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Comparing Progressive Muscle Relaxation and Neural Mobilization for Tension-Type Headaches: A Randomized Comparative Study on Pain and Stress Reduction

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The aim of the study is to compare the effectiveness of the progressive muscle relaxation (PMR) exercise versus neural mobilization on tension-type headaches. Tension-type headache (TTH) is the most prevalent kind of primary headache. These headaches occur in 35-78% of populations. About 44 percent of patients suffering from TTH have demonstrated restricted ability to function, resulting in disability and a lower quality of life, according to the worldwide categorization. Therefore, this research aimed to compare the impact of neural mobilization with PMR for patients suffering from TTH. This study is a pre-post comparative experimental study, and Study duration is about 6 months; the treatment duration is about 6 sessions per week for 8 weeks. The study setting was the ACS Medical College and Hospital campus. For study size, there were 40 subjects recruited; the study sampling is random. Sampling method: Subjects were assessed for inclusion criteria of age group between 19 and 25 years; both males and females were included; clinical diagnosis of tension headache; and exclusion criteria of other type/cause of headache, stroke, brain tumor, and meningitis. The Lakaev Academic Stress Response Scale-2 (LASRS-2) and Headache Impact Test-6 (HIT-6) were taken as outcome measures. 40 patients who fulfilled the criteria were selected based on the simple random sampling method. Of the 40 patients, 20 individuals will be allotted to group A, and the remaining 20 individuals will be allotted to group B. Interventions were given for 6 sessions per week for 8 weeks. Group A received progressive muscle relaxation exercises, while Group B received neural mobilization. When comparing the LASRS-2 along with HIT-6 scores of Groups A and B before and after the test, there is a significant variance in mean values at Pd"0.05. The Lakaev Academic Stress Response Scale-2 (LASRS-2) is a 26-item self-rated questionnaire used to measure academic stress response across four domains: affective, behavioral, cognitive, and physiological, with higher scores indicating greater academic stress. The Headache Impact Test-6 (HIT-6) assesses the impact of headaches on daily life, with a total score ranging from 36 to 78, where higher scores indicate greater impact. The HIT-6 score is categorized into four levels: little or no impact (d"49), some impact (50-55), substantial impact (56-59), and severe impact (60-78). The research's conclusion is that PMR technique has a great role in reducing pain intensity and stress levels and improving quality of life for tension headaches when compared to neural mobilization.

Keywords: Headache management, HIT-6, LASRS-2, Neural mobilization, Physiotherapy interventions, Progressive muscle relaxation.

TTH is a neurological disorder characterized by the occurrence of mild to moderate headaches with few associated symptoms.[1] Tension headaches (TTH), the most frequent type of headache, affect 35-78% of adults, with women being more prevalent. The International Headache Society's International Headache Classification Subcommittee reported in 2004 that 44% of TTH patients have limited function, resulting in disability and a lower quality of life.[2] It is widely acknowledged that stress from daily life is the source of tension headaches. According to clinical studies from several tension headache patients, stress is the most frequent cause of tension headaches, representing as much as 80% of instances.[3] One of the most common headache types is stress headache. However, the cause and origin of this illness remain unknown and controversial. Several factors, such as muscle contraction, psychological problems, vascular abnormalities, and degenerative alterations in the cervical spine, are believed to cause tension headaches.[4] Real tension headaches are distinguished by head discomfort, tension, and contractions of the shoulder, neck, and head muscles.[5] People with headaches regularly request non-pharmacological therapy despite contradictory evidence of benefit. Various physical therapies, including soft tissue manipulations, therapeutic exercises, spinal joint manipulation and mobilization, and needling therapies, have been suggested as helpful headache treatments.[6]Manipulative therapy, muscular relaxation training, counseling (postural and ergonomic education), therapeutic exercise, biofeedback, massage, and acupuncture are examples of non-pharmacological treatments for TTH symptoms.[7] Anxiety is the most common stress response, and uncontrolled stress is harmful to both physical and emotional health. In addition to reducing immunological function, it may cause a number of health difficulties, such as depression, tiredness, sleeplessness, headaches, stomachaches, difficulty eating, hypertension, cardiovascular disease, and even cancer.[8] The Jacobson Relaxation technique, introduced in 1938, is a method for reaching deep relaxation by systematic muscular relaxation.[9] The deep muscle relaxation method called progressive muscle relaxation is predicated on the concept that the body's physiological reaction to stressful thoughts is muscle tension.[10] Dr. Edmund Jacobson et al.,[11] developed the PMR method to alleviate anxiety and stress[11];The mind cannot be angry if the body is at ease, as per Jacobson. From your feet up or your head down, you can gradually contract and relax different muscle groups utilizing a progressive muscle relaxation approach.[12] The PMR technique includes deep breathing and gradual (tense-release) relaxing of major muscle groups. The strategy promotes systematic relaxation of the body's key muscle groups to increase physical as well as mental relaxation, minimize stress reactions, decrease skeletal muscle contractions, and diminish pain perceptions.[13] The effectiveness of the PMR for high-level stress reactions along with mind-body techniques that include minimizing tension headaches, chronic pain management in inflammatory arthritis, cancer adjuvant treatment, insomnia, and irritable bowel syndrome has been supported by empirical research.[14] Learning progressive muscle relaxation is straightforward it does not require a specific location or time, nor does it necessitate the use of specialized tools.[15] Neural mobilization (NM) is a manual treatment method for pain or reduced mechanosensitivity that mechanically treats neural tissues as well as the non-neural structures surrounding them. Neural mobilization has already been proven to have underlying neurophysiological benefits, such as decreased intraneural oedema, enhanced nerve oxygenation, and decreased ischemic pain.[16] Specific neck and arm postures and motions are employed in neural tissue management to diminish nerve mechanosensitivity and relieve symptoms, along with regaining function.[17] Neural mobilization approaches aim to promote adaptability, diminish mechanosensitivity, and activate analgesic processes by mechanically stimulating nerves through elongation, palpation, and sliding.[18] Brain mobilization is the manual or exercise-based movement of brain structures and their surroundings (interface).[19] Facilitating neural mobilization to reduce the intrinsic stresses on the neural tissue.[20] The LASRS-2 is a self-rated, paper-and-pencil psychometric questionnaire that focuses on the perception of stress responses rather than previous exposure to stress (triggers).[21] The HIT-6 is a measurement instrument for assessing the impact of headaches on social functioning, vitality, role performance, cognitive abilities, and psychological

distress, as well as determining headache severity.[22] Despite the separate assessments of PMR and NM in previous studies, there has been no direct comparative analysis of their effectiveness for TTH.

MATERIALS AND METHODS

Based on the selection criteria, we selected a group of 40 subjects by explaining the purpose of the research to the patients. Simple random sampling method was done. The subjects were separated into 2 groups: group A as well as group B. Group A received the Progressive Muscle Relaxation Technique, whereas Group B received the Neural Mobilization Technique. Pre test were done using LASRS- 2 Scale and HIT- 6 Scale. The exercises were carried out for 30 minutes/day for 8 weeks. After the cessation of treatment, a post-test was done using the same outcome measures. Based on the data collected from all the samples, statistical analysis was done.

Group A: progressive muscle relaxation technique

The subjects in group A were given progressive muscle relaxation techniques. It focuses on tightening and relaxing specific groups of muscles in sequence in correlation with breathing exercises. We administered the therapy for 30 minutes, six times a week, for a duration of 8 weeks. The patients were taught how to contract and relax muscles in coordination with breathing exercises.

• Forehead: The patient was asked to hold the tension in forehead muscles for 15 seconds. The muscles should feel strained and tightened. Next, while counting to thirty, slowly let the tension out of the forehead. Ask the patient to relax and pay attention to how their muscles feel differently. Release the strain until they no longer feel any stiffness in their forehead. Take deep, steady breaths.

• Jaw: The patient was asked to hold the jaw clenched tight for 15 seconds. After 30 seconds of counting progressively releasing the tension, keep breathing slowly as well as evenly.

• Neck and shoulders: The patients were asked to Raise the shoulders towards their ears and hold for 15seconds to tense up the neck and shoulders. Start the 30-second countdown as the patient gradually releases the tension.

• Arms and hands: The patient was instructed to slowly clench both hands into fists. Pull the fists to their chest and squeeze as firmly as they can, then hold for 15seconds. After 30seconds of counting, gradually release the tension.

• Buttocks: Patients were asked to stretch their buttocks for 15 seconds, gradually tightening them. In the following 30 seconds, gradually let tension go. Breathe evenly as well as gradually as they normally would.

• Thighs and Legs: The patient was asked to gradually tighten their calf muscles and quadriceps over a period of 15 seconds. Try hardest to tense the muscles. And after 30 seconds, slowly let the tension go.

• Feet: The patient was asked to put more pressure on their foot and toes gradually. As much as they can, contract their muscles. After 30 seconds, release the tension with caution. Then continue to inhale as well as exhale evenly and gently.

Group B: neural mobilization technique

The subjects in group B were given neural mobilization. Neural mobilization increases mechanical stress in the nervous system, increases nerve oxygenation, and reduces nerve mechano-sensitivity. The therapy was given for 30 minutes overall, 6 times per week for a period of 8 weeks.

Mobilization in cranio-cervical flexion: The head was rotated anteriorly by the therapist. The patients were instructed to extend both elbows gradually as they performed a shoulder descent and retropulsion.

Lateral cervical sliding: Laterally slide the cervical region of the patient was allowed to move their shoulders. Patients were instructed to gradually extend, then supinate their forearms and flex their fingers and carpals dorsally.

Opening the mouth in cranio-cervical flexion: Utilizing one hand to open the mouth, the therapist passively supported cranio-cervical flexion (passively assisted). The patient was instructed to gradually extend their elbows, then supinate their forearms and dorsally stretch their fingers and carpal tunnel.

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using

statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis. The Shapiro Wilk test was used to determine the normality of the data. In this study, Shapiro Wilk test showed that the data was normally distributed on the dependent values at P > 0.05. Hence parametric test was adopted. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find statistical difference between the groups.

RESULTS

A comparison of the Mean Values of the Group A along with Group B on LASRS-2 Score exposes a substantial reduction in post-test mean values for each group. Though, the Group A (Progressive Muscle Relaxation Exercises) demonstrates a mean value of 33.00 ± 3.55, which is lower and thus more effective than Group B (Neural Mobilization) at 44.00 ± 3.52, with Pd"0.05. Consequently, null hypothesis is rejected. Similarly, an analysis of Mean Values of the Group A and Group B on HIT-6 Score specifies a substantial decrease in post-test mean values for each group, with Group A showing a mean value of 37.80 ± 1.79, which is again lower and more effective than Group B at 45.45 ± 2.89, at Pd"0.05. Thus, null hypothesis is rejected. Furthermore, comparisons of pre-test along with post-test scores within both Group A and Group B on LASRS-2 Score and HIT-6 Score demonstrate significant differences in mean values at Pd"0.05.

DISCUSSION

The neurological disorder termed TTH is characterized by a tendency for mild to moderate headaches with minimal accompanying symptoms. It is widely acknowledged that stress from everyday life is the primary cause of tension headaches. True tension headaches are defined by cranial discomfort, muscle tension, and contractions in the shoulders, neck, and head. The objective of this research is to examine the eûects of PMR versus neural mobilization in individuals with tension headaches. A cohort of 40 individuals was chosen according to selection criteria, with patient consent acquired through an explanation of the study's purpose. They were segregated into two factions: faction A as well as faction B. Group A received the PMR technique, whereas Group B had been administered the neural mobilization technique. Pretests were conducted with the LASRS-2 Scale and the HIT-6 Scale. Over the course of eight weeks, the exercises were performed for thirty minutes each day. After the treatment ended, we conducted a post-test using the same outcome measures. Statistical analysis was conducted based on the data received from all samples.

Table 1. Comparison of LASRS-2 Score Between Group – A and Group - B in pre and Post Test

Test	Group - A		Group - B		t-TEST	df	Significance
	Mean	S.D	Mean	S.D			
Pre test	73.05	3.87	72.30	2.75	.706	38	.485*
Post test	33.00	3.55	44.00	3.52	-9.82	38	.001**

(*- P > 0.05 - Not Significant) & (**- P ≤0.05 - Significant).

Table 2. Comparison of HIT-6 Score Between Group – A and Group - B in pre and Post Test

Test	Group - A		Group - B		t-TEST	df	Significance
	Mean	S.D	Mean	S.D			
Pre test	65.50	3.08	64.85	3.11	.663	38	.512*
Post test	37.80	1.79	45.45	2.89	-10.05	38	.001**

(*- P > 0.05 - Not Significant) & (**- P ≤ 0.05 - Significant).

Table 3. Comparison of LASRS-2 score within group – A and group - B between pre test and post test

Test	Pre Test		Post Test		t-Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	73.05	3.87	33.00	3.55	10.68	.000**
Group- B	72.30	2.75	44.00	3.52	53.53	.000**

(**- $P \leq 0.05$ - Significant).

Table 4. comparison of HIT-6 socre within group – A and group - B between pre test and post test

Test	Pre Test		Post Test		t-Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	65.50	3.08	37.80	1.79	49.25	.000**
Group- B	64.85	3.11	45.45	2.89	38.43	.000**

(**- $P \leq 0.05$ - Significant).

Soderberg et al. performed a study on chronic TTH management utilizing physical training, acupuncture, and relaxation techniques. In 90 patients with CTTH over a period of 10–12 weeks, between-group differences indicated that relaxation training had the most significant impact immediately after the treatment period.[23]

Lakshmanan Gopichandran and colleagues, Researchers conducted a study to evaluate the effectiveness of PMR and deep breathing exercises on the disability, pain, and sleep of individuals with chronic TTH. The findings concluded that both interventions significantly improved symptom recovery and functional status among 169 subjects over a 12-week treatment period.[24]

Rosemary E. Anderson et al. conducted a study comparing selected osteopathic treatments and relaxation techniques for TTH. According to the study's findings, individuals who underwent three osteopathic treatments along with relaxation techniques reported noticeably more days without headaches per week than those who merely engaged in relaxation exercises. This effect was observed in a cohort of 26 patients over a seven-week treatment period.[25]

Syazwina Muhammed Khir and others studied how well progressive muscle relaxation (PMR) works for stress, anxiety, and depression in adults. They found that PMR helps reduce anxiety, stress, and depression. When combined with other therapies, PMR was effective for 46 participants. The combination of PMR with the other therapies demonstrates eûcacy in 46 participants.[26]

A study by Loren Toussaint et al. examined the way guided imagery, deep breathing, and PMR can improve both physiological and psychological states of relaxation. They concluded that all three stress relaxation techniques effectively promote psychological and physiological relaxation states.[27]

A study by Josphen Youssef Gaied Abdelsaid et al. examined the way PMR affected the blood pressure, stress, and anxiety of senior elderly individuals in assisted living facilities. Over the course of a four-week treatment session, the study found that PMR dramatically reduced blood pressure, stress, and anxiety levels in 60 institutionalized elders.[28]

K. Selvi et al. conducted a study on PMR techniques' impact on stress and anxiety among female students. Findings indicated significant diûerences in the selected criteria of stress and anxiety among 30 women students over a six-week treatment period.[29]

Indrakila S et al. executed an investigation on the eûect of PMR on teenage mental health and concluded that this technique enhances the mental well-being of adolescents, involving 42 subjects.[30]

Maryam Zargarzadeh et al. executed an investigation on PMR's impact on test anxiety in nursing students, concluding that PMR eûectively reduces test anxiety in this population.[31]

M. C. Jong et al. conducted a study comparing transcendental meditation, hypnotherapy, and PMR exercises in treating children suffering from primary headaches. This pragmatic, multicenter, randomized clinical study concluded that all three approaches effectively diminished primary headaches in children and were deemed safe, involving 141 subjects.[32]

An investigation on the impact of PMR on postoperative pain and sleep quality in patients after surgery to replace a heart valve was carried out by Niusha Nazari et al. They came to the conclusion that PMR enhances pain relief and sleep quality in these patients, thereby reducing the necessity for analgesics along with their associated side effects.[33]

Comparing the mean values of Group A along with Group B on the LASRS-2 score exposes a significant reduction in the post-test mean values for each group. Though the Group A (Progressive Muscle Relaxation Exercises) exhibits a lower mean value of 33.00 ± 3.55, signifying greater eûectiveness in comparison with the Group B (Neural Mobilization), which has a mean value of 44.00 ± 3.52, at P d" 0.05. Therefore, we dismiss the null hypothesis. Upon comparison of the mean values of Group A and Group B regarding the HIT-6 score, there is a notable reduction in post-test mean values of each group. Group A (Progressive Muscle Relaxation Exercises) has a mean score of 37.80 ± 1.79, which is lower and more effective than Group B (Neural Mobilization) at 45.45 ± 2.89, and this difference is statistically significant at P d" 0.05. Consequently, we reject the null hypothesis. Comparative analysis of pre-test along with post-test outcomes within Group A and Group B for LASRS-2 Score and HIT-6 Score reveals a statistically significant variance in the mean values at $P<0.05$. This research found that the PMR technique significantly reduces pain intensity and stress levels while enhancing quality of life in tension headache patients compared to neural mobilization. The study's limitations and recommendations can be considered. Large sample sizes allow for analysis across different age groups. Longer studies are recommended, and future research can explore additional outcome measures.

CONCLUSION

This study indicated that both PMR exercises and neural mobilization are eûective; however, the findings concluded that Group A's PMR is more successful in alleviating pain intensity and reducing stress and anxiety levels compared to Group B's neural mobilization. Therefore, the study establishes that gradual muscle relaxation exercises outperform neural mobilization. This study suggests that PMR is more effective than NM in reducing headache severity and stress levels in TTH patients. However, larger randomized trials are necessary to confirm these findings and assess long-term benefits.

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Conflict of Interest

The author(s) do not have any conflict of interest.

Data Availability Statement

This statement does not apply to this article.

Ethics Statement

The procedures were followed according to the recommendations of Helsinki Declaration of 1964(as revised in 2015). This study was registered under Faculty of Physiotherapy, Dr.M.G.R. Educational and Research Institute with [06 B/ PHYSIO/IRB/2023-2024]

Informed Consent Statement

The procedure of the intervention was explained to the treatment group and the informed consent was obtained from the participants.

Clinical Trial Registration

This research does not involve any clinical trials

Permission to reproduce material from other sources

Not Applicable

Author Contributions

K. Kamatchi – Conceptualization, writing, and methodology; K. Bhuvana – Data collection,

analysis and review; N. Kaviraja – Data collection; A. Tanya Bernadite – Writing, review and editing.

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