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Effect of Home Exercise Program Versus Stretching Program ON Chest Expansion For Chronic Non-Specific Mechanical Neck Pain Patients

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Abstract:
Purpose: To investigate the effect of a home exercise program (tele-rehabilitations) versus a stretching exercise program on chronic non-specific mechanical neck pain patients. **Design:** Randomized controlled study.
Setting: Ababa private physical therapy center Beni-suef, Egypt.
Subjects: Thirty male and female patients with ages ranging from 30 to 50 years old diagnosed with mechanical neck pain participated in this study. **Methods:** Patients were randomized into two groups, 15 patients each. Group (A) received a stretching exercise program, and (B) received advice and a home exercise program, Group (A) received a stretching exercise program.. **Main measures:** Patients in both groups assessed before and after 2 weeks of treatment, Visual analogue scale (VAS), active cervical range of motion (ROM), and chest expansion were taken as outcome measures both before and after the intervention.
Results: All outcome measures (pain intensity level, active cervical ROM, and chest expansion) after two weeks of intervention demonstrated a statistically significant difference between groups, based on the results of two-way mixed model multivariate analyses of variance (MANOVA). (P 0.001), For the level of pain, there were statistically significant differences between groups A and B (P 0.001). The results of an active cervical ROM and chest expansion, however, did not differ statistically significantly between group A and group B after 2 weeks of intervention (p>0.5).
Conclusions: It was concluded that chronic mechanical neck pain patients either receiving a home exercise program or a stretching exercise program would have less pain with improved cervical spine ROM and chest expansion However, a passive stretching exercise program enhanced cervical active ROM and chest expansion more than a home exercise program.
Key Words: chronic mechanical neck pain, home program exercise, stretching exercise.

1.Introduction

Physical therapy and other healthcare services are being delivered around the world in a different way as a result of the coronavirus pandemic (COVID-19) (including the United States). In response to this, tele-rehabilitation (TR); a form of clinical service administered at a distance using telecommunication, has emerged as a promising alternative to traditional in-person clinical visits. The Home exercise program or tele-rehabilitation aims to provide treatment, care, and consistent follow-up through telephone communication. This is especially beneficial for patients who find difficulty in regularly visiting a physical therapy center (three times per week) and amidst quarantining; as social isolation and the need to

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limit contact to minimize risk of COVID-19 infection, affects the ability of patients to participate in face-to-face physical treatment (1).

Chronic mechanical non-specific neck pain, Frequently referred to as cervical pain without a definite pathological etiology, is a common musculoskeletal condition. It could affect about 67% of the world's population (2). Both at rest and during physical activity, the alignment of the cervical spine affects how the dorsal neck muscles activity
. Additionally, maintaining a forward head posture for an extended period of time when using a computer is typically related with thoracic functional kyphosis, This has an adverse effect on the cervical range of motion (ROM). Scapular placement and upper trapezius muscle activation are also impacted by this. and results in increased activity of superficial muscles, delayed deep and superficial neck muscular feed-forward activation, neck muscle spasm, and muscle imbalance. Additionally, breathing problems and limited chest expansion or lung capacity result as a consequence of forward head posture, abnormal cervical spine alignment, altered biomechanics, cervical muscle tightness, and chronic neck pain (3).

Patients with chronic neck pain had lower respiratory volumes.. Increased muscular endurance and strength, cervical range of motion, and reduced Pco2 were also found to be significantly correlated with decreased chest expansion and neck pain. Additionally, respiratory retraining was seen to improve some cervical musculoskeletal disorders and respiratory dysfunction (4).
Currently, a variety of physical therapy procedures are used to treat the symptoms of persistent non-specific neck discomfort. The most popular forms of therapy include stretching exercise regimens, neck strength training, core training exercises, electrotherapy, manual therapy, cervical traction, scapula stabilizers retraining exercise, & postural correction exercise. This, in addition to patient education, advice, home-based exercise, ergonomic interventions & workplace adjustment, has been demonstrated to be effective in the management of neck pain. The stretching exercise program decreases muscle tightness, helps elongate and lengthen the shortened elastic component of the musculotendinous unit, reduces pain and improves flexibility. Hence, the stretching exercise program essentially works to improve cervical posture, range of motion, and muscular balance (5)**.** Therefore, the purpose of this study was to assess the efficiency of tele-rehabilitations (home exercise program) to stretching exercise programs for patients with chronic non-specific mechanical neck pain.

2.Patients and Methods

2.1. Study participants and ethics

This research was a controlled, randomised trial. performed on 30 patients (male and female) were referred by an orthopedic specialist for chronic mechanical neck pain (MNP), treated at Ababa private physical therapy center, Beni-suef, Egypt; between May 2020 and April 2021.
The research was already approved by the Faculty of Physical Therapy's Research Ethical Committee under the reference P.T.REC/012/003379. Any participant in this signed the informed consent form.

2.2. Study design:

The participants were split into two equal groups by random. Only those who attended the clinic were assigned to Group (A), received a passive stretching exercise program from a physical therapist, and Group (B), received a home exercise program. for pre and post treatment evaluation. To be included in the study, subjects were evaluated using the following criteria: Subject ages must have ranged between 30-50, had to be non-athletic patients, and had to be complaining about neck pain over the last 3 months.
Exclusion criteria included:

- A history of any of the following : rheumatic illnesses, osteo-metabolic diseases, or inflammatory diseases
- A history of spine surgeries, vertebral fractures, and neurological illnesses.

The sample size was calculated using G*Power version 3.1.9.7 (Statistical 92 Power Analyses for Windows and Mac, http://www.gpower.hhu.de). The sample size was determined using a one-way repeated-measures analysis of variance (ANOVA). The effect size was set at (0.25), a medium effect size, with the statistical power set at (0.95), the significance level at (0.05), and the effect size. The computation produced a sample size of 30 individuals.

2.3. Methods:

Each participant received only the assigned treatment program; they were instructed to not combine their treatment program with drugs or other physical therapeutic treatment.

Group (A): Stretching exercise program consisted of both passive stretching exercises and muscle energy techniques which inhabit and actively elongate shortened overactivated sternocleidomastoid muscle, and cervical extensors (The upper trapezius, levator scapula, and suboccipital muscles). This was coupled with the following breathing cycle: 15-30 seconds hold and 3-5 repetitions per day In addition to advice, instructions, and helpful recommendations for carrying out everyday tasks including sat postures, computer positioning, and desk organization. This was received as part of a clinic program, which involved three sessions each week of face-to-face care. (every second day) of 45 minutes duration and After maintaining each passive stretching exercise for 30 seconds, it was performed four to five times. (6).

Meanwhile, group (B): home-based exercise program consisted of general gentle self-stretching Exercises for the upper trapezius, levator scapula, sternocleidomastoid muscle, and cervical extensors coupled with the breathing cycle (15-30 seconds holds and 5-10 repetitions per day), general active range of motion exercises and postural correction exercise, in addition to patient education by providing simple details about their condition, recommendations, practical demonstrations with guidance for lifting, pushing, pulling, and other daily activities, (including guidance for appropriate seated postures, computer placement, and desk organization), (7). In this group, each patient was instructed to exercise at home (every second day) for 45 minutes for 2 weeks using the exercise-based telerehabilitation service follow up after every home session. When the 2 weeks ended, each patient had a post-treatment evaluation visit inside the clinic, identical to the pre-treatment analysis.

2.4. Outcome measures:

In the beginning, a data evaluation sheet was filled out for each patient and used to record the standard history taking information (age, sex, occupation, onset, duration, nature, location, and mechanism of injury). A detailed physical examination was performed, focused on pre- and post-treatment testing of:

1. 1. Visual analogue scale (VAS) measurement of resting pain intensity; a VAS is a horizontal 100 mm line with 0 denoting no pain and 100 denoting the highest discomfort. Each patient was instructed to mark a location on the line that best represented their current level of pain. (0) no pain and the other end representing (100) maximum pain). Each patient was instructed to mark a location on the line that best represented their current level of pain.2. Cervical active range of motion (CAROM) via tape measurement. Data were taken 3 times and mean was calculated for each ROM.

3. Chest expansion (upper, middle, and lower) via tape measurement as each patient was in a sitting position,

instructed to fully inspire and fully expire, as much as possible. Measurements were taken at the end of deep inspiration and deep expiration; the difference between full inspiration and expiration was calculated, and data were taken 2 times before the mean was calculated for

upper, middle and lower chest expansion (measured before and after treatment) and recorded an evaluation sheet. The evaluation was conducted during their pre-treatment evaluation visit to the clinic**.**

3.DATA ANALYSIS:

Utilizing SPSS software for Windows, version 25.0 (Armonk, NY, USA), statistical analysis was carried out. Percentages were calculated for all groups at baseline and two weeks after the intervention, and descriptive statistics in the form of mean and standard deviation were used. Gender-based data were described using chi-square. The combined mean change scores of pain, cervical range of motion, and chest expansion at each time interval were compared across the groups using a two-way mixed model multivariate analyses of variance (MANOVA). The F value used was based on Wilks' lambda and when the MANOVA showed a significant effect ($P < 0.05$), a follow-up univariate ANOVAs were performed with Bonferroni adjusted p-values to protect against the possibility of a type I error.

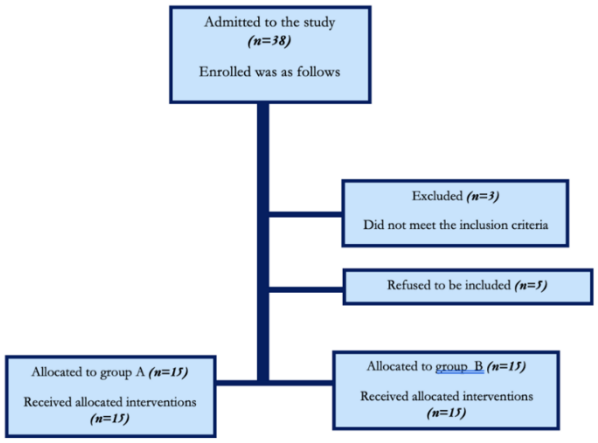

Figure (1): Flow of participants through the study

4.Results:

groupings were conducted throughout the study are represented above (Figure 1) The results revealed no statistically significant differences between the groups in terms of age, height, weight, gender, pain, or cervical range of motion.. and outcome measurements for chest expansion (P>0.05) as shown in table 1. In order to find out whether there were any differences between the groups in terms of the combined mean change scores for final measures of pain, cervical range of motion, and chest expansion, a mixed design multivariate analysis was also carried out. After the intervention lasted for two weeks, there was a statistically significant difference between the groups with regard to of pain severity (P< 0.001). Additionally, this was observed in group A and group B. both of which experienced significant differences in pain intensity however indicated in tables 2 and 3, there were no statistically significant differences (between the groups) in the cervical range of motion or chest expansion outcomes after two weeks of intervention (p>0.5). Within-group comparison showed statistically significant differences in all outcome measures (p< 0.01) after 2 weeks of treatment in each group, shown in table 4.

5.Discussion:

This study compared the effectiveness of a home exercise program to a traditional stretching exercise program in treating patients who have chronic mechanical non-specific neck pain based on the intensity of the pain at rest, active cervical range of motion, and chest expansion. Previous studies utilized different physical therapy interventions in order to improve symptoms of chronic mechanical non-specific neck pain, such as pain intensity, cervical range of motion, quality of life, and neck muscle strength (8).

Table1. Baseline Demographic and Clinical Characteristics of Subjects (N=30)

Characteristics	Group A (n=15) Mean±SD (Median)	Group B (n=15) Mean±SD (Median)	P-Value
Age(years)	39.4±9.98	37.8±8.51	0.9 *
Weight(kg)	78.2±8.12	78.8±7.25	0.94 *
Height(cm)	168.8±4.95	169.7±6.32	0.43*
Sex, n (%) Male Female	6(40%) 9(60%)	7(46.7%) 8(553.2%)	0.76*
VAS (mm)	74.67±11.87	75.33±7.43	0.85*
Flex (cm)	8.8±3.12	9.67±2.79	0.6*
Ext.(cm)	14.47±2.75	14.73±2.91	0.31*
RLF (cm)	14.6±3.66	13.93±3.65	0.87*
LLF (cm)	14.47±3.6	13.0±3.25	0.33*
RR (cm)	15.2±2.73	13.4±3.54	0.15*
LR (cm)	15.8±2.91	14.07±3.28	0.11*
L. Chest(cm)	1.8±0.68	1.8±0.68	0.6*
Up. Chest(cm)	1.6±0.63	1.73±0.46	0.46*
M. Chest(cm)	1.53±0.64	1.6±0.51	0.21*

VAS, Visual Analogue Scale; Flex, Flexion; Ext, Extension; RR, Right Rotation; LR, Left Rotation; RLF, Right Lateral Flexion; LLF, Left Lateral Flexion; L, lower; Up., upper; M, middle; MD, mean difference; CI, Confidence interval; p, probability value. * Data are mean± SD, P-Value > 0.05 indicate statistical non significance. ** Data are mean± SD, P-Value < 0.05 indicate statistical significance.

Patients with chronic non-specific mechanical neck pain responded well to both manual therapy and a stretching exercise regimen for short-term pain relief. (6).

In this study, a passive stretching exercise program appear to be more effective in improving resting

pain intensity when compared to two weeks of home exercise programs. Furthermore, Evans et al. (7) demonstrated that a supervised exercise program was more effective than home-based exercise and provided advice on the short-term effect.

Table 2. Clinical characteristics of the subjects after the intervention lasted for two weeks (N=30)

Characteristics	Group A (n=15) Mean±SD (Median)	Group B (n=15) Mean±SD (Median)	P Value
VAS (mm)	41.0±11.46	58.0±67.61	0.0002**
Flex (cm)	6.47±2.67	8.6±2.92	0.15*
Ext.(cm)	11.87±2.61	13.8±2.96	0.12*
RLF (cm)	11.8±3.17	13.0±3.53	0.48*
LLF (cm)	11.6±2.67	12.07±2.94	0.89*
RR (cm)	12.27±3.28	12.27±3.03	0.99*
LR (cm)	12.2±2.88	12.64±2.91	0.78*
L. Chest(cm)	2.8±0.68	3.67±0.82	0.0002**
Up. Chest(cm)	2.67±0.72	3.33±0.62	0.04*
M. Chest(cm)	2.47±0.52	2.87±0.52	0.005*

VAS, Visual Analogue Scale; Flex, Flexion; Ext, Extension; RR, Right Rotation; LR, Left Rotation; RLF, Right Lateral Flexion; LLF, Left Lateral Flexion; L, lower; Up., upper; M, middle; MD, mean difference; CI, Confidence interval; p, probability value. * Data are mean± SD, P-Value > 0.001 indicate statistical non significance. ** Data are mean± SD, P-Value < 0.001 indicate statistical significance.

Additionally, Afonso et al. (9) came to the conclusion from their systematic research that strength training or stretching was beneficial and had equal effects on cervical range of motion and pain intensity in individuals with chronic non-specific mechanical neck pain.

Many previous studies which worked to examine the effect of home exercise programs (either self-mobilization to address specific spinal levels, or strengthening, and/or endurance exercise, and /or stretching exercise and /or posture correction) seem effective at reducing resting neck pain intensity, function, and disability and improving quality of life (10).

Table 3. Between Groups Effects after 2 weeks of intervention

Outcomes	GA Versus GB		Partial Eta Squared
	MD (95% CI)	P-Value	
VAS (mm)	-1.6 (-2.62, -0.58)	0.001	0.34*
Flex (cm)	-0.87(-3.77, 2.04)	0.99	0.09*
Ext.(cm)	-1.93 (-4.21, 0.34)	0.12	0.1*
RLF (cm)	-1.2 (-4.21, 1.81)	0.98	0.03*
LLF (cm)	-0.47 (-2.95, 2.02)	0.99	0.01*
RR (cm)	0.01 (-2.83, 2.83)	0.99	0.001**
LR (cm)	0.67 (-3.36, 2.03)	0.99	0.01*
L. Chest(cm)	-0.87 (-1.48, -0.25)	0.003	0.33*
Up. Chest(cm)	-0.67 (-1.29, -0.05)	0.03	0.15*
M. Chest(cm)	-0.4 (-0.88, 0.08)	0.14	0.22*

VAS, Visual Analogue Scale; Flex, Flexion; Ext, Extension; RR, Right Rotation; LR, Left Rotation; RLF, Right Lateral Flexion; LLF, Left Lateral Flexion; L, lower; Up., upper; M, middle; MD, mean difference; CI, Confidence interval; p, probability value. * Data are mean± SD, P-Value > 0.001 indicate statistical non significance. ** Data are mean± SD, P-Value < 0.001 indicate statistical significance.

In patients with chronic mechanical neck pain, our study found that both a home exercise program and passive stretching exercises could reduce pain intensity at rest and increase active cervical range of motion. Furthermore, according Häkkinen et al. (6), both home-based training programs (combined strength training and stretching versus stretching training only) were equally effective in bringing about a long-term improvement in neck pain intensity and disability after a one-year follow-up.

Table 4. Within group changes after 2 weeks of intervention

	Group A(n=15)		Group B(n=15)	
	Change from baseline to 2 weeks		Change from baseline to 2 weeks	
	MD (95% CI)	**P Value**	**MD (95% CI)**	**P Value**
VAS (mm)	32.67(26.15, 39.18)	0.0001**	17.33(10.82, 23.85)	0.0001**
Flex (cm)	2.33(1.83, 2.85)	0.0001**	1.07(0.56, 1.57)	0.0001**
Ext.(cm)	2.6(2.2, 3.0)	0.0001**	0.93(0.54, 1.33)	0.0001**
RLF (cm)	2.8(2.21, 3.39)	0.0001**	0.93(0.34, 1.52)	0.003*
LLF (cm)	2.87(2.35, 3.39)	0.0001**	0.93(0.42, 1.45)	0.001**
RR (cm)	2.93(2.37, 3.49)	0.0001**	1.13(0.57, 1.69)	0.0002**
LR (cm)	3.6(3.05, 4.16)	0.0001**	1.2(0.65, 1.76)	0.0001**
L. Chest(cm)	-1.0(-1.11, -0.89)	0.0001**	-1.87(-1.97, -1.76)	0.0001**
Up. Chest(cm)	-1.07(-1.25, -0.88)	0.0001**	-1.6(-1.79, -1.41)	0.0001**
M. Chest(cm)	-0.93(-1.11, -0.76)	0.0001**	-1.27(-1.44, -1.09)	0.0001**

VAS, Visual Analogue Scale; Flex, Flexion; Ext, Extension; RR, Right Rotation; LR, Left Rotation; RLF, Right Lateral Flexion; LLF, Left Lateral Flexion; L, lower; Up., upper; M, middle; MD, mean difference; CI, Confidence interval; p, probability value. * Data are mean± SD, P-Value > 0.001 indicate statistical non significance. ** Data are mean± SD, P-Value < 0.001 indicate statistical significance.

On other hand, Salo et al. (5) found that patients who had only received a guidance session for stretching exercises to be performed at home as a daily routine didn't show any significant changes in quality of life when compared to regular strength or endurance training after a one-year follow-up.

According to the author's knowledge, there has been no relevant previous research, that examined either the effect of passive stretching exercise programs or home-based exercise programs on chest expansion or respiratory function in patients with chronic mechanical nonspecific neck pain. Singh et al. (11) relieved that exercises which strengthen deep flexor muscles and shoulder retractors in addition to passive stretching of cervical extensors and pectoral muscles were effective in improving chest expansion in forward head posture patients. Also, Rehman et al. (12) showed that passive stretching of cervical muscles could clinically improve chest expansion in patients with chronic obstructive lung disease (COPD).

According to Kim & Koo's(13) research, people who have a forward-head posture benefit from sternocleidomastoid, upper trapezius, and pectoralis major stretches because they have better lung function and static vital capacity.

6.Conclusion:

It found that individuals with chronic mechanical non-specific neck pain who participated in a home exercise program or a passive stretching exercise program had improvements in their degree of pain, active cervical range of motion, and chest expansion. However, a passive stretching exercise appears to be more effective; causing better improvements in pain intensity when compared to two weeks of (short-term) home exercise programs. Further research is needed to assess the long-term effect of regular home exercise-based programs on chronic mechanical non-specific neck pain.

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Patient consent statement:

Prior to the start of data collection, all participants .provided their written, informed consent

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