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THE COMBINED EFFECT OF KENDELL AND MCKENZIE POSTURAL CORRECTION EXERCISES ON NECK PAIN AND FUNCTION IN CHRONIC NON-SPECIFIC NECK PAIN

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ABSTRACT

Chronic non-specific neck pain (CNSNP) is a frequent complaint. It is a recognized medical and socioeconomic problem and a frequent cause of job absenteeism. This study was aimed to examine the combination effect of McKenzie and Kendell posture correction exercises on pain intensity and function in patients with chronic non-specific neck pain. Sixty patients with chronic nonspecific neck pain their ages between 25-50 years old from both sex where randomly assigned into two equal groups. Study group (GA) received combined McKenzie and Kendell exercise plus Conventional therapy. Control group (GB) received the Conventional therapy in a form of Hot packs, Ultrasound and cervical stretching and strengthening exercises. Both groups had three sessions per week for a month. Pain intensity and neck functional disability were measured by visual analogue scale (VAS) and neck function disability index (NDI) respectively pretreatment and four weeks after the intervention. T-test within and between groups revealed that significant reduction of pain intensity and functional disability in both groups with remarkable decrease in study group (GA) ($P<0.05$). Combination of Kendell and Mackenzie exercise on a regular basis was more effective as a treatment technique for reducing neck discomfort and disability in patients with chronic non-specific neck pain.

Key Words: Chronic non-specific neck pain, Kendell and Mackenzie exercise, neck disability index.

INTRODUCTION

Neck pain has been reported to be among the most prevalent disorders in the general population and it affects subjects performing either occupational or recreational activities **(Binder, 2007).** Sixty seven per cent of the population suffer from it at least once in a lifetime and the prevalence is about 23%. It is mostly seen in middle-aged people **(Fejer *et al.*, 2006)**. Moreover, neck pain presents a large economic burden on the health care system **(Nagrale *et al.*, 2010).** Chronic non-specific neck pain (CNSNP) is a generalized pain in the neck and/or shoulder that has mechanical characteristics, such as symptoms brought on by holding a certain neck position, moving the neck, or palpating the cervical muscles **(Fernandez-de-las-Penas *et al.*, 2007).** Minor injuries to the neck caused by poor posture and abrupt muscle contractions might further cause the muscles that are not frequently utilized to shrink, which can resulted in mechanical dysfunction and chronic pain **(Boyd-Clark *et al.*, 2002)**.

In addition to neck pain, patients with CNSNP also have other motor dysfunctions, including increased forward head posture, decreased proprioception as a sensorimotor and neuromuscular disturbances. Deep cervical flexor muscle activation is usually inhibited, and this is accompanied by hyperactivity and increased fatigability of the superficial neck flexors **(Kapreli *at al.*, 2008).** McKenzie's exercise program involves repeated self-treatment exercises performed by patients, with a focus on extension exercises. The exercise program includes joint motion exercises, manual therapy, and patient education. Kendell's exercise program focuses on the notion that unstable forward head posture can be corrected via alignment exercises, although this not only involves strengthening the deep neck flexors and shoulder retractors, but also stretching the chest muscles**.** The exercises program recommended by Mackenzie and Kendell adds the effect of both approaches to treat neck pain as well as neck functional ability **(Kong *et al*., 2017).**

For participants with CNSNP, this study was aimed to investigate the effect of applying modified cervical postural correction exercise that combined Mckenzie's and Kendall's exercises, consisted of neck extension exercises and stretching of the pectoralis muscles at the same time on neck pain and function.

MATERIAL AND METHODS

1-Design and setting

Pre-test and post-test randomized controlled trial design were carried out at Al-Safa hospital outpatient clinic and Delta University for Science and Technology,Faculty of Physical Therapy outpatient clinic.

2-Procedures:

Ethical considerations

The study protocol was approved by the Research Ethics Committee of the Faculty of physical therapy, Cairo university, Giza, Egypt (approval number: P.T.REC/012/003920), and registered in clinical trials with ID (NCT05578547). This study was conducted between April 2022 to September 2022. All participants were thoroughly explained the study's methods & objectives, and they were asked to provide informed legal consent to participate in the study and generalize the findings.

Sample size calculation

Based on a previous study of **Metawee *et al.*, (2021)**, sample size was calculated according to the significant difference in the mean value of difference (post-treatment – pre-treatment values) in ROM between control (2.8 ± 0.6) and study (10.9 ± 1.1) groups in chronic non-specific neck pain patients. Using two tailed unpaired t test, with α=0.05, power of 80%, and an effect size of 0.52. A sample size of 30 patients/per group would be required, **(Faul *et al* ., 2009).**

Subjects

Sixty patients were enrolled in this study, representing both genders from the outpatient clinic of the Faculty of Physical therapy, Delta University for Science and Technology and Alsafa hospital in Damietta with CNSNP. The participant's age ranged from 25 to 50 years old and were diagnosed and referred from an orthopedist complaining of CNSNP. Subjects were chosen for the study after meeting certain inclusion criteria. Having neck discomfort symptoms that were triggered by certain neck positions and by palpating the cervical musculature for at least three months **(Martinez-Merinero *et al.*, 2020)**. People were excluded, if they experienced a history of neck injuries, neck surgery, facet joint inflammation, neurological disorders such as cervical spondylosis, spondylolisthesis, disc prolapse and rheumatic disease **(Samaan *et al*., 2018).**

Randomization and allocation

Sixty chronic non-specific neck pain patients were evaluated for eligibility; participants were randomized into two equal groups using computer permuted randomization method, followed by a concealed allocation by opening sequentially numbered and sealed envelopes; a card inside revealed the group assignment as either A or B.; group A (study group) received combined Kendell and McKenzie exercise plus conventional therapy, and group B (control group) received the conventional therapy only in the form of Hot packs, Ultrasound and cervical stretching and strengthening exercises **(Kisner and Colby, 2012; Starkey, 2013)**. Figure (1) shows a flow diagram of the study.

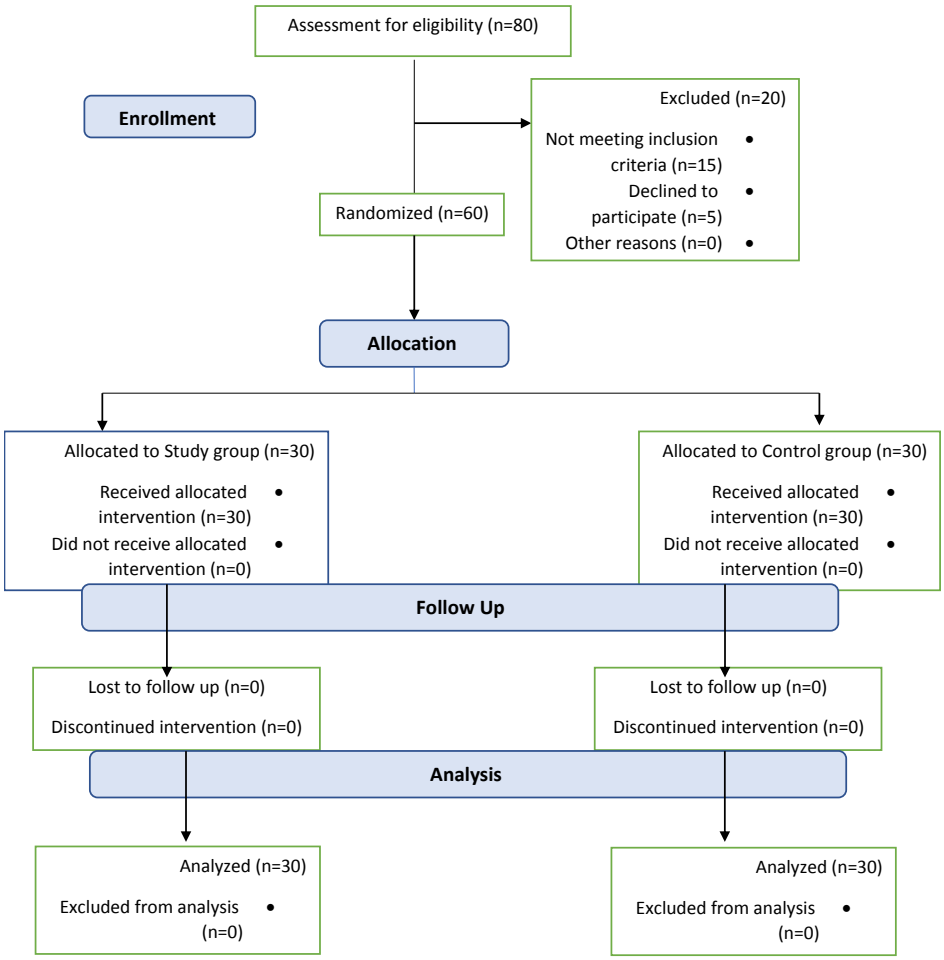

Figure (1): Flow chart of the study

Clinical Assessment

Pain intensity.

The visual analogue scale (VAS) was used to evaluate pain. VAS is a 10-cm long line, with one end representing 'no pain' and the other standing for 'worst pain ever'. VAS has been reported to be a valid and reliable pain assessment tool. The patients were asked to rate their pain intensity from 0 to 10 as it is orientated from the left (best) to the right (worst), Those who scored between 3.4 and 7.4 were considered to be mild pain, 3.5 to 7.4 to be in moderate pain, and 7.4 to be in severe pain **(Boonstra *et al.*,2008).**

Functional disability.

Neck disability was measured by the Arabic version of neck disability index (ANDI). It has been reported as a reliable (Cronbach's alpha: 0.89) and valid instrument to evaluate self-rated disability in patients with neck pain. It is a patient filled questionnaire consists of 10 items (50-point index questionnaire). The test can be interpreted as a percentage or as a raw score, with a maximum score of 50. A higher score indicates more patient-rated disability. Patients who scored 0 to 4 points (0 to 8%) were considered to have no disability , 5 to 14 points (10 to 28%) were considered to have a mild disability, 15 to 24 points (30 to 48%) were presumed to have a moderate disability, 25 to 34 points (50 to 64%) were considered to have a severe disability, and 35 to 50 points (70 to 100%) were regarded to have a total disability, **(Shaheen *et al.*, 2013).**

Intervention:

The combined Kendell and Mckenzie exercise:

From a seated position the physiotherapist slowly pulled the subject's neck to the head, thereby attaching the chin to the neck. The patient's eyes should be looking directly forward, then held both hands on the back of the patient's head and then asked the patient to push his/her head backwards against the hands. Finally, the physiotherapist asked the patient to be spread his hands as wide as possible in order to stretch the pectoralis major. The participant performed the exercise three sets of exercises, with one set being defined as five circuits, that is, performing 7 seconds of exercises followed by 10 seconds of rest **(Kong *et al.*, 2017).**

The conventional therapy:

over the 4 weeks, all patients received conventional therapy three times a week, consisting of moist heat packs that were placed on the cervical region in prone position and covered with two layers of towels for 20 minutes **(Starkey, 2013).** Ultrasound therapy **(**all patients were received continuous US waves with a frequency of 1 MHz and a power density of 1-1.5 W/cm2). Throughout the course of eight minutes, the US was executed bilaterally to cover the trapezius muscle. The dosage was modified to fit the neck's anatomical structure. Three sessions each week for four weeks, utilizing a 5-cm2 US head, therapy was administered **(Noori *et al.*, 2020).** Stretching Exercises**:** To stretch stiff muscles such as the sternocleidomastoid, upper trapezius, suboccipital muscles, and pectoralis major were applied for both groups **(Lynch *et al.*, 2010).** Strengthening Exercises: strengthening activities such as chin tucks and neck isometrics were performed **(Shete and Shah., 2019).**

Outcomes:

VAS and ANDI were evaluated both at baseline and after 4 weeks of interventions.

Data collection:

Data were screened, for normality assumption and homogeneity of variance. Normality test of data using Shapiro-wilk that revealed the data was normally distributed (P>0.05) after removal outliers that were detected by box and whiskers plots. Additionally, Levene's test for testing the homogeneity of variance revealed that there was no significant difference (P>0.05).

Statistical analysis

For each patient in the two groups, the data were gathered both before and after the treatment program. SPSS for Windows, version 18, was used to conduct the statistical analysis **(SPSS., 2010)**. For subject characteristics, descriptive statistics in the form of mean and standard deviation were utilized. The tested variables of interest were compared for each patient before and after therapy using the T-test both within and between groups. P<0.05 was chosen as the threshold for statistical significance. The appropriate sample size for this study was 60 patients (30 individual per group).

RESULTS

As shown in Table (1) there were no significant differences between both groups in the demographic characteristics, including age, height, weight, BMI and gender

Table (1): Demographic characteristics of patients in both groups

	Group A (n=30) $\bar{x}$ **± SD**	Group B (n=30) $\bar{x}$ **± SD**	**p-value**
Age (years)	**32.03 ± 6.67**	**34.70 ± 7.31**	**0.145**
Height (cm)	**169.57 ± 8.97**	**167.90 ± 10.13**	**0.503**
Weight (kg)	**78.13 ± 9.99**	**76.80 ± 9.68**	**0.602**
BMI kg/m^2	**27.08 ± 1.58**	**27.16 ± 1.48**	**0.832**
Gender(males:females)	**9 (30 %) : 21 (70 %)**	**11 (37 %) : 19 (63 %)**	**0.392**

$\bar{x}$: Mean MD: Mean Difference P-Value: Probability Value
SD: Standard Deviation Group A: study group
Group B: control group

Pre-post statistical analysis for group A (study group)

As shown in Table (2) there were significant differences before and after treatment in group A (study group).

Table (2): Pre-Post statistical analysis for the group A (study group)

	Before $\bar{x}$ **± SD**	**After** $\bar{x}$ **± SD**	**MD**	**p-value**
VAS	**7.17 ± 1.39**	**3.03 ± 0.67**	**4.13**	**0.000**
neck disability Index	**36.29 ± 4.31**	**26.67± 4.25**	**9.62**	**0.000**

$\bar{x}$: Mean MD: Mean Difference P-Value: Probability value

Pre-post statistical analysis for group B (control group)

Table (3) shows that there were significant differences before and after treatment in group B (control group).

Table (3):Pre-Post statistical analysis for control group (group B):

	Pre-test $\bar{x}$ ± SD	Post-test $\bar{x}$ ± SD	MD	p-value
VAS	7.07 ± 0.94	3.77 ± 0.77	3.30	0.000
neck disability Index	38.27 ± 5.43	29.75 ± 3.90	8.52	0.000

Pre-treatment statistical analysis of pain intensity and neck function disability.

As shown in Table (4) there were no significant differences found between both groups before treatment in the variables, including VAS and neck disability Index.

Table (4)

	Group A $\bar{x}$ ± SD	Group B $\bar{x}$ ± SD	MD	p-value
VAS	7.17 ± 1.39	7.07 ± 0.94	-0.10	0.746
neck disability Index	36.29 ± 4.31	38.27 ± 5.43	1.98	0.123

Post-treatment Statistical analysis for variables in both group

As shown in Tables (2, 3, 4) there were marked variances between both groups after treatment in favor to group A (study group).

Table (5): Comparison between the mean values of the Visual Analogue Scale (VAS) in both groups:

	Visual Analogue Scale (VAS) (Scale)			
	Group A	Group B	MD	P- value
Mean ± SD	3.03 ± 0.67	3.77 ± 0.77	0.73	0.000

Table (6): Comparison between the mean values of Neck disability Index in both groups

	Neck disability Index(scale)			
	Group A	Group B	MD	P- value
Mean ± SD	26.67± 4.25	29.75 ± 3.90	3.08	0.005

DISCUSSION

The present study showed that the conventional therapy program on the one hand and the combined kendell and mckenzie posture correction exercise on the other had a significant effect on improving pain intensity level and neck functional restriction.

The results showed a significant decrease of neck pain and neck disability level after the treatment with combined kendell and mckenzie posture correction exercise (GA) compared with conventional therapy only (GB). The findings are in line with observations from previous studies that showed that reduced neck pain after deep cervical flexor training **(Kong *et al*., 2017; Kage *et al*., 2016; Iqbal *et al*., 2013)**.

A study conducted by **Edmondston *et al*.,(2011)** revealed that patients suffering from neck pain exhibited low activation of the deep cervical flexors. The authors pointed out that a low-load program focusing especially on the motor control of the deep neck flexors reduced neck pain and headache. Moreover, deep cervical flexors activation with a biofeedback unit has been shown to be beneficial in strengthening the weakened muscles and thereby improving the muscle performance **(Kang , 2015).**

In the present study, decreased neck pain and disability could be attributed to deep cervical flexor muscles and scapular retractors increased strength and activation, which enhanced muscular performance **(Falla *et al*., 2004 ; Kang *et al*. 2015 and Kong *et al*., 2017)**. Moreover, the deep cervical flexor training may have corrected the cervical angle **(Lee *et al*., 2017).** Contributing to the improvement seen in the study group. In order to reduce neck pain, the combined Kendell and Mackenzie correction exercise may have reduced the strains on the cervical spine.

Moreover, an increase in endorphin release during exercise and a gain in neuromuscular control may be responsible for the pain reduction provided by exercises of the combined Kendell and Mackenzie. Stretch receptors are stimulated by muscle contractions, and afferents from stretch receptors activate the pituitary gland to release endogenous opioids and beta-endorphins **(O'Leary *et al*., 2007).**

The obtained results are in agreement with the study of **Kong *et al*., (2017)** who examined the effect of modified cervical exercise on smartphone users with forward head posture and established that the modified cervical exercises, which combine the exercise programs developed by Mackenzie and Kendall and were known to substantially reduce neck pain, increase range of motion and improve function are thought to aid in the improvement and recovery of forward head posture.

The findings of **Persson *et al*., (2000)** are consistent with the current study because they suggested a bilateral increase in the threshold of pain attenuation that could be attributed to a central mechanism that

regulates pain and is essential for both sensory functions in both healthy individuals and people with musculoskeletal pain.

Furthermore, **Dusunceli *et al.*, (2009)** used neck extension exercises and deep neck flexor exercises for subjects with neck pain. They reported that the subjects who had completed 12-months of deep neck flexor exercises exhibited improved pain and functional level, which was aligned with the current findings.

Based on the consequences of the current research, combined corrective exercise diminishes neck pain and disability.

A possible drawback of the current research is evaluating the short-term effects only without evaluating the long-term effects. So, it would be useful to be addressed in the future researches.

CONCLUSION

In CNSNP patients, combined Kendell and Mckenzie posture correction exercise and conventional therapy were both effective in reducing neck pain and enhance neck function, however the combined kendell and mckenzie exercise was more effective making it a preferable treatment.

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التأثير المشترك لتمارين كيندل وماكينزي لتصحيح القوام على آلام الرقبة ووظيفتها على مرضى آلام الرقبة المزمنة الغير محددة

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آلام الرقبة المزمنة غير المحددة هي شكوى متكررة. إنها مشكلة طبية واجتماعية اقتصادية معترف بها وسبب متكرر للتغيب عن العمل. هدفت هذه الدراسة إلى فحص تأثير الجمع بين تمارين كيندل وماكينزي لتصحيح القوام على شدة الالم والوظيفة على المرضى الذين يعانون من آلام الرقبة الغير محددة. ستون مريضا يعانون من آلام مزمنة غير محددة في الرقبة تتراوح أعمارهم بين 25 - 50 سنة من كلا الجنسين حيث تم تقسيمهم عشوائيا إلى مجموعتين متساويتين. تلقت المجموعة الدراسيه (أ) تمارين كيندل وماكينزي المجمعة بالاضافة الى العلاج التقليدي. وتلقت المجموعة (ب) العلاج التقليدي في شكل الكمادات الساخنة والموجات الفوق صوتية وتمارين استطالة وتقوية لعضلات الرقبة. كان لدى كلتا المجموعتين ثلاث جلسات اسبوعيا لمدة شهر. تم قياس شدة الالم والعجز الوظيفي للرقبة بواسطة المقياس التناظري البصري ومؤشر الإعاقة في وظيفة الرقبة على التوالي قبل العلاج وبعد فترة أربع اسابيع من العلاج. اظهر الاختبار الفحصي داخل وبين المجموعتين انخفاضا ملحوظا في شدة الالم والعجز والوظيفي في كلا المجموعتين مع انخفاض ملحوظ في المجموعة (أ). كان الجمع بين تمارين كيندل وماكينزي بشكل منتظم اكثر فعالية كأسلوب علاجي لتقليل الام الرقبة و العجز الوظيفي لدى المرضى الذين يعانون من الام الرقبة المزمنة غير المحددة.