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## INTER-RATER RELIABILITY STUDY

# The scapula backward tipping test: An inter-rater reliability study



Deepak Sebastian, DPT, DO, ND, PhD, OCS, FAAOMPT\*,  
Raghu Chovvath, DPT, OCS, FAAOMPT,  
Ramesh Malladi, DPT, OCS, FAAOMPT

*Institute of Therapeutic Sciences, Residency in Orthopaedic Physical Therapy, Fellowship in Orthopaedic Manual Physical Therapy, Alternative Rehab Inc, 20319 Farmington Road, Livonia, MI 48152, USA*

Received 12 March 2015; received in revised form 4 May 2016; accepted 20 May 2016

### KEYWORDS

Special test;  
Scapula;  
Forward tipping;  
Shoulder pain;  
Reliability

**Summary** *Background & Purpose:* The purpose of this study was to determine the reliability of the scapula backward tipping test (SBTT) in detecting the presence of pectoralis minor (PM) tightness and subsequently scapula forward tipping, in a symptomatic population. PM tightness with scapula forward tipping has been described to cause pain and dysfunction in the shoulder region.

*Methods:* 30 patients with a diagnosis of shoulder pain were randomly assigned and examined by 2 musculoskeletal physical therapists at a time. The procedure consisted of having the individual lay on the stomach in a neutral head position with palms in the anatomical position. The examiner firmly stabilized the inferior angle of the scapula with one hand and the fingers of the other hand hooked the under surface of the coracoid process. A gentle yet firm pull was imparted in an upward direction to sense tightness and to observe movement of the acromion up to the tragus of the ear. A comparison was made with the other side to sense restriction. Inter-rater reliability was determined using the kappa statistic.

*Results:* The SBTT was found to be reproducible between examiners (Kappa = 0.735, SE of kappa = 0.123, 95% confidence interval), with a percentage agreement of 86.67%.

*Conclusion:* The SBTT may be incorporated as a simple yet effective test to determine the presence of PM tightness and subsequently scapula forward tipping.

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\* Corresponding author. Tel.: +1 248 808 3792.  
E-mail address: [institutemanualpt@yahoo.com](mailto:institutemanualpt@yahoo.com) (D. Sebastian).

## Introduction

Mechanical dysfunction of the scapula has been described in patients presenting with shoulder, neck and thoracic pain and dysfunction (Cools et al., 2014). Authors describe the scapula to excessively protract, downwardly rotate, wing and forward tip during dysfunctional states. One structure described to contribute to this phenomenon, when tight, is the pectoralis minor (PM) (Ludewig and Reynolds, 2009). Additionally, studies have demonstrated lengthening of the PM during scapula backward tipping and upward rotation (Muraki et al., 2009; Borstad and Ludewig, 2006). While the fact remains clear that PM tightness contributes to pain and dysfunction, a practically feasible method to dynamically assess its length, and presence of tightness, continues to remain a challenge. Few studies have attempted to demonstrate methods to assess PM length, with good reproducibility (Struyf et al., 2014; Lewis and Valentine, 2007). This study proposes a novel and practical method to assess the possible presence of PM tightness, the scapula backward tipping test (SBTT). As studies have demonstrated the PM to lengthen during scapula backward tipping (Muraki et al., 2009), this method aims to indirectly assess the possible presence of PM tightness as the procedure incorporates backward tipping of the scapula. The SBTT, while indirectly addressing this hypothesis was assessed for reproducibility between raters.

While sensing the presence of tightness of the PM appears to be the objective, the challenge remains in establishing the presence of its 'normal' length. The neutral head posture seems to provide a basis for a hypothetical 'normal length' of the pectoralis minor. A deviation from the neutral head posture, as in a forward head posture, has been described to contribute to upper quarter pain and dysfunction (Lewis et al., 2005). Studies report the forward head posture to cause scapula downward rotation and forward tipping, secondary to a tight PM. They describe the neutral head posture to be an optimal head and scapula position, facilitated by a PM that is not tight (Yoo, 2013; Weon et al., 2010).

A neutral head posture, however, may require an operant definition as well, as the literature substantiating it is scarce. Studies describe the forward head posture in reference to the forward head angle, equal to or greater than  $46^\circ$ , relative to the vertical line extending from C7, to the line connecting C7 to the tragus. A rounded shoulder position is described as one having a forward shoulder angle of equal to or greater than  $46^\circ$ , relative to the vertical line extending from C7, to the line connecting C7 to the acromion (Thigpen et al., 2010; Ashley et al., 2013). Hence, for practical purposes, a neutral head posture, while performing a visual inspection, requires the tragus of the ear to line up directly over the acromion with the head aligned over a normal lordosis (forward head and shoulder angle equal to or less than  $46^\circ$ ), directly over the thorax. Clinicians (Sahrman, 2001; Lewis and Valentine, 2007) may have used this as a precedent to assess normal PM length. They have described a PM rest length normal when the acromion is an inch above the examination table in the supine lying position.

The SBTT describes a starting position analogous to a neutral head posture, and proposes normal PM length to be a movement of the acromion to be in line with the tragus of

the ear, in the prone lying position. It claims a dynamic and observational method of assessing PM length in addition to a qualitative end feel of tightness in comparison to the other side.

## Methods

Three orthopaedic board certified and orthopaedic manual therapy fellowship trained physical therapists, with 23 years of individual experience in orthopaedic physical therapy, conducted a pilot training on patients with shoulder pain. It was understood that at a given time, only 2 of the 3 physical therapists would examine a patient to determine PM tightness. The intention of the pilot training was to first become familiar with the methodology of performing the SBTT and subsequently establish an operant definition. The procedure consists of having the individual lay on the stomach in a neutral head position with palms in the anatomical position. The clinician placed one hand on the inferior angle of the scapula and the fingers of the other hand hooked the under surface of the coracoid process. With a firm inferiorly directed stabilizing force on the inferior angle of the scapula, a gentle pull was imparted in an upward direction (Figs. 1 and 2) to sense tightness and to observe movement of the acromion up to the tragus of the ear. Care was taken to not hook the fingers under the clavicle as this would place a stretch on the acromioclavicular joint and not the pectoralis minor. A statistical analysis was not done for the pilot training as the intent was to simply understand the methodology for consistency of performing the test, prior to conducting the study. Once the 'operant definition' for consistency of performance was clearly understood by the participating clinicians, the study proceeded.

Upon the approval of the 5-member Institutional Review Board of the Institute of Therapeutic Sciences, 30 patients



Figure 1 Test position for the SBTT.

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