

Research Article

Effects of Shoulder Exercises with and Without Cervical Exercises on Pain and Function in the Patients with Cervical Spondylosis: Randomized Controlled Trial

Anam Ashfaq,¹ Iqra Waseem,² Mariam Umer Hayat,³ Syed Asadullah Arslan,⁴ Kamran Hanif⁵

¹⁻⁵University Institute of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Pakistan

Abstract

Background: Cervical spondylosis is a chronic, degenerative, progressive disease of osteocartilagenous component of cervical spine that is usually age related and more common in men than in women, with a peak incidence between the ages of 40 and 60 years for both men and women.

Objective: The aim of the study is to determine effects of shoulder exercises with and without cervical exercises on pain and function in patients with cervical spondylosis.

Methods: Sixty eight diagnosed cervical spondylosis patients with 30-60 years of age were selected and randomly allocated in experimental and control groups, 34 in each group. The study was conducted in the physical therapy department of WAPDA hospital, Lahore. All participants were following the 6 weeks supervised exercise program, 4 sessions per week. Experimental group received shoulder exercises with cervical exercises while the control group received cervical exercises. Clinical outcomes were measured with visual analog scale for pain and neck disability index for function.

Results: Analysis of final 61 patients were included, 31 in experimental and 30 in control (3 and 4 patients did not follow the study completely). Mean aged for experimental and control group was 49.39 ± 7.022 and 49.23 ± 6.704 respectively. Results showed that there was statically and clinically significance difference that as observed in from of reduction of pain $P=0.001$ and improvement of function $P=0.01$

Conclusion: Overall improvement was observed in both groups, results of study shows that shoulder exercises with cervical isometric exercises were more beneficial for outcomes of pain and function in experimental group. So we can conclude that shoulder exercise should be an integral part of treatment for cervical spondylosis patients.

Corresponding Author | Anam Ashfaq, University Institute of Physical Therapy, Faculty of Allied Health Sciences, The University of Lahore, Pakistan. **E-mail:** anam.ashfaq9242@gmail.com

Keywords | Cervical Spondylosis, Pain, Function, Isometric Exercise, Randomized Controlled Trial, Neck Disability Index, Exercise

Introduction

Cervical spondylosis is a degenerative process of the cervical spine that involves degeneration of

disc, facet joint, cervical vertebra and surrounding soft tissues.¹ Cervical spondylosis is directly related to the age, as the age increases the wear and tear in osteo-cartilagenous parts of spine shows the degenerative changes on radiographs and the most common site for degenerative changes are intervertebral disc and facet joints in spine.² Age is the most common risk factor but some other are ergonomics activities such as high pillow,



Production and Hosting by KEMU

<https://doi.org/10.21649/akemu.v30i1.5220>
2079-7192/© 2024 The Author(s). Published by Annals of KEMU on behalf of King Edward Medical University Lahore, Pakistan.
This is an open access article under the CC BY4.0 license
<http://creativecommons.org/licenses/by/4.0/>

prolonged use of computer, abnormal posture during reading, excessive bending, traumatic injuries like flexion injury 3 are the risk factors for cervical spondylosis. The possible reason for cervical spondylosis is the compressional forces that cause wear and tear in spine and loss of normal spinal height and curve.⁴

In the 4th and 5th decade of life, more symptomatic changes are most commonly observed in cervical spine (1) and remain asymptomatic under the age of 40.5 The incidence of cervical spondylosis is 83 per 100000 and prevalence is 3.3 per 1000 in population and more common in male than female with the ratio of 3:2.⁶ Clinically cervical spondylosis are represented with mechanical neck pain/axial pain and pain aggravated by movement and relieved by the rest is main sign of cervical spondylosis,⁷ almost 66%,⁸ study reported that 85% of cervical spondylosis cases represented as neck pain.⁵ Cervical spondylosis with radiculopathy (due to compression and inflammation of cervical nerve roots) and myelopathy (due to the inflammation and compression of cervical cord) are two other representations.⁷ Prevalence of cervical spondylosis is high in sub-continent 54% in Pakistan in general sitting 9 and 56% India.¹⁰

Cervical spondylosis is highly prevalent and continued with age, therefore different protocols are used for the management of degenerative pain, that includes pharmacological and non-pharmacological and as well as surgical.¹¹ The patients with no neurologic symptoms commonly treated by the oral analgesics, muscle relaxant, glucocorticoid injections and brief immobilization by cervical collar and physical therapy.¹² Physical therapy is effective for the management of pain with and without neurological defects and includes electrotherapy and exercise therapy and some manual procedure neural tissue mobilization, manual traction mulligan techniques.¹³

Number of studies reported that exercises therapy is most effective method for cervical spondylosis patients on pain and flexibility of soft tissue that improve the daily activities of livings.^{14,15} Strengthening exercises for spondylosis is acceptable which include both isometric and isotonic have significant effects on clinical outcomes.¹⁶ Researchers reported that strengthening of superficial and deep flexors isometric exercises are effective for cervical spondylosis. While unilateral and bilateral stretches are commonly used program.¹⁷ Stretching and post isometric relaxation are the techniques

that was used for pectoralis major and serratus anterior muscle with cervical isometric exercises and reported that have effective in decrease pain and improve function.¹⁸ Both supervised and home plan are used for cervical spondylosis, but the study reported that supervised sessions of cervical exercises are more effective than home plan.¹⁹

Shoulder exercises with cervical isometric exercises are effective for the management of neck pain, as previously used for patients with chronic neck pain and reported that shoulder exercises with cervical exercise are more effective than only cervical isometric exercises for the management of chronic neck pain.²⁰ However the effects of shoulder exercises remains questionable, number of studies has focused on the significance of neck strengthening in cervical spondylosis, no study so far as we know that determine the effects of shoulder strengthening in patients with cervical spondylosis. Some previous studies demonstrated the effect of shoulder training on pain and function and reports that the shoulder strengthening exercises do not only reduce pain and improve function of the cervical spine. So, in the current study, an exercise program was carried out that includes the neck exercises with and without shoulder strengthening exercises to determine the effects on pain and function in the patients with cervical spondylosis. The primary aim of this study was to determine the effects of cervical isometric exercises with shoulder exercises on pain and the secondary aim was effect of cervical isometric exercises with shoulder exercises to improve on function in cervical spondylosis patients.

Methods

Randomized controlled trial was conducted in the physical therapy department of WAPDA teaching hospital, Lahore. The participants of the current study were diagnosed patients of cervical spondylosis referred by the orthopedic. The inclusion criteria of the current study includes both male and female, aged 30-60 years¹¹, no previous history of trauma, surgery and diagnosed patients by orthopedic.²¹ Pregnant women, history of previous cervical surgery, vertebral compression fracture, neurological deficit, history of malignancy, rheumatoid disorder and other systemic problems, any infectious disease like osteomyelitis, tuberculosis, ankylosing spondylitis were excluded. Purposive sampling was

used in the current study, which is type of non-probability sampling technique, to counter the sample size. The calculation of sample size was done by open epi tool, that was 28 in each group after adding 20% dropout 34 in each group, 68 overall.

The rules and regulations set by the ethical committee of university of Lahore were followed while conducting the research. Informed consent (attached) was taken from all the participants, Participants remained anonymous throughout the study and subjects were informed that there are no disadvantages or risks of the procedure.

Once the above mentioned inclusion and exclusion criteria were taken into account, potential participants were considered. The researcher took a complete history of the demographic characteristic of participants; patients with cervical spondylosis were assessed for clinical outcomes by using visual analog scale (VAS) for pain and Neck Pain Disability Index Questionnaire for function at baseline. Participants were randomly allocated into the experimental and control group by lottery method, 34 in one of each group.

Isometric exercise protocol was used in current study; experimental group received a combined exercise protocol which includes cervical isometrics with shoulder isometrics. The component of isometric exercise program for experimental group includes cervical flexors, cervical extensors rotator and side flexors of cervical with shoulder flexors, shoulder extensor, shoulder rotators and shoulder adductor and abductors isometrics. However the control group received cervical isometrics only, component of cervical isometrics includes cervical flexors, cervical extensors, cervical rotator and side flexors of cervical. The progression in exercise plan was made in three stages by increases the repetition and sets of exercises for both group. First stage consist on the 3 sets, 10 repetitions with 10 seconds hold for each exercise for first 2 weeks (1st and 2nd week). 1 min rest was given after each set of exercise. Second stage consist on the 4 sets, 20 repetitions with 15 seconds hold for next two weeks (3rd and 4th week) 1 min rest was given after each set of exercise. Third and final stages consist on the 5 sets, 30 repetitions with 20 seconds hold for last two week (5th and 6th week) Each exercise plan includes four sessions per week, total of 24 sessions over 6 weeks of period. Each session lasted for 40-50 minutes. All exercises were performed by

therapist while patient was in sitting position.

The researcher reassessed the patient and completed Neck Pain Disability Index Questionnaire with VAS at 3rd and 6th week of treatment as the part of the subjective assessment. The data was tabulated and analyzed using a statistical package for social sciences (SPSS) version 24. The qualitative variables like gender, marital status, and socio economic status were presented with frequency and bar charts or pie charts. The quantitative variables age, height, weight, body mass index and visual analog scale were presented with mean and standard deviation. After checking the normality of the data was checked by using test Kolmogorov Semenov, data was not normally distributed so non-parametric test was used to compare the outcome variables at different follow ups. P value less than and equal to 0.05 was considered as significant.

Results

Sixty-eighth diagnosed patients with cervical spondylosis referred by orthopedic were included in the study. The study was carried out in the physical therapy department of WAPDA Teaching Hospital, Lahore. Patients' inclusions occurred in April 2022 to August 2022. All patients were randomly allocated in the experimental and control group, 34 in each group. There were three dropouts in the experimental group and four dropouts in the control group due to health related problems and some personal reasons. Final analysis of sixty one patients (31 in experimental group and 30 in control group) was carried out and represented in results, shown in study flow Figure I.

Characteristic of the participants of current study were represented in table I & II that consist on quantitative variables age, height, weight, body mass index and visual analog scale and NDI were represented with mean and standard deviation in Table I and qualitative variables gender, marital status and working status that were analyzed by descriptive statistics and represented in percentage in Table II.

Normality of data was checked by using Kolmogorov Semenov test because data was not normally distributed two-way non- parametric Friedman test was used to compare means of outcome variables pain and function. Table II and Figure III describe the mean change in pain in both groups with SD, the statistical and clinical signi-

ficance was observed in both groups but more changes were observed in the experimental group with $P=0.001$. Results showed that the exercise protocol that was neck isometric exercises with shoulder exercises were more statistically and clinically effective for the patient with cervical spondylosis.

Table III and Figure IV describe the mean change in function that was measured by neck disability index for both groups with SD. Results described that the continuous improvement was seen in both groups. Statistically the difference was measured in the experimental group with p value 0.03. Overall both types of exercises protocol were effective but neck isometric exercises and posture correction with shoulder exercises showed more improvement in patients with cervical spondylosis.

Table II: Represented the qualitative variables like gender, marital status, and socio economic status were presented with frequency.

Table 1: Participant Characteristics:

Demographic Characteristics Of Subjects	Experimental Group N=31	Control Group N=30
Age	49.39 ±7.022	49.23 ±6.704
Weight	88.65 ±11.06	89.40 ±11.15
Height	5.12 ± 0.19	5.08 ± 0.17
BMI	36.48 ± 4.77	37.12 ± 4.53
VAS	7.32 ± 0.94	7.80 ± 0.761
NDI at Baseline	34.13±3.263	35.10±3.881

Table 2: Represented quantitative variables with mean and standard deviation for both groups.

Frequency	Experiment Group	Control Group
Gender		
Male	54%	66%
Female	45%	33%
Marital Status		
Married	30	26
Single	1	4
Working Status		
Currently Working Male	14	13
Currently Working Male	3	8
House Wife	9	5
Working Female	5	4

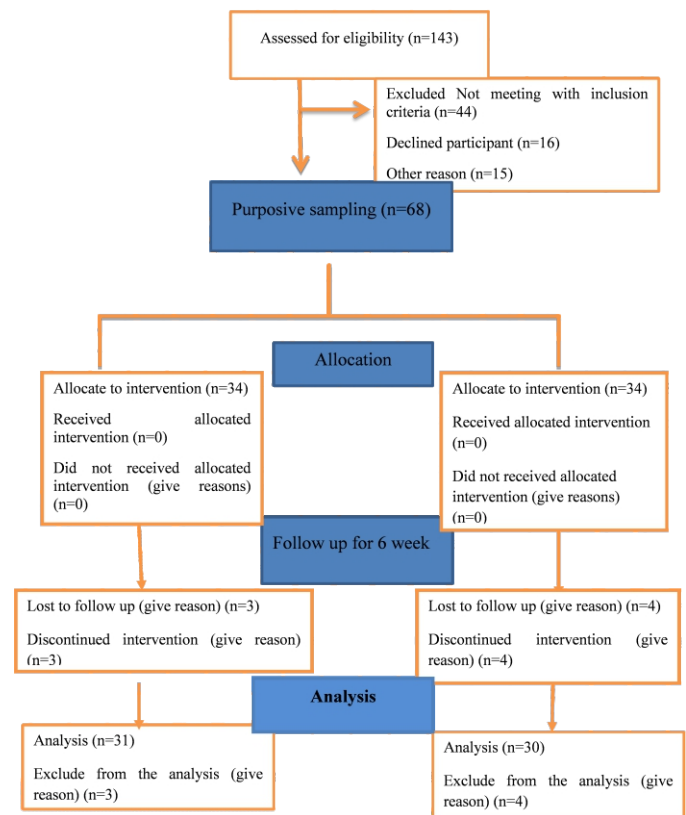


Figure 1: Consort Guidelines

Table II represent the mean of Pain intensity by used VAS at different follow up, 7.32 ± 0.94 and 7.80 ± 0.76 at baseline, 6.48 ± 0.72 and 6.93 ± 0.69 at 3rd week, 3.37 ± 0.75

Table 3: Mean pain intensity at Different Follow Up

Groups	Experimental group Mean ± SD, n=31	Control group Mean ±SD, n=30	P value
VAS at Baseline	7.32±0.94	7.80±0.76	0.002
VAS at 3 rd week	6.48±0.72	6.93±0.69	0.001
VAS at 6 th week	3.37±0.75	3.67±0.60	0.003

and 3.67 ± 0.60 at 6th week in both experimental and control groups respectively.

Table III represented the mean of neck disability at different follow up, 34.13 ± 3.263 and 35.10 ± 3.881 at

Table 4: Mean Of Neck Disability Index at Different Follow Up

Groups	Experimental group Mean ± SD, n=31	Control group Mean ±SD, n=30	P value
NDI at Baseline	34.13±3.263	35.10±3.881	0.010
NDI at 3 rd week	25.65±3.039	31.93±3.965	0.005
NDI at 6 th week	18.06±3.183	28.27±3.648	0.039

baseline, 25.65 ± 3.039 and 31.93 ± 3.965 at 3rd week, 18.06 ± 3.183 and 28.27 ± 3.648 at 6th week in experimental group and control group respectively

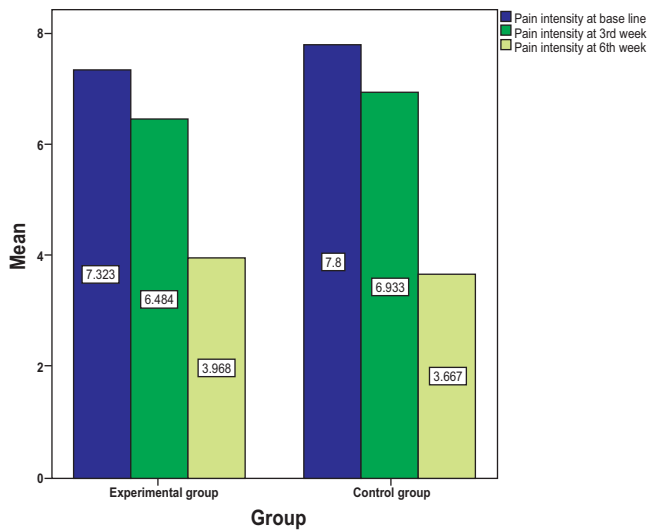


Figure 2: Mean Change in Pain in Both Groups

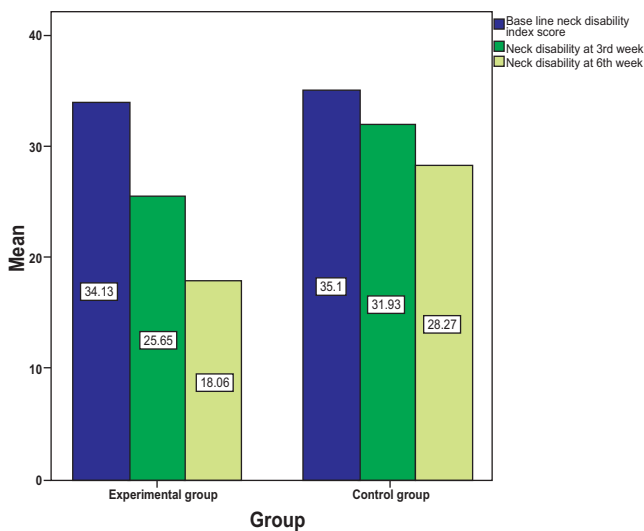


Figure 3: Mean Change in Function

Discussion

The current study was a comparative study to investigate the effects of cervical isometric exercises with and without shoulder exercises on pain and function in patients with cervical spondylosis. Results demonstrated the positive measures in pain and function in both experimental and control groups. More reduction of pain and more improvement in function were seen in the experimental group, so we can state that cervical isometric exercises with shoulder exercises were more significant for the patients with cervical spondylosis to improve

the subjective measures.

Literature 7 supported that neck pain in neck is one of the most common clinical representations of cervical spondylosis so pain was the main outcome for current study, measured by using VAS. Participants of the current study were represented with moderate to severe neck pain. A marked reduction in neck pain was observed clinically and statistically $P=0.001$ by using the combined protocol of cervical isometric with shoulder exercises. Number of studies^{16,21} reported that cervical isometric exercises were effective in reduction of neck pain. The possible reason for neck pain reduction with cervical isometric exercises is due to the strengthening of the superficial and deep cervical flexors muscle as these muscles are prone to weak.²² Shoulder exercises were not used to measure the neck pain for cervical spondylosis patients previously as far as we know but shoulder exercises were used for neck pain with chronic neck pain patients 21 and demonstrated the positive effects in reduction of neck pain that are almost similar to the current study.

Functional loss is also observed in the patients with cervical spondylosis, it is mainly due to pain, decrease range of motion (ROM) and stiffness of neck.³ Function of the neck was measured in the current study. The second main variable, functional level was measured by using the neck disability index questionnaire and reported in three readings, first at baseline, second at 3rd and third at 6th week to compare the functional improvement in both groups. The improvement of functional level was observed clinically and statistically $P=0.01$ with the combined protocol of cervical isometric with shoulder exercises.

Previously 23 strength training of shoulder retractors was used and reported that it is suitable for cervical spondylosis patients to decrease the pain and improve the function, the mechanism through which shoulder exercises were effective in cervical spondylosis is unknown but clinically improvement was reported. All previous research only used shoulder retractor's strength training, but the other groups of shoulder muscle (flexors, extensors, internal and external rotators, abductors and adductors) remained untouched, so in current study exercises of all groups of shoulder muscles included.

As far as we know all previous studies^{24,25} pain and functional improvement in cervical spondylosis measured

and reported in pre and post analysis, but in current study analysis of subjective outcomes were measured at baseline, at 3rd week and at 6th week to evaluate continuous improvement in subjective outcomes that were pain and functional level. Supervised four sessions per week at alternated days with progression in repetition method was used in current study because the previous research 20 reported that supervised sessions for patients with cervical spondylosis were more effective in clinical measures as compared to unsupervised and home plan.

The current study was conducted to find the combined effect of cervical isometric with shoulder exercises on the patients with cervical spondylosis because as far as we know no previous study demonstrated the effects of shoulder exercise on patients with cervical spondylosis. Clinical outcome, pain and function were measured and found positive results, so findings of current study show that shoulder exercises should be used as treatment for cervical spondylosis patients because shoulder exercises have positive effects on clinical outcome. There are some limitations of the study such as no isolated effects of cervical and shoulder strengthening treatment groups were included. Long lasting effects of shoulder exercises were not assessed in current study. The medications used before and during study were not controlled. Recommendation for upcoming research should assess the long lasting effects of shoulder exercises on cervical spondylosis. Isolated effects and mechanism of shoulder strengthening exercises should be measured in further research.

Conclusion

Current study results show that cervical isometric with shoulder exercises have more positive effects in patients with cervical spondylosis on subjective outcomes such as pain and function. Overall improvement was observed in both groups, more reduction in pain and enhancement of function were seen in the experimental group $P=0.001$ and $P=0.01$ respectively. So we can conclude that shoulder exercise should be an integral part of exercise therapy for cervical spondylosis patients.

Ethical Approval: The Research Ethical Committee of University of Lahore approved this study vide letter no. REC-UOL/149-06/2022/

Conflict of Interest: The authors declare no conflict

of interest.

Funding Source: None

Authors' Contribution:

AA: Study concept & design, writing manuscript

IW: Study design, data collection, data analysis, writing manuscript

MUH: Critical review of manuscript

SAA: Proofreading of manuscript

KH: Data analysis and interpretation

Reference

1. Kelly JC, Groarke PJ, Butler JS, Poynton AR, O'Byrne JM. The natural history and clinical syndromes of degenerative cervical spondylosis. *Advances in orthopedics*. 2012;2012(1):62-70..
2. Qian Y, Yu Z, Liu Z, Duan W, Zhao Z, Zheng H, et al. Optimal Time Period of Wearing Protective Collar After Anterior Cervical Discectomy and Fusion. 2020.
3. Srivastava R, Prasad R. Management of Cervical Spondylosis through Exercises and Asanas.
4. Ferrara LA. The biomechanics of cervical spondylosis. *Advances in orthopedics*. 2012;2012.
5. Matsumoto M, Fujimura Y, Suzuki N, Nishi Y, Nakamura M, Yabe Y, et al. MRI of cervical intervertebral discs in asymptomatic subjects. *The Journal of bone and joint surgery British volume*. 1998;80(1):19-24.
6. Hurwitz EL, Randhawa K, Yu H, Côté P, Haldeman S. The Global Spine Care Initiative: a summary of the global burden of low back and neck pain studies. *European Spine Journal*. 2018;27(1):796-801.
7. Voorhies RM. Cervical spondylosis: recognition, differential diagnosis, and management. *Ochsner Journal*. 2001;3(2):78-84.
8. Wieser ES, Wang JC. Surgery for neck pain. *Neurosurgery*. 2007;60(suppl_1):S1-51-S1-6.
9. Waseem I, Tanveer F, Fatima A. Conventional physical therapy with low level laser therapy on pain and functional disability in patients of upper trapezius muscle trigger point. *Rawal Medical Journal*. 2020;45(4): 854-6.
10. Amrithaa B, Mohanraj KG. Prevalence of cervical spondylosis among bike riders in South Indian population-A population-based study. *Drug Invention Today*.

- 2019;12(11):39-45.
11. Lv Y, Tian W, Chen D, Liu Y, Wang L, Duan F. The prevalence and associated factors of symptomatic cervical Spondylosis in Chinese adults: a community-based cross-sectional study. *BMC Musculoskeletal Disorders*. 2018;19(1):1-12.
 12. Liang L, Cui X, Feng M, Zhou S, Yin X, He F, et al. The effectiveness of exercise on cervical radiculopathy: A protocol for systematic review and meta-analysis. *Medicine*. 2019;98(35):75-81.
 13. Damgaard P, Bartels EM, Ris I, Christensen R, Juul-Kristensen B. Evidence of physiotherapy interventions for patients with chronic neck pain: a systematic review of randomised controlled trials. *International Scholarly Research Notices*. 2013;2013(1)12-19..
 14. Abdel-aziem AA, Draz AH. Efficacy of deep neck flexor exercise for neck pain: A randomized controlled study. *Turkish Journal of Physical Medicine & Rehabilitation/ Turkiye Fiziksel Tip ve Rehabilitasyon Dergisi*. 2016; 62(2):25-31
 15. Aslan Telci E, Karaduman A. Effects of three different conservative treatments on pain, disability, quality of life, and mood in patients with cervical spondylosis. *Rheumatology international*. 2012;32(1):1033-40.
 16. O'Riordan C, Clifford A, Van De Ven P, Nelson J. Chronic neck pain and exercise interventions: frequency, intensity, time, and type principle. *Archives of physical medicine and rehabilitation*. 2014;95(4):770-83.
 17. Diab AA, Moustafa IM. The efficacy of forward head correction on nerve root function and pain in cervical spondylotic radiculopathy: a randomized trial. *Clinical rehabilitation*. 2012;26(4):351-61.
 18. Shenouda M. Efficacy of Stretching Exercises Versus Postisometric Relaxation Technique on Pain, Functional Disability and Range of Motion in Patients with Cervical Spondylosis. A Randomized controlled trial. *Bull Fac Ph Th Cairo Univ*. 2012;17(2):73-80.
 19. Ibrahim AA, Kamel EM, Mahmoud WSE, Atteya MRM. Comparative study between supervised and unsupervised exercise program for cervical spondylosis. *Health Sciences*. 2018;7(6):1-10.
 20. Dusunceli Y, Ozturk C, Atamaz F, Hepguler S, Durmaz B. Efficacy of neck stabilization exercises for neck pain: a randomized controlled study. *Journal of rehabilitation medicine*. 2009;41(8):626.
 21. Alpayci M, Ilter S. Isometric exercise for the cervical extensors can help restore physiological lordosis and reduce neck pain: a randomized controlled trial. *American journal of physical medicine & rehabilitation*. 2017; 96(9):621-6.
 22. Saleh MSM, Rehab NI, Sharaf MAF. Effect of deep cervical flexors training on neck proprioception, pain, muscle strength and dizziness in patients with cervical spondylosis: A randomized controlled trial. *Phys Ther Rehabil*. 2018;5(1):14.
 23. Do YL, Nam CW, Sung YB, Kim K, Lee HY. Changes in rounded shoulder posture and forward head posture according to exercise methods. *Journal of physical therapy science*. 2017;29(10):1824-7.
 24. Andersen LL, Kjaer M, SØgaard K, Hansen L, Kryger AI, Sjøgaard G. Effect of two contrasting types of physical exercise on chronic neck muscle pain. *Arthritis Care & Research: Official Journal of the American College of Rheumatology*. 2008;59(1):84-91.
 25. Abdulwahab SS, Sabbahi M. Neck retractions, cervical root decompression, and radicular pain. *Journal of Orthopaedic & Sports Physical Therapy*. 2000; 30(1):4-12.