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Scapular kinesiotaping improves upper extremity functionality in healthy active subjects

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SUMMARY

OBJECTIVE: The aim of this study was to investigate the effect of scapular kinesiotaping and sham-taping applications on upper extremity functionality in healthy active subjects.

METHODS: In total, 60 participants were randomly divided into two groups: scapular kinesiotaping group (n=30) and sham-taping group (n=30). While scapular kinesiotaping was applied to the kinesiotaping group, scapular rigid taping was applied to the sham-taping group. At the end of the third day of the taping application, the individuals were re-evaluated.

RESULTS: Participants in the scapular kinesiotaping group showed improvement in upper extremity functionality and quality of life after taping ($p<0.05$). In the sham-taping group, there was no statistically significant difference after taping ($p>0.05$).

CONCLUSION: Scapular kinesiotaping is effective in improving upper extremity functionality in healthy active subjects.

KEYWORDS: Kinesiotape. Upper extremities. Health related quality of life.

INTRODUCTION

Taping has been used for years in the prevention and treatment of sports injuries as it provides joint and muscle support during movement and is also known to improve proprioception in the prevention of acute and chronic injuries[1]. It is known that kinesiotaping (KT) improves local circulation, reduces edema, facilitates muscles, and improves joint functions by stimulating sensory mechanisms[2].

Scapula is the most important structure connecting the upper extremity and the axial skeleton[3]. Abnormal movement pattern in the scapula indicates shoulder pathologies[4]. Due to the close relationship between scapula and glenohumeral joint functions, it is necessary to focus on scapular control and performance in the rehabilitation of shoulder problems[5]. One of the recommended rehabilitation methods to facilitate scapula control is taping[6]. Although it is known that KT improves functional alignment and local muscle control, the mechanism is still unclear. In a study conducted on athletes, it was stated that ankle taping slows down the speed of inversion movement by activating the cutaneous receptors and fibularis muscle, thus reducing the risk of injury[7]. Similarly, KT application may have a proprioceptive and even mechanical effect on the shoulder joint by stimulating the cutaneous receptors in the upper extremity[8]. Although few studies have mentioned the positive effects of scapular banding on the dynamic position of the scapula, they have not been able to explain its mechanism of action on scapular kinematics[9]. Besides, studies conducted in recent years show that KT has a short-term positive effect on pain and shoulder joint range of motion, and tape applications can affect muscle activation levels[6].

To the best of our knowledge, there is no study in the literature investigating the effect of scapular KT on upper extremity functionality. Therefore, the aim of this study was to determine the effect of scapular KT on upper extremity functionality.

METHODS

Study design

This study was designed as a randomized controlled study. The participants were randomly assigned to the KT group or the control group (sham-taping (ST) group). All assessments were evaluated by a researcher who was blind to the groups.

Participants

A total of 60 healthy volunteers participated in this study. The inclusion criteria for the study group were that participants had (1) to be between the ages of 18 and 50 years[2]; no major musculoskeletal injuries in the upper extremity and shoulder girdle (i.e., osteoarthritis, rheumatoid arthritis, frozen shoulder,

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lateral epicondylitis, etc.)[3]; to involve in exercising at least 3 days a week; and[4] to be healthy and volunteers to be included in the study. Potential participants were excluded if they had[1] any systematic disease[2]; any pathology at the cervical region; or[3] surgery in the upper extremity and neck region. The research was approved by the ethics committee of Clinical Researches of XXX (Decision number: 2022-18/165).

Measurements

Purdue-Pegboard test

Purdue-Pegboard test (PPT) was used to assess dexterity. It consists of PPT nails, washers, and a perforated board assembly. The board has two parallel rows of 25 holes on each side. Nails and washers are located in the spaces reserved above the board[10].

Quick - Disabilities of the Arm, Shoulder, and Hand

Quick - Disabilities of the Arm, Shoulder, and Hand (Q-DASH) was used to measure the functionality of the upper extremity. The questionnaire consists of 11 items addressing the level of difficulty in performing daily activities and the participant's ability to work[11].

Upper Extremity Functional Index

Upper Extremity Functional Index (UEFI) evaluates the upper extremity function of the participant. UEFI consists of 15 items. Each answer is scored from 0 to 4 on a Likert scale. A higher total scores indicate better upper extremity function[12].

Short Form 36

Short Form 36 (SF-36) was used to assess the health status and quality of life. It consists of 36 questions that address areas such as mental health, general perception of health, physical functioning, role limitations, energy and vitality, social functioning, and bodily pain. Higher scores represent better quality of life and health status[13].

Interventions

Scapular kinesiotaping application

Scapular kinesiotaping application was performed by the same physical therapist on the KT group. After cleaning the skin, three strips of red KT were applied on the trapezius muscle. Scapular KT was applied on the three parts of the trapezius muscle. The kinesiotape was applied as type I without any tension (paper-off tension). The basic kinesiotaping method was used for the upper part of the trapezius muscle. The kinesiotape was applied from the insertion to the origin. The base of the kinesiotape was applied to the lateral one-third of the clavicle. The patient was then asked to rotate his head toward the opposite shoulder, and the tape was attached to the tensioned skin just below the hairline. The origo-insertion method was used for the middle and lower trapezius muscles. The processus spinosus of C6-T3 was applied for the middle trapezius, and the processus spinosus of T4-T12 was applied for the lower trapezius muscle.

Sham taping Application

ST was applied to the control group without applying any tension or method. Rigid (non-elastic) tape was applied on the three parts of the trapezius muscle: upper part, middle part, and lower part. All of them were applied from the insertion to the origin[14].

Sample size

A sample size of 26 participants was chosen for each group based on a power calculation of the outcome of Purdue Pegboard[15] to be published separately. We expected few drop-outs and, therefore, aimed 30 participants in each group and a total of 60 participants.

Statistical analysis

While the paired sample t-test is used to examine the change in the values determined by measurement of the KT and ST groups separately over time, the independent-sample t-test was used to compare the baseline data of both groups. Two-way mixed-design repeated-measures ANOVA was used to evaluate the change in the variables determined by the measurement over time and the group-time interactions of the groups.

RESULTS

A total of 66 volunteers applied for the study, and 60 satisfied the inclusion criteria. The volunteers' distributions were n=30 for the KT group and n=30 for the ST group after randomization. The flowchart of the study is shown in Figure 1.

Of the 66 healthy active subjects assessed for eligibility, 6 did not meet the inclusion criteria. Finally, the study was completed with 30 participants in the KT group and 30 participants in the ST group. The sociodemographic data of the participants in both the KT and ST groups were similar ($p>0.05$) (Table 1).

A comparison of pre-taping and post-taping findings showed that participants in the KT group had significant improvements in PPT, UEFI, Q-DASH, and some parameters of Quality of Life (SF-36) (Table 2).

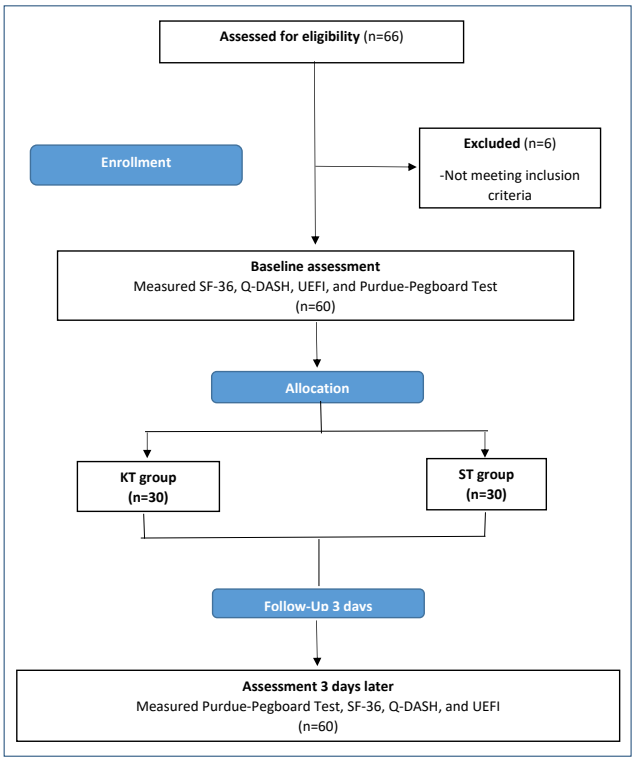

Figure 1. Study flowchart.

DISCUSSION

This is the first study to investigate the effect of scapular KT and ST on upper extremity functionality and quality of life in healthy active subjects. The findings of our study revealed that scapular KT caused significant improvements in upper extremity functionality and quality of life.

A previous study found that scapular taping in overhead athletes resulted in an improvement in scapular dyskinesia and pectoralis major length[16]. In addition, in a randomized controlled study comparing the effect of scapular rigid taping and scapular KT in patients with shoulder impingement syndrome, it was found that KT application reduced pain and had positive effects on scapular kinematics by increasing scapular retraction[17]. In another study, Van Herzeele et al. stated that scapular taping caused an increase in posterior tilt and scapular upward rotation of the scapula in asymptomatic female handball players and suggested that taping caused a mechanical effect on scapular movement[9]. Hsu et al. stated that applying taping to the lower trapezius muscle with shoulder impingement syndrome resulted in positive improvements in scapular movement and muscle performance[6]. The findings of our study are also consistent with the results reported in the literature.

Table 1. Baseline clinical and demographic characteristics of groups.

	Kinesiotape group	Sham tape group	p
Kadın n (%)–Erkek (n) %	(28) 93.3–(2) 6.7	(23) 23.3–(7) 76.7	0.071[a]
Age, mean±SD (min–max)	31.16±8.26 (22–50)	30.36±8.45 (25–54)	0.712[b]
Height, mean±SD (min–max)	165.86±7.20 (155–185)	169.63±9.95 (155–189)	0.990[b]
Weight, mean±SD (min–max)	66.13±10.42 (49–90)	68.86±16.40 (43–107)	0.444[b]
BMI, mean±SD (min–max)	24.11±3.37 (18.36–32.27)	23.69±4.16 (17.47–31.22)	0.663[b]
Dominant side right (n) %	(30) 100	(28) 93.3	0.150[a]
Purdue Pegboard			
Dominant hand	15.13±1.71	16.10±2.23	0.065[b]
Non-dominant hand	12.96±2.34	13.43±1.99	0.409[b]
Both hands	9.63±2.09	10.06±2.03	0.419[b]
Right+left+both hands	37.73±5.43	39.10±5.51	0.338[b]
Assembly	29.20±6.31	32.80±8.09	0.060[b]
Upper Extremity Functional Index	75.51±14.41	89.64±13.76	0.073[b]
Quick DASH	18.62±15.40	14.54±19.73	0.375[b]
SF36 (Quality of Life)			
Physical functioning	75.16±22.83	80.00±18.24	0.369[b]
Role limitations (physical)	61.66±35.19	70.66±30.78	0.296[b]
Role limitations (emotional)	61.03±41.19	67.77±41.54	0.531[b]
Energy and vitality	53.50±18.24	54.06±19.26	0.907[b]
Mental health	58.66±20.91	60.53±16.39	0.702[b]
Social functioning	61.36±25.63	71.66±20.48	0.091[b]
Bodily pain	63.30±22.55	69.66±23.49	0.289[b]
General perception of health	53.16±16.32	61.66±19.57	0.073[b]

SD: standard deviation; BMI: body mass index; min–max: minimum–maximum. [a]Chi-square test; [b]independent sample t-test.

Table 2. Baseline, post-intervention, and change scores for the Purdue-Pegboard test, Upper Extremity Functional Index, Quick - Disabilities of the Arm, Shoulder, and Hand, and Short Form 36.

	KT group			ST group			p^b (ES)	
	Pre-tape	Post-tape	p^a	Pre-tape	Post-tape	p^a	Time	Group×Time
Purdue Pegboard								
Dominant Hand	15.13±1.71	17.73±1.83	<0.001*	16.10±2.23	16.30±1.93	0.565	<0.001 (0.340)*	<0.001 (0.275)*
Non-dominant Hand	12.96±2.34	15.43±1.63	<0.001*	13.43±1.99	14.03±2.02	0.608	<0.001 (0.399)*	<0.001 (0.197)*
Both Hands	9.63±2.09	12.20±1.24	<0.001*	10.06±2.03	11.00±2.22	0.902	<0.001 (0.338)*	<0.001 (0.350)*
Right+Left+Both Hands	37.73±5.43	45.36±3.50	<0.001*	39.10±5.51	42.40±4.92	0.115	<0.001 (0.475)*	<0.001 (0.328)*
Assembly	29.20±6.31	38.00±6.10	<0.001*	32.80±8.09	32.93±9.43	0.882	<0.001 (0.330)*	<0.001 (0.317)*
Upper Extremity Functional Index	75.51±14.41	90.96±12.41	<0.001*	89.64±13.76	90.84±13.76	0.139	<0.001 (0.372)*	<0.001 (0.303)*
QuickDASH	18.62±15.40	9.22±9.43	<0.001*	14.54±19.73	13.15±16.96	0.504	0.001 (0.176)*	0.011 (0.106)*
SF36 (Quality of Life)								
Physical functioning	75.16±22.83	89.50±13.91	<0.001*	80.00±18.24	79.83±18.68	0.801	<0.001 (0.258)*	<0.001 (0.267)*
Role limitations (Physical)	61.66±35.19	79.16±27.91	0.008*	70.66±30.78	72.50±32.92	0.326	0.004 (0.136)*	0.027 (0.081)*
Role limitations (Emotional)	61.03±41.19	78.90±25.56	0.005*	67.77±41.54	71.10±40.81	0.184	0.002 (0.158)*	0.028 (0.081)*
Energy and vitality	53.50±18.24	58.66±18.75	0.045*	54.06±19.26	55.66±20.83	0.118	0.013 (0.101)*	0.184 (0.030)
Mental health	58.66±20.91	65.20±17.23	0.019*	60.53±16.39	63.06±16.96	0.149	0.005 (0.127)*	0.206 (0.027)
Social functioning	61.36±25.63	74.66±18.65	0.002*	71.66±20.48	72.91±21.29	0.326	0.001 (0.179)*	0.005 (0.130)*
Bodily pain	63.30±22.55	78.43±20.36	<0.001*	69.66±23.49	71.16±25.19	0.388	<0.001 (0.249)*	0.001 (0.182)*
General perception of health	53.16±16.32	57.16±13.17	0.045*	61.66±19.57	62.16±20.15	0.415	0.028 (0.080)*	0.086 (0.080)

p^a: paired sample t-test, p^b: mixed-design ANOVA, ES: effect size, *p<0.05.

Scapular KT application was found to be statistically significant in improving upper extremity functionality. In this respect, it can be thought that scapular KT application improves scapular movement and muscle performance and contributes to upper extremity functionality.

Upper extremity movements are performed by the shoulder complex, which consists of the humerus, scapula, and clavicle. The scapula is a center of shoulder activities, and a disorder in the position of the scapula negatively affects the optimal functioning of the rotator cuff muscles. A deterioration in the alignment and stabilization of the scapula on the thorax significantly affects the range of motion and functions of the upper extremity. The scapula contributes to the elevation of the upper extremity by causing upward rotation in the glenoid fossa. Scapula movement is created by the balance of force between the serratus anterior and trapezius muscles. These muscles work synergistically for the upward rotation of the scapula[18]. Naviwala et al. studied the immediate effect of KT on upper extremity movements in post-stroke hemiplegic patients. They applied KT to the upper trapezius, middle trapezius, rhomboids, and serratus anterior muscles of 30 patients and evaluated their upper extremity movements with the Fugl Meyer Assessment Scale. According to the results of the study, they concluded that KT application significantly improves upper extremity movements (i.e., coordination, hand, wrist, etc.)[19]. In our study findings, we concluded that scapular KT may cause a significant improvement in upper extremity functionality and hand motor skills, in line with the literature. We can explain the reason for this by the fact that scapular KT application can increase the intramuscular blood flow by elevating the epidermis and thus may cause improvement in joint functions.

There is limited evidence to support that scapular control can be altered by taping[20,21]. Selkowitz et al.[20] reported that scapular taping decreased the activity of the upper trapezius muscle and increased the activity of the lower trapezius muscle in individuals with suspected shoulder impingement syndrome during a functional overhead reaching activity. On the contrary, in a study involving healthy individuals, Alexander et al.[21] concluded that scapular taping reduces the amplitude

of the H-reflex in the lower trapezius muscle. In another study, Cools et al.[22] concluded that scapular taping on the three parts of the trapezius muscle and the serratus anterior muscle had no effect on muscle activity. In our study, KT application was performed on the upper, middle, and lower trapezius, increasing the upper extremity functionality. We think that KT applied on the muscle can change muscle activation and thus upper extremity functionality by stimulating the muscle spindle, which allows the movement of the muscles in that region to be perceived.

The effect of KT on quality of life is controversial in the literature. Vergili et al. concluded that glenohumeral and scapular KT application significantly improved the quality of life in patients with shoulder impingement[23]. Kul et al. compared the effectiveness of KT and traditional physiotherapy application in patients with shoulder impingement syndrome, and stated that KT application did not provide a significant improvement in the quality of life[24]. In our study, we concluded that the SF-36 quality of life questionnaire improved significantly, except for two subgroups (i.e., emotional role limitations and energy vitality). It is expected to increase the quality of life with the increase in upper extremity functionality.

CONCLUSION

This is the first study to examine the upper extremity functionality of scapular KT in healthy active subjects. Scapular KT application is effective in improving upper extremity functionality and quality of life in healthy active subjects. Also, KT application can be preferred by clinicians and researchers because it is a fast, non-invasive, and inexpensive method. Scapular KT application can be preferred as an effective treatment method in improving upper extremity functionality and movements. Long-term results investigating the effect of scapular KT application on upper extremity functionality in healthy and various pathological conditions are needed in future studies.

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AUTHORS' CONTRIBUTIONS

AÖ: Conceptualization, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. **MC:** Data curation, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing –review & editing. **MA:** Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

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