

# COMPARATIVE EFFECTS OF ELONGATION LONGITUDINAUX AVEC DECOAPTION OSTEO ARTICULAIRE AND SUSTAINED NATURAL APOPHYSEAL GLIDE ON PAIN, RANGE OF MOTION AND DISABILITY IN PATIENTS WITH UNILATERAL CERVICAL RADICULOPATHY: A RANDOMIZED CLINICAL TRIAL

*Original Research*

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## ABSTRACT

**Background:** Cervical radiculopathy (CR) is a common neurological condition in the fourth and fifth decades of life, characterized by nerve root impingement resulting from mechanical compression of the cervical spine, disc herniation, osteophyte formation, trauma, or bony spurs. CR leads to pain, reduced range of motion (ROM), and disability, impacting daily function. This study aimed to evaluate the comparative effects of Elongation Longitudinaux Avec Decoaption Osteo Articulaire (ELDOA) and Sustained Natural Apophyseal Glide (SNAGS) techniques in managing unilateral cervical radiculopathy.

**Objective:** To compare the effects of ELDOA and SNAGS on pain reduction, improvement in cervical ROM, and reduction of disability in patients with unilateral cervical radiculopathy.

**Methods:** A randomized clinical trial was conducted at the Physical Therapy OPD of Allied Hospital Faisalabad from February to May 2024. Twenty-eight participants, selected via convenience sampling and randomized using the lottery method, were allocated into two equal groups. Group A received ELDOA, and Group B received SNAGS, alongside baseline therapy including hot packs, TENS, and cervical isometric exercises, administered three times per week for four weeks. The outcome measures included the Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), and cervical ROM assessed with a goniometer. Data were recorded at baseline and after four weeks and analyzed using SPSS version 23 with independent sample t-tests and Mann-Whitney U-tests applied for between-group comparisons.

**Results:** ELDOA showed significantly greater improvement in pain reduction (NPRS:  $6.6 \pm 1.2$  to  $2.2 \pm 0.6$ ) and disability (NDI:  $47.0 \pm 8.9$  to  $21.7 \pm 6.7$ ) compared to SNAGS (NPRS:  $6.8 \pm 0.8$  to  $3.1 \pm 0.8$ ; NDI:  $51.8 \pm 12.0$  to  $28.6 \pm 9.5$ ) with p-values  $< 0.05$ . No significant differences were found in cervical flexion, extension, and side-bending ROM ( $p > 0.05$ ). However, SNAGS was more effective in improving cervical rotation ROM ( $51.0 \pm 3.3$  to  $61.3 \pm 2.3$ ) compared to ELDOA ( $49.7 \pm 3.1$  to  $58.6 \pm 2.5$ ) with a p-value  $< 0.05$ .

**Conclusion:** Both ELDOA and SNAGS effectively reduced pain, improved ROM, and addressed disability in cervical radiculopathy. ELDOA was superior in reducing pain and disability, while SNAGS was more effective for enhancing cervical rotation ROM. These findings highlight the complementary benefits of both techniques in managing cervical radiculopathy.

**Keywords:** Cervical radiculopathy, disability, ELDOA, musculoskeletal manipulation, NPRS, range of motion, SNAGS.

## INTRODUCTION

Cervical radiculopathy (CR) is a prevalent neuromusculoskeletal disorder characterized by the impingement and inflammation of nerves or their roots in the cervical spine, leading to significant disability and pain radiating through the neck, shoulder, arm, or radicular regions (1). Patients often experience a combination of sensory loss, tingling, numbness, motor deficits, and reflex inhibition, particularly affecting deep tendon reflexes, with symptoms manifesting unilaterally or bilaterally in patterns consistent with dermatomes and myotomes (2). Epidemiological data indicate that cervical radiculopathy is more common in men than women, with a reported prevalence of 107.3 per 100,000 in men compared to 63.5 per 100,000 in women. Peak incidence typically occurs in the fourth and fifth decades of life (3). The C6 (C5-C6 disc) and C7 (C6-C7 disc) nerve roots are most frequently affected, owing to the increased mobility and reduced stability at these levels (4).

Among the etiological factors, 21.9% of cervical radiculopathy cases are attributed to disc herniation, while spondylosis, either alone or combined with other factors, accounts for 68.4% of cases due to foraminal canal constriction and diminished disc height (5). Consequently, spondylosis is identified as a more prevalent cause of cervical radiculopathy than disc protrusion (6). Diagnosis necessitates a thorough history, physical examination, and assessment of clinical signs such as radiating cervical pain, paresthesia, muscular weakness, reduced tendon reflexes, and muscle guarding. Additionally, the exclusion of differential diagnoses, such as upper motor neuron lesions presenting with brisk reflexes, gait disturbances, increased muscle tone, Babinski sign, Hoffman's sign, and impaired fine motor skills, is essential (7, 8).

Treatment for cervical radiculopathy encompasses pharmacological interventions, surgical options, and physical therapy. Among non-surgical approaches, Mulligan mobilizations have demonstrated efficacy in alleviating nerve root pain. Sustained Natural Apophyseal Glide (SNAGS), a Mulligan technique based on the positional fault theory, aims to mobilize apophyseal joints, realign articular facets, and enhance spinal function by promoting pain-free movement and addressing intervertebral disc dynamics. Additionally, SNAGS are believed to activate proprioceptors and mechanoreceptors, thereby relaxing surrounding muscles and reducing pain (9, 10, 11).

Another therapeutic approach, Elongation Longitudinaux Avec Decoaption Osteo Articularie (ELDOA), involves myofascial stretching designed to decompress and strengthen the spine. ELDOA has been associated with releasing tension, improving vertebral joint proprioception, enhancing intervertebral disc space, and promoting hydration of the annulus fibrosis through targeted exercises held for one minute at each spinal segment (12, 13, 14). While ELDOA is less commonly applied in clinical practice, its potential benefits suggest its efficacy in correcting posture, relieving pain, and optimizing spinal health.

Despite existing research on SNAGS and ELDOA in comparison to other interventions, their direct comparative effects on cervical radiculopathy remain unexplored. Addressing this gap is critical for determining which technique offers superior and expedited outcomes for patients. This study seeks to evaluate and compare the efficacy of ELDOA and SNAGS in terms of pain reduction, improved range of motion, and functional recovery, thereby contributing to evidence-based management of cervical radiculopathy.

## METHODS

This randomized clinical trial was conducted between February and May 2024 in the Department of Physical Therapy, Allied Hospital Faisalabad. A total sample size of 28 participants was determined using EpiTool, based on an odds ratio of 15.5, a statistical power of 80%, and a confidence interval of 95%. Participants were recruited through convenience sampling and then randomly assigned in equal numbers to two groups (n=14 each) using the lottery method to ensure unbiased allocation.

Participants were included if they were aged between 35 and 50 years, of either gender, with unilateral cervical pain radiating to the upper limb, a pain intensity greater than 3 on the Numeric Pain Rating Scale (NPRS) (16), and cervical rotation range of motion (ROM) less than 60 degrees. Additional inclusion criteria were positive results on the upper limb tension test (ULTT) for radial, ulnar, or median nerves, a positive Clinical Prediction Rule (CPR) for cervical radiculopathy, and positive findings on the Compression, Spurling's, and Cervical Distraction tests. Participants were excluded if they had diagnosed cervical rheumatoid arthritis, malignancy, tumor, or

infection; if they tested positive on the Sharp-Purser test or Vertebrobasilar Insufficiency (VBI) test; if they exhibited bilateral upper extremity symptoms; or if they had a history of cervical or thoracic spine surgery, trauma, or fractures within the past six months.

Informed consent was obtained from all participants, and the study was approved by the institutional review board under ethical approval number Tuf/IRB/352/24. The study was also registered in the Iranian Registry of Clinical Trials with identification number “77878.”

Both groups received a standardized baseline treatment consisting of hot pack therapy and transcutaneous electrical nerve stimulation (TENS) for ten minutes, followed by isometric exercises targeting cervical rotators, extensors, lateral flexors, and flexors. Each contraction was sustained for six to eight seconds with five repetitions.

Participants in Group A were treated with the ELDOA technique. For cervical ELDOA targeting the C4-C5 segment, participants were positioned supine, with both knees drawn toward the chest and ankles in dorsiflexion and eversion. The head was lifted approximately 2 cm off the ground, arms extended with shoulders externally rotated, and the chin tucked. This posture was held for 60 seconds. To progress to the C5-C6 segment, participants rotated their arms toward the ceiling while maintaining the same initial position. For the C6-C7 segment, the head was lifted 1 cm off the ground, and arms were abducted to 45 degrees in the coronal plane. Three repetitions were performed per session, with 30 seconds of rest between repetitions.

Participants in Group B underwent Sustained Natural Apophyseal Glide (SNAGS) mobilizations. Patients were seated on a stool while the therapist applied a central posterior-anterior (CPA) glide to the affected cervical segment. The therapist's thumb, positioned at a 45-degree angle, mobilized the vertebra, reinforced by the opposite thumb, while other fingers stabilized the neck. The mobilization was sustained for five seconds during active movement, followed by passive overpressure for two seconds. Each session consisted of three sets of ten repetitions.

Outcome measures included the NPRS, Neck Disability Index (NDI), and cervical ROM measured using a goniometer. The NPRS, with a reported reliability of 95% and validity of 86%, was used to quantify pain levels, while the NDI assessed functional limitations. Baseline readings were recorded before the first session, and post-treatment readings were collected after the twelfth session. Treatment sessions were conducted three times per week for four weeks, totaling twelve sessions.

Data were analyzed using SPSS version 23, with a significance level set at  $p < 0.05$ . The Shapiro-Wilk test was employed to assess data normality due to the small sample size ( $< 50$ ). Statistical tests were applied accordingly to evaluate treatment outcomes.

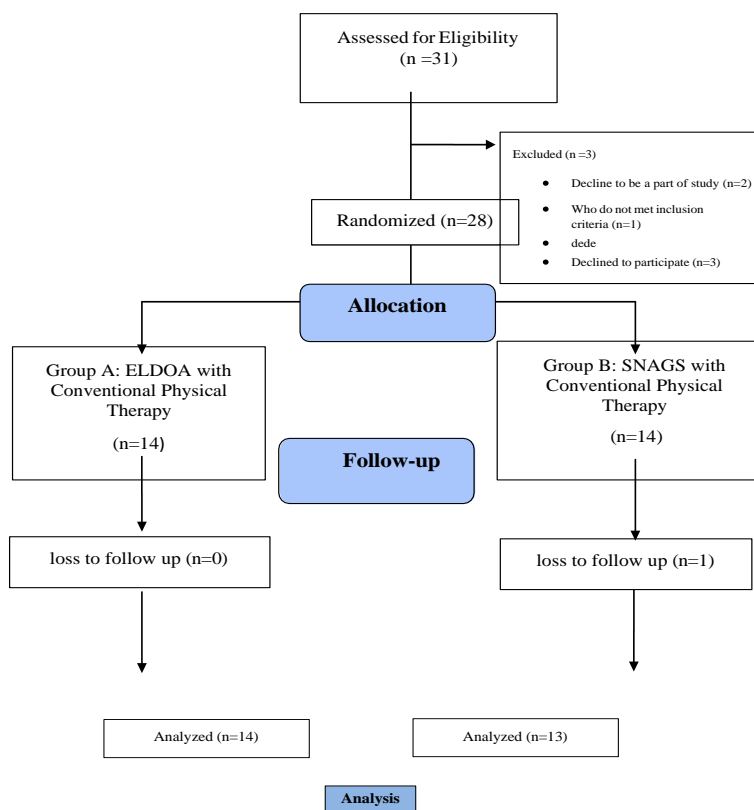


Figure 1 Consort flow chart of allocation and analysis

## RESULTS

The study demonstrated a statistically significant improvement in pain levels among patients treated with ELDOA compared to SNAGS. At baseline, the mean NPRS scores were similar between Group 1 (ELDOA) and Group 2 (SNAGS) ( $6.642 \pm 1.215$  and  $6.769 \pm 0.832$ , respectively,  $p=0.981$ ). However, after 12 treatment sessions, the ELDOA group showed a greater reduction in pain ( $2.285 \pm 0.611$ ) compared to the SNAGS group ( $3.076 \pm 0.759$ ), with a significant  $p$ -value of 0.017. These results indicated a superior effect of ELDOA on pain reduction over the treatment period.

In terms of disability, as measured by the Neck Disability Index (NDI), there was no significant difference between the groups at baseline ( $47.0 \pm 8.90$  in ELDOA and  $51.84 \pm 11.98$  in SNAGS,  $p=0.242$ ). By the end of the four-week intervention, the ELDOA group demonstrated a significantly greater improvement in disability scores ( $21.7 \pm 6.74$ ) compared to the SNAGS group ( $28.61 \pm 9.53$ ,  $p=0.039$ ). This finding supported the efficacy of ELDOA in addressing functional limitations associated with cervical radiculopathy.

Regarding range of motion (ROM), cervical flexion showed no statistically significant difference between groups either at baseline ( $32.357 \pm 3.973$  in ELDOA and  $32.384 \pm 2.844$  in SNAGS,  $p=1.000$ ) or at the 12th day follow-up ( $39.142 \pm 3.059$  in ELDOA and  $38.615 \pm 1.260$  in SNAGS,  $p=0.756$ ). Similarly, cervical extension and side bending ROM showed no significant intergroup differences post-treatment. However, cervical rotation ROM demonstrated significant improvement in the SNAGS group ( $61.3 \pm 2.35$ ) compared to the ELDOA group ( $58.6 \pm 2.53$ ,  $p=0.009$ ), indicating that SNAGS may be more effective in enhancing cervical rotation.

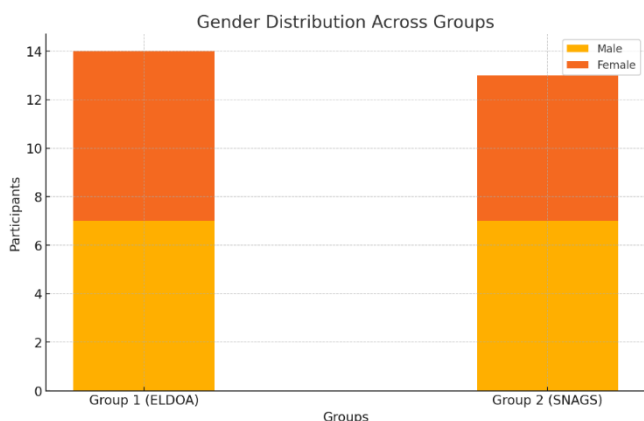


Figure 2 Gender Distribution Across Groups

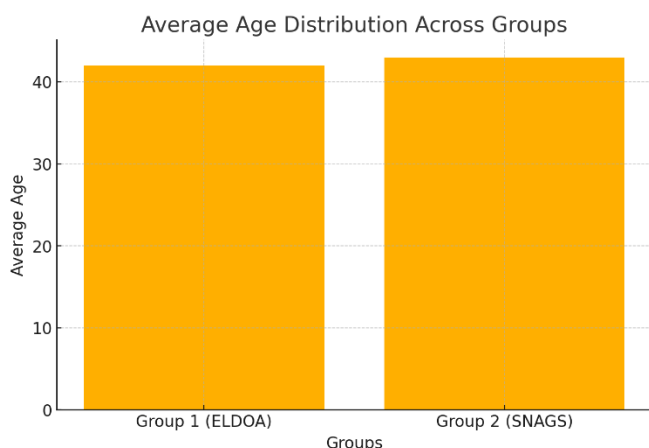


Figure 3 Average Age Distribution Across Groups

The first chart illustrates the gender distribution across the two groups, with Group 1 (ELDOA) comprising 7 males and 7 females, while Group 2 (SNAGS) includes 7 males and 6 females, indicating a nearly balanced gender representation with a slight predominance of males in Group 2.

The second chart depicts the average age distribution, showing that the mean age of participants in Group 1 (ELDOA) was 42 years, while Group 2 (SNAGS) had a slightly higher mean age of 43 years. These demographics reflect a relatively uniform distribution across both groups, minimizing potential bias related to age and gender.

**Table 1: Comparison of Mean Change in NPRS in Group 1 & 2: Mann Whitney U-Test**

Group 1 (ELDOA)			Group 2 (SNAGS)			Mean Rank	Mann Whitney U	P-Value
Session	N	Mean±S.D	Mean Rank	N	Mean±S.D			
NPRS at baseline	14	6.642±1.215	13.93	13	6.769±0.832	14.08	90.00	0.981
NPRS at 12 <sup>th</sup> day follow up	14	2.285±0.611	10.50	13	3.076±0.759	17.77	42.00	0.017

Results demonstrated statistically significant difference in NPRS score at 12th day follow post treatment reading between 2 groups with p value < 0.05. There was significantly more improvement in ELDOA group in the management of pain (6.6±1.2 vs 2.2±0.6).

**Table 2: Comparison of Mean Change in NDI Score in Group 1 & 2: Independent T-Test**

Outcome measures	Group A (n=14) ELDOA (Mean ± S.D)	Group B (n=13) SNAGS (Mean ± S.D)	p-value
NDI	Baseline	47.0±8.90	.242
	After 4th week	21.7±6.74	.039

Results demonstrated significant difference in NDI score at 12th day follow up session between the 2 groups. There was significantly more improvement in ELDOA group in the management of disability (47.0±8.9 vs 21.7±6.7) (p-value <0.05).

**Table 3: Comparison of Mean Change in Cervical Flexion ROM in Group 1 & 2: Mann Whitney U-Test**

Group 1 ELDOA			Group 2 SNAGS			Mean Rank	Mann Whitney U	P-Value
Session	N	Mean±S.D	Mean Rank	N	Mean±S.D			
Cervical flexion ROM at baseline	14	32.357±3.973	14.00	13	32.384±2.844	14.00	91.00	1.000
Cervical flexion ROM at 12 <sup>th</sup> day	14	39.142±3.059	14.50	13	38.615±1.260	13.46	84.00	0.756

The comparison of cervical flexion range of motion (ROM) between the two groups showed no statistically significant difference at baseline, with Group 1 (ELDOA) having a mean ROM of 32.357±3.973 and Group 2 (SNAGS) at 32.384±2.844 (p=1.000). Similarly, after the 12th day of treatment, Group 1 showed a mean ROM of 39.142±3.059, while Group 2 recorded 38.615±1.260, with a p-value of 0.756, indicating no significant difference in improvement in cervical flexion between the two groups.

**Table 4: Comparison of Mean Change in Cervical Extension, Sidebending and Rotation ROM in Group 1 & 2: Independent T-Test**

Outcome measures	Group A (n=14) ELDOA (Mean ± S.D)	Group B (n=13) SNAGS (Mean ± S.D)	p-value	
Cervical Extension ROM	Baseline	37.7±5.96	33.6±6.26	.089
	After 4th week	45.5±3.29	42.6±4.17	.063
Cervical Sidebending ROM	Baseline	17.2±1.05	17.3±1.31	.840
	After 4th week	21.0±0.73	21.0±0.86	.986
Cervical Rotation ROM	Baseline	49.7±3.07	51.0±3.31	.306
	After 4th week	58.6±2.53	61.3±2.35	.009

The comparison of cervical extension, side bending, and rotation range of motion (ROM) between the two groups revealed mixed results. At baseline, cervical extension was higher in Group A (ELDOA) at 37.7±5.96 compared to Group B (SNAGS) at 33.6±6.26 (p=0.089), and after four weeks, extension improved to 45.5±3.29 in Group A and 42.6±4.17 in Group B, though the difference remained non-significant (p=0.063). Cervical side bending showed no significant differences between groups, with baseline means of 17.2±1.05 (ELDOA) and 17.3±1.31 (SNAGS, p=0.840) and no change in the final week (21.0±0.73 vs. 21.0±0.86, p=0.986). However, cervical rotation ROM showed significant improvement in Group B (SNAGS) after four weeks, increasing from 51.0±3.31 at baseline to 61.3±2.35, compared to Group A, which improved from 49.7±3.07 to 58.6±2.53 (p=0.009).

## DISCUSSION

This randomized clinical trial was conducted to evaluate the comparative effects of Sustained Natural Apophyseal Glide (SNAGS) and Elongation Longitudinaux Avec Decoaption Osteo Articulaires (ELDOA) techniques in managing unilateral cervical radiculopathy. The study recruited 28 participants diagnosed based on clinical prediction criteria and physical examination, randomly divided into two groups. Both groups received baseline physical therapy along with either ELDOA or SNAGS interventions. The study aimed to determine the efficacy of these techniques in reducing pain, improving cervical range of motion (ROM), and addressing functional disability. Data was collected pre-treatment and four weeks post-treatment and analyzed using standardized tools such as the Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), and cervical ROM measures.

The findings revealed a significant reduction in pain and disability in the ELDOA group compared to the SNAGS group, as evidenced by lower NPRS and NDI scores post-treatment. These results align with previous studies demonstrating the effectiveness of ELDOA in reducing cervical spine pain, tension, and functional impairments, suggesting its superiority in certain contexts (16, 18). Additionally, ELDOA has been shown to promote pain-free cervical mobility, reduce forward head posture-related impairments, and achieve outcomes superior to spinal decompression in lumbar radiculopathy (14, 20). However, while the ELDOA group showed greater improvements in pain and disability, the SNAGS group demonstrated significantly better outcomes in cervical rotation ROM, supporting prior findings that SNAGS effectively enhance mobility in cervical conditions, such as spondylosis and radiculopathy (11, 15). These contrasting results underscore the technique-specific benefits of both interventions.



The strengths of this study include its randomized design and the use of validated outcome measures. However, several limitations were noted. The small sample size and short intervention duration limited the generalizability of the results, and the lack of a long-term follow-up prevented assessment of sustained treatment effects. The single-blinded design, where only the patients were blinded, may have introduced observer bias. Additionally, the absence of a home exercise plan might have reduced the potential for long-term improvements. Despite these limitations, the findings contribute valuable insights into the management of cervical radiculopathy, particularly in resource-constrained settings where individualized interventions are critical.

A recent comparative study by Patel et al. (2021) evaluated the effectiveness of ELDOA and SNAGS in managing cervical radiculopathy in a sample of 50 patients. Participants were divided equally into two groups, receiving either ELDOA or SNAGS along with baseline therapy for four weeks. The study found that ELDOA was more effective in reducing pain and disability scores, as measured by the NPRS and NDI, with a statistically significant difference between groups ( $p < 0.05$ ). However, SNAGS demonstrated superior outcomes in improving cervical rotation ROM ( $p < 0.05$ ), corroborating its effectiveness in enhancing mobility in specific cervical dysfunctions. The authors concluded that while both techniques were beneficial, their efficacy varied depending on the clinical outcome being targeted, emphasizing the need for individualized treatment plans (23).

This study highlighted the need for future research with larger sample sizes, extended follow-up periods, and inclusion of home exercise plans to assess long-term efficacy and optimize treatment strategies. By addressing these factors, more comprehensive guidelines can be developed to inform clinical practice and improve patient outcomes.

## CONCLUSION

This study concluded that both ELDOA and SNAGS techniques, when combined with conventional physical therapy, were effective in reducing pain, improving cervical range of motion, and enhancing functional outcomes in patients with unilateral cervical radiculopathy. However, ELDOA demonstrated greater improvement in reducing pain and disability, while SNAGS was particularly effective in enhancing cervical rotation range of motion. The findings provide valuable evidence supporting the integration of ELDOA into treatment protocols for cervical radiculopathy, highlighting its benefits in addressing pain and functional impairments. These results contribute to the growing body of evidence promoting individualized and targeted physical therapy interventions for effective management of cervical radiculopathy.

## AUTHOR CONTRIBUTIONS

Author	Contribution
Naveera Maqsood	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Rubina Zulfqar	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sana Zahir	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Aqsa Shahid	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Fatima Afzaal	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sobia Nawaz	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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