



Physiotherapy Management of Migraine Pain: Facial Proprioceptive Neuromuscular Facilitation Technique Versus Connective Tissue Massage

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Objective: Physical therapy modalities are often used by patients with migraine pain. The effectiveness of the methods in the treatment of migraine has not been clarified yet. This prospective study was planned to investigate whether facial proprioceptive neuromuscular facilitation is superior to connective tissue massage in the treatment of migraine pain.

Methods: The study was conducted on 40 female patients with a neurologist-confirmed diagnosis of chronic migraine with non-aura, and who were aged between 18 and 65. They were randomly divided into 2 groups. Facial proprioceptive neuromuscular facilitation techniques were applied to the patients in the study group (Group 1), and connective tissue massage was applied to the patients in the control group (Group 2). The interventions were performed 3 times a week for approximately 20 minutes. Pain and pressure pain threshold scores were recorded on the first day of treatment before starting the session and were reassessed immediately after the end of the 18 treatment (6 weeks) sessions.

Results: Pretreatment and posttreatment results were similar in both groups in terms of pain scores and pressure pain threshold values ($P > 0.05$). Both groups improved in pain-related outcomes ($P < 0.05$).

Conclusions: Our results suggest that facial proprioceptive neuromuscular facilitation was no more effective than connective tissue massage for treating migraine for the sample size used in the present study. Both methods can be used in the treatment of migraine pain.

Key Words: Migraine disorders, migraine headache, physical therapy techniques, proprioceptive neuromuscular facilitation

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Migraine is a neurological disorder that is characterized by disabling and recurrent attacks of headache lasting 4 to 72 hours. The headache in migraine is a kind of throbbing, moderate, or severe pain that is usually localized to one half of the head, prevents the person's daily life, and may increase with physical activity. Multidisciplinary approaches are recommended for the treatment of migraine with pharmacological and nonpharmacological methods. The aim of treatment is usually to prevent, reduce or heal acute pain or migraine attacks.^{1,2} Patients, who experience that pharmacological treatments are symptomatic and do not tolerate migraine medication due to the side effects or prefer to avoid medication for other reasons, tend to seek different treatment methods.³

Migraine is one of the most common primary headache types that is often referred to physiotherapy to support pharmacological treatment.⁴ Various physiotherapy modalities such as resistance training, aerobic exercise, trigger point treatment, electrotherapy modalities, relaxation exercises, mobilization, soft tissue techniques, connective tissue massage (CTM), and manipulation can be applied in the treatment of migraine.⁵ The CTM has been used in the pain treatment of complex conditions such as dysmenorrhea, fibromyalgia, and migraine, and it has been stated as an effective treatment method.^{6,7} Connective tissue massage aims to stimulate the autonomic nervous system to re-balance the parasympathetic and sympathetic systems, usually moving in a parasympathetic direction. Parasympathetic activation increases with the application of CTM while sympathetic activation decreases. As a result, with the increase in circulation and vasodilation, chemicals causing pain in the tissue are removed and the pain is reduced.⁸ Although we have not found its usage in the treatment of migraine, we know that the proprioceptive neuromuscular facilitation (PNF) technique is another method whose effects in pain management are being investigated. There are many studies that examine the effects of PNF techniques on pain. In previous studies, these techniques were applied to determine the reduction in chronic low back and neck pain.^{9,10} The studies in which the effects of PNF techniques on the jaw joint pain are among the applications in the head region.¹¹ In these studies, it is thought that the techniques will cause changes in the central nervous system and sympathetic/parasympathetic nervous system through the muscles and fascia and may cause pain reducing effects.¹² However, to the best of our knowledge, no previous studies have tried to investigate the effect of facial proprioceptive neuromuscular facilitation (FPNF) techniques on migraine.

We believe that PNF techniques, which have effects on pain through the fascial mobility, circulation, or autonomic nervous

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system mechanisms, might have positive effects on migraine pain. Therefore, we performed this study to investigate and support the hypothesis that the FPNF technique might result in greater or similar improvement in treating women with migraine when compared to CTM. Because it is already known that CTM has positive effects on migraine pain. Also, we believe that FPNF techniques might be as effective as CTM. The main aim of this study was to determine the efficacy of the FPNF techniques when compared to CTM for treating migraineurs.

MATERIALS AND METHODS

Ethical Approval

Ethical approval was obtained from the ethical committee of Hasan Kalyoncu University (Ethics committee decision No: 2019/ 101, date of approval: 01.10.2019). Permission was obtained from the Neurology Department of Private Tam-Med Hospital (Decision no: 5997, date: February 20, 2020). The patients had been informed about the procedure and the informed consent has been obtained from all participants.

Study Design and Patient Selection

This study was a single-center, prospective observational, and randomized study conducted on migraineur women between February 2020 and June 2021. The study included female volunteer patients with a neurologist-confirmed diagnosis of migraine, who were aged 18 to 65 and, did not use painkillers or any other medication, did not have any other neurological disease, and had a normal emotional status according to the Beck Depression Inventory (BDI) scores. The exclusion criteria of the study were; pregnancy, lactation, use of prophylactic medication for migraine or practice of other physiotherapy modalities such as cervical manipulation, mobilization, acupuncture and massage, presence of facial nerve palsy, botulinum toxin/filling applications of the face, surgery history of face or upper back, any existing health problem, adaptation problem to the training program. Patients who participated in the study were divided into 2 treatment groups that were the FPNF group and the CTM group by a simple randomization procedure, the lottery method. Randomization was done by a person who did not know which boxes belonged to which groups. She was asked to divide the same colored papers into 2 boxes in equal numbers.

Measurement Tool and Treatment Protocol

The demographic information of individuals were noted. Pain levels were measured by visual analog scale (VAS) ranging from 0 (no pain) to 10 (intolerable pain).¹³ Pressure pain threshold (PPT) was evaluated on 7 trigger points (m. occipitalis, m. trapezius, m. splenius cervicis, m. temporalis, m. frontalis, m. corrugator supercilii, m. procerius) by an algometer. These reference muscles were stated as a result of the literature review on migraine treatment.^{14,15} A digital algometer (Type II, Somedic Electronics, Solna, Sweden) with a 1 cm² probe was used to measure PPTs. The algometer has excellent construct validity (Intraclass correlation coefficients (ICC) > 0.98) compared to a force plate. The ICC values of intrarater reliability are ranged from 0.89 to 0.96 in people with migraine.¹⁶

The intervention protocols were performed by a physiotherapist. Facial proprioceptive facilitation techniques were applied to the patients in the study group (Group 1) and CTM was applied to the patients in the control group (Group 2).

Facial Proprioceptive Neuromuscular Facilitation Group

These techniques were applied to the frontalis, corrugator super-cilii, orbicularis oris, risorius, zygomaticus major, levator labii inferioris, mentalis, buccinator, masseter, and temporalis muscles, which are accepted as important in terms of migraine treatment in the literature (Fig. 1).^{5,13-15} 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.¹⁷

Connective Tissue Massage Group

The first direction of the CTM is over the sacral region while in a sitting position and continues with the application on the face while lying (Fig. 2). The therapist initiates CTM, using the index and middle finger of 1 hand. The fingers place on the skin at an approximately 45-degree angle and, move to cause traction, but never force through the tissue. Some autonomic reactions may occur during the massage, especially on the parasympathetic direction.¹⁸

The interventions were performed 3 times a week for approximately 20 minutes with intervals of 2 to 4 days between sessions, and for a total of 18 sessions, performed over a 6-week period. The sessions were completed in the same amount of time for each participant. Pain and PPT scores were recorded on the first day of treatment before starting the session and were re-assessed immediately after the end of the 18 treatment sessions.

Data Analysis

The sample size was calculated to be 12 subjects in each group with a 5% type 1 and 20% type 2 error limits before and after treatment to gain 0.60 of effect size and a 95% confidence interval. The calculation was performed using the G* Power version 3.1 program based on the mean and standard deviation of pain levels (VAS) in each group.¹⁹ The SPSS program version 22.0 was used to analyze the data. The normal distribution of data was determined by the Shapiro-Wilk test. The Wilcoxon test was used to compare pain and pain pressure threshold levels in groups before and after treatment. Mann-Whitney *U* test was used to analyze pre-/post-treatment pain and pain pressure threshold levels between groups. The value of *P* < 0.05 was considered as significant. The data analysis was performed by a person who was not involved in the measurements.

RESULTS

Forty of the 43 patients were included in the study and evaluated statistically. The sampling flowchart is described in Figure 3.

Demographics of the Participants

The mean age of all individuals was 35.07 ± 9.83 years. The demographic data and characteristics of the patients were statistically similar between the groups (*P* > 0.05). The characteristics of participants are given in Supplementary Digital Content, Table 1, <http://links.lww.com/SCS/D1000>.

Distribution of Pain Related Properties

The majority of the participants stated that the pain was sometimes unilaterally and sometimes bilaterally. Thirty percent of the patients mentioned a unilateral pain. Seventy-five percent of the participants stated that they experienced the pain



FIGURE 1. Examples of the PNF applications for face. PNF, proprioceptive neuromuscular facilitation.

1 to 4 times a month. Most of them said that it takes between 1 and 3 days, could not specify a specific time for the onset of the pain and stated that it was an irregular type. Pain related properties of the participants are given in Supplementary Digital Content, Table 2, <http://links.lww.-com/SCS/D1000>.

Changes in Pain and Pain Pressure Threshold Values After Treatment

In both groups, pain healings were determined. As shown in Supplementary Digital Content, Table 3, <http://links.lww.com/SCS/D1000> the pain pressure threshold values were significantly higher in both groups after the treatment ($P < 0.05$).

As seen in Supplementary Digital Content, Table 4, <http://links.lww.com/SCS/D1000> there was no difference between the groups in terms of pain and PPT value changes after the treatment ($P > 0.05$).

DISCUSSION

This study aimed to determine the efficacy of the FPNF technique compared to CTM for treating women with migraine. The preliminary results from this study suggest that the FPNF was no more effective than CTM for treating migraine for the sample size used in the present study. However, both techniques may decrease pain related outcomes in migraine patients.

Migraine is one of the most common neurological disorders, affecting women disproportionately at a rate of 3:1.²⁰ It appears to be predominantly a female disorder and, many studies report

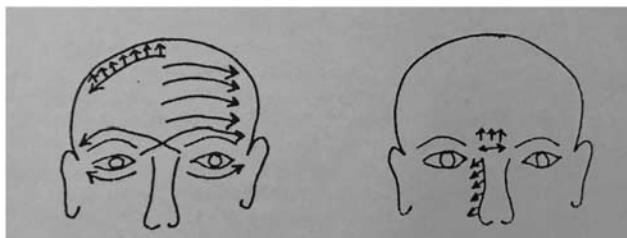


FIGURE 2. Connective tissue massage directions on face.

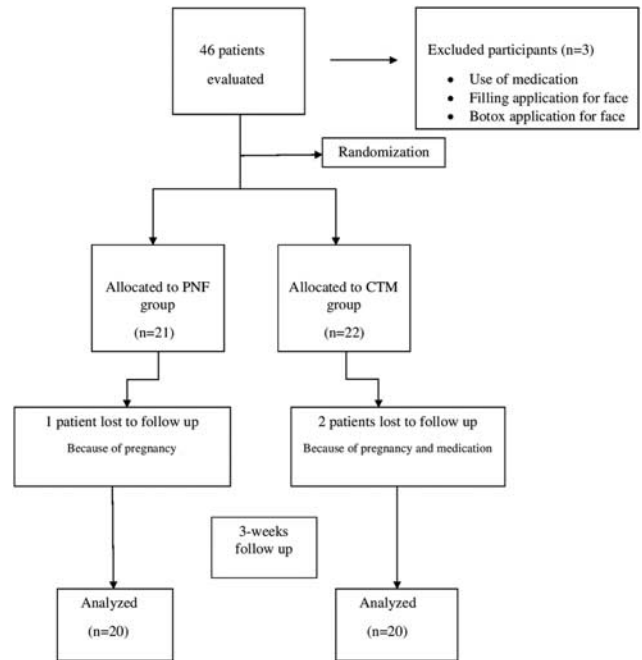


FIGURE 3. Flow-chart diagram and allocation in groups: FPNF and CTM. CTM, connective tissue massage; FPNF, facial proprioceptive neuromuscular facilitation.

that menarche, menstruation, pregnancy, and menopause, and also the use of hormonal contraceptives and hormone replacement therapy may influence migraine occurrence.²¹ Because of the higher incidence of migraine in women, we conducted our study only on female patients in order to eliminate gender differences.

Our migraine patients' mean age was similar to the other reported studies. As an example, Kirteke et al²² have stated the mean age of migraine patients as 36.75 ± 10.33 years. In the study conducted by Satpute et al²³ the mean age of the patients was 40.20 ± 10.03 years. In our study, the mean age of the migraine patient group who underwent CDM was 35 ± 10.97 years, and the mean age of the migraine patient group who underwent PNF techniques was 35.15 ± 8.82 years. We can say that the average age of the participants in our sample is under 50 years old, which is similar to the studies in the literature.

This study determined that headache frequency is substantially 1 to 4 times in a month. The rates that specified in this way were 70% in the CDM group, 80% in the PNF group, and 75% in all participants. Regarding the location of the pain, 30% of the migraineurs in our study represented it as unilateral, 15% as bilateral, 55% of those were sometimes unilateral and sometimes bilateral. It has been reported in the literature that 60% of migraine patients experience migraine pain once a month or less. Regarding the location of the pain, it is stated that migraine pain is usually on 1 side of the head.^{24,25} According to the International Headache Society, the duration of a migraine attack in an adult who has not attempted treatment is 4 to 72 hours.²⁶ Although the localization of the pain in the participants of our study varied, it can be said that it was mostly on 1 side of the head. The duration of pain was stated as between 1 and 4 hours in 5% of participants, 5 to 8 hours in 15%, 1 to 3 days in 60%, and more than 3 days in those 20% by our participants. It is reported that migraine pain is long-lasting, although a precise time frame is not specified.

The present study showed that both groups had healing effects on pain severity and pain threshold levels after the interventions, so it may be said that both treatments for migraine have pain-reducing and PPT-increasing effects. There are similar studies about the effects of massage techniques on migraine pain.^{27,28} Studies examining CTM treatment for migraine are very limited.^{29,30} Both of the treatments in our study (PNF and CTM) are underwent over the fascia. Our study's findings may be attributed to the fact that interventions to the fascia reduce the severity of pain. Also, the reduction in pain may be due to the circulation-enhancing effect of the applications.

Studies are indicating that disorders such as migraine are associated with the maxillofacial region.^{31,32} In some of these studies, it was stated that individuals with temporomandibular joint disorder (TMD) and occlusion problems have a higher risk of migraine.^{33,34} In addition, depression and anxiety are also known to be associated with TMD disorders.³⁵ Depression and anxiety symptoms have also been reported as common symptoms in migraine patients. Therefore, it is quite possible to have TMDs in migraine patients.³³ As Gumrukcu et al³⁶ stated, TMD is associated with neck pain, shoulder pain, headache, and migraine. As Dahan et al³⁷ emphasized, the presence of migraine was positively associated with TMD. The researchers have found that applications to the temporomandibular joint and maxillofacial region provide a significant difference in terms of headache and migraine pain. We also think that relaxing applications to the maxillofacial region may be effective in the treatment of migraine.

It should not be forgotten that, with the stimulation of the skin and also the placebo effect, muscle tension and stress hormones decrease, and the pain threshold rises.³⁸ Also, the intervention might have caused a relaxation of the trigemino-vascular system. It is known that the neurological causes of migraine are attributed to trigeminal nerve activation and substances released by the trigemino-vascular system.³⁹ Furthermore, it is known that the application of CTM activates the gate-control mechanism as a result of the stimulation of mechanoreceptors and the cutaneous tissue (pre- and post-synaptic inhibition). Then the feeling of pain is reduced by the blockage of transmission of low-threshold peripheral sensory fibrils. It has been stated that CTM causes strong analgesia in this way.^{29,30} In our study, we think that the transmission of migraine-related pain was blocked by CTM and PNF, and the severity of pain decreased.

Migraine surgery has been reported as an alternative to medical management to provide a relief to migraine sufferers.⁴⁰ Primarily, individuals with migraines seek nonpharmacological or nonsurgical treatments to reduce headache frequency, severity and improve quality of life.⁴¹ However, surgeries have many risks, and pharmacological methods have side effects as well.⁴² Alternative medical treatment methods are always needed.

The limitations of our study include the absence of gender comparisons and the fact that pain levels according to the VAS are based on the patients' statements by asking them to remember the situations during migraine attacks. It was not possible to blind the physiotherapist and the volunteers due to the nature of both treatments, which does not allow us to guarantee that the apparent effect of therapy on their perception of improvement after the intervention was not produced by placebo.

In our study, the reduction of pain as a result of both treatment methods, which were applied from the skin surface, showed us that fascial interventions by cutaneous stimulations have positive effects on reducing migraine pain. In conclusion, FPNF was no more effective than CTM for treating migraine for the sample size used in the present study. Both treatments

can be preferred over one another interchangeably considering patient preferences. They can be tried as a prophylactic treatment before surgical or pharmacological methods. The number of migraine attacks, severity of the pain, and the duration of pain attacks can be reduced by both methods. The application of PNF techniques and CTM in addition to treatment in individuals who have undergone a surgical procedure or undergoing medication may be beneficial to the patients. In the future studies, each of both applications can be combined with different treatment methods in migraine treatment. The results of our study could provide evidence that both techniques may improve outcomes in migraine patients in terms of pain.

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