



Effect of Kinesio Taping on Motion, Pain with Functional Performance and Subsequent Quality of Life in Subject with Subacromial Impingement Syndrome

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ABSTRACT

Background: This study examined the response of kinesio taping (KT) in combination with the conventional occupational therapy as compared to conventional occupational therapy alone on motion, pain with functional performance and subsequent quality of life in subjects having subacromial impingement syndrome (SIS) across 30. **Methods:** Total 30 subjects of SIS (15 in each group) were allocated in Group 1 (Control) having only conventional therapy and Group 2 (Experiment) with both Kinesio Taping and conventional therapy. Used all KT in the study was (5 cm) beige Kinesio Tex tape with different colours. Dosage of intervention: 5 days in a week for 4 weeks (that includes 15 minutes in application of KT followed by 30 minutes rest, subsequently 40 minutes engagement in activity). **Outcomes:** Goniometer for range of motion, PENN shoulder score for pain with functional performance, SF-12 for Quality of life. These all were applied on day zero (pre-test) and after 4th week (post-test) data. **Results:** Group 2 yielded significant improvement than Group 1 in ROM, PENN shoulder score, & Sf-12 QOL at post treatment with value $p < 0.05$. **Conclusion:** The current study has shown that kinesio taping in combination with the conventional occupational therapy provides improvement in ROM, functional performance and quality of life in subjects with subacromial impingement syndrome than the conventional occupational therapy alone; which proves our hypotheses.

Keywords: KinesioTape (KT), Pain, Functional performance, Quality of life (QOL), Subacromial Impingement Syndrome (SIS)

INTRODUCTION

Subacromial Impingement Syndrome (SIS) occurs due to a mechanical disturbance within Sub-acromial space. It happens due to entrapment of the Supraspinatus, Infraspinatus, Teres minor muscle, Biceps tendon, Soft tissues and subacromial bursa in between coracoacromial arch and humeral head and causes swelling, inflammation and pain in the shoulder. Structural and functional factors reducing the subacromial space can cause subacromial impingement syndrome. Repetitive micro-trauma through mechanical compression to soft tissues within the subacromial space leads to functional disability and pain in the shoulder complex. SIS is the most common diagnosis of shoulder dysfunction, is often described as shoulder pain exacerbated by overhead activities and cause functional restriction [1]. It is also referred to as painful arc syndrome, shoulder impingement syndrome, supraspinatus syndrome, swimmer's shoulder or thrower's shoulder [2]. SIS is commonly reported in general population, and a common cause of disability at work and during daily activities. It is a major cause of shoulder pain and may lead to functional disabilities and reduction in quality of life (QoL) as it interfaces with many activities of daily living (ADL) [3,4].

Taping has been used in recent times in patients having shoulder problems to provide support during movements and to control scapular movements [4,5]. Kinesio tape is much more elastic in nature as compared with the conventional tape forms [6]. Taping is used widely in the field of rehabilitation as both a means of treatment as well as in prevention of sports-related injuries [7]. The basic function of most of the tape is to provide support during movements. Kase, et al. have proposed many benefits, which are dependent on the amount of stretch applied to the tapes during application: like it provides a positional stimulus through the skin, align fascial tissues, create more space by lifting fascia and soft tissue above area of pain/inflammation, provide sensory stimulation to assist or limit motion, and assist in the

removal of edema by directing exudates toward a lymph duct [8]. This study is aimed to see the effect of kinesio taping in combination with conventional therapy in patient with subacromial impingement syndrome and its influence on motion, pain with functional performance and subsequent quality of life.

METHODS

The participants in this study were sample of convenience with random allocation comprised of total 30 subjects in two groups. Group 1 (control, n=15) and Group 2 (experiment, n=15). Data were collected on day zero as pre-test and after 4 weeks as post-test data.

Subjects

The subjects (between age of 18 to 65 years) included in this study were referred from main assessment clinic of NIOH, Kolkata. Those subjects were included who were having a history of proximal anterior/lateral Shoulder pain, Pain beginning prior to 150 degree of active shoulder elevation in any plane and if two or more of the specific Impingement test were found positive: (Empty can test or Jobe test, Hawkins-kennedy test, Neer's sign), Subject with complaint of having difficulty in performing the Activities of daily living and subjects excluded if they had shoulder girdle fracture, glenohumeral dislocation/subluxation, cervical spine symptoms verified by Spurling's test, history of shoulder surgery in the past 12 weeks. osteoarthritis of glenohumeral joint and clinically verified Rheumatoid arthritis.

Outcome measures

Range of motion was measured using standard goniometer (Pain-free Active range of motion (ROM), ROM measurements of Shoulder joint for forward flexion, abduction, and external rotation were taken using standard goniometer. Intratester and intertester reliability of shoulder movements using a goniometer have shown to be excellent, with intratester ICCs of 0.88-0.93 and intertester ICCs of 0.85 and 0.80, MacDermid, Chesworth, Patterson and Roth in 1999.

The Penn Shoulder Scale is a 100-point shoulder-centric self-answerable questionnaire that has 3 subscales, including pain, satisfaction, and function. The pain subscale also has 3 pain items that address pain at rest, with normal activities and with strenuous activities. All of them are based on a 10-point numeric rating scale with end points being "no pain" and "worst possible pain." Satisfaction of patient with shoulder function is also measured with a 10-point numeric rating scale. The end points are specified as "not satisfied" and "very satisfied." The function subsection is based on a sum of 20 items, each with a 4-point Likert scale. Most patients complete the scale in less than 10 minutes, and the clinician can typically calculate the final scores in less than 2 minutes.

The SF-12® Health Survey contains 12 questions from the SF-36® Health Survey (Version 1). These include: 2 questions on physical functioning; 2 questions about limitations of role because of physical health problems; 1 question about the bodily pain; 1 question about the general health perceptions; 1 question about vitality (energy/fatigue); 1 question about social functioning; 2 questions about limitations of role because of emotional problems; and 2 questions about general mental health (psychological distress and psychological well-being). Scoring of individual items is identical to the SF-36® Health Survey.

Intervention

Intervention for both the Groups 1 and 2 included conventional therapy. Experiment group additionally received Kinesio Taping and conventional therapy.

Group 1 received Conventional exercise protocol/standard exercise protocol had adapted from the exercise given by American Association of Orthopaedic Surgeon (AAOS) [9].

Dosage for intervention

Intervention of 40 min, 5 days in a week for 4 weeks in conjunction with occupational therapy remedial activities: Shoulder wheel, Finger ladder, Wall mounted overhead sanding unit, Rope and pulley, Arm ergometer.

Group 2: This group was treated with kinesio taping in combination with conventional therapy. Dosage of intervention - 5 days in a week for 4 weeks. (that includes 15 minutes in application of KT followed by 30 minutes rest subsequently 40 minutes engagement in activity).

Application of kinesio taping

Application is based on text book of clinical therapeutic application of the kinesio taping method, second edition. Before to start the intervention, participant with hair were asked to shave and clean the area to be treated. The three pieces of Kinesio Tape were applied to the patient's shoulder. The first piece of Tape was Y-strip for the Deltoid, which were applied from the muscle insertion to origin with paper-off tension. A Y-strip refers to a section of tape that has a portion which is cut down in the middle to produce 2 tails. Paper-off tension means applying the tape directly to the skin as it comes off the paper backing with approximately 15% to 25% stretch. The first tail attached to the anterior deltoid while the arm will be externally rotated and horizontally abducted. The second tail attached to the posterior deltoid and applied with the arm horizontally adducted and internally rotated as if reaching to the outside of the contralateral hip. Second piece was for the supraspinatus muscle, which were applied from the muscle insertion to origin with paper-off tension. The approximately 20 cm in length, was third piece either an I-strip (no cut down the middle of the tape) or a Y-strip depending on the shoulder contour. It was applied to the region of the coracoid process around to the posterior deltoid with a mechanical correction (approximately 50% to 75% stretch and downward pressure applied to the KT) at the region of perceived pain or tenderness. The mechanical correction technique was applied with the upper extremity externally rotated while at the side and then moved into shoulder flexion and slight horizontal adduction as the end of the tape will be applied with no stretch [10].

Ethical considerations

This study received ethical approval from the institutional ethical committee, National Institute for the orthopaedically handicapped, The West Bengal University of Health Sciences in May 2014.

Statistical analysis

The Data was analysed by using the statistical package of social sciences, Version 20 (SPSS- 20) Normality of the variable within the groups was tested with Kolmogorov-Smirnov test and Shapiro-Wilk test. Differences in outcome parameters among the two groups Control and Experimental were analysed by the following tests. The paired t-test was used to analyse within the group parametric data. The independent t-test was used to analyse between the group parametric data. The significance level was set at $p < 0.05$ with 95% confidence interval. Data were presented as arithmetic mean \pm standard deviation ($X \pm SD$).

RESULTS

A total number of 30 subacromial impingement syndrome patients were recruited for the study with age ranging from 18 to 65 years. There were 18 males and 12 female patients in the study.

Table 1 Descriptive characteristics

S. NO	Baseline Characteristics	Group 1	Group 2
1	No of Subjects	15	15
2	Age range (years)	18 - 65	18 - 65
3	Mean age (SD)	43.40 (7.55)	44.33 (7.22)
4	Sex (Male/Female)	09/06	09/06

There was no drop out during the study. Data were collected at the 1st day of the visit and after the completion of the study. Table 1 shows the description of both groups which were homogenous. Within group analysis of ROM, PENN, S F-12 shows statistically significant improvement at 4th week (post treatment measurement) as mentioned in Tables 2A, 3A and 4A. In between group analysis from pre- to post intervention, a statistically significant improvement was found in all the variables including ROM, PENN, SF-12 ($p < 0.05$) in both the group seen in Tables 2B, 3B and 4B.

Table 2A Within group analysis of ROM

Shoulder Rom	Group	PRE (mean \pm SD)	POST (mean \pm SD)	t value	p value
Flexion	Group 1	109.44 (11.39)	116.49 (12.96)	-2.8	0.014
	Group 2	110.24 (12.48)	136.04 (15.14)	-8.316	0.00
Abduction	Group 1	121.25 (11.62)	124.63 (9.24)	-3.331	0.005
	Group 2	123.65 (10.41)	137.10 (9.24)	-15.495	0.00

External Rotation	Group 1	23.69 (5.16)	26.50 (5.93)	-4.366	0.001
	Group 2	22.68 (5.93)	34.35 (5.94)	-14.62	0.00

Table 2B Between group analysis of ROM

Shoulder ROM	Group 1 (mean ± SD)	Group 2 (mean ± SD)	t value	p value
Flexion	115.96 (13.35)	125.71 (10.66)	-2.209	0.036
Abduction	125.57 (9.28)	137.10 (9.24)	-3.409	0.002
External rotation	27.47 (5.71)	34.35 (5.94)	-3.228	0.003

Table 3A Within group analysis of PENN Shoulder score

Group	PRE (mean ± SD)	POST (mean ± SD)	t value	p- value
Group 1	32.64 (4.45)	35.33 (5.25)	-3.871	0.002
Group 2	32.24 (2.51)	46.88 (2.86)	-23.09	0.00

Table 3B Between the group analysis of PENN Shoulder score

Group 1 (mean ± SD)	Group 2 (mean ± SD)	t value	p value
38.12 (4.45)	46.88 (2.86)	-6.407	0.00

Table 4A Within group analysis of SF-12 (QoL)

Group	PRE (mean ± SD)	POST (mean ± SD)	t value	p value
Group 1	35.44 (5.23)	37.94 (5.79)	-4.469	0.001
Group 2	36.78 (5.24)	56.64 (5.99)	-12.72	0.00

Table 4B Between group analysis of SF-12 (QoL)

Group 1 (mean ± SD)	Group 2 (mean ± SD)	t value	p value
39.68 (5.22)	50.50 (5.14)	-5.7007	0.00

DISCUSSION

Kinesio taping is a relatively new technique used in rehabilitation programs. Although it has been commonly used in orthopaedic and sport setting it is increasingly becoming an adjunct treatment option for the other musculoskeletal impairments [11].

The purpose of the study was to determine the effect of kinesio taping in combination with conventional therapy in patient with subacromial impingement syndrome and its influence on motion, pain with functional performance and subsequent quality of life. The statistical analysis of the result supported the experimental hypothesis which stated that conventional therapy in combination with kinesio taping as compared to conventional therapy alone was effective in improving ROM, Pain, function & subsequent QoL.

The change in pain with functional performance measured by PENN in the experimental group was significant ($p < 0.05$). This is may be due to kinesio tape which helps in reducing the pain by pulling the skin in upward direction, thus increasing lymph and blood flow [12]. Neurophysiological effects by kinesio taping are believed to prevent transmission of pain in the spinal level with the help of a gate-control mechanism [12]. However, the significance of kinesio taping application for pain management is controversial [13].

Above finding may be established by the previous study done by Kaya, et al. that after applying kinesio taping over the supraspinatus and deltoid muscles using the insertion-origin technique in addition with a home exercise program in SIS patients for a minimum of 2 months, they observed a significant decrease in pain and disability in the KT group in the first two weeks.

In this study Range of motion is measured by goniometer. Our results are also consistent with the previous reports showing that KT can have a positive response on ROM when thought to be limited by musculoskeletal shoulder pain [14]. In this result both control and experimental group shows significant result ($p < 0.05$) but experimental group which is using kinesio taping in combination with conventional therapy shows more significance as compared to control group alone. This was possible as experimental group subject were integrating more functional and task-oriented

exercises and strategies directed toward pain behaviour changes. The one more possible reason that experimental group were advised to perform home activities than that of control group.

Above finding may be established by the study of Mark D. Thelen, et al. on a small sample size including subjects having shoulder pain found that KT provides an immediate effect in limitation of the active ROM and pain during abduction with no improvements in disability score after tape application [15]. The physiological mechanisms by which KT is presumed to work remains hypothetical, and they can only speculate what they might be.

In this study, pain free abduction ROM in Group 2 immediately improved without a concurrent significant improvement in pain intensity at the end point of pain free active ROM. Pain modulation via the gate control theory is one possible explanation for such change because it has been proposed that tape stimulates neuromuscular pathways by increased afferent feedback [16]. Under this gate control theory afferent stimulus increases to large-diameter nerve fibres which can serve to mitigate the input received from the small-diameter nerve fibres conducting nociception. Another possibility of this, the improved motion might have been due to an increase in supraspinatus motor units to perform the activity by increased proprioceptive stimulus. However, this proposition has not been supported by recent publications, which opined that there was no significant increase in muscular activity measured with electromyography after taping [17,18].

The significant changes in ROM may be supported by the findings of another study where it was claimed that patients often report symptom relief, improved comfort level and stability of the involved joint that the response of taping may be due to the proprioceptive and sensory-motor feedback mechanisms [19].

In one another study investigators focus on the role of muscle imbalance which should be cured through the alternative treatment methods like KT as well as the exercises [20]. The result of this study shows a significant decrease in disability, pain and improve functional performance after 4 weeks of Taping compared with pre-treatment score in Group 2 (Experiment) and in Group 1 (control).

The data of our study shows that changes in PENN score after taping in combination with conventional therapy was significantly higher in Group 2 than that Group 1. This finding complements the results of the previous studies showing effectiveness of taping in patients with shoulder disorders. The immediate effect on ROM and enhance function may happened due to KT guiding the shoulder through an arc of improved glenohumeral motion, which reduced mechanical irritation of the involved soft tissue structures and reorient the shoulder movements through an arch of improved glenohumeral joint motion.

It was proved that elasticity of KT conforms to the body, allowing for movement compare to rigid ones. Researchers attributed taping in response to proprioceptive feedback and alignment correction during movements. Correction of the scapular alignment during shoulder movement may improve normal glenohumeral motion and decrease the micro trauma and mechanical irritation of the soft tissues in between the subacromial structures, resulting in improvement of the upper extremity function.

Some investigators reported negative effects of the use of rigid tape on performance of upper extremity because of movement restriction and skin irritation [21]. In this study, we used KT and not rigid tape to minimize the skin irritation following taping. Exercise programs for SIS aimed to stimulate recovery in the affected tissues and improve shoulder movements without an increase in pain [22].

The significant result may be supported by the finding of another study by Celik, et al. that noticed a significant reduction in level of pain following their exercise treatment which they applied beneath the painful arch for 2 weeks in subjects with SIS [23].

The above finding may be justified by the statement that when performed with therapeutic KT these exercises & activities were observed improvement in ROM, muscle strength, and functional status followed by decreasing pain in the short-term.

Out of 11 randomized controlled studies investigating the effects of exercise in SIS, 6 discussed the effects of exercise on pain and found exercise therapy alone to be efficient in pain control in both the short- and long-term [24].

Kinesio tape may enhance joint stability and movement biomechanics with the mechanical support. It is believed that the skin receptors are stimulated and proprioception increases, particularly when KT is applied with the correction technique and extra stretching.

This result is also supported by the finding of another study by Lin, et al. who observed a change in scapular muscle activity and an increase in proprioception following KT application in subjects with no shoulder problems. Motor neurons are believed to be activated by the stimulated cutaneous mechanoreceptors [25].

The literature reports inconsistent outcomes of the effects of KT on ROM. In some studies, KT was reported as a cause to increase the ROM [17]. In our study, conventional therapy in combination with therapeutic KT application resulted in a highly significant increase in painless shoulder abduction ROM whereas passive flexion range in the control group was greater than the therapeutic KT group at the end of 4th week of treatment.

Similar study was conducted by Frazier, et al. in a case series that showed significant improvements in DASH scores and decrease in pain on five patients having different shoulder problems treated by kinesio taping and occupational therapy at the same time [14].

Another study showed decreased upper trapezius and increased lower trapezius activity in electromyographic studies in people with suspected shoulder impingement with scapular taping during functional overhead tasks. [26].

The taping induced a reduction in upper trapezius activity [27]. These findings are also focusing on the role of muscle imbalance which should be implemented to the alternative treatment methods like KT as well as the exercises. These results are also supported by a finding of another result in 2011 Jeff Snodgrass conducted a study on special issue on work-related injuries and illnesses and the role of occupational therapy. He found that the use of activities and occupation-based assessments has reasonable yet limited evidence to support its effectiveness. However, her review does support the notion that many client factors can be positively affected through the use of several common occupational therapy-related modalities and methods. Evidence is lacking. It becomes very important for occupational therapy practitioners for the evaluation to develop occupation-based and client-centred intervention plans. In this study, task specific activities (conventional occupational therapy) in combination with kinesio taping showed significant improvement [28].

The PENN Shoulder score is a joint-specific outcome assessment tool that contains 3 subscales related to pain, satisfaction, and function. The PENN score also includes questions related to body structure and functions, activity, and participation. The PENN Shoulder score like the DASH, has been validated across a variety of shoulder disorders and demonstrates good responsiveness. In our study, the result of effect of Kinesio tape shows significant improvement in PENN shoulder score (pain with functional performance) and SF-12 (quality of life).

The findings are justified by the fact of recent case studies of Charles Thigpen, et al. who stated that the pain and satisfaction subscales identify important information for clinical prognosis and intervention in subjects with shoulder pain. The pain score is a combination of 3 pain scores indicating shoulder pain at rest, during usual activities, and during strenuous activities. The patient satisfaction score provides an indication of how pleased patients are with their current shoulder function related to their expectations [29].

The SF-12 used to assess the general health status. The SF-12 provides insight on the impact of subjects with physical impairment on their general health status, and 2 subcategories of the PCS and mental component status reflect emotional well-being. In our study, result of Group 2 shows more significant than that of Group 1. It may be possible due to decrease in pain and increase in ROM and functional performance [2].

Above finding may be supported by a systemic review study done by Mostafavifar, et al. that kinesio tape application improves function by providing proper support of muscle without restricting motion.

However, a different study using multiple types of tape, including KT, found positive changes in scapular motion and muscle performance in amateur baseball players with shoulder impingement syndrome. One study included in our review showed that the use of KT after musculoskeletal injury may immediately improve function, but it was not clear whether this effect is long lasting or not [30].

KT improves time to return to play following musculoskeletal injury. The subjects or athlete may perceive that the use of KT allows him or her to return to play sooner as well as enhance quality of life.

Limitations

The number of high-quality, consistent studies availability is limited, and this topic therefore warrants further research with higher levels of evidence, larger sample sizes, powered outcomes, and longer follow-up times to show the effect/response of KT. Based on the current findings, it can be postulated that KT is effective in the rehabilitation of SIS when administered as an adjunct to conventional therapy for quick results.

CONCLUSION

The present study hypothesized that kinesio taping in combination with conventional therapy will be significantly more effective than conventional therapy alone and the hypothesis was found to be true. Thus, our study concluded that kinesio tape is effective in the management of “Subacromial Impingement Syndrome” and suggests all the therapists to apply kinesio taping in conjunction with conventional therapy in clinical practice.

DECLARATIONS

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Conflict of interest

The research is conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. We alone are responsible for the content and writing of this article.

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