0.68 | 2.03 ±0.55 | 2.11 ±0.48 | 0.859 |
| | MD (change) | 0.07 | 0.17 | 0.19 | 0.37 | |
| | Improvement % | 3.61% | 8.46% | 10.33% | 21.26% | |
| | *P*-value | 0.734 | 0.440 | 0.371 | 0.086 | |
| **Trp4** | Pre-treatment | 1.84 ±0.45 | 1.90 ±0.80 | 2.22 ±0.49 | 1.66 ±0.53 | 0.089 |
| | Post-treatment | 1.86 ±0.52 | 2.05 ±0.77 | 2.53 ±0.46 | 2.58 ±0.56 | 0.017* |
| | MD (change) | 0.02 | 0.15 | 0.31 | 0.92 | |
| | Improvement % | 1.09% | 7.89% | 13.96% | 55.42% | |
| | *P*-value | 0.951 | 0.479 | 0.150 | 0.005* | |

Group A: received phonophoresis hydrocortisone + diclofenac 1% treatment; Group B: received phonophoresis hydrocortisone + diclofenac 5% treatment; Group C: received laser treatment only; Group D: received combined laser and phonophoresis treatment.
Data are expressed as mean ±standard deviation MD: Mean difference
P-value: probability value S: significant * Significant (P<0.05) NS: non-significant

Bonferroni test and mean difference for right side bending and Trp4 at post-treatment between pairwise of the groups (Table 3). There were significant differences in right side bending at post-treatment between pairwise of Group B versus Group C (MD=4.33; P=0.026; P<0.05) and Group C versus Group D (MD=4.93; P=0.007; P<0.05) but, no differences between Group A versus Group B (MD=2.46; P=0.601; P>0.05), Group A versus Group C (MD=1.87; P=1.000; P>0.05), Group A versus Group D (MD=3.06; P=0.250; P>0.05), and Group B versus Group D (MD=0.60; P=1.000; P>0.05).

There were significant differences in Trp4 at post-treatment between pairwise of Group A versus Group C (MD=0.67; P=0.015; P<0.05) and Group A versus Group D (MD=0.72; P=0.009; P<0.05) but, no differences between Group A versus Group B (MD=0.19; P=1.000; P>0.05), Group B versus Group C (MD=0.48; P=0.170; P>0.05), Group B versus Group D (MD=0.53; P=1.000; P>0.05), and Group C versus Group D (MD=0.05; P=1.000; P>0.05). The post-hoc test and mean differences between groups showed that the combined between phonophoresis and laser program (Group D) gave the best Trp4 value. The post-hoc test and mean differences

between groups showed that the combined between phonophoresis and laser program (Group D) gave the best right side bending and Trp4 values.

**Table 3:** Post-hoc test (Bonferroni test) between pairwise of groups for right side bending and Trp 4 at post-treatment

| Variables | Items | Post-hoc (Bonferroni test) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Group A vs. Group B** | **Group A vs. Group C** | **Group A vs. Group D** | **Group B vs. Group C** | **Group B vs. Group D** | **Group C vs. Group D** |
| **Right side bending** | MD | 2.46 | 1.87 | 3.06 | 4.33 | 0.60 | 4.93 |
| | *P*-value | 0.601 | 1.000 | 0.250 | 0.026* | 1.000 | 0.007* |
| **Trp 4** | MD | 0.19 | 0.67 | 0.72 | 0.48 | 0.53 | 0.05 |
| | *P*-value | 1.00 | 0.015* | 0.009* | 0.170 | 1.000 | 1.000 |

Group A: received phonophoresis hydrocortisone + diclofenac 1% treatment; Group B: received phonophoresis hydrocortisone + diclofenac 5% treatment; Group C: received laser treatment only; Group D: received combined laser and phonophoresis treatment.
Data are expressed as mean ±standard deviation MD: Mean difference
P-value: probability value S: significant * Significant (P<0.05) NS: non-significant

## CONCLUSION

Application of both low level laser and phonophoresis achieved results better than using each technique alone and has significant effect on cervical range of motion and pain intensity in neck pain patients.

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