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ORIGINAL RESEARCH

Effect of Postural Correction and Orthopedic Massage Therapy on the Frequency of Headaches and Tenderness of Muscles in Migraine Patients

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Abstract

Background: Due to controversial information about the effect of different physiotherapy methods used in the treatment of migraine patients, the aim of the study was to assess the effectiveness of postural correction and orthopedic massage as interventions against headache, and neck and shoulder area muscles tenderness, on improving active range of cervical motion and upper body posture in episodic migraine patients (n = 10) before, after five-week therapy program and 6 months after the therapy.

Methods: Effectiveness of interventions against headache was measured by the Headache Under-Response to Treatment (HURT) Questionnaire. Neck and shoulder area muscles tenderness was assessed using Total Tenderness Score (TTS) and active range of cervical motion (caAROM) by cervical goniometry. Upper body alignment from lateral and posterior view was assessed by observation.

Results: HURT-3 score was significantly lower both after five-week therapy program (P < 0.05, g = 0.98, 95% CI = 0.06, 1.91) and 6 months after the therapy (P < 0.05, g = 1.08, 95% CI = 0.14, 2.02) as compared to the respective characteristics before the therapy. TTS was significantly lower after five-week therapy program (P < 0.01, g = 1.40, 95% CI = 0.42, 2.38), increasing during half a year, but not significantly (P > 0.05, g = 0.51, 95% CI = -0.38, 1.40). Six different directions of caAROM increased after five-week therapy, but significant increase was registered only in lateral flexion to the right 6 months after the therapy (P < 0.05, g = -1.17, 95% CI = -2.12, -0.22). Upper body posture from lateral view was significantly improved after five-week therapy (P < 0.05, g = -1.25, 95% CI = -2.21, -0.29) and 6 months after the therapy (P < 0.05, g = -1.22, 95% CI = -2.18, -0.27). From posterior view significant postural correction was registered only after five-week therapy program (P < 0.05, g = -1.37, 95% CI = -2.34, -0.39).

Conclusions: Half a year after the postural correction and orthopedic massage therapy the frequency of headaches is lowered, but neck and shoulder area muscles tenderness has increased. Significant positive effect on the frequency of headaches and correct upper body posture from lateral view is maintained 6 months after the therapy. Characteristics of cervical motions are comparable to standard values both after five-week therapy program and 6 months after the therapy. Postural correction and orthopedic massage are effective in reducing frequency of headaches in episodic migraine patients.

Keywords

Migraine, Postural correction, Orthopedic massage, Muscles tenderness

Introduction

Migraine is a neurovascular disorder characterized by recurrent unilateral headaches accompanied by nausea, vomiting, photophobia and phonophobia [1]. It has been estimated that approximately 15% of Europeans suffer from migraine [2] and foremost it affects working age persons [3]. Medication is commonly used to treat migraine attacks, but its inappropriate use in case of acute headache can lead to medication overuse head-

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aches, increasing headache days and reducing quality of life [4].

Since correlation between head, neck and shoulder area muscles pain and migraine frequency has been clinically established [5], recent studies advise to include pain decreasing methods for neck and shoulder area muscles in migraine treatment [6,7]. Migraine patients can have neck stiffness, forward head posture, trigger points in the cervical musculature, and restricted cervical range of motion when compared to healthy controls [8-10]. These factors can trigger migraine attacks, and when not appropriately addressed, will lead to migraine chronification. Whereas the ideal head and upper body posture includes minimal strain on soft tissue, cervical vertebrae bodies, facet joints and discs, it is essential to correct forward head posture as a reason for incorrect weight-bearing capacity in cervical spine [11].

Some studies have shown that in migraine treatment, the effect of massage therapy is comparable to that prophylactic medication on reducing migraine attacks [12,13]. Despite these findings providing preliminary support for the utility of massage therapy as a nonpharmacologic treatment for individuals suffering from migraine [14], it cannot be claimed that physical therapy promotes additional improvement in migraine treatment [15]. It is known that massage therapy as a stand-alone treatment, reduces pain and improves function compared to no treatment in some musculoskeletal conditions [16], but there is a lack of evidence of similar effect in episodic migraine patients. The aim of orthopedic massage is to enhance soft tissue fluid circulation, remove residue of muscle metabolism and replenish nutrient deprived regions to heal properly [17].

We hypothesized that the frequency of migraine headache days is significantly lower for the period of 6 months after conducting the orthopedic massage and postural correction.

The aim of the study was to assess the effectiveness of postural correction and orthopedic massage as interventions for episodic migraine prophylaxis. The purpose was to evaluate neck and shoulder area muscles tenderness, active range of cervical motion and upper body posture in episodic migraine patients before, after five-week therapy program and 6 months after the therapy.

Methods

The current study was approved by Research Ethics Committee of the University of Tartu (permit number: 257/T-11, 21.03.2016), all patients signed a written informed consent for participation in the study. The study was performed in the Institute of Sport Science and Physiotherapy, University of Tartu.

Ten patients (9 women, 1 man) recruited from Tartu University Headache Clinic with migraine diagnosis (2 with aura and 8 without aura) who gave their consent for participation were included in the study. Exclusion criteria were other pathologies in head, neck and shoulder area, tension type headaches or mental health disorders that could affect the outcome of the study.

A therapy program consisted of five sessions administered once a week. Every therapy session, lasting for one hour, included the postural correction counselling (approx. 3 minutes) and the orthopedic massage (approx. 55 minutes). The postural correction counselling included instructions for patients to maintain good upper body alignment during sitting, standing or walking in everyday activities. Orthopedic massage was performed for all deep and superficial muscles in the neck and shoulder area, and also with strong pressure, according to patients` pain tolerance. All intervention procedures were performed by the same physiotherapist. The number of interventions related to the study was consistent with the average number of physiotherapy procedures during half a year in the local national medicine system. Methods used in the current study are applied in customary clinical practise. In the current study, the use of headache medications was not recorded. Additional physiotherapy or massage during the study was not allowed. All measurements of the study were conducted before therapy, after five-week therapy program and 6 months after the therapy.

Effectiveness of interventions against headache was measured with the HURT Questionnaire [18], which is an outcome measure between a health care provider and a patient. In the current study, HURT scores were computed as summations of responses to questions 1-3 as HURT-3 (min point 0, max 9); the sum of responses to questions 4-8 as HURT-5 (min point 0, max 15) and the sum of responses to questions 1-8 as HURT-8 (min point 0, max 24). HURT-3 is assessing the frequency of headache and the level of disability caused by it, HURT-5 is related to different aspects of pain management for example medication use and its effects, perception of headache control, and understanding of diagnosis. HURT-8 analyzes treatment efficiency, considering the samples higher and lower score. Lower scores indicate better effectiveness of interventions against headache [18].

Neck and shoulder area muscles tenderness was assessed using standardized deep manual palpation in subjects who were sitting on a chair with adjustable neck and leg support. The following seven muscles were examined: *m. trapezius pars descendens, m. splenius capitis, linea nuchalis superior, m. levator scapulae, m. sternocleidomastoideus, m. temporalis,* and *m. deltoideus pars anterior.* TTS was based on evaluation criteria where “0” refers to the absence of visually recognizable reaction or verbal feedback to discomfort; “1” refers to moderate mimic reaction but no verbal response to discomfort; “2” refers to verbal and mimic reaction to discomfort and pain; “3” refers to considerable mimic gri-

mace and verbal feedback to pain. TTS was determined by calculation 7 × 2 × 3 (max 42) where "7" indicates evaluated muscles, "2" indicates bilaterality and "3" indicates tenderness evaluation criteria (0-3). Muscles palpation was performed by pushing the index finger with circular motion to the muscle belly for 4-5 seconds, using the pressure of less than 10 kg/cm² [19,20].

Cervical measurement system Keno® (Kuntoväline Oy & David Fitness Medical Ltd, Helsinki, Finland) was used to measure caAROM in participants in the sitting position. Participants received instructions to actively flex (neck flexion) and extend (neck extension) the neck, to incline the head to the right and left (neck lateral flexion) and to turn the head to the right and left (neck rotation) as far as possible. Normal active neck range of motion is: flexion 80-90°, extension 0-70°, lateral flexion 20-45°, rotation 70-90° [21]. In the current study, three measurements were performed for each assessed movement; the best result was accepted for data analysis.

Upper body alignment from lateral and posterior view was assessed by observation. Participants stood in an inherent position a few meters from the observer in a well-lit room. The score of posture was formed of the head, shoulder area and thoracic spine evaluation results. Better alignment of the head, shoulder area and thoracic spine permits a maximum score of 30 points (separately both from lateral and posterior view): points 0-3 indicate poor, 4-7 fair and 8-10 good posture [22]. To reduce the interrater variability bias, the score of muscles tenderness and upper body posture were determined separately by two physiotherapists - the average result of TTS and posture was obtained with three evaluations.

Data are presented as means and standard errors of the mean (± SE). Descriptive statistics were calculated using SPSS software (version 20, IBM Corporation, NY, USA). One-sample Kolmogorov-Smirnov test was used to analyse normality of data distribution. One-way analysis of variance (ANOVA) followed by Tukey's post hoc comparisons were used to test for differences between before therapy, after five-week therapy program and 6 months after the therapy of all measured characteristics. A level of $P < 0.05$ was selected to indicate statistical significance. Hedges´ g effect size values were provided as an estimate of the size of the difference over time. A g of 0.2 was considered small, 0.5 medium and over 0.8 is considered a large and substantial difference. 95% confidence intervals were calculated for effect size.

Results

Participants` anthropometric data, duration of migraine symptoms per years and migraine episodes per months before the therapy are presented in Table 1. The average frequency of migraine episodes per month was 10.3 days, which is defined as high-frequency episodic migraine (10-14 headaches per month) [23]. After the therapy 6.6 and 6 months after the therapy 6.9 headache days per month were registered.

HURT-3 scores were significantly lower after five-week therapy ($P < 0.05$, g = 0.98, 95% CI = 0.06, 1.91) and 6 months after the therapy ($P < 0.05$, g = 1.08, 95% CI = 0.14, 2.02). HURT-5 and HURT-8 scores were also lower after the therapy as compared to the scores before the

Table 1: Participants` anthropometric data and duration of migraine before the therapy.

Characteristics (n = 10) mean ± SE	Migraine patients	Range
Age (year)	41.6 ± 3.41	23-58
Body height (cm)	167.3 ± 2.71	160-171
Body mass (kg)	68.9 ± 4.48	48-93
BMI (kg.m^{-2})	24.5 ± 1.21	18-30
Duration of migraine (years)	14.6 ± 3.85	2-36
Migraine episodes per month	10.3 ± 1.77	3-16

Note: BMI: body mass index. Data are mean and standard error (SE).

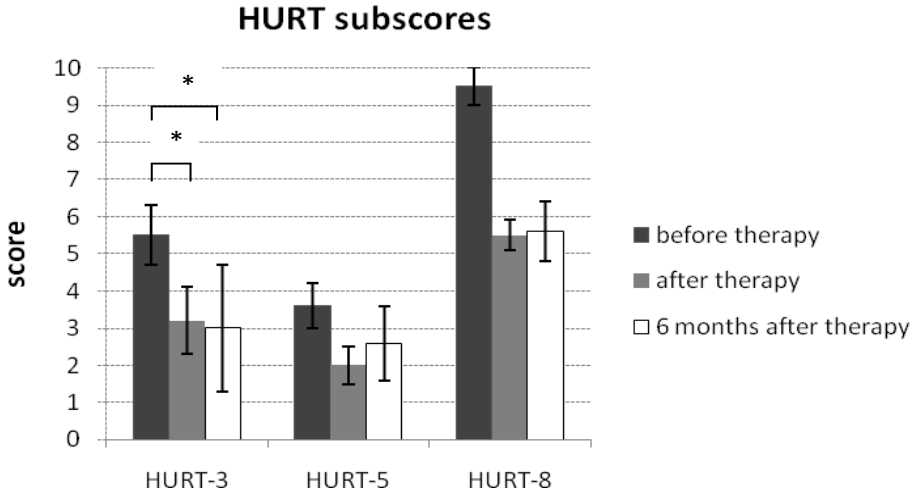

Figure 1: Headache Under-Response to Treatment (HURT) subscores HURT-3; HURT-5 and HURT-8 before therapy, after therapy and 6 months after the therapy in migraine patients (n = 10) (mean ± SE).

*P < 0.05.

therapy, but the change was not statistically significant (g = 0.64, 95% CI = -0.26, 1.54; g = 0.86, 95% CI = -0.06, 1.77 respectively). Six months after the therapy HURT-5 and HURT-8 scores were increased as compared to the scores after five-week therapy, but the referred change was not significant (g = -0.39, 95% CI = -1.28, 0.49; g = -0.03, 95% CI = -0.91, 0.84 respectively) (Figure 1).

TTS was significantly lower after five-week therapy ($P < 0.01$, g = 1.40, 95% CI = 0.42, 2.38). Six months after the therapy, TTS increased, but not significantly ($P > 0.05$, g = 0.51, 95% CI = -0.38, 1.40) (Figure 2).

caAROM values increased in all measured directions after five-week therapy program, but significant improvement was registered only in lateral flexion to the right as compared to the characteristics before and 6 months after the therapy ($P < 0.05$, g = -1.17, 95% CI = -2.12, -0.22) (Figure 3).

Upper body posture from lateral view was improved significantly both after five-week therapy program and 6 months after the therapy ($P < 0.05$, g = -1.25, 95% CI = -2.21, -0.29; g = -1.22, 95% CI = -2.18, -0.27 respectively). Significant improvement in upper body posture from posterior view was registered only after five-week therapy ($P < 0.05$, g = -1.37, 95% CI = -2.34, -0.39), not 6 months after the therapy (g = -0.83, 95% CI = -1.75, 0.08) (Figure 4).

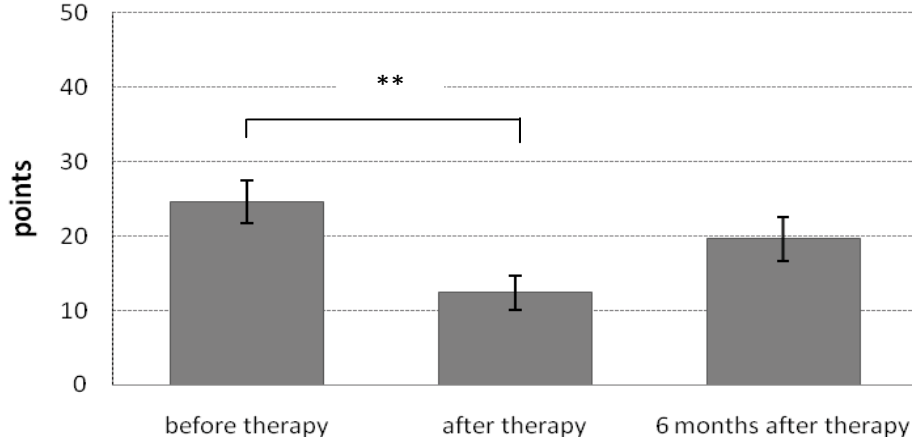

Figure 2: Total Tenderness Score before therapy, after therapy and 6 months after the therapy in migraine patients (n = 10) (mean ± SE).

*P < 0.01.

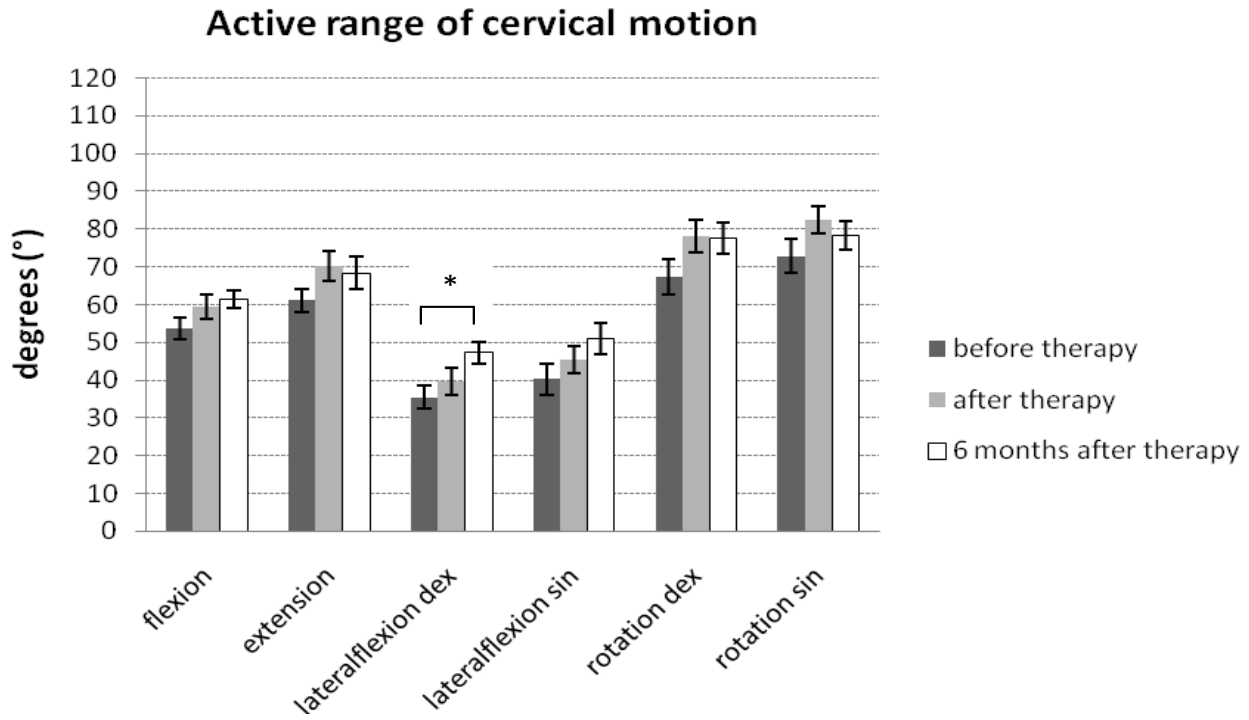

Figure 3: Active range of cervical motion characteristics in six different directions of mobility before therapy, after therapy and 6 months after the therapy in migraine patients (n = 10) (mean ± SE).

*P < 0.05.

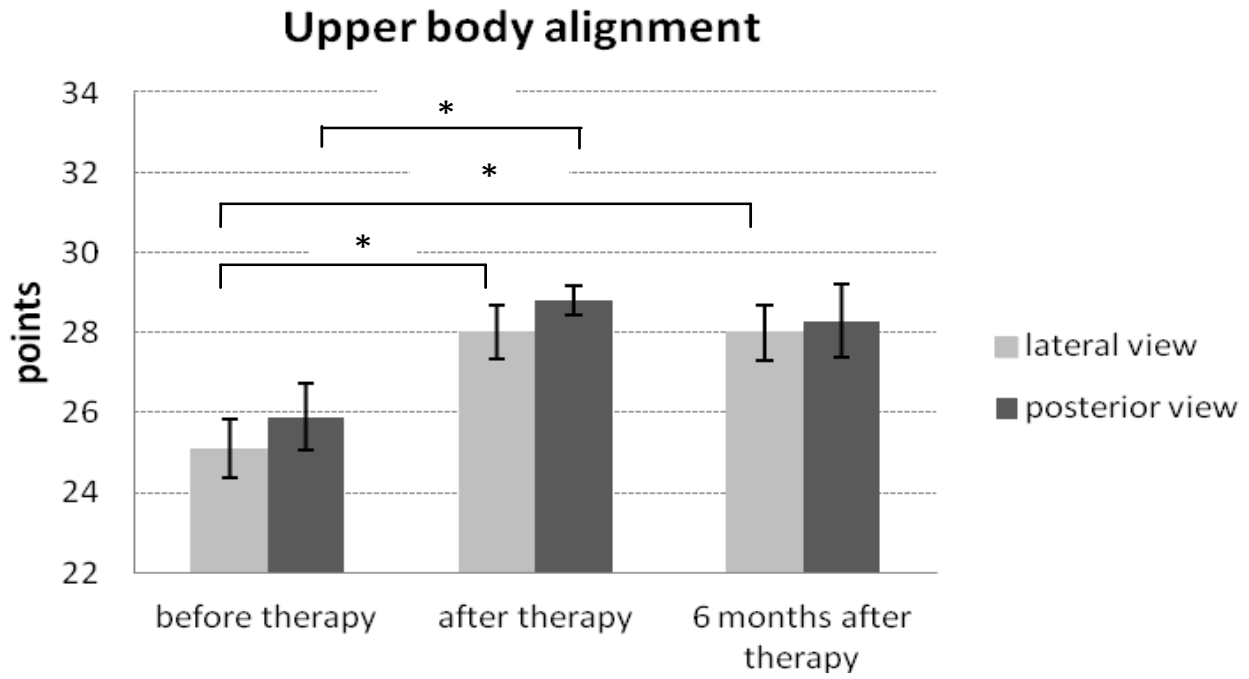

Figure 4: Upper body alignment from lateral and posterior view before therapy, after therapy and 6 months after the therapy in migraine patients (n = 10) (mean ± SE).

*P < 0.05.

Discussion

Due to controversial published information about the effect of different physiotherapy methods used in the treatment of migraine patients, the aim of the study was to assess the effectiveness of postural correction and orthopedic massage as interventions to reduce headache frequency, neck and shoulder area muscles tenderness, active range of cervical motion and upper body posture in episodic migraine patients before, after five-week therapy program and 6 months after the therapy.

Based to the answers of the HURT first question "*On how many days in the last month did you have a headache?"*, the number of headache days before the therapy was 10.3, after the therapy 6.6 and 6 months after the therapy 6.9 days, referring that the headaches after the therapy can be classified as low-frequency episodic migraine (< 10 headaches per month) [23]. In the current study HURT-3 score, indicating the frequency of headache and the level of disability caused by this, was decreased after the therapy 42% and 6 months after the therapy 45%. HURT-3 score was decreased 55% in medication-based intervention study lasting 13.5 months [18].

Despite that HURT-5 score (concerning different aspects of headache management) and HURT-8 score (analyzing the effectiveness of treatment considering the sample's higher and lower score) decreased after the therapy, respectively 44% and 42%, the change was not statistically significant. Six months after the therapy, HURT-5 and HURT-8 scores were increased as compared to the scores after five-week therapy program respectively 3% and 1% but referred change wasn`t significant. It is noted that HURT questionnaire`s conceptual frame covers items such as medication use, medication efficacy, tolerability, self-efficacy, and understanding of diagnosis and these items (causal indicators) are not interchangeable and cannot replace each other. Low test-retest reliability, especially for questions 5, 6, 7 and 8, points toward the dynamic nature of many aspects of headache symptomatology in the short term [18].

Women with chronic, not episodic, migraine exhibit increased activity in superficial neck extensor muscles when acting as antagonists during low-load isometric neck flexion [24]. In the current study, episodic migraine patients exhibited before the therapy neck and shoulder area muscles tenderness, which decreased after five-week therapy program 49%. Despite that, 6 months after the therapy TTS increased 36% compared to the characteristic after five-week therapy, this change was not statistically significant. Six months after the therapy TTS was 20% lower than prior to the intervention. In the present study, TTS was before the therapy 24.5, after five-week therapy program 12.4 and 6 months after the therapy 19.5. In women (*n* = 174, age 43) with non-specific neck and shoulder area pain, TTS was recorded 13 [19], in girls with episodic and chronic tension type headache (*n* = 41, age 12.7) TTS was 23 [20]. The results of the current study confirm that neck and shoulder area muscles tenderness increases during half a year after the therapy, the same tendency is also evident when analyzing HURT-5, HURT-8 scores and the number of headache days per month.

Patients with migraine demonstrate reduced cervical range of motion as compared to controls without migraine headaches [25]. The current study also shows that before five-week therapy program, all caAROM characteristics were lower compared to the characteristics after the therapy and 6 months later. Despite that the therapy didn't include neck mobilization exercises, statistically significant improvement was registered in lateral flexion to the right - 34% as compared to the characteristics before and 6 months after the therapy. All other neck mobility directions increased approximately 13%. The significant range of neck lateral flexion to the right after five-week therapy program and 6 months after the therapy is explained by higher pretherapeutic neck and shoulder area muscles tenderness on the left side that was remarkably reduced. Higher muscles tenderness is explained by higher position of the left shoulder as compared to the right shoulder. It has been observed that right-handed people have higher left shoulder position [22]. As the characteristics of cervical motions were comparable to standard values both after five-week therapy program and 6 months after the therapy, it can be confirmed that postural correction and orthopedic massage had a positive effect to cervical motion as well. Migraine patients should maintain normal cervical motion.

Postural changes are commonly observed in subjects suffering from headache. Subjects with migraine exhibited straightening of cervical lordosis curvature [26]. The importance of good posture was emphasized to participants of the current study. Good posture has an impact on normal cervical mobility and neck and shoulder area muscles functionality. Correct upper body posture from lateral view was registered both five-week after the therapy and 6 months afterwards. From lateral view, patients demonstrated straight head posture, normal curvature of thoracic kyphosis and shoulders on the same line with the axis of the body. Upper body posture from posterior view was significantly improved only after five-week therapy. Six months after the therapy, the left shoulder was slightly higher compared to the right shoulder. Despite counselling, it is hard to change previous habitual postural positions. Half a year after the therapy the frequency of headaches and muscles tenderness were increased, neck extension and rotations were decreased, and upper body posture from posterior view was slightly incorrect as compared to the characteristics after five-week therapy program.

The main component of orthopedic massage is matching the physiology of tissue injury with the physiological effects of treatment, allowing individual, structured assessment approach to normalize soft-tissue dysfunction, restore their flexibility on muscles, correct movement patterns and promote muscles strength [17]. Compared to the traditional massage, orthopedic massage with its broad variety of techniques provides more enhanced neuromuscular and physiological effect to recover soft tissues dysfunction than traditional massage. Orthopedic massage is predominantly a passive intervention, postural correction includes patients' education related with their body positions during everyday activities. Both interventions support each other - postural correction is not successful if neck and shoulder area muscles are hypertonic, weak, shortened or lengthened. To the contrary - muscles dysfunction affects posture. The hypothesis set out in the current study was confirmed: The frequency of headaches was significantly lower half a year after the orthopedic massage and postural correction therapy.

Small sample size and the absence of the control group are limitations of the study. Although participants were recommended to maintain their pre-study everyday activity, this was not ascertained. The same applies for other possible co-factors.

Nevertheless, the present study represents a relevant evidential contribution to the field since, to the best of our knowledge, researches that has assessed the effect of postural correction and orthopedic massage therapy for episodic migraine patients' headache prevention, especially considering the long-term effect, is scarce.

Based on the results of current study, it can be concluded that half a year after the postural correction and orthopedic massage therapy the frequency of headaches is lowered, but neck and shoulder area muscles tenderness have increased. Significant positive effect on the frequency of headaches and good upper body posture from lateral view is maintained 6 months after the therapy. Characteristics of cervical motions are comparable to standard values both after five-week therapy program and 6 months after the therapy. Postural correction and orthopedic massage are effective in reducing the frequency of headaches in episodic migraine patients.

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Conflict of Interest

The authors declare no conflicts of interest.

Statement of Equal Author's Contribution

Study conception and design: Doris Vahtrik, Ingrid Vanahunt.

Acquisition of data: Doris Vahtrik, Ingrid Vanahunt.

Analysis and interpretation of data: Margot Bergmann, Doris Vahtrik.

Drafting of manuscript: Doris Vahtrik.

Critical revision: Mark Braschinsky, Ingrid Vanahunt, Margot Bergmann.

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