

## A COMPARISON OF THE EFFECTIVENESS OF NEURODYNAMICS VERSUS NERVE AND TENDON GLIDING EXERCISES ALONE FOR CARPAL TUNNEL SYNDROME

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### ABSTRACT

**Objective:** To evaluate the effectiveness of full neurodynamics versus nerve and tendon gliding exercises alone in patients of carpal tunnel syndrome by subjective and electrodiagnostic studies.

**Study Design:** Single blinded randomized controlled trial.

**Place and Duration of Study:** Armed Forces Institute of Rehabilitation Sciences, Rawalpindi, from Aug 2015 to Jan 2016.

**Patients and Methods:** Mild to moderate carpal tunnel syndrome (CTS) patients (n=27) diagnosed on (NCS) nerve conduction studies were selected by non-probability purposive sampling then randomly allocated in two groups i.e, control and experimental by sealed envelope method. Data was collected by using Boston carpal tunnel questionnaire; symptom severity scale, functional status scale and quick disabilities of arm, shoulder and hand score. Control was given nerve tendon gliding exercises with electrotherapy (TENS, ultra-sound), while experimental group received additional neurodynamics on alternate days for 4 weeks.

**Results:** Mean age of population was found to be  $45.36 \pm 12.36$  years. CTS was found to be more prevalent in females 20 (90.9%) than in males 2 (9.1%). No significant improvement was observed in functional status scale, quick DASH and nerve conduction studies ( $p$ -value>0.05) although experimental group showed more improvement than control. In contrast, symptom severity scale showed significant improvements between the groups with  $p$ -value<0.01.

**Conclusion:** Nerve and tendon gliding exercises provided alone as well as with neurodynamics showed effectiveness in patients of carpal tunnel syndrome. Combined neurodynamics is not superior to nerve tendon gliding exercises alone for the conservative treatment of carpal tunnel syndrome.

**Keywords:** Carpal tunnel syndrome, Nerve tendon gliding, Neurodynamics.

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### INTRODUCTION

Among the neuropathies carpal tunnel syndrome (CTS) is the most prevalent one with an estimate of about 3.8%, in some researches 4% is also reported. About 2.7% of patients presenting with CTS reported to have this condition in both hands. Point seven percent population presents with carpal tunnel syndrome that cannot be managed conservatively and undergo surgery<sup>1</sup>. Female to male ratio having carpal tunnel syndrome is 3 to 1. Higher incidence of CTS is found in usually patients having age of about 45-64-years<sup>2,3</sup>. In a study done by Saeed *et al* in Pakistan showed its higher incidence in

winter season than in summer<sup>4</sup>, however, exact incidence in Pakistan cannot be found due to limited studies on CTS. Various treatment options have been investigated for the management of CTS. Most of the cases in minimal, mild and moderate stage are managed conservatively, however those in severe and in very severe stage often require surgical inter-vention<sup>5</sup>. In non surgical management of CTS, a variety of options is available both in electro-therapy and in manual therapeutic exercises. Exercises commonly used for the conservative management of CTS are found to decrease the symptoms of the disease as a result of increased transportation across the axons. Longitudinal gliding of median nerve with arm movement in case of CTS is affected with scar formation leading to abnormal function of the median nerve<sup>6</sup>. As explained earlier the

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increased number of cases of CTS and its burden on the economy regarding its treatment, its early diagnosis and management is very important.

Neuromobilization is a new revolution in medical science for treating CTS without surgery. It consists of various active and passive movements that increase the excursion of the nerve<sup>7</sup>. Nowadays nerve gliding that was performed has a concept that it will cause the sliding of the nerve as different movements of the limbs are performed. This will ultimately increase the size of nerve bed. When nerve bed is elongated, nerve is also lengthened in its course, increasing the amount of tension and also the pressure inside the nerve<sup>8</sup>. Sliding techniques of neuromobilization are very effective as they do not cause the provocation of symptoms neither their aggression. These are simple movements that can be even advised to patients as their home plan. They cause a significant reduction in the fear of patient who hesitates to produce any movement in neuropathies. Coppie and Butler worked on the effectiveness of tensioners and sliders for the treatment of CTS and reported good outcomes<sup>9</sup>. When conservative treatment of CTS is being considered, not many studies are available addressing the use of neuromobilization and the concept behind its use. In contrast those limited studies which have been done to evaluate the effectiveness of neuromobilization give different results that do not reveal the exact picture of its effectiveness in treating the neuropathies<sup>10</sup>. The current study is designed in order to determine the most appropriate, precise and beneficial therapeutic maneuver specifically for the patient of CTS.

## **PATIENTS AND METHODS**

A single blinded randomized controlled trial was conducted in Armed Forces Institute of Rehabilitation Sciences, Rawalpindi from August 2015 to January 2016. Forty-three patients were screened for inclusion in the study. Nerve conduction studies were conducted on standard protocols and using latencies, amplitudes and velocities, while classification of carpal tunnel

syndrome was done by using criteria of American Association of Electrodiagnostic Medicine (AAEM)<sup>11</sup>. Patients of both genders with mild to moderate CTS having age 25-55 years were included for study by non-probability purposive sampling. All other cases of wrist pain, fractures, post traumatic stiffness of wrist, cervical radiculopathy, wrist pain due to osteoarthritis, CTS associated with pregnancy, CTS associated with rheumatoid arthritis, post operative cases of CTS, post surgical numbness in the wrist, patients with thyroid problems were excluded from the study. Patients meeting inclusion criteria (n=27) were enrolled for the study and then randomly allocated in to two groups experimental (n=13) and control (n=14) by using sealed envelope method. A proper consent form was signed by each patient in both groups with regard to their confidentiality and no harm to the patient. After which the data was collected from both groups by using Boston Carpal Tunnel Questionnaire (BCTQ) including both symptom severity scale and functional status scale and Quick disabilities of arm, shoulder and hand (DASH). Single blinding was done as the patients enrolled in study were not aware of which treatment protocol they will receive; either experimental or control group. Experimental group received electrotherapy including transcutaneous electrical nerve stimulation (TENS) for 10 minutes and ultrasound for 3 minutes with 3 MHz frequency and intensity of 0.85W/cm<sup>2</sup>, nerve and tendon gliding exercises (10 repetitions twice daily) for 4 weeks and also tensioners and sliders (15 oscillations 3 times in a session 3 days a week) for 4 weeks. And the other group received electrotherapy including TENS for 10 minutes and ultrasound for 3 minutes with 3 MHz frequency and intensity of 0.85W/cm<sup>2</sup>, nerve and tendon gliding exercises (10 repetitions twice daily) for 4 weeks. After four weeks data was again collected from the patients of both groups by using BCTQ including both symptom severity scale and functional status scale, and Quick DASH. Their NCS was again done for the evaluation of any electrophysiological changes.

The reports were collected and then evaluated. Five patients were excluded as they did not complete follow up of the study, 2 from experimental and 3 from control group. So data from 22 patients (n=12 in control and n=10 in experimental group) was then further analyzed by using SPSS version 20. Normality of data was checked by using Shapiro Wilk test for all variables and data was found to be non homogenous so non parametric tests were

control group and to 100% in experimental group respectively. Mean age of affected population was  $44.2 \pm 13.3$  years in experimental group and  $46.33 \pm 11.69$  years in control group.

Median  $\pm$  IQ for symptom severity scale in control group was  $1.50 \pm 0.64$  before intervention that improved to  $0.91 \pm 0.77$  after 4 weeks and in experimental group  $2.13 \pm 0.73$  before intervention that improved to  $0.45 \pm 0.55$  after 4

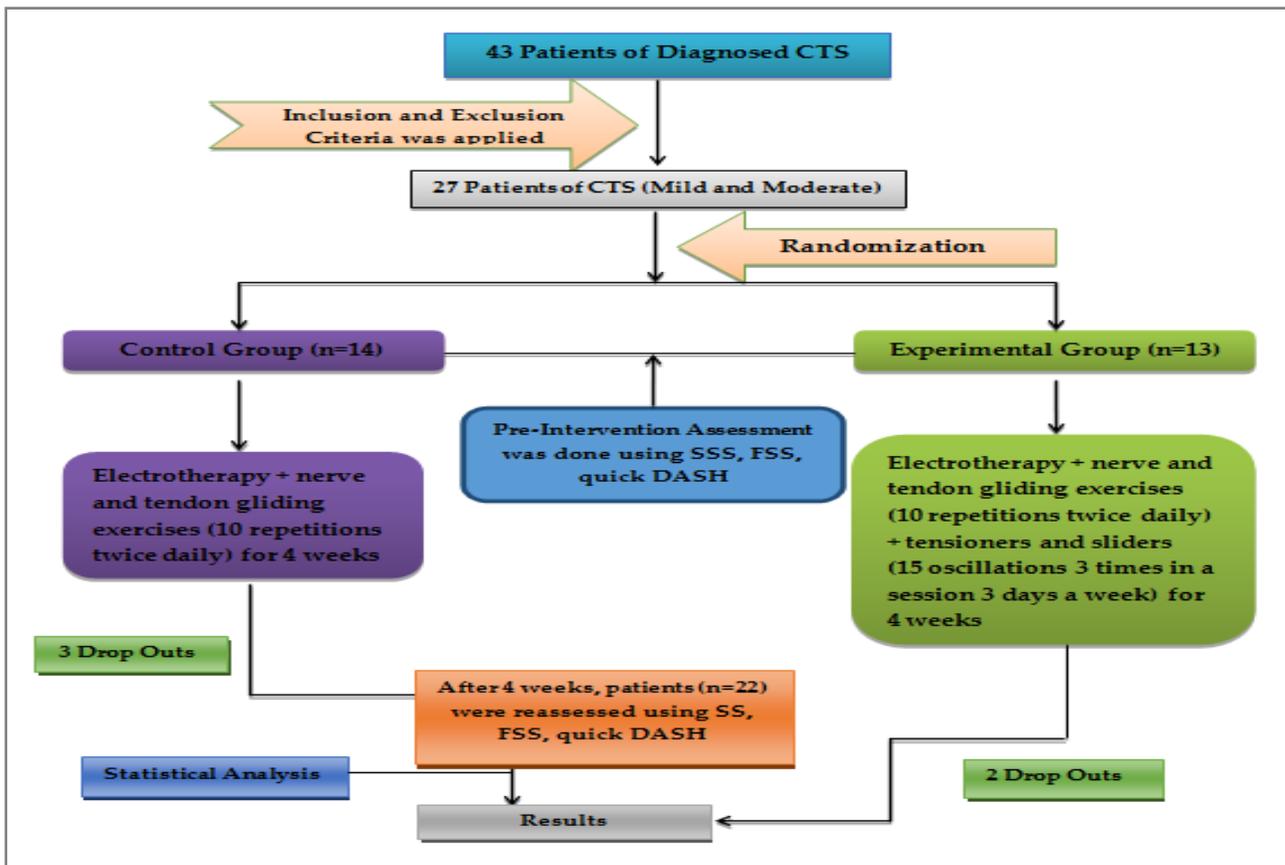


Figure: Consort diagram.

applied. Value of alpha was set at 0.05 and Mann Whitney U-test was applied for comparisons between the groups and *p*-values were evaluated along with median and interquartiles (figure).

**RESULTS**

According to results, 15 (68.2%) patients had involvement of one hand either right or left and 7 (31.8%) patients had bilateral involvement. CTS was found to be more prevalent in females than in males with 2 (16.7%) and 10 (83.3%) in

weeks of intervention. Likewise, median  $\pm$  IQ for functional status scale was  $1.06 \pm 0.84$  at baseline that improved to  $0.63 \pm 0.77$  in control group and for experimental group, it was  $1.94 \pm 0.72$  at baseline that improved to  $0.69 \pm 0.87$  after 4 weeks of intervention. For quick DASH scale, median  $\pm$  IQ was  $31.25 \pm 16.9$  at baseline that improved to  $18.75 \pm 11.8$  in control group and  $42.5 \pm 21.3$  at baseline that improved to  $13.75 \pm 4.37$  in experimental group after 4 weeks of intervention.

When results were evaluated for nerve conduction study, no significant improvement was noted between the groups in any parameter of the nerve conduction study ( $p$ -value>0.05). The details of comparisons between the groups for various outcome tools are shown in table.

## DISCUSSION

To the best of our knowledge, no previous study was conducted in Pakistan using same protocols used in current study for management of CTS. The current study reported improvements on symptom severity scale, functional status scale and quick DASH score. When literature was consulted regarding the effects of

in CTS also reported a reduction in the severity of the symptoms on the same scale<sup>15</sup>. Similarly a study that was done to find out the effectiveness of neuromobilization in the patients of carpal tunnel syndrome shown improvements in symptom severity scale<sup>16</sup>, although these improvements in that study were not statistically significant but in our study these are statistically significant. Contradiction in the results might have occurred as in current study combined neurodynamics including both neuromobilization maneuver and nerve and tendon gliding exercises was provided to treatment group while in that study only neuromobilization was given.

**Table: Inferential statistics of symptom severity scale, functional status scale and quick dash.**

	Post Intervention Control (n=12) Median (IQR)	Post Intervention Experimental (n=10) Median (IQR)	Mann Whitney U-test $p$ -value
Symptom severity scale	0.91 (0.64-1.40)	0.45 (0.22-0.77)	0.012*
Functional status scale	0.63 (0.50-1.27)	0.69 (0.22-1.09)	0.79
Quick DASH Score	18.75 (12.50-24.37)	13.75 (4.37-20.96)	0.29
DML of Rt median nerve	4.75 (4.22-5.10)	4.80 (4.02-5.37)	0.79
DML of Lt median nerve	3.75 (3.42-4.50)	4.20 (3.67-5.15)	0.29
SLP of Rt median nerve	3.95 (3.55-4.17)	3.15 (3.02-4.05)	0.16
SLP of Lt median nerve	3.10 (2.92-3.87)	3.05 (2.77-3.52)	0.39
Motor amplitude of Rt median nerve	9.75 (8.70-11.60)	9.70 (7.05-10.25)	0.41
Motor amplitude of Lt median nerve	7.65 (5.77-9.80)	7.15 (5.55-9.52)	0.67
Sensory amplitude of Rt median nerve	31.50 (13.0-43.25)	39.0 (24-54.70)	0.25
Sensory amplitude of Lt median nerve	34.00 (12.80-41.50)	40.50 (12.90-54.75)	0.43
Motor velocity of Rt median nerve	53.00 (51.25-57.50)	55.00 (50.5-59.25)	0.72
Motor velocity of Lt median nerve	60.00 (56-64.75)	58.50 (54-60.25)	0.28
Sensory velocity of Rt median nerve	48.00 (42.25-52.75)	42.50 (37-47.25)	0.17
Sensory velocity of Lt median nerve	51.50 (36.75-55)	43.00 (36.25-53)	0.36

nerve and tendon gliding exercises, it was observed that these exercises caused significant improvement in many parameters like they improved phalen's sign, improve grip strength, muscle strength, symptom severity scale and functional status scale<sup>11-16</sup>. In current study, the symptom severity score was significantly improved with significant reduction in the symptoms of pain, paresthesias, nocturnal pain, tingling and disturbed sleep in both control and experimental groups. A systemic review was done regarding the efficacy of nerve and tendon gliding exercises

In current study, although functional status scale showed improved results in both control and experimental group but this improvement is not statistically significant. More improvement is noted in our experimental group as compared to control, with obvious differences in the values of the means of both groups showing higher improvements in experimental group. Although previous studies done on nerve tendon gliding exercises and neuromobilization maneuvers have shown significant improvements in functional status scale,<sup>11,14,16,17</sup> but this contradiction in our

result might have occurred as functional status scale had improved in both our groups or this might have occurred due to small sample size and due to shorter duration of the study.

Improvements have also been noted on Quick DASH scale in both control and experimental group as it has been shown in previous studies. A study done to find out the effectiveness of tendon gliding exercises versus nerve gliding exercises have shown significant improvements in the quick DASH score<sup>15</sup>. In our study although changes towards betterment are observed that is shown by differences in means of both control and experimental group with more improvement in experimental group, but no significant improvement was observed in experimental as compared to control. This contrary result might have occurred due to improved changes in both experimental and control group and also might have occurred due to small sample size and decreased time duration.

Nerve conduction studies (NCS) have shown improvements in distal motor latency (DML), sensory latency (SLP), velocity of both motor and sensory component of median nerve that was obvious with the changes in mean in both control and experimental group but statistically this improvement is not significant. Literature review of studies done on nerve and tendon gliding exercises have also shown similar results. According to results of those studies although changes were observed clinically and on subjective tools yet on electrophysiological studies these changes were not found<sup>12,14,15</sup>. Although a study done on neuromobilization technique in combination with transverse wrist extension mobilization have shown significantly improved DML<sup>16</sup> but this change was not observed in current study due to shorten time duration for the nerve conduction study to give significant results.

Another study done on finding the effectiveness of nerve and tendon gliding exercises revealed that that group which received nerve and tendon gliding exercises showed better

results than those who have not received nerve and tendon gliding exercises. Patients showed increased improvements in symptom severity scale, functional status scale and on clinical findings<sup>15</sup>. Rincon *et al* found significant improvement in pain intensity in CTS by applying neurodynamics in combination with soft tissue mobilization<sup>10</sup>. Their results also support the results of the current study. Small sample size, shorter duration of study, unwillingness of patients for follow up and unequal distributions of gender are few limitations of this study that must be addressed in future studies.

## CONCLUSION

Nerve and tendon gliding exercises provided alone as well as with neurodynamics showed effectiveness in patients of carpal tunnel syndrome. Combined neurodynamics is not superior to nerve tendon gliding exercises alone for the conservative treatment of carpal tunnel syndrome.

## Author's Contribution

1. Misbah Marryam, Rehana Yasmeen, Tariq Mehmood Malik, Arshad Nawaz Malik and Imran Amjad did substantial contribution to the conception analysis and interpretation of work.
2. Misbah Marryam and Arshad Nawaz Malik did drafting the work.
3. Imran Amjad did final approval of the version.
4. Imran Amjad did agreement.

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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