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The Effect of Self vs Therapist Mulligan Mobilization on Cervicogenic Headache

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Jerusalem - Palestine

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Declaration

I certify that this thesis submitted for the degree of Master is the result of my research, except where otherwise acknowledged, and this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed: *Wael Nazzal*

Date: 28/05/ /2022

Dedication

First of all, all thanks to God, who gave me strength, ability, and success in getting here.

I dedicate this study to my most wonderful family who supported me in getting here, especially my parents, who were the source of my strength, and I will never forget the support they gave me to bring out the best in me. I do not forget my brothers also, they supported me and were by my side. In addition to my fiancée, who will soon become my wife, I will never forget the support and moral support she gave me, and her constant sympathy for me, and she was constantly motivating me.

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The Effect of Self vs Therapist Mulligan Mobilization on Cervicogenic Headache

Prepared by: Wael Nazal

Supervisor: Dr. Akram Amro

Background: Cervicogenic headache is a chronic Hemi cranial pain that is referred to the head from either bony structure or soft tissue of the neck, and it leads to a lot of disorders and dysfunctions. Recent studies have shown that individuals suffering from CGH had a dysfunction at C1/C2 which was evaluated by the flexion rotation test. To manage this dysfunction, Mulligan prescribed some treatment techniques, although no studies have investigated the effectiveness of these interventions. **Objectives:** To compare the effectiveness of Self-versus therapist mulligan mobilization, in the management of CGH. **Study design:** Randomized clinical trials (single-blinded to the patient).

Methods: The sample included 37 patients, with cervicogenic headache and positive FRT, they were randomly divided into two groups, the experimental group (mulligan self- mobilization technique and conventional therapy (strengthening for deep neck flexor, stretching for neck extensor, massage), and the control group (mulligan therapist mobilization technique and conventional therapy (strengthening for deep neck flexor, stretching for neck extensor, massage)). Headache symptoms and FRT were measured and documented before starting the treatment and one week after finishing treatment.

Results: A statistically significant difference was found between the pre and post-tests observed in the experimental group(self-mobilization) with the improvement in the AROM ($p<0.05$), The same with improvement in headache outcome measures ($p <0.05$), and the improvement in Headache manifestations ($p<0.05$). In addition, there was a statistically significant difference that was documented in the control group (therapist mobilization) between pre and post-tests, in the AROM ($p <0.05$), and the improvement in headache outcome measures ($p<0.05$), and the improvement in Headache manifestations ($p<0.05$). This means that the application of both self and therapist mulligan mobilization was effective and contributed to a better outcome in CGH. When comparing the results between the two groups, there was no statistically significant difference between the two groups in any of the headache outcome measures, Headache pain, and manifestations, and AROM (extension, Rt flexion rotation test), where the improvement was similar in both groups. Age negatively affected the outcome of rehabilitation, unlike other factors.

Conclusion: Both groups were effective in the management of the different outcomes of cervicogenic headache, with no superiority of either approach.

Key words: Cervicogenic headache, mobilization, Mulligan technique, stretching exercises, Strengthening exercises.

أثر التحريك بطريقة مولجان من قِبل المريض مقابل أثر التحريك بطريقة مولجان عن طريق المعالج في علاج وجع الراس الناتج عن مشاكل الرقبة

اعداد: وائل نزال

اشراف: الدكتور أكرم عمرو

ملخص عن الدراسة باللغة العربية

الخلفية: الم الراس الناتج عن مشاكل الرقبة هو ألم مزمن في الجمجمة يرجع إلى الرأس إما من البنية العظمية أو الأنسجة الرخوة للرقبة، ويؤدي إلى الكثير من الاضطرابات والاختلالات الوظيفية. أظهرت الدراسات الحديثة أن الأفراد الذين يعانون من الم الراس الناتج عن مشاكل الرقبة يعانون من خلل وظيفي في الفقرة الرقبة الأولى والثانية والذي تم تقييمه من خلال اختبار دوران الانثناء. لعلاج هذا الخلل الوظيفي، وصف مولجان بعض تقنيات العلاج، على الرغم من قلة وجود دراسات تتحقق من فعالية هذه التدخلات. **الأهداف:** مقارنة تأثير التحريك بطريقة مولجان من قبل المريض مقابل أثر التحريك بطريقة مولجان عن طريق المعالج في علاج وجع الرأس الناتج عن مشاكل الرقبة. **تصميم الدراسة:** تجربة سريرية عشوائية

الطريقة: العينة تكونت من 37 مريض يعانون من صداع مرتبط بالرقبة واختبار انثناء إيجابي للدوران، تم تقسيم المشاركين عشوائيا إلى مجموعتين، المجموعة التجريبية (تقنية مولجان الذاتية مع العلاج التقليدي (تقوية عضلات الرقبة العميقة، استطالة العضلات الخلفية للرقبة، والتدليك) والمجموعة الضابطة (تقنية مولجان من المعالج مع العلاج التقليدي المتعلق بمرونة العنق، إطالة العضلات الخلفية للرقبة، والتدليك). تم قياس أعراض الصداع واختبار انثناء الدوران وقراءتها قبل بدء العلاج وبعد أسبوعين من انتهاء العلاج.

النتيجة: تم العثور على فرق معتد به إحصائيًا بين الاختبارين القبلي والبعدي الذي لوحظ في المجموعة التجريبية (التحريك الذاتي) مع التحسن في مستويات الحركة للرقبة($p <0.05$) ، والتحسن في مقاييس نتائج الصداع($p <0.05$) ، وتحسين مظاهر الصداع .($p <0.05$) بالإضافة إلى ذلك، كان هناك فرق معتد به إحصائيًا لوحظ في المجموعة الضابطة (تحريك المعالج) بين الاختبارات السابقة واللاحقة، والتحسن في مستويات الحركة($p <0.05$) ، والتحسن في مقاييس نتائج الصداع($p <0.05$) ، وتحسن في مظاهر الصداع .($p <0.05$) هذا يعني أن تطبيق كل من التحريك الذاتي والتحريك من المعالج فعال ويساهم في إدارة ومعالجة الصداع.

عند مقارنة نتائج المجموعتين، لم يكن هناك فرق ذو دلالة إحصائية في كل من مقاييس نتائج الصداع، ومظاهر الصداع، و مستوى الحركة (التمديد ، اختبار دوران الانثناء لليمين). أي أن التحسن كان مماثلاً في كلا المجموعتين. اثر العمر سلبا على نتيجة إعادة التأهيل ، على عكس العوامل الأخرى التي لم يكن لها اي تأثير. **الخلاصة:** أن كلا المجموعتين كانا فعالين في الإدارة وعلاج الصداع الناتج من الرقبة، مع عدم تفوق أي من الطريقتين.

الكلمات المفتاحية: الصداع الناتج عن الرقبة، تقنية مولجان، علاج طبيعي، تمارين تقوية.

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List of abbreviations:

- **HIS:** International Headache Society (HIS)
- **CGH:** cervicogenic headache
- **SNAG:** sustained natural apophyseal glide SNAG
- **ROM:** range of motion
- **FRT:** flexion-rotation test
- **TTH**: tension type headache

List of Appendices

Chapter one:

1.1 Introduction and background

Cervicogenic headache (CGH) is a syndrome that is characterized by chronic Hemi cranial pain that is referred to the head from either bony structure or soft tissue of the neck (Biondi, D. M. (2005)). CGH is classified as a secondary headache according to the International Headache Society (HIS), which has published its International Classification of Headache Disorders 2nd edition (Suggestion, C. (n.d.).). Headache is a common and frequently encountered condition by physiotherapists in clinical practice (Suggestion, C. (n.d.).). CGH represents between 15% -20% of all recurrent and chronic headaches (Ramezani, E., & Arab, A. M. (2017).). Often these individuals suffer from pain and restricted cervical range of motion (1). All individuals with CGH suffer greatly from restrictions in daily activities, emotional stress, etc., and thus they have a lower quality of life than healthy individuals (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).).

The diagnosis of CGH is difficult because nearly 70% suffer from frequent intermittent headaches accompanied by pain in the neck, so it is not reasonable to receive unjustified neck treatment for all of them unless the cause is verified (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).). In some studies, it was emphasized that C1 and C2 should be examined in the diagnosis of CGH, and some studies have supported the relative importance of C1 and C2 as the main cause of the problem (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).). To help diagnose the condition, and in particular sectional dysfunction in C1

and C2, some researchers have suggested using the **flexion rotation test (FRT)**. This passive examination procedure involves fully flexing the cervical spine so that vertebral movement is theoretically constrained to C1-C2, then assessing the cervical rotation range of motion in this position. The normal range of motion is 44° to each side (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).).

It was found that people who suffer from CGH have a 17-degree lower turnover rate towards the side of the headache compared to healthy people. In addition, they found that movement impairment found on the FRT has high sensitivity (91%) and specificity (90%) to identify cervicogenic headache, Therefore, it is a useful measure in diagnosing the CGH cases (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).).

Mulligan described a new method and approach for the self-management of articular dysfunction in CGH. In this approach, an accessory motion combined with spinal active movement (C1-C2 self-sustained natural apophyseal glide [SNAG]) is used to restore the normal range of C1-C2 rotation when the FRT reveals substantial rotation limitation at this segment. The C1-C2 self-SNAG targets C1-C2 dysfunction by emphasizing C1-C2 rotation using a cervical self-SNAG strap (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).).

1.2 Problem statement

Cervicogenic headache accounts for 15%- 20% of all chronic headaches (Ogince M, Hall T, Robinson K, Blackmore AM.). Several techniques target both joints and soft tissue techniques in the management and rehabilitation of CGH in physiotherapy centers. Meanwhile, the current situation imposed by the increasing incidence of COVID19, made it hard for both therapists and patients to comply and attend treatment sessions at PT clinics. Which made it difficult for patients

to attend the manual mulligan mobilization used in the management of the CGH, and made it more important to use self-mobilization techniques and home programs.

There is a lack of evidence on the effectiveness of self-mobilization versus therapist mobilization on the management outcome of CGH.

This study is investigating the effectiveness of the self-mobilization in management of CGH as compared to the therapist headache mulligan mobilization performed at the physiotherapy clinics.

1.3 Study Justification

The results of this study may help therapists and patients to take more patients-independent management techniques in the treatment of CGH, which may lead to less contact and need to come to the PT sessions, and it may empower the patients in being an active part of the therapy process, and at the same time, decreases the risk of infection in this pandemic era, together with the decrease of cost of physiotherapy sessions that.

1.4 Objectives

- To compare the effectiveness of Self-versus therapist mulligan mobilization, in the management of CGH.

- To describe the characteristics of the CGH patients, and their relationship with CGH improvement.

1.5 Hypotheses

- There is no statistically significant difference at $p < 0.05$ between the Mulligan therapist mobilization technique compared to patient's mulligan self-mobilization in management the of Cervicogenic headache.

- Personal and anthropometric characteristics do not affect the physiotherapy outcome of CGH.

1.6 Terminology

- Cervicogenic headache: It is a clinically defined headache syndrome, it is believed to originate from nociceptive structures in the cervical spine or occipital area[(5)].

Chapter 2

Literature Review

2.1 Theoretical studies

2.1.1 Cervicogenic headache

Cervicogenic headache is a syndrome is characterized by chronic Hemi cranial pain that is referred to the head from either bony structure or soft tissue of the neck (Biondi, D. M. (2005).).

Headache is classified into primary and secondary according to the classification of the International Headache Society (HIS), and the cervicogenic headache is considered a secondary headache (Suggestion, C. (n.d.).).

Neurologists have strongly questioned the clinical features of CGH. Headache shares many characteristics with other forms of defined headache, in terms of location, severity, periodicity, or associated characteristics. The only criterion for CGH is a palpable pain in the head that originates from the neck. Therefore, diagnosis depends on determining the source of pain in the neck using reliable and valid diagnostic techniques. When primary afferents from two topographically separate regions of the body converge on the same second-order neuron in the spinal cord, nociceptive activity along one of the afferents can be perceived as pain arising in the territory of the other afferent. Anatomical studies in animal laboratories have revealed widespread overlapping of the central limbs of the three upper cervical nerves, in particular, the C2 spinal nerve not only ramifies in the grey matter of the C2 spinal cord segment but also sends ascending collaterals to the C1 segment, and descending collaterals to the C3 segment. The C3 spinal nerves express an

analogous pattern of ascending and descending collaterals. The terminals of the C1 spinal nerve, however, are restricted to their own segment. A recent study showed convergence between afferents from the superior sagittal sinus and afferents in the greater occipital nerve. The overlap between terminals of the trigeminal nerve and those of the upper three cervical nerves has the potential to be the source of CGH. Consequently, the peripheral distribution of the C1 to C3 spinal nerves forms the anatomical basis for the differential diagnosis of CGH. There are some potential sources of pain in CGH, joint (Atlanto-occipital, Median atlantoaxial, Lateral atlantoaxial, C2-3 zygapophyseal), Ligaments(Transverse atlantoaxial and alar; membrane tectoria), muscles (sternocleidomastoid, trapezius, Suboccipital Semispinalis, splenius), Dura (Upper spinal cord; posterior cranial fossa), Arteries (Vertebral; internal carotid) (Bogduk, N. (2001).).

A headache caused by a disorder of the soft tissues or bony structures of the neck has been known as a cervicogenic headache. The headache usually arises when the neck is moved or a continuous position of the head is maintained for some time, or/or external pressure is applied to the area above the neck. It is often when there is limited movement in the neck. The pain is moderate to severe and may come in the form of intermittent attacks that may last from hours to days, and the pain may be permanent. And it is on one side of the face or the head, and it may also be on both sides, Pain is localized to the occipital, frontal, temporal, or orbital regions. It may be accompanied by some of the following signs: Nausea, vomiting, photophobia, dizziness, ipsilateral blurred vision, lacrimation, and ipsilateral neck, shoulder, and arm pain. The first three cervical spinal nerves(C1, C2, C3) and their rami are the primary peripheral nerve structures that can refer pain to in the head. A regional myofascial pain syndrome (MPS) affecting cervical, pericranial, or masticatory muscles can be associated with referred head pain. The entry of sensory nerve fibers from the upper cervical regions into the spine via the spinal accessory nerve before entering the

dorsal spinal cord. The close association between the sensory fibers of the spinal accessory nerve and the sensory nerves in the spine is thought to allow a functional exchange of somatosensory, pain-causing, and pain-receptor information from the trapezius, sternocleidomastoid and other cervical muscles to converge in the nucleus of the cervical triangle, ultimately leading to pain referral To the trigeminal sensory areas of the head and face. Muscular trigger points, a hallmark of MPS, are hyper-irritable areas of contracted muscle that have a low pain threshold and refer pain to distant sites In predictable and reproducible patterns. Many therapeutic interventions have been described for these cases, including pharmacological intervention, physical therapy and other treatments (Pain, C., Biondi, D. M., & Consultant, I. (2014).).

2.1.2 Migrane and tension type of headache

Tension-type headaches (TTH) are the most common type of benign headache. They can affect all aspects of one's life including work, school, and home life. TTH may result in disability, missed workdays, and decreased quality of life. They are characterized by how often an individual experience them in a given month. The etiology behind these headaches is still unknown. It is believed that changes in levels of neurotransmitters may be a contributing factor. According to the Schwartz study in 1998, women are more likely to experience TTHs in every race, age group, and educational level.

There are two types of tension-type headache **episodic** & **chronic**. **Episodic** TTHs are characterized by occurring less than 15 days out of a month. They can last anywhere from a few hours to several days. Patients usually report feeling symptoms such as a tight band or pressure around their head and/or neck. These headaches are most often bilateral but can be

unilateral. They range from mild to moderate in intensity and do not have any of the associated symptoms which are found in migraines.

TTHs are characterized as **chronic** when their symptoms persist for 15 or more days within a month for three consecutive months. Because of the moderate to severe intensity of chronic TTHs, this type of headache is more debilitating than the episodic TTHs. In addition to feeling pressure around the head and/or neck, patients with chronic TTHs may experience mild nausea.

The following list of possible triggers for TTH was taken from the University of Maryland Medical Center: Stress, Depression, Anxiety, Holding your head in one position for a long time, Sleeping in an awkward position or in a cold room, Eye strain, Drugs or alcohol,Over-exertion,Skipping meals, Head and neck injury, even years after the injury, Clenching your jaw or grinding your teeth (bruxism),Medications, including some headache medications (leading to rebound headaches),Hormonal changes (primarily among women)

Migraine is a chronic, episodic primary headache , are the second most common type of primary headache. It is thought to be a neurovascular pain syndrome with altered central neuronal processing (activation of brainstem nuclei, cortical hyperexcitability, and spreading cortical depression) and involvement of the trigeminovascular system (triggering neuropeptide release, which produces painful inflammation in cranial vessels and the dura mater).

Symptoms typically last 4 to 72 hours and may be severe. Pain is often but not always unilateral, throbbing, worse with exertion, and accompanied by autonomic symptoms (eg,

nausea; sensitivity to light, sound, or odors). Fortification spectra and other transient focal neurologic deficits occur in a few patients, usually just before the headache, also known as an aura. Diagnosis of migraine can usually be made by history alone. Treatment includes lifestyle changes (diet, exercise, sleeping habits), medications including NSAIDs, analgesics, serotonin receptor agonists, beta-blockers, calcium channel blockers, and antiemetics.

Migraine is a centrally-mediated pain disorder. This means that there is a disorder in the central nervous system (the brain and spinal cord), involving the nerves and blood vessels, which results in the pain and the neurologic symptoms associated with a migraine headache.

Migraine is thought to be a neurovascular pain syndrome with

- altered central neuronal processing (activation of brainstem nuclei, cortical hyperexcitability, and spreading cortical depression)
- involvement of the trigeminovascular system (triggering neuropeptide release, which produces painful inflammation in cranial vessels and the dura mater).

Vascular: intracranial vasoconstriction and extracranial vasodilation. This results in cerebral hypoxia and may be responsible for the neurologic defects that characterize the aura. Acetylcholine and vasoactive intestinal polypeptide in the cranial arteries as well as dilation of the middle cerebral artery and the superficial temporal artery on the pain side during migraine cause relaxation of the vessels.[3]

Trigeminal complex: It supplies the head and face region via trigeminal nerve. Surrounding the large cerebral vessels, peal vessels, large venous sinuses, and dura mater is a plexus of

largely unmyelinated fibers that arise from the ophthalmic division of the trigeminal ganglion and the upper cervical dorsal roots. The stimulation of these vessels causes the pain associated with migraines via the release of substance P and calcitonin gene-related peptide when the trigeminal ganglion is stimulated. Migraineurs may have sensitization to the mechanoreceptors in these structures enhancing the responses to mechanical stimuli and can result in allodynia (a painful response to non-noxious stimuli).

There may be an aberrant mechanism in the stimulation of sensory fibers that excite GABA receptors, and the inhibition that reduces the excitability of pain neurons in the dorsal horn of the spine in order to modulate pain response to stimulation. Low levels of serotonin have been found in migraineurs. Platelets contain virtually all the serotonin present in the blood and release serotonin during aggregation. Migraineurs also tend to show hyperaggregability of platelets when free from headache. Aggregated platelets release catecholamines and serotonin that may cause the initial stage of vasoconstriction. Platelet aggregation is increased during the prodromal stage of migraine and a decrease of aggregation during the headache. The nuclei raphes also appear to increase blood flow in the brain and can respond to changes in serotonin transmission. The serotonin neurons located in the brainstem nuclei raphes change their firing rate during the sleep-wake cycle and may explain why sleep is often the best antidote to a migraine.

Cortical spreading depression is a mechanism that starts with a small excitatory response that begins to spread through the brain and then causes a suppression of electroencephalographic (EEG) activity that moves through the cortex and can disturb the extracellular environment. Potassium levels increase, extracellular glutamate increases, and extracellular calcium level decreases. Abnormal ion channel function is believed to be the mechanism in

the rare form of familial hemiplegic migraine (FHM). Cortical spreading depression is accompanied by local vascular responsiveness. Cortical hyperemia may be responsible for the flashing jagged light that sometimes occurs just before the pain begins. Cervical musculature can fire the neurons and cause pain and can be taut and tender during a migraine. Lastly, hormone levels, specifically estrogen can contribute ta migraine due to the falling levels of estrogen during menstruation.

2.2 Similar Studies

All of the studies that were reviewed were during the past twenty years, and they were on adult patients with cervicogenic headache, who were treated with the Mulligan technique, strengthening exercises, and stretching exercises in addition to massage.

Several prospective empirical studies have discussed criteria for managing and treating cervicogenic headache headaches.

(Hall et al., 2007) In their study of the effects of the Mulligan technique on the first and second cervical vertebrae in individuals with headaches. The study was on 32 patients who were selected with conditions (18-60 years old, unilateral headache, headache with a stiff neck, headache over the past 3 months, at least once a week, positive flexion rotation, and restrictions greater than 10 degrees), self-SNAG mobilization technique was used for C1, C2. Flexion rotation test was measured before and after practice visit, Headache symptoms were determined by the headache

index assessed by questionnaire preintervention, at 4 weeks postintervention, and at 12 months postintervention. The results that have been shown provide efficacy for mulligan self-SNAG mobilization in treating people with cervicogenic headaches (Hall, T., Grad, P., Manip, D., Ho, T., Chan, T., Ther, M. M., … Manip, D. (2007).).

(Shin & Lee, 2014) , In their study they investigated the effect of SNAGs on women with cervicogenic headaches. The study was on 40 patients, who were selected according to the following (30-60 years, under the condition of atraumatic, nonspecific neck pain and being prescribed physical therapy). The technique of SNAG therapist mobilization was used in the experimental group and the control group, in which contacting pressure of the hand, which was touching the dysfunctional joint was used. Visual Analog Scale (VAS), Headache Duration, and Neck Disability Index (NDI) were evaluated by patients before and after the intervention. From the results that emerged, there was a significant effect on the outcomes measures, and from this, we infer that the SNAG technique has an effective therapeutic effect in treating CGH (Shin, E., & Lee, B. (2014).).

(Professionals & Christian, 2017) aimed at finding the effectiveness of Mulligan's SNAG technique and Maitland's technique for individuals suffering from CGH, as they were 25-35 years old, Persons fulfilling the diagnostic criteria given by IHS (International Headache Society) and Positive FRT (flexion-rotation test) and restricted ROM. The outcome measures were obtained before and after 1 week of the treatment session, in Which was cervical flexion-rotation test (FRT) and Headache disability index were performed, The duration of the study was 1 week (6 sessions for each group). Among the results that appeared, it was found that the Mulligan technique has a

greater significant difference, meaning that it has a better therapeutic effect in the treatment of cervicogenic headache(Professionals, T. O. G. Y., & Christian, N. (2017).).

(Naeem, Rasul, Dustagir, & Malik, 2018), Their study was a randomized control trial and it aimed at identifying and comparing the effect of headache SNAG and Reverse headache SNAG in the treatment of headache. The study included 42 patients of both genders ages 30-60 years, cervicogenic headache was clinically diagnosed, and the outcomes were measured by the Visual Analogue Scale and Headache Pain Scale. From the results it was found that the packing is very effective in treating CGH, It has been shown that The headache SNAG is more efficacy than reverse headache SNAG in treating CGH(Naeem, H., Rasul, U., Dustagir, A., & Malik, A. N. (2018).).

(Cairo, 2018) , studied the effect of C1-C2 Mulligan SNAGs Mobilizations on Cervicogenic headache and associated dizziness symptoms. 48 patients from both genders (25-45 years old), were diagnosed by neurologists with a CGH and dizziness and suffered from headaches for the last three months with unilateral neck pain and stiffness. Also, positive Flexion Rotation Test. In addition; associated dizziness symptoms triggered by headache &neck extension. The outcomes measures were, Headache intensity & neck pain were measured by "NDI", while headache impact adverse effects on social and psychological life was measured using the 6-HIT scale. The amount of rotation between C1-C2 was assessed by FRT and confirmed in degrees using the CROM device. From the results that emerged, it was found that the SNAGs mobilization technique is effective in reducing CGH and dizziness (Cairo, N. (2018).).

(Chung & Jeong, 2018) , compared the effects of neck isometric exercise (NIE) and craniocervical flexion exercise (CFE) on patients with nonspecific neck pain, these comparisons were to be made by measuring the outcomes via neck disability index (NDI), and active cervical range of motion (ACROM), and visual analog scale. The study contained 41 patients, and they were divided into two groups, the experimental (22 patients performing CFE) and control (19 patients performing NIE) group, all patients performed three 30-second repetitions of stretching exercises for the neck flexor, extensor, lateral flexor, and rotator as a warm-up and cool-down exercises. The patients in the experimental group then underwent CFE 30 minutes/day, 3 times a week, for 8 weeks, while the control group underwent NIE. The main outcome measures were pain on the visual analog scale (VAS) and perceived disability based on the neck disability index (NDI). Through the results, it was found that

CFE is targeted at retraining the Craniocervical flexor muscles Helpful and effective in relieving pain and functional disorders associated with the neck in these patients (Chung, S., & Jeong, Y. (2018).).

(Chung & Jeong, 2018) , compared the results of manual therapy and stretching exercises on neck pain and dysfunction. It was found that both techniques are effective and contributed to relieving pain and disability so the difference in therapeutic effectiveness between them was very slight, but exercises remain less expensive and are recommended(Ylinen, J., Nikander, R., Nykänen, M., Kautiainen, H., Häkkinen, A., Promotion, H., … Centre, R. (2010).).

(Ylinen et al., 2010) , conducted a study on the individuals who complained of headache and chronic neck pain, and compared the effects of strengthening and stretching exercises and their

effect on these cases. They concluded that stretching exercises were less effective when used alone (Bogduk, N. (2001).).

2.3 Summary

In this part of the chapter, the researcher points out that the researcher reviewed the studies related to cervicogenic headache and the therapeutic interventions for it (mulligan technique, strengthening, stretching exercises, and massage), and there were some studies supporting the hypothesis and others opposing it, and there was a lack of an optimal therapeutic intervention in the treatment. Studies on the subject we have in Palestinian society are very rare, so we need more studies to come up with an optimal therapeutic intervention for treatment. Try to rewrite it in a better language

Chapter 3

Methods and Procedures

3.1 Study design

The study was a prospective parallel-group randomized clinical trial (single-blinded to the patient).

3.2 Research setting:

The study was conducted in a private physiotherapy clinic in the governorate of Jenin, in the north of the West Bank; it started on the 1st of March – 2021 and ended on the end of May 2021.

3.3 Study population and sample

The sample was composed of a group of individuals suffering from medically diagnosed cervicogenic headache

3.3.1 Sampling method

A convenient sampling method was used for the recruitment for this study, this type of sampling was used because it is cheap, and fast, and can make sure that we get the sample requested in the shortest time, then a random list of 20 codes between 0-40 was used to assign the patients for experimental (self-mobilization) group, and the rest of codes were assigned for the control group (therapist mobilization).

3.3.2 Sample size

The sample consisted of 40 patients, and they were divided randomly into two groups (the experimental and control group) so that each group consisted of 20 patients. Then 3 participants has withdrawn from the study, which kept 37 participants at the end of the research.

3.3.3 Inclusion criteria

- Patients aged from 20-40 years, male and female
- A medical diagnosis of CGH based on the medical report
- Patients Who experienced frequent CGH for at least 4 months. (A headache is considered to be recurring if it appeared at least once every week during the last 3 months)(Khalil, M. A., Alkhozamy, H., Fadle, S., Hefny, A. M., & Ismail, M. A. (2019).).
- Patients who have not undergone physical therapy for 3 months.
- patients who had unilateral pain.

3.3.4 Exclusion criteria

- Patients who are on medication (steroids, analgesics)
- Patients who suffer from dizziness or visual disturbance symptoms.
- Headache which is not of cervical origin.
- Any indication of vertebrobasilar insufficiency.
- Previous cervical spine surgery.

- Migraine and tension-type of headache.
- Cervical disc lesion with or without radiculopathy.

3.4 Data collection

3.4.1 Tools of data collection

- A data collection sheet: consisting of several parts to collect information about each patient will be developed, and it will mainly be of two parts,
  - the first section contains consist of social information about the patient (name, gender, age, marital status, weight, height, occupation).
  - and the second section covers the medical history of the patient's illness (medical history, previous surgery, exposure to injury or hit, the severity of headache, recurrence of headaches, time since starting.

- **Neck Disability Index (NDI)**

It is the most widely used self-reporting scale for neck pain felt by the patient while 10 items, including pain in personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation. Each item is classified on a scale of (0-5), with 0 meaning no pain and 5 meaning severe pain. The categories of disability for him are as follows: 0-8% without disability, 10-28% mild, 30-48% moderate, 50-64% severe, 70-100% complete disability (Macdermid, J. O. Y. C. (2009).).

- **The goniometer**

It is a valid and reliable instrument that measures the available range of motion at a joint. The same measuring instrument was used to avoid any error (Access, O. (2016).).

- **Visual analog scale**.

It is a simple method to determine the severity of pain according to the patient's perception, and easy to see the changes in values later on. VAS is reliable (r=0.71) and valid for pain assessment. It is a unidimensional measure of pain intensity that has been used widely among adults. VAS is a valid tool for measuring neck pain and disabilities in patients with neck pain due to acute or chronic conditions as well as patients suffering from musculoskeletal dysfunctions. It is a horizontal line of constant length, usually 100 mm, and the ends are defined as the maximum limits of the pain or the parameter to be measured, so that they are directed from the left (not the pain) to the right (severe pain) (no pain (0–4 mm), mild pain (5-44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm)(Carlsson, A. M. (1983).

- **Flexion rotation test**

The cervical flexion–rotation test is an easily applied method of manual examination that is said to provide a means of determining the presence of joint dysfunction at the C1/2 level. The flexion–rotation test is conducted with the cervical spine fully flexed in an attempt to block as much rotational movement as possible above and below C1/2. The head is then rotated to the left and the right. If firm resistance is encountered and range is limited before the expected end range, then this is said to be significant, with a presumptive diagnosis of limited rotation of the atlas on the axis. Anecdotally, pain provocation during the flexion–rotation test is also a feature of a positive test result, however, pain is not a feature in asymptomatic subjects. The normal range of rotation motion in end range flexion is 44° to each side. In contrast, subjects suffering from

headaches with C1-C2 dysfunction have an average of 17° less rotation, The sensitivity and specificity of the flexion–rotation test was 91% and 90%, respectively (P<.001), with an overall diagnostic accuracy of 91% (P<.001). (Hall, T., Robinson, K., Briffa, K., Armijo-Olivo, S., Hall, T., & Briffa, K. (n.d.).

- **Headache index**

The Henry Ford Hospital Headache Disability Inventory/Index (HDI) was developed to quantify the impact of headaches on daily living. A 25-item headache questionnaire was derived from case history responses of subjects with headaches, and it was subgrouped into functional and emotional subscales to assess the impact of headaches, and their treatment on daily living. The Headache Disability Inventory/Index designed by Jacobson and Ramadan, et al.(1994)

3.4.2 Study variables

- **Dependent variables**: ROM, the intensity of headache, frequency of headache, cervical pain, cervical range of motion, disability index, headache index.

- **Independent variables**: Mulligan therapist mobilization technique, mulligan self-mobilization technique, and other personal variables like age, gender, and occupation.

3.4.3 Tests and measurements

After dividing the sample into two groups, the experimental group and the control group, the collection of personal information, taking measurements, and applying tests to patients started on

the first day before the first treatment session, and the tests and measurements were repeated two weeks after the end of the treatment.

All patients were assessed by the same physiotherapist(researcher). There was a training session for the patients to make sure that they can properly apply the treatment techniques.

Of course, it should be noted that the treatment will be at the hands of physical therapists with experience, accreditation, and certification in the Mulligan technique for not less than 5 years.

As for the assessment procedures,

1. headache intensity: was measured with a numerical pain rating scale. Patients will be asked to indicate the number value on a scale of 11 values (0-10) to better indicate the severity of their headaches, with 0 no headache and 10 severe headaches (Khalil, M. A., Alkhozamy, H., Fadle, S., Hefny, A. M., & Ismail, M. A. (2019).).

2. headache **frequency**: It generally refers to the average number of headaches a patient has per week.

3. Record the **duration** of headache attacks by each patient in the headache diary/week.

4. **flexion rotation test** was used to detect any limitation in cervical rotation ROM to either side. The patient is placed lying on the back with complete flexion of the cervical spine to limit the movement of lower cervical segments and to concentrate the movement on C1–C2.

The upper cervical rotation, normal ROM is documented to be 44° to each side (Ogince M, Hall T, Robinson K, Blackmore AM., Khalil, M. A., Alkhozamy, H., Fadle, S., Hefny, A. M., & Ismail, M. A. (2019).).

Patients with CGH associated with C1–C2 dysfunction show 10° less than normal upper cervical rotation ROM to the affected side (Khalil, M. A., Alkhozamy, H., Fadle, S., Hefny, A. M., & Ismail, M. A. (2019). , Hall T, Robinson K.).

3.5 Suggested program

*** Group 1 (experimental):** This consisted of 20 patients who were subjected to the mulligan self-mobilization technique and conventional therapy (strengthening for deep neck flexor, stretching for neck extensor, massage) was applied for three sessions per week for two weeks, with a total of 6 sessions (Suggestion, Park, Yang & Kim. (2017)., Hopper, Bajaj, Choi, Jan, Hall, Robinson, & Briffa, K. (2013)., Ramezani & Arab (2017)., Dimitriadis, . (2015).).

* **Group 2**: This consisted of 20 patients, who received the same protocol above, but self-mobilization was replaced by therapist mobilization, with the same number of sessions Park, Yang, & Kim, (2017)., Hopper et al . (2013)., Ramezani & Arab (2017)., Dimitriadis (2015)., Professionals, T. O. G. Y., & Christian (2017).) The Mulligan belt was distributed to patients in the experimental group.

Mechanism of applying mulligan self-mobilization

The following is a description of the procedure of the application of the mulligan technique as was described by ((Hing, Hall, & Rivett, 2013)

- **C1-C2 self SNAG**

• Patient sits in a chair with their back supported.

• Patient places a self-SNAG strap on the posterior arch of C1, below the mastoid process on the contralateral side of restriction.

• With the hand on the side of the restriction, the patient pulls the strap horizontally forward to the corner of their mouth.

• While the strap pressure is sustained, the patient rotates the head/neck towards the restricted side.

• Apply over-pressure only if symptom-free at the end range.

The strap lies on the posterior arch of C1 and then angles around the right side of the neck, and is held loosely by the patient with their left hand on their abdomen.

• Before applying the technique, the patient is advised about what to expect.

• The patient should feel a strong stretching sensation, but there should be no pain or other symptoms.

• The patient pulls on the strap with their right hand in a horizontal direction towards the corner of their mouth. The patient provides a gentle counterforce pressure with the left hand on the other end of the strap. At the same time, the patient will actively rotate their head towards the right for a positive FRT to the right side. At the end of the range of rotation the therapist, or as a home exercise a trusted family member, will apply gentle over-pressure to the rotation movement while the patient maintains force along the strap. The over-pressure is maintained for 1–2 seconds before returning the head and neck to the neutral position.

• On the first occasion it is advisable to only perform the movement 2 times, and on subsequent visits increased repetitions can be used, but only if 2 repetitions do not produce lasting headache relief. The technique is repeated as a home exercise in the morning and evening.

❖ **Self headache SNAG**

• Patient sits in a chair with their back supported and head/neck in a neutral position.

• A cervical self-SNAG strap is placed around the posterior aspect of their C2 spinous process.

• The patient holds the strap with two hands pulling in a forward and horizontal direction.

• The patient gently retracts their head against the fixation of the strap, sustaining for 10 seconds and repeating as often as required to alleviate headache.

• With the strap in place and the C2 vertebra fixed, the patient is shown how to very gently retract the head and upper cervical spine.

• The retraction force is maintained for 10 seconds.

• The exercise may be repeated until the headache resolves or it may be used pre-emptively to prevent headache return.

❖ **Self-reverse headache SNAG**

• Patient sits in a chair with their back supported and head/neck in the neutral position.

• A cervical self-SNAG strap is placed around the posterior aspect of the occiput.

• The patient holds the strap with two hands gently pulling it in a forward and horizontal direction.

• The patient gently retracts their neck, sustaining for 10 seconds and repeating as often as required to alleviate headache.

• With the strap in place and the occiput fixed, the patient is shown how to retract the neck, in effect protracting the head on the neck.

• The force is maintained for 10 seconds.

• The exercise may be repeated until the headache resolves or it may be used pre-emptively to prevent headache return.

Mechanism of applying mulligan therapist mobilization (Hing, Hall, & Rivett, 2013)

❖ **Headache SNAG**

• Patient sits in a chair with the back supported and head/neck in a neutral position.

• Therapist stands to the front and side of the patient.

• The therapist stabilizes the patient's head against their body.

• The therapist's middle phalanx of the little finger contacts the posterior aspect of the patient's C2 spinous process.

• The therapist's thenar eminence of the non-contact hand presses anteriorly in the horizontal plane against the little finger of the opposite hand, sustaining the force for 10 seconds.

• Headache pain should be alleviated.

- Step stance position facing the patient, leg adjacent to patient stepped back, with the therapist's pelvis used to hold the patient's trunk against the support of the chair. The therapist can stand on the right or left side of the patient.

- The therapist places their contact hand around the back of the patient's head, with the middle phalanx of the little finger lying across the posterior aspect of the C2 spinous process.
- The thenar eminence of the therapist's other hand presses against the little finger of the contact hand.

• It is important to stabilize the patient's head in a neutral position when applying the technique. There should be no movement of the head.

• Force is generated by the therapist pressing the little finger of the contact hand with the thenar eminence of the other hand. The direction of force should be horizontal, in the plane of the upper cervical facet joints. In this respect, the little finger of the contact hand is the locator for the application of force generated by the thenar eminence of the opposite hand (motive hand).

• Gentle force is all that is usually required for the technique to be effective.

• Maintain the applied force for 10 seconds. If the patient's headache is significantly reduced then the technique is repeated up to 6–10 times. If the headache is increased the technique should be abandoned and the reverse headache SNAG trailed.

• If there is contact soreness of the little finger during the spinous process then a small piece of sponge rubber can be used to soften the contact. In addition, as with a cervical NAG, an extremely gentle traction force may make the technique more comfortable or provide greater symptom relief to the patient.

❖ **Reverse headache SNAG**

• Patient sits in a chair with their back supported and head/neck in a neutral position.

• Therapist stands to the front and side of the patient.

• The therapist stabilizes the patient's neck by fixing the C2 vertebra with their thumb and middle fingertip in front of the transverse process.

• The therapist's other hand cups around the posterior aspect of the patient's occiput.

• Therapist gently pulls the head anteriorly in a horizontal plane sustaining the force for 10 seconds.

- Step stance facing the patient, leg adjacent to patient stepped back, with the therapist's lower abdomen and hip used to stabilize the patient's trunk. The therapist can stand on the right or left side of the patient.
- The therapist places one hand around the back of the patient's occiput with the fingers spread around the back of the occiput. Using the thumb and middle finger of the opposite hand, grasp around the lateral aspects of the C2 transverse processes using a lumbrical grip, if the neck of the patient is large, or if the neck is small then grasp the anterior aspect of the C2 transverse processes bilaterally.

• It is important to stabilize the patient's neck when applying the technique. There should be no movement of the trunk or lower neck.

• The gliding force should be in the horizontal plane, in a manner to achieve translation of the head on the neck rather than an extension of the neck.

• Gentle force is all that is required.

• Maintain the applied force for 10 seconds. If the patient's headache is significantly reduced then the technique is repeated 6–10 times.

3.6 Statistical analyses

The data will be analyzed using SPSS version 23, descriptive statistical analysis with mean, median ranges, frequency, and percentages will be used, in addition to inferential statistics using both paired sample t-tests for testing the difference in each group and independent-sample t-test to test the statistical difference in between groups, after normality assumption is being tested, otherwise none parametric analysis will be performed. P-value will be set at < 0.05

3.7 Ethical Considerations

The proposal for this study was submitted to the ethical committee at Al-Quds University - Abu Dis - to obtain approval that aims to ensure the consideration of all codes of ethical conduct in this research, and also to ensure and preserve the rights of the participants in the research.

Each participant signed informed consent, after receiving an information sheet that explains the research and its aspects on assessment and intervention. anonymity and confidentiality were guaranteed, and the data will be used only for scientific purposes, and that no names will be used in the analysis, and data was locked in a safe pale with access to the researcher only, the rights of each participant to withdraw without any harm of his interest ant any stages was declared to all patients.

Chapter 4

Results and Discussion

4.1 Results

The following chart (figure.1) explains the process of recruitment and intervention.

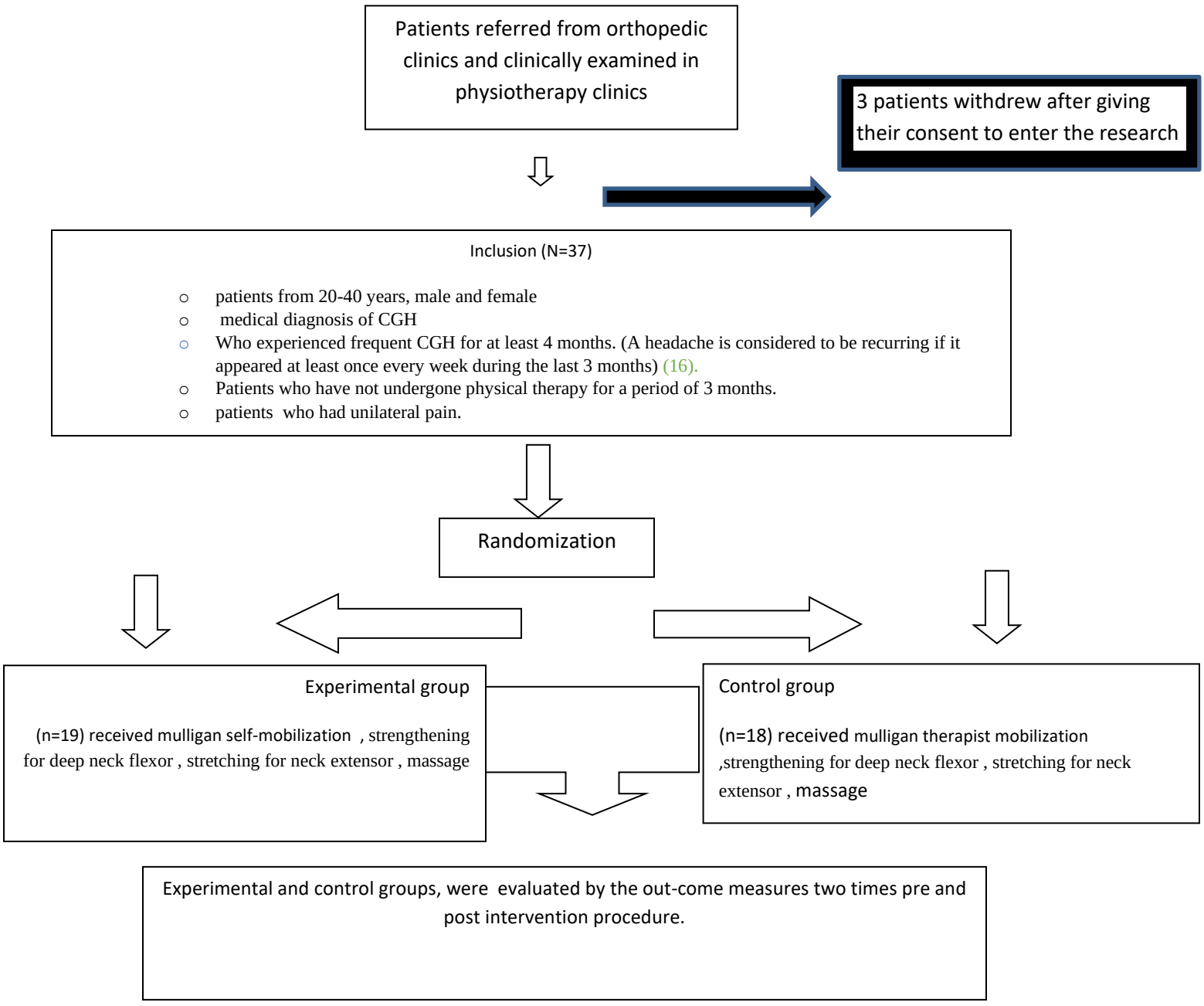

Figure 4.1 flow chart of participants reqruitment

4.1 .1 Participants' Characteristics

Thirty-seven participants met the eligibility criteria and agreed to participate in the study. As shown in table 1, the sample consisted of 19 (51.4%) males and 18 (48.6%) females. The mean age of the participants was 31.1(SD=5.9)years. More than half of them 19(51.4%) live in a city and one-third 13(35.1%) work as physical workers.

According to BMI level, slightly less than half of them, 17(45.9%) were normal weight.

Chi-square and independent t-tests were performed to assess if there was a significant difference between the two groups (self-mobilization group and therapist mobilization group), regarding age, gender, residence, occupation, and BMI level. The results of comparing the two groups' characteristics, revealed no significant differences between the two groups as displayed in (Table 1).

Table 4.1 Comparison of the participant's characteristics between the two groups according to background characteristics (N=37)

Variable			**GROUPS**		**test statistic**	
		Total n (%)	**Self-Mobilization n (%)**	**Therapist mobilization n (%)**	**Chi square**	***p* - *value***
Gender	Male	19 (51.4)	10 (52.6%)	9 (47.4%)	0.026	0.873
	Female	18 (48.6)	9 (50.0)	9 (50.0)		
Residence	City	19 (51.4)	7 (36.8%)	12 (63.2%)	0.222	0.638
	Village	18(48.6)	8(44.4%)	10 (55.6%)		
Occupation	Student	5 (13.5%)	3 (15.8%)	2 (11.1%)	.762	.859
	Physical worker	13 (35.1%)	6 (31.6%)	7 (38.9%)		
	Office	10 (27.0%)	6 (31.6%)	4 (22.2%)		

	Other	9 (24.3%)	4 (21.1%)	5 (27.8%)		
BMI level	Under weight	1 (2.7%)	1(5.3%)	0 (0.0%)	5.219	.156
	Normal weight	17 (45.9%)	11(57.9%)	6 (33.3%)		
	Overweight	14 (37.8%)	4 (21.1%)	10 (55.6%)		
	Obese	5 (13.5%)	3 (15.8%)	2 (11.1%)		
	Total	**Groups**		**test statistic**		
	M(SD)	**Self-Mobilization M(SD)**	**Therapist mobilization M(SD)**	**t-test**	***p-value***	
Age	31.1 (5.9)	30.5(5.8)	31.8(5.9)	-.702	*.488*	
Weight	72.0 (11.8)	69.8(11.6)	74.4(11.8)	-1.196	*.240*	
Height	1.7 (0.09)	1.7(0.1)	1.7(0.1)	.652	*.519*	
BMI	25.2 (3.9)	24.2(3.8)	26.2(3.9)	-1.580	*.123*	

4.1. 2 Pain Assessment

The majority of the participants 27(73.0%) reported that pain location was Occipital pain and 28(75.7%) had changing side headaches. The majority of them 28(75.7%) didn't take pain medication, as seen in (Table 2).

A chi-square test was performed to assess if there was a significant difference between the Self-mobilization group and the therapist mobilization group regarding Pain location, Side headache, and Pain medication. The results revealed no significant differences between the two groups as displayed in (Table 2).

Table 4.2 Comparison of the sample characteristics between the two groups according to Pain assessment (N=37)

Pain assessment			**test statistic**			
		Total n (%)	**Self-mobilization n (%)**	**Therapist mobilization n (%)**	**Chi square**	***p -value***
Pain location	Frontal	2 (5.4%0	1 (5.3%)	1 (5.6%0	3.509	.320
	Parietal	5 (13.5%)	3 (15.8%)	2 (11.1%)		
	Occipital	27 (73.0%)	15 (78.9%)	12 (66.7%)		
	Temporal	3 (8.1%0	0 (0.0%)	3 (16.7%)		
Side headache	Right	7 (18.9%)	3 (15.8%0	4 (22.2%)	.259	.879
	Left	2 (5.4%)	1 (5.3%)	1 (5.6%)		
	Changing	28 (75.7%)	15 (78.9%)	13 (72.2%)		
Pain medication	Yes	9 (24.3%)	5 (26.3%)	4 (22.2%)	.084	.772
	No	28 (75.7%)	14 (73.7%)	14 (77.8%)		

P_ value significant at the 0.05 level

4.3 Risk factors

More than half of the participants 19(51.4%) reported that they sleep supine and 34(91.9%) reported that pain is associated with cervical movement. The majority of them 30(81.1%) reported that headache was associated with neck pain, and 28(75.7%)reported that pain reaches the eye. However, 22(59.5%) didn't associate with TMJ pain.

Also, the average use of computers per day was 1.9 hours (SD=2.5), the average use of phone per day was 3.4 hours (SD=1.0), the average hours of reading per day was 0.7hours (SD=1.0), the average hours of TV watching per day was 0.8 hours (SD=1.0), average cervical exercises per day were 0.02 hours (SD=0.2), and average hours of sport per day was 0.2 hours (SD=0.4), as seen in (Figure.2)

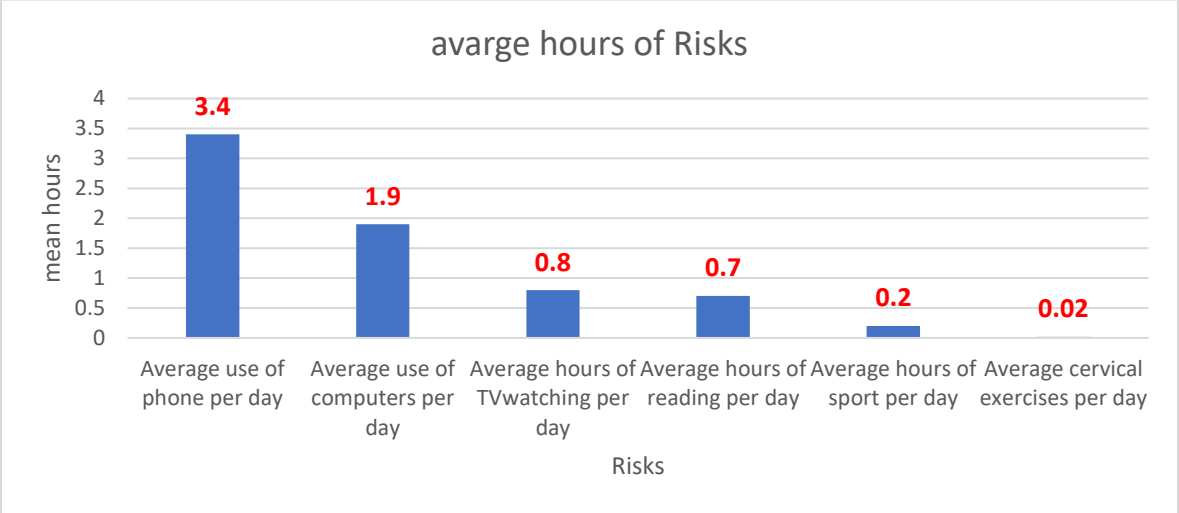

Figure 4.3 average hours of different CGH risks

A chi-square and independent t-tests were performed to assess if there was a significant difference between self-mobilization and by therapist mobilization group regarding Side sleeping, association with the cervical movement, association with neck pain, Pain reaching the eye, association with TMJ pain, Average use of computers per day, Average use of phone per day, Average hours of reading per day, Average hours of TV watching per day, Average cervical exercises per day, Average hours of sport per day. The results revealed no significant differences between the two groups as displayed in (Table 3).

Table 4.3 Comparison of the sample characteristics between the two groups according to Risk factors (N=37)

Variable			**test statistic**			
		Total n (%)	**Self-mobilization n (%)**	**Therapist mobilization n (%)**	**Chi square**	***p* - value**
Side sleeping	Prone	12 (32.4%)	6 (31.6%)	6 (33.3%)	.693	.707
	Supine	19 (51.4%)	9 (47.4%)	10 (55.6%)		

	Right	6 (16.2%)	4 (21.1%)	2 (11.1%)		
Associated with cervical movement	Yes	34 (91.9%)	18 (94.7%)	16 (88.9%)	.424	.515
	No	3 (8.1%)	1 (5.3%)	2 (11.1%)		
Associated with neck pain	Yes	30 (81.1%)	16 (84.2%)	14 (77.8%)	.249	.618
	No	7 (18.9%)	3 (15.8%)	4 (22.2%)		
Pain reaches the eye	Yes	9 (24.3%)	6 (31.6%)	3 (16.7%)	1.117	.291
	No	28 (75.7%)	13 (68.4%)	15 (83.3%)		
Associated with TMJ pain	Yes	15 (40.5%)	9 (47.4%)	6 (33.3%)	.755	.385
	No	22 (59.5%)	10 (52.6%)	12 (66.7%)		
Variable		**Total M(SD)**	**Self-mobilization group M(SD)**	**Therapist mobilization group M(SD)**	**t-test**	***p* – *value***
Average use of computers per day		1.9 (2.5)	2.1(2.3)	1.6(2.7)	.599	*.553*
Average use of phone per day		3.4 (1.0)	3.5(1.0)	3.3(1.0)	.763	*.451*
Average hours of reading per day		0.7 (1.0)	0.9(0.9)	0.6(1.0)	1.075	*.290*
Average hours of TV watching per day		0.8 (1.0)	0.8(1.0)	0.9(1.1)	-.287	*.776*
Average cervical exercises per day		0.02 (0.2)	.05(0.2)	0.0(0.0)	.973	*.337*
Average hours of sport per day		0.2 (0.4)	0.2(0.4)	0.11 (0.3)	.849	*.402*

4.4 CGH Manifestations

More than half of the participants 19(51.4%) were found to suffer from Capital extension and 33(89.2%) had Tenderness of the SC. However, 24(64.9%) didn't have Shoulder height variations, as seen in (Figure. 3)

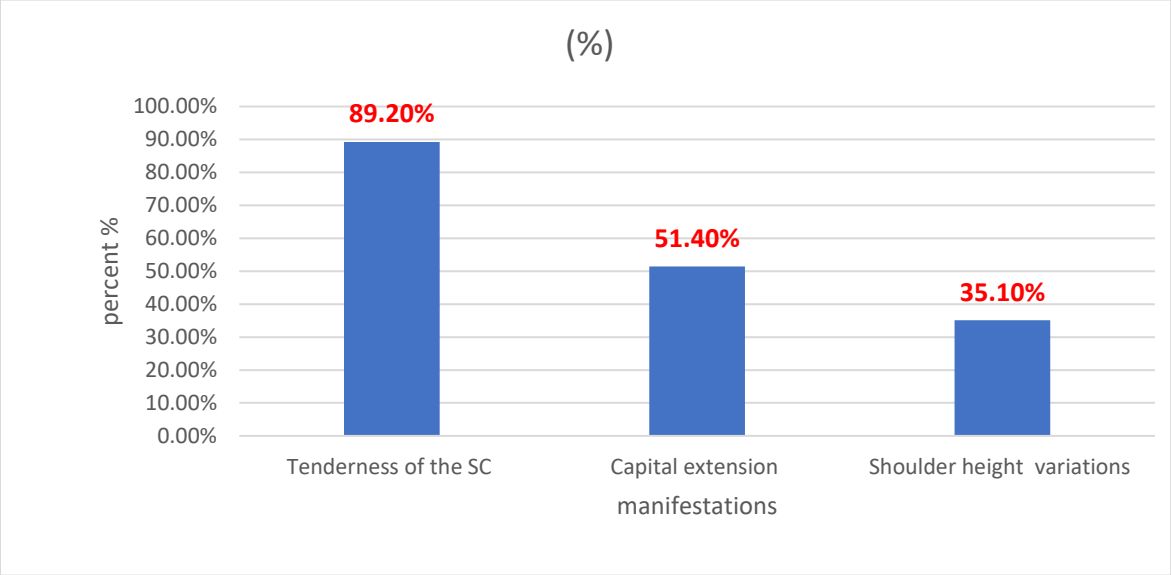

Figure 4.4 CGH manifestations

A chi-square test was performed to assess if there was a significant difference between the self-mobilization group and therapist mobilization group regarding Capital extension, Tenderness of the SC, and Shoulder height variations. The results revealed no significant differences between the two groups as displayed in (Table 4). Thus, both groups were similar without differences according to manifestations at the pretest which make it applicable to make a comparison between both groups at the posttest.

Table 4.4 Comparison of the sample characteristics between the two groups according to the manifestations (N=37)

Variable			**test statistic**			
		Total n (%)	**Self-mobilization n (%)**	**Therapist mobilization n (%)**	**Chi square**	***p* - *value***
Capital extension	Yes	19 (51.4%)	11 (57.9%)	8 (44.4%)	.669	.413
	No	18 (48.6%)	8 (42.1%)	10 (55.6%)		
	Yes	33 (89.2%)	16 (84.2%)	17 (94.4%)	1.004	.316

Tenderness of the SC	No	4 (10.8%)	3 (15.8%)	1 (5.6%)		
Shoulder height variations	Yes	13 (35.1%)	9 (47.4%)	4 (22.2%)	2.565	.109
	No	24 (64.9%)	10 (52.6%)	14 (77.8%)		

4.5 Outcome measures at baseline

In **terms of the range of motion**, the average flexion of the participants was 40.6(SD=4.2), Extension was 51.4(SD=8.2), Rt. Side flexion was 23.8(SD=6.0), Lt Side flexion was 22.7(SD=7.3), Rt. Rotation was 64.1(SD=7.3), Lt Rotation was 61.5(SD=6.0), Rt. The flexion rotation test was 28.2(SD=3.2), Lt Flexion rotation test was 27.2(SD=4.2), as seen in (Table 5).

An independent t-test was performed to assess if there was a significant difference between the self-mobilization group and therapist mobilization group regarding Flexion, Extension, Rt. Side flexion, Lt. Side flexion, Rt. rotation, Lt. rotation, Rt. Flexion rotation test, Lt. Flexion rotation test. The results revealed no significant differences between the two groups as displayed in (Table 5). Thus, both groups were similar without differences according to AROM tests in the pre-test which make it applicable to make a comparison between both groups in the post-test.

Table 4.5 Comparison of the sample characteristics between the two groups according to the AROM tests (N=37) at baseline

AROM		**Group**		**test statistic**	
	Total M(SD)	**Self-mobilization M(SD)**	**Therapist mobilization M(SD)**	**t-test**	***p* – *value***
Flexion	40.6(4.2)	40.7(3.2)	40.5(5.1)	.132	*.896*
Extension	51.4(8.2)	53.9(9.0)	48.8(6.3)	2.007	*.053*

Rt Side flexion	23.8(6.0)	24.6(6.2)	22.8(5.9)	.903	*.373*
Lt Side flexion	22.7(7.3)	24.8(6.5)	20.4(7.5)	1.881	*.068*
Rt rotation	64.1(7.3)	65.8(6.2)	62.2(8.1)	1.513	*.139*
Lt rotation	61.5(6.0)	62.9(6.7)	59.9(4.8)	1.589	*.121*
Rt Flexion rotation test	28.2(3.2)	28.7(2.8)	27.7(3.5)	1.032	*.309*
Lt Flexion rotation test	27.2(4.2)	28.4(4.6)	25.9(3.4)	1.858	*.072*

The average **Neck disability index** was 45.1(SD=15.1), Headache index 57.9(SD=13.9), Pain severity was 6.6(SD=1.6), Headache frequency per day was 6.4times (SD=8.6), Headache duration per day was 7.8 hours (SD=8.7), and seconds of contraction of deep neck flexion was12.1 seconds (SD=4.1), as seen in (Table 6).

An independent sample t-test was performed to assess if there was a significant difference between the self-mobilization group and the therapist mobilization group regarding Neck disability index, Headache index, Pain severity 0-10, Headache frequency per day, Headache duration per day, and Seconds of deep neck flexion. The results revealed no significant differences between the two groups as displayed in (Table 6). Thus, as both groups were similar without differences according to pain tests in the pre-test which make it is applicable to make a comparison between both groups in the post-test.

Table4.6 Comparison of the sample characteristics between the two groups in outcome measures at baseline (N=37)

pain tests		**Group**		**test statistic**	
	Total M(SD)	**Self-mobilization M(SD)**	**Therapist mobilization M(SD)**	**t-test**	***p – value***
Neck disability index	45.1(15.1)	42.2(13.7)	48.2(16.3)	-1.217	*.232*
Headache index	57.9(13.9)	57.3(14.7)	58.7(13.5)	-.303	*.764*

Pain severity 0-10	6.6(1.6)	6.3(1.7)	6.8(1.4)	-1.000	*.324*
Headache frequency per day	6.4(8.6)	5.6(8.2)	7.2(9.2)	-.572	*.571*
Headache duration per day	7.8(8.7)	6.1(8.0)	9.7(9.2)	-1.271	*.212*
Seconds of deep neck flexion	12.1(4.1)	11.9(4.7)	12.2(3.6)	-.159	*.875*

4.6 inferential statistics

4.6.1 ROM

4.6.1.1 ROM before and after at the self-mobilization (experimental)

According to the effect of self and therapist Mulligan mobilization on AROM of cervicogenic headache, a paired sample t-test was performed to assess if there were significant differences between the self-mobilization group regarding AROM tests at pre-test and post-test. The results revealed significant differences between them ($p<0.05$). All AROM tests mean increased from pre-test to post-test, as displayed in (Table 7).

Table 4.7 Comparison between the self-mobilization group at pre- and post- test according to the AROM (N=37)

AROM	**self-mobilization Group**		**test statistic**	
	Pre-test M(SD)	**Post-test M(SD)**	**t-test**	***p – value***
Flexion	40.7(3.2)	44.5(0.8)	-5.539	*0.001**
Extension	53.9(9.0)	65.6(3.8)	-8.447	0.001*
Rt Side flexion	24.6(6.2)	42.3(3.3)	-13.649	0.001*

Lt Side flexion	24.8(6.5)	42.6(2.2)	-13.487	0.001*
Rt rotation	65.8(6.2)	77.4(3.5)	-9.202	0.001*
Lt rotation	62.9(6.7)	78.1(1.8)	-9.407	0.001*
Rt Flexion rotation test	28.7(2.8)	40.9(1.7)	-17.362	0.001*
Lt Flexion rotation test	28.4(4.6)	41.5(2.0)	-13.507	0.001*

**significant at p < .05*

4.6.1.2 ROM before and after at the therapist mobilization (control)

Paired sample t-test was performed to assess if there were significant differences between the therapist mobilization group regarding AROM at pre-test and post-test. The results revealed significant differences between them ($p<0.05$). All AROM test mean increased from pre-test to post-test, as displayed in (Table 8).

Table 4.8 Comparison between the therapist mobilization group at pre and post- test according to the AROM tests (N=37)

AROM	**Therapist mobilization Group**		**test statistic**	
	Pre-test M(SD)	**Post-test M(SD)**	**t-test**	***p – value***
Flexion	40.5(5.1)	47.4 (2.3)	-6.394	.001*
Extension	48.8(6.3)	62.2 (6.5)	-11.580	.001*
Rt Side flexion	22.8(5.9)	38.4 (6.7)	-11.928	.001*
Lt Side flexion	20.4 (7.5)	39.9 (4.2)	-10.669	.001*
Rt rotation	62.2(8.1)	72.1 (5.4)	-5.806	.001*
Lt rotation	59.9(4.8)	72.8 (6.6)	-7.343	.001*
Rt Flexion rotation test	27.7(3.5)	40.6 (2.5)	-18.064	.001*
Lt Flexion rotation test	25.9(3.4)	39.0 (3.8)	-12.025	.001*

**significant at p < .05*

4.6.1.3 Rom comparison between the two groups at post-test

An independent t-test was performed to assess if there were significant differences between the self-mobilization group and therapist mobilization group regarding AROM tests. The results revealed significant differences between the two groups in (Flexion, Rt Side flexion, Lt Side flexion, Rt rotation, Lt rotation, and Lt Flexion rotation test) as displayed in (Table 9). Thus, most of the AROM tests between both groups were different post-test.

Table 4.9 Comparison of the sample characteristics between the two groups according to the ROM tests at post-test (N=37)

AROM	**Group**		**test statistic**	
	Self-mobilization M(SD)	**Therapist mobilization M(SD)**	**t-test**	***p – value***
Flexion	44.5(0.8)	47.4(2.3)	-5.270	*.001**
Extension	65.6(3.8)	62.2(6.5)	1.915	*.064*
Rt Side flexion	42.3(3.3)	38.4(6.7)	2.284	*.029**
Lt Side flexion	42.6(2.2)	39.9(4.2)	2.510	*.017**
Rt rotation	77.4(3.5)	72.1(5.4)	3.568	*.001**
Lt rotation	78.1(1.8)	72.8(6.6)	3.337	*.002**
Rt Flexion rotation test	40.9(1.7)	40.6(2.5)	0.562	*.578*
Lt Flexion rotation test	41.5(2.0)	39.0(3.8)	2.545	*.015**

**significant at $p < .05$*

4.6.2 Headache outcome measures

4.6.2.1 headache variables before and after In the self-mobilization (experimental)

According to Effect of Self and Therapist Mulligan Mobilization on pain tests of Cervicogenic Headache, a paired sample t-test was performed to assess if there were significant differences between the self-mobilization group regarding pain tests at pre-test and post- test. The results revealed significant differences between them ($p<0.05$). All pain tests mean decreased from pre-test to post-test and the seconds of deep neck flexion increased at post-test, as displayed in (Table 10).

Table 4.9 Comparison between the the self-mobilization group at pre-test and post-test according to the pain tests (N=37)

Pain tests	**self-mobilization Group**		**Statistical test**	
	Pre-test M(SD)	**Post-test M(SD)**	**t-test**	***p –value***
Neck disability index	42.2(13.7)	7.2(7.7)	10.860	.001*
Headache index	57.3(14.7)	13.2(12.9)	15.274	.001*
Pain severity 0-10	6.3(1.7)	0.9(1.0)	15.615	.001*
Headache frequency per day	5.6(8.2)	0.6(0.6)	2.572	.019*
Headache duration per day	6.1(8.0)	0.5(0.5)	2.944	.009*
Seconds of deep neck flexion	11.9(4.7)	29.1(4.7)	-16.996	.001*

*significant at $p < .05$

4.6.2.2 Headache variables before and after In the therapist -mobilization (control)

A paired sample t-test was performed to assess if there were significant differences between the therapist mobilization group regarding pain tests at pre-test and post-test. The results revealed significant differences between them ($p<0.05$). All pain tests mean decreased from pre-test to post-test and the seconds of deep neck flexion increased at post-test, as displayed in (Table 10).

Table 4.10 Comparison between the therapist mobilization group at pre-test and post-test according to the headache variables tests (N=37)

Pain test	**therapist mobilization Group**		**test statistic**	
	Pre-test M(SD)	**Post-test M(SD)**	**t-test**	***p –value***
Neck disability index	48.2(16.3)	8.6(8.8)	10.477	.001*
Headache index	58.7(13.5)	16.0(13.7)	14.570	.001*
Pain severity 0-10	6.8(1.4)	1.1(1.4)	16.322	.001*
Headache frequency per day	7.2(9.2)	0.6(0.6)	3.012	.008*
Headache duration per day	9.7(9.2)	0.7(0.7)	4.173	.001*
Seconds of deep neck flexion	12.2(3.6)	30.4(4.3)	-14.723	.001*

*significant at $p < .05$

4.6.2.3 Comparison between the two groups according to the headache variables tests at post- test

An independent t-test was performed to assess if there were significant differences between the self-mobilization group and therapist mobilization group regarding pain tests. The results revealed no significant differences between the two groups as displayed in (Table 11). Thus, both groups were similar without differences according to pain tests at post-test.

Table 4.11 Comparison between the two groups according to the headache variables tests at post-test (N=37)

Pain test	**Group**		**test statistic**	
	Self-mobilization M(SD)	**Therapist mobilization M(SD)**	**t-test**	***p-value***
Neck disability index	7.2(7.7)	8.6(8.8)	-.513	*.611*
Headache index	13.2(12.9)	16.0(13.7)	-.648	*.521*
Pain severity 0-10	0.9(1.0)	1.1(1.4)	-.414	*.682*
Headache frequency per day	0.6(0.6)	0.6(0.6)	-.161	*.873*
Headache duration per day	0.5(0.5)	0.7(0.7)	-1.132	*.265*
Seconds of deep neck flexion	29.1(4.7)	30.4(4.3)	-.903	*.373*

*significant at $p < .05$

4.6.3 Headache manifestations before and after

4.6.3. 1 Comparison between the self-mobilization group at pre- and post- test according to the manifestations

A chi-square test was performed to assess if there was a significant difference between the self-mobilization group regarding Capital extension, Tenderness of the SC, and Shoulder height variations at pre-test and post-test. The results revealed significant differences between them as displayed in (Table 12). The presence of Capital extension increased from 11(57.9%) at pre-test to17(89.5%) at post-test. Also, the Tenderness of the SC decreased from 16(84.2%) at pre-test to 1(5.2%) at post-test, and Shoulder height variations decreased from 9 (47.4%) at pre-test to 1 (5.2%) at post-test.

Table 4.12 Comparison between the self-mobilization group at pre-and post-test according to the manifestations (N=19)

Variable		**self-mobilization group**		**Statistical test**	
		Pre-test n (%)	**Post-test n (%)**	**Chi square**	***p -value***
Capital extension	Yes	11 (57.9%)	2(10.5%)	4.9	0.027*
	No	8 (42.1%)	17(89.5%)		
Tenderness of the SC	Yes	16 (84.2%)	1(5.2%)	23.9	<0.001**
	No	3 (15.8%)	18(94.7%)		
Shoulder height variations	Yes	9 (47.4%)	1(5.2%)	8.7	.003*
	No	10 (52.6%)	18(94.7%)		

***significant at p < .01, *significant at p < .05*

4.6.3. 2 Comparison between the therapist-mobilization group at pre- and post- test according to the manifestations

According to the physiotherapist group, a chi-square test was performed to assess if there was a significant difference between Capital extension, Tenderness of the SC, and Shoulder height variations at pre-test and post-test (P< 0.05). The results revealed significant differences according to Capital extension and Tenderness of the SC. However, no significant difference according to Shoulder height variations (P> 0.05) as displayed in (Table 13). The presence of Capital extension increased from 8(44.4%) at pre-test to 14(77.8%) at post-test. Also, the Tenderness of the SC decreased from 17(94.4%) at pre-test to 2 (11.1%) at post-test, and Shoulder height variations decreased from 4 (22.2%) at pre-test to 1(5.6%) at post-test.

Table 4.13 Comparison between the therapist mobilization group at pre and post- test according to the manifestations (N=18)

Variable		**Therapist mobilization group**		**Statistical test**	
		Pre-test n (%)	**Post-test n (%)**	**Chi square**	***p -value***
Capital extension	Yes	8 (44.4%)	4 (22.2%)	4.2	0.04*
	No	10 (55.6%)	14 (77.8%)		
Tenderness of the SC	Yes	17 (94.4%)	2 (11.1%)	25.1	<0 .001**
	No	1 (5.6%)	16 (88.9%)		
Shoulder height variations	Yes	4 (22.2%)	1 (5.6%)	2.0	0.14
	No	14 (77.8%)	17 (94.4%)		

***significant at p < .01, *significant at p < .05*

4.6.3. 3 Comparison between the two groups according to the manifestations at post-test (N=37)

The comparison between the groups at post-test revealed no significant differences between the two groups as displayed in (Table 14). Thus, both groups were similar without differences according to manifestations at post-test.

Table 4.14 Comparison between the two groupsaccording to the manifestations at post-test(N=37)

Variable		**test statistic**			
		Self-mobilization n (%)	**Therapist mobilization n (%)**	**Chi square**	***p -value***
Capital extension	Yes	2 (10.5%)	4 (22.2%)	0.931	0.335
	No	17 (89.5%)	14 (77.8%)		
Tenderness of the SC	Yes	1(5.2%)	2(11.1%)	0.424	0.515
	No	18(94.7%0	16(88.9%)		
Shoulder height variations	Yes	1(5.2%)	1(5.6%)	0.002	0.969
	No	18(94.7%)	17(94.4%)		

**Significant at p < .05*

4.6.4 Multivariate analysis of potential factors affecting the Cervicogenic headache rehabilitation outcome

Multi variate stepwise regression was performed to investigate potential other factors affecting cervicogenic headache outcome, those factors included a group of intervention age, gender, BMI, and occupation, and we have investigated their role in affecting 4 major outcome measures, represented in pain severity, duration, and frequency, in addition to headache index.

4.6.4.1 Pain severity

Tables from tables 4.15- 4.17 show that the multivariate regression (stepwise) model is significantly justifying (0.15%) variation in the pain severity, with age being the only significant predictor for pain severity ($P<0.05$).

Table 4.15 model summary of pain severity

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.418[a]	.175	.151	1.09609	.175	7.427	1	35	.010	1.496

a. Predictors: (Constant), Age

b. Dependent Variable: 36. Pain severity 0-10

Table 4.16 Anova foe the multivariate regression of factors predicting Pain severity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.923	1	8.923	7.427	.010[b]
	Residual	42.049	35	1.201		
	Total	50.973	36			

a. Dependent Variable: 36. Pain severity 0-10

b. Predictors: (Constant), Age

Table 4.17 coefficients of multivariate regression model for factors predicting pain severity

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.622	.989		-1.641	.110
	Age	.085	.031	.418	2.725	.010

a. Dependent Variable: 36. Pain severity 0-10

4.6.4.2 Pain duration

Tables from Table 4.18 to table 4.20 show that the multivariate regression (stepwise) model is significantly justifying (0.09%) variation in the pain duration, with age being the only significant predictor for pain duration ($P<0.05$).

Table 4.18 model summary of pain duration

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.344[a]	.118	.093	.56694	.118	4.689	1	35	.037	1.750

a. Predictors: (Constant), Age

b. Dependent Variable: 38. Headache duration per day

Table 4.19 Anova foe the multivariate regression of factors predicting Pain duration

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.507	1	1.507	4.689	.037[b]
	Residual	11.250	35	.321		
	Total	12.757	36			

a. Dependent Variable: 38. Headache duration per day

b. Predictors: (Constant), Age

Table 4.20 coefficients of multivariate regression model for factors predicting pain duration

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.508	.511		-.993	.328
	Age	.035	.016	.344	2.165	.037

a. Dependent Variable: 38. Headache duration per day

4.6.4.3 Pain frequency

Tables from Table 4.21 - table 4.23 shows that the multivariate regression (stepwise) model is significantly justifying (0.09%) variation in the pain frequency, with age being the only significant predictor for pain frequency ($P<0.05$).

Table 4.21 Model summary of pain frequency

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.344[a]	.118	.093	.56694	.118	4.689	1	35	.037	1.750

a. Predictors: (Constant), Age

b. Dependent Variable: 38. Headache duration per day

Table 4.22 Anova foe the multivariate regression of factors predicting Pain frequency

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.507	1	1.507	4.689	.037[b]
	Residual	11.250	35	.321		
	Total	12.757	36			

a. Dependent Variable: 38. Headache duration per day

b. Predictors: (Constant), Age

Table 4.23 Coefficients of multivariate regression model for factors predicting pain frequency

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.508	.511		-.993	.328
	Age	.035	.016	.344	2.165	.037

a. Dependent Variable: 38. Headache duration per day

4.6.4.4 Headache index

Tables from table 4.24 to table 4.26 shows that the multivariate regression (stepwise) model is significantly justifying (0.13%) variation in the headache index, with age being the only significant predictor for headache index (P<0.05).

Table 4.24 Model summary of headache index

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.401[a]	.161	.137	12.28260	.161	6.715	1	35	.014	1.785

a. Predictors: (Constant), Age
b. Dependent Variable: 35. Headache index

Table 4.25 Anova foe the multivariate regression of factors predicting headache index

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1013.007	1	1013.007	6.715	.014[b]
	Residual	5280.182	35	150.862		
	Total	6293.189	36			

a. Dependent Variable: 35. Headache index
b. Predictors: (Constant), Age

Table 4.26 Coefficients of multivariate regression model for factors predicting headache index

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-13.688	11.079		-1.235	.225
	Age	.907	.350	.401	2.591	.014

a. Dependent Variable: 35. Headache index

4.6.5 Discussion

The average number of horses participants spent on phones was 3.4, 89% of participants had SCM tenderness, and more than a third had shoulder height variation together with the fact that half of the participants had a capital extension, this confirms the findings of the study of Rattaporn S. et al. (2011) who have suggested that continuous use of the computer will lead to static contraction of neck muscles, which in turn leads to accumulation C++. This accumulation leads to disturbances in the active muscles, due to the weakness of the metabolic waste disposal mechanism and poor blood circulation. These changes will lead to problems and pain due to a lack of nutrition and oxygen. Repetitive movements and static postures for long periods may lead to a shortening of the soft tissue length, which leads to a limitation in the range of motion. Manual therapy, in turn, may help reduce these symptoms (Professionals, & Christian, (2017).

That the basis for a mulligan, mobilization technique is that it is very common that it comes with two versions of the techniques, where one is set for therapist applied maneuver, and another is designed for self or home assisted maneuvers, where both of them are leading to the same results from the physiological point of view, in combining passive mobilization of the accessory movement, with the active movement of the patient, and adding the overpressure a the end of the movement .

The discussion of importance in this field is if there is a difference in the outcome, which is crucial from a patient empowerment point of view, and a cost of service point of view on the other hand, wherein the modern physiotherapy the therapist is becoming more of a facilitator of personal change in behavior, and educator of better movement strategies that will allow the patient to be the center of is a management plan .

In our case the claim that there was no significant difference in the outcome of rehabilitation of Cervicogenic headache, underlines the importance of empowering the patient with an effective and efficient home program, that will either accelerate healing or guarantees less recurrence and in both scenarios are part of the aims of the management plan of nay physiotherapist.

Within the limitations of the corona, that imposed restricted access of patients to health care, and within the financial burden that Palestinians are facing, stressing self-empowerment techniques for management of musculoskeletal challenges, is becoming more crucial to make the patient enabled to have his right of treatment despite both challenges .

Being confirmed as an effective and efficient in this study, self-mobilization is to be trained for all cervicogenic headache patients, and the lesson could be expanded towards other muscular-skeletal dysfunction, that the patients should be directed and educated to take the lead and the responsibility in facing and managing it, the weather this was through the training on therapeutic self-directed manual therapy techniques, or advice on ergonomic or lifestyle modifications that the patient may have to encounter as an essential part of the management plan.

Both groups were effective in the management of CGH, as both had techniques had the same component of mobilization that may have contributed to the prognosis, regardless of the fact if it was performed by the patient home self, or the therapist, these findings were justified by self et al 2017, who explained the improve of CGH after mobilization by that Gliding mobilization that occurs during Mulligan technique can lead to a decrease in pain, and this decrease in pain is due to sympathoexcitatory effect. Also, the mechanical receptors may be a factor in reducing pain so that they are stimulated as a result of the expansion of the capsule resulting from the mobilization of the spine.

Passive joint mobilization may give another explanation for reducing pain modulation through the gate control mechanism as passive mobilization affect the afferent impulses it sent to higher centers through the large-diameter myelinated neurons, which modulates and inhibits the incoming nociceptive information. The activation of afferent nerve endings through manual contact influences the spinal cord neurons, inhibiting nociception and motor neuron pool, It can also be a cause of pain control (Self, Versus, & Ali (2017).

Another explanation that may justify the decrease of pain after mobilization, is that the movement had an effect in reducing pain through Descending pain-inhibitory systems, and the release of some chemicals such as serotonin and noradrenaline which in turn leads to reducing muscle spasms, improving function and facilitating neck movement (Self, Versus, & Ali, I. (2017).

In addition, accessory movement (glide) gives more explanation for patient improvement as it is applied to the spinous process of the cervical vertebra, Which increases blood circulation and nutrition to the joint, which leads to ... causing pain and healing minor injuries in the soft tissues and thus movement without pain. Since there is a greater improvement in the NDI scores of participants in the Mulligan groups, This can be attributed to the reduction in the level of pain and disability, (Jasmita et al.2017); (Self, Versus, Ali, 2017).

Range of motion was improved in both groups, and this may confirm the findings and explanation of the increase in range that was reported by self, et al 2017, who stated that mobilization that more mechanoreceptors are stimulated due to an increase in tissue stretch surrounding the cervical spine. This increase in afferent information near end-ROM may ultimately result in higher precision in position sense than near mid-ROM(Self, Versus, & Ali 2017).

The same results regarding ROM were supported by the findings of Hall et al 2007. As,they concluded that ROM has improved after, Mulligan mobilization (Hall, Grad, Chan, and Manip, 2007).

Similar results ts were confirmed by the professionals et al (2017), who they have reported the effectiveness of Mulligan and Maitland in the treatment of both range of motion, flexion rotation test, and headache index, and that Mulligan's technique had a significant better difference when compared with the results of Maitland's technique in the treatment.

In the multivariate analysis for factors that may affect the cervicogenic headache rehabilitation outcome, it was obvious that the only predictor that has contributed to a weak explanation of variation was age, this finding may be understood with 2 dimensions, 1st is that the age itself is another representation of the length of exposure to malfunction, stress on the musculoskeletal structure, and degeneration of related joints at C1 and C2, But it also reflexes another important dimension associated with the intervention itself, where the group of therapy was included in any of the models, which indicates an important finding of the no difference of results in between self-mobilization outcome performed by the patients, and that outcome, achieved by the therapist mobilization. This finding is an important indicator of the importance of patient empowerment and training, within the capacity of the patient to be responsible, and partner in the management plan, and it again reflects the importance of the mulligan approach to patient-oriented activity, as in this concept, nearly in every technique there is a patient-oriented variation of the technique that Is designed and planned in a way that requests to be performed by the patient home self.

This finding is an indicator of the importance to involves patients in the management plan, and it also shows that when patients are empowered, they can do a pain-relieving and first aid maneuvers, for themselves when they are well trained and oriented to their musculoskeletal

dysfunction, this finding is recommended to be distributed among Palestinian physiotherapists and to open a door for further investigation in the future about the effectiveness of those mobilization techniques lone without any further physiotherapy interventions, where such a study could boldly highlight the contribution of this manual therapy approach in treatment and management of this common dysfunction represented in the cervicogenic headache.

Chapter 5

Conclusion & Recommendation

5.1 Conclusion

This randomized control study was comparing the effectiveness of 2 similar clinical interventions in the management of Cervicogenic headache, where they differed in the approach of the application of manual therapy for cervicogenic headache, (self-versus therapist mobilization techniques in management of cervicogenic headache).

Both groups were effective in the management of the different outcomes in cervicogenic headache, with no superiority of either approach, factors like gender, body mass index, and occupation were not significantly affecting the rehabilitation outcome in any of the groups, while age as a contributor to the factors and risk associated with this musculoskeletal dysfunction as negatively impacted the rehabilitation outcome, as measured by headache severity, frequency, duration, and headache index.

5.2 Recommendations

Based on the results of this study, the researcher recommends the following

For physiotherapists

`1. Dissemination of the results of this study to be evidence of the effectiveness of the physiotherapy protocol effectiveness in the management of cervicogenic headache.

2. To adopt the home program as an essential part of the physiotherapy management plan.

3. To enhance the part of the patient education as an essential part of the management plan in musculoskeletal dysfunction .

For other researchers

1. To investigate the effectiveness of the manual therapy in the management of cervicogenic headache, without the combination with other techniques
2. To use further investigations that may yield further objective findings of changes in musculoskeletal indicators, such as EMG of the short neck extensors
3. To investigate if the difference in intensity and frequency of the self-mobilization could lead to better Cervicogenic headache outcome

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Appendix 1

Constant form

Arabic version

نموذج موافقة على المشاركة في الدراسة

عزيزي المشارك /المشاركة:

توقيعك ادناه على نموذج الموافقة هذا هو بموجب موافقة مكتوبة وموقعة على المشاركة في دراسة بحثية التي يقوم بها الباحث وائل نزال "أثر التحريك بطريقة موليجان من قبل المريض مقابل اثر التحريك بطريقة موليجان عن طريق المعالج في علاج وجع الرأس الناتج عن مشاكل الرقبة ". و هو إقرار بإنه قد تم شرح أهداف البحث و طريقة الفحص و التدخل العلاجي للبحث، وانه قد تم شرح حقوقك المتضمنة:

- سرية المعلومات التي تصرح بها وعدم إطلاع أي شخص عليها و تخزينها في مكان امن لا يصل اليه سوى الباحث.
- إخفاء هوية المشارك في تحليل البحث والنتائج.
- استخدام المعلومات للاغراض العلمية فقط.
- حرية إنسحابك في أي وقت من الدراسة ومن دون الحاجة لإبداء الأسباب ودون اية عواقب شخصية او مالية.
- حقك في الإطلاع على نتيجة فحوصاتك ونتائج البحث النهائية.

وأنه في حال كان لديك أسئلة حول الدراسة او حول أي معلومة متعلقة بها, يرجى الاتصال بالباحث: وائل نزال على رقم التلفون : *0599889088*

موافقة المشارك

لقد تم وصف الدراسة البحثية لي شفهيا، وبما فيه المعلومات المدرجة أعلاه، وأوافق على المشاركة بهذه الدراسة البحثية. سوف أحصل على نسخة موقعة من هذا النموذج للاحتفاظ بها في سجلاتي، أوافق على المشاركة بهذة الدراسة.

اسم المشارك الرباعي: _____ **العمر**: _____

توقيع المشارك (ولي الامر):_____ **توقيع الباحث:**_____

اسم وتوقيع الشاهد:_____ **التاريخ:**_____

Appendix **2**

Patient First Interview Guide

Demographic data	Pre-test measure	Post-test measure
▪ Clinic Name:		
▪ Name:		
▪ Age: ▪ Gender: ▪ Occupation: ▪ Height: ▪ Weight: ▪ BMI:		
▪ Past medical history:		
▪ Past surgical history:		
▪ History of trauma or any other neurological deficits:		
▪ Severity of headache		
▪ Recurrence of headache		
▪ Time since starting		
▪ Flexion rotation test (degree)		
▪ Neck disability index (0-100%)		

▪ Headache index (0-100%)		
▪ Visual analouge scale(0-100 mm)		
▪ Goniometer (degree)		

English version

Appendix 3

Al-Quds University
Jerusalem
Deanship of Scientific Research

بسم الله الرحمن الرحيم

جامعة القدس
القدس
عمادة البحث العلمي

Research Ethics Committee
Committee's Decision Letter

Date: March 30, 2021
Ref No: 182/REC/2021

Dear Dr. Akram Amro, Mr. Wael Nazzal,

Thank you for submitting your application for research ethics approval. After reviewing your application entitled "The Effect of Self vs Therapist Mulligan Mobilization on Cervicogenic Headache", the Research Ethics Committee confirms that your application is in accordance with the research ethics guidelines at Al-Quds University.
We would appreciate receiving a copy of your final research report/ publication.
Thank you again and wish you a productive research that serves the best interests of your subjects.

PS: This letter will be valid for two years.

Sincerely,

Suheir Ereqat, PhD
Associate Professor of Molecular Biology

Research Ethics Committee Chair

Cc. Prof. Imad Abu Kishek - President
Cc. Members of the committee
Cc. file

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