INFLUENCE OF EXTRACORPOREAL SHOCKWAVE THERAPY IN PATIENTS OF MECHANICAL NECK PAIN

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INFLUENCE OF EXTRACORPOREAL SHOCKWAVE THERAPY IN PATIENTS OF MECHANICAL NECK PAIN

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CHAPTER I

INTRODUCTION

About 75% of people have mechanical neck pain (MNP) Which was considered the most common musculoskeletal disorder after low back pain. **(Genebra et al., 2017; Osama & Rehman, 2020)**.

Patients with MNP suffer from pain (decreased pressure pain threshold), active trigger points (often in the upper trapezius), muscle spasm, limited range of motion, proprioceptive deficits causing disability and impaired life quality **(Heintz & Hegedus., 2008; Kindler et al., 2010; Ziaeifar et al., 2014; Stanton et al., 2016; Blanpied et al., 2017; Ye et al., 2017; Osama & Rehman, 2020; Erdem et al., 2021).**

Mechanical neck pain is a multifactorial condition that arises insidiously with many predisposing factors as overhead manual activities, repetitive movements, huge physical effort, poor posture (e.g., with heavy smartphone and computer use) and psychosocial status with associated increased muscle tension **(Heintz & Hegedus, 2008; Genebra et al., 2017; Cho et al., 2019; Osama & Rehman., 2020).**

Conservative management of MNP includes medications and physiotherapy. Physiotherapy includes exercise (stretching, strengthening, stabilization, endurance training), manual therapy (muscle energy technique as post isometric relaxation, myofascial release, trigger point release), dry needling, ultrasound, laser, electrotherapy, heat or infrared and ice with weak evidence for their efficacy except for exercises **(Leaver et al., 2010; Desai et**

al., 2013; Gross et al., 2015; Cerezo-Tellez et al., 2016; Cohen and Hooten, 2017; Thomas et al., 2019: **Sbardella et al., 2021**; **Samiullah et al., 2022)**.

Myofascial release therapy, deep friction massage, stretching, and/or isometric exercises can improve pain, function, cervical ROM, and/or Quality of life in patients with neck pain **(Hou et al., 2002; Pesco et al., 2006; Salo et al., 2010**; **Blanpied et al., 2017; Khan et al., 2022).**

Extracorporeal shockwave therapy has been shown to reduce neck pain, pressure pain threshold, and disability in patients with neck pain with trigger points. However, because the studies of neck pain are of low quality due to lack of blinding and small sample size so its efficacy remains unknown **(Yoo et al., 2020; Jun et al., 2021).**

Statement of the problem

This study will try to answer the following question what is/are the effect(s) of adding extracorporeal shockwave therapy to the Routine physiotherapy on pain, function, range of motion (ROM), and position sense in patients with chronic mechanical neck pain?

Purposes of the study

The purpose of this study to explore the effect the effect of adding extracorporeal shockwave therapy to the Routine physiotherapy on neck pain, function, ROM, joint position sense in patients with chronic mechanical neck pain.

Significance of the study

Mechanical neck pain is a frequent condition that has a detrimental impact on patient's biopsychosocial characteristics as a results of increased

muscle tension **(Heintz & Hegedus, 2008; Genebra et al., 2017; Osama & Rehman, 2020; Erdem et al., 2021).**

Physiotherapy interventions for MNP is effective in short-term, however they lack high quality evidence **(Desai et al., 2013; Cohen and Hooten, 2017; Sbardella et al., 2021; Samiullah et al., 2022).**

Extracorporeal shockwave therapy for treatment of MNP is promising in increasing pressure pain threshold and decreasing disability. Although further high-quality studies were needed to confirm its efficacy **(Carroll et al., 2009; Cohen and Hooten, 2017; Manafnezhad et al., 2019)**.

Myofascial syndrome, which is characterized by taut bands that cause pain and limit range of motion in individuals with non-specific neck pain, is a substantial source of pain, hence breaking the cycle of pain by relaxing tense bands is primary goal of its treatment **(Rahbar., 2021).**

The efficacy of Extracorporeal shock wave therapy on myofascial condition is now the subject of more research to determine its effectiveness, especially in the upper trapezius which need further research to confirm its pain-relieving characteristics and their capability to promote tissue proliferation and repair **(Rahbar., 2021).**

Consequently, extracorporeal shockwave therapy combined with Routine physiotherapy needs to be investigated whether it will be helpful in improving clinical outcomes of mechanical neck pain or not.

Several therapies were used to treat MNP patients; nonetheless, MNP is quite common, with most patients experiencing chronic and recurring symptoms after one year. Newer interventions as extracorporeal shockwave

therapy may help to treat this condition well **(Carroll et al., 2009; Cohen and Hooten, 2017; Manafnezhad et al., 2019).**

Hypotheses

It is hypothesized that:

1- There will be no significant effect of adding ESWT to routine physiotherapy on pressure pain threshold in patients with MNP.

2- There will be no significant effect of adding ESWT to routine physiotherapy program on neck function in patients with MNP.

3- There will be no significant effect of adding ESWT to routine physiotherapy on cervical flexion active range of motion (AROM) in patients with MNP.

4- There will be no significant effect of adding ESWT to routine physiotherapy on cervical extension AROM in patients with MNP.

5- There will be no significant effect of adding ESWT to routine physiotherapy on cervical side bending to the right AROM in patients with MNP.

6- There will be no significant effect of adding ESWT to routine physiotherapy on cervical side bending to the left AROM in patients with MNP.

7- There will be no significant effect of adding ESWT to routine physiotherapy on cervical rotation to the right AROM in patients with MNP.

8- There will be no significant effect of adding ESWT to routine physiotherapy on cervical rotation to the left AROM in patients with MNP.

9- There will be no significant effect of adding ESWT to routine physiotherapy on cervical flexion joint position sense (JPS) in patients with MNP.

10- There will be no significant effect of adding ESWT to routine physiotherapy on cervical extension JPS in patients with MNP.

11- There will be no significant effect of adding ESWT to routine physiotherapy on cervical side bending to the right JPS in patients with MNP.

12- There will be no significant effect of adding ESWT to routine physiotherapy on cervical side bending to the left JPS in patients with MNP.

13- There will be no significant effect of adding ESWT to routine physiotherapy on cervical rotation to the right JPS in patients with MNP.

14- There will be no significant effect of adding ESWT to routine physiotherapy on cervical rotation to the left JPS in patients with MNP.

Delimitations

This study will be delimited to the following:

1. Fifty-two patients (males and females) with non-specific neck pain.
2. The age of the patients will range between 18-29 years **(Jahre et al., 2020).**

3. The instrumentations will be limited to: Pressure algometer to assess pressure pain threshold, The Arabic version of Neck disability index (NDI) to assess neck function, and goniometer to assess cervical range of motion (CROM) and joint position sense, at base line and after 4 weeks of treatment.

4. The intervention will be limited to; extracorporeal shockwave therapy and routine physiotherapy (Deep friction massage, stretching, isometric training, and home program of postural correction).

Basic Assumption

It will be assumed that:

1. All subjects will be committed to the therapist instructions and to assessment and treatment steps during the study.

2. All subjects will not take any medications or modality that interfere with the treatment in this study.

Definition of terms:

Joint position sense: is the ability of a person to perceive a presented joint angle and then, after the limb has been moved, to actively or passively reproduces the same joint angle. **(Riemann & Lephart, 2002).**

Mechanical neck pain (MNP): pain in cervical region (From the inion to the last cervical vertebra including up to spine of scapula, upper clavicle, and suprasternal notch), and has no definitive underlying cause (other than poor posture, repetitive activities, strain, and psychology) often associated with neural pain in the neck or cervical region, and liability of limiting movement

resulting in disability and decreased life quality **(Heintz & Hegedus, 2008; Guzman et al., 2009; Blanpied et al., 2017).**

Myofascial trigger points (MTrPs): hypersensitive bands or spots within skeletal muscle that are taut **(Travell & Simons.,1999).**

CHAPTER II

REVIEW OF LITERATURE

This chapter provides a review of the available literatures related to mechanical neck pain and provides a clear understanding of the current concepts under the following headings:

- Functional anatomy and biomechanics of cervical region.
- Mechanical neck pain.

a. Epidemiology of MNP
b. Impact
c. Causes and risk factors
d. Assessment of MNP
e. Treatment of MNP

Functional Anatomy and Biomechanics of Cervical Region

Cervical region of the spine is made of seven vertebrae aligned in a lordotic curve. The smallest functional unit is the mobile segment; that is, any two adjacent vertebrae, the intervening intervertebral disk (absent at C0-2, i.e between occiput, atlas and axis or atlanto-occipital and atlanto-axial joints), and all the soft tissues that secure them together (capsule, muscles, ligaments).

Muscles acting on the neck are levator scapulae, Obliquus superior, rectus capitis posterior minor, rectus anterior and rectus lateralis, and longus cervicis among others. The ligaments are anterior and posterior longitudinal ligaments, posterior atlanto-occipital and atlantoaxial membranes, Transverse Ligament, ligamentum flavum, Alar Ligaments and the interspinous, supraspinous, and intertransverse ligaments.

There is cartilaginous joint type between the vertebral bodies and synovial joint between the zygapophyseal facets located between the upper and lower articular facets. The movements of the head were produced by muscles and affected by shape of the vertebrae and mobility between them.

The cervical spine is divided into two distinct regions: the upper cervical spine, or craniovertebral region (occipital condyles and the first two cervical vertebrae, C1 and C2), and the lower cervical spine (C3 to C7). Cervical spine allows flexion and extension, side bending, and rotation. side bending is coupled with rotation at individual segment **(Levangie and Norkin., 2011).**

Mechanical Neck Pain

Epidemiology

In terms of prevalence, neck pain ranks among the top five chronic pain conditions **(Cohen and Hooten, 2017).** It affects women more than men **(Erdem et al., 2021)**. Psychosocial and genetic variables were risk factors for its prevalence (**Cohen and Hooten, 2017).** It affects about half of the general population **(Haldeman et al, 2010).**

Impact

Neck pain reduces the quality of life for those who suffer from it. It places a significant financial and social load on the individual as it causes

significant disability. Up to 85% of affected people still complaining or having recurrences more than one year later **(Carroll et al., 2009; Cohen and Hooten, 2017).**

More than 50% of patients of neck pain complain of symptoms that are not improved even after 6 months and less than 50% improved after 6 months **(Borghouts et al., 1998; Blanpied et al., 2017).**

The deep and anterior neck flexors, were the the most frequent muscles in the cervical spine that are prone to weakness in cases of neck pain **(Oh and Song, 2016).**

Active trigger points in the upper trapezius, sternocleidomastoid, levator scapulae, and suboccipital muscles are present in patients with mechanical neck pain, which causes pain, hypomobility, and impairment **(Fernandez-de-Las et al., 2007; Ziaeifar et al., 2014).**

Because of their impaired proprioception, patients with chronic neck pain performed worse on head to neutral repositioning tests compared to asymptomatic controls. **(Treleaven, 2008; Stanton et al., 2016).**

Based on symptoms including hypomobility, headache, trauma, and referred or radiating pain, neck pain can be classified as neck pain with deficits in mobility, neck pain with movement coordination disorders, neck pain with headaches, and neck pain with radiation **(Blanpied et al., 2017).**

Causes and risk factors

Female gender, advanced age, strenuous physical demands at work, smoking, sedentary lifestyle, lack of social or professional support, and a history of neck or low back disorders are risk factors for neck pain **(Carroll et**

al., 2009; McLean et al., 2010). Neck pain is frequently observed as a result of employment factors such as the workplace, such as work overload, computer use, and study time **(Kazeminasab et al., 2022)**.

Along with intra-muscular shear forces, low intensity task contributes to Ca^{+2} accumulations in Type1 fibers and increases motor unit activation due to slow blood supply leading to mechanical Neck Pain **(Visser and van Dieën, 2006).**

Assessment of MNP

In individuals without a clear underlying pathology, routine imaging tests including computed tomography, magnetic resonance imaging, and ultrasound might not be necessary **(Blanpied et al., 2017).**

The neck pain and disability can be assessed using neck disability index (NDI) and numeric pain-rating scale (NPRS) that have acceptable psychometric properties **(Vernon, 2008; Hjermstad et al., 2011; Schellingerhout et al., 2012; Lauche et al., 2013; Abbott and Schmitt, 2014).**

The pressure pain threshold can be precisely measured with a pressure algometer. Locally reduced readings (on the neck) point to a mechanical overreaction at the local level. Widespread lower readings (for example, on the neck and lower extremity) suggest a malfunction of the central processing of noxious receptors as in fibromyalgia and chronic fatigue syndromes **(Walton et al., 2014; Blanpied et al., 2017).**

Cervical ROM can be assessed using cervical range of motion (CROM) goniometer, both standard goniometers, and the inclinometers with acceptable reliability and validity **(Snodgrass et al., 2014).**

The Short Form-36 Health Survey (SF-36) commonly used for investigating health related life quality in patients with non-specific neck pain **(Saarni et al., 2006).**

Joint position error (JPE) in degrees will be used to measure the accuracy of cervical proprioception. **(Reddy et al., 2022).**

Treatment of MNP:

Conservative management of patients with neck pain includes medications (Muscle relaxants and non-steroidal anti-inflammatory drugs) and physiotherapy. Physiotherapy includes exercise that has strongest evidence, massage, acupuncture, yoga, and spinal manipulation with weaker evidence. Surgery is indicated only for patients with significant neurological deficits with failed conservative measures **(Cohen and Hooten, 2017; Samiullah et al., 2022).**

In order to effectively treat patients with neck pain and mobility problems, clinicians should employ a multimodal strategy. The efficacy of manual therapy seems to lessen as the condition progresses from subacute to chronic. Although it may cause brief discomfort, manipulation might not be any more effective compared to mobilization. Patients with subacute and chronic neck pain who have mobility deficits should be managed with exercise (neuromuscular exercise as coordination, proprioception, and postural training, stretching, strengthening, endurance training, aerobic conditioning, and

cognitive training), dry needling, LASER, or intermittent traction **(Miller et al 2010; Schroeder et al., 2013; Blanpied et al., 2017).**

Exercises as strength or endurance training of the neck and upper body seemed to moderately enhance the health-related quality of life in patients with neck pain **(Salo et al., 2010)**. In addition to endurance and stretching exercises, strengthening exercise has a strong record of effectiveness for treatment of neck pain **(Louw et al., 2017)**. Sensorimotor exercises as cervical JPS, cervical movement sense, oculomotor control exercises and balance exercises were indicated for patients with neck pain due to sensorimotor disturbances **(Treleaven., 2008).**

Postural endurance exercises of deep neck flexors are more effective compared to isometric resistive exercises of neck muscles in decreasing pain and disability **(Gogoi, 2015).** Postural exercises at home or work decreased pain and disability, and improved endurance and posture **(Abadiyan et al., 2021).**

Muscle energy Technique (MET), is a soft tissue technique that that combine isotonic and isometric contractions, and were found effective to improve pain, ROM and function **(Visser and van Dieën 2006; Chaitow and Crenshaw, 2006; Samiullah et al., 2022).**

Myofascial release therapy is a soft tissue method that involves application of a low intensity, long-lasting stretch with the elbows or knuckles to apply pressure over compromised fascia after identifying the taut bands in the fascia **(Ajimsha et al., 2014).** slow movement in the spasmed muscles stimulate the parasympathetic nervous system, resulting in relaxation, which

lower discomfort, enhances blood flow, and relieve muscle tension **(Schleip, 2003).**

Extracorporeal Shock wave therapy

ESWT is a modern, non-invasive therapeutic tool which is effective, safe and advantageous. ESWT may replace surgery in several orthopedic pathologies with at least the same results, but without its drawbacks. The potential for translational research and development of ESWT technology is remarkable and probably still undisclosed **(Romeo et al.,2013).** The extracorporeal shock wave therapy is as effective as dry needling for relieving pain, improving function for patients with myofascial trigger points after a series of three treatments. **(Luan et al.,2019).** Shock waves can be classified as extracorporeal or focused and radial (pneumatic) shock waves. There is lack of evidence that focused ESWT is effective for short-term relief of neck pain **(Yoo et al., 2020).** Extracorporeal shock wave therapy is an effective intervention for the treatment of pain, disability, and depression in chronic low back pain patients. **(Han et al.,2015).** Extracorporeal shock wave therapy (focused and radical) is superior to conventional therapies in reducing neck pain patients' pain and pain pressure threshold **(Jun et al., 2021).** In individuals with neck pain, phonophoresis and ESWT both successfully reduced pain and neck impairment, but ECSWT was preferable because it had more effect in a short term **(Taheri et al., 2021).** Patients with generalized neck pain can benefit from ESWT and dry needling to treat upper trapezius myofascial trigger points **(Manafnezhad et al., 2019).** The neck pain therapy program used infrared irradiation to treat patients **(Chiu et al., 2005).** The efficacy of

Extracorporeal shock wave therapy on myofascial condition is now the subject of more research to determine its effectiveness, especially in the upper trapezius which need further research to confirm its pain-relieving characteristics and their capability to promote tissue proliferation and repair **(Rahbar., 2021).** ESWT combined with Wuqinxi exercise can relieve pain, increase joint range of motion and muscle strength better than conventional ultrasound therapy **(Lin S et al.,2023)**. extracorporeal shock wave therapy is superior to other treatments in terms of alleviating the pain intensity and pressure pain threshold of patients with myofascial pain syndrome in the neck and shoulder **(Jun, J.H et al.,2021).** ESWT can avoid the adverse effects of invasive procedures on patient; compared with TPI, dry needling and US, ESWT can more effectively relieve the pain of MPS patients **(Tao wu et al., 2022).** Both dry needle and ESWT applications may improve pain level (based on VAS) and ROMs in patients with active trigger points in upper trapezius muscle **(Toghtamesh et al.,2020).**

CHAPTER III

PATIENTS, MATERIALS, AND METHODS

The aim of this study is to examine the effect of adding ESWT to conventional physiotherapy program in treatment of chronic mechanical neck pain. It will be conducted at the outpatient clinic of physiotherapy, faculty of physical therapy, Benha University from July 2023 to Jun 2024.

Study design

This study will be Double-blinded (participant, statistician and evaluator), pretest- posttest controlled trial.

Patients

Fifty-two patients with mechanical neck pain screened by the principal researcher will be included for study after being informed about study aim and signing the consent form (APPENDIX I).

The study subjects will be randomly assigned into two groups A and group B (ratio 1:1) using a computer-generated random data sheet using www. random. Org.

Group A will receive only routine physiotherapy in the form of stretching, isometric training, and home program of postural correction. Group B will receive ESWT combined with routine physiotherapy. The treatment will last 4 weeks, 2 sessions weekly one session with ESWT and another without.

Sample size calculation

Sample size calculation was done using G-POWER 3.1 software and considering two-sided $\alpha = 0.05$, power = 80% and Effect size = 0.8 (large) based on the study of **Cho et al. (2012)**, the total sample size was calculated to be 52 (26 in each group).

Inclusion criteria

Patients will be included in the study if they fulfil the following criteria:

1. Patients (both males and females) with neck pain for more than three months.
2. Patients will be aged between 18 and 29 years old **(Jahre et al., 2020).**
3. Patient has at least one taut band at upper fibers of trapezius as described in assessment procedures.
4. Patient visual analogue scale (VAS) 3 to 8 out of 10

Exclusion criteria:

Patients will be excluded if they:

1. Were treated for neck or shoulder pain during the last three months.
2. Had neck or shoulder operation during the last two years.
3. Had any structural pathology of the cervical spine, such as disk prolapse, spinal stenosis, or cervical spondylosis.
4. Had traumatic history, instability, spasmodic torticollis.
5. Had cardiovascular, respiratory, or allergic disease, neck osteoarthritis.
6. Had homeostatic disorders.
7. Fibromyalgia, shoulder diseases (tendonitis, bursitis, capsulitis).
8. inflammatory rheumatic diseases.
9. Severe psychiatric illness and other diseases that restrict physical loading, and pregnancy **(Salo et al., 2010).**

Instrumentations:

A. Assessment tools:

1. Pressure algometer (with a circular flat tip of 1 cm^2 will be used to assess pressure pain threshold **(Asiri et al., 2020).** The reliability is excellent **(Walton et al., 2014).**
2. The Arabic version of Neck disability index (NDI) will be used to assess neck function. It includes questions regarding daily living activities such personal care, lifting, reading, working, driving, sleeping, and recreation activities as well as pain severity, focus, and headache **(Elbeltagy et al., 2020).**
3. Goniometer will be used to assess cervical range of motion (CROM) and joint position sense as shown in figure1.

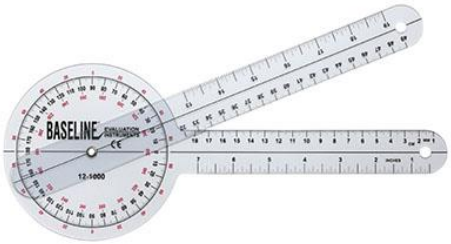

Fig. 1: Standard goniometer

B. Treatment tools:

Extracorporeal shockwave therapy (GymnaUniphy NV Pasweg 6A |/B-3740 Bilzen, Belgium Radial extracorporeal shockwave therapy) (rESWT) pneumatic type machine (figure2).

Fig. 2: Extracorporeal shock wave therapy.

A. Assessment procedures:

Assessment will be done at base line and after 4 weeks of treatment.

Pressure Pain Threshold

For the purpose of measuring the local pressure pain threshold in the upper trapezius, a pressure algometer (Baseline algometer 10kg) will be used. The person will lie down in a prone lying position. After identifying a taut band, a digital pressure algometer will be used to apply pressure perpendicular to the muscle fibers at a rate of 4 to 5 N/s (40–50 kPa/s). Patients will be instructed to provide the examiner with the specific instant at which pressure changed into pain. After that, the test will be repeated three times, with a minimum 30-second gap between each test, and the average will be calculated and the whole procedures will be repeated on the opposite side **(Blanpied et al., 2017; Jun et al., 2021).** Searching for taut bands in trapezius based on anatomically predicted sites of taut bands: MTrP1

intermediate part of the anterior border of the upper part of the muscle near the vertical fibers of the muscle attached to clavicle. MTrP2 distal and slightly lateral to MTrP1. MTrP3 medial to the scapula and on the border of the medial fibers near the inferior border of the muscle. MTrP3.1 medial fibers near the inferior margin of the muscle, medial to MTrP3; nervous branch. MTrP5 medial to scapula in the intermediate part of muscle belly. MTrP5.1 medial to the scapula in the intermediate part of the muscle belly inferior to MTrP5.1. MTrP5.2 medial to the scapula in the intermediate part of the muscle belly. inferior to MTrP5.1 **(Akamatsu et al.,2015).** The previous muscle's taut bands will be evaluated: upper fibers of the trapezius. A mean difference of 0.94 kg/cm^2 in pain pressure threshold was considered as minimal clinically important difference **(Asiri et al., 2020).**

Neck disability assessment

A 10-item neck disability index (NDI) will be used to assess neck disability. Each item will be evaluated and scored on a 5-point scale, with 0 denoting "no handicap" and 5 denoting "full disability." According to the final score, mild, moderate, and severe disabilities were respectively, 5, 14, 15, 24, and 25 **(Vernon and Mior, 1991)**. The Arabic version of NDI is reliable **(Elbeltagy et al., 2018).** In the current investigation, a 10% reduction in the neck disability score was considered to be the lowest clinically significant difference **(Lauche et al., 2013).**

Cervical range of motion assessment

Cervical range of motion (in all directions) will be measured using standard goniometer (Baseline Plastic Goniometer - 360 Degree Head - 12 inches). Participants will be seated upright and asked to actively move their neck in each direction three times. This method is valid and reliable for

assessment of cervical range of motion **(Audette et al., 2010; de Koning et al., 2008).**

The external auditory meatus will be covered by the axis as it measures cervical flexion and extension. The moveable arm will be parallel to the fixed arm and positioned vertically along the imaginary axis that runs from the external auditory meatus to the base of the nares. The patient will be asked to flex and extend his head, and the range of flexion and extension will be assessed in degrees. The axis will be positioned at the middle of the sternal line that runs between the acromion processes for lateral flexion, and the movable arm will be oriented at the most prominent part of the nose. The patient will be requested to complete side-by-side cervical lateral flexion and measures. The axis will be positioned over the center of the patient's head, moving arm positioned at the tip of the nose, fixed arm parallel to an imaginary line going between the acromion process. The patient will be asked to rotate their neck and take measurements. There is a 0.80 to 0.98 intra-rater reliability range. **(Youdas et al., 1991; Khan et al., 2022).**

Cervical joint position sense assessment

Joint position error (JPE) in degrees will be used to measure the accuracy of cervical proprioception. The cervical range of motion in all directions will be assessed, and the target position will be chosen at 50% of the total range. The patient will sit upright on a stool, with their feet flat on the floor. The individual will be asked to choose their own neutral head posture, and the examiner will then fasten the device to their head. Prior to testing, all participants will close their eyes. The participant's head will then be moved into the specified position, which the physical therapist will hold for 5 seconds before instructing them to memorize it after that the participant's head will be

led back to the starting position by the examiner or patient himself. The patient will next be asked to move their heads to the previously learned target position. The accuracy of the subjects' repositioning will be measured in degrees once their heads have been moved to the target position (JPE). The cervical flexion, extension, and rotation to right and left Will be assessed for joint position sense. The test will be repeated three times in each direction, and the final measure will be based on the mean of these trials **(Reddy et al., 2022).**

B. Treatment procedures

Treatment frequency will be 2 sessions per week for 4 weeks **(Lee et al., 2013; Blanpied et al., 2017).**

Extracorporeal shockwave therapy

Patients in the experimental group (B) will receive ESWT with radial prob once a week for four weeks **(Mostafa et al.,2016; Mohamed et al.,2021; Kamel et al 2020; Luan et al 2019; Savas.,2013).** The ESWT will be applied using the following treatment parameters: 2,000 pulses, intensity of 0.2 Mj/mm^2, and 10 Hz frequency **(Manafnezhad et al., 2019)**. The ESWT will be applied for 3 minutes on trigger points of trapezius muscles. Participants will be asked to lie down in a prone position with their arms next to the body. ESWT will be applied (for 4 sessions) at second session of each week.

Routine physiotherapy

Stretching exercises

Exercises were performed in the following order: stretching towards lateral flexion for the upper part of the trapezius as shown in figure 3, and flexion for the extensor muscles. holding each movement for 30 seconds. Each

exercise will be repeated 3 times. Finally, a neck straightening exercise will be performed by chin tuck 5 times for 3–5 seconds. Patients will be advised to perform the stretching program 5 times a week, a stretching take about 10 minutes to perform **(Ylinen et al., 2007**).

Fig. 3: Stretching exercises for the upper fiber of trapezius **(Park, K. N et al 2013).**

Isometric muscle training

The patient will be asked to press against the therapist's hand in each of the six directions; flexion, extension, right rotation, left rotation, right side bending, and left side bending while seated upright **(Jaiya , 2022; Deen et al, 2020).** The therapist or patient himself will exert resistance on the forehead, occiput, right chin, left chin, right head, and left head, in that order as shown in figure 4. The exercise frequency will be two sets of five repetitions with a ten-second hold between each set.

Fig. 4: Isometric muscle training **(Jaya et al., 2022)**

Postural correction home program

Patients will receive instruction on

- **Sitting:** (Switch sitting positions often, take brief walks around your office or home.
- gently stretch your muscles every hour so often to help relieve muscle tension, relax your shoulders; they should not be rounded or pulled backwards.
- Keep your elbows in close to your body. They should be bent between 90 and 120 degrees.

- make sure that your back is fully supported, use a back pillow or other back support if your chair does not have a backrest that can support your lower back's curve.

- **Standing:** in proper posture (Stand up straight and tall**,** keep your shoulders back, pull your stomach in**,** put your weight mostly on the balls of your feet**,** keep your head level**,** let your arms hang down naturally at your sides.

- **Sleeping:** The pillow for your head should support the natural curve of your neck and be comfortable. A pillow that's too high can put your neck into a position that causes muscle strain on your back, neck, and shoulders. Choose a pillow that will keep the neck aligned with the chest and lower back. Your pillow should be adjustable to allow you to sleep in different positions.

- Additionally, they will receive instructions on how to engage their deep neck muscles (e.g., chin in or nodding exercises). They will then be required to carry out this at home and repeat session exercises at home.

Statistical analysis:

Statistical analysis was conducted using SPSS for Windows, version 26 (SPSS, Inc., Chicago, IL). Before final analysis, data were screened for normality assumption, homogeneity of variance, and presence of extreme scores, and the *p*-value was set at < 0.05. This analysis was done as a pre-requisite for parametric testing of the analysis of differences.

Comparison between mean values of the different parameters in the two groups was performed using repeated measure MANOVA test to determine the significant differences between both groups at the two times testing intervals (pre and post).

Appendix I

Consent form

I am ……..freely and voluntarily consent to participate in this research study under direction of the researcher: **Mohamed Faramawy Shible El. deeb**. I may withdraw my consent and discontinue participation in this research at any time without prejudice to me.

Date:/……. /20…….

Participant…….……

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تاثير العلاج بالموجات التصادمية خارج الجسم فى علاج الام الرقبة الميكانيكية