Journal of Bodywork & Movement Therapies (2017) 21, 53—57

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/jbmt

CLINICAL STUDY

Change of pectoralis minor length, and acromial distance, during scapular retraction at 60° shoulder elevation

Nitaya Viriyatharakij, PT, PhD*,
Chatchada Chinkulprasert, PT, PhD, Navarat Rakthim, PT,
Jetjaree Patumrat, PT, Butsarin Ketruang, PT

Department of Physical Therapy, Faculty of Health Science, Srinakharinwirot University, Thailand

Received 11 January 2016; received in revised form 14 April 2016; accepted 18 April 2016

KEYWORDS
Scapular plane;
Posture;
Active stretch;
Pectoralis minor;
Acromial distance

Summary As the pectoralis minor muscle is inserted into the coracoid process, an improper length of this muscle would affect scapular and shoulder motions. Therefore, this study is proposed to assess the effects on pectoralis minor's length and acromial distance after active scapular retraction in scaption at 60° elevation. Sixty right-hand-dominant participants (11 males, 49 females) were randomized into an intervention group and a control group. The intervention group performed pectoralis minor muscle stretching by active scapular retraction, while the control group were asked to sit in an upright position. The result shows that, the mean lengths of pectoralis minor in the intervention group were significantly increased when compared with those of the control group ($p = 0.004$ and $p = 0.014$ respectively). Simultaneously, the reduction in acromial distance of this intervention group was substantially greater than the control group's ($p < 0.001$ and $p = 0.001$ respectively). However, it should be noted that the results reported only relate to the period immediately following muscle stretching.

Introduction

Postures that cause shoulder problems include forward head posture, thoracic kyphosis, and rounded shoulder posture (RSP)/anterior shoulder position (Kendall et al., 2005; Thigpen et al., 2010). RSP occurs when the position of the acromion process has abnormally shifted forward with the scapula in protraction, downward rotation, and anterior tilt (Borstad, 2008), causing the pectoralis minor muscle (PMi)'s function to change and shorten (Kendall et al., 2005). The PMi is the only muscle of the scapulothracic joint that is situated at the front of the shoulder joint. It has four insertions starting from the third, fourth, and fifth rib, continuing diagonally upward to the coracoid process (CP). The length of the PMi muscle is related to RSP (Wong et al., 2010). It also affects scapular movements and

* Corresponding author.
E-mail address: nitayav@g.swu.ac.th (N. Viriyatharakij).

http://dx.doi.org/10.1016/j.jbmt.2016.04.015
1360-8592/

elevation (Borstad, 2008; Borstad and Ludewig, 2005) and is related to the pathology of the shoulder joint (Ludewig and Reynolds, 2009; Tate et al., 2009). Clinical measurement of the PMi can be performed in two ways:

1) Measuring by referencing the anatomy of the PMi. This is done by measuring the distance between the CP and the fourth costosternal (Borstad, 2006; Borstad and Ludewig, 2005) or sternal notch (Nitaya et al., 2015). This method is adapted from Borstad's (2006) method to acquire the pectoralis minor index.
2) Measuring acromial distance (AD) that is the distance from the acromial angle (AA) to the bed or wall. This method is able to produce intraclass correlation (ICC) with reliability ranging from good to excellent. Measurement via this method can be done while lying face up (Lewis and Valentine, 2007) or while standing straight (Struyf et al., 2009).

Stretching the PMi is a method used to correct abnormal posture or shoulder impingement (Kendall et al., 2005; Kuhn, 2009; Struyf et al., 2013). This consists of stretching with or without assistance (Borstad and Ludewig, 2006; Kuhn, 2009). The effectiveness of such stretching depends on the duration, stretching position, and method. The appropriate duration for stretching is around 20—30 s, because muscle relaxation occurs during the first 20 s of stretching (Knudson, 2006). As for the stretching position and method, they must be specific to the muscle. According to previous studies, stretching the PMi by performing active scapular retraction with 60° flexion can increase the length of the PMi by an average of 1.99 mm (95% CI 1.27, 2.72) (Nitaya et al., 2015). Due to the alignment of the scapular on the chest, muscle stretching in the scaption position—the position with arm elevation at 30—45° between the scapular and the frontal plane—has three benefits:

1) Causing the highest point of the greater tubercle to be in the subacromial space with width greater than other plane of shoulder abductions.
2) It reflects the working of the supraspinatus muscle (Neumann, 2002).
3) It has a significant effect on the length of the PMi. A study using a cadaver has shown that shoulder abduction done via scaption has better results in increasing muscle length than via flexion (Muraki et al., 2009).

Methods

The participants consisted of 60 volunteers (aged 18—50 years old) who are right-handed or mainly use the right hand for daily activities. Eligible participants had no history of a broken clavicle, scapula, or humerus; surgery around the upper extremities or neck area; scoliosis; cerebral or spinal nervous system abnormalities; cardiovascular system abnormalities; or signs of arm, shoulder, or elbow pains during the study period (Table 1).

The participants were notified of the research procedures and went through an informed consent process. They were systematically randomised into an intervention group and a control group, with 30 participants each. This study was authorised by the Human Research Ethics committee of the Health Science Faculty of Srinakharinwirot University (HSPT 2014-013).

Markings were made on participants at the AA and sternoclavicular joint (SC). Measurement of the PMi (Fig. 1) was done by lining a long paper strip from the SC to the CP and then measuring it with a Vernier caliper with precision of ±0.03 mm. Measurement of the AD while sitting could be done by using an L-square ruler with water level to measure the length from the AA at the point perpendicular to the wall by adapting Struyf et al.'s (2009) method (Fig. 2). The participants had a digital inclinometer, with precision of ±0.10°, attached to their arm to measure the angle while performing shoulder abduction at 60° by referencing the line between the AA and the lateral epicondyle. To measure the length of the PMi and AD, the participants were placed in a sitting straight posture according to the postural chart, with the femur paralleling the chair, knees bent at 90°, and both arms lying beside the body. Errors were controlled by training the researchers in palpating the bone location, marking, and measuring. All researchers adhered to the measurement procedure throughout the study. The test-retest reliability of the PMi length measurement had an ICC 3,1 = 0.995 (95% CI 0.998, 0.999), while the measurement for AD had an ICC3,1 = 0.993 (95% CI 0.983, 0.998).

The research steps and procedures of the intervention group and control group are shown in Flowchart 1. After the

Table 1 Characteristics of volunteers (N = 60).

Characteristic	Control (N = 30)			Intervention (N = 30)			p-value
	x̄	SD	Min—max	x̄	SD	Min—max	
Age (yrs.)	24.00	6.98	18—50	24.17	8.12	18—48	0.93
Weight (kg.)	56.40	10.38	40—85	55.85	8.22	40—70	0.82
Height (cm.)	161.07	6.89	152—175	162.63	9.38	145—185	0.46
BMI (kg/m^2)	21.66	2.88	16.02—26.35	21.12	2.65	17.09—31.22	0.48
PMi resting length (mm.)	116.09	9.25	99.63—141.48	113.17	9.73	90.60—133.28	0.24
AD at resting (cm.)	7.17	1.48	4.55—10.75	7.38	1.59	4.45—11.15	0.59

PMi = Pectoralis minor; AD = Acromial distance.