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Original Article

Efficacy of Exercise Management for Pain and Forward Head Posture in Cervical Spondylosis: A Randomized Controlled Trial

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ABSTRACT

Objective: To determine exercise management for pain and forward head posture in patients with cervical spondylosis.
Study Design: Randomized Control Trial (IRCT20230124057196N2).
Place and Duration of Study: Physical therapy department of Water and Power Development Authority (WAPDA) Teaching Hospital, Lahore, Pakistan, from Jun to Dec 2023.
Methodology: Sixty-eight diagnosed cervical spondylosis patients aged 40-60 years of age were included, randomly allocated into experimental and control groups, 34 in each group. The experimental group received cervical, postural, and shoulder dynamic exercises, while the control group received cervical and postural exercises for the 6th week. Measurement of clinical outcomes, pain via visual analog scale, and forward head posture via craniovertebral angle was taken at baseline and 6th week.
Results: Analysis of 61 patients was conducted with 31 in experimental group and 30 in the control group. Mean age for the experimental and control groups was 52.26±5.98, 52.40±5.69 years respectively. Results showed that there was a statistically and clinically significant difference between the groups from baseline to 6th week in pain $p \leq 0.001$ and forward head posture $p \leq 0.001$, more reduction in pain and forward head posture were observed in the experimental group.
Conclusion: Cervical isometric, postural corrective exercises with shoulder dynamic exercises (experimental group) have a positive effect on patients with cervical spondylosis on clinical outcomes, that was pain and forward head posture.

Keywords: Cervical Spondylosis, Forward Head Posture, Isometric Exercise, Pain, Strengthening Exercise.

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INTRODUCTION

Cervical spondylosis is a degenerative disorder, caused by arthritic changes in the osseocartilaginous components of the cervical spine, clinically characterized by neck pain, myelopathy, and radiculopathy.[1] Incidence of cervical spondylosis is 83 per 100,000, and prevalence is 3.3 per 1000. More common in males than females, a 3:2 ratio occurs after the 4th decade of life in both genders.[2] A recent study reported that the prevalence of cervical spondylosis is high, and myelopathy is almost 62.37% in patients.[3]

Postural imbalance due to muscular weakness is a major cause of wear and tear in spine, has a direct relation to prevalence of cervical spondylosis, and is associated with certain activities, which includes prolong bending of neck.[4] Deep neck flexors and shoulder flexors, abductors, and stabilizers are mainly weaker muscles in cervical spondylitis patients, as reported by a study.[5] Forward head posture (FHP) increases the load on the spine,[6] by imposing compressional force that leads to narrowing of space and entrapment of nerve root. There is a significant relationship between neck pain and forward head posture.[7] FHP alters the proprioception of cervical spine, which leads to progression of cervical spondylosis.[8]

For the management of cervical spondylosis, isometric exercises of superficial and deep flexors are effective for pain and disability in cervical spondylosis.[9] Shoulder dynamic exercises with cervical isometric exercises are used for patients with chronic neck pain and have reported positive clinical outcomes.[10] Training of postural corrective exercises in patients with neck pain and forward head is effective due to a large change observed in CVA.

As previous research proved, muscular weakness causes pain, more postural imbalances, and spinal changes that may lead to forward head posture and other spinal issues that were treated with different treatment protocols, but in current study, we focus on the specific exercise management of forward head posture and pain in cervical spondylosis that was not evaluated before. So, cervical isometric exercises and

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postural corrective exercises are used with and without Shoulder dynamic exercises in patients with cervical spondylosis.

METHODOLOGY

The randomized controlled trial, in which the participants and analyzer were blinded, was executed in the Physical Therapy Department of WAPDA Teaching Hospital, Lahore, Pakistan, from Jun to Dec 2023. Approval for this randomized controlled trial was granted by the ethical committee of the University of Lahore's IRB-UOL-FAHS/119/06/2023 and retrospectively registered with 'Iranian Registry of Clinical Trials' number IRCT20230124057196N2.

The sample was calculated by an online calculator, the Open-Epi tool, taking a confidence interval 95%, a margin of error 5%, mean post-treatment pain after receiving cervical isometric and postural corrected exercises, with shoulder dynamic exercises 3.06±2.06, and treatment pain after receiving cervical isometric and postural corrected exercises 4.04±1.93.[10] The estimated sample size came out to be 68 patients. We recruited 120 patients, and purposive sampling, a type of non-probability sampling technique, was used to counterbalance the sample, which followed the criteria.

Inclusion Criteria: Patients of either gender with an age range from 40 to 60 years, diagnosed with cervical spondylitis by orthopedics and referred to physical therapy department. Their pain is NOT more than 8 on visual analogue scale (VAS) and were included in the study.

Exclusion Criteria: Pregnant females, either gender with a previous history of cervical surgery, having a traumatic history or vertebral compression fracture, having pain of more than 8 on Visual Analogue Scale (VAS), were excluded from the study.

Allocation of participants into groups was carried out by Lottery method, in which every participant was assigned a number, and the numbers were randomly selected into groups. The experimental group and control group each have 34 participants, CONSORT guidelines of study Figure-1. The written informed consent was taken from all the participants; participants remained anonymous throughout the study, there was no disadvantage or risk to the procedure, and they were informed that they were free to withdraw at any time during the process of the study.

Participants completed the assessment, to follow the outcomes of pain and forward head posture, measurement of forward head posture via cranio-vertebral angle (CVA) and visual analogue scale (VAS) for pain.[11] Cranio-vertebral angle (CVA) is an imaginary line passing between the C7 to the tragus of the ear and a horizontal line to C7, Figure-2 which is normally less than 50; a lesser CVA indicates a greater FHP. CVA can be measured by observational and instrumental methods such as cervical range of motion instrument, electronic head posture instrument, photogrammetry, and plain radiograph imaging. Patients' positions can be sitting or standing.[12] In current study photogrammetry method was used to measure CVA, which is non-invasive and reliable, and a sensitive and cost-effective method.[13] while patient was sitting on a chair. Assessment was carried out at baseline (Before) and 6th week (After) of the treatment.

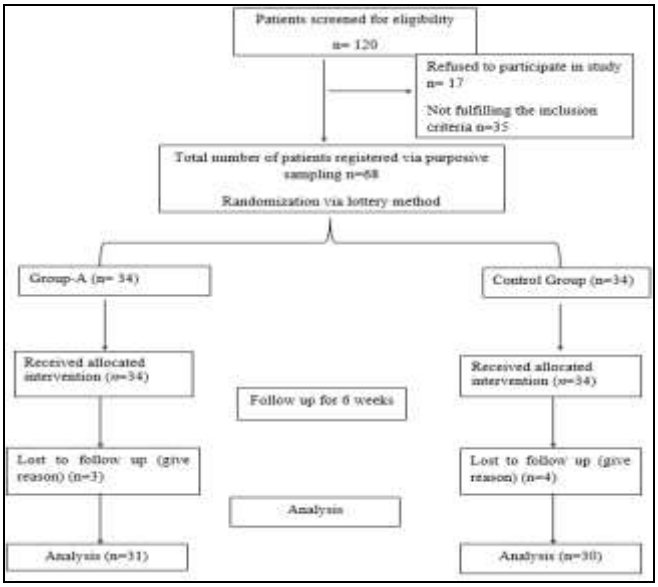

Figure-1: Consort Guidelines of Study

After the initial assessment and allocation of participants in groups, participants received the strengthening exercise program for both groups. The patient's position during the exercise session was chair sitting, in which the back of the patient was fully supported to maintain the alignment of the spine.

Group-A (experimental group) received cervical isometric and postural corrected exercises with shoulder dynamic exercises, which include (isometric of all cervical muscles and shoulder muscles. For shoulder dynamic exercises, free weights (wrist cuff weight) were used from half a kg to one-half kg,

progression was made in 3 stages, after every 2 weeks. In first stage 10 repetition of each exercise of cervical isometric, postural corrective exercises and shoulder dynamic exercises with half kg for first two week (1st and 2nd week), in second stage 10 repetition of each exercise of cervical isometric, postural corrective exercises and shoulder dynamic exercises with one kg for next two week (3rd and 4th week), in final stage10 repetition of each exercise of cervical isometric, postural corrective exercises and shoulder dynamic exercises with one and half kg for next two week (5th and 6th week). Each exercise plan involves four sessions per week over 6 weeks of period. Each session includes 10 repetitions of each exercise, 3 sets with 10 sec rest between the sets. There was total 24 sessions.

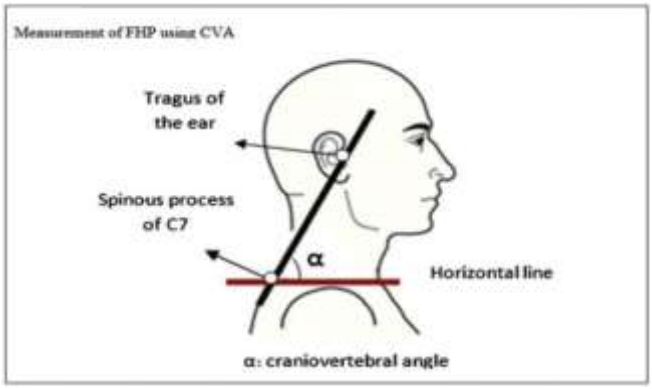

Figure-2: Measurement of Craniovertebral Angle with the CAV from Google

Group-B (control group) received cervical isometric and postural corrected exercises only. The progression was made in 3 stages, after every 2 weeks. In first stage 10 repetition of each exercise of cervical isometric and postural corrective exercises (1st and 2nd week), in second stage 15 repetition of each exercise of cervical isometric and postural corrective exercises a for next two week (3rd and 4th week) in final stage20 repetition of each exercise of cervical isometric and postural corrective exercises and shoulder dynamic exercises with one and half kg for next two week. Each exercise plan involves four sessions per week over 6 weeks of period. Each session includes 3 sets with 10 sec rest between the sets. There was total 24 sessions.

The data was tabulated and analyzed using a statistical package for social sciences (SPSS) version 24. The qualitative variables were presented with percentages such as gender. The quantitative variables age, height, weight and BMI were presented with mean and standard deviation. Median (IQR) was calculated for visual analog scale. Normality of data was checked by Kolmogorov–Smirnov test for variable pain and forward head posture, pain via VAS and forward head via CVA data of variable find not normally distributed so Wilcoxon test was used to compare the outcome variables at baseline (pre-treatment) at 6th week (post treatment), *p*-value less than and equal to 0.05 was considered as significant.

RESULTS

Final analysis of sixty-one participants age ranges from 40 – 60 years were made at the end of study, thirty-one in experimental group, mean age in year 52.26±5.98, and thirty in control group mean age in year 52.40±5.69. Gender frequency and percentage in the groups are following, 17(54.8%) male and 14(45.2%) female in experimental group 20(66.7%) male and 10(33.3%) females in control group. Weight in kilogram and height in feet was measured by participants and represented in Table-I.

Table-I: Descriptive statistics of Demographic Characteristics (n=61)

Demographic Characteristics	Group-A n=31	Group-B n=30
Gender		
Male	17(54.8%)	20(66.7%)
Female	13(45.2%)	10(33.3%)
Age (years)	52.26±5.98	52.40±5.69
Weight (kg)	93.83±5.53	95.36±5.31
Height (feet's)	5.43±0.37	5.62±0.38
BMI (kg/m^2)	34.73±4.32	33.22±4.49

The results showed statistically significant improvement in pain and forward head posture of cervical spondylosis patients from baseline (pre-treatment) to 6th week (post-treatment) in both groups (*p value*=0.005). For experimental group median (IQR) at base-line (pre-treatment) was 7 (2) while 6th week (post-treatment) median was 3 (1) whereas for control group median (IQR) at base-line (pre-treatment) was 7(2) while 6th week (post-treatment) median was 4 (2) for pain via VAS was represented in Table-II, according to *p*-value<0.001 for factor significant improvement was seen in pain from baseline (per treatment) till 6th week (post treatment).

Comparison between the groups forward head posture via CVA with *p*-value was represented in Table-III, the *p*-value shows that there is significant improvement between the groups in term pain and forward head posture from baseline (per treatment) till 6th week (post treatment). The experimental group

showed a significant improvement in the 6th week in term of forward head posture.

TABLE-II: Comparison of Groups at Baseline (Per treatment) and 6th week (post-treatment) of Pain (VAS) (n=61)

GROUP	Pain (VAS)	Median (IQR)	*p*-value
Group-A (n=31)	Pre – Treatment	7(2)	<0.001
	Post- Treatment	3(1)	
Group-B (n=30)	Pre – Treatment	7(2)	<0.001
	Post- Treatment	4(2)	

Table-III: Comparison at Baseline (Per treatment) and 6th week (post-treatment) of Forward Head Posture (CVA) (n=61)

GROUP	Forward head posture	Median (IQR)	*p*-value
Group-A (n=31)	Pre – Treatment	44 (2)	<0.001
	Post- Treatment	48 (2)	
Group-B (n=30)	Pre – Treatment	41 (1)	<0.001
	Post- Treatment	45 (2)	

DISCUSSION

This is a comparative study of cervical isometric exercises and postural corrective exercises with and without Shoulder dynamic exercises, which was done in the middle-aged population diagnosed with cervical spondylitis to investigate the pain and forward posture of cervical spondylosis. Literature has informed about muscular weakness and bad postural issues that may lead to cervical and shoulder muscle weakness. Mylonas *et al*., investigated the muscular weakness that showed the cervical flexor muscles(superficial and deep) are weaker than extensors, and strength training is more beneficial in decreasing pain and increasing muscle strength of the cervical muscles.[14]

Shoulder muscle weakness is also evident in posture-related issues that lead to forward head posture, which compromises different shoulder muscles, including shoulder abductors and retractors, in patients with cervical spondylosis as reported in a study by Saleh *et al*.,[15] Do *et al*., proved that shoulder exercises are effective in cervical spondylosis and chronic neck pain, but the mechanism is still unknown but they have found good results clinically.[16] Hence, Lee *at al*., conducted a study about shoulder retractors training in reduction of pain but no previous researches was done about shoulder strengthening so the current study try to fulfill the literature gap, cervical isometric and postural corrective exercises with shoulder dynamic exercises was used to determine the effects on pain and forward head posture and reported positive clinical outcomes same as chronic neck pain.[10]

Muscular imbalances and spinal wear and tear lead to bad posture and Biomechanical changes in natural curvatures of the spine, leading to straightening of cervical spine and altered normal lordotic curve by decreasing the craniovertebral angle, which is normally 49.9, that proceeds to forward head posture in patients of cervical spondylosis as reported by Ha *et al*.,[17] A systematic review was done by Hoseini et al., which investigated the positive results of postural corrective exercises in neck pain and forward head posture, because great improvement was observed in CVA.[11] Fu *et al*., reported that forward head posture was improved by strength training of neck and upper back muscles.[18] The direct measurement of craniovertebral angle in the pre and post-stages of treatment was not done in previous literature, but in the current study, the forward head posture by using the craniovertebral angle was measured in both stages of treatment.

So results demonstrated positive effects on pain and forward head posture in both experimental and control groups, but a greater reduction of pain and forward head posture was observed in the experimental group. So, the treatment protocol of cervical isometric exercises and postural corrective exercises with shoulder dynamic exercises is more significant for decreasing pain and forward head posture in patients with cervical spondylosis.

LIMITATIONS OF STUDY

This study was conducted at a single center, which may limit the generalizability of the findings. The sample size was relatively small, potentially reducing statistical power. Additionally, the short follow-up period may not capture long-term outcomes.

CONCLUSION

Current study results showed that cervical isometric, postural corrective exercises with shoulder dynamic exercises (experimental group) have a positive effect on patients with cervical spondylosis on clinical outcomes that were pain and forward posture, as compared to cervical isometric, postural corrective exercises without shoulder dynamic exercises(control group). There are significant differences that were observed between the groups. So, we can conclude that shoulder exercise should be an integral part for cervical spondylosis patients.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MUH & AA: Data acquisition, data analysis, critical review, approval of the final version to be published.

HQA & MM: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

KH: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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