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EFFECT OF PNF WITH NEURAL MOBILIZATION ON ELBOW ROM, PATIENT- REPORTED FUNCTIONAL OUTCOMES AND PAIN IN CERVICAL RADICULOPATHY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT **Background:** Cervical radiculopathy is a condition characterized by neck pain radiating to the upper limb, often associated with reduced range of motion and functional limitations. Neural mobilization is widely used in its management; however, the additional effect of proprioceptive neuromuscular facilitation (PNF) with neural mobilization and conventional physiotherapy remains underexplored. **Methods:** Single-blinded randomized controlled trial was conducted on 50 participants aged 40–60 with cervical radiculopathy. Participants were randomly allocated into two groups: Experimental (PNF with neural mobilization and conventional physiotherapy) and control groups (neural mobilization with conventional physiotherapy). Outcome measures included, elbow extension range of motion, pain intensity using the Numeric Pain Rating Scale (NPRS), and functional outcomes using the Cervical Radiculopathy Impact Scale (CRIS). Assessments were performed at baseline, post-intervention, one-week follow-up. **Results:** Both groups demonstrated significant improvements ($p < 0.05$). However, Group A showed significantly greater improvement compared to Group B in elbow range of motion (10.42 ± 2.24 vs. 12.85 ± 1.41), pain reduction (2.38 ± 0.49 vs. 4.43 ± 0.75) and CRIS subscales ($p < 0.05$). At one-week follow-up, Group A maintained and showed marginal further improvement in outcomes (elbow ROM 9.98 ± 2.26; NPRS 2.37 ± 0.45), whereas Group B demonstrated minimal change (NPRS 4.40 ± 0.64), indicating comparatively lesser sustained effects. **Conclusion:** Both interventions were effective in improving range of motion, pain and functional outcomes but addition of PNF to neural mobilization resulted in significantly greater improvements and better short-term retention of therapeutic effects. Incorporating PNF into rehabilitation protocols may enhance clinical outcomes.

KEYWORDS : Cervical Radiculopathy, Proprioceptive Neuromuscular Facilitation, Neural Mobilization, Cervical Radiculopathy Impact Score

INTRODUCTION

Neck pain is a prevalent musculoskeletal condition affecting individuals across all age groups, with cervical radiculopathy being a key contributor, characterized by radiating pain to the arms, chest and shoulders, accompanied by muscle weakness and diminished reflexes. If left untreated, this condition can progressively worsen, significantly impacting daily function and quality of life.[1] Cervical radiculopathy affects approximately 83 out of 100,000 individuals annually, with the highest incidence in those in their 40s and 50s, most commonly involving the C6 or C7 nerve roots.[2,3] The median nerve is frequently implicated due to foraminal narrowing in the lower cervical spine.[4,5] Conservative management commonly incorporates manual therapy techniques including mobilization, manipulation, traction and neural tissue therapy.[6] Research-based studies have demonstrated that cervical radiculopathy is associated with alterations in neuromuscular control involving agonist-antagonist muscle imbalances.[7] Proprioceptive Neuromuscular Facilitation (PNF) has recently been introduced as a therapeutic approach for both mechanical and radicular pain. The technique focuses on engaging various muscle groups to promote neuromuscular control and enhance functional movement patterns. Many studies prove PNF patterns to be advantageous because of its large dynamic movement, resulting in strengthening the muscle as well as train it functionally from the active motor control, increased coordination, ROM and better controlled movements.[8] PNF enhances neuromuscular control through familiar movement patterns, improving flexibility, strength, motor control and proprioception.[9] Suresh V et al. concluded that PNF is beneficial in mechanical neck pain in reducing pain and improve functions. [10]

Most commonly used intervention for patients with cervical radiculopathy is neural mobilization. A study by Dong-Gyu Kim suggest a significant improvement on pain, ROM and disability was seen when manual cervical traction was given with neural mobilization.[11] It reduces neural pressure by promoting nerve gliding, reducing mechanosensitivity and enhancing intraneural blood flow, leading to decreased numbness and muscle tension. [12-16].

Previous studies have highlighted the need for larger, more diverse sample sizes to confirm findings, and have recommended exploring the combined effect of PNF with conservative treatment to determine its isolated therapeutic contribution.[7] To our knowledge, no randomized controlled trial has directly compared the combined effect of proprioceptive neuromuscular facilitation with neural mobilization versus neural mobilization in cervical radiculopathy patients, while also incorporating functional outcomes assessment using the Cervical Radiculopathy Impact Scale (CRIS), a condition-specific patient-reported outcome measure evaluating symptoms, energy and postures, and actions and activities. We hypothesize that PNF along with neural mobilization might be of benefit for treating Cervical Radiculopathy.

Therefore, this study aimed to address these gaps by evaluating the effectiveness of PNF combined with neural mobilization versus neural mobilization across multiple outcomes including pain, elbow range of motion and disability in cervical radiculopathy patients, with outcome measures assessed at baseline, post-intervention and at a one-week follow-up to examine the short-term retention of therapeutic effects.

MATERIALS AND METHODS

A single-blinded randomized controlled trial was conducted after obtaining ethical clearance from Institutional Ethics Committee. 73 participants with cervical radiculopathy were enrolled, out of which 23 were excluded as they did not match the criteria and showed unwillingness. Later, 50 patients, aged 40-60 years of either gender with pain intensity ≥3 on the Numeric Pain Rating Scale (NPRS), a positive median nerve tissue tension test were included and written informed consent was obtained. Those with a history of cervical or thoracic spine surgery, diabetic neuropathy, or unwillingness to participate were excluded. A CONSORT flow diagram depicting participant enrolment, allocation, follow-up, and analysis is shown in Figure 1.

Using simple random sampling with a 1:1 allocation ratio via computer-generated randomization, participants were equally divided into Group A (Experimental: PNF with neural mobilization and conventional physiotherapy, n=25) and Group B (Control: neural mobilization with conventional physiotherapy, n=25).

Outcome measures assessed at baseline, end of 12 sessions, and one week follow up post-intervention include

1) Pain intensity using NPRS [17]

2) Elbow extension range of motion during the median nerve tissue tension test assessed via goniometer
3) Functional outcomes using Cervical Radiculopathy Impact Scale (CRIS) and its three subscales [18]
a) Subscale one - Symptoms
b) Subscale two - Energy and Postures, and
c) Subscale three - Actions and Activities

Follow up data was collected one week post-intervention and reported descriptively to examine short-term retention of therapeutic effects.

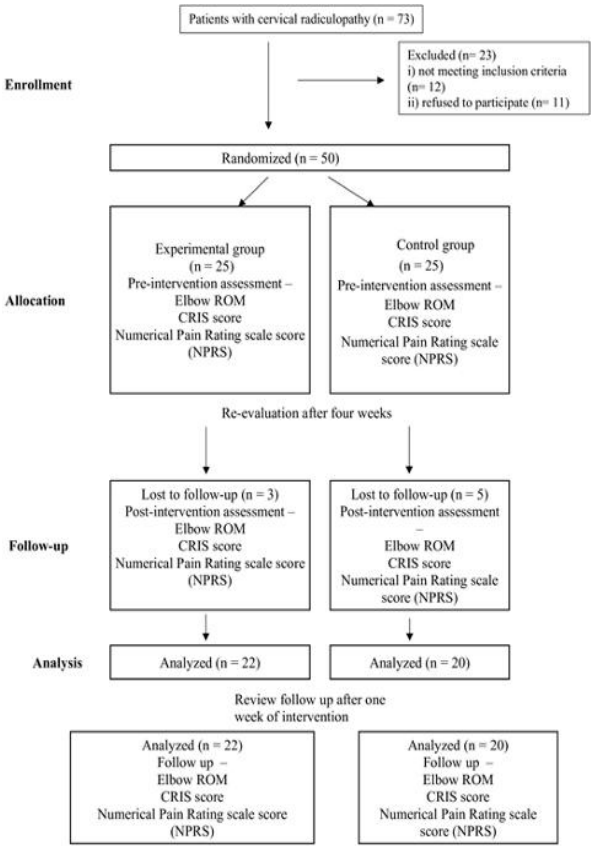

Figure 1: A Consort Flow Diagram Depicting Participant Enrollment, Allocation, Follow-up, And Analysis

Intervention Protocol –

Groups Progression of exercises weekly	PNF (D2 Flexion and Extension) and Median nerve mobilization group with conventional physiotherapy	Median nerve Mobilization group with conventional physiotherapy
First week	PNF - 5 repetitions per set, with 1 set per session, maintained for duration of 5 seconds Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, 5 repetitions per set, with 1 set per session	Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, 5 repetitions per set, with 1 set per session
Second week	PNF - 7 repetitions per set for 2 sets per session, maintained for duration of 5 seconds 5 repetitions per set, with 1 set per session Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, 10 repetitions per set, with 1 set per session	Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, 10 repetitions per set, with 1 set per session
Third week	PNF - 10 repetitions per set with 2 sets per session, maintained for duration of 5 seconds Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension adding cervical lateral flexion 10 repetitions per set, with 1 set per session	Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension adding cervical lateral flexion 10 repetitions per set, with 2 set per session
Fourth week	PNF - resistance was incorporated while maintaining 10 repetitions for 2 sets per session Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, cervical lateral flexion and shoulder depression 10 repetitions per set, with 2 set per session	Median nerve mobilization - Glenohumeral abduction and external rotation, forearm supination, wrist extension, elbow extension, cervical lateral flexion and shoulder depression 10 repetitions per set, with 2 set per session

All the exercises were done for alternate days (three days/week) for four weeks for both the groups.

The conventional physiotherapy included cervical and scapular stretching and strengthening exercises. The complete position of D2 flexion is illustrated in Figure 2. Similarly, D2 extension is illustrated in Figure 3. Figure 4 shows median nerve mobilization.

Figure 2: Proprioceptive Neuromuscular Facilitation D2 Flexion Pattern

Figure 3: Proprioceptive Neuromuscular Facilitation D2 Extension Pattern

Figure 4: Median Nerve Mobilization

RESULTS

Baseline comparability between groups was confirmed with no statistically significant differences in any outcome measure at pre-intervention ($p > 0.05$).

As depicted in Table 1, both groups demonstrated statistically significant improvements across all outcome measures following 12 sessions of intervention. Experimental Group showed notably greater reductions in elbow ROM, NPRS, and all three CRIS subscales compared to the Control, with all values reaching statistical significance ($p < 0.05$). A paired t-test was run for an intragroup comparison.

At one-week follow-up, Experimental Group demonstrated maintenance with marginal further improvement across most outcome measures, including elbow ROM (9.98 ± 2.26), NPRS (2.37 ± 0.45), and all three CRIS subscales, indicating sustained therapeutic effects. Control Group showed minimal change in pain (NPRS 4.40 ± 0.64) and slight improvement in CRIS subscales; however, the magnitude of improvement was comparatively less than that of Experimental group. Detailed follow-up values for both groups are presented in Table 1.

Intergroup comparison at the end of intervention was performed using two independent sample t-test with equal variances, which revealed statistically significant differences in favour of the experimental group across all outcome measures ($p < 0.05$), indicating that the addition of PNF to neural mobilization produced superior outcomes compared to neural mobilization alone, as shown in Table 2

Table 1: Pre Intervention, End of 12 Sessions and One Week Follow up Results of Both Experimental and Control Groups. T-values and P-values Represent Comparison Between Baseline and End of 12 Sessions within the Group.

Timeline	Group A (Experimental)					Group B (Control)				
	Elbow ROM	NPRS	CRIS Subscale-1	CRIS Subscale-2	CRIS Subscale-3	Elbow ROM	NPRS	CRIS Subscale-1	CRIS Subscale-2	CRIS Subscale-3
First day	29.71 ± 2.12	6.76 ± 1.136	75.66 ± 5.886	78.33 ± 6.588	28.401 ± 5.233	29.52 ± 0.70	6.86 ± 1.06	76.322 ± 5.997	75.198 ± 5.107	36.078 ± 6.161
End of 12 sessions	10.42 ± 2.24	2.381 ± 0.498	28.31 ± 6.725	24.801 ± 6.246	13.265 ± 3.935	12.85 ± 1.41	4.43 ± 0.75	38.88 ± 8.333	35.317 ± 7.575	25.85 ± 5.508
One week follow up	9.98 ± 2.26	2.370 ± 0.450	28.01 ± 6.750	24.70 ± 6.312	13.356± 3.967	12.85 ± 1.41	4.40 ± 0.64	38.79 ± 8.289	35.215 ± 7.578	25.789 ± 5.490
t-value	28.66	16.187	24.28	27.02	10.592	48.53	8.57	16.707	19.404	3.857
p-value	0.042 (S)	0.034 (S)	0.032 (S)	0.0175 (S)	0.023 (S)	0.044 (S)	0.045 (S)	0.033 (S)	0.051	0.045 (S)

Table 2: Comparison Between the Findings of All Outcome Measures of the Experimental Group and the Control Group at the End of the 12th Session.

Outcome measures	Group A (Experimental)	Group B (Control)	t-value	p-value
Elbow ROM	10.42 ± 2.24	12.85 ± 1.41	4.2072	0.0002 (S)
NPRS	2.381 ± 0.498	4.43 ± 0.75	10.4298	0.0001 (S)
CRIS Subscale-1	28.31 ± 6.725	38.88 ± 8.333	4.5235	0.0001 (S)
CRIS Subscale-2	24.801 ± 6.246	35.317 ± 7.575	4.9084	0.0001 (S)
CRIS Subscale-3	13.265 ± 3.935	25.85 ± 5.508	8.5197	0.0001 (S)

DISCUSSION

The present randomized controlled trial evaluated the effectiveness of proprioceptive neuromuscular facilitation (PNF) combined with median nerve mobilization and conventional physiotherapy compared to median nerve mobilization and conventional therapy in individuals with cervical radiculopathy. The findings of this study indicate that both groups demonstrated statistically significant improvements in pain, range of motion, and functional outcomes following 12 sessions of intervention.

Majority of patients with cervical radiculopathy were in the 40–45 and 55–60 year age groups, followed by 46–50 and 51–55 years, indicating a higher prevalence in middle-aged to older adults. This aligns with the understanding that degenerative changes in the cervical spine between 35–70 years contribute to development of cervical radiculopathy.[19] The study showed a near-equal distribution of cervical radiculopathy between the left and right sides.

Pre-intervention data for Group A and Group B shows no statistically significant differences across various outcome measures including elbow range of motion, NPRS, CRIS Subscales-1, CRIS Subscales-2, and CRIS Subscales-3 indicating that both groups were comparable in terms of impairment before the intervention.

Pain intensity, as measured by NPRS, showed a substantial reduction in both groups, with the experimental group improving from 6.76 ± 1.13 to 2.38 ± 0.49, compared to 6.86 ± 1.06 to 4.43 ± 0.75 in the control group. The between-group difference was statistically significant ($p = 0.0001$), indicating that the addition of PNF contributed to greater pain relief. The greater improvement observed in the experimental group may be associated with the reactivation of impaired proprioceptive centres through PNF techniques, leading to improved neuromuscular control and coordinated muscle activation. PNF also facilitates better motor unit recruitment and reduces abnormal muscle co-contraction patterns, contributing to pain reduction. Similar findings have been reported, where PNF techniques were found to be effective in reducing pain and improving function in individuals with cervical radiculopathy.[7,9]

Elbow extension range of motion during the median nerve tension test also showed significant improvement, with the experimental group demonstrating a greater reduction (29.71 ± 2.12 to 10.42 ± 2.24) compared to the control group (29.52 ± 0.70 to 12.85 ± 1.41), with a statistically significant intergroup difference ($p = 0.0002$). The diagonal and functional movement patterns inherent to PNF may have contributed to improved flexibility and coordinated muscle activation, thereby facilitating greater range of motion gains in the experimental group. Elbow extension range of motion improvement in the experimental group is also facilitated by median nerve mobilization. Positive results are seen as median nerve mobilization helps reducing mechanosensitivity. These findings are supported by previous research demonstrating that neural mobilization, when combined with other techniques, significantly improves range of motion in cervical radiculopathy patients. [20]

Functional outcomes assessed using the Cervical Radiculopathy Impact Scale (CRIS) showed significant improvements across all subscales in both groups. The CRIS comprises three components: the Symptoms subscale (9 items) capturing pain intensity, tingling, and numbness along the arm; the Energy and Postures subscale (6 items) reflecting fatigue and difficulty maintaining positions such as prolonged sitting or neck posture; and the Actions and Activities subscale (6 items) evaluating limitations in tasks such as lifting, overhead activities, and desk-based work. The experimental group demonstrated markedly better outcomes, with CRIS subscale-1 improving to 28.31 ± 6.72 compared to 38.88 ± 8.33 in the control group ($p = 0.0001$). Similarly, CRIS subscale-2 improved to 24.80 ± 6.24 versus 35.31 ± 7.57, and subscale-3 to 13.26 ± 3.93 versus 25.85 ± 5.50 in the control group, both showing strong statistical significance ($p = 0.0001$). These findings indicate that the addition of PNF not only improves symptoms but also enhances energy levels, posture, and functional activities. This may be attributed to the emphasis of PNF on functional, diagonal movement patterns that closely mimic daily activities, thereby promoting better motor relearning and functional integration. [7, 8] A study by Kim et al. found that neural mobilization alone improves outcomes in cervical radiculopathy patients, but the combination of additional techniques, as seen in Group A, leads to better results. [11]

At one-week follow-up, the experimental group demonstrated maintenance along with marginal further improvement in most outcome measures, including elbow ROM (9.98 ± 2.26) and NPRS (2.37 ± 0.45), indicating sustained therapeutic effects. The continued improvement observed in the experimental group may be attributed to enhanced neuromuscular adaptation, motor learning, and improved proprioceptive control facilitated by PNF techniques along with the effects of median nerve mobilization.

In control group, where median nerve mobilization was given had a restricted positive results as suggested by Basson et al. where a study

which supports the use of neural mobilization for cervical radiculopathy have a more limited effects when used as a stand-alone treatment. [16] Furthermore, combining PNF with neural mobilization appears to enhance neural tissue extensibility and reduce mechanosensitivity more effectively than neural mobilization alone, as evidenced by the superior intergroup differences across all outcome measures.

At one-week follow-up, the control group showed minimal change in pain (NPRS 4.40 ± 0.64) and only slight improvement in CRIS subscales, with the magnitude of improvement remaining comparatively lesser than the experimental group. This suggests that while neural mobilization alone is effective in maintaining outcomes, but when it is combined with PNF its benefits are sustained and comprehensive.

The findings of this study are consistent with previous literature supporting the effectiveness of neural mobilization in reducing pain and improving function in cervical radiculopathy. Furthermore, the results align with studies that highlight the role of PNF in improving pain, range of motion, and functional outcomes in individuals with cervical radiculopathy. The results suggest that incorporating PNF into rehabilitation protocols for cervical radiculopathy can significantly enhance treatment outcomes. Clinicians should consider combining neural mobilization with PNF patterns to achieve greater pain reduction, improved mobility, and better functional recovery. Additionally, the sustained effects observed at follow-up highlight the potential of PNF in promoting longer-lasting therapeutic benefits. Future studies with larger sample sizes and longer follow-up periods are warranted to further validate these findings and establish standardized PNF protocols for cervical radiculopathy rehabilitation.

Despite its strengths, this study has certain limitations. The relatively small sample size may limit generalizability, and the short follow-up duration restricts assessment of long-term outcomes. The focus on median nerve involvement may not represent all types of cervical radiculopathy. Additionally, no statistical comparison between post-intervention and follow-up values was performed, limiting inference regarding retention of therapeutic effects.

CONCLUSION

The findings of this study indicate that both neural mobilization alone and in combination with proprioceptive neuromuscular facilitation (PNF) are effective in reducing pain, improving range of motion, and enhancing functional outcomes in individuals with cervical radiculopathy at the end of four weeks. However, the addition of PNF to neural mobilization resulted in significantly greater improvements across all outcome measures.

Furthermore, the experimental group demonstrated better maintenance and marginal continued improvement at one-week follow-up, suggesting superior short-term retention of therapeutic effects. Therefore, incorporating PNF into conventional rehabilitation protocols may provide enhanced clinical benefits compared to neural mobilization alone.

REFERENCES

1. Magnus, W., Viswanath, O., Viswanathan, V. K., & Mesfin, F. B. (2024). Cervical radiculopathy. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK441828/
2. Taso, M., Sommernes, J. H., Kolstad, F., Sundseth, J., Bjorland, S., Pripp, A. H., Zwart, J. A., & Brox, J. I. (2020). A randomized controlled trial comparing the effectiveness of surgical and nonsurgical treatment for cervical radiculopathy. BMC Musculoskeletal Disorders, 21, 171.
3. Iyer, S., & Kim, H. J. (2016). Cervical radiculopathy. Current Reviews in Musculoskeletal Medicine, 9(3), 272–280.
4. Bielawski, J., Hunter-Smith, D. J., & Pan, W. R. (2018). Anatomy of the median nerve: A systematic review. Journal of Plastic, Reconstructive & Aesthetic Surgery, 71(3), 332–339.
5. Kuijper, B., Tans, J. T. J., Schimsheimer, R. J., van der Kallen, B. F. W., Beelen, A., & Nollet, F. (2009). Degenerative cervical radiculopathy: Diagnosis and conservative treatment. A review. European Journal of Neurology, 16(1), 15–20.
6. Boyles, R., Toy, P., Mellon, J., Hayes, M., & Hammer, B. (2011). Effectiveness of manual physical therapy in the treatment of cervical radiculopathy: A systematic review. Journal of Manual & Manipulative Therapy, 19(3), 135–142.
7. Bhattacharyya, D., & Saha, S. (2025). Efficacy of proprioceptive neuromuscular facilitation (PNF) technique in patients with cervical-originated arm pain on pain and functional disability: A single-arm pilot trial. Journal of Novel Physiotherapy and Physical Rehabilitation, 12, 1–5.
8. Hindle, K. B., Whitcomb, T. J., Briggs, W. O., & Hong, J. (2012). Proprioceptive neuromuscular facilitation (PNF): Its mechanisms and effects on range of motion and muscular function. Journal of Human Kinetics, 31, 105–113. https://doi.org/10.2478/v10078-012-0011-y
9. Maicki, T., Bilski, J., Szczygieł, E., & Trąbka, R. (2017). PNF and manual therapy treatment results of patients with cervical spine osteoarthritis. Journal of Back and Musculoskeletal Rehabilitation, 30(5), 1095–1101.
10. Suresh, V., Venkatesan, P., & Babu, K. (2024). Effect of proprioceptive neuromuscular facilitation and cranio-cervical flexor training on pain and function in chronic mechanical neck pain: A randomized clinical trial. Physiotherapy Research International, 29(1), e2058. https://doi.org/10.1002/pri.2058
11. Kim, D. G., Chung, S. H., & Jung, H. B. (2017). The effects of neural mobilization on cervical radiculopathy patients' pain, disability, ROM, and deep flexor endurance. Journal of Back and Musculoskeletal Rehabilitation, 30(5), 951–959.
12. Butler, D. S. (2005). The neurodynamic techniques: A definitive guide from the Noigroup team. Noigroup Publications.
13. Ibrahim, A. O., Fayaz, N. A., Abdelazeem, A. H., & Hassan, K. A. (2021). The effectiveness of tensioning neural mobilization of brachial plexus in patients with chronic cervical radiculopathy: A randomized clinical trial. Physiotherapy Quarterly, 29(1), 12–16.
14. Ellis, R. F., & Hing, W. A. (2008). Neural mobilization: A systematic review of randomized controlled trials with an analysis of therapeutic efficacy. Journal of Manual & Manipulative Therapy, 16(1), 8–22.
15. Coppieters, M. W., & Butler, D. S. (2008). Do "sliders" slide and "tensioners" tension? An analysis of neurodynamic techniques and considerations regarding their application. Manual Therapy, 13(3), 213–221.
16. Basson, A., Olivier, B., Ellis, R., Coppieters, M., Stewart, A., & Mudzi, W. (2017). The effectiveness of neural mobilization for neuromusculoskeletal conditions: A systematic review and meta-analysis. Journal of Orthopaedic & Sports Physical Therapy, 47(9), 593–615.
17. Ferraz, M. B., Quaresma, M. R., Aquino, L. R., Atra, E., Tugwell, P., & Goldsmith, C. H. (1990). Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis. Journal of Rheumatology, 17(8), 1022–1024.
18. Gärtner, F. R., Marinus, J., van den Hout, W. B., Vleggeert-Lankamp, C., & Stiggelbout, A. M. (2020). The Cervical Radiculopathy Impact Scale: Development and evaluation of a new functional outcome measure for cervical radicular syndrome. Disability and Rehabilitation, 42(13), 1894–1905.
19. Fakhoury, J., & Dowling, T. J. (2024). Cervical degenerative disc disease. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK560772/
20. Rafiq, S., Zafar, H., Gillani, S. A., Waqas, M. S., Liaqat, S., Zia, A., & Rafiq, Y. (2022). Effects of neurodynamic mobilization on health-related quality of life and cervical deep flexors endurance in patients of cervical radiculopathy: A randomized trial. BioMed Research International, 2022, 9385459.