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Research Article

EFFECT OF DORSAL KINESIO TAPING ON PAIN, FUNCTIONALITY, GRIP AND PINCH STRENGTH IN CARPAL TUNNEL SYNDROME: A COMPARATIVE STUDY

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Abstract

Background: Growing prevalence of CTS given the limitations of current conservative interventions, and the need for safe, cost-effective, and evidence-based treatment options, there is a strong rationale for further investigation into the therapeutic value of dorsal Kinesio taping.

Methodology: A Comparative Study was conducted at Santosh College of Occupational Therapy, Ghaziabad on 44 participants. Participants were randomly divided into two groups. Group A received Daily Dorsal application of Kinesio taping along with the Conventional occupational therapy program for and Group B received dorsal application of Kinesio tape once every three days and Conventional occupational therapy program for 2 weeks. Outcome measuresincluding Boston Carpal tunnel syndrome questionnaire, Visual Analog Scale, Hand dynamometer and pinch gauge.

Results: Both the groups showed statistically significant improvements in all outcome measuresfrom pre- to post-test, with all p-values < 0.001. In Group A, the reduction in SSS, FSS, and VAS scores, along with increases in grip and pinch strength, were associated with very high t-values (e.g., SSS: t = 25.499; FSS: t = 25.65; VAS: t = 26.259), indicating strong treatment effects. Group B also showed statistically significant improvements ($p < 0.001$).

Conclusion: The study concludes that both daily and every three days dorsal application of Kinesio taping are effective in reducing pain, improving functional status, and enhancing grip and pinch strength in individuals with carpal tunnel syndrome.

Keywords: Boston Carpal Tunnel Syndrome Questionnaire, Grip Strength, Kinesio Taping, Pinch Strength, Functional Status.

1. Introduction

Carpal Tunnel Syndrome (CTS), resulting from compression of the median nerve at the wrist inside the carpal tunnel, is among the most common peripheral neuropathies impacting the upper limb [1]. CTS usually shows up as pain, numbness, tingling, or weakness along the median nerve—especially in the thumb, index finger, middle finger, and the outer half of the ring finger [2]. In advanced stages, it may cause thenar muscle wasting and significant loss of hand function [2].

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Several studies have investigated the Kinesio taping's impact on pain and function in CTS. Some researchers have reported significant reductions in pain intensity and symptom severity following taping interventions [3]. The development of CTS is significantly influenced by occupational factors, especially in those who conduct repetitive wrist movements, strong grasping, prolonged keyboard use, vibration exposure, and sustained awkward wrist postures [4]. In addition to occupational exposure, systemic conditions such as diabetes mellitus, hypothyroidism, obesity, pregnancy, rheumatoid arthritis, and hormonal changes are known risk factors for CTS [5]. Due to its multifactorial nature and increasing association with modern sedentary and technology-driven lifestyles, CTS has emerged as a growing public health concern [5].

CTS significantly affects quality of lifeand work productivity. Individuals with CTS often have trouble

performing routine activities such as writing, gripping objects, dressing, and household tasks. Night-time symptoms are especially distressing and frequently disrupt sleep, leading to fatigue, irritability, and reduced work efficiency during the day [6]. (Leite JC, Jerosch-Herold C et.al. 2006). If untreated, CTS can progress from reversible nerve ischemia to irreversible nerve damage, resulting in persistent disability [7]. . The socioeconomic burden of CTS includes direct healthcare costs, lost workdays, reduced productivity, and long-term rehabilitation expenses [7].

Improvements in hand function and patient-reported outcomes have also been observed in short-term follow-up studies [8].. Ultrasonography is also increasingly used to assess median nerve swelling and structural abnormalities within the carpal tunnel [9]. Based on clinical and electrophysiological findings, CTS is classified into mild, moderate, and severe stages, which guide the selection of appropriate management strategies [9].

Management of CTS includes both surgical and conservative approaches depending on symptom severity, duration, and functional impairment. If conservative treatments don't work, surgery to relieve pressure in the carpal tunnel may be recommended for severe cases [10].. However, surgery is associated with risks such as infection, scar tenderness, pillar pain, and delayed recovery. Therefore, conservative management remains in theinitial course of treatment, especially in mild to moderate CTS [11]. Wrist splinting, non-steroidal anti-inflammatory medications, corticosteroid injections, physiotherapy, ergonomic changes, therapeutic exercises, nerve and tendon gliding exercises, ultrasound therapy, and manual therapy techniques are examples of conservative treatment alternatives [12].

Among conservative interventions, Kinesio taping has gained increasing attention in recent years because of its non-intrusive character, ease of application, low cost, and minimal side effects. An elastic therapeutic taping technique called kinesio taping is intended to support muscles and joints without limiting range of motion. It is believed to improve circulation, reduce pain, enhance proprioception, and correct biomechanical alignment by lifting the skin microscopically, thereby reducing pressure on underlying tissues [13]. Various Kinesio taping techniques have been explored for the management of musculoskeletal and neurological conditions, including shoulder impingement, knee osteoarthritis, low back pain, lateral epicondylitis, and stroke rehabilitation [14]..

Therefore, this study aims to evaluate how dorsal Kinesio taping improves carpal tunnel syndrome patients' discomfort, functionality, grip strength, and pinch strength. By adopting a rigorous comparative design and incorporating both subjective and objective outcome measures, this study aims to generate high-quality evidence regarding the clinical effectiveness of dorsal Kinesio taping as a supplement to conventional therapy. The results of this study could assist occupational therapists and rehabilitation specialists in making informed choices about incorporating Kinesio taping into standard CTS management practices and support the development of evidence-based standardized treatment protocols.

2. MATERIALS AND METHODS

2.1 Study design and settings

A Comparative study was reviewed, discussed and approved by Institutional Ethical Committee of Santosh college of Occupational therapy**(Ref No.-SCOT/JULY-25/EC-ORTHO-05)** and data collection taking place from Santosh medical college and hospital, Ghaziabad and sparks Minda foundation, Greater Noidato evaluate the relative impact of daily versus every three days dorsal application of Kinesio taping on pain, functionality, and grip and pinch strength in person affected with carpal tunnel syndrome.

2.2 Participants

A total of 44 participants aged between 18-50 years were included in the study, who fulfilled the eligibility criteria and were recruited after obtaining informed consent. The inclusion criteria were Subject diagnosed with CTS, Male or female, Subjects with fluency in Hindi and English, those who reported experiencing clinical symptoms of CTS, including pain, numbness, or tingling in the hand, wrist, or forearm that intensified at night, and those demonstrating a positive Tinel's test. As a volunteer exclusion criteria included those whounderwent recent surgery for CTS, had history of surgery involving carpal tunnel release, had an adhesives allergy, had damaged skin integrity, had previous history including trauma, surgery, or congenital disability affecting the forearm, wrist, or hand, and individuals with medical conditions such as pregnancy, uncontrolled diabetes, thoracic outlet syndrome, or radiculopathy including diabetic or cervical radiculopathy, and those with any Injury involving forearm, wrist, or hand.

2.3 Intervention

The participants were split into two groups using a simple random method and treated over a two-week period.Participants of Group A received Daily application of dorsal kinesio tape and Conventional occupational therapy program for 2 weeks. Participants of Group B receiveDorsalkinesio tape application once every three days and Conventional occupational therapy program for 2 weeks.

Application of Kinesio Tape

- The Kinesio tape was applied from the proximal forearm to the first digit's IP joint and the fifth digit's DIP joint, covering the dorsal part of the upper extremity.
- The tape was stretched by 10% as the subject flexed their wrists within a range of mobility without pain.

- For better adherence, the skin was moisturized with an athletic adhesive spray before tape was applied.
- Every scheduled visit, during the two-week intervention period, new tape was reapplied, which is approximately every three days for control group and daily application for Experimental group.

Conventional Occupational Therapy Program (Nakandala P. 2019) [15].

- Occupational therapy focused on improving occupational performance and hand function.
- Exercises involving stretching of lumbricalswere demonstrated and practiced under supervision.
- Participants of the study were instructed to perform each stretch of 3–5 repetitions daily as tolerated.
- An instructional handout was provided for home practice.

2.4 Outcome Measures:

Visual Analog Scale(VAS)Used to assess Pain.Boston Carpal Tunnel Questionnaire(BCTQ)Used to assess severity of symptoms and level of functioning in individuals with CTS. Camry Hand Dynamometer: Used to measure Grip Strength and Pinch GaugeUsed to measure Pinch Strength.

2.5 Statistical Analysis: Descriptive statistical measures such as mean and standard deviation were used to summarize demographic variables and outcome scores. An independent samples t-test was applied to compare baseline and post-intervention differences between Group A and Group B. Additionally; a paired samples t-test was conducted to determine within-group changes between pre- and post-intervention scores for all outcome measures. Effect size analysis using Cohen's d and Hedges' correction was performed to determine the magnitude of treatment effect. A *p*-value of less than 0.05 was considered statistically significant.

3. RESULTS

Table 1: Demographic characteristics of the participants (N= 44)

Both groups were comparable in baseline characteristics, with similar mean ages (Group A: 34.55 ± 4.75 years; Group B: 33.86 ± 4.75 years). In both the groups, many participants were male, with a slightly higher proportion in Group A (86.36%) compared to Group B (77.27%).

Characteristics	Category	Group A	Group B
No. of participants		22	22
Age (years)	Mean ± SD	34.55 ± 4.75	33.86 ± 4.75
Gender	Male	19 (86.36%)	17 (77.27%)
	Female	3 (13.64%)	5 (22.73%)
Intervention		Daily dorsal application of kinesio tape and Conventional occupational therapy program	Dorsal kinesio tape application once every three days and Conventional occupational therapy program

Table 2: Baseline assessment of Outcome variables

For each outcome measure (SSS, FSS, VAS, grip, and pinch strength), no statistically significant difference existed between the experimental and control groups at baseline, since all p-values exceeded 0.05. This indicates that both groups were comparable before the intervention.

Scale	Group A	Group B	t Value	P Value	Interpretation
PRE-SSS	Pre-test SSS	Pre-test SSS	0.742	0.462	No statistically significant difference
PRE-FSS	Pre-test FSS	Pre-test FSS	0.688	0.495	No statistically significant difference
PRE-VAS	Pre-test VAS	Pre-test VAS	0.911	0.367	No statistically significant difference
PRE-GRIP	Pre-test GRIP	Pre-test GRIP	0.823	0.415	No statistically significant difference
PRE-PINCH	Pre-test PINCH	Pre-test PINCH	0.954	0.345	No statistically significant difference

Table: 3 Post-Data Analysis of the outcome measure

All post-test outcome measures (SSS, FSS, VAS, grip, and pinch strength) showed a statistically significant difference between the experimental and control groups, with all p-values below 0.05. This suggests that the intervention led to significantly greater improvement in the experimental group compared to the control group.

Scale	Group A	Group B	t Value	P Value	Interpretation
POST-SSS	Post-test SSS	Post-test SSS	-2.184	0.034	Statistically significant difference
POST-FSS	Post-test FSS	Post-test FSS	-2.512	0.016	Statistically significant difference
POST-VAS	Post-test VAS	Post-test VAS	-2.036	0.047	Statistically significant difference
POST-GRIP	Post-test GRIP	Post-test GRIP	2.271	0.028	Statistically significant difference
POST-PINCH	Post-test PINCH	Post-test PINCH	2.446	0.019	Statistically significant difference

Paired-Sample Test Analysis

Improvements were statistically significant for both Group A and Group B, in all outcome measures (SSS, FSS, VAS, grip, and pinch strength) from pre- to post-test, with all p-values < 0.001. However, Group Ademonstrated greater mean differences and wider confidence intervals, indicating a more pronounced improvement compared to Group B.

.4. DISCUSSION

The present study aimed to compare the effectiveness of daily versus every three days dorsal application of kinesio taping in individuals with carpal tunnel syndrome (CTS), focusing on pain, symptom severity, functional status, grip strength, and pinch strength. The findings of this study provide clear evidence that while both intervention protocols are beneficial, daily application of kinesio taping produces significantly superior clinical outcomes.

At baseline, both groups were comparable in terms of demographic variables and outcome measures, as indicated by the absence of statistically significant differences ($p > 0.05$). This homogeneity ensures that the observed post-intervention changes can be attributed primarily to the treatment effects rather than external confounding factors. The similarity in age and gender distribution further strengthens the internal validity of the study and supports the reliability of comparisons between the two groups.

Following the intervention, both groups demonstrated statistically significant improvements across all outcome measures, including SSS, FSS, VAS, grip strength, and pinch strength ($p < 0.001$). These findings suggest that kinesio taping, irrespective of application frequency, is an effective adjunct in the management of CTS.

The findings of the present study are consistent with those reported by **Kase et al., 2013; Williams et al., (2012**), who found that the reduction in pain and symptom severity may be explained by the neurophysiological effects of kinesio taping, such as stimulation of cutaneous mechanoreceptors, improved circulation, and reduction of pressure within the carpal tunnel. Additionally, the lifting effect of the tape may contribute to decreased compression on the median nerve, thereby alleviating symptoms and enhancing functional performance.

The present findings also agree with the study conducted by **Parreira et al., 2014**, which suggests that increased frequency of tape application enhances therapeutic effectiveness, possibly due to sustained mechanical support, continuous sensory stimulation, and prolonged facilitation of neuromuscular function.

Similarly, **Mostafavifar et al., 2012; Morris et al., 2013** in their study highlights the effectiveness of kinesio taping in reducing pain and improving function in musculoskeletal and neurological conditions. Studies have reported that kinesio taping can enhance proprioception, support joint and soft tissue structures, and facilitate muscle function.

The results of the present study are further supported by the study conducted by **Lim &Tay, 2015**, which concluded that the superior improvements in strength parameters may be attributed to reduced pain and improved functional capacity, allowing participants to engage more effectively in daily activities. Pain reduction is known to play a crucial role in restoring muscle activation and strength. Therefore, the greater decrease in VAS scores in Group A likely contributed to the observed gains in grip and pinch strength.

Overall, the results clearly demonstrate that both intervention protocols are effective in improving clinical outcomes in individuals with carpal tunnel syndrome. However, the daily application of kinesio taping is significantly more effective than the application every three days. The greater improvements observed in Group A across all outcome measures highlight the importance of application frequency in maximizing therapeutic benefits. Based on these findings, the null hypothesis (H0), which stated that there is no significant comparative effect of daily versus every three days dorsal application of kinesio taping, is rejected. The alternative hypothesis (H1) is accepted, indicating that there is a statistically significant comparative effect between the two intervention protocols. Specifically, daily application of

kinesio taping results in superior improvements in pain reduction, functional ability, grip strength, and pinch strength in individuals with carpal tunnel syndrome.

5. CONCLUSION

The present study concludes that both daily and every three days dorsal application of kinesio taping are effective in reducing pain, improving functional status, and enhancing carpal tunnel syndrome patients' pinch and grip strength. However, the findings clearly indicate that daily application produces significantly greater improvements across all outcome measures compared to application every three days. The superior outcomes observed in Group A highlight the importance of increased application frequency in achieving optimal therapeutic benefits. Therefore, it can be concluded that daily kinesio taping is a more effective intervention strategy for controlling carpal tunnel syndrome symptoms and enhancing hand function.

6. DECLARATIONS

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- **Authors' Contributions:** SM conceptualized the study, drafted the protocol, carried out data collection, and wrote the initial manuscript draft. RKS supervised the project and critically revised the manuscript. PR edited the manuscript and coordinated submission. All authors read and approved the final manuscript.
- **Ethical Approval and Consent: Ethical Clearance:SCOT/JULY-25/ECORTHO-05**. Informed patient consent was obtained from all individual participants included in the study for both intervention participation and publication of data.

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- **Conflict of Interest Statement:** NONE
- **Data Availability Statement:** The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.
- **AI Disclosure:** Artificial intelligence tools were not used in the conceptualization, execution, data analysis, or manuscript drafting of this study.

7. Conflict of Interest: Nil

8. References:

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