

Therapeutic Effect of Kinesio-taping on Disability of Arm, Shoulder, and Hand in Patients with Subacromial Impingement Syndrome: A Randomized Clinical Trial

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Abstract

Objective: The purpose of this study was to investigate the effect of KT on the disability of arm, shoulder and hand in patients with shoulder impingement syndrome.

Methods: A randomized controlled trial was used and 30 patients with shoulder impingement syndrome participated in this study. Patients were assigned randomly to a control (N=15, mean age=46.53 ± 13.31) and a treatment group (N=15, mean age=46.6 ± 14.24). The protocol was standardized therapeutic KT in the treatment group and placebo taping in control group. Disability of arm, hand and shoulder (DASH) questionnaire and was collected before treatment and after 1 week in both groups.

Results: There was no significant difference in pre-test scores between two groups (P=0.62). Statistical analysis revealed a significant decrease in DASH after 1 week KT in treatment group (P=0.001) and control group (P=0.02) compared with pre-treatment score. Mann-whitney test revealed that change in DASH after 1 week was significantly greater for treatment group than control group (P=0.01).

Conclusions: The application of KT produces improvement in the disability of arm, shoulder and hand in patients with shoulder impingement syndrome.

Keywords: Kinesio-Tape; Shoulder impingement; Pain; Disability

Introduction

Shoulder impingement syndrome is one of the most common shoulder complaints in people attending orthopedic and physical therapy clinics (44-65%) [1-3]. Despite its incidence and detrimental effects on individuals' activities the exact causes of shoulder impingement syndrome have not yet been fully understood as no approach or treatment has been shown to be clearly effective.

However, during the recent decades the focus has been placed on the coordinated movements of the scapula and humerus; called as scapulohumeral rhythm, in shoulder impingement [4,5]. It is thought that abnormal scapular motion plays a significant role in the development shoulder impingement symptoms [6-9]. Functional loss and disability is the most common symptoms associated with shoulder impingement.

The restoration of the scapular control has been commonly accentuated in the management of shoulder impingement syndrome [10,11]. Taping has been recently used in patients with shoulder problems to provide support during movement and to control scapular movement [11-16]. Although the exact mechanisms of the effect of KT are not clearly known, some investigators speculated that KT works by inducing proprioceptive feedback or providing alignment correction during dynamic movements [17-19]. KT is more elastic as compared with conventional tape forms. The primary goal of non-stretch rigid tape use is limiting unwanted joint movements or protecting and supporting the joint structure.

However, minimal evidence exists about the tape application in the treatment of shoulder disorders. With use of the different designs, subjects, methods, and testing procedures, controversial results have been reported regarding the effect of KT on shoulder function and disability. Although some investigators showed improved posture alignment, reduced pain and discomfort of the shoulder joint

following taping [13,19-21], the results of the some other studies did not support the use of taping for improvement of pain or disability and upper extremity performance in patients with suspected shoulder impingement syndrome [18].

The purpose of this study was to investigate the effects of KT on disability of arm, shoulder, and hand in patients with shoulder impingement syndrome.

Materials and Methods

A randomized controlled trial (RCT) was conducted. 30 patients presenting with diagnosis of shoulder impingement syndrome were enrolled into the study (Figure 1). The patient population in this study was consecutive patients who fulfilled the inclusion criteria. Patients were included if they showed positive sign in two or more shoulder impingement screening items, and in at least one of the specific subacromial impingement tests. Screening was performed by one orthopedic, one physiatrist and one physical therapist, all with a minimum of 6 years of clinical experience in outpatient orthopedic settings.

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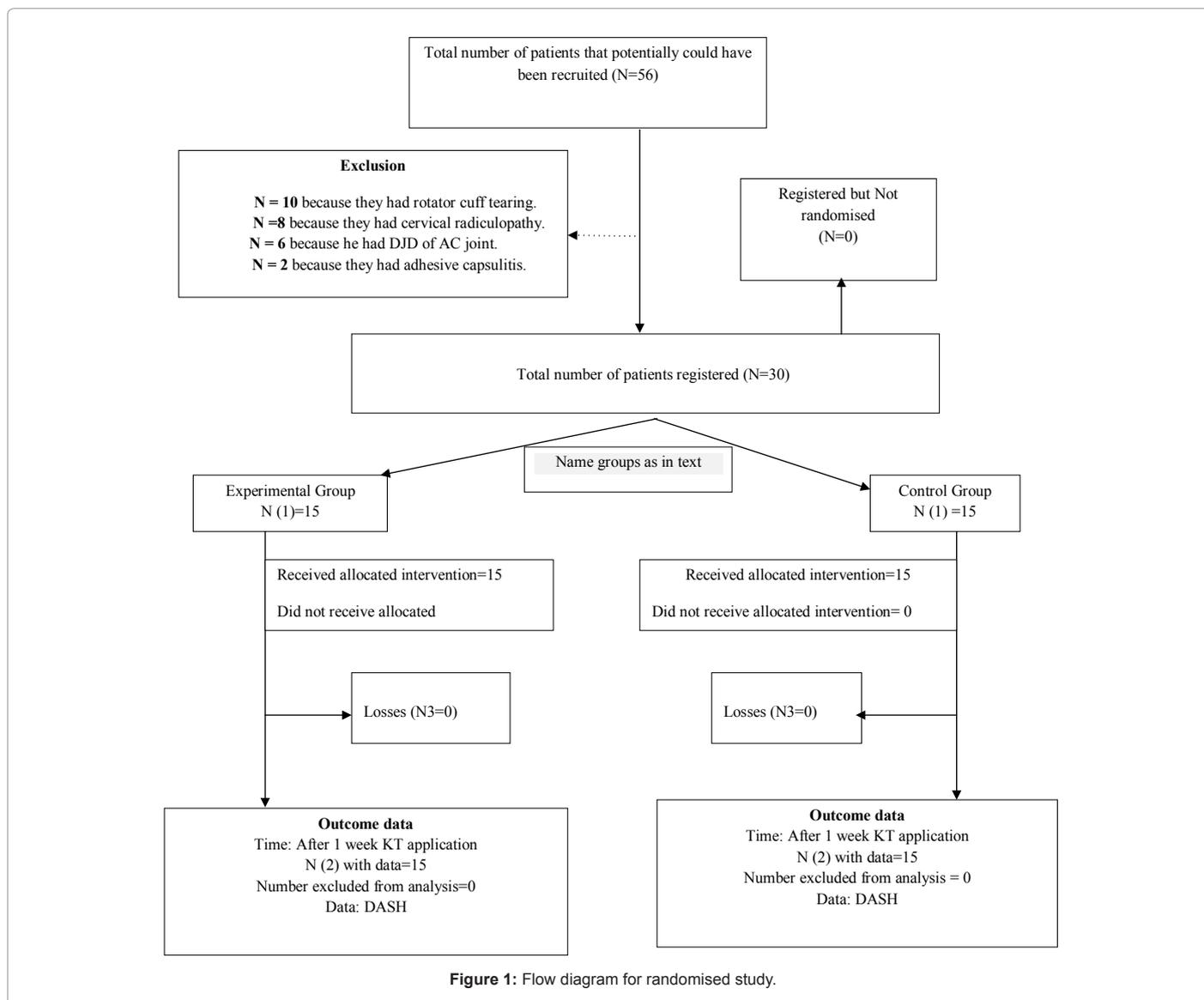


Figure 1: Flow diagram for randomised study.

The shoulder impingement screening items were: (1) a history of proximal anterior or lateral shoulder pain persisted for more than 1 week during the last six months; (2) painful arc during active shoulder elevation; (3) tenderness to palpation of rotator cuff tendons; (4) pain with resisted isometric shoulder abduction; (5) positive Jobe’s test (empty can test). Specific subacromial impingement tests used in the present study were as follow; the Neer sign and Hawkins sign [7,22,23] and Yocum test [24].

Patients were excluded if they had a history of dislocation, fracture or traumatic injuries on the tested shoulder complex; a history of shoulder surgery within the last 6 months; reproduction of symptoms in the cervical screening examination (active and passive ROM, and overpressure); failure to complete two testing sessions; cervical radiculopathy; and complete rupture of rotator cuff muscles with acute inflammation [24]. All subjects signed an informed consent form approved by the human subjects committee at university of social welfare and rehabilitation sciences.

A priori power analysis demonstrated the need for at least 13 subjects per group, given a standard deviation of 20 mm pre-treatment

and 24 mm post-treatment for pain intensity on the VAS, a difference of 30 mm on the VAS, an alpha level of 0.05, and a power set at 90%.

Patients were randomly assigned to a control group and a treatment group. An equal number (N=15) were allocated to each group. We used block randomization method to keep the numbers in each group very close at all times. This method is used to randomize participants into groups that result in equal sample sizes and to ensure a balance in sample size between groups over time. Considering that block size must be a multiple of the number of groups, a block size of 4 was used. With this block size, there were 6 possible ways to equally assign participants to a block. Assignment proceeded by randomly selecting one of the orderings and allocating the next block of subjects to groups according to the specific sequence. Physical characteristics of the subjects in each group are shown in table 1.

The participant flow diagram provided in figure 1 reports the numbers of randomization assignment, interventions, and measurements for each group (Figure 1).

The patients in the treatment group received a standardized taping

procedure. We followed the procedure described by others [25]. The KT technique procedure for treatment group was as follow: The first strip was a Y-shape strip applied on the supraspinatus muscle from its insertion to origin. It was applied with the subject in a position combining contra-lateral cervical side bending and the arm reaching behind the back as if reaching into the contralateral back pocket. The second strip was a Y-strip representative of the deltoid, was applied from insertion to origin with paper-off tension. Paper-off tension means applying the tape directly to the skin as it comes off the paper backing. KT is manufactured and applied to its paper backing with approximately 10% stretch [25].

The first tail of the second strip was applied to the anterior deltoid while the arm was externally rotated and horizontally abducted and the other tail for the posterior deltoid was applied with the arm horizontally adducted and internally rotated as if reaching to the outside of the contra-lateral hip. The third strip was applied from the coracoid process to the posterior deltoid with approximately 50% to 75% stretch and downward pressure applied to the tape at the region of perceived tenderness for glenohumeral mechanical correction. For mechanical correction technique, the upper extremity was externally rotated while at the side and then moved into shoulder flexion and slight horizontal adduction as the end of the tape was applied with no stretch. A I strip tape was performed for glenohumeral mechanical correction. Finally, the fourth strip was a 5 cm-28 cm Y shape tape applied to lower trapezius

The patients in control group received placebo neutral tape application. The placebo taping consisted of some I-strips tapes applied with no tension. One tape was placed over the acromioclavicular joint in the sagittal plane and one on the distal deltoid in the transverse plane. Moreover, I-strip tape was applied on lower trapezius muscle without any tension. It was suggested that the role of the lower part of the trapezius is more consistent with maintaining horizontal and vertical equilibrium of the scapula [26]. Johnson et al. [27] hypothesized that the thoracic fibers of the trapezius muscle do not appreciably change length throughout the entire range of upward rotation of the scapula. So, the KT of the lower trapezius which contributes to net torque about the axis of rotation of the scapula was important.

The placebo group sites were selected because they are the most common locations of perceived pain by patients with rotator cuff tendonitis or impingement [28-30]. All the taping applications were performed by the same researcher, who is experienced in the procedure.

Disability of arm, hand and shoulder (DASH) questionnaire as an appropriate method was collected before taping and after 1 week tape application in both groups to investigate the efficacy of KT in the treatment and improvement of disability in patients with shoulder impingement syndrome. The DASH outcome measure is a single, reliable instrument that can be used in a wide variety of upper extremity disorders. The main part of the DASH is a 30-item disability/symptom scale concerning the patient's health status during the preceding week. The items ask about the degree of difficulty in performing different physical activities because of the arm, shoulder or hand problem (21 items), the severity of each of the symptoms, pain, activity-related pain, tingling, weakness and stiffness (5 items), as well as the problem's impact on social activities, work, sleep and self- image (4 items). The time frame reference is the past week and each question requires the patient to rate personal ability to do the indicated activity by circling the number corresponding to the most

appropriate response. The Persian version of DASH has been shown to be reliable and valid instrument to measure functional status in Persian-speaking patients with upper extremity disorders [31].

Patients were asked to use the tape for 72 hours and after this time; they were requested to come back to the clinic for re-evaluation at the fourth day. Subjects were asked to remove the tape prior to the expected time only if any persistent skin irritation or increased shoulder discomfort occurred. At the day 4, we inspected and checked the subjects' skin. Subjects were again taped with the same method used before, based on their group assignment, and instructed to wear the tape for an additional 48 hours. All subjects were again instructed to return to the clinic on day 7 for the final evaluation.

Patients who were prescribed a non-steroidal anti-inflammatory drug (NSAID) prior to the study were instructed not to take the medication. To control for activity level, subjects were also asked to do not perform upper extremity exercises for one week during the study. These patients were in waiting list to physiotherapy and did not have any injection or surgery experience or condition. This study aimed to find pure effect of KT on shoulder disability.

Statistical Analysis

Wicoxon signed-ranked test was used to determine the significance of the difference in DASH score after 1 week taping compared with pre-treatment score in control and treatment group. Mann-whitney test was used calculated for the significance of the difference between the control and treatment groups in DASH scores changes after KT application.

Results

The demographic data for two individual groups are displayed in table 1.

Pre- and post-measurement scores for the control and treatment group and the results of Wicoxon signed-ranked test and Mann-whitney test are provided in table 2. There was no significant difference in pre-test scores between two groups (P=0.62) .

The DASH score of the control group decreased from 37.18 before treatment to 32.47 after 1 week. The DASH score of the treatment group decreased from 40.95 before treatment to 22.81 after 1 week KT application.

The result of Wicoxon signed-ranked test showed a significant

Variables	Control group (n=15)	Experimental group (n=15)
Age (years)	46.6 ± 14.24	46.53 ± 13.31
Weight (kg)	75.4 ± 7.45	78.43 ± 11.01
Height (cm)	166 ± 9.07	165 ± 8.45
BMI	28.84 ± 3.65	27.52 ± 3.92
Pain duration (month)	9.33 ± 10.48	7.63 ± 7.43

SD=Standard Deviation
BMI=Body Mass Index

Table 1: Demographic data of the subjects (Mean ± SD).

Group	Pre-test	Post-test	Mean change	P-value
	Mean ± SD	Mean ± SD		
Control	37.18 ± 13.37	32.47 ± 14.17	4.71 ± 0.8	0.02
Experimental	40.95 ± 16.05	22.81 ± 9.16	18.14 ± 6.89	0.001
P-value	0.62	-----	0.01	

DASH=Disability of Arm, Hand and Shoulder

Table 2: DASH score before and after 1 week taping control and treatment groups.

decrease in DASH after 1 week KT in treatment group ($Z=3.40$, $P=0.001$) compared with pre-treatment score. However, the change in DASH score was significant in control group ($Z=2.18$, $P=0.02$). Mann-whitney test revealed that change in DASH after 1 week was significantly greater for treatment group than control group ($Z=2.48$, $P=0.01$).

Discussion

One of the novel modality in physical therapy is the application of taping which provides support during movement for musculoskeletal impairments. Some studies have considered KT effects on shoulder disability [28,29,32,33].

The result of this study showed a significant decrease in disability (DASH) after 1 week taping compared with pre-treatment score in treatment and control group. Our data showed that change in DASH score after taping was significantly greater in treatment group than placebo control group.

This finding complements the results of the previous studies showing effectiveness of taping in patients with shoulder disorders. Thelen et al. [32] found that KT provides an immediate effect on the limitation of the active ROM and pain during abduction with no improvements in disability scores among 42 subjects with rotator cuff tendonitis/impingement. Kaya et al. [28] compared the short-term efficacy of therapeutic KT application on reducing pain and disability in 55 subjects with shoulder pain due to rotator cuff problems with conventional physical therapy modalities and found significantly lower DASH scale scores after taping. They stated that KT improved function better than physical therapy modalities in first week but no significant difference between KT and physical therapy modalities was found after second week. With regard to the fact that DASH measures the patient's health status during the preceding week, in this study, we measured DASH after 1 week KT application. Frazier et al. [33] in a case series study showed significant improvements in DASH scores and pain on five patients having various shoulder problems by applying KT and physiotherapy. The patient population in this study included the subjects who had been referred by orthopedic physicians with shoulder impingement syndrome.

It was claimed that the effects of taping may be due to the sensorimotor and proprioceptive feedback mechanisms [34]. Taping provides immediate sensorimotor feedback, and patients often report symptom relief, improved comfort level, or stability of the involved joint.

Investigators emphasized on the role of muscle imbalance which should be cured through the alternative treatment methods like KT as well as the exercises [29,35]. The elasticity of KT conforms to the body, allowing for movement compare to rigid ones.

Review of the literature represents low level of evidence regarding taping in shoulder impingement syndrome. In this study, four KT techniques were applied while the other previous studies applied one to three KT techniques [30,32].

Investigators attributed taping effects to proprioceptive feedback or alignment correction during movements. Correction of the scapular alignment during shoulder movement can improve normal glenohumeral motion and decrease the micro trauma and mechanical irritation of the subacromial soft tissue structures, resulting in improvement in disability of the upper extremity [32].

Pain modulation through the gate control theory is one probable

rationalization for effectiveness of taping. It has been speculated that tape stimulates neuromuscular pathways by increased afferent feedback [12]. Increase in afferent stimulus to large-diameter nerve fibers can alleviate the input received from the small-diameter nerve fibers conducting nociception.

Pain duration may have an impact on outcome measures as acute and chronic stages of injury have clear dissimilarities in terms of clinical and pathophysiological aspects. Although the standard deviation values of pain duration in both groups are high, there was no significant difference between two groups in terms of pain durations ($P=0.61$). In both groups, there was subjects with different pain duration.

Some investigators reported negative effects of the using of rigid tape on movement and performance of the upper extremity because of movement restriction and skin irritation [18]. In this study, we used KT and not rigid tape to minimize the skin irritation effect following taping.

The sudden effects due to KT may reduce mechanical irritation of the involved soft tissue structures and reorient the shoulder movements through an arc of improved glenohumeral motion. However, Bragg et al. [36] explained that athletic tape loses its function due to limit joint motion after 15-20 min of exercise [36]. Although immediate effect of KT is considered as a very important benefit, assessing longer term effect of KT provides useful information for physical therapists and clinicians when prescribing therapeutic modalities for patients with shoulder impingement syndrome attending physical therapy clinics. According to the result of this study, KT application can be considered as a favorable treatment which may increase the shoulder performance during living functions.

However, we acknowledge several limitations. One of the limitations and weakness of this study of this study was the sample size. Although a power analysis was done for sample size calculation, we used the data from the pain intensity (VAS) with a power set at 90%.

Another area of concern in our study is that disability was assessed after 1 week KT application. Although this is short duration, review of the literature showed that most previous studies assessed the immediate effect of kinesio-taping on pain and range of motion. Furthermore, DASH questionnaire assesses the disability based on the activities during last week and at least one week is needed to assess the shoulder disability. This is the first study that investigated the effect of KT on shoulder disability in patients with shoulder impingement syndrome using a placebo-controlled study. More clinical studies are needed to determine the long term therapeutic values of KT on treating and improving the function and disability in long duration with follow up in patients with shoulder impingement syndrome.

The patient population in this study was a sample of convenience made up of subjects who had been referred by orthopedic physicians. Because the sample population in this study was consecutive patients and there were not a large number of patients with shoulder impingement to select the patients from them, convenience sampling was used. Convenience sample is an appropriate way commonly used for RCT trials in clinical studies to examine the new treatment technique.

Conclusion

The application of taping produces improvement in disability of the shoulder, arm and hand and can be prescribed for patients

with shoulder impingement syndrome. Further studies are needed to investigate the long term effect of KT on shoulder disability and functional movements among patients with shoulder impingement syndrome and compare to exercise therapy or other physical therapy modalities.

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