

Effects of thoracic mobility versus stretching exercise program on pain, range of motion and function in patients of cervical radiculopathy

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Objective: To determine the effects of thoracic mobility versus stretching exercise program on pain, Range of motion and function in cervical radiculopathy patient.

Method: The randomized control trial (RCT) was conducted at District Headquarters (DHQ) hospital, Bahawalnagar. A total of 44 patients with one sided radicular pain having chronic pain greater than four weeks of age 35-55 years were randomized into two groups. Group A got thoracic mobility and Group B got thoracic stretching exercises while both had the standard physical therapy program, (neck traction, a heated pack, and stretches). Each patient had three treatments each week on alternate days, lasting between 30 and 45 minutes each. Assessments of pain, range of motion, and function using the Numeric Pain Rating Scale (NPRS), goniometer, and Neck Disability Indexes (NDI) were made at three-week and six-week marks to track the effects over the long term.

Result: Forty-four patients of both sexes, 22 in each of group. Both groups explained significant difference ($p < 0.05$) for Pain with the mean rank of 17.98 and 27.02 at post treatment of Group A and B respectively. NDI result were also significant ($p < 0.05$) with mean \pm SD of 7.13 ± 3.87 and 8.7 ± 5.1 of Group A and B. There was also significant difference of ROM (< 0.05) at post treatment. Follow up assessment also had significant result ($p < 0.05$)

Conclusion: The study concluded that both mobility and stretching exercises program had same results on pain, disability but stretching exercises were more effective in gaining ROM.

Keywords: Thoracic spine, Cervical Radiculopathy, Thoracic mobility Exercises, Thoracic stretching exercises, conventional, neck disability index.

Introduction: -

The Inflammation and compression of whole nerves or roots of nerves cause neurological problems which is known as cervical radiculopathy. The knowledge of its causing factors is insufficient, so it's impossible to make estimation of prevalence and incident rate of cervical

radiculopathy. Signs and symptoms of cervical radiculopathy are dependent on severity level of neurological problem and the involvement of segments.^[1]

Cervical radiculopathy has very strong negative effects on individual's cognitive health, body functions as well as on societal involvement due to its disabling condition.^[2] The signs and symptoms of this disease are nerve related and consist of cervical and arm pain, muscle dystrophy, abnormal sensory stimulations and areflexia/dysreflexia. Individuals which have cervical radiculopathy presents some alteration in sensory stimulation like numbness (mechanoreceptors, thermoreceptors and vibration) and hyperthermia and pressure intolerance. In physiotherapy, some conventional protocols are mostly given to clients for cervical radiculopathy as a starting treatment. It is stated that glides and low or high intensity thrusts of vertebral column (cervical region) are beneficial to improve the mobility of cervical , pain and daily living activity.^[3, 4]

Cervical pain is at number four in those diseases which are most common reason of long-term impairment over the world. Cervical discomfort is almost appearing in 3rd or 4th decades. The spreading rate of this condition surpasses 35% and it is more prevalent in women.^[5] The illness shows different variance in histories, but is primarily defined "cyclic or Repetitive". This might be the case given the connection between the issue and several physical, physiological and societal factors. People with neck ache have also been noted to in reduction of range of motion in upper back.^[6]

Thoracic vertebra's play an important role to support the body mechanics and enhance its functions as well as a main character in sports activities. When we talk about biomechanics, thoracic curvature has contribution in more than half of whole power and motion force. In cervical and pectoral girdle problems, treatments which target the thoracic vertebrae are said to be highly recommended and give us beneficial results. If therapists continue their work to evaluate and adopt the different types of exercises then it can help them to update their prescription of upper back exercises in an advance way.^[7]

People with cervical discomfort experiences functional and structural abnormalities, including a weakening of muscles in the cervical region. Muscular weakness results in strength impairment, decreased movement of mid back, and also restrict the ADL's, Latest research has demonstrated that thoracic region mobilisation and manipulative thrusts can help patients with neck-ache.^[8] Physical therapy that focuses on thoracic extensive locomotion have

shown the alleviation in pain and dysfunction. Glides and mobilisation improve locomotion by doing oscillatory movements of spine in those regions where locomotion is restricted. Diagnostic tools upper back mobilisations alleviate discomfort, enhance locomotion and also decrease shoulder disability.

In individuals with CR, physiotherapy is useful in improving discomfort, ADLs, and range of motion. Exercises and physical treatment procedures are included in an effort to enlarge the canal between foramen which is related to injured roots of nerves.^[9] The thoracic vertebrae brace the neck vertebrae via juncture between the neck and thorax, and also influences the dynamics of upper back.^[10]

It was also discovered that thoracic vertebra's motility was adversely connected with the intensity of cervical discomfort in investigation on the relationship between vertical thoracic motility and cervical pain. So, it is proved that manual therapy of both neck and thorax region plays important role in terms of pain reduction. The study shown that manual therapy can be utilised as an intervention of cervical radiculopathy, although precautions must be taken. Risk factors for cervical radiculopathy include overall medical health, occupational environment, physical characteristics, socio-economic level, and physiological condition.^[11]

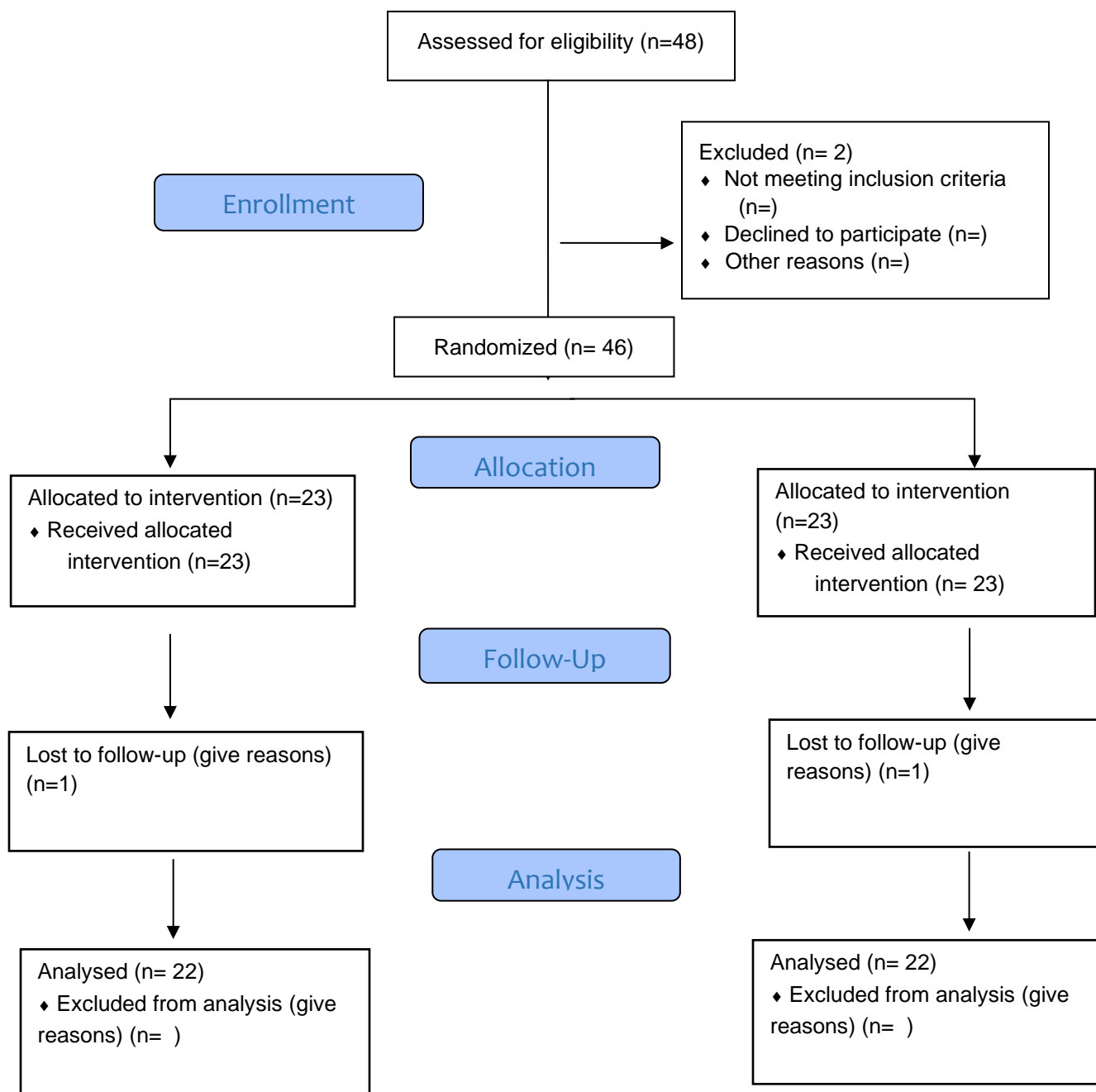
The current study was designed to find out the effects of thoracic mobility versus thoracic stretching exercise on ache, ROM and disability in cervical radiculopathy patients. The purpose of this study was that we could get the evidence about comparison of mobilization and stretching exercises by focusing on the thoracic compartment which could improve functions and daily living activities, and would guide future researchers to add more treatment strategies like postural training and biomechanical training in order to treat cervical radiculopathy.

Materials and Methods:

The study design was Randomized clinical trial. (IRCT#NCT05404646). The research conducted at DHQ Bahawalnagar. Duration of this research was 10 months after approval of BASR. Total sample size of 40 was calculated from epitool by using ROM (neck Extension variable).^[3] A 20% attrition rate will be added which makes the sample size a total of 44. Non- probability convenience sampling technique was used to recruit the subjects. The inclusion criteria included both males and females, Age ≥ 25 and ≤ 55 , patients having one sided radicular pain, NPRS > 4 , patients with ≥ 4 -week chronic pain and patients that met the standards of Wainner (Distraction test, Slump test, ULTT). While patients with history of Fractures, red Flags, rheumatoid arthritis, deficiency in

nervous system, spinal cord injury, cancer and disturbances in vascular system are in exclusion criteria of the research. Study was performed into two groups, patients of group A received thoracic mobility with evidenced based conventional physical therapy ((hot pack, traction, stretching exercises) ^[6, 7] and patients in group B received thoracic stretching exercises with evidence based conventional physical-therapy (hot pack, manual therapy and exercise therapy). Data was collected through tools NPRS (numeric pain rating scale), Goniometry and NDI (neck disability index). NPRS is a common technique for measuring pain using full Numerals, the client is asked to rate their level of pain on a range from zero to ten while using the scale. On this, lowest number denotes the absence of pain and highest denotes the degree of suffering.^[12] Goniometry is the scientific term for the measurement of joint's range in each joint plane. It is a tool that may be used to check the angle of any particular point. Cervical ranges will be evaluated with the help of this device.^[13] NDI is now a widely used tool for assessing neck pain-related self-rated disability. Scores range from zero to five for each of the ten questions. The top score is fifty.^[14]

In interventional protocols, Group A received mobility for the thoracic. These methods for inspecting and treating joints include joint mobilisation, joint manipulation, and gliding. These methods were applied in this instance to mobilise the thoracic. In this course of treatment, the patient received neck stretches, mobility exercises (Unilateral posterior anterior, Central posterior anterior, and transverse glides), a hot pack (10 minutes), and cervical traction. For three weeks, sessions were held three times a week on different days, lasting a total of 45 minutes. ^[15, 16] While Group B received stretching exercise for the thorax. Exercises that stretch the thoracic region's muscles were utilised to correct them. Stretching exercises were given to the group, including passive stretch (thoracic extension while sitting, wall angle stretch), therapist-led exercises (seated mid-thoracic stretch, prone mid-thoracic stretch), a hot pack (10 minutes), neck stretches (neck flexors, extensors, side benders), and tractions. For three weeks, sessions were held three times a week on different days, lasting a total of 45 minutes. The research only included eligible patients who met the inclusion requirements. Baseline assessment was done, and patients were randomly allocated to the two groups. A 3-weeks treatment protocol was given to the patients with thrice a week on alternate days. To know the long-term effects of the two treatment protocols a 6-week follow-up assessment was also being done, using NPRS, goniometer and NDI. The methodology and aim of this research were explained to all the individuals before to get the permission. Subject allocation is shown in consort diagram of figure 1.

Figure 1: CONSORT 2010 Flow Diagram**Data Analysis Procedure: -**

SPSS version 21 was used to analyse the data. Normality tests were used to verify the data's normality. Depending on the situation, parametric or non-parametric tests were used. In parametric

testing, the independent and paired t test as well as the repeated measure anova were utilised. The non-parametric test employed the Friedman's test and the Man Whitney test.

Results: -

Demographic data:

Forty-four participants were recruited in the study and results showed that there were 29 males and 15 females. Baseline data of marital status showed that 31 participants were married and 13 were unmarried. Table 1 shows mean age, height and BMI in both groups (Group A and B).

Table 1: Demographics data

Variables	Group A(mobility) N=22	Group B (stretching) N=22
	Mean (SD)	Mean (SD)
Age (years)	41.2±7.41	41.09±7.84
Height (cm)	167.31±7.77	167.31±7.77
Weight (kg)	65.5±14.25	65.5±14.25
BMI	23.46±4.057	23.46±4.057

Within Group Analysis:

Table 2 showed the NPRS pain score with in Group comparison. P value of both Group was 0.00 which shows the significant difference between pre and post treatment and as well as follow up values. Group B shows the more decrease in mean rank after treatment but Group A shows the more decrease of Mean rank value at follow up assessment.

Table 2: With in Group Comparison of NPRS pain score (Friedman test)

	Median rank		Mean rank		P-value
	Group A	Group B	Group A	Group B	
Pretreatment	6.1	7.00	3.00	3.00	

Posttreatment	1.00	2.00	1.57	1.34	<0.05
Follow-up	1.00	2.00	1.43	1.66	

Table 3 A repeated measure anova with a Greenhouse-Grassers correction was used to elaborate the effects with in groups. The result showed that there was significant result within group because p value was < 0.05. Between group Result showed that both groups had same effects on disability because there was no significant difference in p value, because p value was 0.295 which is more than 0.05.

Table 3: With in group and between group comparison of NDI

	Group A(mobility) (Mean±SD)	Group B (stretching) (Mean±SD)	P-value
Pre treatment	25.41±5.971	25.36±6.521	0.295
Post Treatment (3 week)	7.13±3.87	8.7±5.1	
Follow up (6 week)	7.04±3.78	9.63±5.07	
P value	<0.05	<0.05	

Table 4: showed the ROM of Flexion, Extension, right lateral flexion and left lateral flexion at pre and post treatment within group (paired sample t test). P-value was significant for both groups as it was less than .05

Table 4: ROM pre and post treatment with in group (paired sample t test)

Treatment groups of subject		Mean±SD	Mean difference	P-value
Group A N=22	Pre-treatment ROM of Flexion	32.6±8.02	-40.4	< 0.05
	Post-treatment ROM of Flexion	73.0±6.24		
Group B N=22	Pre-treatment ROM of Flexion	33.9±8.63	-13.36	< 0.05
	Post-treatment ROM of Flexion	47.2±5.71		
Group A N=22	Pre-treatment ROM of Extension	41.18±9.92	-33.27	< 0.05
	Post-treatment ROM of Extension	74.45±4.10		
Group B N=22	Pre-treatment ROM of Extension	40.7±7.04	-6.72	< 0.05
	Post-treatment ROM of Extension	47.5±4.42		
Group A N=22	Pre-treatment (left lateral flexion)	31±6.03	-11.5	< 0.05
	Post-treatment (left lateral flexion)	42.5±2.17		
Group B N=22	Pre-treatment (left lateral flexion)	29.2±5.29	-4.11	< 0.05
	Post-treatment (left lateral flexion)	33.3±4.30		
Group A N=22	Pre-treatment (right lateral flexion)	30.2±3.4	-12.7	< 0.05
	Post-treatment (right lateral flexion)	43.0±1.70		
Group B N=22	Pre-treatment (right lateral flexion)	28.1±4.8	-3.7	< 0.05
	Post-treatment (right lateral flexion)	31.9±3.9		

Between the group analysis:

Table 5 showed Between group comparison of pre, post treatment and follow up of NPRS pain score. Results of mean rank, median rank and Z value of both the group's showed statistically significant difference ($p < 0.05$) by using non parametric Mann-Whitney test.

Table 5: Between Group Comparison of NPRS pain score (Man Whitney test)

	Group	N	Mean Rank	Median	Z score	P value
Pain pre treatment	Mobility	22	21.95	7	-.292	.771
	Stretching	22	23.05			
Pain Post treatment	Mobility	22	17.98	2	-2.452	.014
	Stretching	22	27.02			
Pain follow-up	Mobility	22	18.55	1	-2.199	.028
	Stretching	22	26.45			

Table 6 described the ROM of flexion, extension, right lateral flexion and left lateral flexion at pre and post treatment between group (independent t test). P-value for all variables is significant for both groups. P value (0.000) is less than 0.05 so it shows the significantly difference across the group.

Table 6: ROMs pre and post treatment between the group (independent t test)

	Group A	Group B	Mean Difference	P value
Flexion ROM				
Pre treatment	32.6±8.02	33.9±8.63	-1.22	.628
Post treatment	73.0±6.24	47.2±5.71	2.58	< 0.05
Extension ROM				
Pre treatment	41.1±9.92	40.7±7.04	.409	.875

Post treatment	74.4±4.10	47.5±4.42	26.95	< 0.05
Right lateral flexion ROM				
Pre treatment	30.63±3.5	28.1±4.8	2.45	.063
Post treatment	42.5±1.9	31.9±3.9	10.54	< 0.05
Left lateral flexion ROM				
Pre treatment	31.0±6.03	29.2±5.29	1.77	.306
Post treatment	42.5±2.17	33.3±4.30	9.18	<0.05

Discussion:

This study was performed to check the effectiveness of both mobility and stretching thoracic Exercise's program on cervical radiculopathy. The figures and facts of this study showed that both treatment groups had almost similar effects in terms of pain and disability but somehow showed a little bit difference in ROM values and elaborated that stretching exercises were more effective in gaining range of motion. Result of follow up sessions showed that treatment had long term effect in reduction of pain and gaining of function.

To find out the effect of exercises of thoracic region on neck pain and disability Ronald Schenk et al Performed a work in 2022 and elaborated that there was a strong effect of thoracic exercises but also explained that these effects were not long lasting. So this study supported the effects of intervention both mobility and stretching exercises but rejected the long lasting effects of them.^[17] The present study explained the positive effects of stretching exercises of thoracic region on pain, ROM and disability in CR patients so it was also confirmed in another study done by Na Yeon kang in 2022. That study showed the effects of extension exercises which was also called stretching exercises of thoracic spine and other manual therapies and elaborated that these exercises had strong effect on pain and ROM but in contrast did not explain the effect on disability.^[18]

Rose Fagnoli et conducted a work in 2021 to check out the efficacy of manual work or exercises on discomfort and limited function. The study elaborated the benefits and excellent result of

techniques that's mean the study also proved and was in favour of the effects of mobility and stretching exercises in CR patients.^[19]

According to this study both techniques were equally effective in terms of pain as well as disability in CR. Friedman test and Man Whitney test was used to check the pain value which was recorded less than 0.05 and disability was concluded through repeated measure anova and its p value was also significant which showed benefits of both mobility and stretching exercises. It was also confirmed by meta-analysis done by Long Liang and Minshan Fang in 2019 which proved the efficacy of exercises on pain and disability in CR and this meta-analysis supported this present research.^[4]

This study showed that thoracic mobility (mobilization) work had a great effect on pain, disability and ROM, and also proved the long-term effects of it. So it was also verified and supported by the study which was done by Ian a Young in 2019 in which proved that manual therapy on thoracic had a significant effect on pain, Disability and ROM in CR but in contrast it showed the immediate and short term effects of these techniques but did not prove their long term efficiency.^[15]

Current study showed the significant result of mobility exercises in which mobilization were used to treat the patient having cervical radiculopathy and had discomfort, disability and impairment. Participants showed better result with p value of < 0.05 in contrast Adlina Penneti in 2018 concluded that alone mobilization was not effective in gaining function and reducing pain. This study showed that when mobilization was used with other techniques like postural stability exercises and biomechanics education then results were better and more effective.^[20]

Limitation of study:

The limitation of study was that there were few literatures present on these techniques in terms of comparison for cervical radiculopathy so it was difficult to get evidence on these interventions. Lack of knowledge of participants and limited resources. No other cervical problems were included.

Conclusion:

It was concluded that both mobility and thoracic stretching exercises programs had significant results on pain, disability but stretching exercises were more effective in gaining ROM. It was also concluded that both exercises had significant result at 6th weeks of follow up.

Recommendations:

Comparison of mobility and stretching exercises should also check on acute neck pain. Follow up of study should be 8 to 12 weeks to check the accurate effectiveness of techniques. It is also recommended that future study should also cover the work of these intervention on hand grip. Further studies should also include the strengthening exercises on thoracic region for CR patients.

Ethical approval: The study received approval from the institutional review board of “Ripah International Univeristy” on 23 december, 2021 with registration number “ S21C14G30024”.

Patients consent: Informed consent was taken from all participants before applying the intervention or data collection.

Conflict of interest: Authors revealed no competing interest.

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