RESEARCH PAPER

Effectiveness of Tendon Gliding Exercises versus Stretching on Pain and Hand Function in Patients with Carpal Tunnel Syndrome

Mrunali V Kamble[1], Dr. Archana D. Methe[2*]
[1]Intern, D. Y. Patil College of Physiotherapy, D. Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India
Email: kamblemrunali533@gmail.com
[2*]Associate Professor, Department of Community Physiotherapy, D. Y. Patil College of Physiotherapy, D. Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India
Email: archumethe@gmail.com
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ABSTRACT

BACKGROUND- Carpal Tunnel Syndrome (CTS) is one of the most common peripheral nerve entrapment disorders caused by compression of the median nerve within the carpal tunnel of the wrist. It commonly presents with pain, numbness, tingling, and weakness in the hand, which may impair daily functional activities. Conservative physiotherapy management plays a prominent role in reducing symptoms and improving hand function. Among these interventions, tendon gliding and stretching exercises are widely practised to enhance tendon mobility, reduce pressure in the carpal tunnel, and improve the flexibility of wrist and forearm muscles. These exercises may improve flexor tendon mobility and reduce mechanical stress on the median nerve, thereby alleviating symptoms and improving functional outcomes. Therefore, evaluating the effectiveness of tendon gliding and stretching exercises is important for supporting evidence-based physiotherapy management in patients with CT

AIM OF THE STUDY- To evaluate and compare the effectiveness of tendon gliding exercises and stretching exercises in reducing pain and improving hand functional outcomes in patients with Carpal Tunnel Syndrome

PROCEDURE- This Study was conducted after obtaining Ethical Clearance from the institution's ethical committee. According to the inclusion criteria, 60 participants were included in this study. Participants were included according to Simple Random Sampling. Each participant was assessed by using Special tests for Carpal Tunnel Syndrome.

OUTCOME MEASURES- Visual Analogue Scale (VAS), Boston Questionnaire. (BCTQ)

RESULT? The study found that both intervention approaches reduced pain and improved hand function among individuals with carpal tunnel syndrome. However, participants who performed tendon gliding exercises showed comparatively greater improvement than those who followed stretching exercises alone. Enhanced symptom relief, better hand usage in daily activities, and improved mobility of the involved structures were clearer in the tendon gliding group

CONCLUSION? Based on this study's findings, tendon gliding exercises are more beneficial than stretching for managing carpal tunnel syndrome symptoms. These exercises improve the movement of tendons and associated neural structures, leading to improved hand function and decreased discomfort. Therefore, tendon gliding exercises should be considered as a key part of physiotherapy management for such patients.

KEYWORDS: carpal tunnel syndrome, tendon gliding, stretching, pain relief, hand function

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INTRODUCTION

The term "carpal tunnel syndrome" (CTS), which comes from the Latin word "carpi," meaning "wrist," is caused by pressure, inflammation, and compression of the median nerve as it passes through the carpal tunnel of the wrist (2). A band of fibrous tissues that surrounds the wrist serves as a joint support in most cases. (1) Symptoms include pain, particularly at night, which can result in numbness, tingling, weakness, or hand and finger muscle injury. (1)

This syndrome is the most common neural injury in the general population (1-4%) and workers at risk (15-20%) (4) It affects people who need to perform repetitive wrist and finger motions, such as typing, factory workers, and cleaners, as well as musicians, whose propensity to develop chronic conditions has an economic impact due to missed work and the need for surgical treatments to improve the condition (3)

The non-traumatic hand condition known as carpal tunnel syndrome is brought on by the hand's median nerve becoming trapped. (6) Depending on the severity of the condition, carpal tunnel syndrome can be classified as mild, moderate, or severe. (6) The primary feature seen in patients with CTS is a loss of grip and pinching of the hand and upper limb. (7) The prevalence is 0.6% in adult males and 5.8% in adult females. (5)

Rheumatoid arthritis, obesity, diabetes mellitus, pregnancy, and genetic predisposition are among the risk factors linked to CTS(3)

Chronic wrist flexion, repetitive hand movements, underlying medical diseases such as diabetes and rheumatoid arthritis, or idiopathic causes are major causes of CTS in patients. (11)

Musculoskeletal rehabilitation and neurodynamics provide the physiological justification for CTS treatment activities(12). For long-term symptom management, recent research emphasises the significance of combining physiotherapy with ergonomic changes and patient education. (14) Workplace modifications, such as proper wrist positioning, frequent breaks, and ergonomic tools, are critical in preventing symptom exacerbation and promoting recovery (9)

The carpal tunnel is a narrow osteofibrous canal located on the palmar aspect of the wrist that allows passage of the median nerve and flexor tendons from the forearm into the hand(13)

The roof of the carpal tunnel is formed by the flexor retinaculum (transverse carpal ligament), while the concave arch of the carpal bones forms the floor and walls. (1)

The proximal row of carpal bones consists of the scaphoid, lunate, triquetrum, and pisiform, and the distal row consists of the trapezium, trapezoid, capitate, and hamate. (13)

Because the carpal tunnel is bounded by rigid osseous structures and a strong fibrous ligament, it has limited capacity for expansion; therefore, any increase in tunnel contents can raise intracarpal pressure. (11)

The contents of the carpal tunnel include the median nerve and nine flexor tendons: four tendons of flexor digitorum superficialis, four tendons of flexor digitorum profundus, and one tendon of flexor pollicis longus. (13)

These flexor tendons are surrounded by synovial sheaths that facilitate smooth gliding during finger and wrist movements. (11)

The median nerve originates from the brachial plexus (C5-T1 nerve roots) and travels down the anterior compartment of the forearm before entering the hand through the carpal tunnel. (1)

In the hand, the median nerve provides motor innervation to the thenar muscles (abductor pollicis brevis, opponens pollicis, and superficial head of flexor pollicis brevis) and the first and second lumbricals. (11)

It also provides sensory innervation to the palmar surface of the thumb, index finger, middle finger, and radial half of the ring finger, as well as the dorsal distal phalanges of these digits. (11)

Normal pressure within the carpal tunnel ranges from approximately 2 to 10 mmHg, but this pressure increases significantly during wrist flexion and extension. (3)

Sustained elevation of intracarpal pressure can impair intraneural blood flow, resulting in ischemia and mechanical compression of the median nerve. (11)

Restricted gliding of flexor tendons or thickening of synovial tissue may further increase pressure within the tunnel and contribute to the development of carpal tunnel syndrome(3)

Comprehensive care for CTS patients is also ensured by a multidisciplinary approach, including doctors, occupational therapists, and physiotherapists(2). The relative efficacy of physiotherapy and surgical decompression is a crucial research topic in CTS management. (2) Although surgery, such as carpal tunnel release (CTR), is often regarded as the gold standard for cases of severe CTS, there is evidence that physiotherapy may be just as successful in mild-to-moderate symptoms. (9)

Wrist splinting, physical modalities, and therapeutic exercises are examples of conservative therapy, which is often advised in the early and mild to moderate phases of CTS.(10)The ability of tendon gliding exercises to increase the mobility of the flexor tendons and median nerve, lower intra-tunnel pressure, and relieve symptoms has drawn attention to them among exercise-based therapies. (15) However, further research is still needed to figure out how beneficial these two strategies are in comparison. (9)

The conservative management of CTS heavily relies on exercise therapy. Conventional stretching techniques are commonly recommended to ease discomfort, increase wrist flexibility, and loosen up tense muscles. (12) Although stretching is believed to reduce soft tissue stiffness in the forearm and wrist, it has no direct effect on the median nerve's or flexor tendons' mobility within the carpal tunnel. (14) Stretching alone may therefore have limited functional effects, especially for patients whose symptoms are significantly influenced by neural and tendon adhesion(15).

Tendon gliding exercises, on the other hand, are made expressly to encourage the flexor tendons and median nerve to glide differently in relation to surrounding structures. (18) Reduced adhesions, improved tendon excursion, less pressure, and increased neural mobility are the goals of these exercises. Targeting the underlying neurodynamic and biomechanical deficits linked to CTS (11)

METHODOLOGY

A Comparative study: a randomised clinical trial conducted in patients diagnosed with Carpal Tunnel Syndrome. The study duration was 6 months. Participants who met the inclusion and exclusion criteria were selected for the study. The sample size was 60 (30 in each group)

Inclusive Criteria- Adults aged from 20 to 60 years, Participants of both genders, Ability and Willingness to take part in the study, Patients diagnosed with carpal tunnel syndrome

Exclusive Criteria- Earlier wrist surgery or corticosteroid injection within the past six months, Fractures of the wrist, Pregnancy, or any metal implant near the wrist joint.

PROCEDURE

Ethical approval was obtained from the Institutional Ethical Committee and the protocol committee of D. Y. Patil Education Society, Kolhapur.

Permission was taken from the patients having symptoms of carpal tunnel syndrome.

Further, participants were included in the study according to the inclusion and exclusion criteria, and the procedure was explained to them in their vernacular language.

Written informed consent was taken from the participant who is willing to participate.

Brief demographic data, including name, age, and gender, was collected on data collection sheets.

Performed the special test for carpal tunnel syndrome, such as Phalen's test, Reverse Phalen's test, Durkan's compression test, Tinel's sign, Hand elevation test for the diagnosis and treatment

To compare the effect of tendon gliding exercises vs stretching exercises in patients with carpal tunnel syndrome, there were two groups

Comprising 30 individuals in group A and 30 in group B.

Group A included users who performed tendon gliding exercise, and Group B included users who performed stretching.

Demographic data details like age, gender, etc., as per the data collection sheet and outcome measures like the Visual Analogue Scale (VAS), Boston carpal tunnel syndrome (BCTQ) Questionnaire score were recorded

Pre and post intervention, the participants will be assessed using outcome measures, the Visual Analogue Scale (VAS), and the Boston carpal tunnel syndrome Questionnaire (BCTQ) score will be assessed and recorded

Statistical analysis was conducted, and the results were obtained

Group A included 30 individuals with a treatment protocol of tendon gliding exercises in patients with carpal tunnel syndrome, which was carried out for 3 weeks

Group B included 30 individuals with a treatment protocol of stretching exercises in patients with carpal tunnel syndrome, which was carried out for 3 weeks

Position of the subject: sitting comfortably first, with a look at contraindications and indications needed, and after taking the patient's concerns, we should begin as follows:

Two exercises were performed

Group A: Tendon gliding exercises

Group B: Stretching exercises

As follow -

Procedure for Tendon Gliding Exercises: (Group A)

Start Position: Begin with the wrist in a neutral position, fingers extended, and hand relaxed.

Exercise Sequence:

Position 1 (Straight Hand): Keep fingers straight, palm open, and wrist neutral (neutral extension). This is the starting position.

Position 2 (Hook Fist): Bend the fingers at the middle joints to form a hook fist, with the knuckles still slightly bent and the wrist neutral.

Position 3 (Full Fist): Make a full fist by curling all fingers into the palm, with the thumb wrapping around the outside of the fingers.

Position 4 (Tabletop or Flat Hand): Flatten the fingers back to the starting position (straight hand).

Position 5 (Straight Fist): Form a straight fist (fingers bent at the MCP joints only, not at the PIP or DIP joints.

Repetitions: Perform 10 to 15 repetitions of each position, holding each position for 5 to 10 seconds. Aim to do these exercises 3-4 times daily.

Focus on Controlled Movements: Perform the exercises slowly, with controlled movements to allow the tendons to glide smoothly and reduce pressure on the median nerve.

Position of the subject: sitting comfortably first, with a look at contraindications and indications needed, and after taking the patient's concerns, we should begin as follows:

Procedure for Tendon Gliding Exercises: (Group A)

Start Position: Begin with the wrist in a neutral position, fingers extended, and hand relaxed.

Exercise Sequence:

Position 1 (Straight Hand): Keep fingers straight, palm open, and wrist neutral (neutral extension). This is the starting position.

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Focus on Controlled Movements: Perform the exercises slowly, with controlled movements to allow the tendons to glide smoothly and reduce pressure on the median nerve.

A total of 60 participants were included, 30 in group A and 30 in group B

Table no 1 ? This table shows the distribution of people who took part in this study.

Graph no 1? This pie chart shows that 16.70 % are women and 83.30% are male

This chart shows the gender distribution of carpal tunnel syndrome patients aged 20 to 60 years

The mean average is (35.17) years, indicating that the majority of participants leaned towards the higher end of the age spectrum instead of being uniformly distributed throughout it

The standard deviation of (10.16) years is very small, suggesting that participants' ages vary very little; most people are clustered around the age of 35.

Hence, there was only minor variation between them.

Table no 2 ? The above table shows the comparison of pre- **and** post-treatment **values of VAS Score and Boston Questionnaire in Group A and Group B**

In Group A (tendon gliding exercises), the mean VAS score reduced from 6.80 to 3.03, and the Boston Questionnaire score reduced from 46.97 to 28.07

In Group B (stretching exercises), the mean VAS score reduced from 7.23 to 2.83, and the Boston questionnaire score reduced from 47.67 to 28.17

The p-value for both groups was <0.001, showing that the results are statistically highly significant

Hence, both interventions were effective in reducing pain and improving functional outcomes in patients with carpal tunnel syndrome.

Graph no 2? The graph shows the Comparison of VAS Score in group A (tendon gliding exercises)

Graph no 3 -? The graph shows the Comparison of the **Boston Questionnaire in group A (tendon gliding exercises)**

The above graphs represent the comparison of pre- and post-treatment VAS scores and Boston Questionnaire scores in Group A

Graph no 2- Shows comparison of VAS score in group A, described as follows.

In Group A, there is a noticeable reduction in the VAS score from 6.80 (pre) to 3.03 (post).

There is a marked reduction in pain intensity, as evidenced by the decrease in mean VAS score from 6.80 in the pre-treatment phase to 3.03 in the post-treatment phase

Indicating a significant improvement in hand function and reduction in symptom severity.

Interventions were effective in reducing pain and improving functional outcomes in patients with Carpal Tunnel Syndrome.

Graph no 3 - shows the comparison of the Boston Questionnaire in group A

In Group A, there is a noticeable reduction in the Boston Questionnaire from 46.97(pre) to 28.07 (post) values.

There is a marked reduction in pain intensity, as evidenced by the decrease in Boston Questionnaire mean from 46.97 in the pre-treatment phase to 28.07 in the post-treatment phase.

Indicating a significant improvement in hand function and reduction in symptom severity.

Interventions were effective in reducing pain and improving functional outcomes in patients with Carpal Tunnel Syndrome.

Graph no 4 - The graph shows the Comparison of VAS Score in group B (stretching exercises)

Graph no 5 - The graph shows the Comparison of the **Boston Questionnaire in group B (stretching exercises)**

The above graphs represent the comparison of pre- and post-treatment VAS scores and Boston Questionnaire scores in Group B

Graph no 4 - comparison of VAS score in group B described as follows.

In Group B, there is a noticeable reduction in VAS scores from 7.23 (pre) to 2.83 (post).

There is a marked reduction in pain intensity, as evidenced by the decrease in mean VAS score from 7.23 in the pre-treatment phase to 2.83 in the post-treatment phase

Indicating a significant improvement in hand function and reduction in symptom severity

It's reflecting improvement in functional status and daily activity performance.

Graph no 5 - shows the comparison of the Boston Questionnaire in group B

In Group B, there is a noticeable reduction in the Boston Questionnaire from 47.67 (pre) to 28.17 (post) values.

There is a marked reduction in pain intensity, as evidenced by the decrease in Boston Questionnaire mean from 47.67 in the pre-treatment phase to 28.17 in the post-treatment phase.

Indicating a significant improvement in hand function and reduction in symptom severity

It is reflecting improvement in functional status and daily activity performance.

Table no 3: **Group comparison of both VAS Score and Boston Questionnaire groups**

The table above compares mean VAS and Boston Questionnaire scores between Group A and Group B.

The mean VAS score for Group A was 3.03, and for Group B was 2.83, indicating slightly lower pain levels

in Group B. However, the difference was statistically non-significant (p = 0.422).

Similarly, the mean Boston Questionnaire score for Group A was 28.07 and for Group B was 28.17. The difference between the groups was minimal and statistically non-significant (p = 0.951).

Hence, no significant difference was observed between Group A and Group B in pain or functional outcomes.

Graph 6? The graph shows the comparison of the **VAS Score across both groups**

Graph 7? The graph shows the comparison of the **Boston Questionnaire across both groups**

Both graphs 6 and 7 show a comparison of the VAS Score and Boston Questionnaire in both groups, Group A, Tendon gliding exercises, and Group B, stretching exercises

The above graphical representation compares VAS and Boston Questionnaire scores between Group A and Group B.

The bar diagram of the VAS score shows that Group B has slightly lower pain levels than Group A.

The Boston Questionnaire graph demonstrates nearly equal functional scores in both groups.

Overall, the graphical analysis indicates that both groups showed similar outcomes, with no significant difference in pain reduction and functional improvement.

DISCUSSION

The present study was conducted to evaluate and compare the effectiveness of tendon gliding exercises and stretching exercises in reducing pain and improving functional outcomes in patients with carpal tunnel syndrome.

The study was carried out among 60 participants over a duration of 3 weeks at D Y PATIL Medical College, Kolhapur. Pain intensity was assessed using the Visual Analogue Scale (VAS), and functional status was evaluated using the Boston Carpal Tunnel Questionnaire.

The study demonstrated that both tendon gliding and stretching exercises improved pain and functional outcomes following the intervention period. This highlights the importance of conservative physiotherapy management in individuals with carpal tunnel syndrome.

Compared between the two groups, the mean VAS score in the tendon gliding group was slightly lower than that in the stretching group, indicating greater pain reduction. This suggests a possible clinical advantage of tendon gliding exercises. However, the difference between the groups was not statistically significant (p > 0.05).

Similarly, the Boston Questionnaire scores were nearly equal across both groups, indicating comparable functional improvement. The difference between the groups was statistically non-significant, suggesting that both interventions are equally effective in improving hand function.

Its underlying mechanism may explain the slightly better outcomes observed in the tendon gliding group. Tendon gliding exercises facilitate differential movement of flexor tendons within the carpal tunnel, which may help reduce adhesions, improve tendon excursion, and decrease mechanical compression on the median nerve. This may further enhance neural mobility, improve local circulation, and reduce intraneural oedema, thereby contributing to symptom relief.

In contrast, stretching exercises primarily improve the flexibility of the surrounding soft tissues and reduce muscular tightness. While effective, their direct impact on tendon excursion within the carpal tunnel may be comparatively limited.

The findings of the present study partially align with the initial hypothesis that tendon gliding exercises would be more effective than stretching exercises. Although a trend towards better outcomes with tendon gliding exercises was observed, the lack of statistical significance indicates that this difference cannot be considered conclusive.

CONCLUSION

Within the limitations of the present study, it can be concluded that both tendon gliding exercises and stretching exercises are effective in reducing pain and improving functional outcomes in patients with carpal tunnel syndrome.

Although tendon gliding exercises demonstrated slightly better mean improvement in pain scores, the difference between the two interventions was not statistically significant. Therefore, the hypothesis that tendon gliding exercises are more effective than stretching exercises is not supported.

Both interventions can be effectively incorporated into physiotherapy management based on the patient's condition, clinical judgment, and the therapist's preference.

REFERENCES

1. Capo JT, Tan V. *Atlas of minimally invasive hand and wrist surgery*. CRC Press; 2007 Sep 27.
2. Padua L, Coraci D, Erra C, Pazzaglia C, Paolasso I, Loreti C, Caliandro P, Hobson-Webb LD. Carpal tunnel syndrome: clinical features, diagnosis, and management. *Lancet Neurology*. 2016 Nov 1;15(12):1273?1284.
3. Aroori S, Spence RA. Carpal tunnel syndrome. *Ulster Medical Journal*. 2008 Jan;77(1):6?17. PMID: 18269111; PMCID: PMC2397020.
4. Atroshi I, Gummesson C, Johnsson R, Ornstein E, Ranstam J, Rosen I. Prevalence

of carpal tunnel syndrome in a general population. *JAMA*. 1999 Jul 14;282(2):153?158.
5. Mondelli M, Giannini F, Giacchi M. Incidenza della sindrome del tunnel carpale in una popolazione generale. *Neurology*. 2002 Jan;58(2):289?294.
6. Jablecki CK, Andary MT, Floeter MK, Miller RG, Quartly CA, Vennix MJ, Wilson JR. Practice parameter: electrodiagnostic studies in carpal tunnel syndrome. *Neurology*. 2002 Jun 11;58(11):1589?1592.
7. MacDermid JC, Wessel J. Clinical diagnosis of carpal tunnel syndrome: a systematic review. *Journal of Hand Therapy*. 2004 Apr;17(2):309?319.
8. Dale AM, Harris-Adamson C, Rempel D, Gerr F, Hegmann K, Silverstein B, et al. Prevalence and incidence of carpal tunnel syndrome in US working populations. *Scandinavian Journal of Work, Environment & Health*. 2013;39(5):495?505.
9. O? Connor D, Marshall SC, Massy-Westropp N, Pitt V. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *Cochrane Database of Systematic Reviews*. 2017;(12).
10. Page MJ, Massy-Westropp N, O? Connor D, Pitt V. Splinting for carpal tunnel syndrome. *Cochrane Database of Systematic Reviews*. 2012 Jul 11;2012(7):CD010003.
11. Werner RA, Andary M. Carpal tunnel syndrome: pathophysiology and clinical neurophysiology. *Clinical Neurophysiology*. 2002 Sep;113(9):1373?1381.
12. Akalin E, El, Peker, Senocak, Tamci S, G'lbahar S, et al. Treatment of carpal tunnel syndrome with nerve and tendon gliding exercises. *American Journal of Physical Medicine & Rehabilitation*. 2002 Feb;81(2):108?113.
13. Barkaoui A, Mesbah M, Mekrane FZ. *Computational Biomechanics of Human Joints*. Academic Press; 2025 Jul 25.
14. Butler DS. *The Sensitive Nervous System*. Noigroup Publications; 2000.
15. Kim SD. Efficacy of tendon and nerve gliding exercises for carpal tunnel syndrome: a systematic review of randomised controlled trials. *Journal of Physical Therapy Science*. 2015;27(8):2645?2648.
16. Shem K, Wong J, Dirlikov B. Effective self-stretching of carpal ligament for treatment of carpal tunnel syndrome: a double-blinded randomised controlled study. *Journal of Hand Therapy*. 2020 Jul;33(3):272?280.
17. Sekaringtyas D, Susilo TE, Prihati E. Combination tendon and nerve gliding exercise with neurodynamic mobilisation to improve hand function in a carpal tunnel syndrome patient: a case report. In: *Academic Physiotherapy Conference Proceedings*; 2021.
18. Horng YS, Hsieh SF, Tu YK, Lin MC, Wang JD. Comparative effectiveness of tendon and nerve gliding exercises in patients with carpal tunnel syndrome: a randomised trial. *American Journal of Physical Medicine & Rehabilitation*. 2011 Jun;90(6):435?442.