ORIGINAL ARTICLE

https://doi.org/10.1590/1806-9282.20220668

Demonstration of kinesio taping effect by ultrasonography in neck pain

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SUMMARY

OBJECTIVE: This study aimed to demonstrate the effectiveness of kinesio taping in nonspecific neck pain and to assess whether ultrasonographic parameters of the upper trapezius muscle can be used in the follow-up of kinesio taping treatment.

METHODS: This was a single-blind, prospective, randomized controlled trial study involving 60 participants with nonspecific neck pain. The participants were randomly assigned into two groups. Kinesio taping group (n=29) received a 4-week neck exercise program, with kinesio taping applied twice a week for a total of four times, and the exercise group (n=28) received a 4-week neck exercise program. Participants were evaluated according to pain intensity (Visual Analog Scale), cervical range of motion, and disability (Neck Disability Index). Also, trigger point diameter and upper trapezius muscle thickness were evaluated with ultrasonography. Before and after the therapy, as well as the first month, all measures were taken by an investigator other than the practitioner of the treatment program.

RESULTS: The results showed that the Visual Analog Scale and Neck Disability Index scores in the kinesio taping group were statistically significantly improved when compared to the exercise group ($p<0.05$). In addition, the thickness of the upper trapezius muscle and the diameter of the trapezius muscle trigger point were statistically significantly improved in the kinesio taping group compared to the exercise group ($p<0.05$). In the kinesio taping group, there was no statistical significance in cervical range of motion as compared to the exercise group.

CONCLUSION: The combination of kinesio taping and exercise therapy was effective in reducing nonspecific neck pain and neck disability. Also, this study showed that ultrasonographic evaluation of the trapezius muscle could be used in the follow-up of kinesio taping therapy.

KEYWORDS: Kinesio taping. Ultrasonography. Neck pain. Trigger point. Trapezius muscle.

INTRODUCTION

Nonspecific neck pain is a pain without structural pathology that progresses between the first thoracic vertebra and the superior nuchal line. There are no specific pathologies, and often, a diagnosis cannot be made due to its multifactorial etiology[1]. One of the reasons for nonspecific neck pain is myofascial pain syndrome (MPS), which is relatively widespread in the general population[2]. MPS is caused by myofascial trigger points and is classified as a common local musculoskeletal pain syndrome. The incidence can be up to 54% in women and 45% in men[3].

The diagnosis of MPS is mainly based on manual palpation and clinical experience[4]. Today, although there are no objective criteria, the diagnosis is made by clinical features defined by Simons et al.[5]. Treatments of MPS consisted of oral medicine, physical therapy modalities, soft-tissue release, manual therapies, and needling therapy. There have been a few studies recently looking into the therapeutic impact of the kinesio taping (KT) technique, which is a new MPS therapy[6].

Dr. Kenzo Kase created the KT technique in 1979. With its wavy design, it can change the proprioception and somatosensory inputs. The purpose of KT is soft-tissue support, edema control, joint protection, and reduction of active inflammation[6-8].

To explain the processes of KT, theories such as improving blood and lymphatic circulation, aiding in postural alignment, and relaxing overused muscles have been offered[9,10]. In addition, increased afferent feedback on the skin stimulates the door-control mechanism, resulting in a reduction in pain[9-11]. Many studies demonstrate that KT can help with sports injuries, but there is not enough evidence that it can help with MPS[12-14]. The purpose of this study was to demonstrate the effect of KT in MPS and to show that ultrasonographic evaluation of the trapezius muscle can be used in the follow-up of KT treatment.

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Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.
Received on July 05, 2022. Accepted on July 17, 2022.

METHODS

This single-blinded randomized controlled trial was approved by the Kanuni Sultan Süleyman Research Training Hospital Ethics Committee (KAEK/2021.03.87). All participants were informed, and a formal agreement was obtained for this study, which followed the ethical principles outlined in the Declaration of Helsinki. A total of 262 patients with non-specific neck pain were evaluated. Sixty participants who met the inclusion criteria and were diagnosed with MPS according to Travell and Simons[5] criteria were enrolled in the study and were randomly assigned to one of two groups: exercise group (n=30) or KT group (n=30).

Pain with VAS, extension, flexion and cervical lateral flexion with goniometer, Neck Disability Index (NDI), trigger point diameter, and trapezius thickness were evaluated before treatment, after treatment, and after the first month of treatment.

Following the initial evaluation of the KT group, "I" strip kinesio tape was applied to the upper trapezius muscle using the space correction technique[15] for a total of four sessions, 2 days a week, and the participants were included in a 1-month home exercise program (Figure 1). Participants were assessed before treatment, after treatment, and after the first month of treatment. Participants in the exercise group were required to participate in a 1-month home exercise program.

Figure 1. The application of the "I" strip kinesio tape to the upper trapezius muscle using the space correction technique.

The participants had to be between the ages of 18 and 65 years and have had symptoms for at least 3 months. A history of acute neck injury or cervical surgery, psychiatric disorders, a diagnosis of cervical radiculopathy or myelopathy, recent trigger-point injection or participation in a physical treatment program within the past 6 months, any allergies to the tape, and having previously received treatment with KT were all exclusion criteria.

The exercise program included a cervical range of motion (ROM), isometric chin-in in sitting, upper trapezius stretching, upper trunk extension with chin-in in prone, scapular retraction, bent over row, and reverse flies. Each exercise was asked to be performed in three sets of 10 repetitions, three times a week for 4 weeks. Participants filled out a daily exercise diary.

Participants were evaluated according to pain, the active ROM of the cervical spine, and disability. Active ROM of the cervical spine was measured with the goniometer.

Neck pain was evaluated with VAS. Activity, rest, and night pain were questioned. VAS is a 10-point scale that evaluates pain, with score ranging from 0–10[16].

NDI, which was validated and reliable in Turkish, was used to assess disability. The total score ranges between 0 and 50[17].

Trigger point diameter and trapezius muscle thickness were evaluated with ultrasonography. The ultrasonographic evaluation of the trapezius muscle in MPS was found to have high sensitivity and specificity, and hence, this assessment was considered a useful tool to diagnose MPS[18].

All treatments were performed by an investigator, and evaluations and measurements were made by a different investigator.

The IBM SPSS version 23.0 software was used for statistical analysis. The Shapiro-Wilk test was used to determine the normality of data. The chi-square test was used for categorical variables. For within-group analysis, the Friedman test was utilized. Bonferroni-corrected Wilcoxon signed-rank test was used, if a significant difference was discovered in within-group comparisons. The Kruskal-Wallis test was used to perform between-group analysis. Bonferroni-corrected Mann-Whitney U test was applied, when a significant difference was discovered in between-group analysis. A p-value of <0.05 was considered statistically significant, and for Bonferroni-corrected results, $p<0.0167$ was considered significant.

The G*power version 3.1.2 program was used to calculate study power and sample size. A total of 52 patients were required for the primary VAS, with a minimum of 26 participants in each group, 80% power, 5% type I error, and an effect size of 0.79[19].

RESULTS

A total of 57 participants were evaluated [KT group (n=29) and exercise group (n=28)]. One participant in the KT group was excluded from the evaluation due to an allergic reaction of KT. Two participants in the exercise group were excluded from the evaluation due to a lack of data in the follow-up period. In terms of all outcome variables, there was no significant difference in the baseline assessment between the two groups (Table 1).

Table 1. Differences in terms of demographic and clinical characteristics.

	KT n=29)	Exercise (n=28)	p
Age	34.4 (8.5)	32.7 (7.2)	0.251
Gender, n (%)			0.159
Women	24 (82.8)	21 (75)	
Men	5 (17.2)	7 (25)	
Occupation, n (%)			0.191
Not working	17 (58.6)	10 (35.7)	
Desk worker	6 (20.7)	7 (25)	
Physically demanding	6 (20.7)	11 (39.3)	
Marital status, n (%)			0.322
Married	20 (69)	21 (75)	
Single	9 (31)	7 (25)	
Education, n (%)			0.584
Primary education	15 (51.7)	12 (42.9)	
High school	5 (17.3)	2 (7.1)	
University	9 (31)	14 (50)	
VAS rest, mean (SD)	4.1 (1.1)	3.7 (1.5)	0.064
VAS activity, mean (SD)	6.1 (1.4)	6.1 (1.3)	0.991
VAS night, mean (SD)	2.8 (1.0)	2.3 (1.2)	0.685
Trapezius thickness, mean (SD)	11.2 (1.9)	10.9 (2.1)	0.430
Trigger point diameter, mean (SD)	4.9 (1.1)	5.1 (1.5)	0.160
NDI, mean (SD)	15.1 (4.4)	14.4 (5.6)	0.344
Right lateral flexion, mean (SD)	39.1 (4.8)	38.2 (4.1)	0.291
Left lateral flexion, mean (SD)	37.7 (4.1)	37.5 (3.2)	0.137
Flexion, mean (SD)	44.3 (6.7)	44.8 (6.0)	0.330
Extension, mean (SD)	55.0 (6.8)	54.6(5.8)	0.319

KT: kinesio taping; VAS: Visual Analog Scale; NDI: Neck Disability Index; SD: standard deviation. $p<0.05$ was considered significant for homogeneity of variances.

Compliance with the exercise program was 87% for the KT group and 86% for the exercise group. In terms of adherence rates, there was no significant difference.

The results showed that there was a statistically significant improvement in the VAS, NDI, trapezius thickness, and trigger point diameter scores in the KT group compared to the exercise group after treatment and at the first month. Changes in the outcome measure values are summarized in Table 2.

DISCUSSION

As a result of the study, there was an improvement in ultrasonographic parameters of the upper trapezius muscle, pain, and disability with KT. KT has not been shown to be superior to exercise in ROM evaluation. In addition, it was demonstrated that ultrasonographic parameters of the upper trapezius muscle can be used in the follow-up of KT treatment in MPS.

There are many studies in the literature that include evaluations of the trapezius muscle with ultrasonography in chronic nonspecific neck pain and MPS[18,20,21]. In light of these data, for diagnosing MPS, ultrasonography can be a useful tool. However, Korkmaz et al. showed that ultrasonographic evaluations of the upper trapezius muscle can be used in the follow-up of dry needle therapy in addition to diagnosis[22]. This study showed that ultrasonographic evaluations of the trapezius muscle can be used to demonstrate the effectiveness of KT and different exercise protocols. All the scales evaluating the results of treatments for MPS are patient-based and based on subjective data. Although the ROM measurements are objective data, they are not specific for MPS and are affected by many diseases such as inflammatory, degenerative, or mechanical diseases. Therefore, the trigger point size is important and is specific for the treatment follow-up of MPS.

In this study, pain, neck disability, and cervical ROM improved with KT and exercise therapy, and the improvement in pain and neck disability was higher in the KT group. There are studies in the literature that support the results of this study with an increase in cervical ROM and a decrease in pain and NDI with KT. Hernandez et al. compared the efficacy of KT and cervical confidence manipulation in neck pain and observed similar reductions in disability and pain intensity and increases in ROM in both treatment groups[23]. Azatcam et al. showed an increase in ROM and a decrease in pain with KT and exercise treatment, and a decrease in disability assessed by NDI[24]. In a study comparing KT to sham KT, Ay et al. discovered an increase in ROM and a decrease in pain, which were found similar to these results[19]. They did not detect a decrease in disability in the short term, but in

Table 2. Comparison of data between and within groups.

	KT (n=29)	p^a	p^b	Exercise (n=28)	p^a	p^b	p^c
VAS rest (mm)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p=0.001	p=0.168
BT			AT-1M			AT-1M	AT-1M
	4.1±1.2		p=0.001	3.7±1.5		p=0.002	p=0.824
AT	1.5±1.1		BT-1M	3.1±1.6		BT-1M	BT-1M
1M	0.9±1.1		p<0.001	2.4±1.0		p<0.001	p<0.001
VAS activity (mm)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p<0.001	p<0.001
BT			AT-1M			AT-1M	AT-1M
	6.1±1.4		p<0.001	6.1±1.3		p<0.001	p<0.047
AT	3.5±1.6		BT-1M	5.2±1.6		BT-1M	BT-1M
1M	2.2±1.5		p<0.001	4.3±1.5		p<0.001	p<0.001
VAS night (mm)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p=0.004	p<0.001
BT			AT-1M			AT-1M	AT-1M
	2.8±1.0		p=0.008	2.3±1.2		p=0.022	p=0.985
AT	0.7±1.1		BT-1M	1.8±1.6		BT-1M	BT-1M
1M	0.3±0.7		p<0.001	1.3±1.2		p<0.001	p<0.001
Trapezius thickness (mm)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p<0.001	p=0.008
BT			AT-1M			AT-1M	AT-1M
	11.2±1.9		p=0.001	10.9±2.1		p=0.391	p=0.02
AT	9.4±1.1		BT-1M	10.2±1.9		BT-1M	BT-1M
1M	9.1±1.1		p<0.001	10.1±1.8		p<0.001	p=0.006
Trigger point diameter (mm)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		0.003	p=0.006	p<0.001
BT			AT-1M			AT-1M	AT-1M
	4.9±1.1		p<0.001	5.1±1.5		p=0.196	p=0.075
AT	3.5±1.2		BT-1M	4.6±1.4		BT-1M	BT-1M
1M	3.2±1.1		p<0.001	4.5±1.2		p=0.004	p<0.001
NDI			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p<0.001	p=0.002
BT			AT-1M			AT-1M	AT-1M
	15.1±4.4		p<0.001	14.4±5.6		p=0.003	p=0.199
AT	7.2±2.8		BT-1M	10.0±4.2		BT-1M	BT-1M
1M	5.4±2.2		p<0.001	8.8±4.1		p<0.001	p=0.002
Right lateral flexion (°)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p<0.001	p=0.480
BT			AT-1M			AT-1M	AT-1M
	39.1±4.8		p<0.317	38.2±4.1		p<0.004	p=0.005
AT	44.4±1.5		BT-1M	42.5±2.9		BT-1M	BT-1M
1M	44.6±1.3		p<0.001	44.3±1.8		p<0.001	p=0.609

Continue...

Table 2. Continuation.

	KT (n=29)	p[a]	p[b]	Exercise (n=28)	p[a]	p[b]	p[c]
Left lateral flexion (°)			BT-AT			BT-AT	BT-AT
		<0.001	p<0.001		<0.001	p<0.001	p=0.102
BT			AT-1M			AT-1M	AT-1M
	37.7±4.1		p=0.083	37.7±4.1		p<0.003	p<0.045
AT	44.5±1.5		BT-1M	42.7±3.5		BT-1M	BT-1M
1M	45.0±0.0		p<0.001	44.3±1.8		p<0.001	p=0.501
Flexion (°)			BT-AT			BT-AT	BT-AT
		<0.001	p=0.007		0.009	p=0.053	p=0.527
BT			AT-1M			AT-1M	AT-1M
	44.3±6.7		p=0.011	44.8±6.0		p=0.026	p=0.748
AT	45.9±6.3		BT-1M	46.1±4.8		BT-1M	BT-1M
1M	47.2±4.9		p=0.002	47.8±2.9		p=0.009	p=0.882
Extension (°)			BT-AT			BT-AT	BT-AT
		0.020	p=0.015		0.006	p=0.068	p=0.783
BT			AT-1M			AT-1M	AT-1M
	55.0±6.8		p=0.705	54.6±5.8		p=0.493	p=0.367
AT	57.1±5.1		BT-1M	56.8±4.3		BT-1M	BT-1M
1M	56.8±4.5		p=0.061	57.1±4.4		p=0.053	p=0.482

BT: before treatment; AT: after treatment; 1M: 1-month; VAS: Visual Analog Scale; KT: kinesio taping; NDI: Neck Disability Index. p^a and p^b values show the results of the within-group analysis (Friedman test and Bonferroni-corrected Wilcoxon test). p^c value shows the between-group analysis results (Kruskal-Wallis test). $p^a<0.05$ were considered significant. p^b and $p^c<0.0167$ were considered significant for Bonferroni correction.

this study, a decrease in disability after treatment and at the first month was found. In this study, an improvement was found in the ROM in the KT group, but no difference was found between the exercise group and the KT group in the improvement in the ROM. The KT group received exercise therapy in addition to KT. The improvement in ROM is an improvement due to exercise therapy. No additive effect was observed in the increase of KT on ROM. In the study by Noguera-Iturbe et al., no improvement was found in the ROM with the KT treatment applied with the space correction technique[25]. Similar to this study, Ptaszkowski et al. showed improvement in pain with KT treatment applied with the space correction technique[14]. The effect of exercise and KT therapy on pain and disability may be an additive effect on exercise in this study. Few systematic reviews comparing KT with sham banding or other interventions have shown no significant benefit or small effect of KT. However, the sample sizes of these studies were small, and the quality of these studies was low to moderate[9-11].

In light of these data, higher sample sizes and longer follow-up periods are required to demonstrate the utility of KT in MPS. In this study, KT was performed only for the upper trapezius, and other muscles of the participants were not evaluated in terms of nonspecific neck pain, which is one of the study's limitations. In this study, there was no group that did not receive treatment to show the true effect of KT. Evaluations of ultrasonography in MPS have only been made for the trapezius muscle, and it is unclear whether it can be used in other muscles. In addition, there is a need for studies showing that ultrasonographic evaluation of the trapezius muscle is usable with different treatment approaches.

CONCLUSIONS

In this study, a greater improvement in neck pain, disability, and trigger point diameter and trapezius muscle thickness was found with 2 weeks of KT treatment added to exercise. This study provides information that ultrasonographic assessment for trapezius muscle can be used in the diagnosis and treatment follow-up of MPS. This could give clinicians a dependable and objective method to evaluate treatment response in myofascial pain.

AUTHORS' CONTRIBUTIONS

CMC: Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Software, Writing – original draft. **MDK:** Data curation, Formal analysis, Investigation, Methodology, Resources. **MC:** Data curation, Software, Writing – original draft. **FNK:** Conceptualization, Software, Writing – review & editing.

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