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Original Article

Effect of Kinesiotaping and Stretching Exercise on Forward Shoulder Angle in Females with Rounded Shoulder Posture

Arghavan Hajibashi[1], Ali Amiri[2*], Javad Sarrafzadeh[3], Nader Maroufi[3], Shohreh Jalaei[2]

[1]Iran University of Medical Sciences and Health services, Tehran, Iran
[2]Assistant Professor, Department of Physiotherapy, School of Rehabilitation Science, Iran University of Medical Sciences and Health Services, Tehran, Iran
[3]Associate Professor, Department of Physiotherapy, School of Rehabilitation science, Iran University of Medical Sciences and Health Services, Tehran, Iran

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ABSTRACT

Background: Rounded shoulder posture is a common abnormal posture in upper quarter. Kinesiotape is a new intervention that recently used in rehabilitation. There are no studies have examined the effect of kinesiotape on rounded shoulder posture. Therefore the purpose of this study was to determine the effect of scapular kinesiotaping and pectoralis minor stretching exercise on forward shoulder angle in female subjects with rounded shoulder posture.
Methods: Twenty female students aged between 18 to 25 years old with rounded shoulder posture participated in this study. Then, the subjects were randomly and equally assigned to two groups: the stretch group and the stretch plus kinesiotape group. Both groups were trained for doing home exercise to stretch Pectoralis minor bilaterally for two weeks. Kinesiotape group received kinesiotape on scapular area additionally. Forward shoulder angle was measured in four sessions including pre-intervention (first session), immediately after the first intervention (second session), fourth day (third session) and at the end of two weeks (fourth session). Two-way repeated measures ANOVA (4×2) was used for data analysis.
Results: kinesiotape group showed significant within-group decrease in forward shoulder angle between first session with three other sessions ($P \leq 0.05$).There was no significant within-group difference in stretch group and between groups ($P=0.20$) forward shoulder angle-by-group interaction in measurement sessions was significantly different ($P=0.02$)
Conclusion: scapular kinesiotaping along with pectoralis minor stretching exercise improved rounded shoulder posture in subjects of the present study. kinesiotape is suggested as a complementary treatment with immediate effects on postural correction of rounded shoulder.

Introduction

Abnormal posture is caused by abnormal relationship of body parts [1] and is a common finding in patient with musculoskeletal problems. One of the most common abnormal postures in upper quarter is forward head/ rounded shoulder posture. Eighty five percent and eighty two percent of patients with myofacial pain syndrome have forward head and rounded shoulder posture respectively [2, 3]. Due to these malalignments, joints, ligaments and muscles go under stress so the consequence would be pain and disability [1]. In rounded shoulder posture (RSP), shoulder is placed anterior to the plumb line and scapular position change [1, 3]. Leading to muscle imbalance,

*Corresponding author: Ali Amiri, Department of Physiotherapy, School of Rehabilitation Science, Iran University of Medical Sciences and Health Services, Tehran, Iran, Tel: +98-912-3949202,
E-mail: amiri10.alipt@yahoo.com

deficiency of scapulohumeral rhythm and finally shoulder impingement, bursitis, tendinitis, shoulder pain and instability occur [4-6]. Due to the high prevalence of RSP especially in modern societies[7], proper treatment of this problem is necessary for prevention of further complications.

Using plumb line if shoulder is placed anterior to the plumb line considered as RSP_observational method and supine method according to kendall and Sahrmman could be noted as a diagnostic method for RSP [1, 2, 8]. Thigpen et al. suggested forward shoulder angle for the mentioned purpose. Forward shoulder angle is the angle between vertical line that cross C_7 spinous process and the line that pass through the C_7 spinous process and acromion. The angle equal or greater than 52 degrees was considered as RSP by Thigpen et al. [5]. It seems that, impact of the other body part on the shoulder position is minimized in this method therefore this method may be more sensitive than the other to determine amount of rounded shoulder posture. That did not used in previous rounded shoulder posture studies.

There are different treatments for RSP which are as follows: strengthening of lengthened muscles, such as scapular stabilizers, stretching of shorten muscles especially pectoral muscles and soft tissue mobilization [3]. It is believed that these treatments can recovers normal glenohumeral joint kinematic and scapulohumeral rhythm [2, 6].

For correcting the malalignment and obtaining the ideal posture, it is necessary to use combination therapies consisting stretching and strengthening exercises, biofeedback training and behavior therapy. Although, the improvement of muscle length and strength achieved by exercise therapy could retrieve the normal posture, enhancing the self-awareness of posture should also be considered [9]. Change in scapular position imposed prolonged stress on muscle and joint structure and it may even lead to damaged proprioceptive muscle function [10]. For this reason, minimization of proprioceptive deficit might be one of the purposes of the rehabilitation in these subjects [11]. In fact, RSP is multifactorial and considering all contributing factor is necessary for proper treatment. In the suggested treatment procedures, patients are not controlled between the treatment or assessment sessions [3]. So, it is not clear that, whether the patient avoids kyphotic posture or other activities that exacerbate RSP during daily activities or not [3]. Kinesiotape stimulate cutaneous mechanoreceptor and provides continues feedback for the patient about his/her posture, therefore improves postural awareness during daily activity [11, 12]. Moreover, it helps the patient to avoid kyphotic posture and allows him/her to learn the correct movement patterns. Lewis et al. indicated that scapula and thoracic taping decreased the amount of RSP immediately in shoulder impingement syndrome [4]. Hwang et al. also found that kinesiotaping can decrease RSP in sedentary worker [13]. According to previous studies that demonstrated taping is effective in postural correction and improve proprioception[4, 11, 12], but did not examine the lasting effect of kinsiotape on RSP with upright and functional RSP diagnostic method. The purpose of the present study was to determine the effect of kinesiotape in conjunction with stretching exercise to treat RSP and comprise effect of this combination therapy with effect of stretching exercise.

Methods

This interventional study examined the effect of scapular kinesiotape and pectoralis minor stretching exercise on forward shoulder angle as a dependent variable in two treatment groups.

Participants were included if they had FSA≥52 degree, pectoralis minor shortness according to Kendall [1], BMI≤24/9 Kg/m^2, strength of scapular retractors be equal or more than grade 4 in manual muscle testing. Exclusion criteria consisted of have a history of pain, pathology or trauma in shoulder, cervical and thoracic region, absence in assessment session and skin abnormal reaction to kinesiotape.

The present study consisted of two phases, namely the assessment and treatment phases. Amount of rounded shoulder posture determined with measurement of forward shoulder angle (FSA) according to the measurement technique of Thigpen et al. [5]. Forward shoulder angle was measured in the assessment phase by photography. A digital camera was placed on a fix tripod with 1.5 meters height. Horizontal distance between the camera and the subject was two meter. The subjects were asked to stand with natural posture and look ahead. To facilitate this the subject were asked to raise and lower their arms over head, flex and extend head and neck and take deep breath for three times. Moreover, it was explained to subjects that taking a natural posture is important in this study. The markers were placed on the most postrolateral part of acromion and C_7 spinous process and the photograph was taken from lateral view. The angle between vertical line that cross C_7 spinous process and the line that pass through the C_7 spinous process and acromion was calculated by MB-ruler (Freeware to measure distances and angles on the computer screen) as a forward shoulder angle. Subjects with FSA greater than or equal to 52 degrees were considered as RSP[4, 5]. See FSA in Figure 1. In this study, the intrarater reliability of the forward shoulder angle measurement was evaluated. A group of 27 participants were measured twice by one week interval.

In treatment phase, the subjects were randomly and equally assigned to two groups by single block randomization: Ten subjects were randomly assigned to stretch group and the other 10 assigned to stretch and kinesiotape group (combined group). Both groups were trained for doing Pectoralis minor unilateral self-stretch exercise. The subjects were asked to stand and abduct shoulder to 90 degree with 90 degree elbow flexion and place the palm of their hand on a flat surface. Next they were instructed to rotate trunk to opposite direction until they felt the stretch and discomfort on anterior chest wall and held this position for 30 seconds. All participants had to do this exercise with three repetition in each session

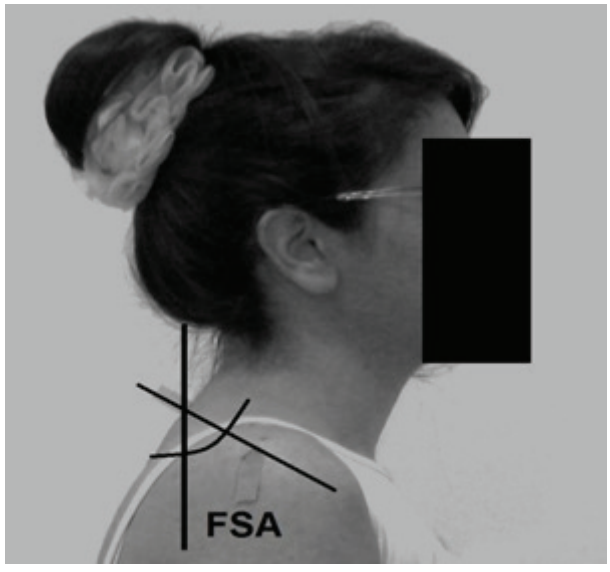

Figure 1: Forward shoulder angle

Figure 2: Scapular kinesiotaping

and with one session in a day [2, 14]. To ensure proper performance of exercise, the first and fourth exercise session were observed by examiner. Also, a daily exercise chart was given to subjects and they were asked to mark each daily exercise on it. Stretch group performed home stretching exercise bilaterally for two weeks. For combined group, in addition of stretching exercise, kinesiotape was used. Kinesiotape was applied with mechanical correction technique with 50-100% tension [15]. Initially the amount of tension was 50% and ultimately achieved 100% in the end of treatment sessions. After preparing kinesiotape with appropriate length, the subjects were asked to flatten their back (thoracic extension). Vertical Kinesiotape was applied on either sides of the spine from first thoracic spine (T_1) to twelfth thoracic spine (T_{12}). Then the subject fully depressed and retracted shoulders and an oblique Kinesiotape was applied from acromion to T_{12} spinous process bilaterally [4, 16-18] (Figure 2). kinesiotape was replaced every three days In treatment period.

FSA was measured in four sessions including pre-intervention (first session), immediately after the first intervention (second session), fourth day (third session) and at the end of two weeks (fourth session). In the second session, measurements were performed while the kinesiotape was on the body but in the third and fourth sessions it was done immediately after removing the kinesiotape for combined group. In order to minimize the effect of lower extremity position on trunk position, the foot place of each subject was marked for next measurement session.

Statistical Analysis

In this study, all statistical calculations were performed using SPSS software. In order to provide descriptive statistics mean and standard deviation were calculated at baseline and to assess normality of variables Kolmogorou - Smirnov (KS) was used. In order to analyze the reliability of forward shoulder angle, intraclass correlation coefficients (ICC) was calculated. To assess the effects of treatment, repeated measures two-way ANOVA was used. The level of significance was considered value (*P)* less than 0.05.

Results

Twenty female students of Iran University of Medical Science, aged 18 to 25 years participated in this study. Two of the participants did not attend in assessment session and those data were excluded from the analysis but other subjects were replaced.

Anthropometric characteristics of the participants are showed in Table 1 into separate group. According to K-S test results all variables follow a normal distribution ($P \geq 0/05$) led to the use parametric statistic in this study. According to independent t-test no significant difference was found between two groups in the baseline.

ICC showed that FSA measurement had a good reliability (Table 2).

Results of repeated measures ANOVA indicated that, there was significant decrease in FSA among first and three other measurement sessions in main effect of treatment, regardless of treatment type ($P<0.001$, $F=8.15$)

Table 1: Descriptive statistic and result of comparing participant in two groups

Variable	Mean±Standard deviation		95%Confidence interval		T	P value
	Stretch group (N=10)	Combined group (N=10)	Stretch group (N=10)	Combined group (N=10)		
Age	21.8±0.63	22.5±1.72	21.32_22.67	20.71_23.08	-1.21	0.06
Weight (Kg)	57.8±4.83	58.0±4.08	55.24_61.75	54.28_60.51	-0.10	0.51
Height (cm)	164.8±6.29	166.3±2.67	161.47_170.12	162.47_167.91	-6.95	0.12
BMI (Kg/m^2)	21.2±0.71	21.1±1.37	20.77_21.77	20.18_21.89	0.58	0.06
FSA (degree)	57.3±8.61	57.9±7.10	51.13_61.46	52.79_63.00	-0.17	0.75

BMI=Body mass index, FSA=Forward shoulder angle

Table 2: Results of intratester reliability study

Variable	Intraclass correlation	P value	95%Confidence interval	
			Lower bound	Upper bound
FSA	0.856	<0.001	0.712	0.931

FSA=Forward shoulder angle

on FSA. There was no significant difference between groups (P=0.20, F=1.75). Besides significant difference was found in FSA-by-group interaction (FSA degree changes) in measurement sessions between groups (P=0.02). Figure 3 indicate FSA comparison chart between groups.

According to bonferroni correction combined group demonstrated a significant within-group decrease in FSA only between first session with three other sessions (P≤0.05) While there was no significant within-group difference in stretch group (Table 3).

Discussion

The results of this study indicated that scapular kinesiotaping along with pectoralis minor stretching exercise decreased forward shoulder angle and therefore improved RSP significantly. Although there were no significant differences between groups and overall intervention after two week is the same, but significant difference was found in FSA-by-group interaction in measurement sessions. It means that the trend of FSA degree change is different between groups, FSA significantly decrease in combined group in second session and maintain it until the end of treatment, this difference could be attributed to the additional effects of kinesiotape and showed that kinsiotape can accelerate treatment process.

The exact mechanism of the effect of kinesiotape on the shoulder is still not clear. However, it has been suggested that its effect is both mechanical and proprioceptive. The literature have emphasized the role of joint structure and myofascial system on proprioception of shoulder girdle and it is believed that cutaneous input is less important[11, 19]. However recent study indicated that cutaneous input that was provided by kinesiotape can facilitate reaction speed and position awareness in ankle [20, 21]. The mechanism for the effect of kinesiotape on proprioception is based on the cutaneous input. For the purpose of mechanical correction, kinesiotape is applied in such a way that there is a minimal or no tension when the body is at the desired position but the tension increase if the body move outside of this position. Therefore it cans aware patients to correct movement pattern or body part position by providing appropriate stimulus. Over time and with enough repetition and feedback these patterns

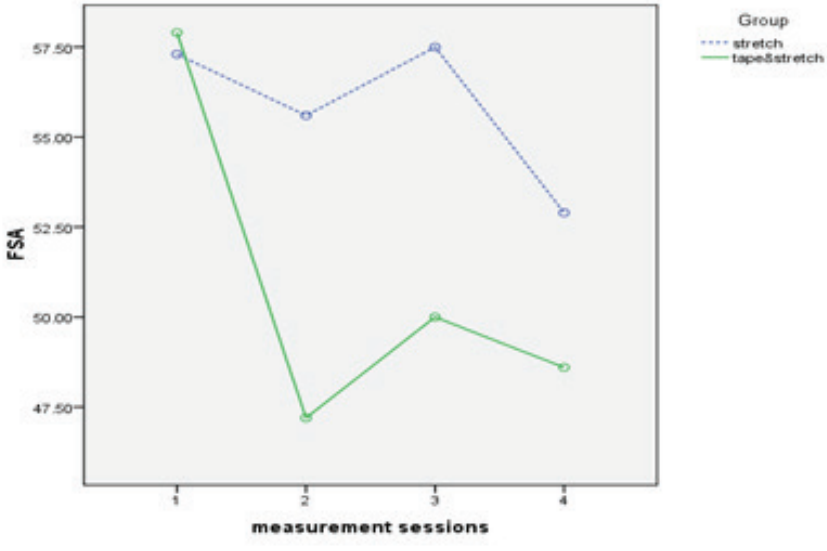

Figure 3: FSA changes in four measurement sessions for both groups.

Table 3: Results of Bonferroni correction for analysis within group difference

	Sessions	Stretch group				Combined group			
		Mean	Confidence interval		P value	Mean	Confidence interval		P value
			Lower bound	Upper bound			lower bound	Upper bound	
1	2	1.70	-2.73	6.13	1.000	10.70	1.34	20.05	0.024
	3	-0.20	-10.29	9.89	1.000	7.90	0.09	15.70	0.047
	4	4.40	-2.06	10.86	0.287	6.85	1.07	17.52	0.025
2	3	-1.90	-10.69	6.89	1.000	-2.35	-6.64	1.04	0.221
	4	2.70	-2.08	7.48	0.541	0.65	-6.92	4.12	1.000
3	4	4.60	-5.01	14.21	0.851	3.00	-3.28	6.08	1.000

become learned in motor program. In fact kinesiotape is considered as an effective cutaneous proprioceptive biofeedback [11].

There are several factors which will explain the success of RSP treatment by kinesiotape thorough mechanical effects according the results of the present study.

Firstly, taping might improve posture with applied prolong stretch on muscles. Muscle and collagen tissue are very adaptable and researches are indicated that prolonged and low load stretch are more effective than short term stretch. Kinesiotape maintain scapula in proper alignment and in this way applied prolonged stretch on tight structure surrounding shoulder and lengthening pectoralis minor and therefore can correct posture [11, 13, 17].

Secondly, the effect of kinesiotaping on postural correction might be thorough altering muscle function. Mechanical taping can applied in this way that place long and weak muscles to short position and lead to shift length-tension curve to left and more muscle force production in inner-range because of optimization of overlapping actin-myosin in cross-bridge cycle. Also kinesiotape can place short and overactive muscle in lengthen position and shift length-tension curve to right and with decrease overlapping actin-myosin in cross-bridge cycle diminished muscle force production [11]. Possible explanation is that scapular taping in RSP might placed pectoralis minor in lengthen position and weak posterior scapular stabilizer in shorten position and it is likely correct shoulder alignment with improve muscle function.

Thirdly, kinesiotape effect can be thorough correct scapular kinematic. Thigpen et al. indicated that rounded shoulder and forward head posture caused to increase scapular internal rotation in overhead reaching activity and loaded flexion task and increase scapular anterior tilt and upward rotation just in loaded flexion task [5]. On the other hand Shaheen et al. stated that scapular taping, increase scapular external rotation, upward rotation and posterior tilt in asymptomatic subjects. Also taping can decrease scapular anterior tilt during arm elevation in saggital plane [18]. Host et al. case-study demonstrate that scapular taping decrease elevation, anterior tilt and internal rotation of scapula and restore normal scapular kinematic in impingement syndrome [22]. Taping technique of these mentioned researches was the similar of our study. According to previous studies and considering the fact that in RSP scapula was in anterior tilt during activity and rest due to pectoralis minor shortness Scapular taping by decreasing scapular anterior tilt in daily activity and in rest place pectoralis minor in normal length and may play an effective role in correcting RSP. The results of this study confirm Hwang et al. case report study that state kinesiotaping can decrease RSP in sedentary back pain worker with different RSP assessment method [13].

Also the result of this study indicate that pectoralis minor stretching exercise alone and for two weak have no significant effect in decreasing forward shoulder angle. On the other hand treatment of tight pectoralis minor is one of the main components of rehabilitation in shoulder pathologies and RSP. During the measurement sessions, a steep decline was observed in FSA for stretch group. It is likely that by continuing the treatment for longer periods, the observed changes in forward shoulder angle could be statistically interpretable.

It seems that because of small sample size, this study did not have enough power to detect possible improvement in stretch group. Therefore performing this study with a larger sample size is recommended for future studies.

Conclusion

The results of this study indicated that scapular kinesiotaping along with pectoralis minor stretching exercise decreased forward shoulder angle significantly. Also, because one goals of rehabilitation is to accelerate the treatment process use kinesiotape is suggested as a Complementary treatment because of its immediate effect and maintain this corrective effect until the end of treatment period.

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Conflict of Interest: None declared.

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