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Acute Effects of Neural Mobilization in Patients with Cervical Radiculopathy: A Randomized Controlled Trial

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ABSTRACT

The aim of this study was to investigate the immediate effect of neural mobilization techniques, one of the manual therapy methods that can be used in the treatment of cervical radiculopathy(CR).

Forty-four patients diagnosed with CR were assigned to the Control Group(CG, n=22) or Neural Mobilization Group(NMG, n=22) by simple randomization. CG received conventional physiotherapy and NMG received additional neural mobilization to conventional physiotherapy. Pain levels and characteristics of the patients were evaluated with the Numerical Pain Rating Scale(NPRS) and Neuropathic Pain Questionnaire(NPQ) at the beginning and end of the intervention, hand grip strength and pinch grip strength were evaluated with digital hand dynamometer(JAMAR Plus Digital Hand Dynamometer) and digital pinch gauge(JAMAR Plus Pinch Gauge).

Although there was a significant difference in the severity of neck pain and grip strength of both hands in both groups($p<0.05$), there was no significant difference between the groups. While pinch grip strength increased in both groups, there was a greater increase in NMG than CG($p<0.05$). In the comparison of the post-intervention pain characteristics of the two groups, the neural mobilization group showed a significant decrease in "unpleasant pain" and "overwhelming pain" values compared to the control group($p<0.05$).The results showed that neural mobilization in CR was effective in acutely reducing pain and increasing hand grip and pinch strength. The addition of neural mobilization to the physiotherapy program may be considered for short-term goals in the treatment of CR, but its long-term effectiveness should be investigated.

Keywords: Cervial radiculopathy, hand grip, neural mobilization, pain, pinch grip

Introduction

Cervical radiculopathy (CR) is a clinical condition marked by pain, sensory and motor impairments, and slowed reflexes that results from compression of the cervical nerve roots (1). The pain usually radiates from the neck to the affected root (2). Another definition of CR is pain radiating to the arm with motor, reflex and sensory changes (paresthesia, numbness, etc.) triggered by neck posture or movements (3). There are several factors that can cause CR, the most common of which is cervical disc herniation (1-4).

Recent evidence in the treatment of CR has shown that conservative treatment is more effective than surgical options (5). Non-operative treatment of CR consists of immobilization, physical therapy, traction, manual therapy, medication and cervical steroid injection roots (5-7). Non-operative treatment has been demonstrated to give good to excellent results in 90% of patients roots (1,8). The effect of various therapeutic interventions of physical therapy has been investigated. The effect of various therapeutic interventions of physical therapy has been investigated. These studies include intermittent cervical traction, immobilization, ultrasound and infrared therapy and exercise therapy (9-11). Neural dynamic techniques (sliding, tension techniques) for the median nerve have been included in the literature in the treatment of CR (12); (13). Although positive results were reported, the duration of treatment was not recorded in these studies. In a systematic review, it was stated that there was no clear information about the treatment parameters, the nerve mobilized, the way mobilization was performed and the duration of the technique in the studies (7).

While there is a general consensus in the literature that manual therapy techniques, in conjunction

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with therapeutic exercise, are effective in reducing pain, disability, and improving function in patients with CR, there are no definitive treatment recommendations. However, the lack of specificity in the manual therapy techniques employed in previous studies raises uncertainty about the effectiveness of the intervention in terms of symptom reduction and functional improvement in patients with CR (7).

In the literature, neural mobilization exercises applied for 8 and 12 weeks in patients with cervical radiculopathy have been found to reduce pain, increase range of motion and endurance, and improve functional capacity (14,15). Research on acutely applied neuromobilization exercises is limited. Therefore, the aim of this study was to investigate the short-term impact of incorporating neural mobilization techniques into conservative treatment for patients with CR. We hypothesize that the addition of neural mobilization to conservative treatment will result in decreased neck pain and neuropathic pain as well as improved hand grip and pinch strength in patients.

Material and Methods

Participants and Setting: This study was designed as a randomized controlled experimental study and was conducted between November and January months in the Physiotherapy and Rehabilitation Department of Istanbul Medicana International Hospital. Population: The study included patients diagnosed with cervical disc herniation who were referred to physiotherapy sessions by a physician. Inclusion Criteria: Participants meeting the following criteria were included in the study: age between 18 and 65 years, referred to physiotherapy with a diagnosis of cervical disc herniation, self-reported neck pain with a visual analog scale (VAS) score of more than 5, presence of pain radiating from the neck to the arm, and at least 3 of the following tests were positive: Spurling's Test, Upper Extremity Tension Test-1, Distraction Test, and ipsilateral cervical rotation less than 60 degrees (16). These tests were assessed by a trained examiner according to standardized procedures

Exclusion criteria were surgical intervention in the head and neck region, history of fracture in the head and neck region, known chronic disease, infection and structural disorders in the bone and soft tissue in the cervical spine, malignancy and severe osteoporosis. A total of 44 patients with cervical disc herniation were included in the study, 22 in the neural mobilisation group and 22 in the control group.

Sample Size and Randomization: A total of 44 patients (22 in each group: Neural Mobilization Group (NMG) and Control Group (CG) were determined according to the G* Power package program, version 3.1.9.4, for statistical power of 80%, 95% confidence interval and medium effect size. Patients who met the inclusion criteria were assigned to two groups by simple randomization: NMG and CG (Figure 1).

Data Collection Tools: The data collection tools used in the study consist of clinical and socio-demographic information form, Numeric Pain Rating Scale (NPRS), Neuropathic Pain Questionnaire (NPQ), JAMAR Plus Digital Hand Dynamometer (Hand Grip strength), JAMAR Plus Pinch Gauge (Finger pinch muscle strength).

Clinical and Socio-Demographic Information Form: Socio-demographic information (age, height, weight, occupation) and clinical information (medical history, comorbidities, medication use, history of operation) of the participants were questioned with this form.

Numeric Pain Rating Scale (NPRS): Pain in the neck region of the participants was evaluated using NPRS before and after the intervention. NPRS is a subjective assessment of pain and a measurement method sensitive to change (17). NPRS was developed by Bond and Pilowsky in 1966 and is a valid and reliable method for measuring pain intensity (18,19). The Turkish validity and reliability study was conducted by Aslan FE in 1998 (17). In this scale, patients are asked to mark the pain they feel on a 10 cm scale. Accordingly, "0" indicates no pain and "10" indicates the most severe pain (20).

Neuropathic Pain Questionnaire (NPQ): The characteristics and severity of the patients' pain were assessed with the Neuropathic Pain Questionnaire before and after the intervention. This scale is used for the initial screening of patients with pain (19). It has the ability to provide a quantitative measurement for signs that are important in the diagnosis and evaluation of neuropathic pain (21). 10 questions in the questionnaire consisting of 12 questions ask about the nature of pain, while the other two questions ask about sensitivity changes (22). It was developed by Krause, Backonja in 2003 and its Turkish validity and reliability was conducted by Yurdakul and Rezvani in 2019 (22, 23). Each option in the 12-item questionnaire is scored between 0-100 points (0=not at all, 100=very

much), and a total score is obtained by multiplying the score given to each question by specified coefficients. A score less than zero indicates non-neuropathic pain and a score greater than zero indicates neuropathic pain (21). In the present study, this questionnaire was used to evaluate the qualities and severity of the participants' pain radiating to the arm and to determine the changes after the intervention.

Hand Girp And Pinch Strength: A digital hand dynamometer (JAMAR Plus Digital Hand Dynamometer) which is recommended by the American Association of Hand Therapists (AETD) and has been found to have high validity and reliability in many studies and is therefore considered the gold standard, was used to measure hand grip strength (23). The test was performed in an upright sitting position, 3 measurements were performed with one-minute intervals between each measurement and the averages were recorded (24). For painless grip strength, patients were asked to squeeze the dynamometer until they felt discomfort before and after treatment (25). The shoulder was in adduction and neutral position, elbow in 90° flexion, forearm in neutral position and wrist in 0-30° extension and 0-15° ulnar deviation position while the patients were sitting in a chair with their arms supported (26). Both hands were measured separately.

Pinch grip (two-point grip) strength was evaluated with a pinch meter (JAMAR Plus Pinch Gauge). Pinch grip strength is the grip force between the tips of the thumb and index finger. The application was performed comparatively in both extremities; patients were sitting in a chair with support, shoulder in adduction and neutral position, elbow in 90° flexion, forearm in neutral position, wrist in 0-30° extension and 0-15° ulnar deviation position (24). Measurements were taken before and after the intervention. Three measurements were made with one minute intervals between each measurement and the averages were recorded.

Intervention Program: The control group received Hotpack and TENS and Ultrason as conventional physiotherapy. Neural mobilization group received neuromobilization of radial, median and ulnar nerves in addition to conservative physiotherapy. Both groups were evaluated before and after the session.

Control Group (CG): Control group patients received one session of conservative physiotherapy program. The conservative program consisted of 20 minutes of heat application to the cervical region, 20 minutes of Transcutaneous Electrical Stimulation (TENS) application and 5 minutes of ultrasound application.

Neural Mobilisation Group (NMG): The neural mobilisation group received one session of conservative physiotherapy and neural mobilization at the end of the session. The content of the conservative program was the same in both groups. Before the neural mobilization application, a nerve stretching test was performed to provide a specific stretching position for each nerve and the patient was asked if he/she had any complaints. After adjusting the intensity of the neural mobilization tension, all participants were asked if they felt numbness, tension or tingling sensation in the nerve. When the symptoms were at a level that did not bother the patient, the nerve was held in that position for 10 seconds and then the nerve was left in the relaxation position. Each neural mobilization was performed in 10 repetitions.

Radial Nerve Mobilization: It was performed with the patient in supine position in bed and the physiotherapist in sitting position. The shoulder was abducted with shoulder girdle depression, elbow extension, shoulder internal rotation, forearm pronation, flexion of the wrist, thumb and all fingers and ulnar deviation. The tension intensity was adjusted with head rotation and lateral flexion movements. (27-29).

Ulnar Nerve Mobilization: With shoulder depression, 90° abduction, elbow in full flexion, forearm in full pronation, head facing the opposite side, the patient's wrist was brought to radial deviation in full extension. (30)

Median Nerve: For median nerve mobilization, the patient was placed in supine position in bed, the shoulder was in 90° abduction with shoulder girdle depression, the elbow was in extension, and the wrist joint and fingers were brought to ulnar deviation with extension movement. The intensity of the tension was adjusted with lateral flexion and rotation of the head (27-29).

Ethical Considerations: The approval of this study in accordance with the ethical rules of the Declaration of Helsinki was approved by the Üsküdar University Non-Interventional Research Ethics Committee with the decision dated 27/05/2022 date and numbered 61351342. Permissions were obtained from the head physician of the hospital where the study was conducted at the beginning of the study. The study was retrospectively registered in ClinicalTrials. Gov. (NCT05887427)

Statistical Analysis: The data analysis was carried out using the IBM SPSS Statistics 24 software package, encompassing various statistical analyses and methods. Descriptive data of the participants were presented as frequency (n), percentage (%), mean and standard deviation (SD). The normality of the data was assessed using the Shapiro-Wilk test, revealing that some of the data were normally distributed ($p>0.05$), while others deviated significantly from normality ($p<0.05$) at the 0.05 significance level. The chi-square test is used for comparing categorical data, the Independent T-test is used for comparing parametrically distributed data, and the Mann-Whitney U test is used for comparing nonparametrically distributed data between two groups. Paired Samples T test was used for parametric data and Willcoxon Signed Rank test was used for non parametric data in the analysis of within-group changes. Statistical significance was accepted as $p<0.05$.

Results

Table 1 presents the demographic characteristics of the participants. Statistical analysis revealed no significant differences in demographic data between the two groups ($p>0.05$).

The severity of neck pain and hand grip strength values among the participants were comparable prior to the intervention, with no significant statistical difference observed ($p>0.05$). A statistically significant difference was detected in the pinch grip strengths of the participants prior to the intervention ($p<0.05$) (Table 2)

Table 3 presents the details of pain characteristics and sensitivity to change as reported by the participants prior to the intervention. No significant differences were observed in the pain characteristics($p>0.05$), other than "unpleasant pain", between the two groups prior to the intervention. ($p<0.05$).

The intensity of neck pain, as measured by the Numeric Pain Rating Scale (NPRS), significantly decreased after the intervention in both groups ($p<0.05$). There was no significant difference observed between the two groups when compared ($p>0.05$). Right and left hand grip strength of both groups improved significantly after the intervention ($p<0.05$). However, no significant difference was found between the two groups after the intervention ($p>0.05$). After the intervention, the neural mobilization group showed a statistically significant increase ($p<0.05$) in pinch grip strength for both the right and left hands, outperforming the control group. Furthermore, there was a significant improvement ($p<0.05$) in right hand pinch grip strength in both groups compared to baseline after the intervention. (Table 4).

After the intervention, all pain identification parameters; except tingling pain in the control group; exhibited a significant decrease ($p<0.05$) compared to baseline in both groups, indicating a reduction in pain levels. Upon comparing the post-intervention pain characteristics of the two groups, it was observed that the neural mobilization group had significantly lower levels of "unpleasant pain" and "overwhelming pain" in comparison to the control group. ($p>0.05$) (Table 5)

Discussion

The aim of this study was to investigate the immediate effects of neural mobilization applications for radial ulnar and medial nerves added to the program in addition to conventional physiotherapy applications in patients with cervical radiculopathy. When we compared neural mobilization and conventional physiotherapy, we found that pain level decreased in both groups and hand grip and pinch grip strength increased in both hands, but there was no difference between the groups. There were significant differences in the characteristics of the pain experienced by the patients in the neural mobilization group compared to the control group; pain characteristics showed some improvements in both groups, but in the intergroup comparison, the neural mobilization group showed better improvement in some parameters compared to the control group.

Cervical radiculopathy (CR) is a disorder of the spinal nerve roots caused by a large space-occupying lesion, disc herniation compression, and bony prominences in the degenerated cervical spine, typically osteophytes, which can lead to nerve root inflammation, compression, or both (31). These lesions can trigger pain receptors in the soft tissues and joints of the cervical spine, leading to both sensory and motor changes such as loss or altered sensation in the upper extremity, numbness and tingling in the upper extremity, muscle weakness in the arms, hands, neck or scapular region, and pain along the nerve pathways to the hand and arm depending on the affected nerve roots (32, 33). Many nonsurgical treatment options for cervical radiculopathy have been discussed in the literature, and conservative

Table 1: Demographic Characteristics of Participants

Group		Control Group (CG) (n=22)	Neural Mobilization Group (NMG) (n=22)	p
		n (%)		
Gender	Female	13 (59.1)	10 (45.5)	0.546
	Male	9 (40.9)	12 (54.5)	
Affected Arm	Right	9 (40.9)	12 (54.5)	
	Left	13 (59.1)	10 (45.5)	0.546
		Mean (SD)		
Age (year)		34.86 (9.92)	29.18 (6.15)	0.65a
Height (cm)		171.59 (9.91)	172.95 (8.65)	0.425b
Weight (kg)		70.55 (11.46)	73.41 (11.40)	0.411b
BMI		23.89 (2.92)	24.52 (3.41)	0.511a

[a] Mann Whitney U Test, [b] Independent T-Test

Table 2: Baseline Clinical Characteristics of Participants

Group	Control Group (CG)	Neural Mobilization Group (NMG)	p
	Mean±SD	Mean±SD	
NPRS	7.09±1.11	7±1.23	0.652a
HGS R	21.52±9.83	24.62±10.02	0.189a
HGS L	19.02±9.16	22.33±10.24	0.139a
PS R	6.69±2.31	8.16±2.36	0.043b
PS L	5.55±1.8	7.32±2.24	0.006b

SD: Standart Deviation, NPRS: Numeric Pain Rating Scale, HGS: Hand Grip Strength, PS: Pinch Strength, L:left, R:right,
[a] Mann Whitney U Test, [b] Independent T-Test

treatment approaches have proven to be more effective in improving symptoms (34).

Roopa et al. 2017 (35) investigated the acute effect of neural mobilization on hand grip strength. In this study, which was conducted with a single group with a pretest-posttest design, the researchers reported that hand grip strength improved after the application and that neural mobilization may be a valuable maneuver to increase hand grip strength because of long-term application. Our study was planned as a randomized controlled trial to examine the acute effect of neural mobilization. In addition to hand grip strength, we evaluated the effect on pinch grip strength. Similar to the findings of Roopa et al, our study showed that hand grip strength increased in the neural mobilization group. However, we found that the same increase was also seen in the group that received only conventional physiotherapy. We think that this may be due to the decrease in pain in both groups and thus the ease of movement.

In the literature so far, treatments for cervical radiculopathy generally involve long- and combined therapies; most of the long-term interventions use neural mobilization and cervical traction as a combined treatment. In a study by Savva (36) and colleagues investigating the effectiveness of neural mobilization combined with traction for 4 weeks, 3 groups were compared: waitlist group, neural mobilization combined with cervical traction, and sham neural mobilization combined with cervical traction At the end of the 4-week follow-up period, it was found that the neural mobilization group combined with cervical traction provided a decrease in disability and pain intensity and improvement in function compared to the sham neural mobilization group combined with cervical traction. The researchers stated that cervical traction alone did not lead to a clinically significant difference. In another study (14) conducted in patients with cervical radiculopathy, the effectiveness of cervical traction and neural

Table 3: Baseline Pain Characteristics of Participants

NMQ Parameters	Control Group (CG)	Neural Mobilization Group (NMG)	pa
	Mean±SD	Mean±SD	
Burning Pain	30.9±26.35	26.36±29.68	0.536
Overly Sensetive to Touch	10.9±17.9	21.36±26.05	0.298
Shooting Pain	11.36±15.82	12.72±19.80	0.927
Numbness	36.81±32.27	42.72±36.92	0.521
Electric Pain	10±20.7	13.18±21.68	0.666
Tingling Pain	33.18±27.14	36.36±33.45	0.656
Squeezing Pain	8.63±16.7	9.52±16.87	0.569
Freezing Pain	12.27±20.91	11.36±16.70	0.658
Unplesant Pain	61.81±20.15	46.36±24.01	0.017
Overwhelming Pain	44.54±25.95	30±22.67	0.075
Increased Pain Due to Touch	8.63±16.7	18.18±23.83	0.342
Increased Pain Due to Weather Changes	11.81±21.52	17.27±23.13	0.470

SD: Standart Deviation, [a] Mann Whitney U Test

Table 4: Changes in Neck Pain Hand Grip Strength and Pinch Strength

	Control Group (CG)		p*	Neural Mobilization Group (NMG)		p*	p**
	BI-AI			BI-AI			
	Mean±SD			Mean±SD			
NPRS	7.09±1.11	4.95±1.04	0.001c	7±1.23	4.54±1.47	0.001c	0.396a
HGS R	21,52±9.83	22.95±10.1	0.001c	24.62±10.02	26,7±11.00	0.001c	0.110a
HGS L	19.02±9.15	20.05±9.97	0.001c	22.33±10.24	23,5±10.79	0.001c	0.105a
PS R	6.69±2.31	7.05±2.28	0.001d	8.16±2.36	8.55±2.37	0.001d	0.039b
PS L	5.55±1.8	5.95±1.65	0.001d	7.32±2.24	7.43±2.36	0.655d	0.021b

SD: Standart Deviation, BI: Before Intervention, AI: After Intervention, NPRS: Numeric Pain Rating Scale, HGS: Hand Grip Strength, PS: Pinch Strength, L:left, R:right,
*: Intra-group comparasion, ** Inter-group comparasion,
[a] Mann Whitney U Test, [b] Independent T-Test, [c] Willcoxon Signed Rank Test, [d] Paired Samples T Test

mobilization combined with cervical traction was compared. Because of the treatment 3 times a week for 8 weeks, a significant decrease in pain and disability and a significant increase in ROM and deep flexor muscle endurance were observed in the group combined with neural mobilization. The authors reported that adding neural mobilization in addition to traction may be an effective intervention for pain relief, relief from neck disability, and increase in ROM and deep flexor endurance. The combined effect of neural mobilization has often been demonstrated in long-term applications, and its combined application with cervical traction has been reported to have positive effects on pain and disability.

Ragones et al. (37) compared 3 treatment models for cervical radiculopathy: manual therapy, therapeutic exercise, and a combination of the two. At the end of a 4-week intervention, a significant reduction in pain and disability (NDI) assessed by NPSRS was observed in the 3 groups, but no statistically significant difference was found between the groups. Despite the acute effect analysis of our current study and the different intervention content of the group we compared, the results were similar and improvements were seen in both groups.

Rafiq et al. (15) compared neural mobilization added to conventional rehabilitation with conventional rehabilitation in patients with cervical radiculopathy and concluded that both neural mobilization and conservative treatment were effective, but neural mobilization was more effective in reducing pain and neck disability in

Table 5: Changes in Pain Characteristics

	Control Group (CG)		p*	Neural Mobilization Group (NMG)		p*	p**
	BI-AI			BI-AI			
	Mean±SD			Mean±SD			
Burning Pain	30.9±26.35	24.09±21.3	0.007	26.36±29.68	12.72±18.81	0.002	0.075
Overly Sensetive to Touch	10.9±17.9	3.1±10.8	0.007	21.36±26.05	10.45±14.95	0.005	0.022
Shooting Pain	11.36±15.82	7.27±12.41	0.041	12.72±19.80	3.63±9.53	0.007	0.273
Numbness	36.81±32.27	29.54±29.02	0.007	42.72±36.92	13.63±13.98	0.001	0.102
Electric Pain	10±20.7	7.27±17±23	0.034	13.18±21.68	4.55±7.38	0.016	0.708
Tingling Pain	33.18±27.14	26.63±24.35	0.07	36.36±33.45	17.72±17.43	0.006	0.131
Squeezing Pain	8.63±16.7	2.27±6.11	0.042	9.52±16.87	2.27±8.69	0.01	0.655
Freezing Pain	12.27±20.91	3.18±6.46	0.018	11.36±16.70	3.63±9.53	0.01	0.764
Unplesant Pain	61.81±20.15	33.18±17.83	0.001	46.36±24.01	20±16.61	0.001	0.014
Overwhelming Pain	44.54±25.95	27.27±17.5	0.001	30±22.67	11.81±11.39	0.001	0.004
Increased Pain Due to Touch	8.63±16.7	4.09±9.59	0.008	18.18±23.83	8.18±10.97	0.011	0.154
Increased Pain Due to Weather Changes	11.81±21.52	7.27±16.08	0.039	17.27±23.13	8.18±14.68	0.007	0.580

BI: Before Intervention, AI: After Intervention *: Intra-group comparasion, ** Inter-group comparasion,
[a] Mann Whitney U Test, [b] Independent T-Test, [c] Willcoxon Signed Rank Test, [d] Paired Samples T Test

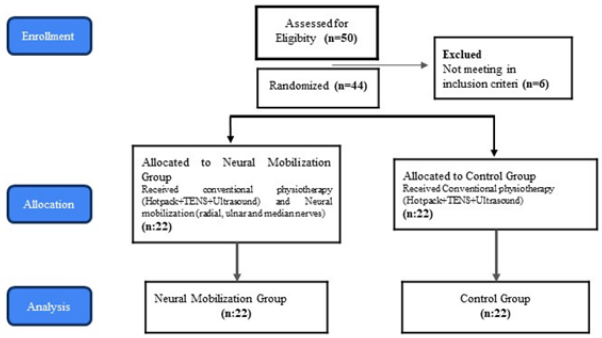

Fig. 1. Flow Chart

cervical radiculopathy. In our study, neural mobilization and conservative physiotherapy applications were found to have similar acute effects in terms of evaluated parameters, and significant improvements were observed in both groups. From this point of view, our acute intervention results are consistent with the 4-weeks intervention results of Rafiq et al. Our study found no significant difference between conservative treatment and neural mobilisation in terms of immediate effects.

In a systematic review by Borella-Andres et al. (38) examining the role of manual therapy methods for treating cervical radiculopathy, neural mobilization had worse results compared with joint mobilizations and neural mobilization showed similar results to conventional treatment. The review stated that neural mobilization along with traction gave better results. It was stated that

manual therapy approaches may be effective in combined treatment in patients with cervical radiculopathy. To investigate the short-term acute effect of neural mobilization, we applied neural mobilization after routine TENS, US, and hotpack treatments. Although there was a significant reduction in pain in the neural mobilization group, the results were similar to those in the group receiving conventional physiotherapy, as mentioned in the review. In addition to the conclusions in the review, we found a significant difference between the two groups in some pain characteristics in our study.

Boyles et al. (79) reported that in articles where physical therapy was found to be effective in cervical radiculopathy, the control group was often missing and details about the intervention applied were missing. They stated that this makes it difficult to determine the reproducibility of interventions found to be effective. They concluded that the most effective intervention in reducing symptoms and improving function in CR treatment cannot be said based on the available literature. In the review, the authors concluded that specific interventions for treating CR require high-quality randomized controlled trials with control groups.

The study's strengths include its design as a randomised controlled trial, a clear and detailed description of the intervention, and the provision of information on the immediate effects of neural mobilisation on multiple outcome measures. This study has some limitations. First, the diagnosis of CR was made clinically by a physician, but a diagnostic method such as EMG was not used. Since an acute effect was to be examined, previous treatment of the patients included in the study was not questioned and its effects were not taken into account. Another limitation was that the participants were divided into two groups by simple randomization and some baseline parameters had non-equivalent values.

As a result of this study, neural mobilization in addition to routine treatment was found to be effective in acutely reducing pain, increasing grip strength and changing the nature of pain in patients with cervical radiculopathy. According to the results of this study, both treatments are a viable option for immediate effect, but the addition of neural mobilization to the treatment was found to be more effective in some subjectively evaluated characteristics of pain. The addition of neural mobilization to the physiotherapy program may be considered for short-term goals in the treatment of CR, but more research is needed on its effectiveness in treatment

Conflict of Interest: The authors declared no conflict of interest.

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