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Efficacy of kinesio taping on hand functioning in patients with mild carpal tunnel syndrome. A double-blind randomized controlled trial

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ABSTRACT

Study design: Double-blind randomized controlled trial.

Introduction: Carpal tunnel syndrome (CTS) is a common mononeuropathy that causes pain and disability in the affected hand. Kinesio taping (KT) has been recently proposed as a promising conservative approach in CTS patients.

Purpose of the study: To investigate the effectiveness of KT compared to a sham taping on symptoms and hand function in patients affected by mild CTS.

Methods: Patients affected by mild CTS with symptoms for at least 8 weeks were enrolled and randomly allocated into two groups: KT group, according to the technique proposed by Kase plus specific exercises; control group, undergoing a sham taping plus specific exercise. All patients performed 2 sessions/week for 5 weeks of exercises of mobilization of fingers and carpal joint. At the baseline, after 5 weeks (T1), and after 6 months (T2), a physician unaware of patients' allocation assessed the Boston Carpal Tunnel Questionnaire (BCTQ) symptom (BCTQ-S) and functional (BCTQ-F) subscales.

Results: Forty-two patients (mean age:54.3 ± 15.0 y) were randomly allocated into KT ($n = 21$) and control group ($n = 21$). At T1, in both groups we found a significant improvement in hand function and symptoms, as showed by BCTQ-F (KT:4.2 ± 0.7 vs 3.0 ± 0.6, $P < .001$; sham: 2.2 ± 0.3 vs 1.7 ± 0.3, $P = .012$) and by BCTQ-S (KT: 2.2 ± 0.3 vs 1.7 ± 0.3, $P < .001$; sham: 2.3 ± 0.4 vs 1.9 ± 0.5, $P = .007$). At T2, only in the KT group there was a significant difference in both sub-items of primary outcome. There were significantly better results in the KT group at T1 and T2.

Discussion: The present study showed that KT compared to a sham taping might be more effective in reducing perceived symptoms in mild CTS patients, reporting a clinically significant difference.

Conclusion: KT might be considered as an effective technique combined to rehabilitative treatment in terms of hand function and symptoms in patients affected by mild CTS.

Introduction

Carpal tunnel syndrome (CTS) is the most common mononeuropathy of the hand, with a prevalence in general population estimated at around 8%, with women having almost double the incidence of men (10% vs 5.8%)[1]. It is caused by compression of the median nerve at the wrist, passing through a limited space

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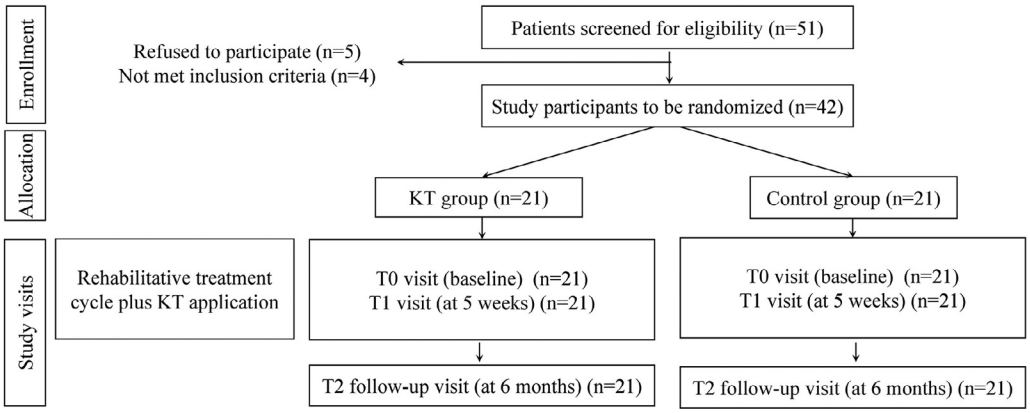


Fig. 1. Study flow chart.

in the osteo-fibrous canal along with digital flexor tendons[2]. CTS occurrence might also be related to local ischemia and neural edema, favored by the enlargement of the flexor tendon synovial sheet, such as in flexor tenosynovitis[3].

The pathogenesis of CTS may be influenced by chronic repeated activities or specific wrist postures that are known to contribute to median nerve compression, such as full pronation and radial deviation, and full supination and ulnar deviation[4] with a tenosynovitis of the flexor tendons and an increased median nerve compression[5]. This latter might lead to an impairment in median nerve conduction, followed by wasting and weakness of thenar muscles in the affected hand[6].

To date, diagnosis and classification of CTS are still debated and are based on clinical tests (Phalen, Tinel, manual carpal compression, and hand elevation tests), ultrasound examination (identifying several causes of median nerve entrapment at carpal tunnel level), and electrophysiologic studies (helpful to confirm or exclude CTS when the clinical diagnosis is uncertain)[6-9].

Patients affected by mild to moderate CTS patients are commonly considered for conservative treatments, including: non-steroid anti-inflammatory drugs, local corticosteroid injections, mobilization and stretching exercises, splinting, kinesio taping (KT), and physical therapies[10-13].

Among physical therapies, superficial heat, microwave or short-wave diathermy and interferential current might provide short term pain relief, albeit the use of electrotherapy techniques alone showed no conclusive effective results and evidence is still limited in literature[14].

As conservative approach, therapeutic exercise might play a key role, considering that combination of orthotic/stretching programs might be prescribed in patients without thenar atrophy and normal 2-point discrimination[3].

Clinicians should assess symptom duration and severity, nighttime symptoms, positive Phalen test and thenar atrophy, and prior conservative management in order to endorse surgical treatment[14]. Indeed, patients whose symptoms have not improved after 6 months of conservative therapy or those affected by severe CTS should be referred to surgical decompression[7].

It has been recently hypothesized that the application of KT on injured soft tissues and joints might provide support to ligaments, tendons and muscles, and may assist patients therapeutic exercise, in muscle strengthening and proprioceptive exercises not only in musculoskeletal diseases[15-17] but also in CTS[11,12].

Indeed, it has been recently demonstrated that KT combined with low laser therapy might have beneficial effects in terms of symptoms and function with a 12-weeks follow up in CTS patients[11]. Moreover, Akturk et al have recently compared kinesio taping and splinting as treatments in idiopathic CTS patients, showing a significant improvement in the KT group compared to the splint group in terms of electrophysiological changes and symptoms and function of the involved hand, assessed by the Boston Carpal Tunnel Questionnaire (BCTQ) symptom subscale (BCTQ-S) and function subscale (BCTQ-F), respectively[12].

To the best of our knowledge, the effects of KT combined with specific rehabilitative exercises have still to be investigated in CTS patients.

Therefore, the aim of this randomized placebo-controlled trial was to evaluate the efficacy of KT compared to a sham taping on symptoms and hand function in patients with mild CTS undergoing specific rehabilitative exercises.

Methods

Participants

We carried out a double-blind randomized controlled trial according to CONSORT Checklist, recruiting patients with CTS symptoms, referred to Rehabilitation Outpatient Clinic of “Mons. L. Novarese” Hospital, Moncrivello, Vercelli, Italy, over a 9-month period (from October 2018 to June 2019). All participants were asked to carefully read and sign an informed consent and were free to withdraw from the study at any time; researchers were instructed to protect the participants’ privacy. The institutional review board approved the study, and all the procedures were conducted according to the principles of the Declaration of Helsinki.

We included participants meeting following eligibility criteria: (a) adult age (range: from 25-80 y); (b) diagnosis of mild CTS according to Padua et al[6]. (abnormal electrodiagnostic hands distoproximal ratio technique or other segmental comparative test, normal distance motor latency of median nerve) (c) positivity to at least one compression test (Tinel test, Phalen test or Carpal compression test); (d) pain or symptoms for at least 8 weeks. Exclusion criteria were: (a) diabetes; (b) rheumatoid or psoriatic arthritis; (c) thyroid disease; (d) brachial plexus injury; (e) polyneuropathy; (f) cervical radiculopathy; (g) previous wrist fracture; (h) pregnancy; (i) previously treated with local infiltrations; (j) previous surgical treatment or scheduled surgery for CTS.

According to a 1:1 distribution randomization algorithm, the enrolled patients were allocated by an operator (not involved in the intervention or clinical assessment) into two groups: KT group, undergoing KT plus specific exercises; control group, undergoing a sham taping plus specific exercise (as depicted by Fig. 1). All study participants were unaware of which KT technique they were undergoing.

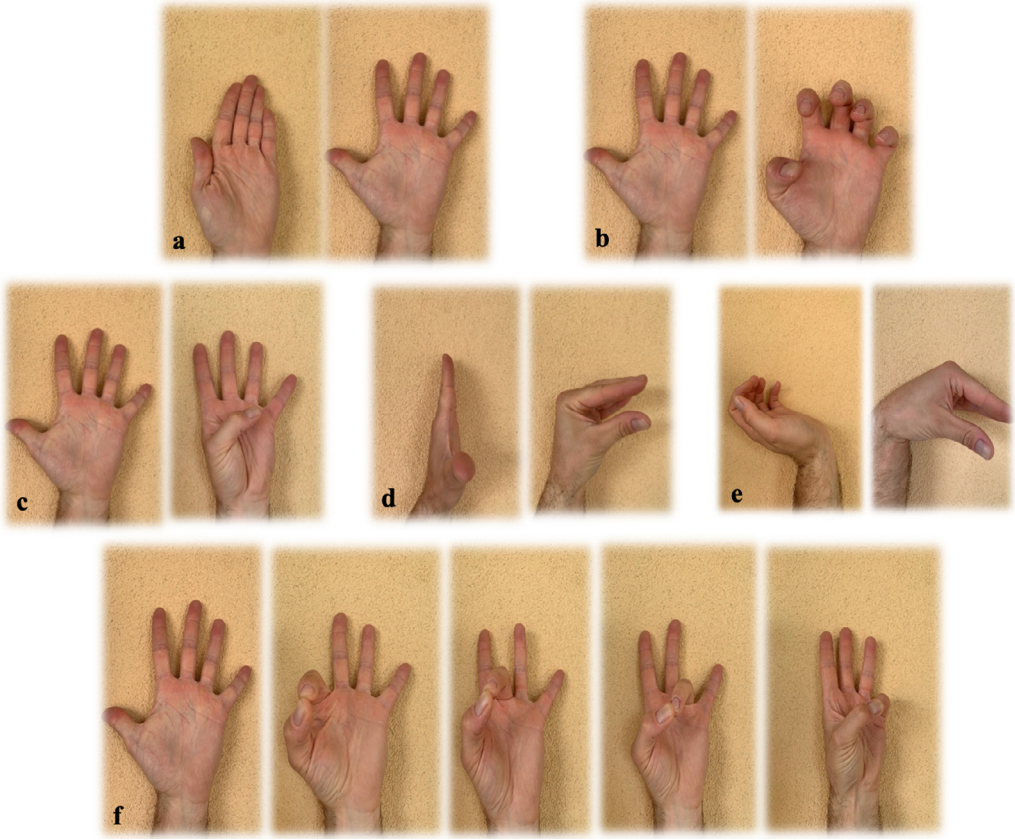


Fig. 2. Rehabilitative exercises performed in both groups. (A) active mobilization of interosseous muscles; (B) activation of flexor digitorum superficialis and flexor digitorum profundus; (C) active opposition of the thumb on the palm of the hand; (D) active metacarpophalangeal joints mobilization; (E) active extension and flexion of the carpal joint; (F) active opposition of thumb on each finger distal phalanx.

Intervention

All study participants of both groups underwent a specific rehabilitative study protocol aimed to decrease the median nerve compression and promote tendon gliding.

The intervention was delivered at our Rehabilitation Outpatient Clinic under the supervision of an expert hand therapist and consisted of 10 sessions (2 sessions/week for 5 wk), including a schedule of 6 exercises (10 repetitions for each): a) active mobilization of interosseous muscles; b) activation of flexor digitorum superficialis and flexor digitorum profundus; c) active opposition of the thumb on the palm of the hand; d) active opposition of thumb on each finger distal phalanx; e) active metacarpophalangeal joints mobilization; f) active flexion and extension of the radiocarpal joint (see Fig. 2 for further details). These exercises are theorized to provide a neuromodulating effect on nociception of the median nerve and may decrease adhesions within the carpal tunnel[18].

In the study group, an expert hand therapist applied KT according to the lymphatic correction technique, proposed by Kase et al[19]. The tape was cut in five strips and applied on palm and dorsum of patients' hands (wrist at 30° extension, forearm in supination, and elbow in extension), using a very light tension (0-15% of available), to relieve inflammation and edema. However, in the control group, a sham taping was applied by the same therapist without using tension on the hands in neutral position[20] (as depicted by Fig. 3).

All patients wore KT and sham taping until the following session and were asked to not use orthoses, splinting, or anti-inflammatory drugs for the duration of the trial.

Outcomes

At the baseline, we collected demographic and anthropometric data, duration of disease, level of scholastic education and working status of study participants. Primary outcome measure was the BCTQ, with its two subscales for symptoms (BCTQ-S) and function (BCTQ-F)[21]. BCTQ is considered as a reliable and valid patient-related outcome in estimating impairment in CTS patients[22].

As secondary outcomes we considered: Quick Version of Disability of the Arm, Shoulder and Hand (Quick-DASH)[23] to assess upper limb function[24]; Numerical Pain Rating Scale (NPRS)[25] to evaluate pain; EuroQol 5-Dimension 3-Level (EQ-5D-3L) and EuroQol Visual Analogue Scale (EQ-VAS)[26,27] for the health-related quality of life.

All the outcome measures were evaluated by a physiatrist unaware of patients' allocation at the baseline (T0), after 5 weeks (T1), and at 6 months from the first clinical assessment (T2).

The author responsible of the randomization was aware of patients' allocation, such as the hand therapist that supervised the intervention. On the other hand, all study participants remained unaware of which KT technique could be considered as therapeutic or not (sham taping). At the same time, also the physiatrist that performed the clinical assessment of all the outcome measures was blinded.

Statistical analysis

Statistical analysis was performed using STATA v.12 (StataCorp LP, College Station, TX). Study power 90% and the statistical

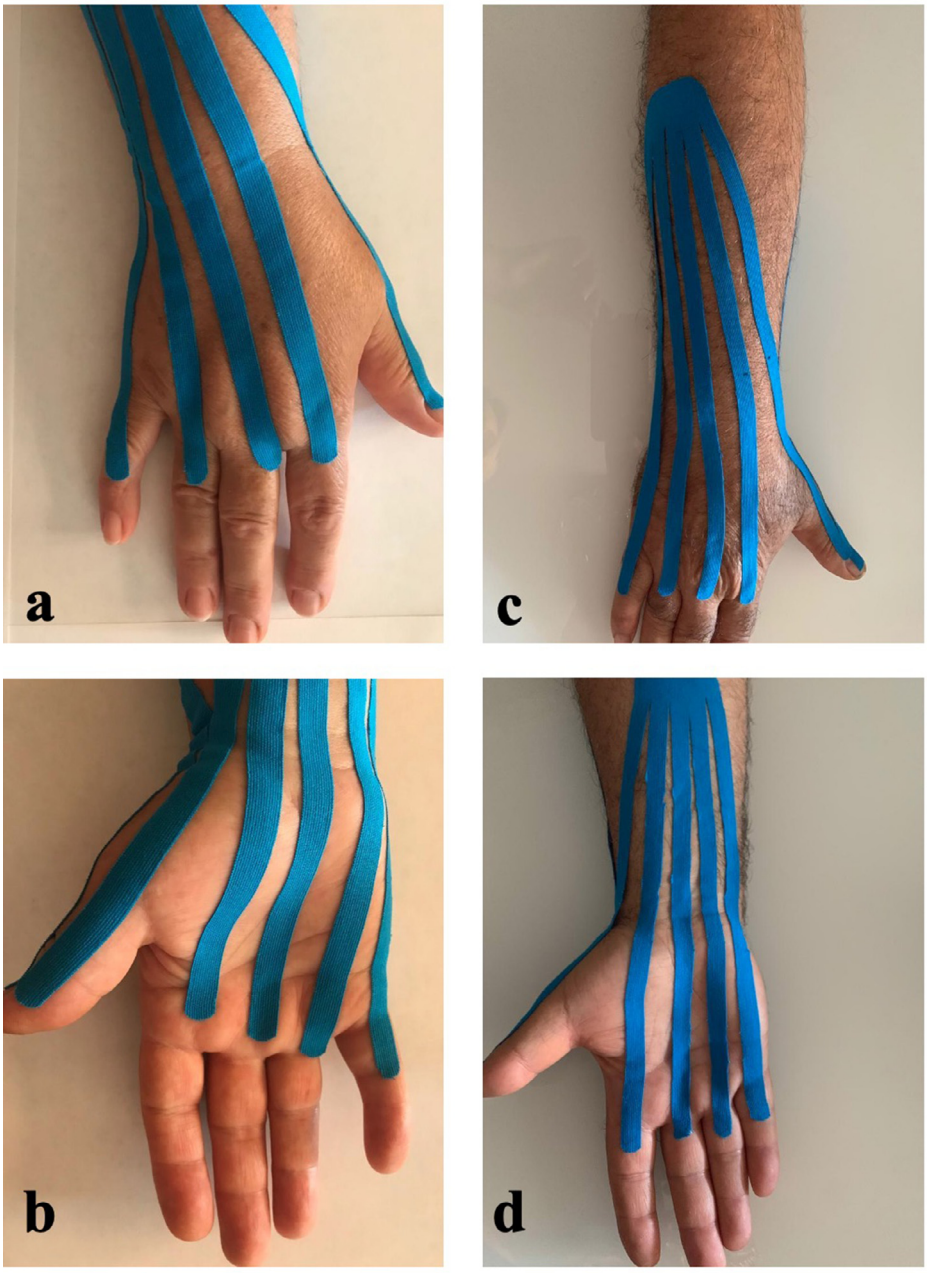


Fig. 3. Application of kinesio tape. (**A-B**) Kinesio tape applied according to the technique recommended by Kase using a very light tension (0-15% of available); (**C-D**) Sham taping.

significance was defined at 0.05 ($\alpha = 0.05$). Considering BCTQ-F as primary outcome and taking into account an effect size of 1.07, obtained from the work performed by Akturk et al[11], the sample size should consider 34 participants, 17 per group. However, considering a 10% drop-out rate, the study population might consist of 38 patients (16/group). We performed a statistical analysis using Wilcoxon matched-pair test to evaluate intra-group differences of continuous variables and Wilcoxon rank sum test was used to compare continuous variables between groups. Mean differences in outcome measures among different time-points are expressed as Δ). Lastly, we considered the difference in outcome measures, taking into account that Minimal Clinically Important Difference (MCID) might vary from 0.16 to 1.45 for BCTQ-S and from 0.47 to 1.6 for BCTQ-F in CTS patients, taking into account that the lowest MCIDs refer to mild CTS patients[28].

Results

Fifty-one patients were screened and recruited for this study; forty-seven of them met the inclusion and exclusion criteria, but 5 did not agree to undergo the study, as depicted by flow-chart in Figure 1. Therefore, we enrolled 42 patients, with mean age of 54.3 ± 15.0 years, that were randomly allocated into KT group ($n = 21$) and control group ($n = 21$). No significant between-group differences were found at the baseline (Table 1 for further details). All study participants showed good compliance and successfully

Table 1
Baseline characteristics of study population.

	Total (n = 42)	Study group (n = 21)	Control group (n = 21)	P values
Age (y)	54.3 ± 15.0	55.0 ± 17.0	53.5 ± 13.2	0.668*
Sex (male/female)	21/21	11/10	10/11	0.758**
BMI (kg/m^2)	25.7 ± 3.0	25.6 ± 3.5	25.7 ± 2.5	0.734*
Disease duration (wk)	14.9 ± 4.6	14.5 ± 3.7	15.3 ± 5.4	1.000*
Side (right/left)	21/21	10/11	11/10	0.212**
Educational qualification				0.889**
Primary	21 (50.0)	9 (42.9)	9 (42.9)	
Secondary	12 (28.6)	7 (33.3)	5 (23.8)	
Bachelor's degree	2 (4.8)	3 (14.3)	4 (19.0)	
Master's degree	7 (16.7)	2 (9.5)	3 (14.3)	
Working status				0.629**
Desk work	16 (38.1)	6 (28.6)	10 (47.6)	
Manual labourer	11 (26.2)	6 (28.6)	5 (23.8)	
Homemaker	3 (7.1)	2 (9.5)	1 (4.8)	
Retired	12 (28.6)	7 (33.3)	5 (23.8)	
BCTQ-F	4.2 ± 0.7	4.2 ± 0.7	4.2 ± 0.8	0.960*
BCTQ-S	2.3 ± 0.4	2.2 ± 0.3	2.3 ± 0.4	0.323*
NPRS	5.7 ± 1.0	5.6 ± 0.9	5.8 ± 1.1	0.583*
Quick-DASH	49.4 ± 11.8	49.5 ± 7.4	49.3 ± 11.1	0.715*
EQ5D3L	0.795 ± 0.086	0.782 ± 0.077	0.809 ± 0.094	0.385*
EQVAS	6.3 ± 1.2	6.3 ± 1.2	6.3 ± 1.2	0.889*

Continuous variables are expressed as mean ± standard deviations; categorical variables are expressed as numbers (%); ratios are expressed as x/y. Differences are considered significant when P is less than .05
Abbreviations: BMI = body mass index; BCTQ-F = Boston Carpal Tunnel Questionnaire–Functional; BCTQ-S = Boston Carpal Tunnel Questionnaire–Symptom; NPRS = Numerical Pain Rating Scale; Quick-DASH = Quick Version of Disability of the Arm, Shoulder and Hand; EQ-5D-3L = EuroQol 5-Dimension 3-Level; EQ-VAS = EuroQol Visual Analogue Scale.
* U-Mann Whitney test
** Fisher exact test.

Table 2
Between-group and intra-group differences in outcome measures.

	Study group (n = 21)					Control group (n = 21)						
	T0	T1	P value T1-T0	T2	P value T2-T0	T0	T1	P value T1-T0	T2	P value T2-T0	P value (T1 between-group)	P value (T2 between-group)
BCTQ-F	4.2 ± 0.7	3.0 ± 0.6	<.001	2.9 ± 0.5	<.001	4.2 ± 0.8	3.6 ± 0.8	.012	3.8 ± 0.8	.125	.029	<.001
BCTQ-S	2.2 ± 0.3	1.7 ± 0.3	<.001	1.6 ± 0.4	<.001	2.3 ± 0.4	1.9 ± 0.5	.007	2.0 ± 0.5	.027	.030	.019
NPRS	5.7 ± 1.0	4.1 ± 1.2	<.001	3.7 ± 0.6	<.001	5.8 ± 1.1	4.9 ± 1.1	.017	4.9 ± 1.5	.049	.018	.001
Quick-DASH	49.4 ± 11.8	39.3 ± 8.3	<.001	35.9 ± 7.7	<.001	49.3 ± 11.1	39.4 ± 11.4	.004	37.6 ± 11.3	.002	.890	.512
EQ5D3L	0.80 ± 0.09	0.78 ± 0.08	.043	1.00 ± 0.00	<.001	0.81 ± 0.09	0.81 ± 0.09	.342	1.00 ± 0.00	.281	.418	.300
EQVAS	6.3 ± 1.2	7.3 ± 0.9	<.001	7.7 ± 0.6	<.001	6.3 ± 1.2	7.0 ± 0.8	.004	7.1 ± 1.4	.004	.889	.173

Continuous variables are expressed as mean ± standard deviations. Differences are considered significant when P is less than .05. The intra-group statistical analysis was evaluated with Wilcoxon matched-pairs signed-rank test.; The between-group statistical analysis was evaluated with Wilcoxon rank sum test. Abbreviations: T0: baseline; T1: after 5 wk; T2: at 6 mo. after intervention; BCTQ-F: Boston Carpal Tunnel Questionnaire – Functional; BCTQ-S: Boston Carpal Tunnel Questionnaire – Symptom; NPRS: Numerical Pain Rating Scale; Quick Version of Disability of the Arm, Shoulder and Hand (Quick-DASH); EuroQol 5-Dimension 3-Level (EQ-5D-3L); EuroQol Visual Analogue Scale (EQ-VAS).

completed the treatment protocol in all the programmed sessions, with no adverse events.

Both groups showed statistically significant improvements on BCTQ-S, NRS, Quick-DASH and EQVAS measures at 5 weeks and at 6 months. Between-group comparisons showed better results in the KT group at T1 and at T2 in BCTQ-S, BCTQ-F and NRS.

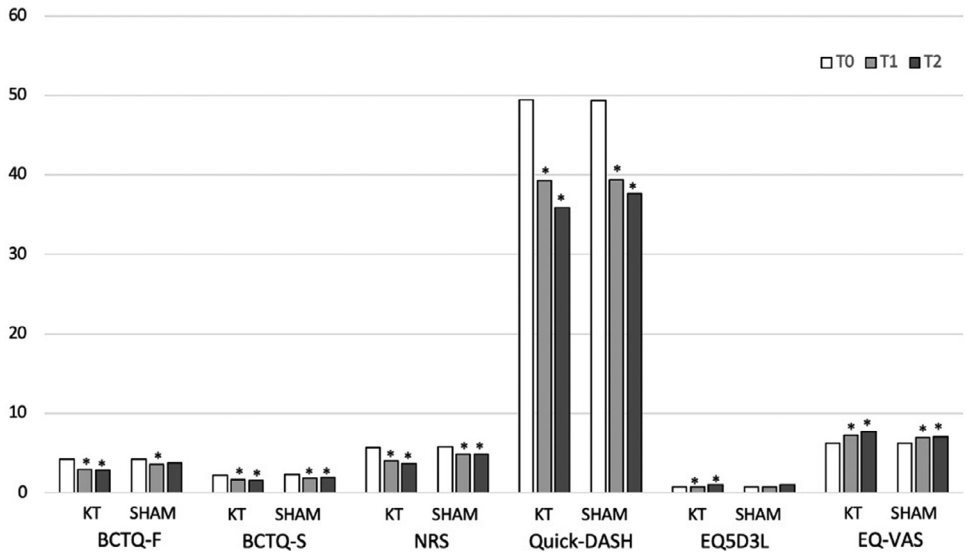
As depicted in Table 2 and Figure 4, both groups demonstrated a statistically significant improvement in the primary outcome measures at 5 weeks (T1), with the treatment group demonstrating a larger change in scores in both the BCTQ-F (KT group: $\Delta = 1.2$; $P < .001$; control group: $\Delta = 0.6$; $P = .012$) and the BCTQ-S (KT group: $\Delta = 0.5$; $P < .001$; control group: $\Delta = 0.4$; $P = .007$). At 6 months (T2), there was a statistically significant difference ($P < .05$) in both sub-items of primary outcome in the study group, but the control only demonstrated improvement in the BCTQ-S. These results could be considered as clinically meaningful, especially in the study group, taking into account the relative MCIDs[28].

In the KT group, scores on the other outcome measures revealed a significant reduction in hand disability and pain and a significant improvement of health-related quality of life at both time points (T1-T0) and (T2-T0). In contrast, the control group demonstrated a significant improvement of NRS, QuickDASH and EQ-VAS at T1 and at T2, compared to the baseline (Table 2 and Fig. 4). The between-groups analysis found significantly better results in the KT group at T1 and at T2 in terms of primary outcome (BCTQ-S and BCTQ-F) and pain, assessed by NRS.

Discussion

The present study showed that KT compared to a sham taping might be more effective in reducing perceived symptoms and increasing hand functional abilities in patients affected by mild CTS performing specific rehabilitative exercises.

It is important to note that both groups had significant improvements in pain, self-reported disability, and perceived quality



*= p<0.005. Abbreviations: BCTQ-F: Boston Carpal Tunnel Questionnaire – Functional; BCTQ-S: Boston Carpal Tunnel Questionnaire – Symptom; NRS: Numerical Rating Scale; Quick Version of Disability of the Arm, Shoulder and Hand (Quick-DASH); EuroQol 5-Dimension 3-Level (EQ-5D-3L); EuroQol Visual Analogue Scale (EQ-VAS).

Fig. 4. Outcome measures assessed in both groups at the different time-points.

of life at both 5 weeks and 6 months after commencing treatment, suggesting that the exercise protocol that we utilized might be useful in mild CTS. However, those in the active KT group scored significantly better on the BCTQ and pain scales, compared to the sham taping group at both time-points.

Moreover, we assessed a difference that can be considered as clinically significant in comparison with MCID[28] in both BCTQ-F (KT group: $\Delta = 1.2$; control group: $\Delta = 0.6$) and by BCTQ-S in KT group (KT group: $\Delta = 0.5$). Recent trials have investigated the effectiveness of KT application in patients affected by CTS as conservative approach[11,12,29]. Aktürk et al showed a significant improvement in hand function and electrophysiological findings using KT, with medium stretch (about 60%) compared to splinting after 6 weeks of treatment[12]. A recent pilot study, Guner et al suggested that KT with moderate stretch combined with low-power laser treatment might increase hand grip strength and finger pinch strength at 12 weeks compared to the single use of laser treatment in mild cases of CTS[11]. Furthermore, in a recent randomized, placebo-controlled study neural technique and space correction (described as KT positioning from hand to medial epicondyle with 15%-25% tension and ended at medial epicondyle with no tension) showed better results on pain and function in CTS patients compared to orthotic devices or sham (no tension, inconsistent position) KT treatment[29]. Despite the fact that KT was applied at lighter tension, our findings showed a similar beneficial effect in terms of function and symptoms.

Although KT might be promising in patients affected by CTS, there are still some doubts regarding mechanisms of action, that have still to be clarified. It has been hypothesized that KT might have beneficial effects, improving blood flow in the treated tissues, lowering congestion and edema, reducing pain due to central modulation, and improving sensorimotor feedback and proprioceptive stimuli during the functional tasks[15,30].

As stated in literature by Huisstede et al on behalf of European HANDGUIDE Group[31], mild CTS might be treated with therapeutic exercise and patient education, such as changes in habits and implementing ergonomic movements might prevent inflammation, and consequent symptoms exacerbation.

Exercise might have mobilized the impaired structures into the carpal tunnel, decreasing adhesion. Indeed, exercises might reduce nociception by decreasing algogenic and pro-inflammatory substances[18]. Therefore, the first-line management should include non-surgical approaches, although these techniques have only been shown to be effective in short-term follow-up, and long-term effectiveness is unclear[7].

To the best of our knowledge, this is the first randomized controlled trial that investigated the role of KT compared to a sham taping in CTS patients and it might be considered as a starting point for further research.

Limitations of the study

Our study could not be considered free from limitations. First, the difficulty in the reproducibility of KT, a technique subjected to operator-dependent variations; however, in our study, it was performed by the same specialized hand therapist; second, it should be taken into account that KT might have different effects according to the potential anatomical differences of treated wrists; third, we did not provide data on the potential confounding factors, such as the use of anti-inflammatory drugs; lastly, the low number of study participants, although we obtained the sample size, based on the effect size of a previous work in literature[12].

Conclusion

In this double-blind randomized controlled trial, we demonstrated that KT combined with specific exercises may be more effective than exercise alone for improving hand function and symptoms in patients affected by mild CTS. Further studies are necessary to confirm these findings in order to improve the knowledge regarding the effects of this technique in CTS patients.

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None.

References

1. Luckhaupt SE, Dahlhamer JM, Ward BW, Sweeney MH, Sestito JP, Calvert GM. Prevalence and work-relatedness of carpal tunnel syndrome in the working population, United States, 2010 National Health Interview Survey. *Am J Ind Med*. 2013;56:615–624.
2. Bland JDP. Carpal tunnel syndrome. *Curr Opin Int Med*. 2005:578–582.
3. Erickson M, Lawrence M, Jansen CWS, Coker D, Amadio P, Cleary C. Hand pain and sensory deficits: carpal tunnel syndrome. *J Orthop Sports Phys Ther*. 2019;49 CPG1-CPG85.
4. Vignais N, Weresch J, Keir PJ. Posture and loading in the pathomechanics of carpal tunnel syndrome: a review. *Crit Rev Biomed Eng*. 2016;44:397–410.
5. Urits I, Gress K, Charipova K, Orhurhu V, Kaye AD, Viswanath O. Recent advances in the understanding and management of carpal tunnel syndrome: a comprehensive review. *Curr Pain Headache Rep*. 2019;23:70.
6. Padua L, Lo Monaco M, Gregori B, Valente EM, Padua R, Tonali P. Neurophysiological classification and sensitivity in 500 carpal tunnel syndrome hands. *Acta Neurol Scand*. 1997;96:211–217.
7. Padua L, Coraci D, Erra C, Pazzaglia C, Paolasso I, Loreti C. Carpal tunnel syndrome: clinical features, diagnosis, and management. *Lancet Neurol*. 2016;15:1273–1284.
8. Roomizadeh P, Eftekharsadat B, Abedini A, Ranjbar-Kiyakalayeh S, Yousefi N, Ebadi S. Ultrasonographic assessment of carpal tunnel syndrome severity: a systematic review and meta-analysis. *Am J Phys Med Rehabil*. 2019;98:373–381.
9. Sayin R, Keskin S, Hamamci M. Evaluation of several classification methods in carpal tunnel syndrome. *J Pak Med Assoc*. 2017;67:1654–1657.
10. Parish R, Morgan C, Burnett CA, et al. Practice patterns in the conservative treatment of carpal tunnel syndrome: survey results from members of the american society of hand therapy. *J Hand Ther*. 2019;33(3):346–353. doi:10.1016/j.jht.2019.03.003.
11. Guner A, Altan L, Aksoy MK. The effectiveness of the low-power laser and Kinesiotaping in the treatment of carpal tunnel syndrome: a pilot study. *Rheumatol Int*. 2018;38:895–904.
12. Aktürk S, Büyükavcı R, Aslan Ö, Ersoy Y. Comparison of splinting and Kinesio taping in the treatment of carpal tunnel syndrome: a prospective randomized study. *Clin Rheumatol*. 2018;37:2465–2469.
13. Sim SE, Gunasagaran J, Goh KJ, Ahmad TS. Short-term clinical outcome of orthosis alone vs combination of orthosis, nerve, and tendon gliding exercises and ultrasound therapy for treatment of carpal tunnel syndrome. *J Hand Ther*. 2019;32:411–416.
14. Barrio SJ, Gracia EB, García CH, et al. Conservative treatment in patients with mild to moderate carpal tunnel syndrome: A systematic review. *Neurología (English Edition)*. 2018;33:590–601.
15. Halseth T, McChesney JW, DeBeliso M, Vaughn R, Lien J. The effects of kinesio taping on proprioception at the ankle. *J Sports Sci Med*. 2004;3:1–7.
16. Kase K, Hashimoto T, Okane T. Kinesio Perfect Taping Manual: Amazing Taping Therapy to Eliminate Pain and Muscle Disorders. Albuquerque, NM, USA: Kinesio Taping Association; 1998.
17. Slupik A, Dwornik M, Bialoszewski D, Zych E. Effect of kinesio taping on bioelectrical activity of vastus medialis muscle. *Ortop Traumatol Rehabil*. 2007;9:644–651.
18. Ballestero-Pérez R, Plaza-Manzano G, Urraca-Gesto A, et al. Effectiveness of nerve gliding exercises on carpal tunnel syndrome: a systematic review. *J Manipulative Physiol Ther*. 2017;40:50–59.
19. Kase K, Kase T, Wallis J. Clinical therapeutic applications of the Kinesio taping methods. Kenzo Kase; 2003.
20. Ramírez-Vélez R, Hormazábal-Aguayo I, Izquierdo M, González-Ruíz K, Correa-Bautista JE, García-Hermoso A. Effects of kinesio taping alone versus sham taping in individuals with musculoskeletal conditions after intervention for at least one week: a systematic review and meta-analysis. *Physiotherapy*. 2019;105:412–420.
21. Padua R, Padua L, Romanini E. Boston carpal tunnel questionnaire: italian version. *It J Ort Traumatol*. 1998;24:121–129.
22. Mehta SP, Weinstock-Zlotnick G, Akland KL, Hanna MM, Workman KJ. Using carpal tunnel questionnaire in clinical practice: a systematic review of its measurement properties. *J Hand Ther*. 2020;33:493–506.
23. Franchignoni F, Ferriero G, Giordano A, Sartorio F, Vercelli S, Brigatti E. Psychometric properties of QuickDASH - a classical test theory and Rasch analysis study. *Man Ther*. 2011;16:177–182.
24. Greenslade JR, Mehta RL, Belward P, Warwick DJ. Dash and boston questionnaire assessment of carpal tunnel syndrome outcome: what is the responsiveness of an outcome questionnaire? *J Hand Surg Br*. 2004;29:159–164.
25. McCaffery M, Beebe A. Pain: Clinical Manual for Nursing Practice. Baltimore: V.V. Mosby Company; 1993.
26. EuroQolGroup, EuroQol–a new facility for the measurement of health-related quality of life. *Health Policy*1990; 16: 199-208.
27. Marti C, Hensler S, Herren DB, Niedermann K, Marks M. Measurement properties of the EuroQoL EQ-5D-5L to assess quality of life in patients undergoing carpal tunnel release. *J Hand Surg Eur*. 2016;41:957–962.
28. De Kleermaeker FGCM, Boogaarts HD, Meulstee J, Verhagen WIM. Minimal clinically important difference for the Boston Carpal Tunnel Questionnaire: new insights and review of literature. *J Hand Surg Eur*. 2019;44:283–289.
29. Geler Külcü D, Bursali C, Aktaş İ, Bozkurt Alp S, Ünlü Özkan F, Akpinar P. Kinesiotaping as an alternative treatment method for carpal tunnel syndrome. *Turk J Med Sci*. 2016;46:1042–1049.
30. Kneeshaw D. Shoulder taping in the clinical setting. *J Body Mov Ther*. 2002;6:2–8.
31. Huisstede BM, Fridén J, Coert JH, Hoogvliet P. European HANDGUIDE Group. Carpal tunnel study syndrome: hand surgeons, hand therapists, and physical medicine and rehabilitation physicians agree on a multidisciplinary treatment guideline—results from the European HANDGUIDE Study. *Arch Phys Med Rehabil*. 2014;95:2253–2263.

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Quiz: # 922

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1. The study design is
   a. retrospective cohort
   b. qualitative
   c. RCTs
   d. case series

2. The authors utilized the kinesio taping method of
   a. Kase
   b. Kleinert
   c. Artzberger
   d. Anderson

3. Both groups were given exercises. The control group was
   a. told they were in the control group
   b. taped with two techniques
   c. not taped
   d. sham taped

4. The _____ was used to assess outcomes
   a. Harvard Hand Function Questinnaire
   b. Michigan Hand Function Survey
   c. Quick DASH
   d. DASH

5. The experimental group outperformed the control group
   a. false
   b. true

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