

# Efficacy of shockwave Therapy on Neck pain and function in patients with Non-specific Neck Pain: A Randomized Control Trial (RCT)

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## ABSTRACT

**Background:** Non-specific mechanical neck dysfunction is one of the common musculoskeletal disorders leading to personal suffering, Sick leave and social cost. Purpose: To evaluate the extracorporeal shockwave therapy (ESWT) effect on non-specific mechanical neck pain.

**Methods:** Thirty adult female participants with non-specific neck pain were engaged in this study. Their age ranged between 18-25 years with normal BMI (18-25 kg/cm<sup>2</sup>). They were distributed randomly into study and control groups each one contained 15 participants. The study group received ESWT and traditional treatment. While only traditional treatment was given to the control group. The treatment program was scheduled for 1 session per week for 4 weeks. Each participant was assessed pre and after 4 weeks of treatment to measure pain, neck ROM and neck function by VAS, CROM and NDI, respectively.

**Results:** The result showed a significant difference between the mean values of all variables measured in the two groups before and after treatment as P value <0.05. While after treatment mean values in all variables of the two groups showed a non-significant difference, as P value >0.05 except in CROM flexion, extension, LT lateral bending and RT rotation.

**Conclusion:** ESWT and traditional treatment have positive effect on neck dysfunction and they nearly have the same effect on Neck Pain, ROM and functional level.

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## INTRODUCTION

In the body one of the most utilized and mobile parts is the neck region. This may result in many problems as neck pain that represent one of the top five chronic pain conditions in incidence and lose of disability years. It can be caused disorders of the posture that lead to the musculoskeletal system stress or due to fracture or compression of nerve <sup>1</sup>.

Although the debate of the etiology neck pain, there are many factors contribute to it, including psychosocial and physical contributors such as: dépression, anxiety, neck strain, bad posture, or occupational activities. Poor posture is the main cause of mechanical neck pain after traumatic injuries, that results in mal distribution of forces that lead to strain of muscles that responsible of head control and balance <sup>2</sup>.

Musculoskeletal pain including neck is strongly associated with many factors as increased body mass index (BMI), female, old age, and smoking. Up to 30% to 50% of adult's population experience neck pain. A study showed a high incidence of (54%) among Saudia female undergraduate students with neck pain. There is especially reported prevalence between 45.7% and 65.1% of musculoskeletal pain among medical students <sup>3</sup>.

## KEYWORDS:

Mechanical Neck dysfunction,  
Extracorporeal shockwave  
therapy (ESWT),  
CROM,  
Upper Trapezius,  
NDI,  
VAS.

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Neck pain can be treated effectively by many conservative modalities as thermotherapy. The application of Heat pack may be effective in improving somato-sensory function and pain relieving in patients suffering from chronic idiopathic pain of neck<sup>4</sup>.

Other effective modality in treating neck pain (NP) is therapeutic exercises that successfully decrease pain, and disability and improve posture, and health status in female dentists suffering from chronic NP<sup>5</sup>. Some studies compared the effectiveness of isometric exercises and general exercises (active range of movement exercises) in the treatment of non-specific chronic neck pain; they found that isometric exercises are clinically more effective than general exercises<sup>6</sup>.

Also, stretching exercises effectiveness on office workers suffering chronic neck and shoulder pain with moderate-to-severe degree is studied. After four weeks of regular stretching exercise program, it was found that pain of neck and shoulder decreased and functions of the neck improved<sup>7</sup>.

Recently, extracorporeal shock wave therapy (ESWT) is developing rapidly and it is used mainly for orthopedic disorders treatment such as myofascial pain syndrome of upper trapezius, plantar fasciitis, patellar tendinopathy elbow epicondylitis, and non-union fractures<sup>8,9</sup>.

The mechanism of how shock wave produces therapeutic effect is still unclear, but it thought to be due to mechano-transduction by converting shockwaves mechanical stimulation of exposed tissues into biochemical signals and releasing of growth factors involved in neo-angiogenesis, tendon proliferation, and collagen synthesis<sup>10</sup>.

Many recent studies suggested that ESWT application has an effect on the biological reactions interplayed chain by controlled inflammation that lead to regeneration of the tissue and "reset" local metabolism. Great efforts are exerting for exploring the effects of ESWT in several pathological conditions with fibrosis especially post-traumatic complications as skin and muscle lesions and heart failure as well<sup>11</sup>.

The effect of ESWT and its mechanisms of treating pain and musculoskeletal disorders are still unclear. So, this study was done to evaluate the effectiveness of extracorporeal shockwave therapy (ESWT) on neck dysfunction adding to traditional treatment.

## METHODS

### Study Design

A randomized control trial pre-test post-test controlled design was carried out from February to June 2021 at research laboratory of physical therapy department at Applied Medical Sciences Faculty/ Umm Al Qura University, Makkah, Saudia Arabia to evaluate the effectiveness of extracorporeal shock wave therapy on neck dysfunction.

### Participants

The sample of 30 female students complained from neck pain was recruited in this study through a website link. They were assigned randomly into two groups: study group (n=15) who received extracorporeal shock wave therapy combined with

traditional treatment, and control group (n=15) who received traditional treatment only. Range of motion, pain intensity and neck disability index (NDI) were measured pre and post 4 weeks of treatment. The participants were female medical students from Umm-Al Qura University complained from non-specific mechanical neck pain with age ranged between 18-25 years old with a mean of 21.5± 0.845 years and BMI was between 18-25 with a mean of 20.6±2.66.

The exclusion criteria included any participant with neck pain that generating from various pathologies (tumor, rheumatoid arthritis, ankylosing spondylitis, fracture, dislocation, myelopathy, radiculopathy, etc) also any dermatological conditions, hemorrhagic blood diseases, long term use of corticosteroids or receiving any treatment for their pain currently, or had any metal implants near to treated area.

Randomization: Participants were assigned randomly into equal two groups (control and study) 15 for each group. This was done by using a dice as odd number for control group while even number for study group. Firstly, the procedures of the study were described for all participants and then they signed the consent form for their participation.

Ethical Approval: The study proposal was approved by the Biomedical Research Ethics Committee, Umm Al-Qura University (No: HAPO-02-K-12-2020-11- 950).

The sample Size Power Analysis: Overall thirty participants satisfying the inclusion conditions were involved in the study, using G\*Power statistical software, a sample size calculation was done (version 3.0.10) and it was discovered that suitable sample size was n=30.

Measured outcome: Pain intensity was the primary outcome in patients with non-specific neck pain, while cervical range of motion and neck function were secondary outcomes.

Visual Analog Scale (VAS): It's a reliable and valid measurement of intensity of pain<sup>12</sup>. Participants asked to mark their pain severity on the scale, where 0 represented no pain and 10 for very severe pain.

Neck Disability Index (NDI): It is a scale that was used to assess how the daily life of the participants was affected by their neck pain. The scale score ranges from 0 to 45, and higher levels of disability indicated with higher scores.

Cervical Range of Motion (CROM): It was used to measure the cervical ROM as it has shown to be reliable in all movement directions including flexion, extension, right and left lateral flexion, and rotation<sup>13</sup>.

## Interventions

### Control group

The control group received the selected traditional physical therapy treatment program for only 4 weeks (8 sessions, 2 times per week). It included the following:

- 1) Electromagnetic heat therapy. It is emitted a heat with electromagnetic waves and it was applied on the back of the neck and upper trunk for each participants for about 15 minutes to enhance vasodilatation and decrease muscle spasm (Figure 1).



FIGURE 1: Electromagnetic heat device

2) Stretching exercises. The patient asked to sit on chair to depress her shoulder by grasping lowest point on chair, the therapist pushed her head down to passively flex the patient head then bending it laterally to the opposite side of pain holding this for 20 seconds then slightly release this stretching ex repeated 5 times/session for 2 sessions/ week for 4 weeks.

3) Isometric strengthening exercises. These were followed the stretching exercise in the form of (Neck flexion, extension, and lateral flexion) each movement held 10 sec and repeated 5 times/session for 2 sessions/ week for 4 weeks.

### Study group

The study group received traditional program as control group in addition to shock wave therapy. Participants received one session every week, for 4 weeks of 1,500 shock waves (Figure 2) at the frequency of 15 Hz, each with low energy flux density of 1.5 bars on the right and left upper fibers of trapezius. While the Patients were in prone with her head in neutral position, the shock wave was applied bilaterally along upper fibers of trapezius muscle and coupling gel must be used between the shock wave head and the muscle.



FIGURE 2: Shock wave instrument

### Statistical Analysis

Descriptive analysis in the form of means and standard deviation for comparisons of data of both groups was used in this study. T-test was used to measure the demographic data and mean values for all variables in all subjects within the group and between both groups pre and post treatment, level of significant was set as 0.05. All statistical calculations were done using computer program SPSS release 22 for Microsoft Windows.

### RESULTS

The subjects were assigned randomly into two groups with their mean age was  $21.5 \pm 0.845$  years and body mass index was  $20.6 \pm 2.66$  kg/m<sup>2</sup>. Unpaired t-test was performed to compare between groups in the mean values of cervical ROM, pain intensity and NDI. There was no significant difference in all demographic data and pre-treatment mean values of all measured variables in both groups. The results showed a significant difference in all measured variables as compared pre and post treatment mean values in both studied groups, while The results showed that there was no significant difference between both studied groups in the post mean values of all variables (Table1&2).

**Table 1:** Baseline demographic data in both groups and CROM within and between groups

		Control group	Study group	p value
agE	Baseline	21.000 ± 0.845	21.33±0.21	0.79 <sup>c</sup>
BMI	Baseline	20.60±2.66	20.59±3.74	0.69 <sup>c</sup>
Flexion	Pre-treatment	55.20 ± 10.84	56.00 ± 7.17	0.813 <sup>c</sup>
	Post treatment	63.60 ± 10.53	68.80 ± 13.197	0.243 <sup>c</sup>
	p value	0.041 <sup>b</sup>	0.001 <sup>b</sup>	
Extension	Pre-treatment	68.26 ± 14.55	66.86 ± 11.82	0.775 <sup>c</sup>
	Post treatment	87.06 ± 12.78	83.60 ± 9.29	0.403 <sup>c</sup>
	p value	0.0001 <sup>b</sup>	0.0001 <sup>b</sup>	
Rt Bending	Pre-treatment	43.33 ± 15.18	42.13 ± 7.38	0.785 <sup>c</sup>
	Post treatment	49.20 ± 6.794	57.33 ± 8.83	0.009 <sup>b</sup>
	p value	0.145 <sup>c</sup>	0.0001 <sup>b</sup>	
Lt Bending	Pre-treatment	43.60 ± 5.96	42.133 ± 5.42	0.487 <sup>c</sup>
	Post treatment	49.73 ± 6.96	53.60 ± 10.47	0.244 <sup>c</sup>
	p value	0.017 <sup>b</sup>	0.0001 <sup>b</sup>	
Rt Rotation	Pre-treatment	65.86 ± 7.189	66.93 ± 5.44	0.650 <sup>c</sup>
	Post treatment	73.46 ± 6.78	76.66 ± 7.50	0.231 <sup>c</sup>
	p value	0.0001 <sup>b</sup>	0.003 <sup>b</sup>	
Lt Rotation	Pre-treatment	69.20 ± 7.84	65.86 ± 6.43	0.214 <sup>c</sup>
	Post treatment	72.86 ± 5.91	74.93 ± 6.96	0.388 <sup>c</sup>
	p value	0.177 <sup>c</sup>	0.003 <sup>b</sup>	

RT: right LT: left **b:** Significant difference between two treatment groups (Independent t- test;  $p < 0.05$ ) **c:** Non-significant difference in pre-treatment mean values.

**Table 2:** Changes in pain and neck disability index among and between treatment groups.

	VAS			NDI		
	pre	post	p value	pre	post	p value
Control	3.50±1.88	0.33±0.89	0.0001 <sup>b</sup>	7.60±4.62	3.26±3.21	0.0001 <sup>b</sup>
Study	3.8±1.74	0.66±1.04	0.0001 <sup>b</sup>	7.93±3.15	1.80±2.14	0.0001 <sup>b</sup>
p value	0.654 <sup>c</sup>	0.358 <sup>c</sup>		0.819 <sup>c</sup>	0.153 <sup>c</sup>	

**b:** Significant difference between two treatment groups (Independent t- test;  $p < 0.05$ ) **c:** Non-significant difference in pre-treatment mean values.

## DISCUSSION

This study was conducted to evaluate the extracorporeal shock wave therapy effect on neck dysfunction. Thirty female medical students complained of pain in the neck were participated in the study. The cervical range of motion was measured by CROM in all directions. While the pain was assessed by VAS and the NDI used to assess neck dysfunction. The control group (15 participants) received traditional treatment. While the study group (15 participants) received ESWT in addition to traditional treatment. The shock wave treatment was scheduled for 1 session per week for 4 weeks while traditional treatment was 2 sessions/week for 4 weeks.

The result showed a significant difference between pre and post treatment all measured variables in the two groups but there was non-significant difference between post treatment mean values of both groups in all variables except in CROM flexion, extension, LT bending and RT rotation.

This agree with a study that investigated the effect of ESWT on stroke patient lower limb spasticity, there were 28 patients randomly assigned into two groups one of them receive ESWT with anti-spastic oral medication and stretch exercise. The other group received anti-spastic oral medication and stretch exercise only. It was one session per week for three weeks. After treatment, lower limb spasticity, passive ROM, pain, 3meters duration of walking and lower extremity functional

score (LEFS) results were measured. The findings revealed that the spasticity, passive ROM and pain improved significantly immediately after first session treatment of ESWT and during 12 weeks of follow-up compared to control group <sup>14</sup>.

The result of the study illustrated that ROM is positively affected by ESWT and this is supported by the study which studied the effects of ESWT on range of motion and pain in adhesive capsulitis patients and reported that the patients who received ESWT have better result in the decrease of pain and increase in ROM compared to the patients who received conservative physical therapy only <sup>10</sup>.

The findings of this study show a significant pain levels improvement as measured with VAS, several studies were compatible with these findings that investigated the ESWT effect on upper trapezius myofascial pain syndrome using VAS and pressure threshold by digital algometer, it found that there is a significant improvement in pain levels post 2 weeks of treatment <sup>8</sup>. Another study showed a significant decrease in VAS scores after 4 treatment sessions of ESWT with one week interval <sup>15</sup>. A study that compared the effect of ESWT versus Ultrasound in patients with upper trapezius myofascial pain syndrome showed a significant decrease in pain in favor to ESWT than US after 4 weeks <sup>16</sup>. although the shock wave mechanism on soft tissue is not completely understood, there was a study that explained the underlying effects by which ESWT improving pain. It illustrated that the effect of ESWT may be due to facilitation of perfusion, improve angiogenesis of



blood vessels, and enhancing connective tissue recovery. Also ESWT may cause a transient dysfunction of excitability of nerve via selective partial denervation at neuromuscular junction, as an important part of physiological effects of ESWT<sup>17</sup>.

This study showed a great improvement of NDI after applying ESWT, this result was compatible with study that studied the effect of ESWT with high-energy flux density versus traditional modalities of physical therapy in myofascial pain syndrome. It found that there was a statistically significant decrease in the NDI scores after treatment by one month in both ESWT and control groups, and ESWT with high-energy flux density can be a more effective modality of treatment than combined physical therapy methods when using for a high number of sessions<sup>18</sup>.

However, there is a study revealed that ESWT may have a low level evidence for its short-term effectiveness in relieving of pain in neck in MPS. The poor quality of these study and limited sample size confirm the need for good quality, large scale, placebo controlled studies<sup>19</sup>.

Limitations. This examination was constrained by diminished the capacity of patient to complete the treatment procedures. Psychophysiological factors for participants at the time of examination and treatment that was assumed to be the same all over the study.

## CONCLUSION

From the obtained results, it concluded that patients with mechanical neck dysfunction who received shock wave and traditional treatment program can be improved by decreasing their pain intensity and NDI and increasing their neck ROM. Both modalities of treatment were successful in improvement and there was non-significant difference between them. So, they can be used alternatively to treat patient with mechanical neck dysfunction.

## Data availability

The used to support the findings of this study available from the corresponding author upon request.

## Conflicts of interest

The authors do not have conflict of interest to declare.

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