International Journal of Health Sciences and Research
Volume14; Issue: 4; April 2024
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effect of Median Nerve Mobilization on Pain and Handgrip Strength in Cervical Radiculopathy Patients

Dr. Bhagyashree Salekar[1], Dr. Shruti Mankar [2], Divya Salekar [3]

[1] Assistant Professor, Department of Kinesiotherapy and Movement Sciences, [2] Assistant Professor, Department of Cardiorespiratory Physiotherapy, [3] Certified Ergonomist
[1] Dr. D. Y. Patil College of Physiotherapy, Dr. D. Y. Patil Vidyapeeth, Sant Tukaram Nagar, Pune, India.
[2] PES, Modern College of Physiotherapy, Shivajinagar, Pune, India.
[3] Medical Writing Intern, Klarity Health, United Kingdom.

Corresponding Author: Dr. Bhagyashree Salekar

DOI: https://doi.org/10.52403/ijhsr.20240438

ABSTRACT

Cervical radiculopathy, a nerve root disorder can be a debilitating disease causing significant impairment with complaints of neck pain radiating to upper limb, paraesthesia, weakness and altered hand functions. Upper Limb Tension Test can be used to assess and to mobilize the entrapped nerve as it is both diagnostic and therapeutic. Hence this study was conducted to determine the effect of median nerve mobilization on pain and handgrip strength in cervical radiculopathy patients. 40 patients with cervical radiculopathy were allocated into 2 groups - Group A (control group) which received conventional treatment (Transcutaneous Electrical Nerve Stimulation and strengthening exercises) and Group B (experimental group) which received median nerve mobilization along with conventional treatment for 3 times a week for 4 weeks. Pre-intervention (day 1) and post-intervention (end of 4th week) assessment was taken for pain by Visual Analogue Scale and handgrip strength by handheld dynamometer for both groups. Results showed that both groups had statistically significant improvement in pain and handgrip strength post treatment with $p < 0.05$. Between group analysis revealed that experimental group showed more improvement post treatment as compared to control group with $p < 0.0001$. Hence, current study concludes that Median nerve mobilization along with conventional treatment was more effective than conventional treatment alone in reducing pain and improving grip strength in cervical radiculopathy.

Keywords: Cervical radiculopathy, median nerve mobilization, Upper Limb Tension Test, handgrip strength, visual analogue scale.

INTRODUCTION

The cervical spine allows more mobility at the expense of stability and strength due to its anatomical and biomechanical nature, which results in frequent cervical pain and dysfunction. Natural wear and tear and water content loss occur with aging leading to reduced intervertebral disc height. This process causes the narrowing of intervertebral foramina, which results in cervical radiculopathy [1]. Cervical radiculopathy is a common clinical diagnosis classified as a nerve root disorder due to a compressive or space-occupying lesion like a disc herniation, spondylotic spur, or cervical osteophyte [2]. It can be

caused by conditions like tumors, trauma, sarcoidosis, and arteritis in addition to disc herniation and cervical spondylosis. While chronic radiculopathies are related to spondylosis, acute radiculopathies are frequently associated with disc herniation [3].

Patients with cervical radiculopathy often experience significant functional limitation and disability due to pain, paraesthesia, numbness, tingling, and weakness in the dermatomal or myotomal distribution of an affected nerve root [4]. Muscle atrophy is hard to detect early as it is a late sign. Neck pain with limitation of mobility is often precipitated or aggravated by neck movements like extension and rotation or side flexion, sustained neck posture, or certain activities like lifting heavy weights, coughing, sneezing, jarring, or straining. Sedentary activities including prolonged sitting, watching television, reading, or desk work may affect neck posture [5].

A higher prevalence of cervical radiculopathy is observed in females and in the fifth decade of life, with an annual incidence rate of 83.2 per 100 000 people. The most commonly involved nerve roots in cervical radiculopathy are 6th and 7th cervical roots which are caused by C5-6 and C6-7 disc herniation or spondylosis [6]. C7 root involvement is linked to the motor deficit pattern of the wrist extensor and finger flexor muscles. The role of synergistic function of these muscles in hand grip causes loss in grip strength in patients with cervical radiculopathy, which is mentioned in several studies [7].

Cervical radiculopathy can be a debilitating disease causing significant impairment. The toll on this population can be significant both economically from lost work and wedges and psychologically from prolonged pain and impaired social functioning. Rapid diagnosis and treatment of this ailment should be the aim of clinicians to assist patients to return to their normal state of health [8].

A multitude of physiotherapy interventions such as electrotherapeutic modalities, mobilization, exercises have been proposed to be effective in the management of cervical radiculopathy. Investigators have attributed the therapeutic effects of Transcutaneous Electrical Nerve Stimulation (TENS) [9]. Others suggest that mobilizing the entrapped nerve with Upper Limb Tension Test (ULTT) can relieve sensory and motor deficits in these patients [10]. However, outcome studies using comprehensive treatment approaches on a well-defined sample of patients are lacking. Considering reduced grip strength in patients with cervical radiculopathy, grip strength can be an appropriate objective parameter to determine the efficacy of treatment regimes. Grip strength has been widely accepted as an objective index of the functional integrity of the upper extremity [7]. In this study, we measured grip strength as an objective parameter and VAS as subject-based outcome measure for pain to investigate the effectiveness of median nerve mobilization along with conventional physical therapy in the management of cervical radiculopathy.

MATERIALS & METHODS

This experimental study was conducted in Physiotherapy OPD of a tertiary health care centre in Pune, Maharashtra after obtaining the approval of the Institutional Ethics Committee. Patients with neck pain radiating to unilateral UE were assessed and 40 cervical radiculopathy patients fulfilling inclusion and exclusion criteria were included in the study.

Inclusion criteria

The study included cervical radiculopathy patients having unilateral symptoms, within the age group of 20-60 years, of both genders, tolerant to ULTT, and fulfilling diagnostic criteria mentioned in Table 1 [11].

Table 1: Diagnostic criteria for cervical radiculopathy

Sr. No.	Test	Performance	Criteria for positive test
1	Spurling Test	Patient was seated in chair and passive lateral flexion of neck towards symptomatic side was done then force through patient's head in caudal direction was applied.	Reproduction of patient's symptoms
2	Neck distraction test	Patient was in supine lying. Examiner grasped patient's head by placing one hand under patient's chin and other on occiput and then applied distraction force.	Reduction or resolution of patient's symptoms
3	ULTT for Median nerve	Patient was in supine lying and examiner placed patient's upper limb into scapular depression, shoulder adduction, forearm supination, wrist and finger extension, shoulder external rotation, elbow extension, contralateral and then ipsilateral cervical lateral flexion.	Any of the following: Symptom reproduction Greater than 10 degree difference in elbow extension Symptom aggravation with contralateral cervical lateral flexion or symptom reduction with ipsilateral cervical lateral flexion
4	Cervical ROM	Patient was seated in chair and cervical ROM was measured with a standard goniometer.	Ipsilateral cervical rotation less than 60 degrees.

Exclusion criteria

Patients with bilateral UE symptoms, cervical instability, central cord compression, spinal tumors or infection, history of fracture, trauma, and surgery around the cervical region, vertigo, and dizziness, carcinoma around the cervical region, whiplash injury, and uncooperative patients were excluded from the study [10].

Intervention

The intervention was explained to patients in the language understood by them and written informed consent was obtained. Patients were divided into one of the 2 intervention groups- Group A: Control Group (n=20) & Group B: Experimental Group (n=20), by convenient sampling method. Both groups received a conventional treatment protocol consisting of TENS for 10 minutes and 20 minutes of strengthening exercises for 3 days a week for 4 weeks. The experimental group received median nerve mobilization for 20-30 seconds in addition to the conventional treatment. Pre-intervention (day 1) and post-intervention (end of 4th week) evaluations were taken for pain by VAS and for grip strength by Jamar Dynamometer in the standardized arm and hand positioning for both the groups. The American Society of Hand Therapists (ASHT) recommended standardized positioning for grip-strength measurements where patient was seated with his shoulder adducted and neutrally rotated, elbow flexed at 90° and the forearm and wrist in neutral position. The dynamometer was lightly held around the readout dial by the examiner to prevent inadvertent dropping [12]. Average of 3 trials were noted.

Group A (Control Group):

This group received a conventional treatment protocol consisting of TENS and strengthening exercises.

1. **TENS:**

- Duration: 10 minutes
- Frequency: 2-5 Hz
- Biphasic, rectangular, long duration of greater than 300 microseconds (high intensity)
- Electrode placement: area of greatest intensity of pain [13].

Figure 1. Application of TENS

2. Strengthening exercises:
Patients performed one set of strengthening exercises mentioned in Table 2 with 10 repetitions of each exercise during the intervention session and 2 sets at home for 3 days a week for 4 weeks [14].

Table 2: Strengthening exercises

Sr. No.	Exercise	Description
1	Deep neck flexor	Patiently was instructed to slowly nod head and flatten the curve of neck without pushing head back into bed. Therapist monitors sternocleidomastoid muscle to ensure minimal to no activation of this muscle during deep neck muscle contraction.
2	Lower and middle trapezius	Patient horizontally abducted shoulder with scapular depression, adduction and external rotation with thumb pointing up towards ceiling. This was performed at 120° to 135° abduction for lower trapezius and at 90° for middle trapezius muscle. Patient placed his/her head and neck in comfortable posture by either rotating the neck to one side or by placing a pillow under upper chest and keeping neck in neutral position with forehead resting on a small towel roll.
3	Serratus anterior	Patient was in standing position in front of a wall and performed a "push-up with a plus" exercise by pushing away from wall until elbows were fully extended and scapulae were protracted as far as possible.

Group B (Experimental group):
This group received neural mobilization using ULTT for the median nerve for 20-30 seconds in addition to the conventional treatment. The patient was in supine lying and the therapist passively performed scapula depression, shoulder abduction (110°), forearm supination, wrist and fingers extension, shoulder external rotation, elbow extension, and neck contralateral side flexion [15].

STATISTICAL ANALYSIS

Data was analyzed using the statistical package SPSS19.0 (SPSS Inc., Chicago, IL) and level of significance was set at $p<0.05$ with 95% confidence interval. Descriptive statistics were performed to find out the mean and standard deviation of all the variables. Intergroup analysis of data was carried out by Student's independent t-test and for intra-group analysis paired t-test was employed.

RESULT

This study included 40 patients (18 males and 22 females) with unilateral cervical radiculopathy within age group of 20 to 60 years. Mean age and standard deviation (SD) of Group A was 47.93±5.6 and for Group B was 49.35±6.8.

Table 3: Gender distribution within study population

Group	Group A		Group B	
Gender	Male	Female	Male	Female
Frequency	7	13	11	9
Percentage	35%	65%	55%	45%

Table 4: Intragroup and intergroup comparisons of VAS

	Mean ± SD		Mean Difference	Intragroup comparison
	Pre-treatment	Post-treatment		P value
Group A	5.20 ± 1.51	3.90 ± 1.41	1.30	<0.0001
Group B	5.50 ± 1.57	2.25 ± 1.16	3.25	<0.0001
Intergroup comparison				<0.0001

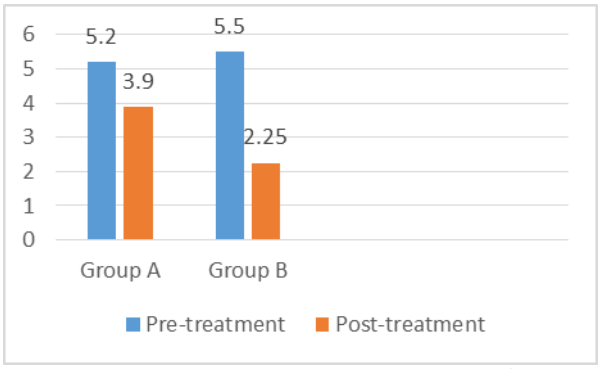

Figure 2 Intragroup and intergroup comparisons of VAS

Table 4 and Figure 2 represents within and between group comparisons of VAS. Post treatment VAS score reduced by 1.30 in Group A and by 3.25 in Group B. Results of paired t test revealed that both Group A and Group B showed statistically significant improvement in pain post treatment with p <0.0001. Unpaired t test showed that there is statistically significant difference between Group A and Group B with p <0.0001 stating that Group B is more effective in reducing pain with higher mean difference of 3.25.

Table 5: Intragroup and intergroup comparison of Handgrip strength

	Mean ± SD		Mean Difference	Intragroup comparison
	Pre-treatment	Post-treatment		P value
Group A	16.45 ± 1.84	19.53 ± 2.67	3.08	<0.0001
Group B	15.87 ± 1.57	2.25 ± 3.31	5.35	<0.0001
Intergroup comparison				<0.0001

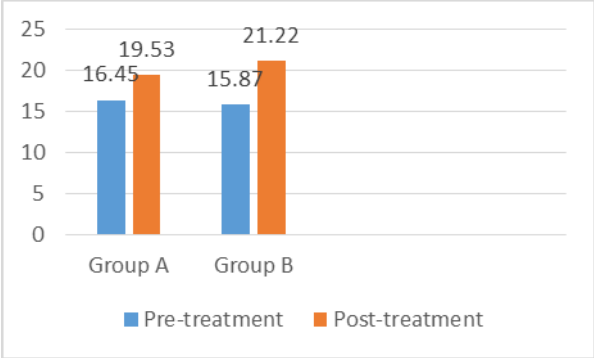

Figure 3. Intragroup and intergroup comparisons of Handgrip strength

Table 5 and Figure 3 represents within and between group comparisons of Handgrip strength. Post treatment Handgrip strength was increased by 3.08 in Group A and by 5.35 in Group B. Results of paired t test revealed that both Group A and Group B showed statistically significant improvement in Handgrip strength post treatment with p <0.0001. Unpaired t test showed that there is statistically significant difference between Group A and Group B with p <0.0001 stating that Group B is more effective in improving Handgrip strength with higher mean difference of 5.35

DISCUSSION

The main objective of current study was to reduce pain and improve handgrip strength in patients with cervical radiculopathy. Statistical analysis revealed that both median nerve mobilization along with conventional treatment and conventional treatment were effective in reducing pain (p <0.0001).

Conventional treatment included application of TENS and deep neck muscle strengthening exercises which reduced pain in cervical radiculopathy patients. TENS is a simple, non-invasive analgesic technique which produces a comfortable sensation without muscle contractions to modulate pain. This approach was first proposed by Melzack and Wall, who suggested that electrical stimulation may reduce the sensation of pain by interfering with pain transmission at the spinal cord level. This approach is known as gate control theory of pain as A Beta fibres (large diameter fibres) are stimulated by low rate TENS and transmission of impulses from A Delta and C fibres (small diameter fibres) are blocked and encephalin is also released at the level of substantia gelatinosa in the 2nd lamina of spinal cord. Stimulation of mechanoreceptors reduces excitability of nociceptors and reduces pain perception [13]. Strengthening exercises reduce pain by increasing activity in motor pathways and inhibiting pain centers in Central Nervous

System [16]. Deep neck muscles, the longus colli and the longus capitis play an important role in the maintenance of cervical stability, hence increased in the strength and endurance of the deep muscles can improve the ability to maintain a standing posture and the proper neutral position of the neck [17]. Exercises improve blood circulation and oxygenation which reduces spasm and stiffness decreasing neck pain. Strengthening and endurance exercises may have been able to reduce neck pain and improve neck posture by bringing the centre of gravity at its place and correcting the biomechanics of spine [18].

Neural mobilization via upper limb tension test was useful as an examination and intervention tool for cervical radiculopathy patients. Kleinrensink et.al found that the test for median nerve is most specific and considerably more tension is produced in the MN than radial or ulnar nerve [15]. Hence, current study used median nerve mobilization to reduce pain and improve handgrip strength. A few researchers attempted to improve pain and other symptoms by mobilizing the nervous system. Butler stated that in joint problem it is possible and clinically effective to treat pain via nervous system mobilization. Studies by Burton et al showed that mobilization of the SLR concerning pain reproduction can lead to improved pain free range of movements [19].

Elvey(1986), Maitland(1986) and Butler and Gifford (1989) have mentioned cause for restricted function can be restricted movement of the nervous system, then termed adverse mechanical, or neural tension(AMT or ANT). That is to say impairment of movement and/or elasticity of the nervous system may cause symptoms from within its own tissues, such as pain and restriction of movements. The goal of mobilization was to increase the flexibility of collagen that maintains the integrity of the nerve and movement of the nerve in relation to its surrounding structures. Mobilization of nervous system has a mechanical effect that must affect the vascular dynamics, axonal transport systems and mechanical features of nerve fibres and connective tissue. The stuck peripheral nerve surrounded by fresh blood and oedema would benefit from movement. Dispersion of an intraneural oedema could be enhanced by alteration of pressures in the nervous system during movement. Some of this improvement could be due to improved blood supply to hypoxic nerve fibres [15].

Pain may lead the individual to avoid work and/or exercise. The consequent decrease in muscle loading may cause muscle weakness [20]. Pain reduction and improvement in neck posture help in improving upper extremity functional ability such as handgrip strength. The present study was also supported by recent electrodiagnostic studies that have also shown significant improvement of neurological deficit of the affected nerve root in patients with cervical radiculopathy after neural mobilization and exercises. Both nerve root conduction and circulation improvements seem to contribute to the restoration of nerve function early enough to produce immediate effects in neuromuscular performance of the hand and grip [7]. All statistically calculated values showed that the experimental protocol was more helpful in the management of cervical radiculopathy with respect to handgrip strength and Pain.

CONCLUSION

Median nerve mobilization along with conventional treatment was more effective than conventional treatment alone in reducing pain and improving hand grip strength in patients with cervical radiculopathy. It can be incorporated effectively in the management of cervical radiculopathy.

Declaration by Authors

Ethical Approval: Approved
Acknowledgment: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Kuijper B. Et al. Degenerative cervical radiculopathy; diagnosis and conservative treatment: A Review. European journal of neurology 2009, 16(1):15- 20.
2. Ellenberg MR, Honet JC, Treanor WJ, Cervical radiculopathy Arch Phys Med Rehabil. 1994; 75:342-352.
3. Magee, David J. Orthopedic Physical Assessment. 5th ed. Philadelphia: Saunders; 2002.
4. Sampath P, Bendebba M, Davis JD, Ducker T. Outcome in patients with cervical radiculopathy. Prospective, multicenter study with independent clinical review. Spine. 1999; 24:591-597.
5. Binder AI. Cervical Spondylosis and Neck Pain. BMJ. 2007; 334(7592):527- 31.
6. Gerard A Malanga, MD. Cervical radiculopathy clinical presentation. Dec 14 2016.
7. Joghataei MT, Arab AM, Khaksar H. The effect of cervical traction combined with conventional therapy on grip strength on patients with cervical radiculopathy. Clin Rehabil. 2004 Dec; 18(8):879-87.
8. Radhakrishnan K, Litchy WJ, O'Fallon WM, Kurland LT. Epidemiology of cervical radiculopathy. A population based study from Rochester, Minnesota, 1976 through 1990. Brain. 1994; 117(Pt 2):325-335.
9. Schoenfeld, Andrew J. MD; George, Alan A. DO; Bader, Julia O. PhD; Caram, Pedro M. Jr MD. Incidence and epidemiology of cervical radiculopathy in United States Military: 2000 to 2009. Journal of spinal disorders and techniques. Feb 2012- vol.25.
10. Shah Sarfraz Nawaz, F et al. "The effect of the upper limb tension test in the management of rom limitation and pain in cervical radiculopathy." International journal of physiotherapy and research 3 (2015): 1065-1067.
11. Wainner RS, Fritz JM, Irrgang JJ, Boninger ML, Delitto A, Allison S. Reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. Spine. 2003; 28:52-62.
12. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. J Hand Surg Am. 1984 Mar; 9(2):222-6.
13. Low J (John L), Reed A. Electrotherapy Explained : Principles and Practice / John Low, Ann Reed ; Foreword by Mary Dyson. 2nd ed. Butterworth-Heinemann; 1990.
14. Kang DY. Deep cervical flexor training with a pressure biofeedback unit is an effective method for maintaining neck mobility and muscular endurance in college students with forward head posture. J Phys Ther Sci. 2015 Oct; 27(10):3207-10.
15. Buttler DS mobilization of the nervous system New York, NY; Churchill Livingstone Inc; 1991.
16. González-Iglesias J, Fernández-de-las-Peñas C, Cleland JA et al. Short-term effects of cervical Kinesio Taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. J Orthop Sports Phys Ther. 2009; 39:515521.
17. Ekstrom RA, Bifulco KM, Lopau CJ, et al. Comparing the function of the upper and lower parts of the serratus anterior muscle using surface electromyography. J Orthop Sports Phys Ther, 2004, 34: 235–243.
18. Thomas, Knottnerus JA. Effects of exercises on mechanical disorder. A Cochrane review 2007; 2(6): 42-56.
19. Burton S, Brunsdon J and Bleicher K. An investigation of different methods of stretching the structures which limit straight leg raise. In Proceedings 5th biennial conference Manipulative therapists association of Australia 1987.Melbourne.
20. Arja häkkinen, petri salo, ulla jari ylinen et al. Effect of manual therapy and stretching on neck muscle Strength and mobility in chronic neck pain; J Rehabil Med 2007; 39: 575–579.

How to cite this article: Bhagyashree Salekar, Shruti Mankar, Divya Salekar. Effect of median nerve mobilization on pain and handgrip strength in cervical radiculopathy patients. *Int J Health Sci Res.* 2024; 14(4):266-272. DOI: *https://doi.org/10.52403/ijhsr.20240438*

******