

The comparative efficacy of kinesio taping and local injection therapy in patients with subacromial impingement syndrome



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ABSTRACT

Objective: The aim of this study was to compare the therapeutic effects of kinesio taping (KT) and local subacromial injection in patients with subacromial impingement, syndrome (SIS) with regard to pain, range of motion (ROM) and disability.

Methods: Sixty-one patients (48 females and 13 males; mean age: 43.04 ± 6.31 , years) with SIS were enrolled into the study. The patients were randomized into two treatment groups receiving either a single corticosteroid and local anesthetic (LA) injection, or kinesio taping performed three times by intervals of 3 day. Visual analog scale (VAS) was used to assess pain intensity, range of motion (ROM) degrees of, shoulder were recorded and Shoulder Pain and Disability Index (SPADI) was performed to evaluate functional disability, before treatment, at the first and fourth, weeks after therapies. A exercise program was prescribed for both groups including pendulum, active range of motion (ROM) and strengthening exercises.

Results: Pain, functional outcome measures were determined to have improved significantly in both groups at the end of therapies at first and fourth weeks ($p < 0.05$), but these improvements were more significant in the injection group than in kinesio taping group ($p < 0.05$). The improvements in pain at rest, shoulder abduction degrees, and SPADI scores at first and fourth weeks were statistically higher in injection group than in kinesio taping group.

Conclusion: Although the improvement in pain intensity at rest, ROM and disability were better with local injection, KT may be an alternative noninvasive method to local subacromial injection for patients suffering from subacromial impingement syndrome.

Level of Evidence: Level I, Therapeutic study.

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Introduction

Subacromial impingement syndrome (SIS) is one of the most common causes of shoulder pain and it is suggested that one third of patients presenting with shoulder pain has rotator cuff tendinitis/subacromial impingement.¹ SIS has been defined as compression and mechanic abrasion of rotator cuff structures under coracoacromial arc during arm elevation.^{1–3} Vascular, degenerative, traumatic, anatomic causes and shoulder kinematic abnormalities play important role for shoulder impingement syndrome.^{4–7}

The treatment of subacromial impingement is mainly conservative and encompasses rest, therapeutic exercises, non-steroidal

anti-inflammatory drugs (NSAIDs), physical therapy modalities and local subacromial injection.^{8–10} Subacromial injection of corticosteroid and local anesthetic (LA), is one of the most common non-operative interventions and has been shown to be effective in several studies in the treatment of impingement syndrome.^{11–14} On the other hand a systematic review conducted by the Cochrane Collaboration also concluded that although the available evidence from randomized controlled trials supports the use of subacromial corticosteroid injection for disease of rotator cuff, the effect may be small and short-lived and no better than NSAIDs.^{15–17} Despite considerable research, no real alternative to corticosteroid injections has been found.

Kinesio taping[®] technique (KT) and Kinesio tex tape[®] (KTT) had developed by Japanese chiropraxy specialist Dr. Kenso Kase in 1973 and has been used for musculoskeletal diseases widely in recent years.^{18–21} The effects of KT may be listed as to provide positional stimulus signaling to central nervous system by stimulating

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mechanoreceptors, align fascial tissues, widen the space above area of pain and inflammation by lifting fascia and soft tissues, provide sensory stimulus to limit or assist motion and help to removal of edema by directing exudates to lymphatic ducts.^{21,22}

There are few studies in the literature concerning the efficacy of kinesio taping treatment and conflicting results were indicated for shoulder disorders.^{18–20,23} Frazier et al²³ showed significant improvements in pain and DASH scores of patients with various shoulder diseases by KT and physical therapy. Kaya et al¹⁹ found no statistical differences in pain and disability measures of their patients receiving either KT or physical therapy for SIS. A systematic review concluded a moderate evidence that in the short term, there are no beneficial effects of KT therapy over sham taping for pain, ROM or function in individuals with shoulder impingement syndrome.²⁴ To the best of our knowledge, there is no study in the English literature about the comparative efficacy of local subacromial injection and KT in patients with SIS.

The aim of this study was to compare the therapeutic effects of single local corticosteroid/LA injection and KT in patients with SIS with regard to pain, shoulder ROM and functional outcome measures.

Patients and methods

Subjects

The study comprised 61 consecutive patients who were diagnosed as SIS (clinically and by magnetic resonance imaging) between 2012 and 2013. Fig. 1 summarizes the flowchart regarding patients' enrollment. The study protocol was approved by the local ethics committee.

Inclusion criteria

Inclusion criteria were as follows: aged 20–50 years, presented with shoulder pain which had been ongoing for one–three months, pain before 150° in any plane of range of motion, positive Jobe or Hawkins test,²⁵ pain in daily living activities, detection of rotator cuff tendinopathy/subacromial impingement syndrome on magnetic resonance imaging (MRI).²⁶

Exclusion criteria

Subjects with the presence of any of the following were excluded: previous fracture in the shoulder girdle complex, glenohumeral dislocation/subluxation, acromioclavicular sprain or separation, adhesive capsulitis, diabetes mellitus, use of anticoagulants, history of steroid injection therapy for shoulder, total rupture in the rotator cuff tendons on MRI, history of neck and shoulder surgery, or radicular neck pain within previous 3 months, patients taking regular systemic NSAIDs or steroids, pregnant or breastfeeding mothers and malignancy.

Kinesio taping technique

Patients in group 1 received therapeutic KT application three times by 3 days intervals. KT application has been made according to the protocol for rotator cuff tendinitis/impingement suggested by Kase et al.^{21,22} Standard 5-cm beige Kinesio Tex tape was used for all patients in KT group. Initially, a Y-strip for supraspinatus was applied from its insertion to origin with inhibition technique. The length of strip was determined by measuring from acromion to spine scapula. Later in a sitting position base of strip applied to tuberculum major; then superior tale of Y-strip was terminated at the superomedial angle of scapula passing between middle and superior fibers of trapezius

with light tension (% 15–25) while the shoulder was extended, adducted and internal rotated with cervical contralateral bending; final part of the tape (2.5–5 cm) was applied without stretching. The inferior tale of Y-strip was applied similarly with light tension (% 15–25) in the same position and terminated at the spine of scapula.

The second strip was a Y-strip representative of the deltoid and applied with inhibition technique again. First the length of strip was determined by measuring from acromion process to deltoid tuberosity. In sitting position base of tape applied to deltoid tuberosity; then anterior tale of Y-strip was terminated around acromioclavicular joint and lateral 1/3 of clavicle along lateral border of anterior deltoid with light tension (% 15–25) while shoulder was horizontally extended and external rotated. The final part of the tape (2.5–5 cm) was applied without stretching. Posterior tale of Y-strip was applied with light tension (% 15–25) while shoulder was horizontally flexed and internally rotated and terminated around acromioclavicular joint and lateral 1/3 of clavicle. The final part of this tape (2.5–5 cm) was applied without stretching. Finally mechanic correction technique was added. Depending on shoulder contour base of a Y-strip of 15–20 cm in length was applied at the most painful region around coracoid process; thereafter attached to posterior deltoid with severe tension (%50–75) and with downward pressure. After this the tails of Y strip were applied without stretching in a splayed out pattern while shoulder was flexed and horizontally adducted (Fig. 2). KT therapy was performed by the same physician (PB).

Subacromial injection technique

The patients in Group 2 received subacromial corticosteroid injection (1 cc triamsinolone acetonide – 40 mg) and 4 cc bupivacaine combination with a 22-G injector using posterior subacromial approach (Fig. 3).²⁵ The injections were performed into the patients' affected subacromial space by the same physician (HG).

Outcome measures

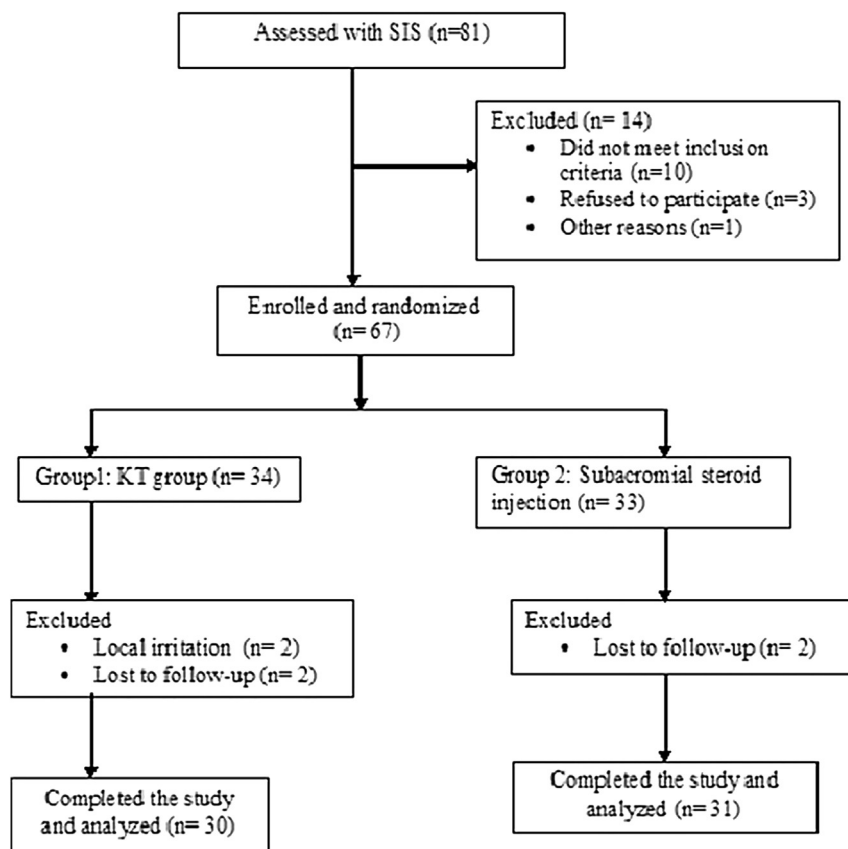
SIS staging was made depending on Zlatkin classification.²⁶ Both groups were educated for home exercise program comprising pendulum exercises and pain-limited active ROM exercises of shoulder elevation, depression, flexion, abduction, rotations, and strengthening exercises. Strengthening exercises were isometric in nature, working on the external shoulder rotators, internal rotators, biceps, deltoid, and scapular stabilizers.²⁷ Prescription details of exercise program for groups were as follows; 10 repetitions in 1 set daily, 30 s rest periods between sets of different types of exercises; 7 sessions with 24 h between sessions.

Outcome measures were active flexion and abduction range of motion, shoulder pain at rest and movement assessed by VAS and shoulder functional status detected by Shoulder Pain and Disability Index (SPADI).^{28,29} Shoulder ROM measurements were taken with a standard goniometry.³⁰ Pain intensity at rest and movement were assessed by a 100-mm VAS. 20 mm reduction on visual analog scale was accepted as clinically meaningful.³¹ The Turkish validated version of SPADI was used to assess functional ability of the shoulder.²⁹ Higher scores indicated greater pain and disability.²⁸ In our study 10 point decrease in scores has been defined as clinically meaningful.³²

Power analyses demonstrated a need for at least 30 participants per group given on SD of 20 mm VAS, a difference in pain intensity between groups of 20 mm on the VAS, on level of 0.05 a power set at 60%.

Procedure

The patients were randomly allocated to receive either single local subacromial corticosteroid/LA injection or KT therapy. Casual



SIS: Subacromial impingement syndrome **KT:** Kinesio taping

Fig. 1. Flowchart diagram for the participants who were randomized into two groups as receiving steroid injection or KT.

randomization using sealed numbered envelopes without strata or blocks was performed by an administrative assistant. The same physician blinded to randomization evaluated all the patients before treatment, and on the first and fourth week of the treatments (FT). During the study patients were not allowed NSAIDs, they were permitted only paracetamol when needed.

Statistical analysis

Statistical analysis was performed with SPSS 18.0 version. While the differences among the groups for continuous data were compared using Kruskal–Wallis test, Student's t test, or Mann–Whitney U test. When the p value from the Kruskal–Wallis test statistics was statistically significant, Conover's nonparametric multiple comparison test was used to determine which group differed from which others. Categorical data were analyzed using chi-square or Fisher's exact test, where applicable. Logistic regression analysis was performed to identify the related factors associated with meaningful change at VAS pain scores and SPADI scores. Odds ratios are expressed with 95% confidence intervals. A p value less than 0.05 was considered statistically significant.

Results

Demographic features of the subjects are given in Table 1. Both groups were similar with respect to age, sex, disease duration and side of involvement. The MRI findings of the groups were also similar. Most of the patients had stage 1 changes on MRI (Table 2).

No meaningful differences existed between two groups at baseline in terms of ROM, pain intensity and SPADI scores. No patient experienced any complication following local injection or KT.

Both groups had significant improvements in all types of ROM, pain by VAS scores and SPADI scores at the end of first and fourth weeks after treatments (Table 3). When comparing the shoulder range of motion degree of improvement between groups; the improvements in injection group were found to be statistically higher than in patients receiving KT with regard to shoulder pain at rest, abduction range of motion and SPADI scores at the end of first and fourth weeks. Both groups had similar improvements in terms of pain at motion and ROM degrees of flexion and rotations (Table 4). Meaningful change frequency on VAS pain at rest, and SPADI pain scores were higher in the injection group than in KT group at fourth weeks after treatment (Table 5). Logistic regression analysis showed that related factors associated with meaningful change at VAS pain scores and SPADI scores were; duration of pain (<2 months) and female sex.

Discussion

Our results have shown that pain, shoulder ROM and function improved after both local injection therapy and KT; however these improvements were more significant in injection group than in KT group at the end of first and four weeks. There are several treatment choices in subacromial impingement syndrome. Previous reviews of the use of corticosteroid injections in shoulders have found conflicting results and there is an underlying concern



Fig. 2. The application of KT.

regarding potential damage to the rotator cuff following repeated injections into the subacromial space.^{8–10} In our study we have performed the posterior route for subacromial injection.³³ Early onset pain relief following injection may be due either a placebo benefit or the spreading effect of the LA. Similar to previous



Fig. 3. Posterior subacromial steroid injection.

Table 1

The demographic characteristics, clinical and functional outcome measures of the groups at baseline.

	KT group (n = 30)	Injection group (n = 31)	P
Sex (n)			
Female	25	23	0.384
Male	5	8	
Age	42.63 ± 6.88	43.45 ± 6.39	0.900
Shoulder affected (n)			
Dominant	21	20	0.648
Nondominant	9	11	
Duration of pain(months)	2.33 ± 0.78	2.37 ± 0.81	0.920
Range of motion			
Flexion°	124.80 ± 14.83	128.06 ± 14.87	0.379
Abduction°	117.30 ± 17.35	120.81 ± 14.61	0.333
External rotation°	80.50 ± 11.30	82.58 ± 7.83	0.690
Internal rotation°	84.50 ± 8.23	82.74 ± 10.55	0.685
Pain by VAS			
VAS at rest	33.00 ± 11.18	36.77 ± 13.00	0.431
VAS at movement	59.66 ± 15.42	60.64 ± 15.69	0.740
Shoulder disability			
SPADI pain score	52.33 ± 14.05	53.29 ± 15.20	0.800
SPADI disability score	35.54 ± 14.06	36.57 ± 14.07	0.776
SPADI total score	43.94 ± 13.39	44.93 ± 13.48	0.775

Values are presented as mean ± standard deviation or n (number).

investigators we found that patients with local subacromial injection had greater pain relief and this pain relief seems to be continued longer with the addition of LA.

Kinesio taping is relatively a new treatment modality. Various studies reported improvements in function and pain for shoulder problems; but numbers of studies are little and most of them are case reports and/or performed on healthy subjects.^{11–16} Thelen et al.^{8–10} compared therapeutic and sham KT application immediately after taping, day 3 and day 6 in patients with shoulder pain aged 18–24 years. Immediately after taping KT was more effective in terms of ROM; but there were no meaningful differences in regard to pain and function. Kaya et al.^{8–10} compared KT with physical therapy program at first and second weeks of treatment in patients who had subacromial impingement syndrome and, reported that KT treatment was more effective at first week of treatment in terms of pain and disability, and equally effective as physical therapy at second week of treatment.¹² Frazier et al.^{8–10} found significant improvements in pain and DASH scores in patients with various shoulder diseases by KT and physical therapy. Hsu et al.^{8–10} found that KT improved scapular rhythm by increasing posterior scapular tilt during arm elevation and lower trapezius muscle activity during arm depression and expands subacromial space. Another study showed that scapular taping decreased upper trapezius and

Table 2

The comparative MRI findings of groups.

	KT group (n = 30)	Injection group (n = 31)	p
Zlatkin stage			
Stage 1	25	28	0.473 ^a
Stage 2	5	3	
Type of acromion			
Type 2	28	29	0.681 ^a
Type 1/3	2	2	
Effusion in subacromial-subdeltoid bursae	17	19	0.714
Degenerative changes of acromioclavicular joint	22	24	0.711
Effusion around biceps tendon	19	20	0.923

^a Fischer test.

Table 3
Summary of treatment effects in both groups.

Group	Baseline	1 week after therapy	4 weeks after therapy
VAS-pain-rest			
KT group	33.00 ± 11.18	22.33 ± 15.24 ^a	21.00 ± 12.68 ^b
SASI group	36.77 ± 13.00	19.67 ± 13.03 ^c	15.48 ± 12.06 ^d
VAS-pain motion			
KT group	59.66 ± 15.42	46.00 ± 19.22 ^a	41.66 ± 20.18 ^b
SASI group	60.64 ± 15.69	41.61 ± 17.90 ^c	35.48 ± 19.46 ^d
Flexion ROM			
KT group	124.80 ± 14.83	136.00 ± 25.86 ^a	141.80 ± 16.63 ^b
SASI group	128.06 ± 14.87	143.87 ± 16.57 ^c	148.39 ± 18.50 ^d
Abduction ROM			
KT group	117.30 ± 17.35	125.00 ± 21.05 ^a	132.30 ± 21.08 ^b
SASI group	120.81 ± 14.61	136.94 ± 15.74 ^c	142.90 ± 16.11 ^d
Internal rotation ROM			
KT group	84.50 ± 8.23	89.67 ± 14.62 ^a	88.00 ± 6.51 ^b
SASI group	82.74 ± 10.55	86.61 ± 5.22 ^c	88.71 ± 3.15 ^d
External rotation ROM			
KT group	80.50 ± 11.30	84.67 ± 7.30 ^a	86.00 ± 6.99 ^b
SASI group	82.58 ± 7.83	85.97 ± 5.68 ^c	86.94 ± 4.77 ^d
SPADI-total score	43.94 ± 13.39	31.93 ± 15.34 ^a	29.25 ± 13.69 ^b
KT group	44.93 ± 13.48	28.10 ± 15.18 ^c	23.60 ± 14.36 ^d
SASI group			

Values are presented as mean ± Standard deviation, Wilcoxon test.

KT: kinesio taping SASI: subacromial steroid injection.

^a p < 0.05, baseline vs. 1 week after KT.

^b p < 0.05, baseline vs. 4 week after KT.

^c p < 0.05, baseline vs. 1 week after injection.

^d p < 0.05, baseline vs. 4 week after injection.

increased lower trapezius activity in people with suspected shoulder impingement during a functional overhead-reaching task, and decreased upper trapezius activity during shoulder abduction in the scapular plane.¹⁷ On the other hand, Thelen et al^{18–10} concluded that utilization of KT for decreasing pain intensity or disability for young patients with impingement is not supported. As seen KT was mostly found to be effective for immediate functional outcome improvement in shoulder impingement syndrome.^{8–10} These studies represent low level of evidence and suggest that KT may be an alternative or adjuvant treatment to exercises to improve the muscle balance and scapular rhythm. Our results are partially consistent with previous reports showing that KT can have a

Table 4
The difference of improvements in measurements of both groups.

Groups	KT group	SASI group	p ^a
VAS-pain rest			
Baseline-1 week	10,6 ± 10,4	17,1 ± 10,1	0,025
Baseline-4 week	12,0 ± 12,1	21,2 ± 13,8	0,010
VAS-pain motion			
Baseline-1 week	13,6 ± 12,9	19,0 ± 13,0	0,079
Baseline-4 week	18,0 ± 13,9	25,1 ± 15,5	0,068
SPADI-total			
Baseline-1 week	12,0 ± 8,9	16,8 ± 9,7	0,043
Baseline-4 week	14,6 ± 8,9	21,3 ± 13,1	0,031
ROM-flexion			
Baseline-1 week	11,1 ± 8,7	15,8 ± 9,8	0,068
Baseline-4 week	17,0 ± 11,1	20,3 ± 13,4	0,351
ROM-abduction			
Baseline-1 week	7,6 ± 18,9	16,1 ± 9,5	0,028
Baseline-4 week	15,0 ± 11,6	22,1 ± 1,7	0,043
ROM-internal rotation			
Baseline-1 week	5,1 ± 13,4	3,8 ± 6,4	0,826
Baseline-4 week	3,5 ± 6,5	5,9 ± 9,1	0,348
ROM-external rotation			
Baseline-1 week	4,1 ± 8,4	3,4 ± 5,6	0,782
Baseline-4 week	5,5 ± 8,8	4,3 ± 6,0	0,842

KT: kinesio taping SASI: subacromial steroid injection.

^a Statistically meaningful P values are written in bold characters.

^a Differences of improvements between the groups by Mann Whitney U test.

Table 5
Meaningful change frequency on VAS and SPADI scores at fourth weeks after treatment.

	KT group (n = 30)	SASI group (n = 31)	P
VAS score changes (≥20 scores)			
Rest	12	28	0.030
Movement	18	3	
SPADI score changes (≥10 scores)			
Pain subscale	28	29	0.038
Disability subscale	2	2	

KT: kinesio taping SASI: subacromial steroid injection.

* Statistically meaningful P values are written in bold characters.

positive effect on pain ROM and functionality. Immediate effects of kinesio taping obtained in other previous studies have also been found in our study. But our findings also indicate that the potential benefits of KT application are not limited to improving pain free ROM of shoulder immediately after application. A relatively long term benefit up to 1 month, related to pain or function occurred over 3 day period of tape application for three times.

The physiological mechanisms of decreasing pain and disability by KT can be explained as pain modulation via gate control or guidance of shoulder through an arc of improved glenohumeral motion, which reduced mechanical irritation of the involved soft tissue structures. These effects can be due to helping to support periarticular structures and reduce soft tissue inflammation and pain by KT.^{8–10} Through its effect on sensorimotor and proprioceptive systems, KT can assist in postural trunk and scapula alignment and support weak rotator cuff muscles. Another possibility is the placebo effect which also must be considered.³⁴ An important point regarding to study is that how often and how many times KT has been applied. We performed three times KT application by 3 days intervals. In the literature, there are different protocols used in patients with subacromial impingement syndrome.^{11,12} No consensus exists about method, duration and frequency of KT application in patients with subacromial impingement.

Home exercise programme and a relatively short duration of disease may also effect on these improvements in both groups. A home programme of appropriate and correct movement patterns can ensure prolonged and automatic pattern corrections which all integrate well with the therapies.^{8–10}

As far as we have known there are a few study comparing the therapeutic effects of local subacromial injection with a noninvasive method-KT. Subası et al³⁵ compared KT with subacromial steroid injection at baseline and first and third months of treatment in patients who had subacromial impingement syndrome and, reported that both KT and steroid injection were equally effective at end of treatment in terms of VAS and SPADI scores. There may be some limitations of our study. One of them is the absence of sham taping or sham injection to compare. Also combination therapy could be compared with local injection and kinesio taping alone. Although out of our scope, it would have been useful had we also an additional group with combination therapy of KT and injection. A relatively short follow-up time may be accepted as another limitation. The major strengths of the present study include the randomization of patients, statistical baseline similarity between groups in terms of demographic and clinical characteristics and sufficient statistical power to address the hypothesis.

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