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Comparing the effects of carpal bone mobilization and tendon gliding in patients with carpal tunnel syndrome

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[1-4]Conception and design, [1-3]Collection and assembly of data, [1,3-6]Analysis and interpretation of the data, Statistical expertise, [1-2]drafting of article, [4-6]Critical revision of the article for important intellectual content, [4]Final approval and guarantor of the article.

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Background: Idiopathic carpal tunnel syndrome is a carpal tunnel median nerve neuropathy. CTS is the most typical type of peripheral neuropathy

Objective: To determine the effects of carpal bones mobilization and tendon gliding exercise on patients with Carpal Tunnel Syndrome.

Methodology: This was a quasi-experimental study. Data was collected from Faisal Hospital and Civil Hospital Faisalabad from April 2022 to August 2022. The total sample size was 32 and calculated from the open epi tool. Patients were recruited in this study by considering the inclusion and exclusion criteria. Patients were divided into two groups. The patients in group A were treated by carpal bone mobilization, and those in group B were treated by tendon gliding exercise. Throughout the course of four weeks, the intervention was carried out three times per week. The outcome measure tools of this study were the Numeric Pain Rating Scale and the Boston Carpal Tunnel Questionnaire. The data was analyzed using SPSS version 23.

Results: There was a significant difference in reduction of pain intensity, symptom severity and improvement in functional ability between two groups i.e. Carpal Bone Mobilization and Tendon Gliding at end of four weeks (P<0.002) (P<0.000) (P<0.001). There was more reduction in pain (P<0.002), and symptom severity (P<0.000) and improvement in functional ability (P<0.001) in Tendon Gliding group at end of 4 weeks

Conclusion: Tendon gliding exercises were most effective in reducing pain, range of motion, and neck function as compared to nerve mobilization in patients with carpal tunnel syndrome.

Keywords: Carpal tunnel syndrome, nerve neuropathy.

ABSTRACT

Introduction

Idiopathic carpal tunnel syndrome is a carpal tunnel median nerve neuropathy. CTS is the most typical type of peripheral neuropathy. Patients experiencing numbness, tingling, or burning are common symptoms CTS. The carpal tunnel's median nerve provides sensation to the thumb, forefinger, and half of the middle finger.[1]

In the general community, CTS affects between 3% and 6% of people[2,3]. Among clinical subpopulations, the prevalence of CTS ranges from as high as 62% in pregnant women[4–7] to roughly 20% in diabetic patients.[8,9] CTS is more common in several professions.[3] The prevalence of CTS is between 4 and 5% globally, with 50 per 1000 people in wealthy nations, 12.1% in east Africa, and 29.2% in Ethiopia.[4]

Flexion and extension cause the CT pressure to rise. On the other hand, as wrist is flexed, the CT's proximal aperture's cross-section gets smaller. This is brought on by displacement of transverse carpal ligaments and circular changes to the distal end of capitates bone. The lunar bone is

compressed when it is forced toward the tunnel's interior by excessive extension.[5]

If individual suffer from severe pain, their grip power and hand coordination may decrease. The long-term presence of CTS can lead to muscle breakdown at the bottom of the thumb.[6]

Tendonitis of the flexors of the limbs is another non-occupational cause. Finger, thickening distal radius fracture or dislocation with transverse carpal ligament. Autoimmune diseases, lipomas, diabetes, hyperthyroidism and pregnancy are all the risk factors of CTS. [7]

There are a variety of factors that contributing to the growth of CTS, such as mechanical stress, high blood pressure, and a median nerve ischemia injury in the carpal tunnel. When a nerve is compressed, demyelination starts there and continues until it reaches the axon-containing intermodal section still there. Sustained compression alters endoneural swelling develops the blood-nerve barrier is altered as a result flow of blood to the endoneural capillary network. Thus, a vicious circle of ischemia, venous blockage, and localised metabolic abnormalities begins.[8]

The patient typically experiences numbness or swelling in the hand when waking from sleep, but no obvious swelling. The clinical diagnosis of CTS is being made at this stage. The acute wrist pain that travels to the shoulder and is accompanied in fingers and hand tingling is known as brachialgia paresthetica nocturna. After shaking hands, the discomfort typically goes away, but the hand may continue to feel uncomfortable. The patient's emergence second stage of CTS includes symptoms that last throughout the day. Such symptoms when patient engages in repeated wrist or hand movements motions and holds a fixed posture for a lengthy amount of time. Additionally, patients may become clumsy when grasping objects with their hands, which increases the risk of falling. CTS has progressed to its final stage when the thenar eminence hypotrophy or atrophy is present.[9]

If a patient's medical history and physical examination indicate that they may have CTS, they may also be electro-diagnosed (require proper sentence). CTS was verified using electromyography and nerve conduction.[1]

There are several treatments available for CTS such as Paraffin, Laser, Ultrasound therapy, Magneto therapy, Iontophoresis, Acupuncture, Shockwave therapy, Immobilization, Kinesiotherapy.[10] Carpal bone mobilization in order to increase wrist extension, the carpal bones in the proximal row are moved dorsally, and the palmar row is moved in the opposite direction to promote wrist flexion.[11] This study's tendon slide exercise entails slipping the fingers in the five different fist positions—straight, hook, tabletop, hook, and straight in accordance with typical protocol. In accordance with the Totten and Hunter study.[12]

The purpose of the study was to evaluate the efficacy of tendon gliding against carpal bone mobilization in the treatment of CTS. Due to its rarity and ability to cover some research gaps, this study is helpful to scholars. Using innovative research methodologies, patients will receive treatment plans that will improve their quality of life.

Methodology

This was a Quasi Experimental Study. Data was collected after taking ethical permission from Faisal institute of health sciences.(Ref No: **FIHS/2022/192**) Data was collected from Faisal Hospital and Civil Hospital in Faisalabad from April 2022 to august 2022. Informed consent was signed from all participants. Participants were enrolled using a non-probability purposive sampling technique. All participants were questioned regarding their personal characteristics and medical histories, and a sample size of 32 was computed using a calculation in the Open Epi tool, with 16 patients in each group. The sample size was calculated by the following formula keeping the power of study equal to 90% and level of significance equal to 5%. Expected Mean Difference in toxicity= $\mu_1 - \mu_2 = 4.41-2.86=1.55$, Standard Deviation of Group A (Ultrasound Therapy) = $\delta_1 = 1.05$, Standard Deviation of Group B (Nerve Mobilization) = $\delta_2 = 1.88$.

All 32 participants were randomly assigned using software that was available online apportioned at random select from two groupings: carpal bone mobilization (n = 15) or tendon gliding (n = 15). All subjects were given the directive to keep any information about their therapy from the other participants. Both genders of participation, ages 31 to 60y, patient with complain of wrist pain for instructions was excluded group A was receiving carpal bone mobilization and group B was receiving tendon gliding exercise**.** Total treatment was of 4 weeks. 3 sessions were given per week for consecutive 4 weeks. In Carpal bone mobilization five techniques were developed: wrist with 3 sets of 3 minutes each of diversion, rhythmic, and gentle stretching TCL, palmar hand fascia release, wrist movement with respect to the surrounding metacarpal, radius, ulna, or poster anterior (P-A) and anteroposterior (A-P) carpal bones and Maitland grade 2 mobilization techniques of wrist. Manual methods were done for a total of 15 minutes every session, with each technique consisting of three sets of three minutes each. Tendon gliding exercise group received exercises called "tendon gliding"

involved sliding the hand's flexor tendons by counting with the fingers from 1 to 5 distinct positions: straight, hook, fist, table top, and straight fist (10 repetitions twice daily three times a week) for 4 weeks. Numeric Pain Rate Scale and Boston Carpal Tunnel Questionnaire are the outcome measurements used in the methodology of CTS. All data was analyzed by SPSS version 23. Independent t test was used for determine the difference between two groups in term of Numeric Pain Rating Scale, Boston CTS Questionnaire and Functional Status Scale

Results

Out of 30 there were 11 males and 4 females in group A and 7 males and 8 females in group B. Two participants were drop out from both groups one in each group. The table I shows minimum and maximum age of patients in both groups. Minimum age was 35 years in group A and 31 years in group B. Maximum age of group 1 and 2 was 60 and 53 respectively. Table demonstrates mean and standard deviation of group A and B being 45.2±6.24 years and 38.27±5.72 years respectively.

Table I: The mean age of gender, frequency and % of genders in both groups.

Parameters	Group A	Group B
Minimum Age	35	31
Maximum Age	60	53
Mean±S.D	45.2±6.247	38.27±5.725
Gender Male	11(73.33%)	7(46.67%)
Female	4(26.67%)	8(53.33%)
Total number of genders in both groups Male	18(60%)	
Female	12(40%)	

Shapiro Wilk test was used that shows data was normal distributed (P > 0.05) so parametric test that involved repeated measure ANOVA and independent t test applied to determine the significant difference within and between groups.

Independent t test shows that there was significant difference in mean value of decreasing pain value on Numeric Pain Rating Scale between two groups at end of 4 week of treatment (1.93±.15 vs 1.20±.56 P <.001). Pain was more reduced in group B at end of 4 weeks with mean value 1.93±.15(Table II)

Independent t test also shows significant difference in decreasing symptom severity and improving functional abilities value on Boston CTS Questionnaire (1.81±.36 vs 1.24±.37 P =.000) and Functional Status Scale (1.42±.22 vs 1.14±.18 P= .001) between two groups at end of 4 week of treatment (P<0.05). Symptom severity reduction and improvement in function was more observed in group B. (Table III)

Table II: Comparison of NPRS value between Group 1 and Group 2 subjects by independent t Test.

Sessions	Group 1 (n=15)	Group 2 (n=15)	P Value
	Mean±S.D	Mean±S.D	
Baseline	7.33±.96	6.80±1.26	.207
1st Week	7.07±1.16	5.00±1.19	.000
2nd Week	5.27±1.10	3.67±.97	.000
3rd Week	3.67±1.04	2.27±.54	.000
4th Week	1.93±.15	1.20±.56	.001

Discussion

This study stated that Carpal mobilization was more superior to tendon gliding exercise in term of decreasing pain, symptom severity and improving function in CTS patients.

Ata e al. (2011) had the therapeutic results of low level laser therapy (LLLT) combined with nerve and tendon gliding exercises for CTS. Ata et al. (2011) involved the 30 participants. This study found that for the treatment of mild to moderate CTS, LLLT must be a more effective treatment choice in lowering pain and strengthening grip than nerve and tendon gliding activities.[14] This present study was inconsistent with above study because present study shows that carpal mobilization was more effective in reducing pain in CTS as compared to tendon gliding exercise. This present study used the carpal mobilization and tendon gliding exercise separately than above study that used tendon gliding exercises with nerve mobilization [13]

Marayam et al. (2018) had determined the efficiency

Table III: Comparison of BCTQ and FSS value between group 1 and 2 subject by independent t Test.

	BCTQ			FSS		
Sessions	Group A (n=15)	Group B (n=15)	P Value	Group A (n=15)	Group B (n=15)	P Value
	Mean±S.D	Mean±S.D		Mean±S.D	Mean±S.D	
Baseline	2.84±.135	2.91±.13	.147	2.78±.21	2.66±.12	.075
1st Week	2.63±.26	2.23±.22	.000	2.39±.23	1.95±.33	.000
2nd Week	2.55±.27	2.04±.14	.000	2.16±.19	1.60±.34	.000
3rd Week	2.21±.15	1.83±.19	.000	1.86±.21	1.34±.26	.000
4th Week	1.81±.36	1.24±.37	.000	1.42±.22	1.14±.18	.001

of comprehensive neurodynamics compared to nerve and tendon gliding exercises alone in CTS patients. Total participants were 27. This study found that individuals with CTS responded effectively to nerve and tendon gliding exercises given both alone and in combination with neurodynamics. When treating CTS conservatively, combined neurodynamics is not more effective than nerve tendon gliding exercises alone, the groups was given electrotherapy (tens and ultrasound).[15] This present study in consistent with above study because present study shows that carpal mobilization was more effective in reducing pain in CTS as compared to tendon gliding exercise. This present study used the carpal mobilization and tendon gliding exercise than above study that used neurodynamics with nerve and tendon gliding exercise alone for CTS [14]

Horng et al. (2011) had determine the efficacy of combined therapy for CTS, which included tendon and nerve gliding activities in patients with CTS. Total participants were 60 and 53 complete the study. Group 1 got additional tendon gliding exercises and group 2 underwent additional nerve gliding activities in addition to the standard treatments (splint and paraffin therapy, as in group 3).[16] This present study in consistent with above study because present study shows that carpal mobilization was more effective in reducing pain in CTS as compared to tendon gliding exercise. the groups was given electrotherapy (tens and heating pad). This present study used the tendon gliding exercises with conventional treatments was more effective than that of nerve gliding exercises with conventional treatments.[15]

Sheereen et al. (2022) determined that when combined with tendon gliding exercise, neurodynamics proved to be more efficient than carpal bone mobilization in improving hand function (P = 0.001). However, **w**hen treating participants with persistent CTS, both neurodynamic and carpal bone mobilization were equally successful at reducing pain (P=0.16). Additionally, the tendon gliding exercise served as a good, effect-enhancing complement to the carpal bone mobilization and neurodynamics, respectively.[16] The above study was contrast to present study in which carpal bone mobilization and tendon gliding exercise were performed separately. Carpal mobilization was more superior to tendon gliding exercise in term of decreasing pain and function in CTS.[16]

Combining the current study with the prior one, which discovered that tendon gliding exercise lessened the severity of CTS symptoms. To our knowledge, no earlier study on CTS treatment in Pakistan adhered to the same guidelines as this one. The functional status scale, BCTQ, and NPRS all showed improvement in the current study. The drawbacks of this study included the language barrier, patient disinterest due to time limits, and lack of collaboration.

Conclusion

According to the findings of the current investigation, both therapies are effective in alleviating pain and improving function. Tendon Gliding Group demonstrated considerable improvement in treating CTS patients' pain and enhancing their functional state.

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