

COMPARING THE IMPACT OF CRANIOSACRAL THERAPY VERSUS FACIAL PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON SEVERITY AND SLEEP QUALITY IN PATIENTS WITH MIGRAINE

Nithyasri N¹, Manoj Abraham Manoharlal², Akila Venkatachalam³

¹ Assistant Professor, Kg College of Physiotherapy, Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai.

² Professor/Principal, Kg College of Physiotherapy, Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai.

³ Undergraduate Student/Intern, Kg College of Physiotherapy, Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai.

DOI: <https://doi.org/10.5281/zenodo.16752438>

Published Date: 06-August-2025

Abstract: Migraine is a neurological disorder characterized by recurrent episodes of moderate to severe headaches, usually affecting one side of the head. It is often accompanied by the symptoms such as nausea, vomiting, and sensitivity to light and sound and is more prevalent in females than in males, with global prevalence of about 12%. Migraine is found to be seventh cause of the disability worldwide. This study aimed to compare the effect of Craniosacral Therapy (CST) and Facial Proprioceptive Neuromuscular Facilitation (FPNF) on severity and sleep quality in patients with migraine. A comparative study was conducted with 30 participants aged 18 – 25 years Selected based on the inclusion and exclusion criteria. The participants were divided into two groups Group A (n=15) received Craniosacral therapy (CST) and Group B (n=15) received Facial Proprioceptive Neuromuscular Facilitation (FPNF) severity was assessed using Migraine Disability Assessment Scale (MIDAS), and sleep quality was evaluated using Pittsburgh Sleep Quality Index (PSQI). The statistical analysis revealed a significant difference between Group A and Group B, as indicated by the unpaired t- test values for the Migraine Disability Assessment Scale (MIDAS) (t=2.9136) and the Pittsburgh Sleep Quality Index (PSQI) (t=2.4973). These results suggest notable variations in treatment effectiveness between the two groups. The study concluded that craniosacral therapy is more effective than facial proprioceptive neuromuscular facilitation in alleviating migraine – related disability and improving sleep quality in individuals with migraine.

Keywords: Migraine, craniosacral therapy, facial proprioceptive neuromuscular facilitation, migraine disability, sleep quality, MIDAS, PSQI.

I. INTRODUCTION

Migraine is a prevalent and disabling neurological disorder characterized by recurrent headaches of moderate to severe intensity. These headaches are often unilateral and pulsating, lasting from a few hours to three days. Common associated symptoms include nausea, vomiting, and heightened sensitivity to light, sound, or smell. Additionally, some individuals experience transient sensory or motor disturbances, known as aura, which occur before or during a migraine attack. The

condition can be classified as either episodic or chronic, with its underlying mechanisms involving both neurological and vascular components. [1-3] The precise cause of migraines remains unclear; however, they are believed to result from multiple physiological changes in the brain. These include vasodilation (widening of cerebral blood vessels), neurotransmitter imbalances particularly involving serotonin and disturbances in electrical brain activity, such as cortical spreading depression, which is a major contributor to migraine onset. [4,5] Several internal and external triggers have been identified, including hormonal fluctuations (e.g., menstruation), sleep disturbances, stress, bright lights, strong Odors, certain foods, caffeine withdrawal, and infections. [4]

Migraine is a widespread condition affecting millions globally and is the second leading cause of disability worldwide. Among women under the age of 50, it is the primary cause of disability. [6] The prevalence of migraine varies geographically; in the United States, approximately 15.3% of the population experiences migraines, with a significantly higher prevalence among women (20.7%) compared to men (9.7%). [7] In Europe, migraine prevalence ranges from 8% to 17.6% among adults, while it is lower in children and adolescents (5.2%–9.1%). In Asian populations, the prevalence of migraine is generally lower than in Western countries. [8] Several factors contribute to an increased risk of developing migraines. A family history of migraines strongly suggests a genetic predisposition. The condition often begins in adolescence or early adulthood, peaking in frequency during the 30s, and tends to decrease with age. Women are significantly more affected than men, with a female-to-male ratio of approximately 3:1, primarily due to hormonal fluctuations related to menstruation, pregnancy, and menopause. Environmental triggers such as stress, inadequate sleep, exposure to bright lights, and certain dietary factors also play a role in migraine occurrence. [9]

The pathophysiology of migraine involves complex neurological and vascular mechanisms. One key process is Cortical Spreading Depression (CSD), a wave of neuronal and glial depolarization that spreads across the cortex, leading to visual disturbances (aura) and possibly contributing to headache pain. The Trigemino-Vascular System also plays a crucial role, as activation of the trigeminal nerve leads to meningeal vasodilation and the release of inflammatory mediators, which contribute to headache symptoms. [10] Additionally, serotonin imbalances have been implicated in migraine development. Fluctuations in serotonin levels can trigger vasodilation and the release of substances such as calcitonin gene-related peptide (CGRP), which promotes inflammation and pain [11,12].

Genetic predisposition is another contributing factor, with certain mutations affecting brain excitability and vascular responses. [13] Furthermore, inflammatory pathways are activated during migraine attacks, with neuropeptides such as CGRP and substance P playing a role in pain and symptom generation. [14,15]. Migraines typically progress through four distinct phases, although not all individuals experience each stage. The prodrome phase occurs one to two days before the headache and includes subtle symptoms such as mood changes, food cravings, neck stiffness, increased thirst, constipation, and yawning. The aura phase, experienced by some individuals, involves visual disturbances (flashing lights, blind spots) or sensory changes (tingling, numbness) and usually lasts between 20 to 60 minutes. The attack phase is characterized by severe, pulsating headache pain lasting between 4 to 72 hours, often accompanied by nausea, vomiting, and sensitivity to light, sound, or smell. Finally, the postdrome phase follows the headache, during which individuals may feel exhausted, confused, or even euphoric, with some experiencing brief recurrences of pain upon sudden head movement. [16]

Understanding these mechanisms has led to more effective treatment strategies, including the use of triptans, which target serotonin receptors, and CGRP antagonists, which specifically block inflammatory pathways involved in migraine. [17,18] Pharmacological treatments remain the primary approach for managing migraines; however, they are associated with side effects, including gastrointestinal, cardiovascular, and central nervous system complications [19]. Physiotherapy-based treatments, particularly manual therapy techniques, have shown promising effects in reducing pain intensity, migraine frequency, episode duration, disability, and medication dependency. [20-21] Approaches like craniosacral therapy, which involves non-invasive fascial techniques applied between the skull and sacrum to relax myofascial structures and regulate sympathetic nervous system activity. [22-24]

II. METHODOLOGY

STUDY DESIGN:

The study was pre-test and post-test comparative study design.

STUDY SETTING:

This study was conducted in Department of physiotherapy, K.G hospital, Coimbatore.

STUDY DURATION:

The study duration was conducted over a period of 8 months each patient received treatment 3 days per week with one session per day and treatment duration for about one hour per session for a total of 6 weeks.

STUDY SAMPLING:

A total of 30 individuals meeting the inclusion criteria were selected and randomly divided into two groups with 15 participants in each group. Informed consent was obtained for all participants, and a clear explanation of the study was provided before their participation.

SELECTION CRITERIA:

The inclusion criteria were, age group between 18-25 years, Both Females and males were included, Patients who have clinically diagnosed by neurologist were included, Patient who have migraine with aura were included, Patients who have both poor sleep and having migraine pain were included, Headache frequency/month: 5-9, History >2year. the exclusion criteria were, Subjects who have fewer than 3 migraine days per month are excluded, Patients with severe depression, anxiety, and those who have used psychiatric medication in the last 3 months, Secondary headaches and cervicogenic headache were excluded, Pregnancy, cardiac pacemaker's major medical illness under treatment for clotting factors, Headache caused by other disease such as sinusitis, brain tumors were excluded, Head or neck injury in the past 2 year, History of skull, neck, spine surgery.

PROCEDURE:

A total of 30 individuals who met the inclusion criteria and voluntarily agreed to participate were selected using a purposive sampling method. Informed consent was obtained, and detailing explanation of the study was provided before participation. The participants were then randomly assigned to 2 groups, each consisting of 15 individuals. Group A received craniosacral therapy and Group B received facial proprioceptive neuromuscular facilitation. Participants were assessed using the Migraine Disability Assessment Scale (MIDAS) and the Pittsburgh Sleep Quality Index (PSQI). A pre-test evaluation was conducted on the first day before treatment initiation, and the post- test evaluation was performed on final day of treatment.

GROUP A: CRANIOSACRAL THERAPY

Each session followed a structured sequence of craniosacral therapy techniques, applying deep, sliding, and progressive pressure with precise finger contact. The intervention protocol included: Sub occipital Inhibition Technique – 10minutes, Frontal Technique – 5 minutes, Sphenoid Technique – 5 minutes, Fourth Ventricle Technique – 10 minutes, Lumbosacral Technique – 5 minutes These techniques were administered once per session, three times a week, for a total duration of six weeks. Following each session, participants remained in a supine position with a neutral head and neck alignment for 10 minutes to facilitate relaxation and reduce residual tension.

SUBOCCIPITAL INHIBITION TECHNIQUE:

Patient position: supine lying, **Therapist position:** stand behind the patient.

Procedure: Both hands were placed under the occiput, with the fingers in contact with the atlas (posterior arch). Deep, sliding, and progressive pressure was applied for 10 min. The objective of this technique was to relax the sub occipital muscles.

FRONTAL TECHNIQUE:

Patient position: supine lying, **Therapist position:** stand behind the patient.

Procedure: The therapists' ring and little fingers were placed along the outside of the frontal bone (zygomatic processes), while the middle and index fingers were positioned next to the frontal bone (midline). A slight pressure in a posterior direction was performed with the index fingers on the midline of the frontal bone, and, at the same time, the ring fingers were moved in an anterior and caudal direction for 5 min. The aim of this technique was to relax the tissue around cranial structures, since extra cranial tissues such as peri cranial muscles and periosteum are innervated by some meningeal afferents, and such tissues may be related to migraine onset.

SPHENOID TECHNIQUE:

Patient position: supine lying, **Therapist position:** stand behind the patient.

Procedure: The index finger was put over the sphenoid (greater wing), the middle finger on the pterion, and the ring finger behind the ear over the asterion, and the little finger over the occiput (lateral angle). Both thumbs were applied together on the midline of the head. A gentle distraction force was performed for 5 min. The objective of this technique was to relax the tissue around the cranial structures.

FOURTH VENTRICLE TECHNIQUE:

Patient position: supine lying, **Therapist position:** stand behind the patient.

Procedure: Both hands with palms up were applied under the patient's occiput, with the thumb tips together. The therapist made a slight approximation of the thenar eminence and a cephalic traction for 10 min. This cranial technique may be helpful in cases of imbalance in the autonomic nervous system and may accordingly provide analgesia and reduce pain sensitivity.

LUMBOSACRAL TECHNIQUE:

Patient position: prone lying, **Therapist position:** stand beside the patient.

Procedure: Lumbosacral technique. One flat and palm-up hand was located under the sacrum and the lumbar vertebrae L4–L5, whereas the other hand was placed flat and palm down on the pelvic upper surface, with both hands vertically aligned. The therapist performed a slight compression with both hands for 5 min. The objective of this technique was to relax the muscles and other structures around the lumbosacral area to improve their movement and to improve the sagittal balance of the spine, since there are significant correlations between occipitocervical and spinopelvic alignment.

GROUP B: FACIAL PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION

Facial Proprioceptive Neuromuscular Facilitation Group These techniques were applied to the frontalis, corrugator supercili, orbicularis oris, risorius, zygomatic major, levator labi inferioris, mentalis, buccinator, masseter, and temporalis muscles, which are accepted as important in terms of migraine treatment in the literature Combined isotonic technique that includes concentric contractions and stabilizing contractions was used in the present study. The application started with concentric contraction of the focused muscle, at the end of the movement the position kept for 6 seconds against resistance (stabilizing contractions). These exercises were done as 30 repetitions per muscle/1 set per day/3 days a week for 6 weeks.

FRONTALIS:

Patient position: supine lying, **Therapist position:** behind the patient.

Procedure: ask patient to lift your eyebrows up, look surprised, and wrinkle your forehead. Apply resistance to forehead pushing caudally and medially. This motion works with eye-opening. It is reinforced with neck extension.

CORRUGATOR SUPERCILLI:

Patient position: supine lying, **Therapist position:** behind the patient.

Procedure: ask patient to frown. Look angry or worried pull eyebrows down give resistance just above the eyebrows diagonally in a cranial and lateral direction. This motion works with eye closing.

ORBICULARIS ORIS:

Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask patient to Purse your lips, whistle, say prunes kiss. Give resistance laterally and upward to the upper lip, laterally and downward to the lower lip.

RISORIUS AND ZYGOMATIC MAJOR:

Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask patient to smile Apply resistance to the corners of the mouth medially and slightly downward (caudally).

DEPRESSOR LABII INFERIORIS:

Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask the patient to Show the lower teeth Apply resistance upward and medially to the lower lip. This muscle and the platysma work together.

MENTALIS:

Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask patient to Wrinkle your chin. Apply resistance down and out at the chin.

BUCCINATOR:

Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask patient to Suck the cheeks in, pull in against the tongue blade. Apply resistance on the inner surface of the cheeks with your gloved fingers or a dampened tongue blade. The resistance can be given diagonally upward or diagonally downward as well as straight out.

MASSETER AND TEMPORALIS:

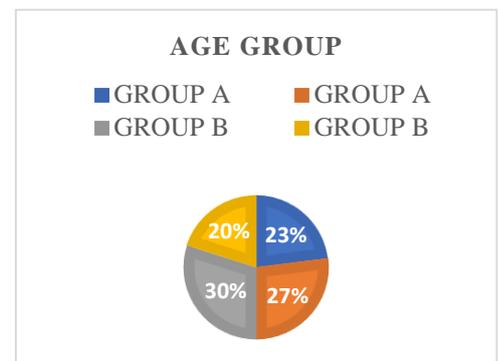
Patient position: Supine lying, **Therapist position:** Behind the patient.

Procedure: Ask patient to close the mouth, bite. Apply resistance to the lower jaw diagonally downward to the right and to the left. Resist in a caudal direction if diagonal resistance disturbs the temporomandibular joint. Resistance to the neck extensor muscles reinforces

III. DATA ANALYSIS AND INTERPRETATIONS

1.1 Table I: AGE GROUP CLASSIFICATION

S.NO	GROUP	AGE RANGE	MEMBERS	PERCENTAGE
1.	GROUP A	18-21	7	23%
2.		22-25	8	27%
3.	GROUP B	18-21	9	30%
4.		22-25	6	20%
TOTAL			30	100%



1.2 Table II: GENDER CLASSIFICATION:

S.NO	GROUP	GENDER	MEMBERS	PERCENTAGE
1.	GROUP A	MALE	7	23%
2.		FEMALE	8	27%
3.	GROUP B	MALE	6	20%
4.		FEMALE	9	30%
TOTAL			30	100%

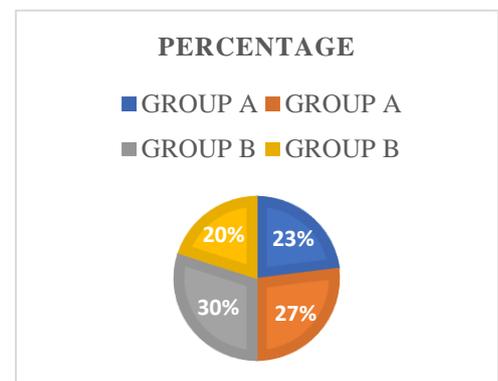
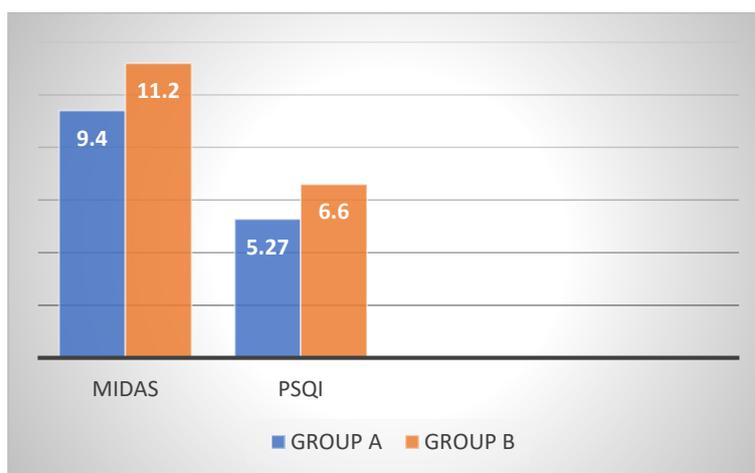


TABLE III: SHOWS DISCRIPTIVE ANALYSIS OF MIGRAINE DISABLITY ASSESSMENT SCALE AND PITTSBURGH SLEEP QUALITY INDEX

PARAMETER	TEST	MEAN ±SD	TABLE T VALUE	P VALUE
MIDAS GROUP A	POST TEST	9.40±1.76	2.9163	0.05
MIDAS GROUP B	POST TEST	11.20±1.61		
PSQI GROUP A	POST TEST	5.27±1.26	2.4973	0.05
PSQI GROUP B	POST TEST	6.60±1.76		

Table III Descriptive analysis of migraine disability assessment scale of (group A and group B) the post mean and standard deviation values in group A were 9.40 and 1.76 the post mean scores of group B were 11.20 and 1.61 The unpaired t test analysis revealed a t-value of 2.9163 with 28 degrees of freedom and a p-value of 0.05 .the obtained table is greater than the significant value at the level of 0.05 hence the statistical report states there were statistically significant differences in post-test comparison and Descriptive analysis of Pittsburgh sleep quality index of (group A and group B) the post mean and standard deviation values in group A were 5.27 and 1.26 the post mean scores of group B were 6.60 and 1.76. The paired t-test analysis revealed a t-value of 2.4973 with 14 degrees of freedom and a p-value of 0.05. The obtained table is greater than the significant value at the level of 0.05 hence the statistical report states there were statistically significant differences in post-test comparison.



IV. DISCUSSION

Migraine is a neurological condition characterized by intense, throbbing headaches, usually on one side of the head accompanied by the symptoms of sensitivity to light, sound, nausea and vomiting. The objective of this study to analyse the effect of craniosacral therapy and facial proprioceptive neuromuscular facilitation on pain and sleep quality in patients with migraine. 30 patients who fulfilled the predetermined inclusion and exclusion criteria were selected and divided into two groups with 15 in each group. Group A underwent craniosacral therapy and Group B underwent facial proprioceptive neuromuscular facilitation. Statistical analysis was done using paired and unpaired t test there was significant difference in craniosacral therapy and facial proprioceptive muscular facilitation in migraine disability assessment scale and Pittsburgh sleep quality index. Group A shows significant improvement in Migraine disability assessment scale and Pittsburgh sleep quality index these results have an earlier finding of, Craniosacral therapy (CST) is a gentle, non-invasive manual therapy that focuses on the craniosacral system, which includes the membranes and cerebrospinal fluid surrounding the brain and spinal cord. By applying light touch, practitioners aim to release restrictions in this system, thereby enhancing the body's natural healing processes. The underlying mechanisms through which CST may influence migraine severity and sleep quality include the reduction of musculoskeletal tension, regulation of the autonomic nervous system, and improvement of

sleep patterns. CST is thought to relieve musculoskeletal tightness in the head, neck, and back, which can contribute to pain relief and the release of both emotional and physical stress. Additionally, CST helps modulate the autonomic nervous system by reducing sympathetic overactivity and enhancing parasympathetic function, promoting deep relaxation and overall well-being. Furthermore, by reducing stress and tension, CST may help regulate sleep patterns and enhance the body's natural sleep wake cycle. Several studies have explored the efficacy of CST in migraine management UPLEDGER J ETAL., Suggests that skull sutural immobility can cause migraines. Therapists found patients experienced migraine pain when sutures were performed. The study also links craniosacral rhythm disorder to migraine, which is related to ventricle contraction, cranial endometrial system expansion, and contraction. In a pathological state, abnormal cranial sacral rhythm occurs. Therapists can adjust cerebrospinal fluid rhythm and flow by gently touching the skull and patient's craniosacral system, regulating functional functioning. The treatment aims to restore the brain and spinal cord's normal function, adjust body system balance, remove metabolites, and enhance self-healing function by restoring normal connections and movement of the central nervous system. Craniosacral therapy protocol contributes to a reduction in pain, migraine severity, and frequency of attacks, functional and emotional disabilities, overall disability, and the need for medication among patients experiencing migraines. The therapeutic effects of this manual therapy protocol on emotional disability in migraine patients, applying various techniques to the cranial and sacral regions Manual techniques targeting the cranio cervical and lumbosacral soft tissues, when applied independently, have demonstrated positive outcomes in patients suffering from migraines MUNOZ-GOMEZ ETAL., Used frontal technique, sphenoid technique, CV-4 technique, lumbosacral technique, and sub occipital inhibition technique these techniques have been associated with improvements in pain levels, migraine severity, and frequency of episodes, overall disability, and medication usage for migraine. This approach helps to minimize variations in pressure and speed, facilitates progress monitoring, and strengthens the therapeutic alliance. Individually, craniocervical and lumbosacral soft-tissue manual treatments have demonstrated positive outcomes in terms of pain, migraine severity, frequency of migraine episodes, and total disability in patients with migraine. This promotes the correct balance of the autonomic nervous system, lymphatic drainage, cerebral-spinal fluid exchange, and healthy blood circulation. GUANGYA JIANG ET AL., The membranes and cerebrospinal fluid that surround the brain and spinal cord, the bones that these membranes link to, and the connective tissue that surrounds these membranes are all part of the known and functional craniosacral system. The body's neurological, musculoskeletal, lymphatic, circulatory, endocrine, and respiratory systems all have a close relationship with and impact it. The physiological movements associated with circulatory activity are quite distinct from the rhythmic and mobile actions that define the craniosacral system. The foundation of CST is the idea that mobility restriction at the skull's cranial sutures impairs the rhythmic impulses that go via the cerebrospinal fluid from the skull to the sacrum. Every structure that comes into contact with the CSF fluid, such as the brain, spinal cord, and its protective membrane are all regarded as components of the craniosacral system and are susceptible to its effects, as are all other structures that come into touch with the cerebrospinal fluid. Each and every other structure in the body may be impacted either directly by the musculoskeletal system's activity or indirectly by innervations that come from or return to the central nervous system. Consequently, the goal of craniosacral therapy is to release the constraints surrounding the brain and spinal cord. ASLIHAM KURT ET AL., Migraines are among the most prevalent neurological disorders, with a notable prevalence in women at a ratio of 3:1 Facial Proprioceptive Neuromuscular Facilitation (PNF) is a therapeutic approach that involves specific facial movement patterns and proprioceptive stimulation to improve neuromuscular coordination and reduce muscle tension. In migraine management, PNF may help alleviate pain by promoting relaxation, enhancing blood circulation, and reducing muscular stress in the craniofacial region. Additionally, by addressing muscle dysfunction and facilitating neuromuscular re-education, PNF can contribute to improved sleep quality, as sleep disturbances are commonly associated with migraine. Effectiveness of the FPNF technique. The initial findings indicate that the FPNF technique appear to contribute to a reduction in pain-related outcomes among migraine patients. The intervention may have relaxed the trigeminovascular system, which is responsible for migraines. FPNF activates the gate-control mechanism by stimulating mechanoreceptors and cutaneous tissue, reducing pain by blocking low-threshold peripheral sensory fibrils. This leads to strong analgesia, as causes strong pain relief. The study suggests that PNF blocked migraine-related pain transmission, resulting in a decrease in pain severity. This suggests that the intervention may have contributed to migraine relief. The result of proprioceptive neuromuscular (PNF) is correlation upon the relationship between the body's sagittal axis and the diagonal lines. Rapid stretching is done while using the PNF technique, which involves moving the muscles gently and with little resistance. Prior to using the PNF technique, it is crucial to activate the facial muscles in order to improve the functional ability of facial muscles.

V. CONCLUSION

This study aimed to evaluate the effectiveness of craniosacral therapy versus facial proprioceptive neuromuscular facilitation in reducing migraine severity and improving sleep quality in individuals with migraine. A total of 30 participants, aged 18 to 25 years, were selected based on specific inclusion and exclusion criteria using a convenience sampling method. Informed consent was obtained from all participants before enrolment in the study. Participants were randomly assigned to two groups Group A received craniosacral therapy, while Group B underwent facial proprioceptive neuromuscular facilitation. The impact of these interventions was assessed using the Migraine Disability Assessment Scale (MIDAS) and the Pittsburgh Sleep Quality Index (PSQI). Pre-treatment assessments were conducted on the first day, and post-treatment evaluations were performed at the end of the intervention period. Statistical analysis demonstrated a significant difference between pre- test and post-test scores for both MIDAS and PSQI, indicating improvements in both migraine severity and sleep quality. Based on the findings, the null hypothesis was rejected, and the alternative hypothesis was accepted. Therefore, this study concludes that craniosacral therapy is more effective than facial proprioceptive neuromuscular facilitation in managing migraine symptoms and enhancing sleep quality in patients with migraine.

ACKNOWLEDGEMENT

I sincerely thank my institution KG college of physiotherapy, principal, central library and all the faculty members for their invaluable guidance. I deeply grateful to the supportive staff guide, friends and family for their constant encouragement and support throughout this journey.

REFERENCES

- [1] Charles A. The pathophysiology of migraine: Implications for clinical management. *The Lancet Neurology*. 2018;17:174–82.
- [2] Headache Classification Committee of the International Headache Society (IHS). *The International Classification of Headache Disorders*, 3rd edition. Cephalalgia: An International Journal of Headache. 2018;38:1–211.
- [3] Buse DC, Greisman JD, Baigi K, Lipton RB. Migraine Progression: A Systematic Review. *Headache: The Journal of Head and Face Pain*. 2018;59:306–38.
- [4] Ibrahim Z. Major causes of Migraine headache. *IDOSR Journal of Biochemistry, Biotechnology and Allied Fields*. 2020;5(1):52–6.
- [5] Khan J, Al Asoom LI, Al Sunni A, Rafique N, Latif R, Al Saif S, et al. Genetics, pathophysiology, diagnosis, treatment, management, and prevention of migraine. *Biomedicine & Pharmacotherapy*. 2021;5.
- [6] Stovner LJ, Hagen K, Linde M, Steiner TJ. The global prevalence of headache: an update, with analysis of the influences of methodological factors on prevalence estimates. *The Journal of Headache and Pain*. 2022;23(1):34.
- [7] Lipton RB. Migraine: Epidemiology, Burden, and Comorbidity. *Neurologic Clinics*. 2019;37(4):631–49.
- [8] Mohammadi P, Khodamorovati M, Vafae K, Hemmati M, Darvishi N, Ghasemi H. Prevalence of migraine in Iran: a systematic review and meta-analysis. *BMC Neurology*. 2023;2.
- [9] Antonaci F, Nappi G, Galli F, Manzoni GC, Calabresi P, Costa A, et al. Migraine and psychiatric comorbidity: a review of clinical findings. *The Journal of Headache and Pain*. 2016;12:115–25.
- [10] Costa ABP, Rodrigues AMDS, Martins LB, Dos Santos LC, Gomez RS, Teixeira AL, et al. Nutritional intervention may improve migraine severity: a pilot study. *Arquivos de Neuro-Psiquiatria*. 2019;77(9):723–30.
- [11] Gasparini CF, Smith RA, Griffiths LR. Genetic and biochemical changes of the serotonergic system in migraine pathobiology. *The Journal of Headache and Pain*. 2017;18:20.
- [12] Ibrahim K, Danser AHJ, Terwindt GM, Van Den Meiracker AH, MaassenVanDenBrink A. A human trigeminovascular biomarker for antimigraine drugs: a randomised, double-blind, placebo-controlled, crossover trial with sumatriptan. *Cephalalgia: An International Journal of Headache*. 2017;37:94–8.
- [13] Olesen J. Headache Classification Committee of the International Headache Society (IHS). *The International Classification of Headache Disorders*, third edition. Cephalalgia: An International Journal of Headache. 2018;38:1–211.

- [14] Peck J, Urits I, Zeien J, Hoebee S, Mousa M, Alattar H, et al. A comprehensive review of over-the-counter treatment for chronic migraine headaches. *Current Pain and Headache Reports*. 2020;24:19.
- [15] Sullivan A, Cousins S, Ridsdale L. Psychological interventions for migraine: a systematic review. *Journal of Neurology*. 2016;263(12):2369–77.
- [16] May A, Schulte LH. Chronic migraine: risk factors, mechanisms and treatment. *Nature Reviews Neurology*. 2017;12:455–64.
- [17] Ma Q, Xing C, Long W, Wang HY, Liu Q, Wang RF. Impact of microbiota on central nervous system and neurological diseases: the gut-brain axis. *Journal of Neuroinflammation*. 2019;16(1):53.
- [18] Ibrahim K, Danser AHJ, Terwindt GM, Van Den Meiracker AH, MaassenVanDenBrink A. A human trigeminovascular biomarker for antimigraine drugs: a randomised, double-blind, placebo-controlled, crossover trial with sumatriptan. *Cephalalgia: An International Journal of Headache*. 2017;37:94–8.
- [19] Capi M, Gentile G, Lionetto L, Salerno G, Cipolla F, Curto M, et al. Pharmacogenetic considerations for migraine therapies. *Expert Opinion on Drug Metabolism & Toxicology*. 2018;14:1161–7.
- [20] Luedtke K, Allers A, Schulte LH, May A. Efficacy of interventions used by physiotherapists for patients with headache and migraine: systematic review and meta-analysis. *Cephalalgia: An International Journal of Headache*. 2016;36:474–92.
- [21] Maistrello LF, Geri T, Gianola S, Zaninetti M, Testa M. Effectiveness of Trigger Point Manual Treatment on the Frequency, Intensity, and Duration of Attacks in Primary Headaches: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Frontiers in Neurology*. 2018;9:254.
- [22] Espí-López GV, Ruescas-Nicolau MA, Nova-Redondo C, Benítez- Martínez JC, Dugailly PM, Falla D. Effect of soft tissue techniques on headache impact, disability, and quality of life in migraine sufferers: a pilot study. *The Journal of Alternative and Complementary Medicine*. 2018;24(11):1099–107.
- [23] Xu J, Kong F, Buse DC. Predictors of episodic migraine transformation to chronic migraine: A systematic review and meta-analysis of observational cohort studies. *Cephalalgia: An International Journal of Headache*. 2019;40:503–16.
- [24] Haller H, Lauche R, Sundberg T, Dobos G, Cramer H. Craniosacral therapy for chronic pain: A systematic review and meta-analysis of randomized controlled trials. *BMC Musculoskeletal Disorders*. 2019;21:1.
- [25] Kamonseki DH, Lopes EP, Van Der Meer HA, Calixtre LB. Effectiveness of manual therapy in patients with tension-type headache. A systematic review and meta-analysis. *Disability and Rehabilitation*. 2020;12:1–10.
- [26] Carrasco-Uribarren A, Mamud-Meroni L, Tarcaya GE, Jimenez-Del- Barrio S, Cabanillas-Barea S, Ceballos-Laita L. Clinical Effectiveness of Craniosacral Therapy in Patients with Headache Disorders: A Systematic Review and Meta-analysis. *American Society for Pain Management Nursing Journal*. 2023;2.
- [27] Kisner C. Therapeutic Exercise: Foundations and Techniques [Internet]. Goodreads. 2020 [cited 2025 Feb].
- [28] Kurt A, Turhan B. Physiotherapy Management of Migraine Pain Facial Proprioceptive Neuromuscular Facilitation Technique Versus Connective Tissue Massage. *Journal of Craniofacial Surgery*. 2022;33.
- [29] Chang Q, Xia Y, Bai S, Zhang X, Liu Y, Yao D, et al. Association between Pittsburgh Sleep Quality Index and depressive symptoms in Chinese resident physicians. *Frontiers in Psychiatry*. 2021;12:564815.
- [30] Raniti MB, Waloszek JM, Schwartz O, Allen NB, Trinder J. Factor structure and psychometric properties of the Pittsburgh Sleep Quality Index in community-based adolescents. *Sleep*. 2018;41.
- [31] Duan S, Ren Z, Xia H, Wang Z, Zheng T, Liu Z. Association between sleep quality, migraine, and migraine burden. *Frontiers in Neurology*. 2022;3.
- [32] Stewart WF, Lipton RB, Dowson AJ, Sawyer J. Development and testing of the Migraine Disability Assessment (MIDAS) Questionnaire to assess headache-related disability. *Neurology*. 2023;56(1):20–8.