EFFECT OF MULLIGAN MANUAL THERAPY ON INTENSITY, FREQUENCY, FUNCTIONAL LIMITATIONS, AND ACTIVITIES IN PATIENTS WITH CHRONIC, CERVICOGENIC HEADACHE

Simeon Andreev, Martin Eremiev
National Sports Academy "Vasil Levski", Sofia, Bulgaria

ABSTRACT
Introduction: Headache is a prevalent ailment on a global scale, with the potential to exert a significant impact on individuals' lives. The consequences of this condition are manifold, encompassing detrimental effects on the quality of life and professional activities.
Methodology: Eight patients with cervicogenic headache were included in the study. These patients were assessed at three distinct time points: at the initial baseline, and subsequently after one and three months. The selected instruments for assessment were the Headache Disability Index (HDI) and the Flexion-Rotation Test (FRT). Mulligan mobilizations and self-mobilization were applied to all patients for a period of 4 weeks. Patients were also instructed to perform self-mobilization exercises three times a day
Results: By the conclusion of the initial month, a discrepancy in the frequency of headaches was observed among the patients, with headaches occurring once a month. In the third month, the result remained unchanged. In terms of functional limitation, the study revealed a positive shift, with the majority of patients demonstrating a mild response (10-28%) by the study's conclusion.
Discussion: The applied methodology was designed for patients with chronic headaches and was tailored to specific indicators related to the condition of the upper cervical spine, making it particularly easy to apply. The approach entailed a comprehensive solution, which was implemented using a self-mobilization technique. This enabled patients to perform the solution at home and in their workplace.
Conclusion: The application of Mulligan's mobilization techniques reduced the frequency and intensity of chronic headaches, thereby minimizing their negative impact on patients' daily activities through the use of individually selected active mobilization and self-mobilization techniques.

ORCID
Martin Eremiev
https://orcid.org/0000-0002-7073-5833
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INTRODUCTION

Headache is a prevalent global health concern, impacting a substantial proportion of the population. Within the European Union (EU), the prevalence of headaches is particularly pronounced, with 79% of the population experiencing headaches annually. This statistic positions headaches as the second most prevalent cause of years lived with disability worldwide. The economic repercussions of headaches are also considerable, with an annual economic impact exceeding 100 billion euros on EU national economies.

Headache is the most prevalent type of pain in children and adolescents, with a significant impact on their quality of life, school attendance, and social activities. In fact, in a 2016 Global Impact of Illness study, migraine was ranked as the most disabling disease in the 15-49 age group.

There are two types of Headaches: primary and secondary. Primary headaches include migraine, tension headache, trigeminal autonomic cephalgia, and hypnic headache. It has been determined that these headaches account for two-thirds of all headaches diagnosed in adults (Bravo et al., 2015). Secondary headache is a type of headache caused by another source, manifesting with symptoms such as those associated with cervicogenic headache or tumors. Secondary headaches have been documented to account for up to 19.7% of cases in adults, while 1.6% of cases in young

headache sufferers are secondary headaches. Primary headaches are defined by clinical criteria and diagnosed based on the patient's symptoms and the exclusion of secondary causes. Secondary headaches are characterized by a hypothesized etiology (Kaniecki et al., 2006).

The present study aims to examine the efficacy of a physiotherapeutic methodology that utilizes mobilization techniques from Mulligan's concept.

These techniques are selected based on the results of functional tests, and their application is targeted at patients suffering from chronic headaches.

METHODOLOGY

The follow-up group is composed of eight patients. The study was conducted with the written informed consent of the patients. The subjects were subjected to a 4-week program of physiotherapy interventions, administered once weekly for a duration of 1 hour. Furthermore, all patients were required to perform a self-corrective exercise task three times daily. The characteristics and features of the patients included in the study are shown in Table 1.

The assessment tests were administered before and after the treatment, as well as the therapeutic intervention, and were performed by the authors.

Table.1 *General characteristics of the study sample*

Gender	**4– men** **4– women**
Average a**ge**	29.7yo
Degree of functional limitation according to HDI	Mild–5 Moderate–1 Severe–2
Intensity of headache	Mild–0 Medium–6 Severe–2
Headache frequency	Once a month–1 More than once but less than four times a month–2 More than once a week–5
Duration of headache	Chronic over 3 months–8
Headache side Chronic over 3 months-10	Left–4 Right–4
Positive FRT-side	Left–4 Right-–4

Table 2. *Inclusion criteria*

Inclusion Criteria	Exclusion Criteria
Prior physician consultation.	Presence of Red Flags.
Selection based on IHS classification	Autoimmune or Inflammatory Disease.
Unilateral or side-dominant headache without changing sides.	Surgery within the last 6 months.
Headache accompanied by neck stiffness or pain.	Kinesiotherapy or chiropractic interventions within the last 3 months.
Headache in the last 3 months, at least once a week.	Headache with autonomic involvement, vertigo, or visual disturbances.
Age - 20 to 40 years old.	Congenital disorders in the cervical spine.
Positive flexion and rotation test (FRT)	Contraindications to Manual Therapy.
	Inability to tolerate the flexion and rotation test (FRT) test.

The selection of specific tests and questionnaires to assess the condition and the impact of therapeutic interventions on headache utilizes internationally recognized tests and questionnaires that have been published in numerous studies with high clinical validity. The patient condition was evaluated using a standardized questionnaire that is well-studied and has high clinical validity (The Henry Ford Hospital Headache Disability Inventory (HDI), 1994)[5]. This questionnaire was used to assess the patient's condition on an activity basis and to follow up on therapy. The physical test used in the study to assess impaired function was the FRT (Figure 1).

Figure 1. *C1-C2 Rotation SNAG*

Figure 2. *C1-C2 Rotation Self-SNAG*

FRT is a test used to evaluate mobility within the C1-C2 segment. Research has demonstrated that dysfunctions in this region are a substantial cause of headaches of cervicogenic origin (Hall et al., 2007; Hall et al., 2008, p. 3; Ogince et al., 2006; Smith et al., 2008).

The therapeutic methodology was based entirely on the active approach, incorporating specific techniques from Mulligan's manual therapy concept (Figure 2).

The manual-mobilization techniques were selected in a strictly specific way, according to the individual outcomes of the C1-C2 rotation test. The individual self-mobilization techniques were also based on the C1-C2 rotation test results and were exclusively associated with the manual approach utilized in our encounters. The patients performed the exercises independently, three times per day, for a period of four weeks. The therapeutic interventions administered to each patient consisted of a total of four visits, distributed over a four-week period. The treatment methodology was customized to address the direction of movement restriction and the presence of symptoms, with this customization being determined by a specific diagnostic flexion-rotation test (FRT) score. Based on the symptomatic response, Mulligan's mobilizations and Mulligan's self-mobilization were applied (Table 3).

Table 3. *Therapeutic techniques and dosage*

	C1-C2 Rotational SNAG	C1-C2 Rotational Self-SNAG
Week 1	2 reps	2 times per day, 2 sets of 6 reps
Week 2	4 reps	2 times per day, 2 sets of 6 reps
Week 3	6 reps	2 times per day, 2 sets of 6 reps
Week 4	8 reps	2 times per day, 2 sets of 6 reps

RESULTS

The results were reported based on differences in the values recorded at the first measurement, after the first month, and after the third month of follow-up. Table 4 demonstrates a decline in the intensity and frequency of symptoms experienced by the patient in the follow-up group.

Table 4. *Changes in headache intensity and frequency*

Questions	Grades	FG (*n* = 8)	
		B (*n.*)	E (*n.*)
I have a headache	1 time per month	1	5
	More than 1 but less than 4 times per week	2	3
	More than 1 time per week	5	–
My headache is	Lght	–	5
	Medium	6	3
	Heavy	2	–

The majority of patients in the follow-up group demonstrated a frequency of headaches that exceeded once a week during the initial studies. In the first month of treatment, patients reported a substantial decrease in headache frequency, with headaches occurring only once a month. In the third month of the treatment period, patients retain the result.

At the initial visit, the intensity of headaches was classified as medium to high in the majority of patients. By the conclusion of the study, specifically in the third month, the intensity had diminished to a low-medium level.

The second part of the HDI questionnaire was used to monitor the results and assess the impact of the treatment on the patients' activity limitations due to headache. The questionnaire comprises 25 questions that address the impact of headaches on various daily activities and quality of life. As illustrated in Table 5, the study revealed alterations in the limitations experienced by individuals in their daily activities due to headaches, as measured by the HDI questionnaire.

The findings indicate that there was a positive shift in responses for all patients on all questions following the post-assessment conducted after the initial one-month period. The vast majority of patients, with the singular exception of one, exhibit mild functional limitations (10-28%), with certain individuals demonstrating levels below 10%. The beneficial outcomes were sustained following three months of patient observation, indicative of a favorable long-term response to the therapeutic interventions..

Descriptive statistics for all time points are presented in Table 6. Mean scores showed a progressive reduction from Day 1 (M = 26.50, SD = 19.59) to 4 weeks (M = 17.12, SD = 13.17), and further to 3 months (M = 11.25, SD = 12.96).

A paired-samples t-test was conducted to compare baseline (Day 1) and 3-month follow-up scores. The results indicated a statistically significant decrease at 3 months, $t(7) = -3.16$, $p = .016$, with a large effect size (Cohen's $d = -1.12$). The mean difference was -15.25 (95% CI [-26.66, -3.84]).

Because the assumption of normality was violated, as indicated by the Shapiro–Wilk test ($p = .040$), a nonparametric Wilcoxon signed-rank test was also conducted. This analysis confirmed the result, showing a significant reduction in scores at 3 months ($T = 0.00$, $p = .008$). Full inferential results are reported in Table 5.

Table 5. *Paired-samples comparison between Day 1 and 3 months (n = 8)*

Measure	*Mean (SD)*	*Mean* Difference	95% CI	*t*(df)	*p* (*t*-test)	Cohen's *d*	Wilcoxon *T*	*p* (Wilcoxon)
Day 1	26.50 (19.59)							
3 months	11.25 (12.96)	-15.25	[-26.66, -3.84]	-3.16 (7)	.016	-1.12	0.00	.008

Table 6. *Descriptive statistics across all time points (n = 8)*

Time point	*Mean (SD)*
Day 1	26.50 (19.59)
4 weeks	17.12 (13.17)
3 months	11.25 (12.96)

DISCUSSION

A comparison of the results revealed substantial differences in the symptoms experienced on the first day of treatment and after the first and third months, which suggests that Mulligan's approach to the rehabilitation process contributes to a reduction in the frequency and intensity of headaches over an extended period. A similar effect was reported in a randomized controlled trial (Hall et al., 2021). This study confirmed the role of Mulligan manual therapy in reducing the frequency and intensity of headaches in patients with cervicogenic dysfunction.

Subsequent evaluation of the patients' activity limitations revealed a significant improvement following treatment..

A subsequent analysis of the results pertaining to the activity questions indicated that the follow-up group exhibited improvements. A 3-month follow-up of the patients revealed sustained positive results, indicating the long-term efficacy of the therapeutic intervention.

The findings of this study are consistent with those of other research (Cardoso et al., 2022; Hall et al., 2021), suggesting that the implementation of manual therapy, particularly Mulligan manual therapy,

results in a significant enhancement in functional limitations associated with chronic headaches in patients.

A potential limitation of the present study is that the assessment tests conducted before and after the treatment, as well as the therapeutic intervention, were performed by the same therapist. This potential influence on the results is a matter of concern. In future studies, the assessments and therapeutic interventions will be conducted by different therapists. This approach is designed to minimize the potential for bias.

CONCLUSION

The findings indicate that the implemented methodology, which incorporates techniques from the Mulligan concept, is capable of reducing the prevalence of headaches in the subsequent group of patients. The methodology that was investigated resulted in a positive change in terms of activities of daily living in patients with chronic headache associated with a reduction in the frequency and intensity of symptoms. The applied methodology resulted in an increase in the functional capacity of the high cervical spine, improving the range of motion in patients with chronic headache. The positive effect of patients with chronic headaches who actively participate in their own treatment by performing prescribed exercises has been shown to result in a reduction in the number of therapeutic procedures required.

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Corresponding author:
Simeon Andreev
Department of Kinesitherapy and Rehabilitation,
National Sports Academy "Vassil Levski"
1, Gurgulyat Street, Sofia 100, Bulgaria
E-mail: simomonka@abv.bg

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