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ORIGINAL RESEARCH

Comparison of the Effectiveness of 2 Different Kinesio Taping Techniques Added to Exercises in the Treatment of Carpal Tunnel Syndrome: Randomized Controlled Trial, Double-Blind, Parallel Groups

Muhammed-Azad Sahin, MD,[a] Basak Cigdem-Karacay, MD, PhD,[a] Naime-Meric Konar, PhD,[b] Figen Tuncay, MD, PhD[a]

From the [a]Department of Physical Medicine and Rehabilitation, Kirsehir Ahi Evran University Faculty of Medicine, Kirsehir; and [b]Department of Biostatistics and Medical Informatics, Bandirma Onyedi Eylul University Faculty of Medicine, Balikesir, Turkey.

Abstract

Objective: To compare the effectiveness of I-tape and button hole kinesio taping (KT) techniques added to exercises in the treatment of carpal tunnel syndrome (CTS).

Design: Prospective randomized controlled blinded study.

Setting: Physical Medicine and Rehabilitation Outpatient Clinic.

Participants: A total of 108 patients (165 wrists) diagnosed with CTS (N=108).

Interventions: Button hole technique (BG), I-band technique (IG), and exercises (EG).

Main Outcome Measures: Visual analog scale (VAS), Douleur Neuropathique 4 Questions (DN4), Boston carpal tunnel syndrome questionnaire, and Jamar dynamometer were used. Median sensory nerve action potential (SNAP), compound muscle action potential (CMAP), median distal sensory latency (DSL), median distal motor latency (DML), sensory conduction velocity, and motor conduction velocity were recorded. Measurements were made at baseline, week 3, and week 12.

Results: Thirty-six patients were in each group. Significant statistical improvements in VAS and DN4 scores were found in the BG and IG compared with EG ($P<.05$). Statistically significant improvements in hand grip strength were observed in the IG compared with the EG ($P<.05$). Significant improvements in DML levels and motor conduction velocity were observed in the BG and IG compared with the EG ($P<.05$). A significant increase in sensory conduction velocity was detected in the BG compared with the other groups ($P<.05$).

Conclusions: Both KT techniques are effective in terms of pain, functionality, symptom severity, grip strength, and electrophysiologically. The button hole technique was more effective in DSL, sensory conduction velocity, CMAP amplitude, and SNAP.

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Carpal tunnel syndrome (CTS) is the most common cause of upper extremity entrapment neuropathies, and the syndrome affects approximately 3% of the adult population.[1] Although the diagnosis of CTS is made by symptoms and physical examination, electrodiagnostic techniques such as electroneuromyography (ENMG) are considered the criterion standard because of their high sensitivity and specificity. Furthermore, ENMG permits the disease to be classified as mild, moderate, or severe.[2,3] The aim of CTS treatment is to reduce the compression of the median nerve in the carpal tunnel.[4] Conservative treatments for CTS include methods such as exercise, splint, manual therapy, extracorporeal shock wave therapy, corticosteroid injection, and platelet-rich plasma injection. Although a recent review reported that these

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methods were quite reliable, it was emphasized that more research should be done on the effectiveness of new conservative methods.[5]

In the 1970s, Dr Kenzo Kase developed the kinesio taping (KT) method to enhance stability and support in muscles without impeding joint range of motion.[6] KT has been reported to have therapeutic potential in central and peripheral nervous system pathologies.[7-10] Application of KT reported reduce discomfort, increase range of motion, and improve function. Additionally, KT enhances blood and lymph circulation, which in turn reduces inflammation and promotes a healing environment.[11] Although there is a growing body of literature on the effectiveness of KT in CTS, no agreement has been reached on the optimal KT technique. Different application techniques, including the I-band,[12] button hole,[13] area correction technique,[14,15] neural inhibition techniques, and area correction technique,[16,17] have been studied in patients with CTS. However, to our knowledge, no study has compared these techniques with each other. Furthermore, clinical studies in the literature have compared the KT with other conservative treatment methods, including paraffin and splint.[13,16,17]

This study was designed on the hypothesis that one of these techniques is superior to the other on pain, functions, muscle strength, and ENMG parameters by adding I-tape and button hole KT techniques to the exercises in the treatment of CTS. This study aimed to compare the effectiveness of I-tape and button hole KT techniques added to exercises in the treatment of CTS.

Methods

Study population

Patients aged between 18 and 65 years who complained of pain, tingling, and numbness in the thumb, index finger, or middle finger for the last 2 weeks were examined by the physician. On physical examination, Tinnel's sign was detected by percussion of the wrist, and Phalen's sign was detected by passive flexion of the hand at the wrist.[18] Patients who tested positive for 1 of these 2 tests underwent ENMG to confirm the diagnosis of CTS. ENMG was performed in accordance with the American Association of Neuromuscular and Electrodiagnostic Medicine guideline; in this way, cervical radiculopathy affecting the C5-T1 roots, proximal median nerve lesion, and brachial plexopathy were excluded.[19] Participants meeting the inclusion criteria and consenting to participate were assessed.

The exclusion criteria of the study were determined as cervical radiculopathy; polyneuropathy; brachial plexopathy; systemic corticosteroid use; history of fractures and trauma in the treated forearm and wrist; inflammatory rheumatic disease; pregnancy and lactation; systemic diseases such as renal failure, peptic ulcer, diabetes mellitus, hypothyroidism, and coagulation disorder; history of CTS surgery; thoracic outlet syndrome; thenar atrophy; and severe CTS (fig. 1).

Before starting the research, approval was obtained from the University Clinical Research Ethics Committee (date: September 6, 2022, Ethics Committee Approval Number: 2022-16/146). After ethics committee approval was obtained, the study was registered on ClinicalTrials.gov (NCT05592067) before the first patient was included in the study. The study was conducted in accordance with the Declaration of Helsinki.

List of abbreviations:

ANOVA	analysis of variance
BCTQ	Boston carpal tunnel questionnaire
BG	button hole group
CMAP	compound muscle action potential
CTS	carpal tunnel syndrome
DML	median distal motor latency
DN4	Douleur Neuropathique 4 Questions
DSL	median distal sensory latency
EG	exercise group
ENMG	electroneuromyography
IG	I-band group
KT	kinesio taping
MSL	median medial sensory latency
SNAP	median sensory nerve action potential
VAS	visual analog scale.

Randomization and blinding

The patients were randomly assigned to groups using the sealed envelope method. The patients were randomly assigned to 1 of the following 3 groups: button hole group (BG), I-band group (IG), and exercise group (EG; the control group) by the investigator (MAS) who performed the interventions. The evaluator (BCK) and the investigator (MAS) were different individuals. Tapes were removed before taking measurements to ensure that the assessor remained blinded. Additionally, the statistical analysis was performed by an investigator (NMK) who was unaware of the group allocation.

Interventions

Button hole technique

KT was applied to the BG using Dr Kenzo Kase's button hole technique. In this technique, KT was cut by measuring from the level of the medial and lateral epicondyles on the palmar side of the forearm and from the base of the proximal phalanges to the humeral epicondyles on the dorsal side of the forearm. The tape was folded to locate the midpoint. Two tiny incisions were then made at the midpoint to produce 2 button holes, through which the third and fourth fingers could pass. Subsequently, the paper behind the tape was torn, and the third and fourth fingers were inserted through the holes. The wrist of the patient was extended and radially deviated, and the tape was applied to the palmar aspect of the forearm with a slight (15%-25%) tension toward the medial epicondyle. The wrist was then flexed and ulnarly deviated before being affixed to the lateral epicondyle with a slight (15%-25%) tension. The last few centimeters of the tape were applied without tension. KT was applied to the wrist from the dorsal side using the area correction technique. The wrist was slightly flexed, and the middle part of a 15-20-cm I-tape was glued to the ulna and distal radius from the dorsal side with a slight (15%-25%) tension. The band was held on the styloid processes of the ulna and radius with one hand, the wrist was extended with the other hand, and the remaining ends were cut and applied without tension until there was a small gap between both ends (fig. 2).

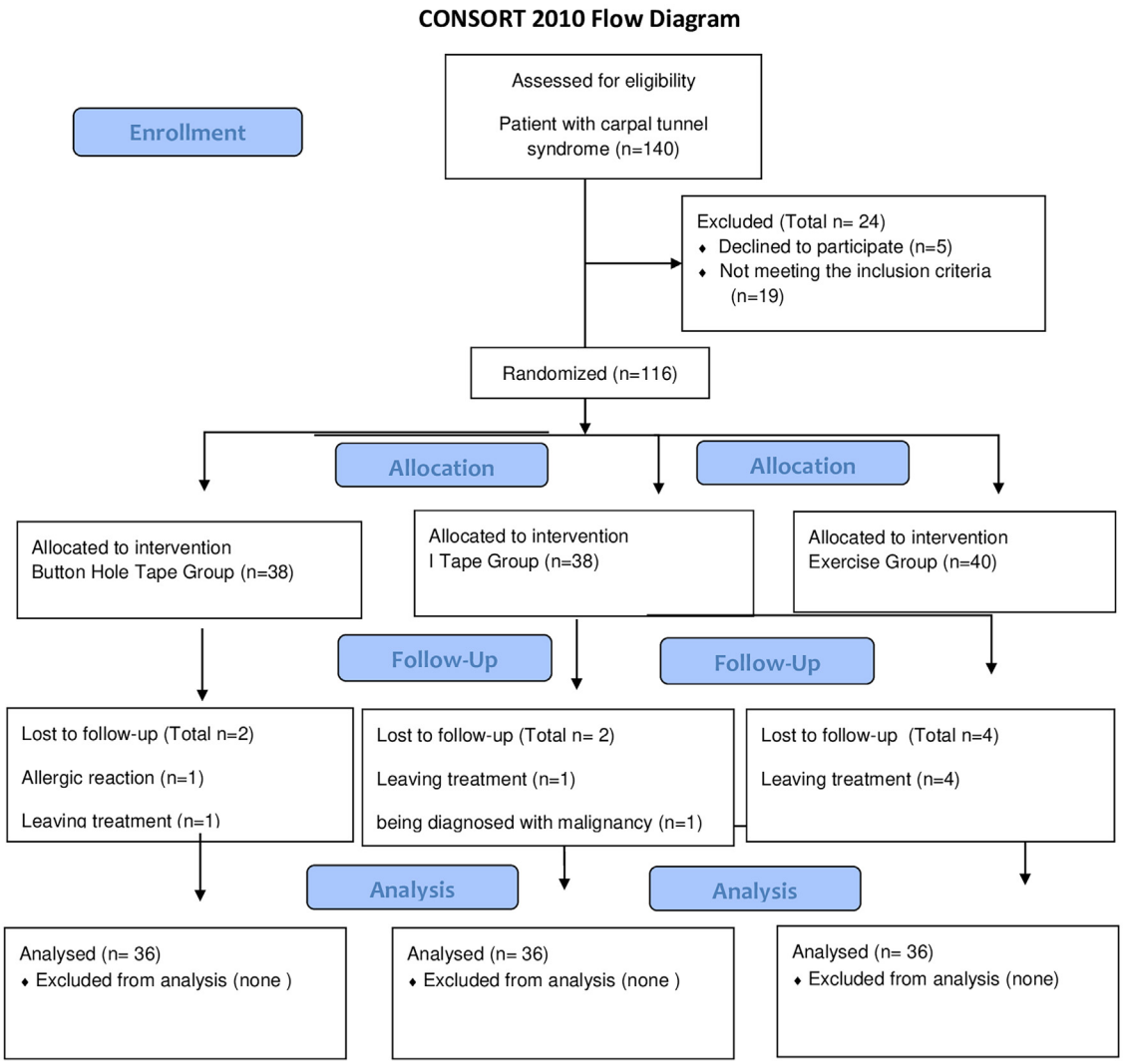

Fig 1 CONSORT flow chart.

I-band technique

In the IG, KT was performed using the I-band technique described by Dr Kenzo Kase. In this technique, an I-tape was cut after measuring from the metacarpals to the humeral epicondyles. The ends of the tape were cut, and an X shape was created at the ends of the tape. The tape was folded, its center was located, and the paper behind it was removed. Starting from the midpoint of the tape, it was applied with light (15%-25%) tension from the palmaris longus insertion to the carpal tunnel area of the lower forearm, distally below the antecubital fossa. Taping was applied to the wrist from the dorsal side using the area correction technique. With the wrist slightly flexed, the middle section of 15-20-cm I-tape was applied to the distal radius and ulna from the dorsal side with light (15%-25%) tension. The band was held on the styloid processes of the ulna and radius with one hand, the wrist was extended with the other hand, and the remaining ends were cut and applied without tension until there was a small gap between both ends (fig. 3).

Exercises

Median nerve stretching exercises and flexor tendon gliding exercises were performed by all groups.[20] The exercises were explained to the patients verbally, and a visual exercise sheet was provided. The patients performed 3 sets of 10 repetitions of the exercises every day for 21 days, keeping their hands in each position for 5 seconds during the exercise. During follow-up visits, we monitored whether the patients were performing the exercises correctly and regularly using an exercise chart.

All groups received treatment for a total of 3 weeks. All the exercise and KT sessions in this study were conducted by the same physician (MAS) who had a KT certificate and postgraduate training in exercise practice. Patients in IG and BG underwent KT for a total of 3 times: at baseline, on day 7, and on day 14. Patients were instructed to cut the separated bands with scissors within a week. When the tape became wet, they were instructed to gently dry it with a dry towel without rubbing. They were advised against using a hair dryer or any other heating device. All patients were called for follow-up on the seventh and 14th days. Patients in the IG and BG had their bands changed. Additionally, exercise charts were reviewed to encourage all patients to comply with the exercise program.

Outcome measurements

The visual analog scale (VAS), Boston carpal tunnel questionnaire (BCTQ), Douleur Neuropathique 4 Questions (DN4), and hand

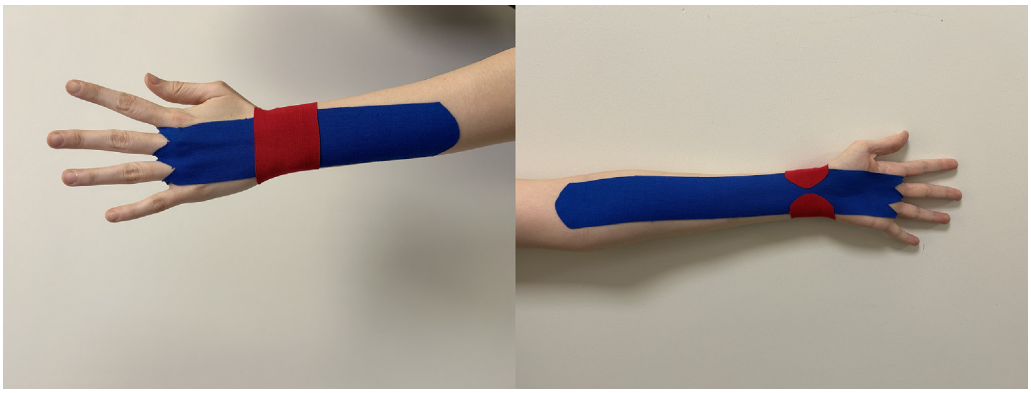

Fig 2 Kinesio taping application with button hole technique.

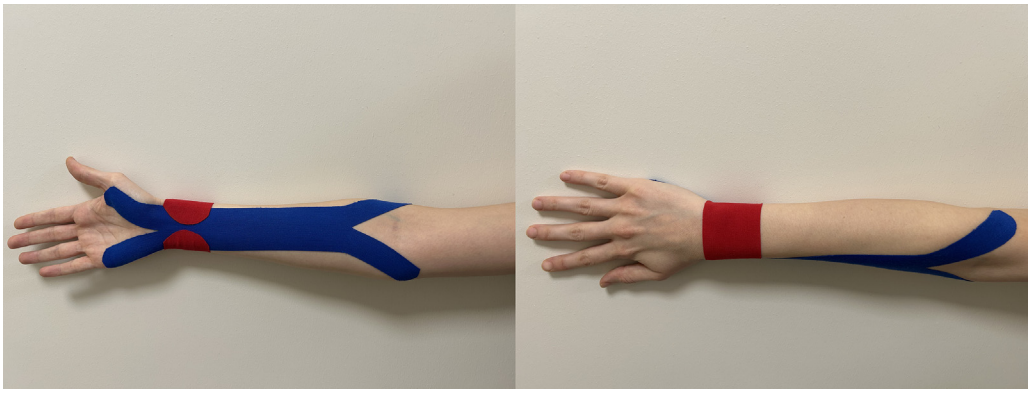

Fig 3 Kinesio taping application with I-band technique.

grip strength were repeated before treatment (week 0), at the end of treatment (week 3), and at week 12. These measurements were performed by the same blinded evaluator—a physiatrist (BCK). ENMG was performed before treatment and at week 12 by a blinded evaluator (FT) with 20 years of experience in ENMG.

The VAS is a pain rating scale. The patient is asked to mark on the line where their pain corresponds. On this scale, 0 means "no pain" and 10 means "unbearable pain." Participants were asked to rate the pain they felt because of CTS using this scale, and the result was recorded. A 23% decrease in VAS pain scores was considered statistically significant.[21]

The DN4 consists of 4 items: the first 2 items relate to the type of pain and the last 2 items relate to sensory examination findings. A score of ≥4 out of 10 indicates neuropathic pain. The DN4 has been culturally adapted.[22,23]

The BCTQ consists of 2 parts: the Boston Symptom Severity Scale and the Boston Functional Status Scale. The Boston Symptom Severity Scale has 11 questions, and the answers range from "not at all" (1 point) to "very severe" (5 points). The Boston Functional Status Scale has 8 questions and answers range from "very easy" (1 point) to "very difficult" (5 points).[22] The score received by the patient is divided by the total score, and a ratio between 0 and 1 is obtained. When this ratio approaches 1, it indicates that dysfunction and symptoms are increased.

The Jamar dynamometer was used to measure grip strength. The Jamar dynamometer measures static grip strength in kilograms. Measurements were taken in the position recommended by the American Association of Hand Therapists, with the patient seated, the arm adducted, the elbow flexed at 90°, and the forearm in a neutral position.[24] Patients were asked to tighten the dynamometer at its maximum power for ≥3 seconds. Three measurements were taken at 1-minute intervals, and the average was recorded in kilograms.

Electroneurophysiological studies were performed in the same ENMG laboratory. Measurements were made with a Nihon Kohden Neuropack S1 MEB-9400K ENMG machine. Recordings were performed at room temperature. Recording electrodes and a superficial stimulator were used. Median nerve motor conduction studies and median nerve sensory conduction studies were performed.

For the median nerve motor nerve conduction study, the stimulus duration of the ENMG device was set to 0.2 milliseconds, the sweep rate to 50 milliseconds, and the filter bandwidth to 2 Hz-10 kHz. The patient was seated with the palms facing upward. The ground electrode was placed on the forearm, the reference electrode on the thumb, and the active recording electrode on the abductor pollicis brevis muscle. The first stimulus was delivered 5 cm proximal to the active electrode, and the second stimulus was delivered from the ulnar side of the brachial artery pulse. Median nerve in motor conduction, motor conduction velocity, compound muscle action potential (CMAP), and median distal motor latency (DML) were examined.[25]

For the median nerve conduction study, the filter width of the ENMG machine was set to 20 Hz-2 kHz, and the sweep rate was

set to 15 ms. Superficial electrodes were placed on the distal interphalangeal joint (reference electrode) and the metacarpophalangeal joint of the second finger (active electrode), and recordings were made antidromically by applying supramaximal stimulation from the wrist with the stimulator electrode. The median distal sensory latency (DSL), median sensory nerve action potential (SNAP), and sensory nerve conduction velocity were assessed. Amplitude and latency were measured. Amplitude refers to the distance between peaks, whereas latency is the distance from the beginning of stimulation to the peak of the major negative deflection.[25]

Sample size calculation

A pilot study was conducted with the patients included in the study. In the first stage, a total of 140 patients were evaluated for eligibility. One hundred sixteen patients who met the inclusion criteria and agreed to participate in the study were randomized into 3 groups. No additional patients were included in the study because the sample size was 108 (36 in each group) with a 5% error rate, and 96.7% post hoc power was obtained to achieve an effect size of 0.324 for the sensory nerve conduction velocity parameter (Supplemental Appendix S1). G Power program (v.3.1.9.4) was used for post hoc power analysis. Dropout rates for each group were observed as 5.3%, 5.3%, and 10% in the BG, IG, and EG, respectively. Additionally, a total dropout rate of 6.9% was recorded. The study flow chart is presented in fig. 1.

Statistical analysis

Numerical variables were reported as mean ± SD, median, minimum, and maximum. Categorical variables were reported as frequency (n) and percentage (%). Normality and homogeneity of variance were evaluated with Shapiro-Wilk and Levene tests, respectively. Two-way analysis of variance (ANOVA) was employed using repeated measurements, 3 × 3 design to analyze VAS, Jamar, DN4, Boston Symptom Severity, and Boston Functional Status parameters. Additionally, a 3 × 2 design was used for CMAP, SNAP, sensory latency, motor latency, sensory speed, and motor speed parameters. For intergroup comparisons, 1-way ANOVA or Kruskal-Wallis tests were applied depending on whether the normality assumption was fulfilled. Bonferroni and Dunn tests were used for pairwise comparisons. Within each group, ANOVA in repeated measurements, Friedman test, paired *t* test, or Wilcoxon test were used to determine whether repeated measurements showed statistically significant differences. Bonferroni correction was used to determine the different measurements. The chi-square test was used to analyze categorical variables. The McNemar test was used to evaluate whether there was a statistically significant difference between pretreatment and posttreatment motor latency levels. A 2-sided *P* value of ≤.05 was considered statistically significant. All analyses were performed using SPSS v.21.0 (IBM Corp).

Results

No significant difference was found between the groups in terms of age, sex, affected hand, body mass index, dominant hand, and disease duration (*P*>.05) (table 1).

Although a significant pain reduction was detected in VAS pain and DN4 questionnaire pain levels in the BG and IG after treatment compared with the EG, no difference was found between the BG and IG groups. In the measurements made with the BCTQ, a more significant improvement was detected in the BG and IG than in the EG. No difference was found between BG and IG. Although the increase in hand grip strength measurements was greater in the IG than in the EG at the third and 12th weeks, there was no difference between the BG and IG (table 2).

In the ENMG studies, SNAP and CMAP measurements were found to be significantly higher in the BG than in the IG at the 12th week. DSL measurements performed at the 12th week were found to be significantly lower in the BG than in the IG. Although the DML levels of the patients showed a significant decrease in the BG and IG at the 12th week, no statistical difference was detected in the EG. There was no statistically significant difference between the BG and IG. Although a significant increase in

Table 1 Baseline parameters of the participants

Parameters	BG (n=36)	IG (n=36)	EG (n=36)	*P*
Age (y)	50.86±8.388	51.64±9.946	51.78±8.986	.9*
Sex				.1†
Female	34 (94.4%)	32 (88.9%)	28 (77.8%)	
Male	2 (5.6%)	4 (11.1%)	8 (22.2%)	
Side				.724†
Right	9 (25%)	12 (33.3%)	14 (38.9%)	
Left	7 (19.4%)	5 (13.9%)	4 (11.1%)	
Bilateral	20 (55.6%)	19 (52.8%)	18 (50%)	
BMI (kg/m^2)	30.1683±4.593	31.1942±5.528	29.3117±4.04	.248*
Dominant hand				.087†
Right	35 (97.2%)	35 (97.2%)	31 (86.1%)	
Left	1 (2.8%)	1 (2.8%)	5 (13.9%)	
Disease duration (mo)	37.33±31.281	28.53±31.706	22.31±15.993	.246‡

NOTE. Values shown as n (%) or mean ± SD. Abbreviations: ANOVA, analysis of variance; BG, button hole group; BMI, body mass index; EG, exercise group; IG, I-band group.
* : ANOVA;
† : chi-square;
‡ : Kruskal-Wallis.

Table 2 Comparison of differences in measurements by groups and difference analysis findings on DN4, JD, VAS, BSSS, and BFSS values in repeated measurements

Variables	Group	Before Treatment[1] Mean ± SD	*P*	Week 3[2] Mean ± SD	*P*	Week 12[3] Mean ± SD	*P*	*P*	Difference Post hoc* *P*
DN4	**BG (n=56)**	5.36±2.101	.002*	2.57±1.943	<.001*	1.82±1.82	<.001*	<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$.016^{2.3}$
	IG (n=55)	5.93±2.308		3.53±2.308		3.07±1.989		<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$.121^{2.3}$
	EG (n=54)	4.59±1.252		4.3±1.11		3.8±1.188		<.001	$.003^{1.2}$
									$<.001^{1.3}$
									$.182^{2.3}$
JD	**BG (n=56)**	16.607±6.395	.427*	20.286±6.486	.036†	22.036±6.511	.004†	<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$.024^{2.3}$
	IG (n=55)	18.291±7.228		22.491±7.346		24.291±7.205		<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$.258^{2.3}$
	EG (n=54)	18.074±7.857		19±7.389		19.741±7.382		<.001	$.014^{1.2}$
									$<.001^{1.3}$
									$.048^{2.3}$
VAS	**BG (n=56)**	6.554±1.640	.009*	3.446±2.07	<.001*	2.25±1.938	<.001*	<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$
	IG (n=55)	6.309±1.731		3.455±1.864		2.618±1.759		<.001	$<.001^{1.2}$
									$<.001^{1.3}$
									$.045^{2.3}$
	EG (n=54)	5.63±1.509		5.074±1.6		4.537±1.463		<.001	$.01^{1.2}$
									$<.001^{1.3}$
									$.004^{2.3}$
BSSS	**BG (n=56)**	0.577±0.918	.519*	0.398±0.106	<.001*	0.339±0.109	<.001*	<.001‡	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$
	IG (n=55)	0.589±0.098		0.425±0.107		0.367±0.09		<.001‡	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$
	EG (n=54)	0.566±0.098		0.513±0.087		0.483±0.085		<.001‡	$<.001^{1.2}$
									$<.001^{1.3}$
									$.005^{2.3}$
BFSS	**BG (n=56)**	0.635±0.114	.930*	0.455±0.120	<.001*	0.386±0.123	<.001*	<.001§	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$
	IG (n=55)	0.642±0.119		0.469±0.135		0.402±0.125		<.001§	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$
	EG (n=54)	0.629±0.116		0.580±0.112		0.551±0.112		<.001§	$<.001^{1.2}$
									$<.001^{1.3}$
									$<.001^{2.3}$

Abbreviations: ANOVA, analysis of variance; BFSS, Boston Function Status Scale; BG, button hole group; BSSS, Boston Symptom Severity Scale; DN4, Douleur Neuropathique 4 Questions; EG, exercise group; IG, I-band group; JD, Jamar dynamometer; VAS, visual analog scale.
* : Kruskal-Wallis;
† : ANOVA;
‡ : Friedman;
§ : Repeated measures ANOVA paired *t* test.

motor conduction velocity was detected in the BG and IG at the 12th week, no statistically significant difference was detected in the EG. No difference was found between the BG and IG. The increase in sensory conduction velocity in the BG at the 12th week was found to be significantly higher than that in the IG and EG (table 3, fig. 4).

Table 3 Comparison of differences in measurements by groups and difference analysis findings on ENMG parameters in repeated measurements

Variables	Group	Before Treatment[1] Mean ± SD	P	Week 3[2] Mean ± SD	P	Week 12[3] Mean ± SD	P	P	Difference Post hoc* P
mSNAP **amplitude**	**BG (n=56)**	18.231±3.815	<.001*	-	-	24.145±3.667	<.001*	<.001†	<.001[1.3]
	IG (n=55)	16.7915±4.002		-		22.1029±4.142		<.001†	<.001[1.3]
	EG (n=54)	20.276±4.699		-		20.721±4.003		.175†	.175[1.3]
mCMAP **amplitude**	**BG (n=56)**	7.219±1.036	.048*	-	-	8.264±1.15	.001*	<.001‡	<.001[1.3]
	IG (n=55)	7.10±1.118		-		7.6362±1.07		<.001‡	<.001[1.3]
	EG (n=54)	7.575±1.073		-		7.5056±0.954		.176‡	.176[1.3]
Distal sensory latency	**BG (n=56)**	2.942±0.319	.003*	-	-	2.6±0.349	0.01*	<.001†	<.001[1.3]
	IG (n=55)	3.026±0.386		-		2.809±0.408		<.001†	<.001[1.3]
	EG (n=54)	2.771±0.431		-		2.757±0.423		.559†	.559[1.3]
Distal motor latency	**BG (n=56)**	4.031±0.622	.082*	-	-	3.707±0.621	.216*	<.001‡	<.001[1.3]
	IG (n=55)	4.15±0.576		-		3.8375±0.639		<.001‡	<.001[1.3]
	EG (n=54)	3.918±0.651		-		3.9376±0.675		.887§	.887[1.3]
Sensory nerve conduction velocity	**BG (n=56)**	40.37±4.93	.486*	-	-	46.475±5.5	<.001*	<.001‡	<.001[1.3]
	IG (n=55)	40.068±5.610		-		43.471±6.830		<.001‡	<.001[1.3]
	EG (n=54)	40.933±6.188		-		41.622±6.154		.001‡	.001[1.3]
Motor nerve conduction velocity	**BG (n=56)**	54.184±2.702	.866*	-	-	55.309±2.613	.005*	<.001‡	<.001[1.3]
	IG (n=55)	54.387±2.535		-		55.6±2.535		<.001‡	<.001[1.3]
	EG (n=54)	54.226±2.042		-		54.13±2.006		.230‡	.230[1.3]

Abbreviations: BG, button hole group; EG, exercise group; ENMG, electroneuromyography; IG, I-band group; CMAP, compound muscle action potential; SNAP, median sensory nerve action potential.
* : Kruskal-Wallis;
† : paired *t* test;
‡ : Wilcoxon.

Discussion

Based on the findings of this investigation, KT using both the button hole and I-tape methods added to exercises is an efficient treatment for pain. Moreover, neither taping technique is superior to the other in terms of pain outcome measures. Krause et al[12] evaluated the effectiveness of KT on pain in CTS using the I-band technique in placebo-controlled studies, whereas Geler Külcü et al[13] used the button hole technique. Both studies showed that the KT method is effective in reducing pain. The results of the present study are in agreement with the literature, indicating that both forms of KT have a relatively enduring effect on pain after 12 weeks.

Yıldırım et al[26] conducted a study to evaluate the effectiveness of KT using the I-tape technique in patients with CTS. They found that although adding KT to exercise improved function in the short term, it did not lead to a significant difference in BCTQ results in the long term. De Sire et al[15] found that KT, applied with lymphatic correction technique, had a positive effect on functionality in the sixth month in patients diagnosed with CTS. Although literature findings provide conflicting data regarding the long-term effectiveness of improving function, the present study's results indicate that both application techniques of KT added to exercises are effective in improving function at both the third and 12th week.

Sen et al[27] found that there was no significant difference between splint treatment applied with KT and splint treatment alone in terms of grip strength in the short term. However, according to Öncü et al,[14] KT applied with the field correction technique increased grip strength at week 8. Consistent with previous research, the present study found a notable increase in grip strength across all groups at the 3-week mark. However, at the 12-week assessment, both KT groups displayed significant ongoing improvement compared with the EG, with no significant difference between the 2 taping techniques. These results indicate that regardless of the taping method, KT may enhance grip strength over the long term.

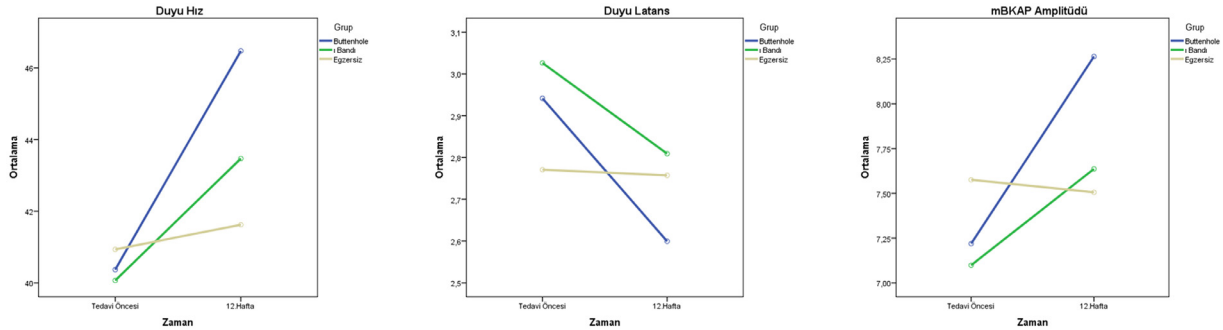

Fig 4 Electromyographical findings.

Park et al,[27] in their study investigating the effectiveness of KT using the I-band technique electrophysiologically, found no effect on CMAP and SNAP after 4 weeks of KT treatment. Another study reported that KT had no effect on the amplitude of the motor conduction velocity and the CMAP.[28] Based on the findings of the present study, KT with the button hole technique added to exercises was found to be more effective than I-band technique and exercise on CMAP and SNAP at week 12.

A study by Ali et al[29] showed that KT with button hole technique reduces DML and median medial sensory latency (MSL). Aminian-Far et al[30] examined the effectiveness of KT using the I-tape technique in patients with CTS and showed the effectiveness of the I-tape technique on DML in a sham-controlled study. The present study found that incorporating KT into exercise using the button hole and I-band techniques is effective in improving MSL and DML. Although the button hole technique did not prove to be more effective than the I-band in terms of DML, it was more effective in improving MSL.

Akturk et al[16] demonstrated the effectiveness of KT, applied with neural and inhibition techniques, on DML, DSL, and sensory conduction velocity in patients with CTS. Mansiz Kaplan et al[17] found that KT, applied with neural and area correction techniques, was effective in improving MSL, sensory nerve conduction velocity, and DML in patients diagnosed with CTS. Both the button hole and I-band techniques added to exercises were found to be effective in treating sensory nerve conduction velocity; however, the button hole technique was found to be superior to the I-band technique.

Study limitations

A total of 16 patients withdrew from the study during the treatment and follow-up periods. Consequently, the data from these patients were not included in the analysis. This knowledge means that all of the data analyzed in this study came from patients who followed the investigators' instructions and maintained communication throughout the 12-week study period.

The study has limitations, including the detection of statistical differences between the groups in some parameters before treatment and the absence of a sham KT group. Despite these limitations, the study has several strengths. First, to our knowledge, it is the first of its kind to compare 2 different KT methods. Second, many patients completed the study. Third, the study used ENMG measurement as the evaluation and diagnostic method. The follow-up period was relatively long.

Conclusions

The study found that both button hole and I-band methods are effective in KT when added to exercise therapy in patients with CTS in terms of functionality, symptom severity, grip strength, and electrophysiology. However, the button hole technique is more effective than the I-band technique for electrophysiological measurements such as DSL, sensory nerve conduction velocity, CMAP amplitude, and SNAP.

Suppliers

a. Neuropack S1 MEB-9400K; Nihon Kohden
b. IBM SPSS Statistics for Windows, version 21.0; IBM Corp.

Keywords

Carpal tunnel syndrome; Electromyography; Entrapment neuropathy; Kinesiotape; Median nerve; Taping

Corresponding author

Basak Cigdem-Karacay, MD, Department of Physical Medicine and Rehabilitation, Kirsehir Ahi Evran University Faculty of Medicine, Bagbası Discret, Kırsehir, Turkey. *E-mail address:* basakcigdem@hotmail.com.

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Authorship Contributions/CRediT statements

MAS: Conception, Intervention, Data analysis, Writing-Original draft. BCK: Conception, Data collection, Writing-Reviewing and Editing. NMK: Data analysis, Writing-Original draft. FT: Conception, Data collection, Critical Reviewing and Final Approval.

References

1. Atroshi I, Gummesson C, Johnsson R, Ornstein E, Ranstam J, Rosén I. Prevalence of carpal tunnel syndrome in a general population. JAMA 1999;282:153–8.
2. Chen YT, Williams L, Zak MJ, Fredericson M. Review of ultrasonography in the diagnosis of carpal tunnel syndrome and a proposed scanning protocol. J Ultrasound Med 2016;35:2311–24.
3. Aroori S, Spence RA. Carpal tunnel syndrome. Ulster Med J 2008;77:6–17.
4. Calandruccio JH, Thompson NB. Carpal tunnel syndrome: making evidence-based treatment decisions. Orthop Clin North Am 2018;49:223–9.
5. Wielemborek PT, Kapica-Topczewska K, Pogorzelski R, Bartoszuk A, Kochanowicz J, Kułakowska A. Carpal tunnel syndrome conservative treatment: a literature review. Postep Psychiatr Neurol 2022;31:85–94.
6. Kase K, Wallis J, Kase T. Clinical therapeutic applications of the kinesio taping method. 2nd ed. Tokyo, Japan: Ken Ikai Co Ltd; 2003.
7. Ickert EC, Griswold D, Ross O, Dudash S, Duchon C, Learman K. Effects of kinesiotaping during early post-operative rehabilitation in individuals who underwent a total knee arthroplasty: a systematic review and meta-analysis of randomized control trials. Clin Rehabil 2024;38:732–48.
8. Analay Akbaba Y, Kaya Mutlu E, Altun S, Celik D. Does the patients' expectations on kinesiotape affect the outcomes of patients with a rotator cuff tear? A randomized controlled clinical trial. Clin Rehabil 2018;32:1509–19.
9. Li Y, Yin Y, Jia G, Chen H, Yu L, Wu D. Effects of kinesiotape on pain and disability in individuals with chronic low back pain: a systematic review and meta-analysis of randomized controlled trials. Clin Rehabil 2018;33:596–606.
10. Jassi FJ, Del Antônio TT, Azevedo BO, Moraes R, George SZ, Chaves TC. Star-shape kinesio taping is not better than a minimal intervention or sham kinesio taping for pain intensity and postural control in chronic low back pain: a randomized controlled trial. Arch Phys Med Rehabil 2021;102. 1352-60.e3.

11. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. Sports Med 2012;42:153–64.
12. Krause D, Roll SC, Javaherian-Dysinger H, Daher N. Comparative efficacy of the dorsal application of Kinesio tape and splinting for carpal tunnel syndrome: a randomized controlled trial. J Hand Ther 2021;34:351–61.
13. 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;46:1042–9.
14. Öncü J, İlişer R, Yılmaz F, Kuran B. [The effect of kinesio taping technique on disease symptoms, hand function and grip strength in the treatment of carpal tunnel syndrome: a single-blind randomized controlled study] [Turkish]. Turk J Phys Med Rehab 2014;60(Suppl 1):S43–51.
15. de Sire A, Curci C, Ferrara M, et al. Efficacy of kinesio taping on hand functioning in patients with mild carpal tunnel syndrome. A double-blind randomized controlled trial. J Hand Ther 2022;35:605–12.
16. 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;37:2465–9.
17. Mansiz Kaplan B, Akyuz G, Kokar S, Yagci I. Comparison of the effectiveness of orthotic intervention, kinesiotaping, and paraffin treatments in patients with carpal tunnel syndrome: a single-blind and randomized controlled study. J Hand Ther 2019;32:297–304.
18. Phalen GS. The carpal-tunnel syndrome. Seventeen years' experience in diagnosis and treatment of six hundred fifty-four hands. J Bone Joint Surg Am 1966;48:211–28.
19. Guidelines in electrodiagnostic medicine. American Association of Electrodiagnostic Medicine. Muscle Nerve 1992;15:229–53.
20. Rozmaryn LM, Dovelle S, Rothman ER, Gorman K, Olvey KM, Bartko JJ. Nerve and tendon gliding exercises and the conservative management of carpal tunnel syndrome. J Hand Ther 1998;11:171–9.
21. Todd KH, Funk JP. The minimum clinically important difference in physician–assigned visual analog pain scores. Acad Emerg Med 1996;3:142–6.
22. Unal-Cevik I, Sarioglu-Ay S, Evcik D. A comparison of the DN4 and LANSS questionnaires in the assessment of neuropathic pain: validity and reliability of the Turkish version of DN4. J Pain 2010;11:1129–35.
23. Bouhassira D, Attal N, Alchaar H, et al. Comparison of pain syndromes associated with nervous or somatic lesions and development of a new neuropathic pain diagnostic questionnaire (DN4). Pain 2005;114:29–36.
24. Fess E. The effect of Jamar dynamometer handle position and test protcol on normal grip strength. J Hand Surg 1982;7:308–9.
25. Aydin G, Keleş I, Ozbudak Demir S, Baysal AI. Sensitivity of median sensory nerve conduction tests in digital branches for the diagnosis of carpal tunnel syndrome. Am J Phys Med Rehabil 2004;83:17–21.
26. Yıldırım P, Dilek B, Şahin E, Gülbahar S, Kızıl R. Ultrasonographic and clinical evaluation of additional contribution of kinesiotaping to tendon and nerve gliding exercises in the treatment of carpal tunnel syndrome. Turk J Med Sci 2018;48:925–32.
27. Park YD, Park YJ, Park SS, Lee HL, Moon HH, Kim MK. Effects of taping therapy for carpal space expansion on electrophysiological change in patients with carpal tunnel syndrome. J Exerc Rehabil 2017;13:359–62.
28. Akgol G, Elbasti MS, Gulkesen A, Alkan G, Kaya A, Ulusoy H. Comparison of low power laser and kinesio taping for the treatment of carpal tunnel syndrome: a prospective randomized study. J Back Musculoskelet Rehabil 2021;34:545–53.
29. Ali R, Battecha K, Mansour W. Influence of kinesio tape in treating carpal tunnel syndrome. J Med Sci Clin Res 2013;1:1–9.
30. Aminian-Far A, Pahlevan D, Kohnegi FM. Kinesio taping as an alternative treatment for manual laborers with carpal tunnel syndrome: a double-blind randomized clinical trial. J Back Musculoskelet Rehabil 2022;35:439–47.