





Can Kinesiotaping Reduce Pain in Rib Fractures?: A Randomized Prospective Study

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Introduction: The aim of this study is to investigate the effect of kinesiotaping on pain scores in patients with rib fractures following isolated thoracic trauma.

Materials and Methods: In this randomized prospective study, patients with isolated thoracic trauma and rib fractures were randomized into kinesiotaping and control groups between January 24, 2024, and October 1, 2024. Patients in the control group received standard analgesic treatment. In the kinesiotaping group, kinesiotaping bands were applied in addition to the standard treatment. Pain scores using the visual analog scale (VAS) were recorded at admission, the 24th hour, the 4th day, and the 7th day, and the results were statistically compared.

Results: A total of 118 patients were evaluated. Eighty-four patients did not meet the inclusion criteria. The 34 patients included in the study were randomized into kinesiotaping and control groups. The two groups were demographically homogeneous. On the 4th day, the mean VAS score was significantly lower in the kinesiotaping group (2.7 ± 1.2) compared to the control group (4.1 ± 1.9) ($p = 0.037$). No statistically significant difference in VAS scores was observed on the other days.

Conclusion: In patients with rib fractures, pain scores decreased more rapidly in those treated with analgesics plus kinesiotaping compared to those treated with analgesics alone.

Trial Registration: ClinicalTrials.gov, NCT06222320. Registered on January 15, 2024.

Keywords: rib fracture, pain, visual analog scale, kinesiotaping



Introduction

Thoracic trauma is common, and approximately 90% of all thoracic traumas are blunt traumas.¹ In blunt thoracic traumas, the most frequently fractured bones are the ribs.¹ Rib fractures are associated with acute and chronic pain, loss of work capacity, hemothorax, pneumothorax, pneumonia, and mortality.² Rib fixation is indicated in cases of multiple rib fractures, where the stability of the thoracic wall is compromised, or when flail chest deformity causes paradoxical breathing. Surgical treatment is associated with longer hospital stays and higher costs.³ Conservative treatment is standard in uncomplicated rib fractures, with the goal of controlling pain and respiratory secretions.

Studies have shown that pain control using epidural analgesia, thoracic erector spinae block, or paravertebral block in rib fractures can reduce mortality.⁴⁻⁷ In the last decade, kinesiotaping has gained popularity as a method for managing pain associated with rib fractures. This technique was developed five decades ago by Kenzo Kase, drawing inspiration from traditional Japanese medicine.⁸ In kinesiotaping, a waterproof, elastic tape is applied to the patient's skin. The tape is made of polymer elastic threads wrapped in 100% cotton fibers, nearly the same thickness as the epidermis, which helps to wick away moisture. The tape contains no medication, and its adhesive is activated by body heat. Theoretically, this method works through the gate control mechanism.⁹ The gate control mechanism suggests that stimulation of thick Aβ sensory fibers from peripheral touch receptors suppresses pain signal transmission in the same area of the body.¹⁰ Additionally, kinesiotaping increases blood and lymphatic circulation and reduces muscle tension in the applied area.¹¹

In recent years, conflicting results have been reported regarding the effectiveness of kinesiointaping for conditions such as rotator cuff-related shoulder pain,¹² chronic wrist instability in athletes in sports like soccer, basketball, and volleyball,^{13–16} carpal tunnel syndrome,¹⁷ and thoracic trauma.^{18,19} However, the literature on kinesiointaping for thoracic trauma is extremely limited. In the US National Library of Medicine (NLM) database, two original articles on this topic were identified. In the study by Bakker et al,¹⁸ the effectiveness of kinesiointaping was investigated in a randomized prospective design. Nevertheless, the patient population in this study consisted of a heterogeneous group, with 6% of the patients having rib fractures. The other original article was conducted prospectively on patients with isolated rib fractures; yet, randomization was not applied.¹⁹

The aim of this study is to investigate the effect of kinesiointaping on pain scores in patients with rib fractures following isolated thoracic trauma, in a randomized and prospective manner.

Materials and Methods

Study Design

This randomized prospective study was conducted in the thoracic surgery department of our hospital between January 24 and October 1, 2024. Ethical approval was obtained from the university's clinical ethics committee with the reference number 2023-KAEK-181 before the study began. The study was registered on ClinicalTrials.gov with the registration number NCT06222320 on January 15, 2024. The study was conducted in compliance with the Declaration of Helsinki.

Patient Selection

Adult patients with rib fractures resulting from acute isolated thoracic trauma were included in the study.

Patients with multiple traumas, an Injury Severity Index (ISI) >16, a Glasgow Coma Scale (GCS) <15, those who presented to the hospital more than 24 hours after the trauma, patients with fractures in the first three ribs, patients with hemothorax and/or pneumothorax requiring intervention, patients referred from other institutions, and those with cognitive or language impairments were excluded from the study.

Patients were recruited by the responsible investigator. The study protocol was explained to the patients verbally, and a visual summary of the study was also shown. Patients who signed the informed consent form were included in the study. The “integer generator” tool of the random.org website was used to create randomization blocks. Patients were randomly assigned to the “kinesiointaping” and “control” groups using these blocks.

Interventions and Measurement Method

In the control group, standard IV analgesic medications were administered, including paracetamol 1000 mg three times a day and dexketoprofen 50 mg twice a day. If necessary, tramadol 100 mg was administered. The same medical treatments were applied to the kinesiointaping group as well. Pain scores were measured using the visual analog scale (VAS). VAS scores were measured face-to-face at the time of admission, at 24 hours, on the 4th day, and on the 7th day. Measurements were conducted in the emergency room, clinic, and outpatient clinic by the ward nurse or the responsible investigator. Participants were presented with an assessment scale featuring facial expressions to express their pain levels. This scale was designed so that each facial expression represented a specific level of pain.²⁰ On the scale, a “smiling face” indicated no pain, while a “very sad face” represented unbearable pain. Participants were asked to select the facial expression that best represented their current pain level.

The treatment protocol used in this study was developed by the authors based on current studies and practices in the literature.^{18,19} The kinesiointaping technique was consistently applied by a single expert physiotherapist. Kinesiointaping was performed within the first 24 hours after the trauma. First, the painful area was identified and marked (Figure 1a). The patient's arm on the treated side was raised to ensure that the skin in the painful area was taut. If the area was moist, it was dried, and if there was hair, it was shaved. Two parallel strips of tape were applied (Figure 1b). No additional tension was applied to the skin during the application. Then, two more strips of tape were applied with 50% tension, surrounding the painful area (Figure 1c) (Figure 2). After the tape was applied, it was rubbed for a few seconds to activate the adhesive. The patient was instructed on how to remove the tape and was informed that it would be removed



Figure 1 Kinesioteaping technique. (a): The treatment area is being marked. (b) and (c): Kinesioteaping strips are being applied.



Figure 2 Image of a patient with kinesioteaping applied.

after four days. Since kinesioteaping strips can remain on the skin for 3–5 days without compromising adhesive quality, the strips were removed on the 4th day in patients. No re-taping was performed afterward. No experimental intervention was performed after the fourth day.

Complications were systematically monitored through daily clinical evaluations, routine laboratory tests, and scheduled radiological assessments to ensure accuracy and consistency in data collection. Hemothorax was diagnosed based on a decrease in hemoglobin levels and the presence of newly developed pleural effusion, primarily assessed via posterior-anterior chest radiographs. When required, thoracic ultrasound was used for confirmation. Pneumonia was diagnosed using criteria including a body temperature $\geq 38^{\circ}\text{C}$, purulent sputum, typical pneumonic infiltrates observed on chest radiographs, and leukocytosis ($\geq 10,000/\text{mm}^3$). Atelectasis was diagnosed based on typical findings observed on chest radiographs, with confirmation by computed tomography (CT) when deemed necessary.

Outcome Measures

The primary outcome measure of the study is the VAS scores on the 4th day post-trauma in both groups. Since the Kinesio tapes were removed after 4 days, this value was determined as the primary outcome variable.

The secondary outcome variables of the study were complications that developed in the patients, the length of hospital stay, and the Visual Analog Scale (VAS) scores assessed on the 1st and 7th days.

Statistical Analysis

Categorical data were presented as numbers and percentages, while continuous data were expressed as means and standard deviations (SD). The Independent Samples *T*-test and the Mann–Whitney *U*-test were used to compare continuous variables. The Chi-square and Fisher’s exact tests were used to analyze categorical data. A *p*-value of <0.05 was considered statistically significant. The sample size was calculated using a web-based application (ClinCalc LLC, 2024) prior to the initiation of the study. With 80% power and an alpha level of 0.05, the sample size was determined to be 16 patients for each group. Statistical analyses were performed using IBM SPSS Statistics version 23.0 (IBM Corporation, Armonk, NY, USA).

Results

A total of 118 patients were evaluated during the study period (Figure 3). Of these, 84 patients were excluded based on specific criteria. The reasons for exclusion were as follows: 34 patients were excluded due to having multiple trauma, 21 patients were excluded because their hospital admission occurred more than 24 hours after the traumatic event, and 13 patients were excluded because their Injury Severity Index (ISI) was greater than 16. Additionally, 5 patients were excluded due to fractures in the first three ribs, 5 patients were excluded because they had a Glasgow Coma Scale (GCS) score of less than 15, and 2 patients were excluded due to being referred from external centers. Two more patients were excluded because they had a chest tube inserted, one patient was excluded as they were incapacitated due to being deaf and mute, and another patient declined to participate. All patients completed the study.

After applying these exclusion criteria, 34 patients remained eligible for the study. These patients were randomly assigned to either the kinesiotope group ($n=17$) or the control group ($n=17$). All patients completed the study.

The mean age was 58.5 ± 19.3 years in the kinesiotope group and 58.8 ± 13.5 years in the control group, with no statistically significant difference ($p=0.951$). The baseline demographic data for both groups are summarized in Table 1.

No statistically significant differences were found between the two groups in terms of laboratory and biochemical test results (Table 2).

The mean VAS score at the 24th hour was 4.6 ± 1.7 in the kinesiotope group and 4.5 ± 1.9 in the control group, with no statistically significant difference ($p = 0.786$) (Table 3). However, on the 4th day, the mean VAS score was significantly lower in the kinesiotope group (2.7 ± 1.2) compared to the control group (4.1 ± 1.9), showing

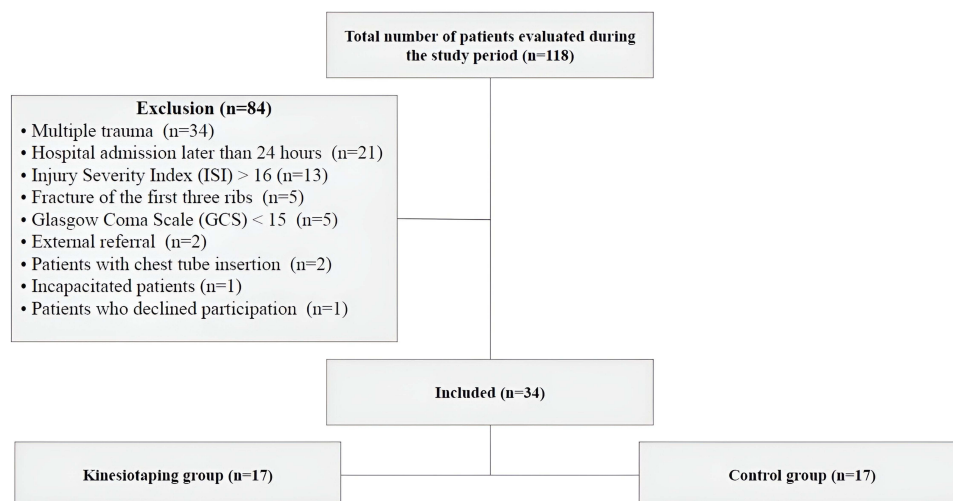


Figure 3 Patient Selection.

Table 1 Baseline Demographic and Clinical Characteristics of the Kinesiotaping and Control Groups

	Kinesiotaping (n=17)	Control (n=17)	P value
Age, years	58.5 ± 19.3	58.8 ± 13.5	0.951 ^a
Height, cm	169.7 ± 10.3	167.4 ± 7	0.491 ^a
Weight, kg	75.9 ± 17.5	74 ± 14.2	0.756 ^a
Male, n (%)	14 (82,4)	12 (70,6)	0.688 ^b
Trauma Mechanism			0.468 ^c
Motor Vehicle Accident, n (%)	5 (31,3)	3 (17,6)	
Fall, n (%)	10 (62,5)	11 (64,7)	
Others, n (%)	1 (6,3)	3 (17,6)	
Smoking Status			0.088 ^c
Yes, n (%)	6 (40)	3 (20)	
No, n (%)	4 (26,7)	10 (66,7)	
Ex-smoker, n (%)	5 (33,3)	2 (13,3)	
Smoking History, p/y	19.7 ± 25.4	12.7 ± 27.7	0.106 ^d
Injury Severity Index Score	6.4 ± 2.5	7.4 ± 3.3	0.563 ^d
Fractured Ribs, n	2.9 ± 1.2	3.4 ± 1.2	0.540 ^d

Notes: ^aIndependent samples t-test. ^bChi-square test with Fisher's correction. ^cPearson correction. ^dMann Whitney U-test.

Table 2 Laboratory and Biochemical Parameters of the Kinesiotaping and Control Groups

	Kinesiotaping (n=17)	Control (n=17)	P value
Hgb, g/dl	13,5 ± 1,3	12,8 ± 1,2	0,107 ^a
WBC × 10 ³ /μL	11,3 ± 5	10,6 ± 4,2	0,760 ^b
PLT × 10 ³ /μL	234,1 ± 53	241,9 ± 49,5	0,657 ^a
Creatinin, mg/dl	0,9 ± 0,2	0,9 ± 0,2	0,929 ^b
AST, IU/L	32,8 ± 21,3	38,2 ± 23,6	0,488 ^b
ALT, IU/L	21,9 ± 11,9	24,6 ± 13	0,657 ^b
INR	1,1 ± 0,1	1,1 ± 0,1	0,967 ^a

Notes: ^aIndependent samples t-test. ^bMann Whitney U-test.

Abbreviations: Hgb, hemoglobin; WBC, white blood cell; PLT, platelet; AST, aspartate aminotransferase; ALT, alanine aminotransferase; INR, international normalized ratio.

a statistically significant difference ($p = 0.037$) (Figure 4). By the 7th day, the mean VAS score was 2.6 ± 1.4 in the kinesiotaping group and 2.5 ± 0.9 in the control group, with no statistically significant difference ($p = 0.794$).

Complications were reported in 4 patients (23.5%) in the kinesiotaping group and in 3 patients (17.6%) in the control group, with no statistically significant difference ($p = 1$). In the kinesiotaping group, three patients developed hemothorax, which was not present at admission, and one patient developed atelectasis. In the control group, one patient

Table 3 Clinical Outcomes in the Kinesiotaping and Control Groups

	Kinesiotaping (n=17)	Control (n=17)	P value
Admission VAS Score	6,5 ± 1,1	6,4 ± 1,6	0,946 ^a
24th Hour VAS Score	4,6 ± 1,7	4,5 ± 1,9	0,786 ^a
4th Day VAS Score	2,7 ± 1,2	4,1 ± 1,9	0,037 ^a
7th Day VAS Score	2,6 ± 1,4	2,5 ± 0,9	0,794 ^a
Admission Time (days)	2,9 ± 1,4	2,3 ± 1,2	0,205 ^a
Complications (n)	4 (23,5)	3 (17,6)	1 ^b

Notes: ^aMann Whitney U-test. ^bChi-square test with Fisher's correction.

Abbreviation: VAS, visual analog scale.

developed both hemothorax and pneumonia (neither present at admission), one patient developed atelectasis, and another developed isolated pneumonia. None of the complications required invasive intervention, and antibiotic therapy was initiated for the patients with pneumonia.

Out of the 34 patients included in the study, only 1 patient required a total of 200 mg of IV tramadol, administered in 2 doses during hospitalization. The patient who needed to use tramadol was in the Kinesiotaping group. Aside from this, none of the patients required the use of opioid medications, either during their hospital stay or after discharge.

Discussion

In this study, it was found that pain scores were significantly lower on the 4th day in patients who received kinesiotaping after rib fractures. Additionally, kinesiotaping did not increase the length of hospital stay or complications.

Pain control is of primary importance in reducing pulmonary complications associated with rib fractures.²¹ It is well known that pain tends to decrease after the first two weeks of a rib fracture.²² Therefore, pain management is especially crucial during the acute phase. Various adjunctive methods are frequently investigated to provide early pain control in rib fractures alongside standard analgesic treatments. Kinesiotaping is one of the techniques used in the acute period to reduce pain from rib fractures. However, the literature on the application of kinesiotaping for rib fractures is limited.

In a case report by Köseoğlu Tohma et al,²³ a 74-year-old frail patient with a fourth rib fracture developed after a sudden trunk rotation was treated with kinesiotaping. The patient's pain was reported to have decreased following the application of kinesiotaping.

In the study by Akça et al, 30 patients with isolated rib fractures were prospectively examined.¹⁹ However, randomization was not applied, and the study focused on patients presenting to the emergency department without an indication for hospitalization, who were followed as outpatients. In this study, pain scores at the 15th minute and on the

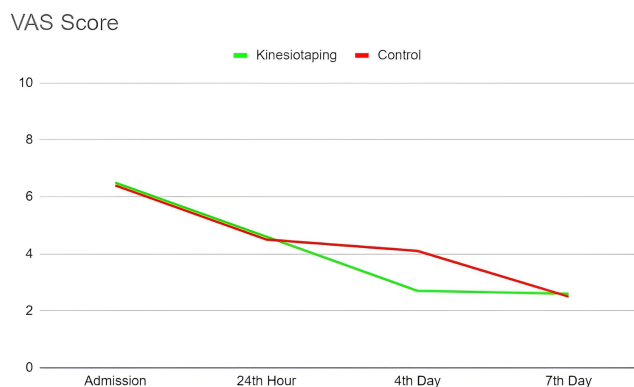


Figure 4 Comparison of VAS Scores Between Kinesiotaping and Control Groups.

4th day were significantly lower in the kinesiotopeing group compared to the control group. Unlike this study, our research focused on a population of hospitalized patients with an indication for admission, the patients were randomized, and detailed blood tests were compared. Similar to Akça's study, we also found lower pain scores on the 4th day in the kinesiotopeing group.

In the randomized prospective study by Bakker et al, 57 patients completed the study.¹⁸ A more heterogeneous group of patients with shoulder and chest pain was selected. Only 6% of the randomized patients had a rib fracture, with the majority having a proximal humerus fracture (54.2%). In this study, pain scores were lower in the kinesiotopeing group on the 4th day compared to the control group. However, unlike Akça's study, no statistically significant difference in pain scores was found at the 15th minute. In our study, no measurement was taken at the 15th minute. The first measurement post-kinesiotopeing was performed at the 24th hour. We found no significant difference in pain scores between the groups at the 24th hour.

Dedeoglu et al compared kinesiotopeing plus sling with sling alone in clavicular shaft fractures.²⁴ In this randomized prospective study, the time to return to work was significantly better in the kinesiotopeing group. Constant score and American Shoulder and Elbow Surgeons (ASES) score were also better in the kinesiotopeing group. This group showed better clinical functional outcomes and higher union rates.

In the randomized controlled single-blind study by Horoz et al, kinesiotopeing was reported to reduce swelling and pain while improving functionality in distal radius fractures.²⁵ In the study by Guasconi et al, the potential effect of kinesiotopeing on reducing swelling in wrist fractures was investigated.²⁶ In this clinical trial, which included a small patient population of 23 participants, it was reported that although not statistically significant, kinesiotopeing might have a potential benefit in reducing swelling in the wrist by day 7.

Limitations

The study was conducted at a single center and involved patients who presented over a relatively short period of nine months. Additionally, there was only one thoracic surgeon working at the hospital at the time the study began. On days when the thoracic surgeon was on leave, patients were either referred to external centers or followed on an outpatient basis. As a result, some patients could not be evaluated for inclusion in the study. Moreover, none of the patients included in the study underwent rib fixation. Therefore, the effect of kinesiotopeing in patients who receive rib fixation remains unknown. Another limitation of the study is the lack of blinding, which may have introduced bias into the evaluation of the outcomes.

Conclusion

The study demonstrated that patients who received kinesiotopeing experienced a faster reduction in pain scores compared to those who were treated with analgesics alone.

Kinesiotopeing has minimal cost, is well-tolerated by patients, and can be easily applied in clinical practice, both for hospitalized patients and during outpatient follow-ups in the emergency department.

In the future, studies with larger patient populations, conducted in multiple centers, and utilizing blinding are needed.

Data Sharing Statement

The raw data of the study can be shared upon reasonable request. The following anonymized patient data can be shared: age, gender, height, weight, smoking status, anticoagulant status, type of trauma, ISI score, number of fractured ribs, hemogram and biochemistry parameters, pain scores, complications, and length of hospital stay. These data will be shared indefinitely via a permanent DOI link. For access to the data, the responsible researcher can be contacted via Email at: drismaildal@gmail.com.

Ethics Approval

Before the start of the study, approval was obtained from Kastamonu University Clinical Research

Ethics

Committee with the number 2023-KAEK-181.

Consent to Participate

Yes.

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Disclosure

The researchers participating in the study do not have any conflict of interest.

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