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THERAPEUTIC EFFECT OF NEURODYNAMIC AND ACTIVE RELEASE TECHNIQUE IN CARPAL TUNNEL SYNDROME
Randomized Clinical Trial

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Abstract

Background: Carpal tunnel syndrome (CTS) is a common medical condition and one of the most often reported examples of compression of the median nerve. CTS occurs when the median nerve is compressed or pinched as it passes through the wrist. The symptoms of the sickness include tingling in the median nerve distribution, numbness, and discomfort in the hands. Despite the fact that CTS is an idiopathic syndrome, there are risk factors that are linked to the development of this condition. Notable ecological risk factors include extended postures involving wrist flexion or extension, repetitive use of the flexor muscles, and vibration exposure.

Purpose: To compare the Therapeutic Effects of Neurodynamic and Active Release Techniques in Carpal Tunnel Syndrome.

Methods: The study design was a Randomized Clinical Trial. The study was conducted at Rehab Max Physiotherapy and Sports Injury Clinic, Layyah. The participants of these study are 12 of both genders. A randomized clinical trial was conducted in which 12 participants were randomly assigned with pre-diagnosed numbness and tingling in the first three digits, aged 25 to 50 years, having DASH Score ≥ 4. The study was conducted in Rehab Max physiotherapy clinic Layyah within six months. Group A and Group B (Experimental Groups) received neurodynamic and Active Release techniques, respectively. Pain Severity and Disability were assessed using the DASH scale at baseline, 4^{th} week, and 8^{th} week. Data was analyzed by using SPSS version 24

Results: The study findings were significant for both groups' outcome variables. The result of intra-group analysis (Friedman test) and inter-group analysis obtained value is $p<0.05$ for all variables.

Conclusions: This study concludes that both Neurodynamic and Active Release Techniques effectively treat Carpal Tunnel Syndrome, but neurodynamic showed more significant results for pain, severity, and disability

Keywords: Carpal Tunnel Syndrome, Neurodynamic Technique, Active Release Technique, *Nerve Gliding,* Therapeutic Effect

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Introduction

One of the most often documented cases of compression of the median nerve is carpal tunnel syndrome (CTS), a prevalent medical ailment. When the median nerve is crushed or constricted while passing through the wrist, CTS results. Hand discomfort, numbness, and tingling in the median nerve distribution are the hallmarks of the illness. Even though CTS is an idiopathic syndrome, there are risk factors that are still connected to the occurrence of this illness. Extended postures over wrist flexion or extension, repetitive flexor muscle usage, and vibration exposure are notable ecological risk factors. Medical risk factors for CTS are categorized into four groups, in contrast to environmental influences. These include neuropathic variables, extrinsic factors that change the tunnel's contour, extrinsic factors that increase the volume inside the tunnel on either side of the nerve, and intrinsic factors that do the same. Circumstances that alter the body's fluid homeostasis are examples of extrinsic influences that raise the volume inside the tunnel. Pregnancy, menopause, obesity, kidney disease, hypothyroidism, oral contraceptive use, and congestive heart failure are a few examples of these variables. Tumor-like strains and lumps are examples of intrinsic causes within the nerve that increase the occupied volume inside the tunnel. These could result from distal radius fractures either directly or indirectly through posttraumatic arthritis. Conditions including diabetes, alcoholism, vitamin toxicity or deficiencies, and exposure to pollutants are examples of neuropathic causes. The fact that these variables impact the median nerve without necessarily raising the interstitial pressure in the carpal tunnel makes them noteworthy. Patients with diabetes have a lower onset of nerve damage and therefore higher risk of developing CTS. The incidence of diabetic patients is 14% in non-diabetic individuals and 30% in patients with diabetic neuropathy; the prevalence rate during pregnancy was determined to be 2% (1).
The pathophysiology of carpal tunnel syndrome (CTS) includes mechanical trauma, elevated intracranial pressure, and ischemic injury to the median nerve. Normal pressure was seen to range between 2 mmHg and 10 mmHg with regard to elevated pressure. Changes in wrist position can cause significant variations in fluid pressure within the carpal tunnel. As a result, while wrist flexion results in an eight-fold rise in pressure, extension raises the pressure to parts by more than ten times its initial amount. As a consequence, wrist repetitions pose a serious risk factor for CTS cases. When a patient is first diagnosed with CTS clinically, they typically wake up from sleep with no discernible swelling or numbness in their hands. Nighttime brachialgia paresthesia is characterized by severe pain radiating from the wrist to the shoulder and tingling in the hand and fingers. Shaking the hand usually stops the

discomfort, though afterwards the hand could feel hard. The patient's symptoms start to appear throughout the day, marking the second stage of the condition's development. These symptoms appear when the patient performs repetitive hand or wrist movements or stays in one place for long periods of time. In a similar vein, the patients may report feeling unsteady when grasping objects with their hands, which could lead to falls (2). For carpal tunnel syndrome, there are several therapy options that can help with impairment. The clinical results of the Neurodynamic and Active Release Techniques in comparison for reducing the severity of symptoms and functional impairment have not been sufficiently covered in the literature. The results of this study will have a number of significant ramifications for future practitioners and researchers. It will let the physiotherapist select the technique that will effectively cure carpal tunnel syndrome.

Chen S, Qian Y, Sun Z, et al., 2022, carried out research to evaluate the efficacy of therapeutic ultrasound in the management of carpal tunnel syndrome. The research methodology involves conducting a prospective, multicenter, randomized controlled experiment with three arms. Using criteria derived from a consensus survey conducted by the UK Primary Care Rheumatology Society, 122 eligible adult participants with a diagnosis of mild to moderate CTS will be assigned to one of three groups: (1) therapeutic ultrasound, (2) night splint, or (3) therapeutic ultrasound + night splint (combined). The main result will be a difference between the therapeutic ultrasound + night splint and night splint groups at six weeks on the Symptom Severity Scale of the Boston Carpal Tunnel Questionnaire (BCTQ-SSS). Secondary outcomes comprise the Hospital Anxiety and Depression Scale for mental status, the Functional Status Scale of BCTQ for interrupted sleep, the Sleep Questionnaire for interrupted sleep, the EuroQol-5D for general health, the Work Limitations Questionnaire-25 for functional limitations at work, the Global Rating of Change for treatment success and recurrence rate, the physical examination, and the electrophysiological and ultrasound parameters. The use of intention-to-treat studies (3).

Mohammad Reza Asadi et al. in 2021 sought to ascertain the Impact of Therapeutic Ultrasound and Low-Level Laser Therapy on Hand Pain and Function After Carpal Tunnel Syndrome. 45 patients (84 wrists) with CTS were randomly assigned to one of three treatment groups in this single-blind trial: 15 patients received ultrasound and laser combination therapy, 15 patients received ultrasound therapy, and 15 patients received laser therapy. The carpal tunnel underwent 10 sessions of low-level laser therapy (total intensity of 9 J on 5 sites) and ultrasound therapy (intensity of 1.25 W/cm and duty cycle of 20% for 5 minutes per session). In the group that received both ultrasound and laser therapy, the

laser treatment was administered first using the same protocol as the laser therapy group. Subsequently, ultrasound was administered using the same parameters as the ultrasonic therapy group. The outcomes of the Boston Questionnaire, grip and pinch strength, and a visual analog scale (VAS) were assessed both before and after the treatment. In patients with mild to moderate CTS, both laser and ultrasound treatments significantly reduce discomfort and enhance functional hand performance over the short term. When treating these patients, the combined application of these two modalities might have a greater effect (4)

César Fernández-de-las-Peñas et al., in 2020 have out research to compare the benefits of manual therapy and surgery for treating carpal tunnel syndrome. In this tertiary public hospital randomized controlled trial, 120 women with CTS were randomized to receive either manual therapy or surgery. The three physical therapy sessions included tendon/nerve gliding exercises at home in addition to desensitization techniques for the central nervous system or carpal tunnel release. Pain intensity (the mean and the worst pain) was the main result. Functional status, symptom intensity, and self-perceived improvement as assessed by a global rating of change scale were among the secondary outcomes. The analysis's results were evaluated at baseline, after a year, and after four years. Each group's rate of surgical intervention was assessed over the course of the investigation. When compared to surgery in women with CTS, manual therapy, which includes desensitization techniques of the central nervous system, produced comparable long-term results and surgery rates. Together with a schedule of at-home tendon/nerve gliding exercises (5).

To the best of our knowledge, there were several treatment options for carpal tunnel syndrome. Before this, no research has been done comparing Active Release Technique with Nuerodynamic. Thus, this study contributed to the expanding body of knowledge regarding whether those two Techniques produce Comparable results occur when one is better than the other. The goal of the current study is to examine the therapeutic effects of active release technique and Nuerodynamic technique on the functional impairment and severity of symptoms in patients with carpal tunnel syndrome.

Methods

This study took place at Rehab Max Physiotherapy and Sports Injury Clinic, Layyah. It employed a randomized clinical trial design to assess outcomes. Non-probability purposive sampling was used to select participants, comprising both genders. A total of 12 participants met the inclusion criteria for this study. The inclusion criteria includes;

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- Age was between 25-50 years (6)
- Both gender (7)
- Complaints of pain, numbness, or tingling in the first three digits (8)
- Positive Phalen's Sign (9)
- Unilateral Compression of Nerve (10).

The exclusion criteria includes;

- History of Carpal Tunnel Release Surgery (11).
- Patients with median nerve involvement in proximal areas, such as thoracic outlet syndrome and cervical radiculopathy (12)
- Steroid injection in the carpal tunnel, thenar muscle atrophy (13)
- Metabolic diseases such as diabetes, severe thyroid disorders, anemia, and pregnancy (14).

Data Collection Tool

- Demographic Questionnaire (Name, age, gender, involved side)
- DASH Scale
- Symptoms Severity Scale (SSS)

DASH Scale

Self-rated upper-extremity impairment and symptoms are measured with the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, a self-administered, region-specific outcome tool. The thirty-item disability/symptom scale makes up the majority of it.

- 1= No Difficulty
- 2= Mild Difficulty
- 3= Moderate Difficulty
- 4= Severe Difficulty
- 5= Unable

SSS Scale

The SSS is a score measuring Symptoms of fatigue (on a scale of 0-3), unrefreshing sleep (on a scale of 0-3), and cognitive symptoms (on a scale of 0-3).

- 0= No Symptoms
- 1= Mild

- 2= Moderate
- 3= Severe

Data Collection Procedure

Data was collected after getting validation from the ethical committee of GC UNIVERSITY FAISALABAD LAYYAH CAMPUS LAYYAH, PAKISTAN, which provided information to the participants.

Screening

The Subjects who met the inclusion criteria were allocated for this study.

Randomization

The patients in the concealed envelope approach get sealed opaque envelopes with a treatment schedule inscribed on them. An envelope is opened and the patient is given the designated treatment plan once the patient gives permission to participate in a trial.

Assessment

Data was collected at baseline, 4^{th} week, and 8^{th} week(follow-up).

Baseline Treatment

Ten minutes of infrared therapy were given to both groups at the start of each treatment session. Each intervention session lasted fifteen to twenty minutes in total.

Neurodynamic Technique (Group A):

In the nerve mobilization group, special techniques used for median nerve mobilization include gliding and tension maneuvers for 5 minutes (8 repetitions in which we applied manual technique for 20s and rest for 10 seconds) in each session.

Active Release Technique (Group B)

A thorough examination allowed us to identify specific entrapment points and any muscle adhesions causing nerve compression. Active Release Technique was a manual soft-tissue mobilization therapy, so we used our hands to identify muscle adhesions. The patient was sitting, and we had to approach the patient on their affect.

Data Analysis Procedure

SPSS Version 24 was used to enter and evaluate the data. Age-related numerical data was shown as mean ± SD. The frequency (Percentage) of categorical data, such as gender categories like male and female, was displayed. A non-parametric test ($p<0.05$) was used after the Shapiro-Wilk test was used to confirm that the data were normal. The Friedman Test was utilized to evaluate severity and

impairment at baseline on weeks four and eight for the within-group analysis. To compare the results between the experimental groups, the Mann-Whitney test was employed. P: A significance level of less than or equal to 0.05 was used.

RESULTS

A total of 12 participants were included in this study. 6 participants belonged to Group A and 6 participants in Group B. Among the total participants of the study, three were male i.e. 50.0%, and 3 were females i.e. 50.0%. In group A, the overall figure of male and female participants was 3 and 3, respectively. In group B, the overall figure of males and females was 3 and 3 respectively. **(Table 1 & Figure 1)**

The results regarding descriptive statistics of age showed that the mean and standard deviation were 37.17± 6.494 for Group A (Neurodynamic Technique) and 33.33 ± 5.124 for Group B (Active Release Technique). **(Table 2)** The histogram with a normal curve regarding age showed that the mean and standard deviation were found to be 37.17± 6.494 for Group A, while the curve was normally distributed. The histogram with a normal curve regarding age showed that the mean and standard deviation were found to be 33.33 ± 5.124 for Group B, while the curve was normally distributed. **(Figure 2 & Figure 3)**

Descriptive statistics regarding the Affected side showed that Group A had 50% of patients with the right side affected and 50% left side affected, while Group B showed the same 50% affected right side, 50% with the left side affected. **(Table 3 & Figure 4)**

The normality test as measured by Shapiro Wilk showed by significant p-value (<0.05) that data was not normally distributed. Therefore, the data was non-parametric. **(Table 4)**

Participants were arbitrarily distributed into two groups. In group A, participants received Neurodynamic Technique while in group B, participants received Active Release Technique. The outcomes were assessed by the SSS and DASH Scale.

Friedman test was applied for within-group analysis of the SSS and DASH Scale. A statistically significant difference was documented in SSS and DASH at baseline,4th week, and 8th week for Group A ($p<0.05$). **(Table 5)** within-group analysis of Group B showed statistically significant differences at

baseline,4th week and 8th week follow-up in SSS and DASH Scale. **(Table 6)**

All groups were compared to observe differences from baseline to post 8 weeks in the DASH Scale (Disability of Arm Shoulder and Hand) and SSS Scale (Severity Symptom Scale) in carpal tunnel syndrome. The between-group analysis using the Mann-Whitney test showed a statistically significant difference in the DASH Scale and SSS Scale for Carpal Tunnel at 8th week while not substantial at baseline. **(Table 7)**

In group A, the mean rank of the SSS scale was 7.00 at baseline, 5.33 at 4th week, and 4.33 at 8th week. The mean rank value of the DASH Scale at baseline was 5.33, at 4th week 5.17, and 4.33 at 8th week. In Group B, the mean rank value of the SSS scale was 6.00, 7.67, and 7.51 at baseline,4th week, and 8th week, respectively. The mean rank values of the DASH Scale at baseline were 7.67, at 4th week 7.53, and 7.00 at 8th week.

DISSCUSSION

The current study looked into how pain is affected by neurodynamic and active release methods. At every assessment level, statistically significant improvements in disability and severity as determined by the Disability of Arm, Shoulder, and Hand (DASH) scale and Severity symptom scale (SSS) were found through statistical analyses that included the Freidman Test, the Mann-Whitney test, and descriptive statistics. The significant improvements in the obtained p-values (<0.0001) suggested that both therapies were successful in improving the severity of symptoms. The outcomes of the neurodynamic technique were clearly more significant than those of the active release technique.

The descriptive statistics revealed that age mean and standard deviation were 37.17±6.494 for Group-Neuro-dynamic and 33.33±5.124 for Group-Active Release Technique. These values provide an overview of each group's central tendency and variability. The Shapiro-Wilk test indicated that the age data followed a normal distribution ($p < 0.05$), supporting the assumption of non-parametric data. This finding is consistent with previous studies that not have reported normal distributions of age. The mean and standard deviation of the Freidman Test and the SSS scores for the Neuro-dynamic group at baseline were 4.6667±.5164, at the 4th week, they were 3.1667±.7527 and at 8th week they were 1.833±.7527. On the other hand, mean and standard deviation for DASH scale at baseline 4.1667±.8527, DASH at 4th week 3.4444±.8127 and DASH at 8th week 1.833±.7527. In contrast, the Active Release Technique group exhibited mean and standard deviation value for SSS score was 4.500±.5477 at baseline, 3.6667±.51640 at the 4th week and 2.833±.4082 at 8th week. On the other

hand, the mean and standard deviation for the DASH scale at baseline was 4.6667±.5164, in the 4th week 3.666±.5164, and 8th week 2.833±.4082. The mean and Standard deviation for Mann Whitney Test of SSS Score at baseline were 4.583±.5149, at the 4th week were 3.416±.6685 and at 8th week 2.333±. 7785. On the other hand, the DASH Scale at baseline was 4.416±.6685, in the 4th week 3.333±.7785 and in the 8th week 2.3333±.77850. The corresponding p-values were .575 at baseline.212 at the 4th week and .023 at 8th week for SSS respectively. On the other hand, p -values for DASH scale were .212 at baseline, .162 at 4th week and .023 at 8th week Regarding the gender distribution of participants, the results showed that Group-Neuro-dynamic had 50% males and 50% females, whereas Group. Active Release Technique had 50% males and 50% females. These findings indicate a relatively balanced gender distribution within each group, which is important for minimizing potential gender-related confounders.

Muhammad Junaid Ijaz et.al .in 2022 carried out investigations to assess prospective randomized clinical trials. to investigate and contrast how median nerve neuro-mobilization at the wrist and standard physical therapy contribute to the improvement of pain, muscle strength, range of motion, and functional status as measured by the numeric pain rating scale (NPRS). Convenient sampling was used to enlist 66 patients, who were then split into two groups at random. The neuro-mobilization groups demonstrated a statistically more significant gain in flexion, extension, decrease in discomfort, drop in SSS, decrease in FSS, and BCTQ in comparison to the conventional physical therapy group, despite the fact that both groups improved considerably across all outcome measures. Better treatment outcomes are seen when neuro-mobilization is included in the carpal tunnel syndrome rehabilitation program.

Sadu B, Wicaksono U, Proyogo D et.al .in 2022 This research makes use of a control group in an experimental pretest-posttest setup. Amount subject study: 16 participants were split into two groups; group 1 received myofascial release as a form of intervention practice, while group 2 received neurodynamic mobilization. Four weeks of three interventions a week. The Boston Carpal Tunnel Questionnaire (BCTQ) is used in the instrument study. Measurement results for groups receiving treatment 1 and treatment 2 equally demonstrated repair with a p-value of 0.000 for both the pretest and posttest. The findings of the comparison test indicate that there is a significant difference in the effectiveness of mobilization neurodynamic treatment in repairing CTS problems, with a p-value of 0.000. Both myofascial release and mobilization exercise have the potential to heal, but complaints about internal mobilization in buildings with CTS have shown that neurodynamic treatment works

better.

T. Wolny, E. Saulicz et.al .in 2016 examine the Two-point discrimination (2PD) test can be used to assess both clinical condition and the effects of therapy in carpal tunnel syndrome (CTS) patients. Therapy for the neurodynamic mobilization group was based on manual UV therapy and neurodynamic techniques. Therapy for the electrophysical modalities group was based on red and infrared laser and ultrasound therapy using a contact method applied in the transverse ligament area. Therapeutic cycle consisted of 20 therapy sessions delivered at twice-weekly intervals. After therapy, 2PD in the symptomatic limbs in the neurodynamic mobilization and electrophysical modalities groups significantly improved ($p < .001$). However, there was no statistically significant difference between the treatment groups. Both therapy programs used in this study were beneficial for improving 2PD. The previous research's indicating the benefits of nerve mobilization in relieving pain and improving symptoms in patients with carpal tunnel syndrome. It is important to acknowledge that the mechanism of action and the specific effects of myofascial release, METs may differ from Neurodynamic. These result corelates with current study report significant improvement of severity and disability by using Neurodynamic. It is important to note that pain level decreased with the passage of time in both groups

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