International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Effect of Combined Neck, Shoulder and Hand Exercises with Conventional Physiotherapy Treatment on Hand Grip Strength and Hand Function in Patients with Unilateral Cervical Radiculopathy: A Comparative Study

Ishika S. Patil[1], Saumi Sinha[2]

[1]Intern, Department of musculoskeletal physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, PIMS (DU), Loni, Maharashtra, India.
[2]Professor & Head Of Department, Department of Cardiorespiratory Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, PIMS (DU), Loni, Maharashtra, India.

ABSTRACT

Background: Weakness, numbness, discomfort, pain, radicular symptoms in the ipsilateral extremity may come from a herniated disc or a bone spur pressing against an irritated nerve root. This arises problems like decreased neck ROM, neck- shoulder pain, it's possible that the injured nerve root will weaken the muscles it controls. Finally, the intrinsic hand muscles are noticeably weaker as a result of the 8th cervical nerve root being affected by a herniated C7-T1 disc. The interosseous muscles may quickly atrophy as a result of this involvement. A considerable reduction in fine hand motion results from the loss of the interossei this results in weak hand grip and poor prehension patterns and pinch which impairs the individual's ability to perform everyday activities.

Introduction: Cervical radiculopathy has an annual incidence rate of 83 per 100,000, a prevalence rate of 3.3 instances per 1000 people. Cervical spondylosis or disc herniation are the most common causes. Most cervical radiculopathy patients seek medical attention for neck pain, numbness, tingling, decreased grip strength, and general upper extremity muscular weakness. Depending on the level of the damaged nerve root, the loss of upper extremity strength results in limitations in upper extremity functions. When compared to the unaffected or normal side, studies have indicated that patients with unilateral cervical radiculopathy have significantly reduced hand and grip strength on the affected side. In this study a combined Neck, Shoulder, Hand (NSH) exercise protocol is implemented in treatment of patients with unilateral cervical radiculopathy. Efficiency of this experimental exercise protocol is compared with conventional physiotherapy treatment for cervical radiculopathy by using hand grip strength and hand function as outcome measures.

Objective: To observe the effect of combined neck, shoulder, hand exercise protocol on hand grip strength and hand function in patients with unilateral cervical radiculopathy.

Methodology: 56 participants were screened and 40 participants were recruited according to the selection criteria and were randomly allocated to group A (conventional exercise protocol) (n =20) and group B (

combined NSH exercise protocol) (n= 20). Baseline assessment of handgrip strength using Jamar handheld dynamometer (HHD) and hand function using Jebson Taylor hand function test (JTHFT) was obtained for all participants. Following which participants underwent exercise program training for 4 weeks, 3 sessions per week. After which post intervention assessment was done.

Result: Group A and B demonstrated significant improvement in hand grip strength and hand functions ($p > 0.0001$). Also significant improvement was seen in hand grip strength and hand function when intergroup comparison was done ($p > 0.0001$)

Conclusion: The study concludes that there is significant improvement in hand grip strength and hand functions after implication of 4 weeks of combined neck, shoulder, and hand exercise protocol in patients with cervical radiculopathy having complains of pain, weakness and difficulty in performing ADLs

Keywords: Cervical radiculopathy, Jamar handheld dynamometer, Jebson Taylor hand function test.

1. INTRODUCTION

In the mid-1930s, cervical radiculopathy was first linked to disc disease, despite being identified as early as the 20th century. Cervical spondylosis or disc herniation are the most common causes. To diagnose the radiculopathy and identify the underlying level implicated, a history and physical examination that includes manual muscle testing, specialized testing (Spurling's maneuver), and pain localization are typically sufficient.[1] Cervical radiculopathy can often be diagnosed with a thorough history and physical examination, but an magnetic resonance imaging or computed tomographic myelogram should be used to confirm the diagnosis. Because of the ubiquity of degenerative changes found on these imaging modalities, the patient's symptoms must correlate with pathology for a successful diagnosis.[2]

The disorder known as cervical radiculopathy is brought on when a nerve root in the cervical spine is compressed. Radicular symptoms in the ipsilateral extremity may come from a herniated disc or a bone spur pressing against an irritated nerve root.[3] Weakness, numbness, and discomfort where the nerve travels are caused by nerve root compression. Along the nerve's course, the pain may be intense, stabbing, or deep, dull, and achy. It's possible that the injured nerve root will weaken the muscles it controls.[4] According to a study, C5-C6 and C6-C7 are the most frequently affected sites in cervical radiculopathy because they allow for more motion [5] Finally, the intrinsic hand muscles are noticeably weaker as a result of the 8th cervical nerve root being affected by a herniated C7-T1 disc. The interosseous muscles may quickly atrophy because of this involvement. A considerable reduction in fine hand motion results from the loss of the interossei. [4]

Cervical radiculopathy has an annual incidence rate of 83 per 100,000, a prevalence rate of 3.3 instances per 1000 people, and a peak incidence of occurrence in the fourth and fifth decades of life, although not being as prevalent as lumbar radiculopathy. Although the illness affects both genders equally, it manifests more prominently in the fourth and fifth decades of life. [5][6]

Most cervical radiculopathy patients seek medical attention for neck pain, numbness, tingling, decreased grip strength, and general upper extremity muscular weakness. Depending on the level of the damaged nerve root, the loss of upper extremity strength results in limitations in upper extremity functions [3]. When compared to the unaffected or normal side, studies have indicated that patients with unilateral cervical radiculopathy have significantly reduced hand and grip strength on the affected side. [4] Disability results from postural distortions, such as the forward head posture, in the advanced condition because the

cervical muscles, which are particularly important to the mechanical stability of the cervical region, are compromised.[3]

The existing treatment for these condition are medications, surgical management and physiotherapy. The physiotherapy management for the condition includes; educating the patient, heating modalities like SWD, ultrasound, TENS, infrared lamps, hydrocollator packs, hydrotherapy, stretching of the neck muscles and range of motion exercises.[4] Chest flies, bench press, shoulder shrug, biceps curl, and bend over roll on the upright position,[3] chin tucks[7], wall slides, wall push ups[8], scapular retractors exercise, stretching the chest muscles and the neuromobilization exercises[9]Some treatments that have been proven to be successful include cervical manipulation, manual traction, specialized pillows, cervical massage, relaxation techniques to reduce mental stress that aggravates the symptoms, and intermittent cervical spine traction. Unfortunately, no agreement on the best course of intervention has yet been found.[3]

In cervical radiculopathy structural impairments result in impaired functions of neck, shoulder, hand. In this study a combined Neck, Shoulder, Hand (NSH) exercise protocol is implemented in treatment of patients with unilateral cervical radiculopathy. Efficiency of this experimental exercise protocol is compared with conventional physiotherapy treatment for cervical radiculopathy by using hand grip strength and hand function as outcome measures.

The combined neck, shoulder, hand exercise protocol includes hot pack ,TENS[4], cervical dynamic isometric exercise this is a form of cervical stabilization exercise which increases cervical stability by improving muscle strength and endurance, enhances cervical mobility, increases vertebral alignment and improves sensorimotor function [3], Swiss ball exercise for neck flexors and scapular retractors has many benefits such as allowing free weight resistance exercise , neuromuscular demands on the whole body for motor coordination and facilitate multi-angle resistance training which elicits greater ROM.[10], stretching for trapezius, levator scapulae, scalene muscles[4], upper extremity PNF diagonal patterns, Proprioceptive neuromuscular facilitation (PNF) is most commonly used to restore range of motion (ROM), decrease pain, increase strength and endurance, hasten motor learning, improve coordination, facilitate proximal stability, and initiate functional progression [11], therapeutic putty exercise for hand have beneficial effects on manual dexterity and strength in persons who have difficulty combining movements of reach and grip which affects performance of functional activities. [12].The combined NSH protocol includes stretching and strengthening exercises, studies report decreased neck strength in patients with chronic neck pain may be related to pain induced inhibition of motor system as well as structural changes in neck muscles. It is suggested that strengthening exercise should lead to beneficial morphological changes in the muscles.[13]

ADLs, gross and fine motor skills, tool use, manipulations, dexterity, grip and release of items, and unilateral and bilateral hand use and sensibility are all considered upper extremity functions. Assessment of handgrip strength is a crucial part of hand rehabilitation because without the capacity to grasp, a person loses their functional independence and is unlikely to be able to work. Power is a good predictor of hand function. Among all muscle function tests, measurement of hand grip strength has gained attention as a simple, non-invasive marker of muscle strength of upper extremities, well suitable for clinical use. There are reviews to outline the prognostic relevance of grip strength in various clinical and epidemiologic settings and investigates its suitability as marker of nutritional status in cross-sectional as well as intervention studies [3] It is common practice to use a dynamometer to measure hand muscle strength as a metric to evaluate hand function.[2]

A literature review conducted concluded that HHD is a valid and reliable method that may be used for the assessment of strength [14]. HHD has normative values which are particularly useful when it is necessary to compare the patient against norm[15]A standardized method for use of HHD is established for proper assessment. The patients were seated in a chair with shoulder adducted, neutrally rotated, elbow flexed at 90-degree, forearm neutral, wrist between 0 degree and 15-degree dorsiflexion and 0 degree and 15-degree ulnar deviation. Hold the dynamometer lightly around readout dial. Then the patient has instructed to hold the handle and "squeeze" as hard as possible and then "Relax". Same technique was repeated with same instructions for the second and third trial. [2]

The prehension patterns, lateral pinch, opposition pinch, and functional grasps are the characteristics of hand functioning that are most frequently measured. [4]. In an evaluation setting where the therapist has not had the opportunity to see the patient using the hand, the hand function test is useful to examine grip patterns and create an issue index. It is also useful to study and evaluate treatment outcomes. [4]. For a variety of medical and surgical disorders, the Jebsen-Taylor hand function test has been extensively utilized to assess hand functioning. It is reasonably easy to put together. It is quick and simple to use..[4] Studies have reported that JTHFT is a reliable and valid outcome measure to assess broad aspects of common hand functions of daily use [16][17]. It consists of 7 subtests, each with known procedures and materials to be performed with.[4][18] Each test is timed, and there are published standardized times against which to evaluate the performance of the patient[18].Subtests includes : (1) Writing (2) Turning Cards (3) Lifting small objects(4) Simulated feeding(5) Stacking checkers(6) Lifting large, lightweight object(7) Lifting large, heavy objects [4]. The examiner reads the directions to the patient and records the time that the patient requires to complete each subtest with the non-dominant and then the dominant hand. The results are compared with normative data available relative to gender and age.[16] Seven subtests were chosen to provide a broad sampling of hand function. Each of the subtests was designed to be administered in precisely the same manner to each subject. The results were measured objectively using a stopwatch. Each subject was seated in a chair of 18-inch height at a desk of 30-inch height in a well – lighted room. Questions were answered after the instructions were given to be certain that the instructions were understood. The subtests were always presented in the same sequence and were always performed with the non-dominant hand first.[4] Progression in the test score was seen as decrease in the seconds required to perform a subtest post- treatment compared to previous score.

So in this study pre and post assessment of hand grip strength and hand function is assessed using Jamar hand held dynamometer (HHD) and Jebson-Taylor hand function test (JTHFT) respectively to compare effectiveness combined NSH exercise with conventional therapy in patients with unilateral cervical radiculopathy.

2. MATERIALS AND METHODS

Study setting: The study took place in Dr. APJ Abdul Kalam College of physiotherapy, Pravara Institute of Medical Sciences, Loni from 15 April 2023 until 31 January 2024 after the ethical approval from the institute.

Population and sampling: Participants were selected based on inclusion and exclusion criteria which is mentioned below. The software tool used to calculate the sample size was Openepi. The study included 40 patients between the age of 30 to 60 years who were diagnosed with unilateral cervical radiculopathy

Study design: The type of study was a comparative study. The study included 40 patients between the age of 30 to 60 years who were diagnosed with unilateral cervical radiculopathy and were selected based

on inclusion and exclusion criteria. Informed written consent was obtained and instructions were provided about the test to be performed and exercise protocol to be followed. Participants were divided in two equal groups i.e group A and group B. Hand grip strength and hand function assessment was done for participants in both the groups. Group A followed conventional exercise protocol and group B followed combined NSH exercise protocol for intervention period of 4 weeks with 3 sessions per week. Post - intervention assessment for hand grip strength and hand function was taken in last session. The difference in data obtained from pre and post assessment was analyzed to evaluate the efficacy of conventional exercises in comparison to combined NSH exercise protocol.

2.1 SELECTION CRITERIA

Inclusion Criteria:

1. Subjects with diagnosed unilateral cervical radiculopathy based on MRI findings.
2. Age 30-60 years
3. Both males and females
4. Patients with active complaints of pain, weakness of unilateral upper extremity on involved side at least for past three months.
5. 2 of 3 tests used for clinical assessment should be positive:

- Spurling test
- Distraction test
- Upper limb tension test

Exclusion Criteria:

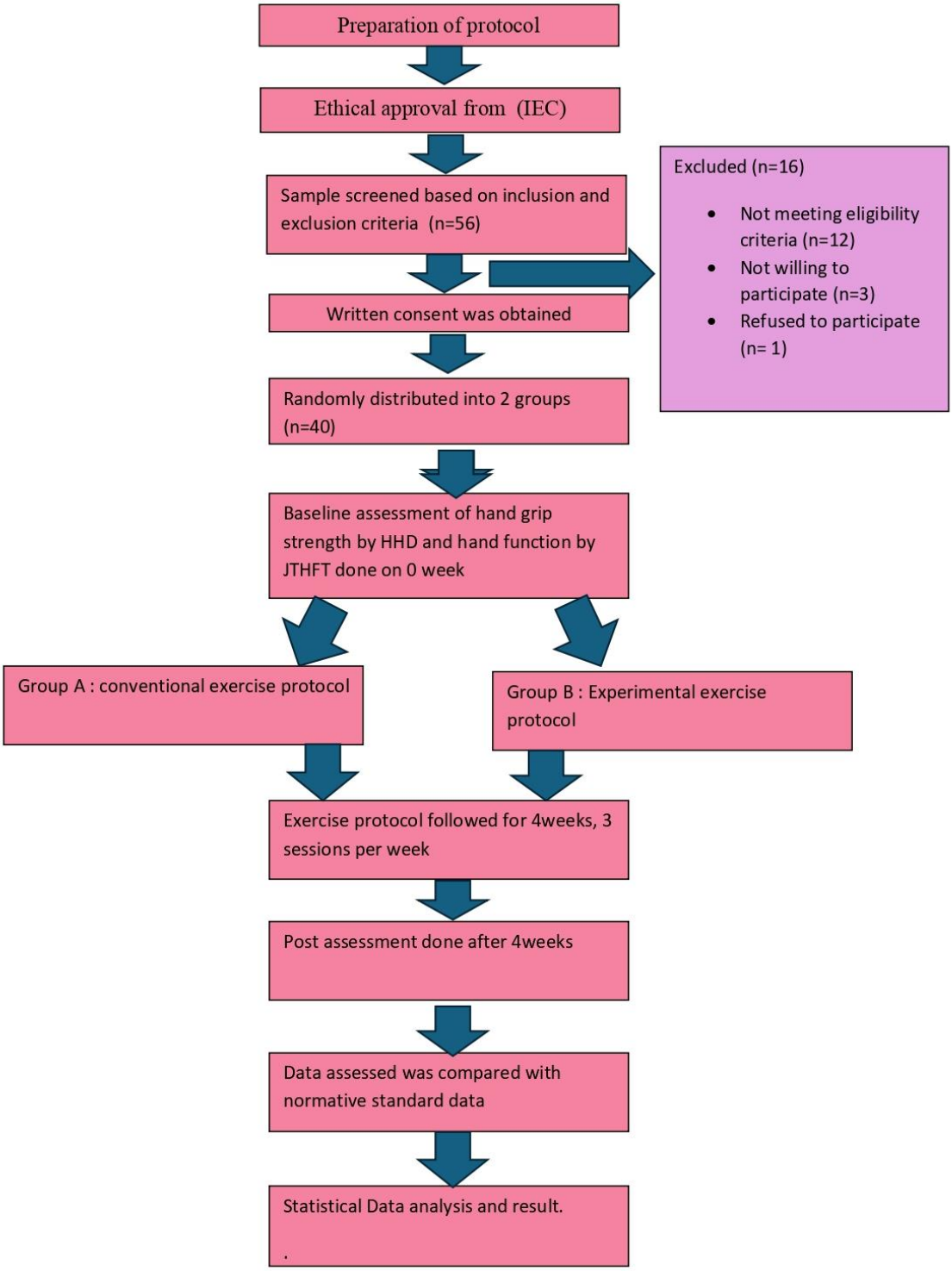
1. History of previous cervical or thoracic spine surgery
2. Bilateral upper-extremity symptoms of cervical radiculopathy and patients with complaints of paresthesia, numbness.
3. Signs or symptoms of upper motor neuron disease
4. Medical “red flags” (e.g: tumor, fracture, cervical myelopathy, rheumatoid arthritis, osteoporosis, prolonged steroid use
5. Subjects with diagnosed musculoskeletal conditions (e.g: carpal tunnel syndrome, De Quervain’s tenosynovitis, trigger finger, rotator cuff injury, epicondylitis, impingement syndrome)
6. Subjects with diagnosed neuromuscular disorders (e.g: myasthenia gravis, gullian barre syndrome)
7. Subjects with peripheral vascular diseases (e.g raynaud syndrome)

2.2 OUTCOME MEASURES

Outcome measures used for this study are as follows:

1. Hand grip strength – Jamar handheld dynamometer (HHD) will be used for assessment of hand grip strength. It is a valid and reliable method that may be used for the assessment of strength.
2. Hand functions – Jebson-Taylor hand function test (JTHFT) will be used for assessment of hand function. Is a reliable and valid outcome measure to assess broad aspects of common hand functions of daily use. Subtests include: (1) Writing (2) Turning Cards (3) Lifting small objects (4) Simulated feeding (5) Stacking checkers(6) Lifting large, lightweight object(7) Lifting large, heavy objects.

2.3 PROCEDURE



2.4. INTERVENTION

Treatment for the group A is conventional exercise, it includes: -

- Hot water formentation (15mins)[3]
- Transcutaneous electrical nerve stimulation(15mins)[3][21]
- Neck isometrics exercise (5 reps × 2sets)[3]
- Stretching for trapezius, levator scapulae, scalene muscles (5 reps × 1sets) 30 sec hold[18]

- Shoulder shrugging exercise (5 reps × 3sets)
- Chin tucks (5 reps × 3sets) [7]
- Scapular seeting exercise (5reps × 3sets)[7][22]

Treatment for the group B is combined Neck, Shoulder, Hand exercise, it includes: -

- Hot water formentation (15mins)[3]
- Transcutaneous electrical nerve stimulation (15min)[3][21]
- Cervical flexion , extension and side bending dynamic isometric exercise :

The exercise is performed with patients in sitting position, initiated with a yellow resistance TheraBand, repetitions will be gradually increased along the sessions to a total of 15 reps × 3sets [3][23] (fig 2.1 -4)

- Swiss ball exercise for neck flexors and scapular retractors:

For strengthening the neck flexors, subjects lay supine on Swiss ball with the head up and chin-tuck. Both hands were placed on the abdomen. (fig 2.8)

For strengthening the scapular retractors, the subjects lay prone on Swiss ball with the shoulders in 90–120° abduction, then extended spine by external rotation of the arms with chin-tuck. The training consisted of 10 repetitions 10- second holds in the first two weeks, followed by 15sec hold in final week.[10]

- Stretching for trapezius, levator scapulae, scalene muscles (5 reps×1sets) 30 sec hold[24]. (Fig 2.5 -7)
- Hand exercises: Therapeutic putty was moved between the wrist and finger tips centrally and laterally, squeezed in one hand, flattened with the heel of the hand, putty was rolled between both hands and was pinched between the thumbs and all the fingers with both hands (3reps×2sets)[12](fig 2.9-15)
- Shoulder PNF: D2 Flexion pattern is performed with the chin tucked, the patient holds 1 end of the TheraBand under the foot of the side of the unaffected side and holds the other end of the TheraBand with the hand of the affected side. The patient then extends, adducts, and internally rotates the shoulder of the affected extremity with the TheraBand across the body and finishes the exercise with the shoulder in the flexed, abducted, and externally rotated position. The patient is verbally prompted to perform the exercise with the words: “pull wrist up and reach.” The exercise is performed at a rate of 4 repetitions/30 second.[11](fig 2.10)

Figure 2.1 cervical dynamic isometric; extension

Figure 2.2 cervical dynamic isometric; flexion

Figure 2.3 cervical dynamic isometric; side bending

Figure 2.4cervical dynamic isometric; side bending

Figure 2.5 Levator scapulae stretch

Figure 2.6 Trapezius stretch

Figure 2.7 scalene stretch.

Figure 2.8 Swiss ball exercise for Neck Flexors

Figure 2.9 Thera putty squeezed in one Hand.

Figure 2. 10 Shoulder PNF - D2 flexion pattern

Figure 2. 11 Rolling putty between both hands

Figure 2. 12 Rolling putty centrally

Figure 2. 13 rolling the putty laterally

Figure 2. 14 flattening the putty with heel

Figure 2.15 squeezing putty between fingers tips

3. RESULT AND DISCUSSION

RESULT:

In this study a paired t test was done to compare inter group difference in the outcome measures, in the

result obtained between group A and group B and unpaired t test was done to compare intra group differences.

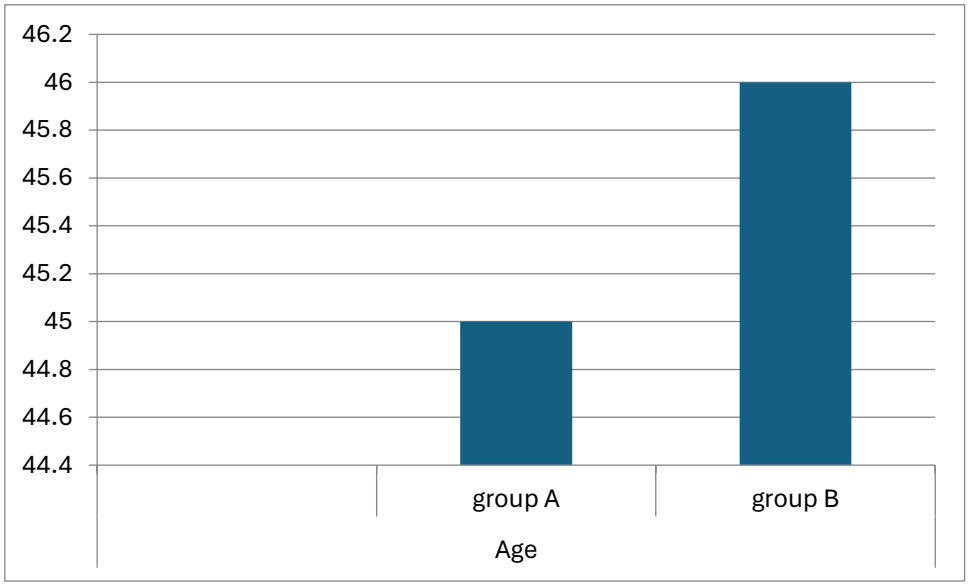
This study's outcome measures included the Jamar hand held dynamometer and Jebson Taylor hand function test

The study included participants between the ages of 30 and 60 who had clinically diagnosed unilateral cervical radiculopathy.

The study included 40 participants, group A (n=20) included 10 males and 16 females, while group B (n=20) included 10 males and 4 females. Furthermore, the mean age range for group A was 45 years, while group B was 46.

Table 3.1 shows baseline demographic data.

Baseline measurement		Group A	Group B
1.age		45±10	46±8.5
2.participants	male	10	10
	female	16	4



Graph 3.1 shows comparison of age mean between group A and B

Table 3.2:- Shows within data analysis of group A

Parameters	pre – treatment (Mean ± SD)	Post – treatment (Mean ± SD)	t - values	p – values	significance
Hand grip strength	32.4 ±11.8	37 ± 11.23	9.976	< 0.0001	extremely
subtest 1	21.6 ± 8.2	19.5 ± 7.75	5.578	< 0.0001	extremely
subtest 2	7.67 ± 1.03	6.83 ± 1.19	6.218	< 0.0001	extremely
Subtest 3	12.9 ± 3.96	11.2 ± 3.78	6.842	< 0.0001	extremely

Subtest 4	16.3 ± 1.94	14.9 ±1.81	6.598	< 0.0001	Extremely
Subtest 5	6.99 ± 1.18	6.31 ±1.16	5.760	< 0.0001	extremely
Subtest 6	6.23 ±1.17	5.76 ± 1.16	3.389	0.0031	Very
Subtest 7	6.63 ± 1.31	5.84 ± 1.28	3.688	0.0016	very

Within group analysis was done using paired t test. Participants in group A demonstrated significant difference $p < 0.001$ increase in hand grip strength and hand function. In terms of Mean ± SD, hand grip strength increased from 32.4 ±. 11.8 to 37 ±11.23 and in hand functions subtest 1 decreased from 21.6 ±.8.2 to 19.5 ±. 7.75, subtest 2 decreased from 7.67 ±.1.03 to 6.68 ±. 1.19, subtest 3 decreased from 12.9 ±.3.96 to 11.2 ±.3.78, subtest 4 decreased from 16.3 ±.1.94 to 14.9 ±.1.81 , subtest 5 decreased from 6.99±.1.18 to 6.31 ±.1.16 , in subtest 6 values went from 6.23 ±. 1.17 to 5.76 ±.1.16 and in subtest 7 values

Table 3.3:- Shows within data analysis of group B

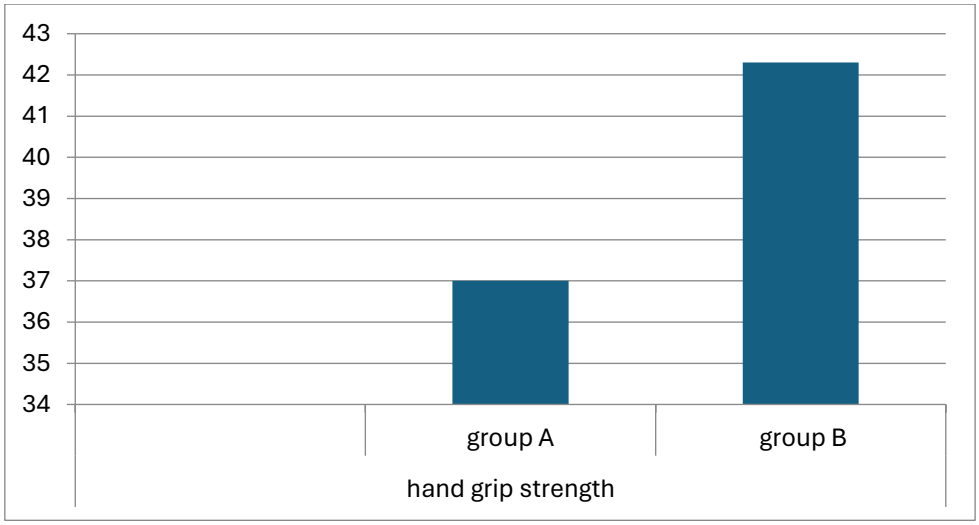
Parameters	pre – treatment (Mean ± SD)	Post – treatment (Mean ± SD)	t - values	p – values	significance
Hand grip strength	31.8 ± 9.512	42.3 ± 9.846	11.917	< 0.0001	extremely
subtest 1	23.2 ± 7.2	17.8 ± 6.23	5.453	< 0.0001	extremely
subtest 2	14.5 ± 4.03	12.3 ± 3.62	.4.284	0.0004	extremely
Subtest 3	.8.8 ± 3.36	6.5 ± 2.25	3.748	0.0014	very
Subtest 4	14.1 ± 2.54	12.3 ± 2.6	5.760	< 0.0001	extremely
Subtest 5	5.76 ± 2.39	4.46 ± 1.88	4.521	0.0002	extremely
Subtest 6	7.27 ± 1.56	5.29 ± 1.29	4.521	0.0002	extremely
Subtest 7	7.58 ± 1.49	5.35 ± 0.92	7.613	< 0.0001	extremely

Within group analysis was done using paired t test. Participants in group B demonstrated significant difference $p < 0.001$ increase in hand grip strength and hand function. In terms of Mean ± SD, hand grip strength increased from 31.8 ± 9.15 to 42.3 ±9.84 and in hand functions subtest 1 decreased from 23.2 ±.7.2 to 17.8 ±.6.23, subtest 2 decreased from 14.5 ± 4.03. to 12.3 ±. 3.62, subtest 3 decreased from 8.8 ±.3.36 to 6.5 ±2.25, subtest 4 decreased from 14.1 ±.2.54 to 12.3 ±.2.6, subtest 5 decreased from 5.76 ±2.39. to 4.46 ±1.88, in subtest 6 values went from 7.27 ±. 1.56 to 5.29 ±.1.29 and in subtest 7 values went from 758 ±1.49 to 5.35 ±.0.92

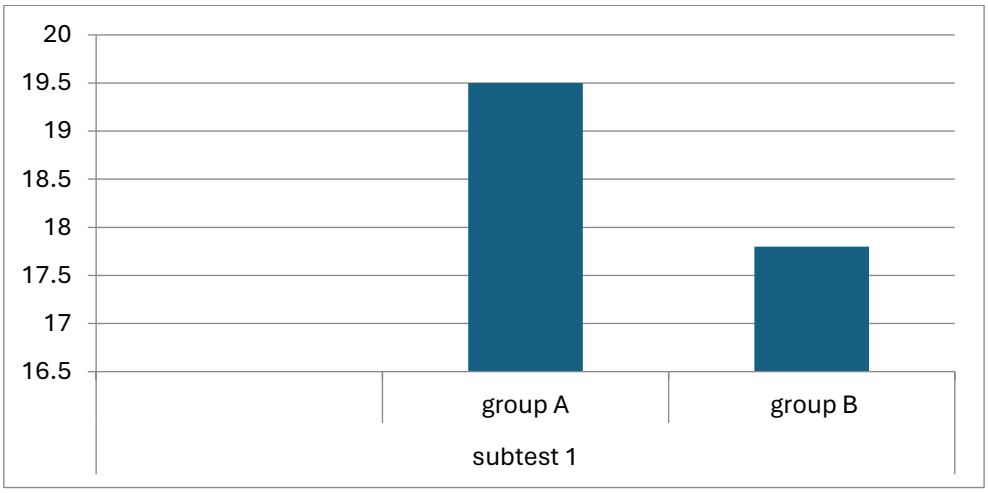
Table 3.4: - Shows inter group data analysis between group A and B

Parameters	Post – treatment Group A (Mean ± SD)	Post – treatment Group B (Mean ± SD)	t - values	p – values	Significance
Hand grip strength	37 ± 11.23	42.3 ± 9.846	1.587	0.1208	Not significant
subtest 1	19.5 ± 7.75	17.8 ± 6.23	0.7716	0.4451	Not significant
subtest 2	6.83 ± 1.19	12.3 ± 3.62	6.464.	<0.0001	Extremely
Subtest 3	11.2 ± 3.78	6.5 ± 2.25	4.747	<0.0001	Extremely
Subtest 4	14.9 ±1.81	12.3 ± 2.6	3.696	0.0007	Extremely
Subtest 5	6.31 ±1.16	4.46 ± 1.88	3.742	0.0006	Extremely
Subtest 6	5.76 ± 1.16	5.29 ± 1.29	1.214	0.2324	Not significant
Subtest 7	5.84 ± 1.28	5.35 ± 0.92	1.429	0.1610	Not significant

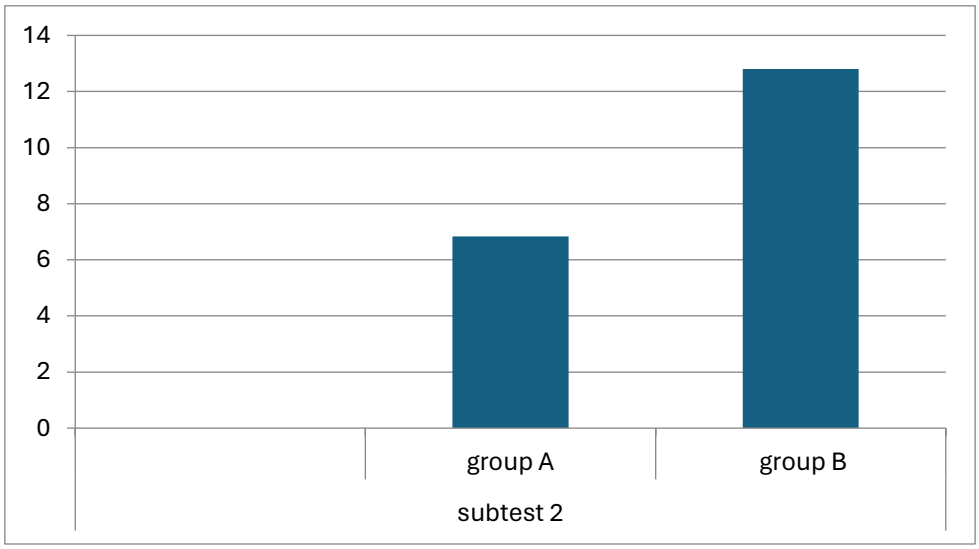
Inter group data analysis was done using unpaired t test. When mean of post- treatment hand grip strength values of group A and group B were compared i.e 37 ± 11.23 and 42.3 ± 9.846 there was no statistically significant difference in group B compared to group A with p value (0.1208). For mean of post- treatment subtest 1 values of group A and group B were compared i.e 19.5± 7.75 and 17.8 ± 6.23 there was no statistically significant difference in group B compared to group A with p value (0.4451). For subtest 2 values of group A and group B were compared i.e 6.83 ±1.19 and 12.3 ± 3.62 there was extremely significant difference in group B compared to group A with p value (<0.0001) indicating improvement. For subtest 3 values of group A and group B were compared i.e 11.2 ± 3.78 and 6.5 ± 2.25 there was extremely significant difference in group B compared to group A with p value (<0.0001) which indicated improvement. For subtest 4 values of group A and group B were compared i.e 14.9 ± 1.81 and 12.3 ± 2.6 there was extremely significant difference in group B compared to group A with p value (0.0007) indicated improvement. For subtest 5 values of group A and group B were compared i.e 6.31 ±1.16 and 4.46 ± 1.88 there was extremely significant difference in group B compared to group A with p value (0.0006) indicated improvement. For subtest 6 values of group A and group B were compared i.e 5.76 ± 1.16 and 5.29 ± 1.29 there was no significant difference in group B compared to group A with p value (0.2324). Similarly, For subtest 7 values of group A and group B were compared i.e 5.84 ± 1.28. and 5.35 ± 0.92 there was no significant difference in group B compared to group A with p value (0.1610).



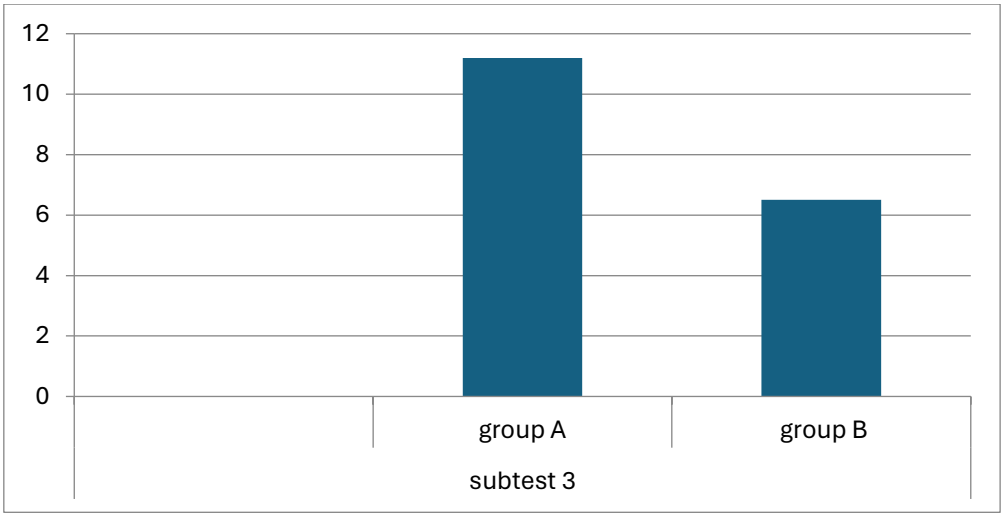
Graph 3.2 comaprison of post treatment hand grip strength values between group A and B which shows no significant difference (p = 1.208)



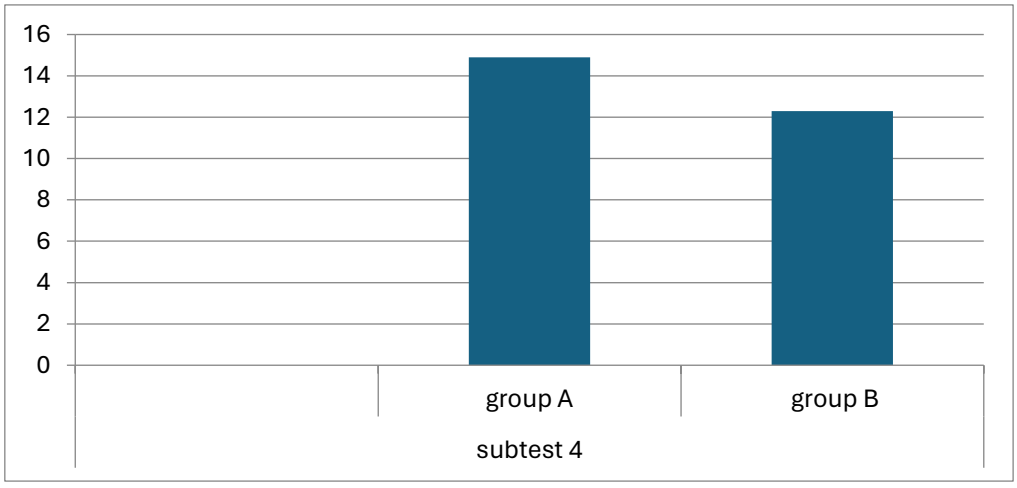
Graph 3.3 comaprison of post treatment subtest 1 values between group A and B which shows no significant difference (p = 0.4451)



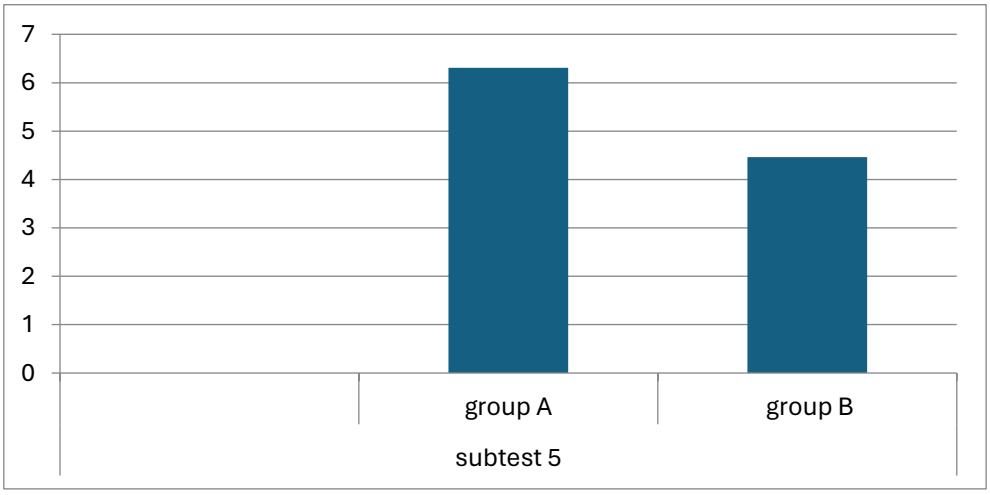
Graph 3.4 comaprison of post treatment subtest 2 values between group A and B which shows extremely significant difference (p = < 0.0001)



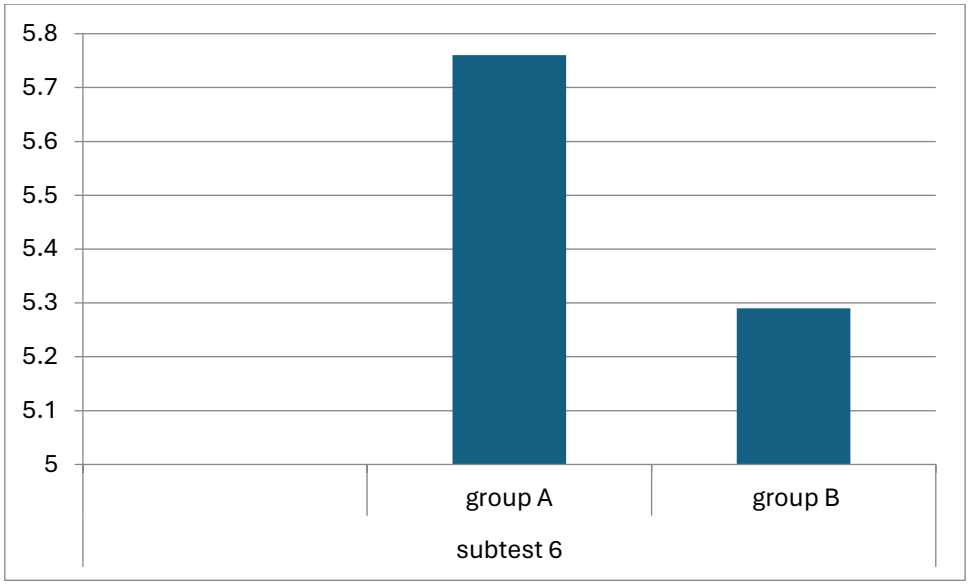
Graph 3.5 comaprison of post treatment subtest 3 values between group A and B which shows extremely significant difference (p = < 0.0001)



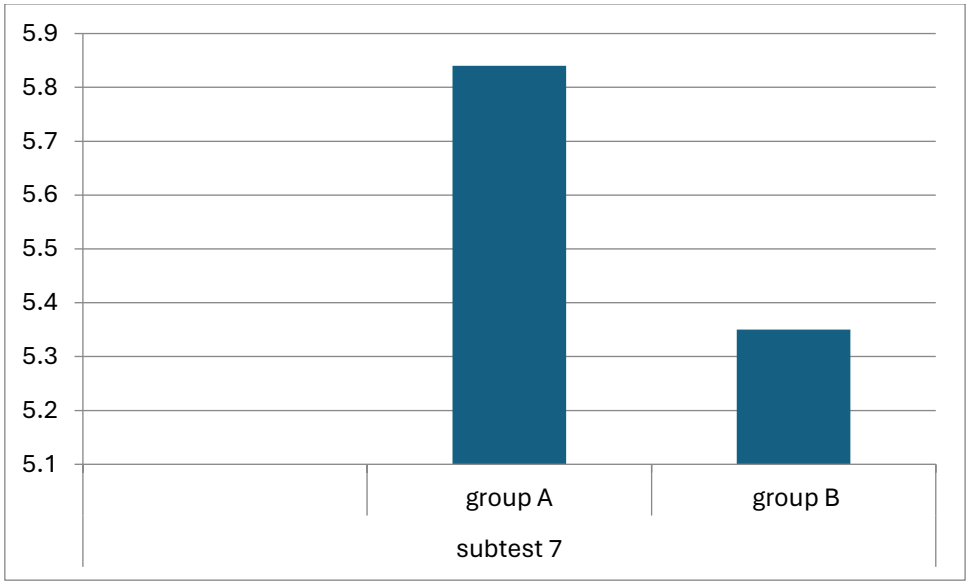
Graph 3.6 comaprison of post treatment subtest 4 values between group A and B which shows extremely significant difference (p = 0.0007)



Graph 3.7 comaprison of post treatment subtest 5 values between group A and B which shows extremely significant difference (p = 0.0006)



Graph 3.8 comaprison of post treatment subtest 6 values between group A and B which shows no significant difference (p = 0.2324)



Graph 3.9 comaprison of post treatment subtest 7 values between group A and B which shows no significant difference (p = 0.1610)

DISCUSSION :

The objective of this study was to compare the effect of combined neck, shoulder and hand exercise protocol with conventional physiotherapy protocol based on changes seen in hand grip strength and hand function pre and post treatment in patients with unilateral cervical radiculopathy and to find out the effect of combined neck, shoulder, hand exercise protocol on hand grip strength and hand function in patients with unilateral cervical radiculopathy.

The study was conducted in Pravara Institute of Medical Sciences (DU), Loni. Total number of participants assessed were 56 from which 16 excluded and 40 participants were included according to eligibility criteria and randomization was done from which 20 participants were divided in group A which followed conventional exercise protocol and 20 participants were in group B which were given

experimental exercise protocol. Both protocols were administered for 4 weeks, 3 sessions per week. Pre and post assessment of hand grip strength and hand function and data was analyzed, and result was obtained.

Paired t test was done to analyze the effect of conventional exercise protocol used to treat patients of cervical radiculopathy using hand held dynamometer and JTHFT test which showed significant improvement in hand grip strength and hand function in group A .Similarly, in group B effects of combined stabilization exercise on hand grip strength and hand function were analysed using paired t test which showed significant improvement.

Compared analysis was done between group A and group B using unpaired t test to find out effectiveness of combined NSH exercise compared to conventional exercise protocol on hand grip strength and hand functions. Statistical analysis revealed that there was a significant difference found in subtest 2, 3, 4, 5 and no statistically significant difference in subtest 1, 6, 7.

In cervical radiculopathy, irritation to nerve root results in weakness, numbness, tingling, pain and weakness of muscle which limits upper extremity functions like grip strength and prehension patterns which has direct effects on person's ability to perform everyday activities. In a study conducted by Mohamed Faisal C. K et al to known and compare the extent of effects of unilateral cervical radiculopathy on hand grip strength and hand function by comparing with unaffected side. The study concluded significant difference in hand grip strength and hand function when side affected by cervical radiculopathy was compared with unaffected side. It was stated that, in cervical radiculopathy there could be myotomal involvement which results in weakness of intrinsic muscles of hand. Also assessment of hand grip strength and hand function provides objective index for functional integrity of upper limb.

Previously, by Nihal Gelece et al study was done to investigate the effect of stabilization exercise training on pain and functional status in patients with cervical radiculopathy. The aim was to know whether adding stabilization exercises to the standardized cervical physiotherapy program improved the outcome. Cervical dynamic isometric exercise along with other stabilization exercises were applied to focus on increasing strength and cervical mobility. Similar improvement was seen in this study. In a study done by Shaji J. Kachanathu et al the purpose of this study was to investigate the effect of shoulder stability exercises on hand grip strength in patients with unilateral shoulder impingement syndromes. Shoulder PNF exercise included in the study used proprioceptive neuromuscular stimulation to decrease pain, improve ROM, strength and improve proximal stability for efficient distal movements. The study showed that Scapular stabilization exercise are significantly effective in improving isometric hand grip strength in patients with unilateral shoulder impingement syndromes. The result obtained in this study mirrors the above-mentioned study. In a study done by Jeoung-Ah Ahn, MS, PT et al participants performed strengthening exercises for the neck flexors and scapular retractor on a Swiss ball with result showing significant improvement in neck mobility and shoulder- neck pain, these exercise showed similar result on hand grip strength and hand function in this study. A study conducted by Sara Mateos-Toset, OT, MS et al hand exercise protocol using Thera putty was followed by Parkinson patient to show significantly improved results on dexterity, hand grip and pinch strength. The same exercise was implemented in this to obtain similar results on hand grip strength and function impairment found in patients with cervical radiculopathy.

Previously conducted studies have no mention of exercise protocol which combines neck, shoulder, and hand exercises in treatment of hand grip strength and hand functions in patients with cervical radiculopathy. In this study an attempt was made to assess the effect of these exercises. The result obtained from the statistical analysis of this study supported the alternative hypothesis which stated that there is a

beneficial effect to the subjects treated with combined NSH exercise protocol on hand grip strength and hand functions.in patients with cervical radiculopathy.

4. LIMITATIONS

- Small sample size
- Gender inequality
- Current study focused on patients within a specific age criteria
- Difficulty in avaliabity of tools required to perform JTHFT and exercise protocol.
- All the patient were recruited from single institutional setup
- The study was conducted on patients having active compains , the result can't be assumed to be same for patients in chronic stage of condition.

Patient may not be easily conviced to perform the exercise due to distinctness of the protocol and longer commitment

5. CONCLUSION

The study concludes that there is significant improvement in hand grip strength and hand functions after implication of 4 weeks of combined neck, shoulder, and hand exercise protocol in patients with cervical radiculopathy having complains of pain, weakness and difficulty in performing ADLs. The result obtained from this study is sustained evidence that these exercises recruit scapular, neck, shoulder and intrinsic muscles of hand to provide further insight in improvement in neck mobility, pain, weakness, to increase hand grips strength and hand function.

Funding: No funding sources
Conflict of interest: None declared.
Ethical Approval: The study was approved by institutional ethics committee.

6. ACKNOWLEDGMENTS

Authors would like to thank Pravara Institute of medical Sciences and Dr. APJ Abdul Kalam College of Physiotherapy for supporting this study.

7. REFERENCES

1. Norman K, Stobäus N, Gonzalez MC, Schulzke J-D, Pirlich M. Hand grip strength: Outcome predictor and marker of nutritional status. Clinical Nutrition. 2011 Apr;30(2):135–42. doi: 10.1016/j.clnu.2010.09.010
2. Woods BI, Hilibrand AS. Cervical radiculopathy. Journal of Spinal Disorders & Techniques. 2015 Jun;28(5). doi:10.1097/bsd.0000000000000284
3. Akkan H, Gelecek N. The effect of stabilization exercise training on pain and functional status in patients with cervical radiculopathy. Journal of Back and Musculoskeletal Rehabilitation. 2018 Mar 21;31(2):247–52. doi:10.3233/bmr-169583
4. Faisal CK, Mathew N, Mathias L, Ajith S. Grip strength and hand function changes in unilateral cervical radiculopathy, International Journal of Current Research and Review. 2012 Nov 1;4(21):82.
5. Amita A, Ruvitte G, Tushar J Palekar. Mulligan Versus Conventional Neurodynamic Mobilization in Pati w Cervical Radiculopathy

6. Cricchio M, Frazer C. Scapulothoracic and scapulohumeral exercises: A narrative review of electromyographic studies. Journal of Hand Therapy. 2011 Oct;24(4):322–34. doi:10.1016/j.jht.2011.06.001
7. Ganu S, Gor U. Effects of abdominal control feedback and scapular stabilization exercise on chronic neck pain. International Journal of Health Sciences and Research. 2021 Jun 22;11(6):318–25. doi:10.52403/ijhsr.20210647
8. Vinod 5, Sachin P. Diagnostic utility of electroneuromyography and late responses in cervical radiculopathy. Indian Journal of Applied Research vol-9. 2019 January
9. Costello M. Treatment of a patient with cervical radiculopathy using thoracic spine thrust manipulation, soft tissue mobilization, and exercise. Journal of Manual & Manipulative Therapy. 2008 Jun 1;16(3):129-35
10. Ahn JA, Kim JH, Bendik AL, Shin JY. Effects of stabilization exercises with a Swiss ball on neck-shoulder pain and mobility of adults with prolonged exposure to VDTs. Journal of physical therapy science. 2015;27(4):981-
11. Kachanathu SJ, Zedan AM, Hafez AR, Alodaibi FA, Alenazi AM, Nuhmani S. Effect of shoulder stability. exercises on hand grip strength in patients with shoulder impingement syndrome. Somatosensory & Motor Research. 2019 Apr 3;36(2):97-101
12. Mateos-Toset S, Cabrera-Martos I, Torres-Sánchez I, Ortiz-Rubio A, González-Jiménez E, Valenza MC. Effects of a single hand-exercise session on manual dexterity and strength in persons with Parkinson disease: a randomized controlled trial. PM&R. 2015 Feb 1,8(2):115-22
13. Häkkinen A, Kautiainen H, Hannonen P, Ylinen J. Strength training and stretching versus stretching only in the treatment of patients with chronic neck pain: A randomized one-year follow-up study. Clinical Rehabilitation. 2008 Jul;22(7):592–600. doi:10.1177/0269215507087486
14. Kolber MJ, Cleland JA. Strength testing using hand-held dynamometry. Physical therapy reviews. 2005 Jun 1;10(2):99-112.
15. Lim SH, Kim YH, Lee JS. Normative data on grip strength in a population-based study with adjusting confounding factors: Sixth Korea national health and nutrition examination survey (2014-2015). International journal of environmental research and public health. 2019 Jun;16(12):2235.
16. Sığırtmaç IC, Öksüz Ç. Investigation of reliability, validity, and cutoff value of the Jebsen-Taylor Hand Function Test. Journal of Hand Therapy. 2021 Jul 1:34(3):396-403
17. Artilheiro MC, Fávero FM, Caromano FA, Oliveira AD, Junior NC, Voos MC, de Så CD. Reliability, validity and description of timed performance of the Jebsen-Taylor Test in patients with muscular dystrophies. Brazilian journal of physical therapy. 2018 May 1;22(3):190-7.
18. Cilento Negrão CG, Albuquerque Rufino L, Bernardes de Souza A, Cymrot R, Blascovi-Assis SM Standardization of the Jebsen Taylor hand Function test for the brazilian population. Saúde e Pesquisa. 2022 Jan 1;15(1).
19. Young IA, Michener LA, Cleland JA, Aguilera AJ, Snyder AR. Manual therapy, exercise, and traction for patients with cervical radiculopathy: a randomized clinical trial. Physical therapy. 2009 Jul 1;89(7):632-42.
20. Thoomes EJ, Scholten-Peeters W, Koes B, Falla D, Verhagen AP. The effectiveness of conservative treatment for patients with cervical radiculopathy: a systematic review. The Clinical journal of pain. 2013 Dec 1;29(12):1073-86

21. Nitsure P, Welling A. Effect of Gross Myofascial Release of Upper Limb and Neck on Pain and Function in Subjects with Mechanical Neck Pain with Upper limb Radiculopathy: A Clinical Trial. Int J Dent Med Res 2014;1(3):8-16
22. Lee S, Park J, Lee D. The effects of cervical stabilization exercises on the electromyographic activity of shoulder stabilizers, Journal of Physical Therapy Science. 2013;25(12):1557-60
23. Ylinen J, Hakkinen A, Nykanen M, Kautiainen H, Takala E. Neck muscle training in the treatment of chronic neck pain: a three-year follow-up study. Europa medicophysica. 2007 Jun 1;43(2):161
24. Lynn C, John B, Carolyn K. Stretching for improved mobility. Therapeutic exercise foundation and techniques-7th edition
25. Rezasoltani A, et al. The effect of a proprioceptive neuromuscular facilitation program to increase neck muscle strength in patients with chronic non-specific neck pain. World Journ of Sport Sci. 2010;3(1):59–63.
26. Fatima A, Veqar Z, Zaidi S, Tanwar T. Effects of scapular stabilization and upper limb proprioception as an adjunct to cervical stabilization in chronic neck pain patients: A randomized controlled trial. Journal of Bodywork and Movement Therapies. 2022 Jan;29:291–301. doi:10.1016/j.jbmt.2021.10.016