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Original Article

Adverse Neural Tension Versus Neural Gliding on Pain and Hand Grip in Patients with Cervical Radiculopathy

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Abstract:

Purpose: to compare the therapeutic impact of adverse tension versus gliding neurodynamic mobilization on pain as well as hand grip strength in patients with cervical radiculopathy. **Methods:** forty-five patients complaining of cervical radiculopathy with pain along the course of median nerve from both genders, they aged from 35 to 55 years old, were randomized into 3 groups of the same number. Study group [I]: were given median nerve adverse tensioning neural mobilization technique along with a designated physical therapy program [interferential current, infrared, stretching as well as strengthening exercises for cervical and shoulder muscles], study group [II] were given median nerve gliding neural mobilization technique as well as the identical designated physiotherapy program as study group [I] and a control group that were given only the designated physiotherapy program for 12 sessions for 4 weeks, 3 times per week, with 60 minutes for every session. All patients were evaluated with the Visual analogue scale and the digital handheld dynamometer. **Results:** there was a significant difference between the three groups as the p-value was [0.001] which indicated that study group [II] showed reduction in cervical radicular pain intensity more than study group [I] and control group. **Conclusion:** The study revealed that four weeks of median nerve gliding neural mobilization technique as well as a designated physiotherapy program was a beneficial approach and was an effective treatment for patients with cervical radicular pain.

Key Words: cervical radiculopathy, neurodynamic techniques, visual analogue scale and digital handheld dynamometer.

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1. Introduction:

When cervical spinal nerves or nerve roots are compressed and inflamed, neurological impairment is the result. This is known as cervical radiculopathy [CR]. In terms of dermatomal distribution, symptoms such as pain, numbness, weakness, and altered reflexes are most commonly experienced in the neck and arms. Cervical disc herniation along with cervical spondylosis are the two most prevalent causes of CR **[1].**

The ability to maintain grip strength in the upper extremities is crucial for a wide range of daily activities. However, a fully functional neurological system is necessary for the best possible grip strength results. In other words, it should to have perfectly optimized physical and physiological features. Patients with CR frequently have low grip strength, making it essential to develop and employ an efficient method of restoring this strength **[2}.**

Recovering the nervous system's mobility and flexibility through neural mobilization is crucial for regaining normal function. Reducing the intrinsic pressure within neural tissue through movement and/or tension may regain the neural biomechanics, including elasticity as well as axoplasmic flow, to withstand normal compressive, tensile, as well as friction forces experienced in daily life and athletic competition **[3].**

So, the present study was conducted to investigate the impact of tension versus gliding neurodynamic mobilization on pain as well as hand grip strength in patients suffering from CR.

2. Patients and Methods

Participants*:*

forty-five patients complaining from CR with pain along the distribution of the median nerve. were recruited from neurological outpatient clinics of Faculty of physical therapy, Pharos University and Out Patient Clinics of Al Emam- El Asafra Hospital. this study was carried-out from October 2022 to May 2023.

Inclusion and exclusion criteria :

Inclusion criteria :

Forty-five patients were selected based on power analysis, complaining from CR with radiating pain along the distribution of the median nerve, they were diagnosed with CR by their own orthopedic or neurosurgical physicians by MRI as well as clinical assessment tests and referred for physical therapy management, their ages ranged from 35 – 55 years old from both genders, average duration of radiculopathy ranged from 3 to 8 months, they were selected with no history of any neurological problems, they were medically stable and consented to participate in the study, all patients had a weak hand grip strength on the scale of Camry digital hand dynamometer of [Male <35 kg – Female <25kg] and all patients had a positive Upper Limb Neural Tension [ULNT] test as well as spurling's compression test .

Exclusion criteria :

Patients were excluded from the study if they have: Any disorders limiting neural tissue testing [such as limitation of range of motion], cervical myelopathy, fracture, joint instability, a history of preceding cervical operation, gross neurological dysfunctions, thoracic outlet syndrome, inflammatory joint arthritis, medical red flags [dizziness produced by vertebrobasilar insufficiency] as well as severe psychiatric disorder or cognitive deficits, medically unstable and uncooperative patients and patients suffering from unstable onset of pain fewer than three months.

Instrumentation:

Assessment equipment :

Height as well as weight scale, visual analogue scale and digital handheld dynamometer [Item model number: EH101, Manufacturer: CAMRY].

Therapeutic equipment:

Interferential current [IFC] device.

Procedures of the study:

All patients were randomized into four-week randomized clinical trial Pre and post experimental design study. The approval of the study was obtained by the Ethical Committee for Scientific Research of the Faculty of Physical Therapy, Cairo University. The patients were randomly assigned to 3 matched equivalent groups. Study group I were given adverse tension neural mobilization for median nerve along with a designated physical therapy program, study group II were given gliding neural mobilization for median along with the identical designated phys-

ical therapy program as study group I and control group III were given the designated physical therapy program only [interferential current, infrared on the cervical region as well as upper back, cervical and shoulder muscles stretching as well as strengthening exercises].

Assessment procedures:

Both groups were assessed at baseline as well as after the treatment program by:

The comprehensive clinical evaluation sheet: [such as careful history taking in addition to evaluation of motor, sensory, co-ordination, activity of daily living as well as gait and radiological investigation [CT or MRI] to determine site of the lesion.

Visual analogue scale for pain Assessment: The patients were instructed to place a mark anywhere on a horizontal line that measured 100 mm in length and was labeled "no pain" at the beginning and "worst pain possible" at the opposite end of the line. The construct validity of VAS is confirmed up by the available evidence. Correlations between pain and the scales other measures of pain intensity are thought to be especially sensitive to therapies that reduce or eliminate pain. Pain levels were classified as follows: not painful [4 mm], mildly painful [5-44 mm], moderately painful [45-74 mm], and extremely painful (75-100 mm) **[4].**

The digital hand-held dynamometer for hand grip strength assessment: The patient was instructed to sit in a chair with a flat back and to put each foot on the floor. The tested shoulder had to be kept in a position of 0 degrees of flexion, abduction, as well as rotation, the elbow bent to 90 degrees, the forearm supported in a neutral position, and the wrist extended to among 0 and 30 degrees and in an ulnar deviation position of 0 to 15 degrees. After subjects established the standard arm posture, they were given a dynamometer with the second handle space adjusted and instructed to perform three 5-second periods of maximal grip strength. A 15-second rest was taken to reduce fatigue. Patients were advised to exert maximum force during each session by squeezing the handle. The results were expressed as a mean in kilograms [Kg] from three separate trials. The testing was performed using the dominant [right] hand **[5].**

Treatment procedures:

Median nerve tensioning for study group I:

When using a tensioning technique, the nerve is stretched by moving one or more joints to create a longer nerve bed. Tension was applied by extending the wrist [from 0° to 60°] as well as the elbow [from 90° to 165°] at the same time, and then bringing them back to their neutral positions [60° for the wrist and 90° for the elbow]. An elbow angle of 180° was considered full extension.

Median nerve gliding for study group II:

After the therapist has positioned themselves on the affected side adjacent to the patient and depressed the shoulder utilizing one hand whereas the elbow was at a 90-degree flexion angle, the forearm was in a supinated position, as well as the wrist and fingers were extended, the subject's arm was passively taken into a 90- to 100-degree of abduction [as tolerated by the subject] position. The next step will be to slide or glide, depending on the situation. following nerve gliding was done, a series of four sets of ten repetitions was alternated between extending the elbow [stretching the median nerve] and flexing the wrist [unloading the median nerve], and flexing the elbow [stretching the median nerve] and flexing the wrist [unloading the median nerve]. Slow oscillations were done for 10 seconds at each repetition, with 30 seconds between each set .

Interferential Therapy [IFT] for control group III:

All patients in all groups got a selected conventional physical therapy program designed to treat cervical radiculopathy with radiating pain along the course of the median nerve. It included Interferential Therapy [IFT] application with a four-electrode arrangement therapy 20 minutes. The beat frequency was set to 100 Hz.

A towel was placed on the plinth for hygiene purposes and the patient was in prone-lying position, uncovering the affected area and pillows were positioned below the abdomen for more relaxation; the cervical area was

cleaned using a gauze pad. The IFC adhesive electrodes were cleaned with alcohol also and were positioned on the patient's low back in a crossover manner **[6].**

In addition, 15 minutes per day of supervised isometric as well as static strengthening exercises of the cervical as well as shoulder muscles were conducted by all patients within all groups under the close supervision of a physical therapist.

Statistical analysis:

The characteristics of the subjects were compared across groups utilizing an ANOVA. The Shapiro-Wilk test was utilized to make sure that the data followed a normal distribution. Levene's test was conducted to see whether or not the variances between the groups were comparable. VAS as well as hand grip strength comparisons were made utilizing a mixed design MANOVA. For further multiple comparison, post-hoc tests with the Bonferroni correction were conducted. All statistical tests were performed at the p<0 0.05 level of significance. IBM SPSS Statistics Version 25 for Windows [Chicago, Illinois, USA] was utilized for all statistical analysis.

3. Results

3.1. Subject characteristics:

Table [1] reveals the patients characteristics of group I, II as well as III no significant difference has been observed among groups in age, weight, height, BMI as well as gender distribution [p > 0.05].

Table [1] Basic characteristics of participants:

	Group I	Group II	Group III	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age [years]	39.80 ± 4.25	38.40 ± 5.08	39.47 ± 3.56	0.65
Weight [kg]	77.53 ± 8.63	76.20 ± 6.56	75.40 ± 3.83	0.75
Height [cm]	174.20 ± 7.32	175.66 ± 8.03	173.3 ± 4.62	0.67
BMI [kg/m²]	24.39 ± 1.62	24.42 ± 0.77	24.56 ± 1.24	0.92
Sex distribution, N [%]				
Females	5 [33%]	5 [33%]	5 [33%]	
Males	10 [67%]	10 [67%]	10 [67%]	0.84

$\bar{x}$, mean; SD, Standard deviation; MD, Mean difference; p value, Probability value

3.2. Impact of treatment on VAS and hand grip strength:

The results of a mixed-model ANOVA showed that the two factors "treatment" and "time" interacted significantly [F = 72.21, p = 0.001]. Specifically, time had a significant main impact [F = 14751.07, p 0.001]. Treatment had a statistically significant main impact [F = 5.96, p = 0.001]**.**

•Within group comparison:

The 3 treatment groups all showed statistically significant improvements in hand grip strength after treatment in comparison with pre-treatment values [p < 0.001]. Group I reported a 42.08 % increase in VAS and a 102.26% increase in hand grip strength, Group II reported a 65.69 % increase and a 129.81 % increase, and Group III reported a 20.79 % increase and an 89.65 % increase**. Table 2** and **Figures 1-2**.

Between groups comparison:

at baseline, there was no statistically significant difference among the groups. There was a significant reduction in VAS as well as an improvement in hand grip strength in group II in comparison with groups I and III [$p < 0.001$], and there was a similar reduction in VAS and an improvement in hand grip strength in group I in comparison with group III after treatment [$p < 0.01$]. **Table 2 and Figures 1-2.**

Table [2] Mean VAS and hand grip strength pre and post treatment of group I, II and III:

	Group I	Group II	Group III	p-value		
	mean ± SD	mean ± SD	mean ± SD	A vs B	A vs C	B vs C
VAS						
Pre treatment	7.13 ± 1.36	7.20 ± 1.52	7.07 ± 1.49	0.99	0.9٩	0.9٦
Post treatment	4.13 ± 0.92	2.47 ± 0.92	5.60 ± 1.45	0.001	0.00٣	0.00١
MD	3	4.73	1.47			
% of change	42.08	65.69	20.79			
	p = 0.001	*p = 0.001*	*p = 0.001*			
Hand grip [lb]						
Pre treatment	26.07 ± 3.06	25.53 ± 3.50	25.80 ± 3.27	0.89	0.97	0.97
Post treatment	52.73 ± 3.23	58.67 ± 3.67	48.93 ± 3.65	0.001	0.01	0.0٠1
MD	-26.66	-33.14	-23.13			
% of change	102.26	129.81	89.65			
	p = 0.001	*p = 0.001*	*p = 0.001*			

SD, Standard deviation; MD, Mean difference; p-value, Level of significance

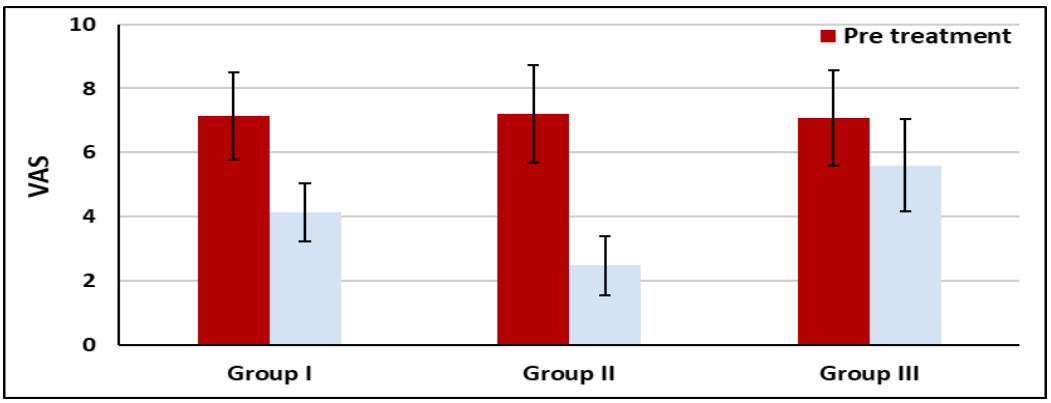

Fig [1]: Mean VAS pre and post treatment of group I, II and III.

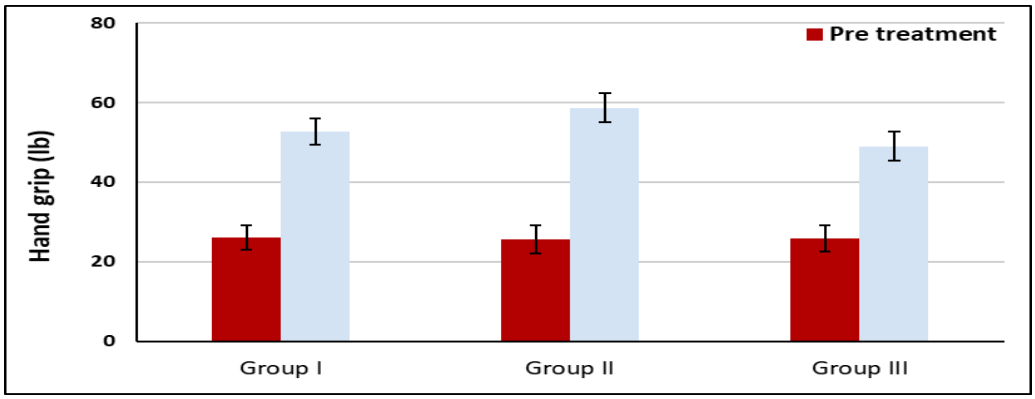

Fig. [2]: Mean hand grip pre and post treatment of group I, II and III.

4. Discussion:

The findings revealed that patients in group I that were given median nerve tensioning neural mobilization technique as well as group II that were given median nerve gliding neural mobilization technique had a greater statistically significant decline in pain as well as enhancement in hand grip strength, than group III which were given the designated physiotherapy program only, which had also a percentage of improvement but less than the study groups.

The findings of the present study came in agreement with a one case study conducted by Savva and Giakas [2013] [**7**], who stated that using a slider NM method on the median nerve in conjunction with cervical traction for a patient diagnosed with CR. Following 12 sessions throughout the course of a month, the patient informed improvements in pain as well as functional activities.

Consistent with our findings, Laxmi et al. [2015] [**8**] found that patients with CR who was given ITF in along with neural mobilization as well as traditional treatment demonstrated greater improvement than patients who was given ITF in addition to traditional therapy alone, as measured by reductions in VAS as well as NDI scores and increases in cervical range of motion. Therefore, this study provided supporting evidence that multimodal treatment, involving ITF with neural mobilization as well as standard treatment, may be most beneficial for individuals with CR.

Previous research by Shivani and Neha [2018] [**9**], examining the impact of median nerve NDM on those suffering from CR, found that patients' range of motion [ROM] improved from 6.47 cm prior to treatment to 1.53 cm after treatment. This finding is consistent with our own findings, which found that patients' VAS scores improved by 42.08 % in the study group [I] as well as 65.69 % in the study group [II] after treatment .

The findings of the current study also agreed with Roopa et al., [2017] [**10**], who examined the impacts of median as well as ulnar neural mobilization on hand grip strength in patients with CR, and according to the results, hand-grip power, as evaluated by a hand-held dynamometer, increased from a baseline mean of 37.89 Kg to an after treatment mean of 45.55 Kg.

In the same direction, Ranade and Snehal [2017] [**11**], investigated the impact of NDM on the cylindrical grip strength of older individuals. Consistent with the findings of the current study, there was a statistically significant difference between the means of grip strength prior to and following mobilization in males as well as females [the improvement was more in males than females].

Contradicting the findings of Fernandez-Carnero et al. [2019] [**12**], who showed that the neural tension approach was not better than the sham technique in reducing acute pain and increasing cervical mobility, the current study found the opposite to be true .

Also, the findings of the present study contradicted with Omer et al., [2021] [**13**], who found that combining tensioning NM with conventional physical therapy did not improve outcomes for patients with respect to mechanosensitivity or pain severity in comparison with those in the control group.

5. Conclusion

From the previous obtained statistical findings of the current study, it could be concluded that the study groups that received neurodynamic techniques specially the gliding neural mobilization as well as a designated physiotherapy program revealed a significant decline in the cervical radicular pain in comparison with the control group who were given the designated physiotherapy program alone, so the present study indicates that nerodynamic techniques specially the gliding neural mobilization is helpful in the decline of pain, functional abnormality and improving the physiological functioning of the nerve root and increasing the hand grip strength. Moreover, the cervical and shoulder muscles strengthening exercises are clinically capable of reducing pain and improving ROM, as well as function. highlighting that the significance of an exercise program in treatment targeted at functional recovery has been shown to be inexpensive, practical, as well as safe. So, the combination between the nerodynamic techniques and

the designated physiotherapy program could be used as a form of rehabilitation, and practitioners of physical therapy should recommend it as an efficient, reliable, noninvasive approach.

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