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EFFECTS OF DEEP NECK FLEXOR AND EXTENSOR EXERCISES ON PAIN, RANGE OF MOTION AND MUSCLE STRENGTH IN MECHANICAL NECK PAIN

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ABSTRACT

Objective: To determine the effects of deep flexor muscle exercises along with deep extensor muscle exercises on pain, range of motion and muscle strength in mechanical neck pain.

Methods: Randomized clinical trial was conducted at Riphah Rehabilitation Clinic Lahore from July 2022 to February 2022. Sample size of 36 patients with the age ranging from 18 to 40 years having mechanical neck pain, recruited through non-probability consecutive sampling. All were randomly allocated through simple random sealed opaque enveloped method into two groups; Group A was treated with standardized physiotherapy treatment and Group B was treated with deep neck flexor and extensor exercises along with standardized treatment. Both groups underwent treatment for 3 times per week for a total of 4 weeks. Outcome measures used were NPRS, Goniometer and MMT to measure the treatment effect at baseline, and after 4 weeks of the treatment. Analysis was done using SPSS version 25.

Results: Participants N=36 were randomly allocated to two groups. Group A mean age was 34.44 ± 6.45 while group B mean age was 33.66± 6.97. With-in group comparison by Wilcoxon signed-rank Test revealed significant differences ($p < 0.05$) on pain, range of motion and muscle strength. The between-group comparison by Mann Whitney-Test showed reduction in pain intensity with improvement in range of motion. Significant difference was observed between two groups ($p<0.05$).

Conclusion: This study concluded that both intervention and control groups showed decrease in pain intensity and improvement in range of motion and strength but there was significant improvement in the intervention group receiving deep neck flexor and extensor exercises

Keywords: Exercise, Muscle Strength, Neck muscles, Neck pain, Range of Motion

Clinical Trial Registry No: NCT05618964

INTRODUCTION

The prevalence of neck pain in 2019 was 27.0 per 1000 population, one of the most prevalent musculoskeletal disorders (1). It implies a heavy burden on the individual level as well on the socioeconomic level (2) . Having neck pain in the area from the superior nuchal line to the spinous process of the T1 is mechanical neck pain (3). Neck pain is way common among female as compared to male (2). In today's society, neck pain is a major problem due to its multifactorial nature (1). The majority of neck pain is of mechanical causes (4). Conservative options for treatment of MNP, include modalities, therapeutic exercises, thrust manipulation, and non-thrust manipulation also called mobilization (5).

The function of the muscles of cervical region changes among the patients of mechanical neck-pain(6). There is reduced activity of deep neck flexor muscle including longus colli and longus capitis muscles, and compensatory increased activity of Anterior Scalene and Sternocleidomastoids(7). The effected activity of DCF results in insufficiency of activation, coordination, poor support, and overload on other structures that further increases neck pain (8). This imbalance decreases normal lordotic curve alignment leading to cervical impairments (9).

The deep neck extensors are key muscles for segmental support of cervical spine thus rehabilitation, training of neck extensors is considered to be equally significant(10). Superficial neck muscles exercises training programs were used to increase ROM of the neck while the deep neck flexors training program are required for better motor control and coordination (11).

Most focused Muscles in the treatment of mechanical neck pain are Superficial Neck muscles while the deep neck muscles are being ignored. Hence there is recurrent pain reported. This study aims to determine the effect of both deep neck flexor and extensor exercises on pain, range of motion and muscle strength. Thus, this study may help a physiotherapist with alternating approach in treating the Mechanical neck pain.

METHODS

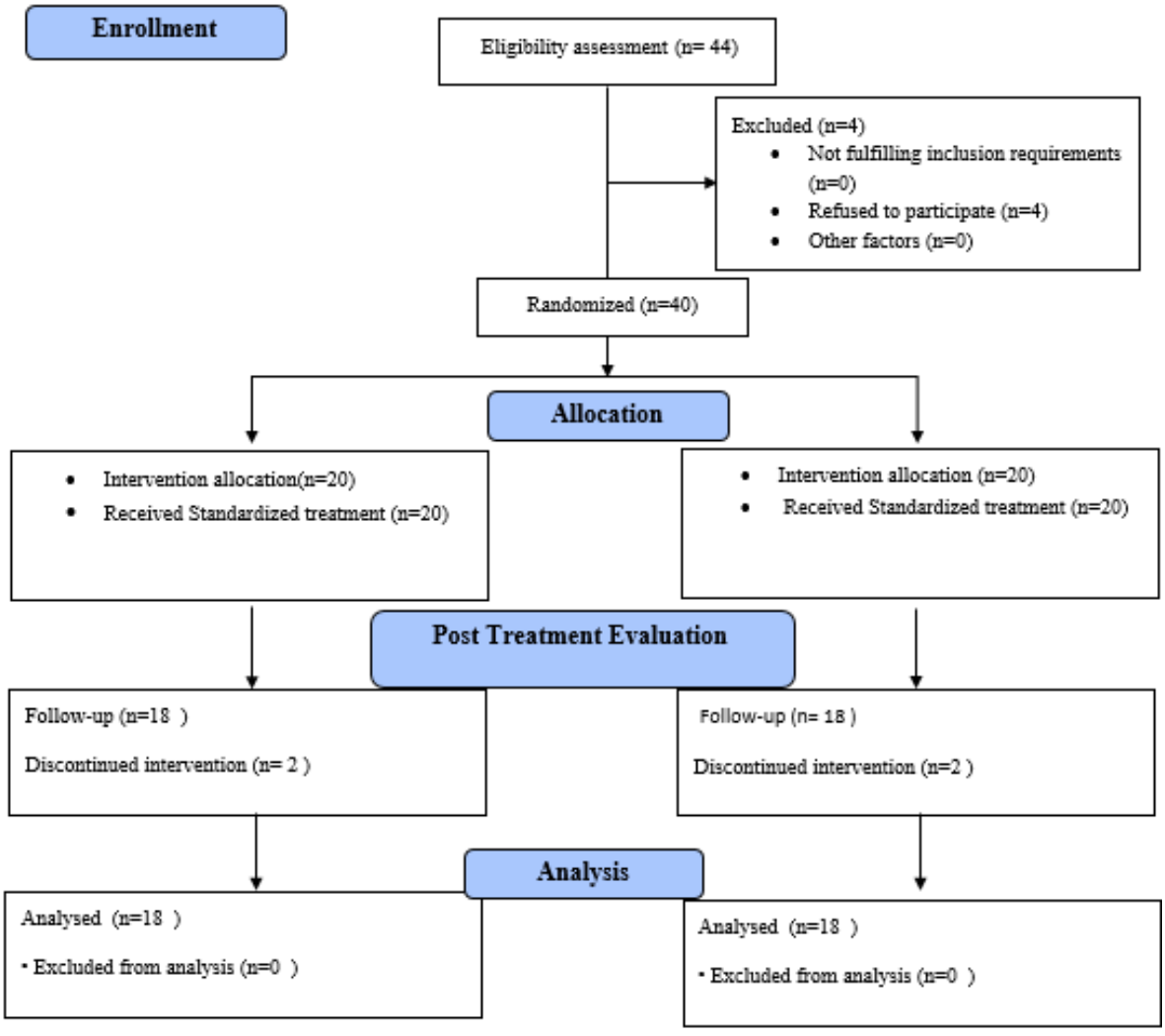
This randomized clinical trial was carried out at Riphah rehabilitation clinic Lahore after getting ethical approval from research ethical committee of Riphah Lahore campus (Ref. No. REC/RCR &AHS/22/0154) from July 2022 to February 2023.This study registered at Clinical Trials with identifier no: NCT05618964. Participants were selected through non probability consecutive sampling. Sample size calculated was 36 by EPITOOL software using NPRS scale (12). With 95% confidence interval. Sample was 40 after 10% attrition rate to manage any drop outs. Inclusion criteria have both male and female within age range 18 to 40 years with mechanical neck pain for more than 3 months and MMT grade less than 6 on Kendal 10 point scale. Patients with recent accidents, neck surgeries, tumor, cervical radiculopathy and vertigo related neck pain were excluded. All were randomly allocated through simple random sealed opaque enveloped method into two groups. Informed consent was taken from all the participants. Outcome measures used were the NPRS, Goniometer and Manual muscle testing. This was a single blinded study in which assessor was blind.

Group A was treated with standardized physiotherapy treatment that includes, Hot pack for 10 minutes, SNAG (6 reps for 60 sec) (13). Superficial neck muscle stretches including Upper trapezius,

levator scapulae and pectoralis Major(14). Neck isometrics were performed 10 times with 6 sec hold (15). These treatments were given three times weekly for four weeks.
Group B was treated with standardized treatment in first 2 weeks and after that deep neck exercises were introduced. Deep neck flexor exercises (2 set of 10 repetitions) that included: Contraction of deep neck flexor muscle in supine and Deep Neck Extensor exercises (2 set of 10 repetitions) that included Contraction of deep neck extensors in quadruped position performed 3 times per week for 4 weeks.

The data was analyzed by using SPSS version 25. Statistical significance was set at p= 0.05. Shapiro-wilk test was used to know normality of data. Most variable values were less than 0.05 which showed that data is not normally distributed and non-parametric tests were applied. For within group analysis Wilcoxon signed-rank-test was used and for between group analyses Mann Whitney-test was used.

CONSORT Diagram



RESULTS
Table 1 showed total number of participants were 36 (Group A Standardized treatment =18 and Group B Deep neck exercises=18). Descriptive data for gender shows, 16 females (44%) and 20 males (56%).

Table 2 showed mean and standard deviation for Age, weight, height, and BMI values for group A and Group B. Mean age of Group A was 34.44 ± 6.45. The mean age of group B was 33.66± 6.97. Mean BMI and standard deviation of the Group A was 23.99 ± 3.80 while the Group B was 24.47 ± 4.06 respectively.
Within Group analysis done by Wilcoxon signed-rank Test for pre and post treatment comparison. Within Group A analysis for NPRS, for ROM of flexion and extension for MMT shows p value <0.001 shown in Table No.3. Within Group B analysis for NPRS, for ROM of flexion and extension for MMT shows p value <0.001 shown in Table No.4.
Between Group A and B analysis done by Mann Whitney-test. The results showed that there was significant difference in post treatment between groups with p value < 0.05 for NPRS for ROM of flexion and extension for MMT as shown in Table No.5.

Figure 1 showed the Clustered Bar graph for all variables for within group analysis.
Figure 2 showed the Bar graph for NPRS for between group analyses. This shows that both treatments were effective in reducing pain but adding Deep neck exercises shows more significant decrease in pain.

Table No 1: Gender of Group A and B Participants

	Treatment Groups			
	Group A (Control Group)		**Group B (Intervention Group)**	
Gender	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**
Male	11	61.1	9	50
Female	7	38.9	9	50
Total	18	100	18	100

Table No 2: Descriptive Statistics of Group A and B Participants

Variables	**Group A (Control)**				**Group B (Intervention)**			
	N	Minimum	Maximum	Mean ± SD	N	Minimum	Maximum	Mean ± SD
Age	18	22	44	34.44±6.45	18	23	45	33.66± 6.97
Height	18	1.57	1.87	1.72± 0.08	18	1.60	1.85	1.71± 0.08
Weight	18	46	95	71.66±14.37	18	45	90	72.11±15.14
BMI	18	16.49	31.25	23.99±3.80	18	17.15	29.30	24.47± 4.06

Table No 3: Within Group-A (Control Group) Analysis

Variables	**Treatment**	**Median**	**Interquartile range**	**z-value**	**p-value**
NPRS	Pre-treatment	6.00	2.00		
	Post- treatment	2.00	2.00	-3.789	<0.001
ROM Flexion	Pre-treatment	30.00	7.50		
	Post- treatment	45.00	6.00	-3.732	<0.001
ROM Extension	Pre-treatment	44.00	10.75		
	Post- treatment	61.50	10.00	-3.726	<0.001
MMT Flexors	Pre-treatment	6.50	2.00		
	Post- treatment	8.00	0.50	-3.866	<0.001
MMT Extensors	Pre-treatment	6.00	1.00		
	Post- treatment	8.00	1.00	-3.816	<0.001

Table No 4: Within Group-B (Intervention Group) Analysis

Variables	Treatment	Median	Interquartile range	z-value	p-value
NPRS	Pre-treatment	5.50	1.00	-3.775	<0.001
	Post- treatment	1.00	1.00		
ROM Flexion	Pre-treatment	35.00	7.50	-3.728	<0.001
	Post- treatment	48.5	5.00		
ROM Extension	Pre-treatment	45.00	2.00	-3.728	<0.001
	Post- treatment	68.50	5.50		
MMT Flexors	Pre-treatment	7.00	1.00	-3.866	<0.001
	Post- treatment	9.00	1.00		
MMT Extensors	Pre-treatment	7.00	2.00	-3.796	<0.001
	Post- treatment	8.50	1.00		

Table No 5: Between Group Analysis

Treatment-variables	Group A (Control Group n=18)		Group B (Intervention Group n=18)		Z-value	p-value
	Median	Interquartile range	Median	Interquartile range		
Pre-NPRS	6.00	2.00	5.5000	1.00	-1.378	0.16
Post-NPRS	2.00	2.00	1.00	1.00	-2.572	<0.05
Pre-Flexion ROM	30.00	7.50	35.00	7.50	-2.733	0.006
Post-Flexion ROM	45.00	6.00	48.00	5.00	-2.998	0.003
Pre-Extension ROM	44.00	10.75	45.00	12.50	-0.191	0.849
Post-Extension ROM	61.50	10.00	68.50	5.500	-2.675	<0.05
Pre-Flexion MMT	6.500	2.00	7.00	1.00	-1.235	0.217
Post-Flexion MMT	8.00	0.50	9.00	1.00	-3.015	< 0.05
Pre-Extensor MMT	6.00	1.00	7.00	1.00	-1.039	0.29
Post-Extensor MMT	8.00	2.00	8.50	1.00	-1.890	<0.05

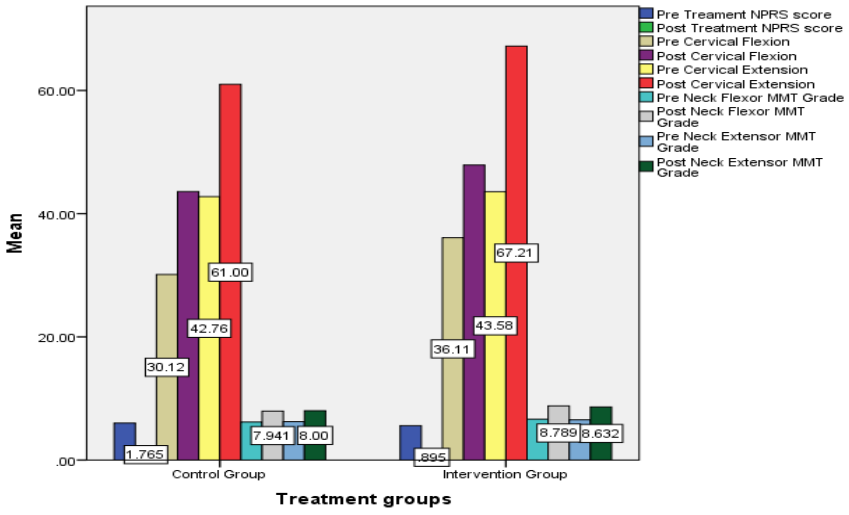


FIGURE 1: Cluster bar graph for within group comparison

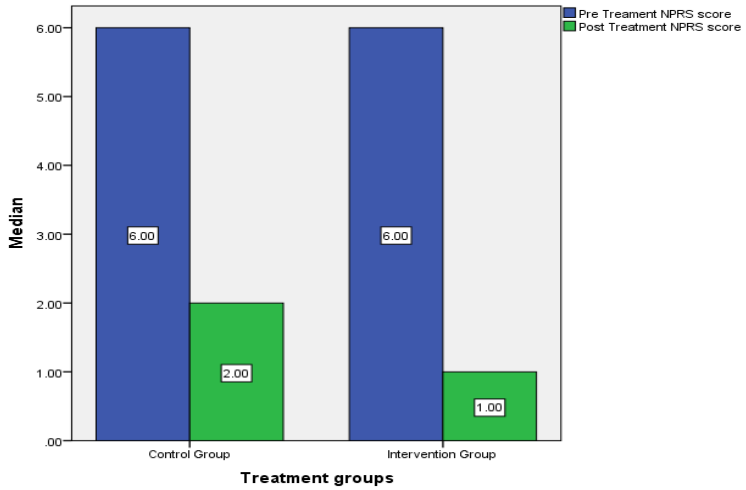


FIGURE 2: Bar graph for NPRS between group comparisons

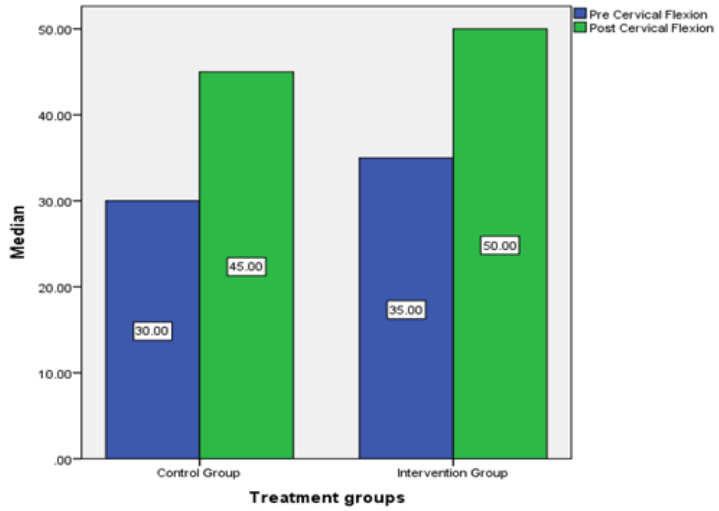


FIGURE 3: Bar graph for cervical flexion ROM between group comparisons

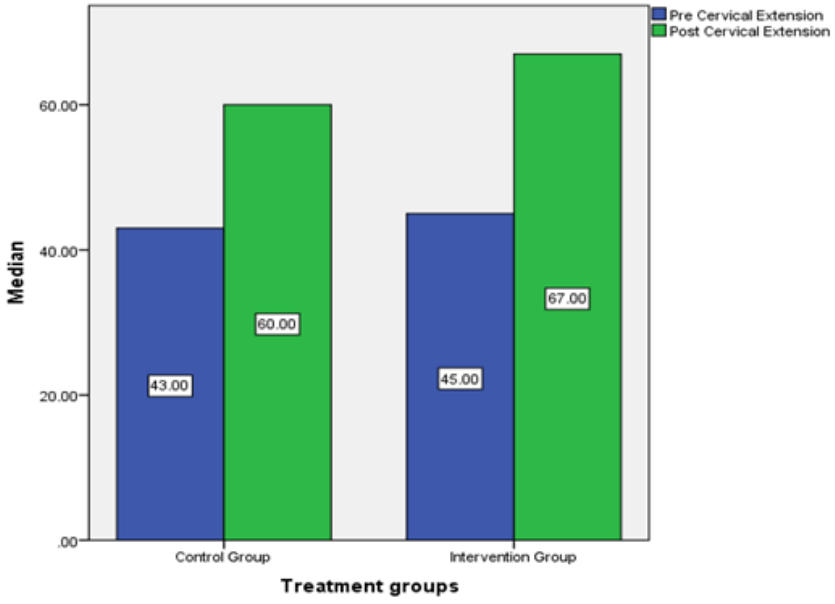


FIGURE 4: Bar graph for cervical extension ROM between group comparisons

DISCUSSION

The current study was a Randomized control trial done to find the effects of deep neck flexor and extensor exercises on pain, range of motion and muscle strength in patients with mechanical neck pain. Total 36 subjects were randomly assigned into two groups. In this study the demographic variables showed similar values between two groups.

The results of this study are quite consistent with previous studies. As in a study done by Suvarnnato et.al in 2019 it was concluded that the outcomes of deep cervical extensor-training and deep cervical flexor training showed benefits over the outcomes of conventional care(6).

In contrast to this in 2017, Buyukturan et al concluded in an RCT that there was no difference between the outcomes of cervical stability training and core stability training(16).

The current study NPRS showed significant difference between the groups. This finding in the current study was in agreement with previous study by Ahmad H. Alghadir et.al in 2021 that worked on two groups, Group A received Conventional treatment and Group B received Deep cervical Flexor training with Pressure biofeedback unit. They concluded that both groups showed improvement in neck pain and forward head posture, but there was significant improvement in the Second group(8). While in another study done by Jacobo Rodríguez-Sanz et al in 2021 where one group received only deep cervical exercise and other group received manual therapy along with deep cervical exercise. Both the groups showed significant reduction in pain intensity but the group involving manual therapy showed more pain alleviation(11). The results of present study was in agreement with another study done by Suvarnnato et.al in 2019 that have reported pain-intensity reduction after deep neck flexor and extensor training in chronic neck-pain patients against the conventional treatment(6).

According to Wilcoxin Test within group analysis showed significant values for both groups. While the range gained at the end of treatment was higher in the treatment group as compared to the other group. In a previous study conducted by Amr Almaz Abdel-Aziem et al in 2022, which was a RCT on three groups. One received baseline treatment and second received McKenzie exercise and third received Deep neck Flexion training. For Cervical mobility DNF group showed significant improvement in ROM as compared to other two groups, which is in line with the current study(17). In another study conducted in 2016 by Kwan-Woo Lee et al where deep craniocervical flexor training and Thoracic manipulation along exercise were compared in an RCT. Concluded that deep flexor training improved ROM but Group receiving manipulation showed more improvement(18).

Strength of cervical Flexor and Extensor measured using manual muscle testing showed quite similar results for both groups. In between group analysis done by Mann Whitney-Test there was significant p-value for post treatment MMT for both groups. In contrast to this Suvarnnato et al in 2019 used dynamometer as measuring tool and concluded that the group receiving specific Deep Cervical muscle training showed significant improvement in strength as compared to the one receiving conventional training(6).Previously, in the study done by Kwan-Woo Lee et al in 2016 the outcomes of Strength were seen between deep craniocervical flexor training and Thoracic manipulation with exercise group and a third group was a control group. Here the strength showed significant improvement along with other variables in both Thoracic manipulation with DNF and DNF alone as compared to the control group (18).

This study had a few limitations as only cervical flexion and extension ranges were measured to see cervical mobility ,also the occupation of participants was not considered while inclusion. But in this study both deep neck flexor and extensor training was included in intervention which was rarely combined in other studies. Study results recommend deep neck flexor and extensor training should be added in intervention to improve cervical function, and reduce pain as it demonstrated excellent effectiveness in the patients with chronic mechanical neck pain.

CONCLUSION

This study showed that both intervention and control groups showed improvement in pain intensity, range of motion and strength but there was significant improvement in the group receiving deep neck flexor and extensor exercises . Therefore it may be necessary to add deep neck flexor and extensor

training along with other treatment methods to achieve effective results in mechanical neck pain patients.

Conflict of Interest: None

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