

# Effects of Thoracic Manipulation in patients with Cervical Radiculopathy: a randomized control trial

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## Abstract

**Objective:** To determine the effects of Thoracic manipulation on Pain, Cervical and Thoracic range of motions as well as Neck disability in patients with Cervical Radiculopathy.

**Study design:** It is a Randomized Control Trial Study.

**Place and duration of study:** A Six-month study was carried out in The Physiotherapy Clinic, Saidpur Road, Rawalpindi. (from January 2023 to July 2023)

**Material and Methods:** 44 patients in accordance to the inclusion exclusion criteria were randomly allocated through sealed enveloped method in Group A (Thoracic manipulation) and B (SNAGS) i.e. Group A (n=22) and Group B (n=22). Both groups received conventional therapy including IFT, hot pack and stretching for SCM, levator scapulae etc. The frequency of treatment was 3 sessions per week for a total of 4 weeks. Variables of the study were Numeric pain rating scale (NPRS), Neck disability index (NDI), cervical and thoracic range of motions.

**Results:** Between group Analysis shows that there was no significant difference in effects of thoracic manipulation and SNAGS with p value > 0.05 in all variables i.e. NPRS, NDI, Cervical ranges, thoracic ranges.

**Conclusion:** Both techniques i.e. thoracic manipulation and SNAGS are equally effective in reducing neck pain, improving range of motion in cervical and thoracic spine and reducing neck disability in patients with cervical radiculopathy.

**Keywords:** Cervical radiculopathy, NPRS, NDI, SNAGS, Thoracic range of motion, Thoracic manipulation

## 1. Introduction

Cervical radiculopathy, commonly called "Pinched Nerve," is a neurological ailment brought on by underlying musculoskeletal conditions, such as herniated discs and degenerative changes in the cervical spine that cause the intervertebral foramen to narrow or become stenosed.<sup>1</sup> The nerve root at the corresponding foramen is compressed as a result of this constriction. Numbness, tingling, discomfort, and motor weakness in the neck and upper extremity are signs of a compressed nerve root.<sup>2</sup> The cervical radiculopathy is often unilateral, but in severe cases, it can be bilateral where nerve roots are compressed on both sides.

The pathological condition associated with compression and inflammation of the cervical spinal nerve or nerve root is known as cervical radiculopathy. Herniated cervical discs and cervical spondylosis are the two main causes of cervical radiculopathy.<sup>3</sup> Only 21.9% of cervical radiculopathy cases are caused by disc herniation.<sup>4</sup> Tumors, trauma, synovial cysts, meningeal cysts, Dural arteriovenous fistulae, or twisted vertebral arteries cause cervical radiculopathy.<sup>5</sup>

Cervical radiculopathy, is a wide condition with multiple causes of pathology that can afflict persons of any age but peaks in prevalence between the ages of 40 and 50.<sup>6</sup>

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The most prevalent type of lesions, according to historical studies comparing radiological, clinical, and surgical data, are C7 root lesions. The most frequent form of cervical root lesion is a compressive radiculopathy. Compressive lesions can also be brought on by focal masses like tumors or infectious diseases, though less frequently.<sup>7</sup>

Cervical radiculopathies are characterized by discomfort, sensory as well as motor impairment of area served by the afflicted nerve root. The pain itself is described in a variety of ways that can include aching, lancinating, or burning sensations.<sup>8</sup> Neck discomfort, paresthesia, muscle weakness in a myotomal pattern, reflex impairment or loss, headaches, scapular pain, sensory and motor dysfunction in the upper extremities, and neck pain are typical symptoms of cervical radiculopathy.<sup>9</sup> Stiff neck, a reduction in the cervical spine's range of motion (ROM), secondary musculoskeletal problems, a shortening of the muscles that support the neck (the upper fibres of the trapezius, scalene, and levator scapulae) may also occur

Common physiotherapy techniques used for the treatment of cervical radiculopathy includes Cervical Traction, Heating pad, strengthening techniques.<sup>10</sup> Manual techniques include positional release technique, muscle energy technique, myofascial release technique, Cyriax technique, NAGS and SNAGS, manual pressure release, proprioceptive neuromuscular facilitation and ischemic compression.

Thoracic spine manipulation a high-velocity/low amplitude movement or "thrust" directed at any segment of the thoracic spine. Recent research has shown that Thoracic Joint Manipulation directed to the thoracic spine provides a therapeutic benefit to patients with neck pain and has been suggested as an appropriate strategy to minimize the risks associated with manipulation of the cervical spine.<sup>10</sup> Sustained Natural apophyseal glides are proved to be an effective treatment for cervical radiculopathy in improving pain, cervical and thoracic range of motions.

There are many manual therapy techniques which are effective in reducing pain, improving ROM, improving functional disability including Sustained natural apophyseal glides and thoracic manipulation. There is lack of evidence to allow conclusions to be drawn about

the effectiveness of Thoracic manipulation combines with. Therefore, in this study we have checked the effectiveness of thoracic manipulation for decreasing pain, improving cervical and thoracic ranges and functional disability in patients with cervical radiculopathy. Parent article that claimed SNAGS was useful for radiculopathy in the long run had a number of flaws, including a small sample size and inadequate follow-ups. This study's evaluation of the effects of thoracic manipulation on the upper thoracic spine, which becomes dysfunctional as a result of lower cervical spine diseases, is equally significant. Comparing the results of thoracic manipulation and SNAGS is the study's goal.

The objective of this study was determine the effects of Thoracic manipulation on Pain, Cervical and Thoracic range of motions as well as Neck disability in patients with Cervical Radiculopathy.

## 2. Materials & Methods

A Randomized controlled trial (RCT) was conducted at the Physiotherapy clinic, satellite town Rawalpindi from January to July 2023. After the approval from Riphah international university ethics review committee, BASR and permission from the physiotherapy clinic the RCT was registered under the international RCT registry which was NCT05749835. Ethical values during study were considered on priority. Sample size was calculated using GPower application through post treatment values of cervical ROM. Total sample size is 44; 22 participants in each group.<sup>11</sup> Non probability purposive sampling was used and patients were randomly allocated using sealed envelope method in group A and B, 22 participants in each group.

Patients included in the study lied between the age of 18 to 40 years,<sup>12</sup> patients complaining of pain in cervical spine and paresthesia travelling from the neck into arm, forearm and hand,<sup>13</sup> patients having cervical lateral flexion and rotation of the involved side less than 60 degree, patients having positive score on 3 out of 4 test i.e. spurling test, upper limb neurodynamic test median nerve, cervical distraction test, painful and limited cervical rotation,<sup>14</sup> patients having Hypomobility at T1-T5 thoracic vertebrae on springing test were also included in the study.<sup>15</sup> Those participants who had any history of VBI, cervical surgeries, trauma or fracture of

cervical spine, history of osteoporosis and any congenital deformity were excluded from the study

For the sake of study, patient that came to clinical setting with complaint of neck pain, diagnosis of their problem was done based on, symptoms and special tests (spurling test) after that if they were diagnosed as Cervical-radiculopathy patients then verbal as well as written consent was taken from the patients before study and after their consent patients were included in research. After that patients were divided into two groups, groups A (SNAGS+ Thoracic manipulation) and group B (SNAGS), randomly using sealed enveloped method in which an envelope is opened and the patient is then offered the allocated treatment regimen, labeled as snags and thoracic manipulation, to ensure transparency in randomization. After allocation baseline readings were obtained by using tools like numeric pain rating scale for pain, inclinometer was used for measuring flexion and extension, side bending and rotational ranges and NDI for functional activity status. After obtaining the baseline values, physiotherapy session was given and intervention is applied based on their group and again readings were obtained using above mention tools and these readings were labeled as after session day 1 readings and patient were guided for home plan and similar protocol is repeated and data was recorded at 2nd and 4th week of the study. To ensure confidentiality data was self-collected and analyzed. All patients were provided with complete information about the study and intervention and written informed consent was signed before the treatment program in English/Urdu according to the need.

Data was analyzed with SPSS version 25. Normality of data was checked through Shapiro-wilk. Demographics and descriptive data was presented in form of percentages, frequencies and mean + SD.

### 3. Results

Total 44 patients were treated in this study with mean age  $43.84 \pm 10.24$  years with min age 27 years and max age 65 years. The patients were equally divided, 22 each into both groups. Mean age of patients in group A and group B was  $42.36 \pm 11.21$  years and  $45.31 \pm 9.19$  years respectively. (54.5%) patients were male and 20 (45.5%) patients were female. In group A 11 (50%) were male and 11 (50%) were female while in group B 13 (59.1%) were male and 9 (40.9%) were female.

Mixed way ANOVA was used to compare and determine the time and interaction effects of two groups. The variance and covariance was greater than .05 measured from box plot and lavene's test respectively. That fulfilled the assumption of normality to use the mixed way ANOVA. To examine the effects of time and intervention on NPRS p-value = 0.21 indicate that the intervention had no discernible primary impact. However, there was a significant main impact of time with a p-value of 0.001. Furthermore p-value = 0.85 indicated that there was no significant relationship between the intervention and the time. For cervical flexion. p-value = 0.55 indicate that the intervention's main effect was not statistically significant. However, there was an appreciable primary impact of time with a p-value of 0.001. Additionally, the relationship between treatment and time, was not statistically significant and had a p-value of 0.20. For cervical extension. p-value = 0.15 indicate that the intervention's main effect was not statistically significant. The main effect of time, however, was significant with a p-value of 0.001. Furthermore, p-value = 0.20 indicated that there was not a significant connection between the intervention and time. For right side bending. F-value (1, 42) = 0.01 and p-value = 0.90 indicate that the intervention's main effect was not statistically significant. The main effect of time, however, was significant with an F (1, 42) value of 641 and a p-value of 0.001. Likewise, F (1, 42) = 0.90 and p-value = 0.53 indicated that there was not a significant connection between the intervention and time. For left side bending to examine the effects of intervention and time. F-value (1, 42) = 0.02 and p-value = 0.86 indicate that the intervention's main effect was not statistically significant. The main effect of time, however, was significant with a F (1, 42) value of 672 and a p-value of 0.001. Furthermore, F (1, 42) = 1.6 and p-value = 0.21 indicated that there was no significant interaction between the intervention and time.

For left side bending to examine the effects of intervention and time. F-value (1, 42) = 0.02 and p-value = 0.86 indicate that the intervention's main effect was not statistically significant. The main effect of time, however, was significant with a F (1, 42) value of 672 and a p-value of 0.001. Furthermore, F (1, 42) = 1.6 and p-value = 0.21 indicated that there was no significant interaction between the intervention and time. For left rotation, a two-way mixed ANOVA was performed. F-value (1, 42) = 0.02 and p-value = 0.86 indicated that the

main effect of the intervention was insignificant.  $F(1, 42) = 1398$  and  $p$ -value = 0.001 indicated that the main effect of time was significant. Furthermore,  $F(1, 42) = 1.10$ ,  $p = 0.31$ , and the interaction between time and intervention was not statistically significant. For NDI to examine the effects of intervention and time.  $F$ -value  $(1, 42) = 1.7$  and  $p$ -value = 0.19 indicate that the intervention's main effect was not statistically significant. Yet, there was a noteworthy main effect of time with a  $p$ -value of 0.001 and  $F(1, 42) = 6438$ . A substantial relationship between the intervention and time was also present, with  $F(1, 42) = 0.25$  and a  $p$ -value of 0.006.

For thoracic flexion to examine the effects of intervention and time.  $F$ -value  $(1, 42) = 0.02$  and  $p$ -value = 0.86 indicated that there was no significant main effect of the intervention.  $F(1, 42) = 6121$  and  $p$ -value = 0.001 indicated that the main effect of time was significant. Furthermore,  $F(1, 42) = 0.17$  and a  $p$ -value of 0.83 indicated that there was no significant interaction between the intervention and time. For Thoracic extension. The main effect of the intervention was not statistically significant, with  $F$ -value  $(1, 42) = 2.8$  and  $p$ -value = 0.96. The main effect of time, however, was significant with a  $F(1, 42)$  value of 19200 and a  $p$ -value of 0.001. Furthermore,  $F(1, 42) = 2.5$ ,  $p$ -value = 0.08, indicated that there was no significant interaction between the intervention and time. For right lateral bending.  $F$ -value  $(1, 42) = 0.0009$  and  $p$ -value = 0.92 indicate that the intervention's main effect was not statistically significant. The main effect of time, however, was significant with a  $p$ -value of 0.001 and  $F(1, 42) = 4043$ . A significant relationship among intervention and time was also present, with  $F(1, 42) = 0.02$  and a  $p$ -value of 0.95. For left lateral bending to examine the effects of intervention and time.  $F$ -value  $(1, 42) = 0.0009$  and  $p$ -value = 0.92 indicated that the main effect of the intervention was insignificant.  $F(1, 42) = 4043$  and  $p$ -value = 0.001 indicated that the main effect of time was significant. Furthermore, there was a notable interaction between the intervention and the time, with  $F(1, 42) = 0.02$  and a  $p$ -value of 0.95.

#### 4. Discussion

Within group analysis of NPRS for cervical painful ranges in radiculopathy shows that both techniques i.e. thoracic manipulation and SNAGS are effective in

reducing cervical pain in patients with radiculopathy symptoms having  $p$  value  $<0.001$ . Between groups Analysis of NPRS in patients with cervical radiculopathy shows that both group A and group B are equally effective in reducing cervical pain in symptomatic patients having  $p$  vale of 0.85. These results are in accordance to the previous studies In a study, Cleland contrasted the instantaneous consequences of thoracic manipulation on individuals with cervical pain. He concluded that thoracic pain immediately improved NPRS score from 7 to 5 in 1 session. In his study, Ghada A. Abdallah came to the conclusion that patients with unilateral cervical radiculopathy who received both LLLT and SNAGs Mulligan methods showed improvements in pain intensity, EMG dermatomal somatosensory evoked potential, and functional level. Within group analysis for cervical range of motions shows that both techniques are effective in the improvement of cervical ranges towards normality with  $p$  values  $<0.001$ . Between groups Analysis for Cervical range of motions in radiculopathy patients shows that both techniques are equally effective in improving cervical ranges having  $p$  value  $> 0.05$  which shows non-significant results. This can be justified through previous studies In his study, Adesola Ojo Ojoawo came to the conclusion that sustained natural apophyseal glides are useful for treating cervical radiculopathy patients' discomfort and enhancing their range of motion and neck function. Within group analysis of Neck disability index in patients with functional limitation and ADLS dependency shows that both techniques are effective in the improvement of ADLS towards independency and reducing values on disability index. Between group analysis of NDI in both group A and B in patients with cervical radiculopathy shows that both groups are equally effective in improving ADLS in patients and reducing their disability level with  $p$  values  $> 0.05$ . These results are in accordance with our previous studies Young IA et al. (50) came to the conclusion that thoracic manipulation had rapid and short-term effects on cervical radiculopathy, and they saw improvements in pain, cervical range of motion, and cervical flexor endurance after just one session. Michael et al. in 2019 came to the conclusion that Thoracic Spine Manipulation is more beneficial than thoracic mobilization, cervical mobilization, and conventional care in their comprehensive review and meta-analysis. Within group analysis of Thoracic range of motions shows that both

techniques are somewhat effective in improving thoracic spine ranges in patients with cervical radiculopathy. Between group analysis of thoracic range of motions variable shows that both techniques i.e. thoracic manipulation and SNAGS are equally effective in improving thoracic ranges with p value >0.05. These results contradicts previous studies In their 2016 study, Kwan-Woo Lee et al. Came to the conclusion that deep cranio-cervical flexor training in conjunction with thoracic manipulation was a more successful intervention for treating non-specific chronic neck pain and enhancing patients' range of motion, muscle function, and neck impairment.

### Conclusion:

This study concludes that both techniques thoracic manipulation and sustained natural apophyseal glides are equally effective in improving patient's ranges of cervical and thoracic region, in reducing cervical pain and making patient more comfortable in performing ADLS whilst reducing neck disability in all variables i.e. NPRS, cervical and thoracic spine ranges and neck disability index. The limitation faced during this study were that gender was not equally distributed among both groups, numbness was not improved in both groups although pain was subsided for future reference some other technique must be added to improve numbness in the study. Effects of thoracic manipulation can be observed on the respiratory system. Control group should be added in the study to assess the results more efficiently.

### References:

- Mesregah MK, Feng W, Huang W-H, Wei-Cheng C, Yoshida B, Mecum A, et al. Clinical effectiveness of interlaminar epidural injections of local anesthetic with or without steroids for managing chronic neck pain: a systematic review and meta-analysis. 2020;23(4):335.
- Liang L, Feng M, Cui X, Zhou S, Yin X, Wang X, et al. The effect of exercise on cervical radiculopathy: a systematic review and meta-analysis. 2019;98(45).
- Peolsson A, Söderlund A, Engquist M, Lind B, Löfgren H, Vavruch L, et al. Physical function outcome in cervical radiculopathy patients after physiotherapy alone compared with anterior surgery followed by physiotherapy: a prospective randomized study with a 2-year follow-up. LWW; 2013.
- Wainner RS, Gill HJJoO, Therapy SP. Diagnosis and nonoperative management of cervical radiculopathy. 2000;30(12):728-44.
- Abbed KM, Coumans J-VCJN. Cervical radiculopathy: pathophysiology, presentation, and clinical evaluation. 2007;60(suppl\_1):S1-28-S1-34.
- Ojoawo AO, Olabode ADJHKPJ. Comparative effectiveness of transverse oscillatory pressure and cervical traction in the management of cervical radiculopathy: A randomized controlled study. 2018;38(02):149-60.
- González-Uriel P, Pérez VA, Suárez-Quintanilla JAJEJA. Clinical anatomy of cervical spondylosis. 2020;24(5):439-48.
- McDonald MA, Kirsch CF, Amin BY, Aulino JM, Bell AM, Cassidy RC, et al. ACR Appropriateness Criteria® cervical neck pain or cervical radiculopathy. 2019;16(5):S57-S76.
- Chu ECPJJoFM, Care P. Alleviating cervical radiculopathy by manipulative correction of reversed cervical lordosis: 4 years follow-up. 2021;10(11):4303.
- Son B-K YHJGJHLJHHWB. Muscle Energy Technique for Neck Pain: Systematic Review.. Korean Society of Chuna Manual Medicine Spine and Nerves. 2020.
- Hübscher M MMKKSRLHWLXea. Thoracic spine manipulation for the management of mechanical neck pain: A systematic review and meta-analysis.. 2019; 14(2):e0211877.
- Young IA, Pozzi F, Dunning J, Linkonis R, Michener LA. Immediate and Short-term Effects of Thoracic Spine Manipulation in Patients With Cervical Radiculopathy: A Randomized Controlled Trial. Journal of Orthopaedic & Sports Physical Therapy. 2019 May;49(5):299-309.
- Kuijper B TJBANFdVM. Cervical collar or physiotherapy versus wait and see policy for recent onset cervical radiculopathy: randomised trial. BMJ.. 2009 Oct 7.; 339:b3883.
- Kumari C SBBDASSRBA. Efficacy of muscle energy technique as compared to proprioceptive neuromuscular facilitation technique in chronic mechanical neck pain: A randomized controlled trial. Int J Health Sci Res. 2016;6.
- Nihinlol AOOaBJ. EFFECTS OF SUSTAINED NATURAL APOPHYSEAL GLIDES IN THE MANAGEMENT OF CERVICAL RADICULOPATHY. 2018.

**Tables:**

**Table 1:** Mixed way ANOVA time, treatment group and interaction effect

Sr. No.	Variables		Time			Treatment Group			Interaction effect		
			F(df)	$\eta^2$	p-value	F(df)	$\eta^2$	p-value	F(df)	$\eta^2$	p-value
1.	NPRS	Baseline	2487 (1)	0.97	.000	1.5(1)	0.03	0.21	0.10 (1.5)	0.003	0.85
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
2.	flexion ROM	Baseline	4393 (1)	0.99	.000	0.35(1)	0.008	0.55	1.66(1.1)	0.38	0.20
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
3.	extension ROM	Baseline	1521(1)	0.97	.000	2.0(1)	0.04	0.15	1.6(1.4)	0.03	0.20
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
4.	Rt-side bending	Baseline	641(1)	0.93	.000	0.01(1)	0.000	0.90	0.55(1.5)	0.01	0.53
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
5.	Lt-side bending	Baseline	672(1)	0.94	.000	0.02(1)	0.001	0.86	1.6(1.4)	0.03	0.21
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
6.	Rt-rotation	Baseline	1727(1)	0.97	.000	2.8(1)	0.06	0.10	1.4(1.1)	0.03	0.24
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
7.	Lt-rotation	Baseline	1398(1)	0.97	.000	0.02(1)	0.001	0.86	1.10(1.1)	0.02	0.31
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
8.	NDI	Baseline	6438(1)	0.99	.000	1.7(1)	0.04	0.19	0.25(1.9)	0.77	.006
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
9.	Thoracic flexion	Baseline	6121(1)	0.99	.000	0.02(1)	0.001	0.86	0.17(1.1)	0.004	0.83
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
10.	Thoracic extension	Baseline	19200(1)	0.99	.000	2.8(1)	0.06	0.96	2.5(1.9)	0.05	0.08
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
11.	Rt-lateral bending	Baseline	4043(1)	0.99	.000	0.009(1)	.000	0.92	0.02(1.7)	0.001	0.95
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									
12.	Lt-Lateral bending	Baseline	4043(1)	0.99	.000	0.009(1)	.000	0.92	0.02(1.7)	0.001	0.95
		2 <sup>nd</sup> week									
		4 <sup>th</sup> week									