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Research Article

Effect of Aerobic Exercise along with Craniosacral Therapy on Pain and Sleep Quality in Subjects with Migraine: An Experimental Study

C Sri Venkatesh[1], V Pradhapsankar[2], M Manoj Abraham[3]

[1]Student, Bachelor of Physiotherapy, K G College of Physiotherapy, Tamil Nadu Dr. M. G. R Medical University, Chennai, India
[2]Assistant Professor, Faculty of Physiotherapy, K G College of Physiotherapy, Tamil Nadu Dr. M. G. R Medical University, Chennai, India
[3]Principal, Department of Physiotherapy, K G College of Physiotherapy, Tamil Nadu Dr. M. G. R Medical University, Chennai, India
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I N F O

Corresponding Author:
V Pradhapsankar, Faculty of Physiotherapy, K G College of Physiotherapy, Tamil Nadu Dr. M. G. R Medical University, Chennai, India
E-mail Id:
pradhapsankar3@gmail.com
Orcid Id:
https://orcid.org/0009-0003-3758-8477
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A B S T R A C T

Introduction: Migraine is defined as a severe recreating headache generally affecting only one side of the head characterised by sharp pain, nausea, puking, and visual and sleep disturbances. It is triggered by the activation of a medium deep in the brain, resulting in the release of pain-producing seditious compounds around the jitters and blood vessels of the head. It commonly affects females because of hormonal influences and it affects the age group between 15 and 55 years.

Objectives: The aim of the study is to find out the effects of aerobic exercise along with craniosacral therapy on pain and sleep quality in subjects with migraine.

Methods: It was an experimental study with only one group. The inclusion and exclusion criteria were used to select a sample size of 20 subjects aged 18 to 25 years. Craniosacral therapy was combined with aerobic exercise for the group. Throughout four weeks, participants attended three 60-minute sessions per week. Pain was assessed by using Migraine Disability Assessment Scale questionnaire and sleep quality was assessed by using the Pittsburgh Sleep Quality Index.

Results: The results showed that there is a significant improvement in Migraine Disability Assessment Scale (pre-test: 18.65 and post-test: 9.05) and Pittsburgh Sleep Quality Index (pre-test: 11.20 and post-test: 6.05).

Conclusion: The study concludes that aerobic exercise along with craniosacral therapy is very effective in reducing pain and improving sleep quality among subjects with migraines.

Keywords: Migraine, Aerobic Exercise, Craniosacral Therapy, Migraine Disability Assessment Scale Questionnaire, Pittsburgh Sleep Quality Index

Introduction

According to WHO, one of the most prevalent nervous system disorders is a headache disorder characterised by recurrent headaches. The definition of a migraine is "A severe, recurrent headache that usually affects only one side of the head, characterised by sharp pain and frequently accompanied by nausea, vomiting, and problems with vision". Migraine is a primary headache disorder. It is also known as hemicrania. Occur at ages between 38 and 45 years. It is more common in women in a ratio of 2:1 because of hormonal influence.[1] The reason behind it is the release of inflammatory chemicals that cause pain around the head's blood vessels and nerves, which is triggered by a mechanism located deep within the brain. Migraine is mainly caused by two factors; one is genetics and inheritance and another is familial hemiplegic migraine.[2] Migraine is mainly classified into; migraine with aura, migraine without aura, familial hemiplegic aura, basilar migraine, aura without headache, and migraine with acute onset aura. Migraine has four phases which include the prodrome phase, aura phase, headache phase, and postdrome phase. The prodrome phase begins hours before migraine and sometimes even the day before has premonitory symptoms associated with hypothalamus activation. It has the following symptoms: extreme thirst, bloating, constipation or diarrhoea, fatigue, food cravings, mood swings, and sensitivity to light, sound, and smell.[2] The aura phase begins before the headache or starts along with it and it may not happen with every headache. About 25% of cases experience changes in neurovascular integration, blood circulation, and cortical function. This phase includes the following symptoms: hallucinations, tunnel vision or complete blindness, difficulty speaking, a heavy sensation in your arms and legs, and ringing in your ears are possible symptoms. Headache phase or attack phase, here only the headache begins and this can last for hours to days. The average length is about 4 hours. Additional changes in blood circulation and function of the brainstem, thalamus, hypothalamus and cortex. Symptoms include pulsing or throbbing head or neck pain, nausea, vomiting, and faintness. Another name for the postdrome phase is "migraine hangover". This stage may continue for a full day or two days. Persistent blood changes with symptoms after headache termination. Postdrome symptoms include Exhausted or tired, unusually refreshed or happy, muscle pain and weakness, cravings or loss of appetite.[3] Numerous factors can trigger migraine, the factors are as follows: menstruation (hormonal changes in 65%), pregnancy, stress (80%), weather changes (53%), excessive or insufficient sleep (50%), some odours, ingestion of certain foods (eggs, alcohol, caffeine, chocolate), exposure to light and sounds, smoking (36%), late sleeping (32%), exercise (22%), and sexual activity (5%). Medications are prescribed for migraine for pain relief as well as improve the condition. Some of the medications are acetaminophen, aspirin, caffeine, ibuprofen, triptans (almotriptan, rizatriptan, sumatriptan), ergotamine, CGRP receptor antagonists (atogepant, erenumab), NSAID's, antiemetics, ergots, dexamethasone and preventive medications such as beta-blockers, calcium channel blockers, antidepressants, botulinum toxin type A, CGRP receptor antagonist, anticonvulsants.[4,5] Other than the medications, there are several treatment procedures which include Single Pulse Transcranial Magnetic Stimulation (STMS), neuromodulation devices, transcutaneous supraorbital nerve stimulation, peripheral nerve blockings, biofeedback, cognitive behavioural therapy, yoga and meditation, lifestyle changes, reduction of triggers, relaxation training, detoxification, aerobic exercise, chiropractic, massage, acupressure, acupuncture and craniosacral therapy. In this study, we treated migraine subjects with aerobic exercise along with craniosacral therapy. Aerobic exercises are endurance-style workouts that require a person to move their muscles for an extended amount of time in a rhythmic and coordinated manner. They are referred to as aerobic exercises because these exercises require oxygen to produce energy. Increased breathing and heart rate during aerobic exercise help the body's muscles receive more oxygen.[6] It improves heart function, lung function, and blood circulation, decreases high blood pressure, improves sleep, mood and energy, and lowers high cholesterol. Examples of aerobic exercise include swimming, hiking on level terrain, dancing, bicycling, walking, downhill skiing, tennis, gardening, jogging, tap backs, burpees, stair climbing, playing sports, running, squats, skipping, and jumping jacks.[7]

A recognised, functional physiological system, the craniosacral system is made up of the membranes and cerebrospinal fluid that surround the brain and spinal cord, the bones that these membranes attach to, and the connective tissue that surrounds these membranes.[8] It is closely associated with and impacted by the body's neurological, musculoskeletal, lymphatic, vascular, endocrine, and respiratory systems.[9,10] Different from the physiological movements associated with breathing and cardiovascular activity, the movements of the craniosacral system are rhythmic and mobile.

These are numerous scales to measure the pain, disability and quality of life of migraine such as the Headache Disability Index, Headache Impact Test (HIT-6),(11) Migraine Specific Quality of Life Questionnaire (MSQOL), Migraine Disability Assessment (MIDAS), and Migraine Pain Scale. Sleep Quality is assessed by using various scales like the Sleep Quality Scale, Pittsburgh Sleep Quality Index, and Sleep Quality Numeric Rating Scale. In this study, we used the MIDAS Scale questionnaire and Pittsburgh Sleep Quality Index to examine the disability and sleep quality of subjects with migraine. The aim of the study is to find out the effects of aerobic exercise along with craniosacral therapy on pain and sleep quality in subjects with migraine. The objective of the

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study is to find out the effect of aerobic exercise along with progressive muscle relaxation training on pain and sleep quality in subjects with migraine.

Methodology

This study followed a single-group experimental design with convenience sampling. Students of the KG College of Physiotherapy were informed about the study and those who were interested, registered their name in the Physiotherapy and Rehabilitation Centre, KG College of Physiotherapy. About 30 participants were registered and only 20 of them were selected based on the inclusion criteria. Participants included both male and female individuals in the age range of 18 to 25 years. Individuals experiencing four or more migraine episodes each, particularly those with migraine accompanied by aura were included in this study. Individuals experiencing fewer than three migraine days each month were not included in this study. Additionally, those with secondary headaches and cervicogenic headaches were also excluded. Furthermore, participants using antipsychotic medications were not eligible for inclusion. Instructions were given to the volunteers about the study and procedures that would be done to them. They accepted and were willing to participate in the study. Everyone who took part signed the written consent form. Volunteers were allocated to a single group. The single group received aerobic exercise along with craniosacral therapy. With ten minutes for warm-up and cool-down, aerobic exercise was given for forty minutes and each exercise was performed for 5 minutes and 1-minute rest was given between exercises. Craniosacral therapy was given for 20 minutes. The study was conducted over a period of 10 minutes, with intervention given for a total of 3 days per week.[12] Only one session was conducted per day and each session had treatment duration of one hour for 8 weeks.

Aerobic exercise protocol consisted of the following:

1. Warm-up session – 5 minutes
2. Aerobic exercise training – 30 minutes
3. Cooldown session – 5 minutes

The warm-up session included the following:

1. Marching in place
2. Heel digs
3. Knee lifts
4. Shoulder rolls
5. Knee bends

Aerobic exercise training included the following (Fig 1-4).

1. Rocket jumps
2. Squats
3. Jumping jacks
4. Burpees
5. Lunges

Cool down session included the following:

1. Stretching

Craniosacral therapy included the following (Fig 5-8).[13]

1. Suboccipital inhibition technique
2. Frontal lift technique
3. Parietal hold and lift technique
4. Fourth ventricle or CV4 technique

Figure 1.Squats

Figure 2.Burpees

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Figure 3.Lunges

Figure 4.Rocket Jumps

Figure 5.Sub-Occipital Inhibition

Figure 6.Frontal Lift

Figure 7.Parietal Hold and Lift

Figure 8.Fourth Ventricle

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Statistical Analysis

Statistical analysis was done using paired 't' test.

To compare the pre-test and post-test results within groups by the help of Pittsburgh sleep quality index and MIDAS.

Results

A total of 20 subjects were conveniently selected into Group I with ages between 18 and 25 years. The MIDAS scale questionnaire was used to measure the migraine disability[14,15] and the Pittsburgh Sleep Quality Index was used to measure the quality of sleep of the subjects.[16] A pre-test was taken before intervention and a post-test was taken after the intervention.

Table 1 shows the analysis of MIDAS questionnaire score in this group. Using paired 't' test with 19 degrees of freedom and 5% as the level of significance, a comparison of the pre-test and post-test values was done. The calculated 't' value was 20.566. This value was significantly greater than the tabulated 't' value (2.093). The result shows that there is a marked difference between the pre-test and post-test values.

Table 2 shows the analysis of the Pittsburgh Sleep Quality Index score in this group. Using paired 't' test with 19 degrees of freedom and 5% as the level of significance, a comparison of the pre-test and post-test values of this group was done. This analysis showed the calculated 't' value to be 15.765, which was significantly greater than the tabulated 't' value (2.093). The result shows that there is a marked difference between the pre-test and post-test values.

Table 1.MIDAS questionnaire

Group	Mean	Mean Difference	Standard Deviation	Calculated t Value
Pre-test	18.65	9.60	1.69	20.566
Post-test	9.05		2.04	

Table 2.Pittsburgh Sleep Quality Index score

Group	Mean	Mean Difference	Standard Deviation	Calculated t Value
Pre-test	11.20	5.15	1.40	15.765
Post-test	6.05		1.05	

Discussion

The subjects in this study underwent an exercise programme followed by treatment for a period of 8 weeks. Their pre-test and post-test values were analysed and calculated for the results. The analysis of pre-test and post-test values of this group is at a 5% level of significance. It shows significant improvements in the MIDAS and Pittsburgh Sleep Quality Index scores. The finding of this study revealed that the group which received 8 weeks of aerobic exercise along with progressive muscle relaxation training showed an extremely significant reduction in pain and improvement in sleep quality.

The improvement in this study could be due to the following mechanism. Stress is an important trigger for migraine attacks. A wide range of conditions, including depression, memory loss, insomnia, pain, and migraine-related disabilities, have been linked to the benefits of aerobic exercise. Specific neurotransmitters, such as serotonin, are released into the brain during exercise. This vital neurotransmitter elevates mood and balances the circadian rhythm. The amino acid tryptophan, which is needed to produce the brain chemical serotonin, which reduces both physical and emotional pain, is also increased by exercise and frequently assists in easing the symptoms of anxiety and stress.

In addition to relieving pain by blocking the pain pathway, aerobic exercise also triggers the release of endorphins. Humans were to lose the nerve tissue beginning at age 30. Exercise exerts its effects on the brain through mechanisms including neurogenesis, mood enhancement & endorphin release.[17] According to researchers, one of the main reasons physical activity may help reduce migraines is that during exercise, the body releases endorphins, which act as natural painkillers.

Endorphins are the body`s best pain-coping mechanism, and they provide a feel-good mood that can last one to two hours post-workout. Many other health advantages are also associated with regular exercise. You can reduce cholesterol, feel better, lose weight, and strengthen your heart with exercise. Migraines can undoubtedly be affected by the ability to enhance various aspects of your general health.

Research indicates that it may also be useful in treating anxiety, sleep apnoea, and hypertension-conditions that are linked to migraines. 150 minutes of exercise a week was found to significantly improve sleep quality. Additionally, exercise can lessen stress by lowering the body's levels of cortisol and adrenaline, two stress hormones. But the practice is not without reservations. Exercise may be a migraine trigger for certain migraineurs. The American Migraine Foundation suggests that this could be because exercise raises blood pressure, which encourages the body's circulation of oxygen-rich blood.

Enhancing the number of dendrite connections between neurons through aerobic exercise results in a denser network, which is then better equipped to process and store information. This process strengthens neural connections

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within the brain. Migraine is a syndrome of self-limited neurogenic inflammation. Elevated plasma concentration of C reactive protein (CRP), pro-inflammatory cytokines (CGRP, substance P), and alteration in adipocytokines (TNF-a, IL-6) have been implicated in migraine pathogenesis. Aerobic exercise regulates or diminishes systemic and neurogenic inflammation, and may therefore yield migraine improvement that exercise targets inflammatory pathways potentially responsible for reducing pain and disability. Aerobic exercise enhances self-efficacy for managing migraine. Aerobic exercise has a more natural depressant effect with significant improvements in depressive symptoms equal to or better than antidepressant drugs alone and also aid's relaxation. Sub-maximal intensity exercises are included in aerobic exercise. The ability to aerobically convert carbs from glycogen and fat stores into energy for an extended length of time without producing a high concentration of lactate is something that can last for a long time.[18] Aerobic exercise confers its benefit on migraine via exercise-induced enhancement in aerobic fitness. An improvement in fitness levels leads to a reduction in stress levels. It is a well-known fact that engaging in physical exercises is a positive way to manage stress, migraine and migraine-related disability.

One possible hypothesis is that reduced sleep may exacerbate symptoms of depression, while another suggests that exercise interacts with the dual processes of circadian and homeostatic regulation, potentially enhancing the restorative functions of sleep and leading to an elevation in body temperature. The subsequent decrease in temperature following exercise may facilitate the onset of sleep and promote slow-wave sleep.

Craniosacral therapy is non-invasive, manual therapy it delivers gentle, rhythmic vibrations that facilitate better communication between various body parts, help to move CSF gently, and induce a calming response that is both physically and psychologically soothing. It promotes better sleep and helps to reduce anxiety, depression, and migraine headaches.

Craniosacral therapy is recognised as a form of mindfulness-based intervention, as it facilitates a sense of tranquillity in patients by directing their attention towards their breath rather than their thoughts. Typically, sessions of craniosacral therapy are characterised by a high degree of comfort, given that the techniques employed are subtle and gentle. Additionally, participants are encouraged to engage in deep breathing throughout the treatment, which can enhance relaxation by stimulating the parasympathetic nervous system.[19]

CST is predicated on the idea that movement restriction at the skull's cranial sutures has an adverse effect on the rhythmic impulses that travel through the cerebrospinal fluid from the skull to the sacrum. The brain, spinal cord, and its protective membrane are all regarded as parts of the craniosacral system and are potentially impacted by it, as are all other structures in contact with cognition. Any one of the body's other structures may be directly impacted by musculoskeletal system activity, or indirectly by innervations that come from or return to the central nervous system. Because of this, the goal of craniosacral therapy is to free the area surrounding the brain and spinal cord and subsequently restore bodily function.[20] So Craniosacral therapy was more effective and safer in alleviating the migraine intensity and frequency as well as the headache-related disability.

Conclusion

This study explored the impact of combining aerobic exercise and craniosacral therapy on pain and sleep quality in individuals with migraine. Twenty participants, aged 18 to 25, were evaluated using the Pittsburgh sleep quality index and MIDAS questionnaire. The results showed significant improvements in both pain relief and sleep quality. These findings indicate that incorporating aerobic exercise with craniosacral therapy may serve as an effective, non-invasive strategy for migraine management.

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