



Original Article

Pain-diminishing and quality of life-related outcomes of Kinesio taping in patients on non-steroidal anti-inflammatory drug therapy for post-thoracotomy pain syndrome

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ABSTRACT

Objectives: This study aims to evaluate pain-diminishing and quality of life-related outcomes of Kinesio taping in patients on non-steroidal anti-inflammatory drug (NSAID) therapy for post-thoracotomy pain syndrome (PTPS).

Patients and methods: Between February 2016 and May 2017, a total 60 patients (39 males, 21 females; median age 43.5 years; range, 18 to 76 years) with PTPS were included in this single-center, prospective, randomized study. The patients were randomized into two groups based on five-day pain management protocol including NSAIDs per se (NSAID group; n=30) and NSAIDs plus Kinesio taping (NSAID-KT group; n=30) groups. Pain intensity (via visual pain scale [VAS]), neuropathic pain (Leeds Assessment of Neuropathic Symptoms and Signs [LANSS] Pain Scale), major chronic pain symptoms (via Short-Form McGill Pain Questionnaire [SF-MPQ-2]), and quality of life (via Nottingham Health Profile [NHP]) were assessed before and after five-day treatment period.

Results: In both NSAID and NSAID-KT groups, treatment was associated with a significant decrease in the VAS-pain ($p<0.001$), LANSS Pain Scale scores (from median 8.0 to 3.0 and from median 18.5 to 15.0, respectively, $p<0.001$ for each), SF-MPQ scores ($p<0.001$), and physical mobility and pain domains of NHS ($p<0.001$ for each).

Conclusion: In conclusion, our study findings indicate no additional benefit of KT application on further amelioration of long-term PTPS in patients under NSAID analgesia. Both NSAID and NSAID-KT treatments produced a significant improvement in the VAS, LANSS, SF-MPQ scores, and in the quality of life after five-day treatment.

Keywords: Kinesiotaping, long-term, non-steroidal anti-inflammatory drug, pain, post-thoracotomy pain syndrome, quality of life.

Post-thoracotomy pain syndrome (PTPS) is a significant and relatively common complication of thoracic surgery which affects 21 to 61% of patients and may persist up to four to five years after surgery in 30% of patients.^[1-6] While the exact pathogenesis still remains unclear, cumulative evidence indicates PTPS to be a combination of neuropathic and non-neuropathic (myofascial) pain.^[4-8]

In current practice, pain control remains a challenge in the postoperative care in thoracic surgery which may necessitate the use of more than one form of therapy or complementary methods (i.e., acupuncture, transcutaneous electrical nerve

stimulation, or physical therapy) to control pain and minimize disability.^[6,9-16]

Kinesio taping (KT) is a method to support physiotherapy with application of an elastic tape to the skin which is specifically designed to facilitate the body's natural healing processes after trauma or inflammation by modifying the underlying soft tissue spaces.^[17] It is proposed to have several potential effects depending on the technique and degree of tape stretch.^[17] This involves alignment of the fascial tissues, creation of more space by lifting fascia and soft tissue above area of pain, sensory stimulation, and assisting in edema reduction by increasing the

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blood circulation and lymphatic drainage.^[17-19] In recent years, KT has become increasingly used as a method combined with other pharmacological and physiotherapeutic interventions in the management of sports injuries, postoperative complications, and pain problems including myofascial pain.^[12,18,19]

The use of KT as a measure to alleviate postoperative pain has been addressed only in a few trials, which indicated its efficacy in orthopedic, gastrointestinal, and thoracic surgery patients during early postoperative rehabilitation.^[12,13,18,20] Hence, there is a need for high-quality controlled studies to confirm the potential efficacy of KT on postoperative pain management combined with more traditional analgesic therapies.^[6,21]

To the best of our knowledge, there is no study to date which has addressed the utility of KT in patients with long-term PTPS. In the present study, therefore, we aimed to evaluate pain-diminishing and quality of life (QoL)-related outcomes of Kinesio taping in patients on NSAID therapy for PTPS.

PATIENTS AND METHODS

This single-center, prospective, randomized study was conducted at Yüzüncü Yıl University Faculty of Medicine between February 2016 and May 2017. A total 60 patients (39 males, 21 females; median age 43.5 years; range, 18 to 76 years) with PTPS for at least two weeks after the operation were included. All patients were randomized using the random number tables into two groups based on five-day pain management protocol

including NSAIDs per se (NSAID group; n=32) and NSAIDs plus Kinesio taping (NSAID-KT group; n=32) groups. *Exclusion criteria were as follows:* pediatric age, pregnancy, renal or hepatic dysfunction, presence of infection or open wound within the region to be taped, post-thoracotomy pain for shorter than two weeks, hypersensitivity to KT or NSAIDs, and recent use (within 4 weeks prior to enrolment) of NSAIDs. Final study population subjected to analysis was composed of 30 patients in each group with the exclusion of two patients (due to gastrointestinal adverse events and lost-to-follow up) in the NSAID group and two patients (due to allergic reaction) in the NSAID-KT group during the study period.

A written informed consent was obtained from each patient. The study protocol was approved by Yüzüncü Yıl University Faculty of Medicine Clinical Research Ethics Committee (Date: 28/02/2017; No. 01). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data collection

Data including patients' demographics (age and sex), anthropometrics, and duration of post-thoracotomy pain were recorded in each patient at the study enrolment. Pain intensity (via visual pain scale [VAS]), neuropathic pain (Leeds Assessment of Neuropathic Symptoms and Signs [LANSS] Pain Scale), major chronic pain symptoms (via Shortform McGill Pain Questionnaire [SF-MPQ-2]), and QoL (via Nottingham Health Profile [NHP]) were assessed before and after five-day treatment period.

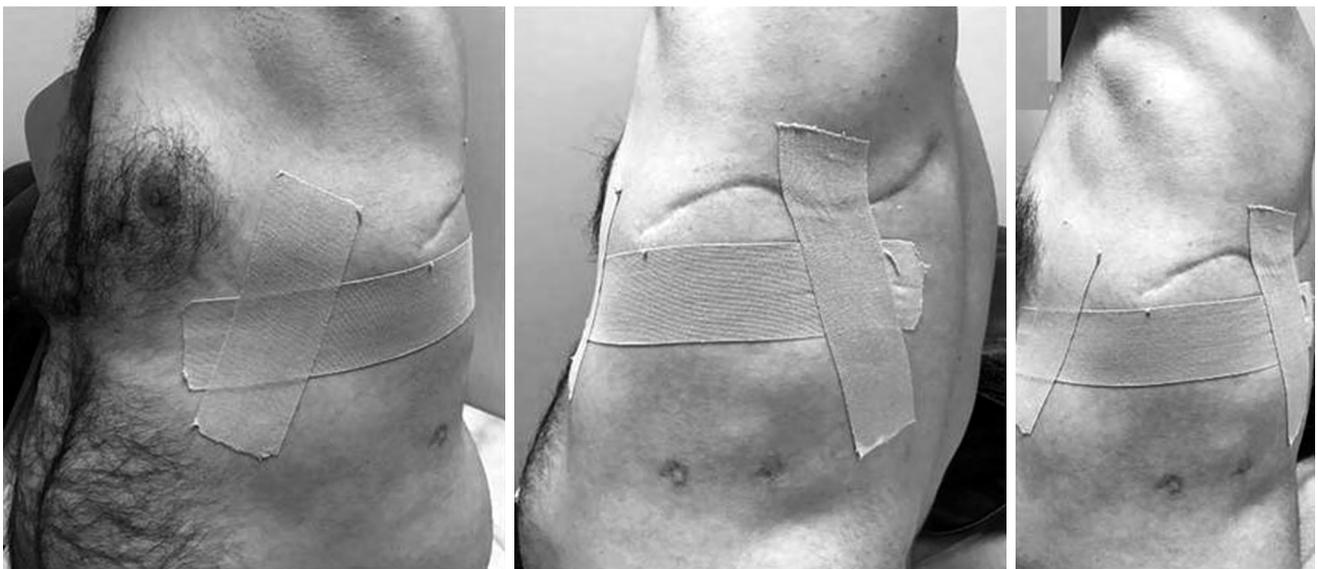


Figure 1. Kinesio taping application.

Kinesio taping

In the NSAID-KT group, Kinesio Tex Gold™ (Kinesio Holding Corp., Albuquerque, NM, USA), a 100% cotton, latex-free, 5-cm x 0.5-mm elastic tape was applied by a specialized physiotherapist to the chest skin in accordance with the principles and techniques described by Kase et al.^[17] Accordingly, KT was applied to the chest skin with two overlapping I-shape bands to decongest the main painful area by lifting up the underlying tissues and with 50% tension in the center of each strip. The I-shaped KT application was directly above the main pain trigger point (target area) identified by chest palpation (Figure 1). The patients received etodolac (600 mg/day) as the analgesic agent.

VAS-pain

The VAS-pain is a self-administered, unidimensional measure of pain intensity, which has been widely used in diverse adult populations. It is a continuous 100-mm scale anchored by two verbal descriptors for pain intensity, including “No pain” (score of 0) and “Worst imaginable pain” (score of 100 [100-mm scale]). It provides a range of scores from 0 to 100 with higher scores indicating greater pain intensity.^[22,23] In this study, the VAS-pain scores were assessed in different settings including resting, during deep breathing, coughing, and bending to the operated side.

LANSS pain scale

LANSS Pain Scale, developed by Bennett in 2001,^[24] provides immediate information on discrimination of neuropathic pain from nociceptive pain in the clinical setting. Total score of the scale is 24 with likelihood of neuropathic mechanisms indicated by scores ≥ 12 . The Turkish version of the LANSS Pain Scale has been validated by Yucel et al.^[25] in 2004.

SF-MPQ

The SF-MPQ, a shorter version of the MPQ developed by Melzack in 1987,^[26] is an interviewer-administrated, multidimensional measure of perceived pain in adults with chronic pain. It is comprised of 15-item Pain Rating Index, one item for the present pain intensity, and one item for a 10-cm VAS for the average pain.^[23,26] The pain Rating Index has two subscales including sensory subscale with 11 words or items and affective subscale with four words or items, each selected word is rated on an intensity scale from 0 (none) to 3 (severe). The total Pain Rating Index score is obtained by summing the item scores (range 0-45) with higher scores indicating the greater the pain levels. Scores on the present pain intensity range

from 0 to 5, while those on the VAS from 0 to 10.^[23,26] The Turkish version of the SA-MPQ was validated by Yakut et al.^[27] in 2007.

NHP

The NHP indicates the effect of ill-health on QoL.^[28] The 38 items in the NHP are divided into six domains: physical mobility (8 items), pain (8 items), sleep (5 items), fatigue (3 items), social isolation (5 items), and emotional reactions (9 items). Each domain is independently scored from 0 to 100 with higher scores indicating a poor health function in a particular domain. The QoL of respondents is calculated by generalizing the scores in six domains.^[28] The Turkish version of the NHS was validated by Kucukdeveci et al.^[29] in 1997.

Statistical analysis

According to the post-hoc power analysis, a sample size of 30 in each group achieves 89% power to detect a difference of 3.5 between the null hypothesis mean of 18.5 and the alternative hypothesis mean of 15.0 with a known standard deviation of 6.0 and with a significance level (alpha) of 0.05 using a two-sided one-sample.

Statistical analysis was performed using the SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive data were expressed in median (min-max) and number and frequency. The Pearson chi-square test was used to analyze categorical data, while the Mann-Whitney U and Wilcoxon tests were used to analyze numerical data between the treatment groups and change from baseline in each treatment group, respectively. The Power Analysis and Sample Size (PASS) software was used for power calculation using the LANSS Pain Scale scores as the variable. A *p* value of <0.05 was considered statistically significant.

RESULTS

Compared to the NSAID group, in the NSAID-KT group, the number of younger patients was significantly higher ($p=0.012$) and the number of patients with a longer (>8 weeks) duration of PTPS was significantly higher (63.3% vs. 36.7%, $p=0.020$) (Table 1).

In both NSAID and NSAID-KT groups, treatment was associated with a significant decrease in the VAS pain scores for all tested conditions ($p<0.001$ for each), with a significant decrease in the LANSS Pain Scale scores (from median 8.0 to 3.0 and from median 18.5 to 15.0, respectively, $p<0.001$ for each) and with a significant decrease in all subdomains of SF-MPQ

TABLE 1
Stimulus perception thresholds, maximum applied current intensity, and visual pain scale at maximum current intensity between groups

	Total (n=60)			NSAID group (n=30)			NSAID-KT group (n=30)			p			
	n	%	Median	Min-Max	n	%	Median	Min-Max	n		%	Median	Min-Max
Age (year)			43.5	18.0-76.0			49.0	21.0-76.0			40.5	18.0-62.0	0.012*
Gender													>0.05**
Female	21	35.0			10	33.3			11	36.6			
Male	39	65.0			20	66.7			19	63.4			
Weight (kg)			75.0	30.0-110.0			75.0	30.0-110.0			74.0	49.0-95.0	0.518*
Height (cm)			1.70	1.50-1.87			1.73	1.50-1.87			1.65	1.60-1.87	0.296*
Duration of post-thoracotomy pain													0.020**
2-8 weeks	31	51.7			20	66.7			11	36.7			
>8 weeks	29	48.3			10	33.3			19	63.3			

NSAID: NSAID per se; NSAID-KT: NSAIDs plus Kinesio taping; Min: Minimum; Max: Maximum; * Mann-Whitney U test; ** Pearson chi-square test.

($p < 0.001$ for each) (Table 2). In the pre-treatment period, the LANSS Pain Scale scores were >12 among 22 (73.3%) patients in the NSAID-KT group and in eight (26.7%) patients in the NSAID group. The NHS scores significantly decreased for physical mobility ($p < 0.001$), pain ($p < 0.001$), sleep ($p < 0.05$) and fatigue ($p < 0.05$) domains in the NSAID-KT group, but only for physical mobility and pain domains in the NSAID group ($p < 0.001$ for each) (Table 2).

In the pre-treatment period, the LANSS Pain Scale scores ($p = 0.001$) and SF-MPQ scores for affective subdomain ($p = 0.001$), present pain intensity ($p < 0.001$), and VAS for pain ($p = 0.010$) were significantly higher in the NSAID-KT group than in the NSAID group (Table 2). After five-day treatment, the LANSS Pain Scale scores ($p = 0.002$), SF-MPQ scores for affective subdomain ($p = 0.001$), and present pain intensity scores ($p = 0.049$) remained significantly higher in the NSAID-KT compared to the NSAID group, whereas VAS pain scores related to the SA-MPQ were similar after the treatment between NSAID and NSAID-KT groups, as were the VAS pain scores and NHP scores (apart from significantly lower values for physical mobility in NSAID-KT group, $p = 0.039$) (Table 2).

DISCUSSION

In the present study, we found that five-day NSAID therapy and NSAID plus KT protocol yielded similar efficacy on pain reduction in patients with PTPS (persistent for at least two weeks after the operation). The VAS-pain (for all conditions tested), SF-MPQ (for all domains), and LANSS Pain Scale scores were significantly improved in both groups. However, the impact of treatments on QoL seems to differ with respect to certain domains of NHL with significantly improved physical mobility and pain scores in both treatment groups, whereas improvement in only sleep and fatigue scores was seen in the NSAID-KT group.

Efficacy of KT in postoperative pain reduction was evaluated in a previous study including 92 patients undergoing lobectomy for lung cancer who were randomized to KT group (standard postoperative analgesia plus KT) or placebo-control group (standard postoperative analgesia plus usual dressing tape-mimicking KT).^[12] The authors found a greater postoperative pain reduction from Day 1 to Day 5 in the KT group than in controls (VAS -3 vs. -2), as well as significantly lower median VAS scores and less frequent persistence of moderate-to-severe intensity chest pain (VAS ≥ 3) in the KT treatment group (7% vs. 24%) at 30 days after lobectomy. In addition,

	TABLE 2 The impact of treatment on study parameters in terms of intra- and inter-group comparisons									
	Pre-treatment					Post-treatment				
	NSAID group (n=30)		NSAID-KT group (n=30)		p†	NSAID group (n=30)		NSAID-KT group (n=30)		p†
	Median	Min-Max	Median	Min-Max		Median	Min-Max	Median	Min-Max	
VAS pain scores										
Resting	3.0	0.0-9.0	4.5	0.0-10.0	0.358	2.0	0.0-6.0**	2.0	0.0-7.0**	0.415
Coughing	4.0	0.0-10.0	4.5	0.0-10.0	0.473	2.0	0.0-9.0**	2.5	0.0-8.0**	0.946
Deep breathing	4.0	0.0-10.0	4.0	0.0-10.0	0.852	2.0	0.0-7.0**	3.0	0.0-9.0**	0.707
Bending to operation side	4.0	0.0-10.0	5.0	0.0-10.0	0.434	2.0	0.0-7.0**	3.0	0.0-9.0**	0.405
Nottingham Health Profile										
Physical mobility	54.5	0.0-673.0	42.6	9.3-75.8	0.050	20.1	0.0-75.8**	9.9	0.0-75.8**	0.039
Pain	59.4	10.5-100.0	79.7	9.8-100.0	0.367	25.4	0.0-94.2**	24.1	0.0-100.0**	0.744
Sleep	54.9	0.0-87.4	39.5	0.0-77.6	0.719	12.6	0.0-84.4	12.6	0.0-77.6*	0.611
Fatigue	100.0	0.0-100.0	100.0	0.0-100.0	0.229	0.0	0.0-100.0	100.0	0.0-100.0*	0.298
Social isolation	0.0	0.0-100.0	0.0	0.0-100.0	0.628	0.0	0.0-100.0	0.0	0.0-100.0	0.899
Emotional reactions	6.9	0.0-100.0	10.5	0.0-100.0	0.644	0.0	0.0-100.0	10.5	0.0-100.0	0.084
LANSS pain scale score	8.0	0.0-24.0	18.5	0.0-24.0	0.001	3.0	0.0-19.0*	15.0	0.0-19.0**	0.002
Short-form McGill pain questionnaire pain rating index	8.0	2.0-22.0	11.0	1.0-26.0	0.242	3.5	0.0-15.0**	4.0	0.0-18.0**	0.278
Sensory aspects	2.0	0.0-7.0	5.0	0.0-10.0	0.001	0.0	0.0-5.0**	2.5	0.0-7.0**	0.001
Affective aspects	10.5	3-25.0	16.0	2.0-39.0	0.023	4.0	0.0-17.0**	6.0	0.0-24.0**	0.093
Total score										
Present pain intensity	3.0	1.0-5.0	4.0	1.0-5.0	< 0.001	1.0	0.0-4.0**	2.0	0.0-4.0**	0.049
VAS for pain	5.0	1.0-10.0	6.5	1.0-10.0	0.010	2.0	0.0-9.0**	4.0	0.0-8.0**	0.061

NSAID: NSAID per se; NSAID-KT: NSAIDs plus Kinesio taping; Min: Minimum; Max: Maximum; VAS: Visual pain scale; LANSS: Leeds Assessment of Neuropathic Symptoms and Signs; † Mann-Whitney U test (NSAID vs. NSAID-KT); * p<0.05 and ** p<0.001 compared to pre-treatment scores in the same group (Wilcoxon test).

the increased efficacy of KT on postoperative pain control was observed, when the patients discontinued intravenous/epidural analgesia and switched to less effective oral medications. Also, the observed outcome of one-point less VAS pain score in the KT group might be considered a small difference in a subjective reporting, while this enabled lesser need for supplemental analgesia and lower rate of moderate-to-severe chest pain (VAS ≥ 3) at 30 days after lobectomy in the KT group.^[12]

Our findings revealed a significant decrease in the VAS pain scores for all conditions tested after treatment in both NSAID (from 4.0-4.6 to 1.9-2.2) and NSAID-KT (from 4.5-5.0 to 2.6-2.7) treatment groups. This seems notable given the concomitantly improved QoL scores in physical mobility and pain domains in both groups. Hence, our findings support the consideration of one-point reduction in VAS scores to have a positive impact on patient QoL via decreased inhibition of painful movements and reduced need for additional pain killers.^[12,30] However, given that no superiority of NSAID-KT over NSAID was identified in terms of reduction in VAS pain scores, our findings seem to support the consideration of VAS score 3 to be the threshold of postoperative pain above which KT is ineffective as an auxiliary analgesic measure.^[12]

In a prospective, randomized-controlled study in 39 patients investigating the impact of KT on postoperative morbidity after median sternotomy, KT was considered to be a low-risk, non-pharmacological, cost effective, and promising method for control of early postoperative pain after median sternotomy.^[13] Since acute postoperative pain is considered amongst the strongest predictors of PTPS,^[5,31] the potential role of aggressive perioperative anesthetic and analgesic techniques has been suggested in reducing the incidence of PTPS.^[32]

A possible long-term effect of KT, albeit removed at hospital discharge, was reported on reduced late postoperative chest pain on postoperative Day 30 among lobectomy patients.^[12] Thus, adopting an aggressive multimodal perioperative pain management regimen and application of KT in the early postoperative period is considered likely to offer a favorable late effect to prevent PTPS.^[6,12,33] On the other hand, our findings seem not to indicate KT application as an effective auxiliary technique to ongoing NSAID analgesia in further reduction of long-term/chronic PTPS, although there is a possibility of better improvement in sleep and fatigue-related QoL scores with the application of KT.

Nonetheless, there are some limitations to this study. First, relatively low sample size might prevent us to achieve the statistical significance concerning the KT application in terms of pain-related parameters as well as to generalize our findings to the entire population. Second, while the duration of pain and patient age differed significantly at baseline between the treatment groups, no significant difference was observed in the LANSS scores according to duration of pain (2-12 weeks vs. >12 weeks) before and after treatment in both KT and NSAID groups. Hence, alongside the likelihood of age-independent variability of postoperative pain previously reported in the literature,^[34] these baseline differences seem not to refer to a significant source of bias for the current study. Third, the lack of a placebo/sham group as well as lack of data on long-term efficacy is another limitation which, otherwise, would extend the knowledge achieved in the current study. However, all thoracotomy operations were performed in a single institution by members of the same surgical team, and randomization and tape application were performed by a single specialized physiotherapist which revealed a homogeneous and unbiased management.

In conclusion, our findings indicate no additional benefit of KT application on further amelioration of long-term post thoracotomy pain in patients under NSAID analgesia. In the present study, both NSAID and NSAID-KT treatments revealed a significant improvement in VAS, LANSS, and SF-MPQ scores as well as in the QoL after five-day treatment. Future large-scale, prospective, randomized-controlled studies are needed to address the efficacy of KT application in the early postoperative period in prevention of PTPS and its efficacy in amelioration of persistent long-term post-thoracic pain, particularly in combination with oral analgesics effective on neuropathic component of pain.

Declaration of conflicting interests

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