

*ORIGINAL ARTICLE*

## **Kinesiotaping Effects on Shoulder Pain, Mobilization and Functional Capacity in Leisure Basketball Athlete**

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### **ABSTRACT**

**Introduction:** Shoulder pain is a common issue among basketball players and it can decrease their range of motion (ROM) and overall upper limb functional ability. Kinesiotaping modulates pain mechanoreceptors on the skin and thus can reduce pain and improve shoulder ROM.

**Methods:** This study aims to evaluate the effects of KT application on the severity of pain, shoulder mobilization, and functional ability of the upper limb in leisure basketball players. Quantitative quasi-experimental method with intervention design in 32 basketball leisure athletes was used. Pain was assessed by using the 100mm Numeric Rating Scale instrument, shoulder flexion and abduction were measured using a goniometer and the Shoulder Pain & Disability Index (SPADI) instrument was used to assess upper limb functional ability.

**Results:** There was a significant decrease in shoulder pain (4.78±0.79 to 2.90±1.42 on day 5, p= 0.05), and an increase in flexion and abduction (on day 5, p=0.05 for flexion and p=0.05 for abduction). There was also a significant increase (p =0.05) in upper limb functional ability after the intervention.

**Conclusion:** KT application shows benefits in decreasing shoulder pain and increasing shoulder mobilization and functional ability of upper limb during first 3<sup>rd</sup> day until 5<sup>th</sup> day application.

**Keywords:** functional abilities, kinesiotaping, mobilization, pain, shoulder joint

## ABSTRAK

**Pendahuluan:** Sendi bahu mempunyai peran yang besar pada kemampuan fungsional seseorang. Nyeri bahu merupakan hal yang umum ditemukan pada pemain basket karena pergerakan berulang. Nyeri berdampak pada berkurangnya rentang luas gerak sendi (LGS) dan kemampuan fungsional alat gerak atas secara keseluruhan. *Kinesiotaping (KT)*, memodulasi mekanoresptor nyeri pada kulit, sehingga menurunkan nyeri dan memperbaiki rentang LGS bahu.

**Metode:** Penelitian ini berusaha mengetahui efek aplikasi KT pada nyeri, mobilisasi sendi (fleksi dan abduksi) dan kemampuan fungsional alat gerak atas pada atlet rekreasional basket. Metode *quantitative quasi-experimental* dengan rancangan intervensi dipergunakan pada 32 pebasket. Skala nyeri dinilai dengan instrumen 100mm *Numeric Rating Scale*, mobilisasi bahu diukur dengan goniometer serta *Shoulder Pain & Disability Index* untuk menilai kemampuan fungsional alat gerak atas.

**Hasil:** Terdapat penurunan bermakna tingkat nyeri (pada hari ke 5,  $p = 0,05$ ), peningkatan fleksi (pada hari ke 5,  $p = 0,05$ ) dan abduksi (pada hari ke 5,  $p = 0,05$ ). Kemampuan fungsional alat gerak atas mengalami peningkatan bermakna ( $p = 0,05$ ).

**Kesimpulan:** Aplikasi KT menurunkan nyeri, meningkatkan mobilisasi sendi serta kemampuan fungsional alat gerak atas untuk aplikasi pada hari ke 3 hingga hari ke 5.

**Kata Kunci:** kemampuan fungsional, kinesiotaping, mobilisasi, nyeri, sendi bahu.

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## INTRODUCTION

Shoulder pain is a common musculoskeletal disorder, and it is reported as one of the five top ranks as musculoskeletal complaint and second most common pathology following lower back pain.<sup>1,2</sup> Population surveys show shoulder pain affects 18-26% of adults at any point in time and can be seen as a persistent symptom that is associated with disability

that may lead to difficulty in doing daily life, work, and leisure activities.<sup>1,3</sup>

Risk factors that affect the incidence of shoulder pain can be classified as non-occupational (such as gender, obesity, older age, coexisting medical disorder, and psychological factors) and occupational risk factors (activities that involve repetitive overhead action).<sup>3,4</sup> Athletes who practice throwing above the head, like basketball, present a higher probability of developing shoulder injuries, it is because the motion of throwing involves this joint to be a part of the main gesture. The overhead throwing motion generates tremendous demand on the glenohumeral joint at excessively high angular velocities.<sup>5,6</sup>

Management of shoulder pain varies greatly based on the time and severity of the disease. The treatment goal is to relieve pain, reduce

inflammation, prevent muscle atrophy, and restore the motion of joints without pain. Some modalities can be used as additional therapy, one of them is the use of taping.<sup>7,8</sup> The underlying mechanisms of taping effects are still unclear. Clinical research in a systematic review showed the effectiveness of KT in reducing pain and improving joint motion, restoring joint kinematics, improving lymphatic circulation, and improving proprioception.<sup>7,9</sup> Gate control theory, being the most described so far, justifies the hypoalgesic effect; and the effects were only found in short term (24 hours to 1 week).<sup>8</sup>

Kinesiotaping has now been widely used in various injuries involving the musculoskeletal structure as both means of treatment and prevention, but only a few studies show significant results with inadequate study methodology.<sup>9</sup> Study on the effect of KT in shoulder pain, range of motion, and upper limb function is still limited. Recent studies indicate that KT may provide some short-term gains (effects produced by KT up to 24 hours after the application) with respect to pain and range of motion (ROM) of the shoulder, and so this study aims to investigate the effect of KT on the severity of pain, shoulder pain-free movement and functional activity in medium-term effects (effects produced by KT 24 hours to 1 week after KT application) in shoulder pain subjects.<sup>10</sup>

## METHODS

A quantitative quasi-experimental method with consecutive sampling method was done to 32 participants at the C-Tra Arena Basketball Court, Dago Stamford International School Basketball Court, Basketball Cemara - Soekarno Hatta

School Basketball Court, and Antapani Basketball Court from February until September 2017.

Male subjects who complained of shoulder pain within an age range of 20-30 years old, have a history of shoulder pain accompanied by the decrease of motion in the shoulder joint, able to follow oral instructions, and signed approval to participate in the study were included. Subjects were excluded if they had a history of arthritis that causes recurrent inflammation or upper extremity surgery. Subjects will be dropped out if they are allergic to KT, have a recurrent injury in the same shoulder that KT is being applied to, and if KT application was loose or accidentally peel off during the study. Subject characteristics including age, gender, pain severity, shoulder flexion and abduction range of motion, and functional ability of the upper limb were taken through history taking and physical examination. Pain severity data were collected using a 100 mm (0-10 score) of Numeric Rating Scale (NRS), with the number 0 indicating no pain and the number 10 meaning the most intense pain that the subject felt. The shoulder joint range of motion (ROM) was taken using a goniometer. Subjects were asked to stand, flex and abduct their arms until the end range of motion. Data of the upper limb functional ability were collected using the score of Shoulder Pain & Disability Index (PADI) questionnaire.

The tape that was used is Kinesiotaping, which was applied by a researcher that has been certified for KT application, with the "I strip" method on the shoulder of the subjects (Figure 1), with 0% tension of the tape. Data of NRS score, ROM of shoulder joint (flexion and abduction), and score of SPADI were taken on 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> day after KT application.



**Figure 1. Kinesiotaping Application**

Distribution of numerical data were calculated using Shapiro-Wilk test. Significance of pre and posttest intervention was determined

using t test and Wilcoxon test, with  $p \leq 0.05$  is considered as statistically significant. The data processed using SPSS version 24.0 for Windows. This study was done after having permission from Health Research Ethics Committee Faculty of Medicine Universitas Padjadjaran Bandung with Registration Number 0317101100.

## RESULTS

Thirty-two subjects were participating with not normally distributed data on all variables with no significant differences ( $p \leq 0.05$ ) on the NRS, ROM and SPADI score before and after 1<sup>st</sup> day of application (Table 1), but showed statistically significant decrease of pain, increase ROM of shoulder joint and upper limb functional after 3<sup>rd</sup> and 5<sup>th</sup> day of KT application (Tables 2 and 3).

**Table 1. Comparison of Pain Severity, Shoulder Range of Motion and Upper Limb Functional Ability Before and After 1st day KT Application**

Variables	Before Application N= 32	1 <sup>st</sup> day N= 32	p value
<b>Pain Scale (NRS)**</b>			0.157
Median	5.00	5.00	
Range (min-max)	3.00-6.00	2.00-6.00	
<b>Flexion (Degree)**</b>			1.000
Median	110.00	110.00	
Range (min-max)	66.00-177.00	66.00-177.00	
<b>Abduction (Degree)**</b>			1.000
Median	121.50	121.50	
Range (min-max)	64.00-178.00	64.00-178.00	
<b>SPADI (Figure)**</b>			1.000
Median	62.00	62.00	
Range (min-max)	32.00-89.00	32.00-89.00	

\*\*: data is not normally distributed

**Table 2. Comparison of Pain Severity, Shoulder Range of Motion and Upper Limb Functional Ability Before and After 3<sup>rd</sup> day KT Application**

Variables	Before Application N= 32	1 <sup>st</sup> day N= 32	p value
<b>Pain Scale (NRS)**</b>			0.00*
Median	5.00	4.00	
Range (min-max)	3.00-6.00	1.00-6.00	
<b>Flexion (Degree)**</b>			0.00*
Mean±STD	120.00±30.56	133.31±28.92	
Range (min-max)	66.00-177.00	57.00-180.00	
<b>Abduction (Degree)**</b>			0.00*
Median	121.50	139.50	
Range (min-max)	64.00-178.00	78.00-180.00	
<b>SPADI (Figure)**</b>			0.00*
Median	62.00	50.00	
Range (min-max)	32.00-89.00	9.00-88.00	

\*: p≤0.05 = statistically significant; \*\* : data not normally distributed; \*\*\* : data normally distributed

**Table 3. Comparison of Pain Severity, Shoulder Range of Motion and Upper Limb Functional Ability Before and After 5<sup>th</sup> day KT Application**

Variables	Before Application N= 32	5 <sup>th</sup> day N= 32	p value
<b>Pain Scale (NRS)**</b>			0.000*
Median	5.000	3.000	
Range (min-max)	3.00-6.00	0.00-5.00	
<b>Flexion (Degree)**</b>			0.000*
Median	110.00	152.00	
Range (min-max)	66.00-177.00	60.00-180.00	
<b>Abduction (Degree)**</b>			0.000*
Median	121.50	164.00	
Range (min-max)	64.00-178.00	88.00-180.00	
<b>SPADI (Figure)**</b>			0.000*
Median	62.00	36.00	
Range (min-max)	32.00-89.00	0.00-86.00	

Note: The sign \* indicates a value of p≤0.05 which means significant or statistically significant. The \*\* sign indicates that the data is not normally distributed.

## DISCUSSION

Shoulder injuries are common in athletes, the complexity of shoulder girdle function contributes to the variety of injury types, any of which may be associated with restriction of glenohumeral ROM.<sup>11</sup>

Management of shoulder pain is varied based on its etiology. Kinesiotaping is currently used in clinical practice in conjunction with other modalities and therapy. According to its creator, KT provides (1) correction of muscle function by strengthening weak muscles; (2) cutaneous stimulation, which facilitates movement limitation; (3) aid in the reduction of edema by directing exudates toward the lymphatic duct and the lymph nodes; (4) correction of joint positioning for easing muscle spasms; and (5) reduction of pain by neural pathways.<sup>12</sup>

This study found that the application of KT in shoulder pain significantly reduced pain severity by NRS score after the 3rd day of application (Table 3 and 4). The effect of KT in reducing shoulder pain in this study supports the result of the studies done by Thelen et al. and Kaya et al. that suggests that KT has an immediate effect on relieving shoulder pain.<sup>7,13</sup> Some hypotheses were made to understand how KT provides pain relief. One hypothesis is that the cutaneous stretch stimulation provided by KT may interfere with the transmission of mechanical and painful stimuli.

KT may provide afferent impulses, facilitate pain inhibitory mechanisms (gate control theory) and pain reduction. Gate control theory is an act done by increasing "afferent

feedback" through the mechanoreceptors on the skin that will send tactile signals through fast-conducting fibers (A $\beta$ ), performing synapses with inhibitory interneurons when reaching the Ronald's Gelatinous Substance (posterior horn of the spinal cord), causing the closure of the gate and not allowing the passage of notion sensory stimulus (C and A $\delta$  fibers).<sup>14</sup> The tape also provides sensorimotor feedback that only allows movements that cause minimal mechanical irritation of the tissues; hence less pain occurs. In this regard, using three KT stripes in this study, the same protocol in the study done by Paolini et al., might lead to an increased involvement of cutaneous receptors.<sup>8,12</sup>

Application of KT on the skin was also hypothesized to relieve pressure and irritation of the neurosensory receptors that can create pain. Kinesiotaping application on the skin can "lift" the skin layer, thereby reducing the stress on nociceptive receptors on the skin. Another theory for KT in decreasing pain was by improving lymphatic and blood circulation without restricting the ROM of the affected part. The tape microscopically lifts the skin, increasing lymphatic drainage and thus reducing inflammation in the affected areas.<sup>7,12</sup> Range of motion is defined as the movable range of a joint's potential movement. Good range motion prevents unnecessary energy consumption, enhances accuracy and muscle activity during exercise, and improves coordination.<sup>15,16</sup> This study showed a statistically significant improvement in moving the shoulder flexion and abduction after KT application. Some participants even showed an increase of shoulder movement of more than 20° at the end of the evaluation,

that can be assumed as clinical significance based on the study done by Thelen et al., which stated an increase of ROM of more than 20° was considered to have clinical relevance.<sup>17</sup> Two mechanisms was proposed to explain how KT can improve the range of motion of the active joint, one of them is by reducing the density between layers of skin in the area applied with KT, which will make the skin layer change (convolution), thereby increasing the range of motion of the joints and reducing pain. The second theory is that attachment of KT increases sensory feedback, which reduces fear of movement and reduces pain so that patients can move the joints and allow an increased active range of motion.<sup>18</sup>

As the pain and range of motion increased, this study also shows that subjects have increased upper limb functional ability by the SPADI score at the end of the study. The SPADI consists of 13 items that were developed to evaluate shoulder pain and disability. The SPADI has reliability coefficients of ICC  $\geq$  0.89 in a variety of patient populations. Its internal consistency is high, with Cronbach's typically exceeding.<sup>18,19</sup>

Results of this study support that KT will encourage pain relief, but still, it does not represent a reason for it to become the primary treatment of choice. This study has several limitations, it includes all etiology of shoulder pain in inclusion criteria and was done in a limited population (leisure athlete). Another limitation is the limited duration of the follow-up, so the result cannot determine whether KT is the treatment of choice or not for long-term shoulder pain. However, same with another study before, a combination of low cost,

limited risk of complications, and immediate reduction in pain, supports the use of KT as an adjunct or complementary technique to reduce shoulder pain.

## CONCLUSIONS

Kinesiotaping has a medium-term effect on reducing shoulder pain, increasing the ability of flexion and abduction range of motion of shoulder joint, and improving functional ability of upper limb in shoulder pain subjects.

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