Brazilian Journal of Physical Therapy 2018;xxx(xx):xxx–xxx

abrapg·ft
Associação Brasileira de Pesquisa e Pós-Graduação em Fisioterapia

Brazilian Journal of Physical Therapy

https://www.journals.elsevier.com/brazilian-journal-of-physical-therapy

ORIGINAL RESEARCH

Effect of flexibility deficit on scapular asymmetry in individuals with and without shoulder pain

Q1 **Elif Turgut**[a,*], **Gul Baltaci**[b]

[a] *Hacettepe University, Ankara, Turkey*
[b] *Private Guven Hospital, Ankara, Turkey*

Received 15 May 2017; received in revised form 13 March 2018; accepted 22 March 2018

KEYWORDS
Pectoralis minor;
Posterior capsule;
Kinematics;
Tightness;
Physical therapy

Abstract
Background: Many studies have investigated the relationship between soft tissue tightness and shoulder kinematics. However, there is a lack of information on the dynamic properties responsible for side-to-side differences such as scapular asymmetry.
Objective: To determine the relationship between a deficit in soft tissue flexibility and scapular asymmetry.
Methods: A total of 58 individuals (29 patients with shoulder pain and 29 asymptomatic participants) were enrolled. Bilateral shortening of the pectoralis minor muscle and posterior shoulder tightness were assessed. Additionally, side-to-side flexibility deficit was calculated. Scapular kinematics were measured with an electromagnetic tracking device while individuals were standing in a resting position and during arm elevation. The symmetry angle was calculated to quantify scapular asymmetry.
Results: The pectoralis minor and the posterior capsule flexibility deficit showed a significant positive relationship with the symmetry angle in the resting position separately for both asymptomatic ($r = 0.47$, $r = 0.37$ relatively) and symptomatic groups ($r = 0.58$, $r = 0.38$ relatively), indicating that the increased deficit in the pectoralis minor and posterior capsule flexibility were associated with increased scapular asymmetry. However, no significant relationship was found between flexibility deficit and scapular asymmetry during arm elevation and lowering for both asymptomatic and symptomatic groups.
Conclusion: The findings of the study provided information on the relationship of a flexibility deficit on the scapular position and orientation in asymptomatic and symptomatic populations.

Q2 * Corresponding author at: Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Samanpazari, 06100 Ankara, Turkey.
E-mail: elifcamci@hacettepe.edu.tr (E. Turgut).

https://doi.org/10.1016/j.bjpt.2018.03.007
1413-3555/

Please cite this article in press as: Turgut E, Baltaci G. Effect of flexibility deficit on scapular asymmetry in individuals with and without shoulder pain. *Braz J Phys Ther.* 2018, https://doi.org/10.1016/j.bjpt.2018.03.007

Introduction

It is widely accepted that the scapula plays an important role in providing mobility and stability for the shoulder joint complex.[1,2] During shoulder elevation, the scapula moves through upward rotation, posterior tilt, and internal or external rotation.[3] Abnormal movement alterations in these scapular movements are known as scapular dyskinesis.[4] Kinematic alterations and side-to-side kinematic asymmetry in the shoulder complex across symptomatic and asymptomatic populations have been previously reported.[5–8] Although there are several factors that might affect scapular kinematics, research till date has shown that pectoralis minor and posterior capsule tightness may be potential mechanisms for the development of kinematic alterations in the shoulder complex with movement dysfunctions, such as impingement symptoms.[9]

Borstad and Ludewig[10] categorized healthy shoulders as having a short or long pectoralis minor resting length. They reported that tightness in the pectoralis minor muscle resulted in significantly less scapular posterior tilt and greater scapular internal rotation during arm elevation. Similarly, forward shoulder posture with the protraction of the scapula was also related to soft tissue tightness of the pectoralis minor muscle,[11] which was regarded as a contributing factor to shoulder impingement.[12]

The posterior capsule of the glenohumeral joint has a complex structure,[13] and its tightness has been associated with altered scapular kinematics.[14] Borich et al.[14] conducted a study on asymptomatic shoulders with posterior capsular tightness and reported that the posterior capsule tightness resulted in increased scapular anterior tilt when the humerus moved toward internal rotation. In a cadaveric study, Harryman et al.[15] showed that the tightening of the posterior capsule also resulted in significant superior translation of the humerus on the glenoid.

A recent study has shown that both involved and non-involved shoulders have alterations in scapular kinematics in individuals with shoulder impingement.[16] Additionally, these symptomatic individuals had increased scapular asymmetry when compared to asymptomatic individuals.[16,17] Although there are many investigations conducted on the relationship between soft tissue tightness and shoulder kinematics, there is a lack of information concerning the dynamic properties responsible for side-to-side differences such as scapular asymmetry.[10,14,15] It is not yet clear whether side-to-side pectoralis minor and posterior capsule flexibility deficits have an effect on the observed scapular asymmetry in asymptomatic and symptomatic individuals.

This study investigated the relationship between pectoralis minor and posterior capsule flexibility deficits and scapular asymmetry in the resting position and during arm elevation in asymptomatic and symptomatic individuals. We hypothesized that there would be a positive relationship between soft tissue flexibility deficits and scapular asymmetry.

Methods

A total of 58 individuals participated in the study, including both symptomatic individuals with unilateral shoulder pain in the dominant arm lasting more than six weeks ($n = 29$) and asymptomatic individuals ($n = 29$). Symptomatic individuals with unilateral shoulder pain were selected from a group of patients who were diagnosed with unilateral rotator cuff tendinopathy. The symptomatic individuals recruited for the current study met at least two of the following criteria: (1) painful arc during flexion or abduction, (2) a positive Neer[18] or Hawkins-Kennedy test,[19] and (3) painful resisted external rotation or painful Jobe's test.[20] Asymptomatic individuals were selected among age-matched controls who had no history of shoulder pain or injury related to the upper extremities. They were included in the present study if they had 180° of shoulder flexion and abduction, 90° external rotation, and 70° internal rotation measured with a universal goniometer.[21] We excluded participants if they regularly participate in any overhead sports and patients with a rotator cuff tear >5 cm, a tendon tear in the long head of biceps, or degenerative joint disease based on magnetic resonance imaging or ultrasound findings. The Institutional Review Board (186-35, Hacettepe University, Ankara, Turkey) approved the protocol for this study, and all volunteers were informed about the nature of the study and signed a written consent form.

Bilateral indirect measurement of shortening of the pectoralis minor muscle was assessed using the pectoralis minor length test described by Lewis and Valentine[22] [intraclass correlation coefficients (ICC) ranging from 0.90 to 0.97]. Posterior shoulder tightness was assessed using measurements suggested by Tyler et al.[23] (ICC values ranging from 0.92 to 0.95). For the pectoralis minor length test (Fig. 1), the linear distance from the treatment table to the posterior aspect of the acromion was measured for each individual in a supine position.[22] The posterior shoulder tightness measurement was made with each individual in a side-lying position (Fig. 2).[23,24] During this measurement, the assessor first stabilized the scapula, and then the humerus was slowly lowered to a horizontally adducted position. The limit of posterior shoulder flexibility was considered as the onset

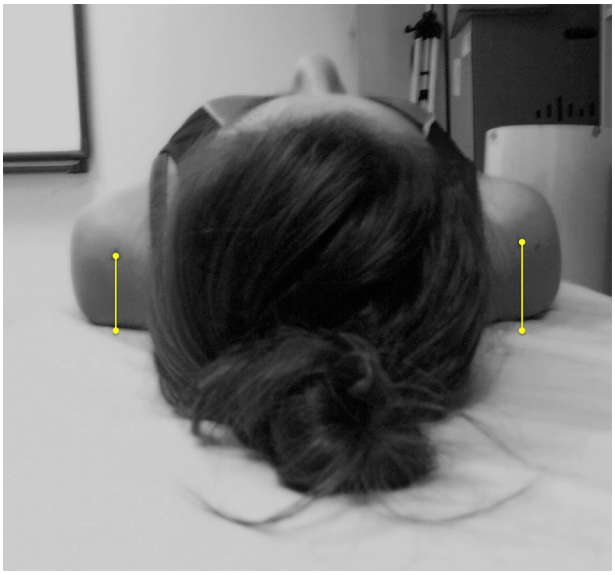

Figure 1 The pectoralis minor tightness assessment in asymptomatic and symptomatic shoulder groups.

Please cite this article in press as: Turgut E, Baltaci G. Effect of flexibility deficit on scapular asymmetry in individuals with and without shoulder pain. *Braz J Phys Ther.* 2018, https://doi.org/10.1016/j.bjpt.2018.03.007