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EFFECTIVENESS OF LOW-LEVEL LASER THERAPY AGAINST MIRROR THERAPY IN POST STROKE SHOULDER PAIN: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Introduction: Post-stroke shoulder pain (PSSP), also known as hemiplegic shoulder pain, is a frequent and disabling complication following cerebrovascular accidents, affecting 30–70% of stroke survivors.
Aims: To compare the effectiveness of low-level laser therapy (LLLT) versus mirror therapy (MT) in reducing post-stroke shoulder pain and improving shoulder function.
Materials & Methods: This randomized controlled trial (RCT) was conducted at Department of Physical Medicine and Rehabilitation, Nil Ratan Sircar Medical College and Hospital, Kolkata, West Bengal, India, over a period of one year (from 1st June 2023 to 31st May 2024). A total of 100 patients with post-stroke shoulder pain symptoms were enrolled.
Result: The mean pain score (VAS 0–10) was 7.2 ± 1.1 in the LLLT group and 7.3 ± 1.2 in the MT group (p = 0.68). Shoulder flexion ROM was 90 ± 15° versus 88 ± 14° (p = 0.52), and SPADI scores were 65 ± 10 and 66 ± 11, respectively (p = 0.70). Pain scores decreased in both groups over time, with a greater reduction observed in the LLLT group. After 2 weeks, mean VAS scores were 4.8 ± 1.2 versus 5.2 ± 1.3 (p = 0.12).
Conclusion: We concluded that over the course of eight weeks, this randomized controlled research shows that mirror therapy (MT) and low-level laser therapy (LLLT) are both beneficial in lowering post-stroke shoulder pain and enhancing shoulder function. The groups' baseline characteristics were similar, guaranteeing fair comparisons.

Keywords*: Mirror Therapy, Hemiplegic Shoulder, Pain Management, Shoulder Function, Rehabilitation*

INTRODUCTION

Post-stroke shoulder pain (PSSP), also known as hemiplegic shoulder pain, is a frequent and disabling complication following cerebrovascular accidents, affecting 30–70% of stroke survivors [1]. It can significantly impede rehabilitation, limit functional recovery, reduce independence in activities of daily living, and negatively impact quality of life. The aetiology of PSSP is multifactorial, involving soft tissue injury, glenohumeral subluxation, spasticity, adhesive capsulitis, rotator cuff lesions, and prolonged immobility, which collectively contribute to pain, reduced range of motion (ROM), and impaired upper-limb function [2]. Addressing PSSP effectively is therefore critical to optimize post-stroke recovery and improve overall patient outcomes. Non-pharmacological interventions play an important role in the management of PSSP. Among these, low-level laser therapy (LLLT), also referred to as photo-biomodulation, has gained attention due to its anti-inflammatory, analgesic, and tissue-healing properties. LLLT delivers low-intensity red or near-infrared light to targeted tissues, promoting mitochondrial activity, increasing adenosine triphosphate (ATP) production, modulating inflammatory mediators, enhancing microcirculation, and facilitating tissue repair [3,4]. Studies in musculoskeletal disorders, including rotator cuff tendinopathy and subacromial impingement, have shown that LLLT combined with exercise can significantly reduce pain and improve shoulder function and ROM [3]. Preliminary studies in post-stroke patients suggest that LLLT, when added to conventional rehabilitation, may reduce pain intensity and improve functional outcomes, although sample sizes have been small and evidence remains limited [4,5]. Mirror therapy (MT) is another rehabilitative approach increasingly used in post-stroke upper limb rehabilitation. MT involves performing movements with the non-paretic limb while watching its reflection in a mirror, creating the illusion that the paretic limb is moving. This visual feedback is thought to stimulate cortical reorganization, enhance neuroplasticity, and modulate pain perception, thereby improving motor function and potentially reducing pain [6]. Randomized controlled trials and systematic reviews have demonstrated that MT can improve upper limb motor function, activities of daily living, and in some cases, pain levels in stroke survivors. However, studies focusing specifically on post-stroke shoulder pain are limited, and the extent of pain reduction varies among reported trials [7,8]. Study aims to compare the effectiveness of low-level laser therapy (LLLT) versus mirror therapy (MT) in reducing post-stroke shoulder pain and improving shoulder function.

MATERIALS AND METHODS

Type of Study: Randomized Controlled Trial (RCT)
Place of Study: Department of Physical Medicine and Rehabilitation, Nil Ratan Sircar Medical College and Hospital, 138, Acharya Jagdish Chandra Bose Road, Sealdah, Kolkata, West Bengal, Pin Code: 700014, India
Study Duration: 1 year (From 1st June 2023 to 31st May 2024)
Sample Size: 100 patients with post-stroke shoulder pain symptoms.

Inclusion Criteria:

- Adults (≥18 years) with a history of stroke.
- Presence of hemiplegic shoulder pain for at least 2 weeks.
- Medically stable and able to participate in therapy sessions.
- Ability to follow instructions and provide informed consent

Exclusion Criteria:

- Severe cognitive impairment or aphasia preventing participation.
- Shoulder fractures, dislocations, or recent surgery.
- Active infection or malignancy in the affected shoulder.
- Contraindications to low-level laser therapy or mirror therapy.
- Participation in other conflicting rehabilitation interventions.

Study Variables:

- Low-Level Laser Therapy (LLLT)
- Mirror Therapy (MT)
- Pain intensity measured by Visual Analog Scale (VAS)
- Shoulder range of motion (ROM)

Statistical Analysis:

Data were entered into Excel and subsequently analyzed using SPSS and GraphPad Prism. Continuous variables were summarized as means with standard deviations, while categorical variables were presented as counts and percentages. Comparisons between independent groups were performed using two-sample t-tests, and paired t-tests were applied for correlated (paired) data. Categorical data were compared using chi-square tests, with Fisher's exact test applied when expected cell counts were small. A p-value of ≤ 0.05 was considered statistically significant.

RESULT

Table 1: Baseline Demographic Characteristics

Variable	LLLT Group	MT Group	p-value
Age	58.6 ± 10.2	59.1 ± 9.8	0.75
Gender (M/F)	28/22	30/20	0.68
Stroke Side (Right/Left)	27/23	25/25	0.68
Duration since stroke (months)	6.2 ± 3.1	6.5 ± 3.5	0.62

Table 2: Baseline Clinical Scores

Variable	LLLT Group	MT Group	p-value
Pain (VAS 0–10)	7.2 ± 1.1	7.3 ± 1.2	0.68
Shoulder ROM (Flexion, degrees)	90 ± 15	88 ± 14	0.52
Shoulder Disability (SPADI score, 0–100)	65 ± 10	66 ± 11	0.7

Table 3: Post-Intervention Pain Scores

Time Point	LLLT Group	MT Group	p-value
After 2 weeks	4.8 ± 1.2	5.2 ± 1.3	0.12
After 4 weeks	3.2 ± 1.0	4.1 ± 1.1	0.01
After 8 weeks	2.5 ± 0.8	3.6 ± 1.0	0.001

Table 4: Post-Intervention Shoulder ROM (Flexion)

Time Point	LLLT Group	MT Group	p-value
After 2 weeks	105 ± 12	100 ± 13	0.08
After 4 weeks	120 ± 10	112 ± 11	0.005
After 8 weeks	130 ± 8	118 ± 10	<0.001

Table 5: Adverse Events (AE)

Adverse Event	LLLT Group	MT Group	p-value
Mild skin redness	2 (4%)	0 (0%)	0.15
Fatigue	1 (2%)	2 (4%)	0.56
Pain flare	3 (6%)	4 (8%)	0.7
Total participants with any AE	6 (12%)	6 (12%)	1

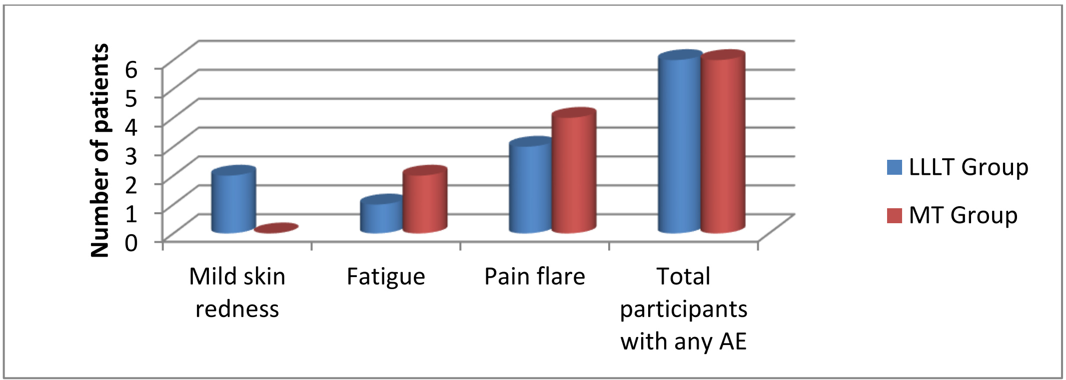

Figure 1: Adverse Events

In our study, the baseline characteristics of participants in the LLLT and MT groups were comparable. The mean age was 58.6 ± 10.2 years in the LLLT group and 59.1 ± 9.8 years in the MT group (p = 0.75). Gender distribution (M/F) was similar, with 28/22 in the LLLT group and 30/20 in the MT group (p = 0.68). The distribution of stroke side (right/left) was also comparable (27/23 vs. 25/25; p = 0.68), as was the duration since stroke (6.2 ± 3.1 vs. 6.5 ± 3.5 months; p = 0.62). At baseline, pain, shoulder range of motion, and disability were comparable between the LLLT and MT groups. The mean pain score (VAS 0–10) was 7.2 ± 1.1 in the LLLT group and 7.3 ± 1.2 in the MT group (p = 0.68). Shoulder flexion ROM was 90 ± 15° versus 88 ± 14° (p = 0.52), and SPADI scores were 65 ± 10 and 66 ± 11, respectively (p = 0.70). Pain scores decreased in both groups over time, with a greater reduction observed in the LLLT group. After 2 weeks, mean VAS scores were 4.8 ± 1.2 versus 5.2 ± 1.3 (p = 0.12). At 4 weeks, the difference became significant (3.2 ± 1.0 vs. 4.1 ± 1.1; p = 0.01), and by 8 weeks, the LLLT group showed a significantly lower pain score than the MT group (2.5 ± 0.8 vs. 3.6 ± 1.0; p = 0.001). Shoulder flexion improved in both groups over time, with greater gains in the LLLT group. After 2 weeks, mean flexion was 105 ± 12° versus 100 ± 13° (p = 0.08). At 4 weeks, the difference became significant (120 ± 10° vs. 112 ± 11°; p = 0.005), and by 8 weeks, the LLLT group showed significantly better shoulder flexion than the MT group (130 ± 8° vs. 118 ± 10°; p < 0.001). Adverse events were mild and comparable between groups. In the LLLT group, 2 participants (4%) experienced mild skin redness, 1 (2%) reported fatigue, and 3 (6%) had a pain flare, while in the MT group, 2 (4%) reported fatigue and 4 (8%) experienced a pain flare. Overall, 6 participants (12%) in each group reported any adverse event, with no significant difference between groups (p = 1).

DISCUSSION

We showed that baseline characteristics of participants in the LLLT and mirror therapy (MT) groups were comparable, ensuring balanced groups at study entry. The mean age was 58.6 ± 10.2 years in the LLLT group and 59.1 ± 9.8 years in the MT group (p = 0.75). Gender distribution was similar (M/F: 28/22 vs. 30/20; p = 0.68), as was stroke side involvement (right/left: 27/23 vs. 25/25; p = 0.68) and duration since stroke (6.2 ± 3.1 vs. 6.5 ± 3.5 months; p = 0.62). Baseline pain and shoulder function were also comparable, with VAS scores of 7.2 ± 1.1 vs. 7.3 ± 1.2 (p = 0.68), shoulder flexion 90 ± 15° vs. 88 ± 14° (p = 0.52), and SPADI scores 65 ± 10 vs. 66 ± 11 (p = 0.70). Both interventions led to progressive improvements in pain and shoulder mobility over the 8-week follow-up, but LLLT produced greater benefits. Pain scores decreased more rapidly in the LLLT group, reaching 4.8 ± 1.2 vs. 5.2 ± 1.3 at 2 weeks (p = 0.12), 3.2 ± 1.0 vs. 4.1 ± 1.1 at 4 weeks (p = 0.01), and 2.5 ± 0.8 vs. 3.6 ± 1.0 at 8 weeks (p = 0.001). Similarly, shoulder flexion improved to 105 ± 12° vs. 100 ± 13° at 2 weeks (p = 0.08), 120 ± 10° vs. 112 ± 11° at 4 weeks (p = 0.005), and 130 ± 8° vs. 118 ± 10° at 8 weeks (p < 0.001). Adverse events were mild and comparable in both groups (12%; p = 1). **In similar study by Karabegović et al. (2009)** reported significant pain reduction and improved disability in post-stroke patients receiving low-level laser therapy compared with electrotherapy [9]. **Başaran & Büyükşireci** (2025) found that LLLT combined with conventional physiotherapy significantly improved pain (VAS), disability (SPADI), and upper-extremity function versus physiotherapy alone [10]. Similarly, **Korkmaz et al. (2021)** demonstrated that high-intensity laser therapy plus rehabilitation improved pain, shoulder ROM, and functional independence compared to control [11]. Like these studies, our results confirm that laser therapy — even low-level is safe, well-tolerated (adverse events 12% in both groups; p = 1), and provides superior short-term analgesic and functional benefits over comparator therapies in hemiplegic shoulder pain.

CONCLUSION

We concluded that this randomized controlled research shows that mirror therapy (MT) and low-level laser therapy (LLLT) are both beneficial in lowering post-stroke shoulder pain and enhancing shoulder function. The groups' baseline characteristics were similar, guaranteeing fair comparisons. LLLT shown superior efficacy, with faster and bigger decreases in pain scores and more noticeable gains in shoulder flexion, even though both therapies produced gradual improvements in pain intensity, shoulder range of motion, and functional outcomes. Good safety profiles were indicated by the minor and comparable adverse events that occurred in both groups. According to these results, individuals with post-stroke hemiplegic shoulder pain may benefit more from LLLT than with MT in terms of pain reduction and functional rehabilitation.

REFERENCE

1. Zhang X, Chen Y, Shen Z, Bian J, Wang L, Li W, et al. Incidence and prevalence of post-stroke shoulder pain: a systematic review and meta-analysis. Stroke. 2021;52:1452–1459.
2. Finestone HM, Greene-Finestone LS, et al. Shoulder pain after stroke: etiology and management. Top Stroke Rehabil. 2018;25:272–280.
3. Castaldo M, De D'Ossat AA, Gnessi P, Galeoto G. Low-level laser therapy in the management of shoulder impingement syndrome: a systematic review. Appl Sci. 2023;13:3536.
4. Bjordal JM, Lopes-Martins RA, Iversen VV. A systematic review of low-level laser therapy with implications for musculoskeletal disorders. Phys Ther Rev. 2019;24:17–28.
5. Karabegović A, et al. Laser therapy of painful shoulder and shoulder-hand syndrome in hemiplegic arm – a controlled study. Bosn J Basic Med Sci. 2009;9:59–65.
6. Thieme H, Mehrholz J, Pohl M, Behrens J, Dohle C. Mirror therapy for patients with severe arm paresis after stroke. Lancet Neurol. 2018;17:557–567.
7. Chan BL, Witt R, Charrow AP, Magee A, Howard R, Pasquina PF, et al. Mirror therapy in stroke rehabilitation: a meta-analysis. Stroke. 2021;52:1925–1933.
8. de Sire A, Andrenelli E, Negrini F, et al. Efficacy of rehabilitative techniques in reducing hemiplegic shoulder pain in stroke: systematic review and meta-analysis. Eur J Phys Rehabil Med. 2019;55:297–309.
9. Karabegović A, Kapidžić-Duraković S, Ljuca F. Laser therapy of painful shoulder and shoulder-hand syndrome in treatment of patients after the stroke. Bosn J Basic Med Sci. 2009;9(1):59–65. doi:10.17305/bjbms.2009.2858.
10. Başaran PÖ, Büyükşireci DE. Comparison of low-level laser therapy versus neuromuscular electrical nerve stimulation at hemiplegic shoulder pain and upper extremity functions. Lasers Med Sci. 2025;40(1):42. doi:10.1007/s10103-025-04305-1.
11. Korkmaz N, Gurcay E, Demir Y, Tezen Ö, Korkmaz İ, Atar MÖ, Yaşar E. The effectiveness of high-intensity laser therapy in the treatment of post-stroke patients with hemiplegic shoulder pain: a prospective randomized controlled study. Lasers Med Sci. 2022;37(1):645–653. doi:10.1007/s10103-021-03316