

EFFECTIVENESS OF MCKENZIE PROTOCOL VERSUS MULLIGAN PROTOCOL IN TREATMENT OF CERVICOGENIC HEADACHE: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background: Cervicogenic Headache is secondary type of headache that occurs due to dysfunctions in cervical spine, intervertebral discs, its soft tissue components. Physiotherapy interventions showed good results in managing cervicogenic headache. Mobilisation techniques showed good efficacy in many of the experimental studies. On the other hand, McKenzie Exercises which is based on the principle of centralisation of pain have also shown good effectiveness for treating cervical dysfunction, which in turn helps in decreasing cervicogenic headache intensity and frequency.

Objective: The objective of this study was to find and compare the effects of Mulligan Protocol versus the McKenzie protocols to treat the Cervicogenic Headache.

Methods: A randomized, controlled study was conducted on 132 participants at the Physiotherapy OPD, Chandigarh University. The participants were divided into Mulligan Mobilization therapy group (MMT; n=66), and McKenzie Therapy group (MT; n = 66), they received the respective interventions for four weeks. The primary outcome CGH frequency, CGH pain intensity, CGH disability. The secondary outcomes are neck pain and upper cervical rotation, they were measured at baseline, and after 4 weeks.

Results: Four weeks following the intervention, Mulligan and McKenzie protocols were effective, as all post-test values showed significant improvement compared to pre-test values ($p < 0.001$). However, between-group comparison showed important differences Mulligan Protocol (Group A) was more effective in reducing headache intensity (NPRS), headache disability (NDI), headache impact (HIT score), duration of headache and improving cervical ROM. While McKenzie Protocol (Group B) showed slightly better improvement in frequency of headache episodes.

Conclusion: Overall, although both interventions were beneficial, the Mulligan Protocol demonstrated superior effectiveness in improving most clinical outcomes in patients with cervicogenic headache. Hence, it can be concluded that Mulligan Protocol is more effective than McKenzie Protocol for the management of cervicogenic headache in this study.

KEYWORDS: Headache Disorders, Cervicogenic Headache, Physiotherapy, McKenzie, Mulligan

INTRODUCTION

Most of people have experienced headaches at some point in their lives, making it the most prevalent complaint. (1,2)Cervicogenic headache (CGH) is one sub-category, It is classified as a secondary headache in the latest Worldwide Classification of Headache Disorders, Third Edition (ICHD-3). The cervicogenic headache is attributed to cervical musculoskeletal dysfunction(3). A cervicogenic headache is one in which the cervical spine or any of the soft tissues connected to it is the foundation of pain. Pain in the neck is a common side effect. The cervical vertebrae may become inflamed due to cervicogenic headaches. These headaches can result from alterations in the cervical spine structure, which supports the head and permit range of motion. The prevalence of cervicogenic headaches are disproportionately affects females. Factors influence the variation in the prevalence rate of CGH, which ranges from 4.6% to 18% (4). However, (Mathur R et al 2024) have reported prevalence of CGH with 64 out of 78 participants, yielding an 82.64% prevalence rate. The findings revealed an elevated prevalence of cervicogenic headache among university students of various ages. Features of Cervicogenic headache, including radiated pain from the back to the front, side-locked discomfort, and the induction of a classic headache through digital pressure on the neck muscles as well as the upper cervical joint dysfunction. The majority of individuals characterize neck discomfort as dull, chronic, and non-throbbing. It is often ipsilateral to the headache side and confined to the occiput. The headache initially presents unilaterally but may subsequently become bilateral. According to clinical observations, about 55% of patients may exhibit multiple headache types at the same time. The International Headache Society sets up the CGH diagnosis, which has changed throughout time. Sjaastad et al. published criteria for the diagnosis of CGH in 1990, and they were revised in 1998 (5). "The ICH

D-3 Criteria states that Evidence of causation demonstrated by at least two of the following:

1. Headache has developed in temporal relation to the onset of the cervical disorder or appearance of the lesion

2. Headache has significantly improved or resolved in parallel with improvement in or resolution of the cervical disorder or lesion
3. Cervical range of motion is reduced and headache is made significantly worse by provocative manoeuvres
4. Headache is abolished following diagnostic blockade of a cervical structure or its nerve supply (5)
5. Spinal manipulation and mobilisation are two physical therapy (PT) treatments for cervicogenic headaches”

The physiotherapy interventions including Spinal manipulation and Mobilisation(6) , Graston technique (7) Transcranial Direct Current Stimulation (8) Conventional Massage Therapy (4) Mulligan Mobilisation (4,9) Postural Correction Exercises and Soft Tissue Techniques (10) are used clinically in treatment of cervicogenic headache. In 1985, McKenzie technique was introduced by Robin McKenzie in Sweden, and by the 1990s, it was widely employed as a treatment option for individuals with spinal mechanical disorders. Two significant findings from the examination that are detailed by McKenzie are the centralization phenomena and directional preference. The technique works on the principle of the centralisation phenomenon. As a positive indicator, centralization occurs when pain moves quickly from the periphery or distal area to the centre or proximal area. Derangement, Dysfunction, and Posture syndromes are the four primary diagnostic categories used by the McKenzie approach. These exercises can be utilised widely to maintain activities of daily living in individuals with cervical region pain. It helps in repairing damaged muscles, and developing muscle strength, tone, and flexibility. It enhances self-awareness of discomfort related to spinal mobility and posture. (11). On the other hand Mulligan Mobilisation Therapy is an alternate treatment option for cervicogenic headaches. Mulligan Mobilisation Technique (MMT), is technique in which the therapist glides the affected joint and the patient engages in active movement. A relatively recent concept involves application of pain free, low-velocity joint mobilisation procedures that involve active movement. This idea proposes a method of modifying headache outcomes and increasing mobility in the upper cervical spine by applying painless prolonged stress.(9)

Aim of the Study:

The aim of the study was to compare the effectiveness of McKenzie protocol and Mulligan protocol in treatment of cervicogenic headache.

METHODOLOGY

Study Design:

This study was a prospective, parallel-group, patient blinded randomized controlled study conducted to find the effectiveness of Mulligan protocol versus the McKenzie Protocol in management of Cervicogenic Headache. The study was initiated in month of December 2025, and the required participants were screened and recruited from Physiotherapy OPD, Chandigarh University, Punjab. The ethical approval was taken from the institute (Project No. 80255) , and all participants were informed prior to any intervention and written consent form was given to all of them priorly.

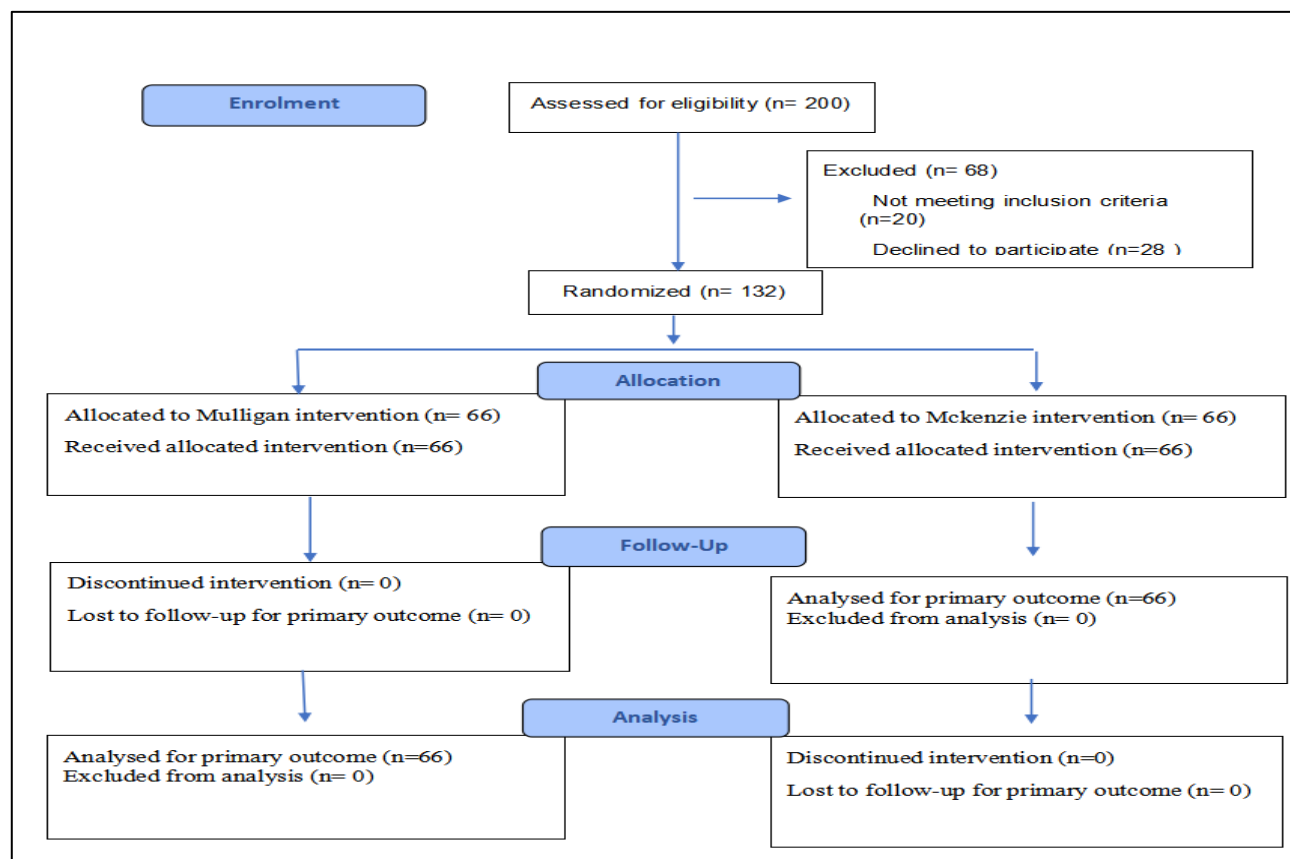


Figure 1: CONSORT 2025 Flow Diagram

Participants:

A total of 132 participants diagnosed with cervicogenic headache according to the International Classification of Headache Disorders, 3rd Edition (ICHD-3) criteria were recruited. Participants were screened from individuals attending the Physiotherapy OPD and were enrolled based on predefined inclusion and exclusion criteria.

Inclusion Criteria:

1. Participants with age group of 20-25yrs
2. University students
3. Diagnosis of cervicogenic headache (as per ICHD-3 criteria) with symptoms >3 months.
4. Unilateral pain without side shift
5. Pain triggered by neck movements or sustained awkward posture
6. Restricted cervical range of motion
7. Headache resolves with treatment of cervical dysfunction
8. Pain rating of 3-8 on NPRS Scale

Exclusion Criteria:

1. Participants with other types of headache (migraine, tension type headache, cluster headache)
2. Recent head/spine injury, whiplash injury (< 6months)
3. Any contraindications to manual therapy (fracture, low bone mineral density)
4. Diagnosed Metastasis
5. Neurological conditions (cervical radiculopathy or myelopathy, multiple sclerosis or other neurological conditions)
6. Previous cervical spine injury
7. Any history of brain and spinal cord surgery will be excluded.

Sample Size Calculation:

The sample size was calculated using the G-Power software latest version. (Version 3.1.9.7, Heinrich Heine University, Düsseldorf, Germany). The calculation was based on an independent comparison between two intervention groups with a significance level (α) of 0.05 and a statistical power ($1-\beta$) of 80%. The effect size was estimated from previous literature on physiotherapy interventions for cervicogenic headache. Where, Confidence Level =95% , Margin of Error = 5 % , Population proportion= 50, Population Size = 200, Sample Size = 132.

Randomization:

After baseline assessment, participants were randomly allocated into two equal groups using a computer-generated randomization sequence. Allocation concealment was ensured through sequentially numbered, opaque, sealed envelopes prepared by an independent researcher not involved in recruitment or treatment. Participants were assigned in a 1:1 ratio to either the Mulligan Protocol Group (Group A; n = 66) or the McKenzie Protocol Group (Group B; n = 66).

Blinding:

Participants were blinded, Outcome assessments were conducted by an assessor who was not involved in treatment administration. The treating physiotherapist could not be blinded due to the nature of the interventions.

Interventions:

Participants were randomly allocated into two intervention groups: Mulligan Protocol (Group A) and McKenzie Protocol (Group B). All interventions were administered by a qualified physiotherapist under supervised conditions.

Group A received Mulligan Manual Therapy, specifically SNAGs were applied at the C2 level. The technique involved a sustained accessory glide by the therapist while the patient performs active movements. Each glide was maintained for approximately 10 seconds and repeated 6–10 times per session within a pain-free range.

Group B received the McKenzie Protocol, which consisted of repeated cervical movements based on directional preference. Exercises included cervical retraction, extension, side flexion, rotation, and flexion performed in sitting and supine positions. Each exercise was performed for 10 repetitions per set, with 2–3 sets per session, emphasizing symptom centralization.

The intervention period lasted 4 weeks, with sessions conducted 3–5 times per week. Patient adherence was monitored through supervised sessions and exercise logs.

No co-interventions were allowed during the study period to avoid confounding effects.

Treatment Duration:

Both groups received their respective interventions over a period of 4 weeks, with supervised sessions and monitored compliance.

Treatment Dosage:

Group A – Mulligan Protocol

Sustained Natural Apophyseal Glides were applied on the affected vertebra, 6-10 repetitions were applied per session. The glide was sustained for about 10 second per repetition. The sessions were given for 4 times a week. This was followed by cervical isometrics in flexion , extension and side flexion and they were hold by 5-10 seconds.

Group B – McKenzie Protocol

The McKenzie Protocol included the Chin Retraction, Chin Retraction with extension, Chin Retraction with extension, Chin Retraction with Side Flexion, Chin Retraction with Rotation, Flexion, Supine lying with chin retraction, Supine lying with extension.

These exercises were given in 10 repetitions per set, 2-3 sets per session with a frequency of 2-3 times per day. They were held at an end range for about 2-5 seconds.

Outcome Measures:

Primary Outcome Measure

Headache Diary:

Headache frequency were measured as headache days/month, headache diary, a set of paper diaries were given to patients to maintain their headache records before, during, and after the treatment to measure the headache frequency.

Numeric Pain Rating Scale (NPRS):

Headache intensity was measured from 0 (no pain) to 10 (worst imaginable pain) by NPRS Scale (Young et al., 2019a).

Reliability: The NPRS showed moderate reliability, with an intraclass correlation coefficient (ICC) of 0.72 (95% CI: 0.08–0.90) for cervicogenic headache patients in a randomized clinical trial setting.

Validity: NPRS demonstrates construct validity (high correlation, $p < 0.001$) for cervicogenic headache when compared to standard instruments. (Young et al., 2019b)

Headache Impact Test-6 (HIT-6)

Headache related disability recorded with Headache Impact Test-6 (HIT-6), it consists of six items with a total score ranging from 36 to 78 points on 5 response options: never (6 points), rarely (8 points), sometimes (10 points), very often (11 points), and always (13 points) (Kosinski et al., 2003)

Test-retest reliability (Intraclass Correlation Coefficient) is also solid, reported between 0.76 and 0.80 in mixed samples with primary and secondary headache disorders.

Validity: The HIT-6 has been validated as a unidimensional tool measuring headache impact across various headache disorders, including cervicogenic headache. It discriminates well between headache severity levels and correlates with other quality-of-life and headache-specific disability questionnaires, supporting construct and convergent validity. The test is responsive to change, making it suitable for tracking symptom or functional improvement after interventions in cervicogenic headache patients (Pradela et al., 2021).

Secondary Outcome Measure:

The secondary outcome, the Neck Disability Index (NDI) for neck pain and disability. It consists of 10 items and each item was measured with 0 as no disability to 5 as a maximum disability. Overall score out of 100 was calculated by adding each item score together and multiplying it by two (Vernon, 2008).

Reliability of NDI: The NDI shows excellent test-retest reliability, with Intraclass Correlation Coefficient (ICC) values reported mostly between 0.88 and 0.92, indicating consistency of the measure over time in stable patients.

Validity of NDI: The NDI has strong construct and concurrent validity, correlating significantly with other disability indices, pain scales (like the NPRS), and quality-of-life measures, supporting its relevance and accuracy. (Ian Young et al., 2017)

Other secondary outcome is, Cervical Flexion Rotation Test Upper Cervical Rotation Range Of Motion was measured in degrees to both sides with the cervical flexion-rotation test. (Paquin et al., 2022)

Reliability: The CFRT shows good to excellent reliability, with intra- and inter-rater reliability reported as high in multiple studies. For example, reliability coefficients (ICC) range from about 0.80 to above 0.90, indicating consistent measurements of upper cervical rotation. (Hall et al., 2010)

Validity: The CFRT has good construct validity for assessing upper cervical rotation deficits, a feature strongly associated with CGH due to impairment at the C1-C2 zygapophyseal joints (Hall et al., 2010)

Statistical Analysis:

Data were analysed using IBM SPSS Statistics software (latest version). Descriptive statistics were calculated as mean and standard deviation for continuous variables and frequency with percentages for categorical variables. Normality of data distribution was assessed using the Shapiro–Wilk test.

Within-group comparisons between pre- and post-intervention values were performed using paired t-tests. Between-group comparisons were analysed using independent sample t-tests. Statistical significance was set at $p < 0.05$ with a 95% confidence interval.

RESULT OF STUDY

Participant Flow:

A total of 200 participants were screened for eligibility. Of these, 68 participants were excluded due to not meeting the inclusion criteria ($n = 20$) or declining participation ($n = 28$). The remaining 132 participants were randomized equally into the Mulligan Protocol group ($n = 66$) and the McKenzie Protocol group ($n = 66$). All participants completed the intervention period and follow-up assessments. No participants were lost to follow-up or excluded from the final analysis (Figure 1).

Baseline Characteristics:

The baseline demographic characteristics of the participants are presented in Table 1. The mean age of participants in the Mulligan Protocol group was 20.95 ± 2.11 years, whereas the McKenzie Protocol group had a mean age of 21.21 ± 2.26 years. No statistically significant difference was observed between groups at baseline ($p = 0.500$), indicating homogeneity of the study population. Gender distribution was comparable between groups, with a slightly higher proportion of males in the Mulligan group and females in the McKenzie group.

Table 1: Frequency and Percentage Distribution of Subjects According to Gender in Group A (Mulligan) and Group B (McKenzie).

Group	Group A	Group B
Male (%)	58%	47%
Female (%)	42%	53%
Male(f)	38	31
Female(f)	28	35

Within Group Analysis:

Following four weeks of intervention, both groups demonstrated statistically significant improvements across all outcome measures compared with baseline values ($p < 0.001$).

In the Mulligan Protocol group, significant reductions were observed in headache frequency, headache duration, pain intensity (NPRS), headache disability (HIT-6), neck disability (NDI), and improvements in cervical flexion-rotation range of motion.

Similarly, participants receiving the McKenzie Protocol showed significant improvements in headache frequency, headache duration, pain intensity, headache disability, neck disability, and cervical range of motion following the intervention period ($p < 0.001$ for all comparisons).

Between Group Analysis:

Between-group comparison demonstrated significant differences in favor of the Mulligan Protocol for most clinical outcomes after four weeks of treatment. Participants treated with Mulligan Mobilization showed greater reductions in headache intensity (NPRS), headache duration, headache-related disability (HIT-6), neck disability (NDI), and greater improvements in cervical flexion-rotation range of motion compared with those treated using the McKenzie Protocol.

However, the McKenzie Protocol demonstrated a slightly greater reduction in headache frequency compared with the Mulligan Protocol.

Primary Outcome:

For headache frequency, both interventions resulted in substantial improvement. The mean number of headache episodes per week decreased from 3.67 ± 1.03 to 1.88 ± 0.85 in the Mulligan group and from 3.41 ± 0.98 to 1.61 ± 0.70 in the McKenzie group.

Pain intensity measured using NPRS significantly improved in both groups. The Mulligan group demonstrated a reduction from 5.70 ± 0.99 to 2.73 ± 1.32 , whereas the McKenzie group improved from 5.59 ± 1.15 to 3.23 ± 1.16 .

Headache-related disability also improved significantly following treatment in both groups, with superior post-intervention outcomes observed in the Mulligan group.

Secondary Outcomes

Significant improvements were observed in neck disability and upper cervical rotation range of motion in both intervention groups. The Mulligan Protocol demonstrated greater improvements in cervical mobility and functional disability scores compared with the McKenzie Protocol.

Overall, both treatment approaches were effective in the management of cervicogenic headache; however, the Mulligan Protocol produced superior improvements in most clinical outcomes following four weeks of intervention

DISCUSSIONS

The findings revealed that both groups showed statistically significant improvement in all outcome variables, including frequency of headache episodes, duration of headache, pain intensity, neck disability, headache impact, Cervical rotation range of motion.

Within-group analysis demonstrated that both Mulligan and McKenzie protocols were effective, as all post-test values showed significant improvement compared to pre-test values ($p < 0.001$).

However, between-group comparison showed important differences:

Mulligan Protocol (Group A) was more effective in reducing:

- Pain intensity (NPRS)
- Neck disability (NDI)

- Headache impact (HIT score)
- Duration of headache
- Improving cervical ROM

McKenzie Protocol (Group B) showed slightly better improvement only in:

- Frequency of headache episodes

Overall, although both interventions were beneficial, the Mulligan Protocol demonstrated superior effectiveness in improving most clinical outcomes in patients with cervicogenic headache. Hence, it can be concluded that Mulligan Protocol is more effective than McKenzie Protocol for the management of cervicogenic headache in this study.

The present study aimed to compare the effectiveness of the Mulligan Protocol and McKenzie Protocol in the management of cervicogenic headache. The findings demonstrated that both interventions produced statistically significant improvements in all outcome measures, including headache frequency, duration, pain intensity, neck disability, headache impact (HIT-6), and cervical rotation range of motion. These results suggest that both treatment approaches are effective in treating CGH.

However, between-group analysis revealed that the Mulligan Protocol was superior in improving most clinical outcomes. Greater reductions were observed in pain intensity, headache duration, disability scores, and cervical range of motion in the Mulligan group. This may be attributed to the methods of Mulligan mobilization, which combines sustained accessory glide with active movement, facilitating pain-free joint repositioning, improving joint biomechanics, and enhancing neuromuscular control.

In contrast, the McKenzie Protocol showed slightly better improvement in reducing headache frequency. This could be explained by its emphasis on repeated movements and postural correction, which may influence central pain modulation and reduce recurrence of symptoms through the principle of centralization.

Overall, while both protocols are beneficial, the Mulligan Protocol appears to be more effective for comprehensive clinical improvement, whereas the McKenzie approach may be more useful for long-term symptom control and self-management strategies.

Baseline Comparability

At baseline, both groups were comparable in terms of age, gender distribution, and outcome measures. The mean age in Group A (20.95 ± 2.11 years) and Group B (21.21 ± 2.26 years) did not differ significantly ($p > 0.05$), indicating homogeneity of the sample. Similarly, pre-intervention values for headache frequency, duration, pain intensity (NPRS), neck disability (NDI), headache impact (HIT-6), and cervical range of motion showed no statistically significant differences between groups. This baseline equivalence ensures that the post-intervention differences can be attributed primarily to the treatment effects rather than confounding variables.

Within-Group Improvements

Both Mulligan and McKenzie groups showed statistically significant improvements in all outcome measures ($p < 0.001$), indicating that both interventions are effective in managing cervicogenic headache.

Mulligan Protocol (Group A)

Group A demonstrated marked improvements across all variables:

- □ Headache frequency reduced from 3.67 to 1.88 episodes/week
- □ Duration decreased from 3.08 to 1.56 hours
- □ NPRS reduced from 5.70 to 2.73
- □ NDI improved from 18.58 to 12.97
- □ HIT score reduced from 47.42 to 38.35
- □ Cervical ROM increased from 31.21° to 38.29°

These findings suggest that Mulligan mobilization techniques are highly effective in reducing pain, disability, and improving functional mobility. Mulligan's SNAG technique works by correcting positional faults of the cervical facet joints and restoring normal joint kinematics [3]. Additionally, it enhances proprioceptive input and activates central pain inhibitory mechanisms, thereby reducing pain and improving function.

McKenzie Protocol (Group B)

Similarly, Group B also showed significant improvements:

- □ Headache frequency reduced from 3.41 to 1.61
- □ Duration decreased from 3.35 to 1.83 hours
- □ NPRS reduced from 5.59 to 3.23
- □ NDI improved from 19.35 to 15.50
- □ HIT score reduced from 47.89 to 40.00
- □ Cervical ROM increased from 30.14° to 32.89°

These results indicate that the McKenzie approach is also effective, likely due to its emphasis on repeated movements and postural correction. The McKenzie method promotes centralization of symptoms and mechanical loading strategies that help reduce pain and restore function.

Between-Group Comparison

Despite improvements in both groups, statistically significant differences were observed in favor of the Mulligan Protocol for most outcomes.

Pain Intensity (NPRS)

The Mulligan group showed greater reduction in pain compared to McKenzie ($p = 0.0224$). This may be due to the activation of mechanoreceptors and inhibition of nociceptive pathways through manual therapy, as explained by the pain gate theory.

Neck Disability (NDI)

A significantly greater reduction was observed in Group A ($p = 0.0022$), indicating better functional recovery. Joint mobilization techniques are known to improve functional outcomes by reducing stiffness and restoring normal joint movement.

Headache Impact (HIT-6)

Mulligan Protocol demonstrated superior improvement ($p = 0.0300$), suggesting better quality of life outcomes.

Cervical Range of Motion

A highly significant improvement was seen in Group A compared to Group B ($p < 0.001$). This supports previous findings that manual therapy techniques are effective in improving joint mobility and reducing restrictions.

Duration of Headache

Group A showed significantly greater reduction ($p = 0.0391$).

Frequency of Headache

McKenzie Protocol showed slightly better improvement in reducing frequency ($p = 0.0462$), although the difference was minimal.

Pathophysiological Basis

The cervical spine is highly mobile and prone to dysfunction, which can lead to cervicogenic headache due to involvement of upper cervical joints and neural structures. Dysfunction in these regions may result in referred pain to the head, restricted motion, and functional limitations.

Manual therapy techniques, such as Mulligan mobilization and spinal manipulation, have been shown to reduce pain and improve mobility through neurophysiological mechanisms. These include stimulation of joint receptors, inhibition of nociceptive signals, and activation of descending inhibitory pathways.

The superior effectiveness of the Mulligan Protocol can be explained through several biomechanical and neurophysiological mechanisms:

- ☐ SNAG (Sustained Natural Apophyseal Glide) restores positional faults in facet joints
- ☐ Improves joint alignment and reduces mechanical stress
- ☐ Enhances proprioceptive input and neuromuscular control
- ☐ Activates pain inhibitory pathways (central modulation)
- ☐ Reduces joint stiffness and adhesions

These mechanisms collectively contribute to improved cervical mobility and reduced pain.

In contrast, the McKenzie Protocol primarily works through:

- ☐ Repeated end-range movements
- ☐ Postural correction
- ☐ Centralization of symptoms

While effective, it may not directly address joint dysfunction to the same extent as Mulligan mobilization.

Comparison with previous studies:

The findings of this study are consistent with previous literature supporting the effectiveness of manual therapy in cervicogenic headache. Mulligan mobilization has been shown to significantly reduce pain and disability by correcting joint dysfunction and improving biomechanics.

Similarly, studies on spinal manipulation have demonstrated improvements in pain intensity and joint mobility due to neurophysiological effects. However, some studies have reported conflicting results, suggesting that the effectiveness of different manual therapy techniques may vary depending on patient characteristics and treatment protocols.

Massage therapy has also been reported to produce analgesic effects through opioid and oxytocin-mediated pathways and by reducing muscle tone, although its effects are generally less pronounced compared to mobilization techniques.

However, some studies have reported spinal manipulation or other techniques to be superior, indicating that treatment effectiveness may vary depending on patient characteristics and intervention protocols.

Clinical Implications

The results of this study have important implications for physiotherapy practice. Both Mulligan and McKenzie protocols can be used effectively in Cervicogenic Headache. Mulligan Protocol should be preferred when pain reduction is the primary goal, Range of Motion restriction is significant, Functional disability is high

McKenzie Protocol may be beneficial for long-term self-management of cervicogenic headache, Postural correction of cervical spine, Reducing recurrence of headache. A combined approach may provide even better outcomes.

Limitation of the Study

Despite its strengths, the study has several limitations. Sample size was although adequate, but can still limit generalizability. Lack of blinding of therapist, No placebo or sham group, Short duration of intervention, No long-term follow-up, Gender-based subgroup analysis was not performed.

CONCLUSION OF THE STUDY

The present study was conducted to compare the effectiveness of the Mulligan Protocol and McKenzie Protocol in the management of cervicogenic headache. Based on the findings, it can be concluded that both interventions were effective in significantly improving all measured outcomes, including headache frequency, duration, pain intensity (NPRS), neck disability (NDI), headache impact (HIT-6), and cervical range of motion.

However, the Mulligan Protocol demonstrated superior effectiveness in improving most clinical parameters, particularly in reducing pain intensity, headache duration, disability, and enhancing cervical mobility. This suggests that Mulligan mobilization may be more beneficial in addressing the mechanical dysfunctions of the cervical spine associated with cervicogenic headache.

On the other hand, the McKenzie Protocol showed slightly better results in reducing the frequency of headache episodes, indicating its potential role in long-term management through postural correction and self-directed exercises. Therefore, it can be concluded that while both protocols are clinically effective, the Mulligan Protocol may be preferred for immediate and overall functional improvement, whereas the McKenzie Protocol can be considered as an adjunct for long-term self-management. Further studies with larger sample sizes and longer follow-up periods are recommended to validate these findings.

Scope of Future Study

During this randomized controlled trial it was noted that the future studies should include larger sample sizes, incorporate long-term follow-ups, compare combined therapy approach, study underlying neurophysiological mechanisms, perform subgroup analysis based on gender and severity. Thus, both Mulligan and McKenzie protocols are effective in the management of cervicogenic headache. However, the Mulligan Protocol demonstrated superior outcomes in reducing pain intensity, disability, headache impact, duration, and improving cervical range of motion. The McKenzie Protocol showed slightly better improvement only in headache frequency. Therefore, Mulligan mobilization appears to be a more effective treatment approach for cervicogenic headache, particularly when the primary goals are pain reduction and functional improvement.

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