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Athletic Training Students' Ability to Identify Scapular Dyskinesis

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A dissertation submitted in partial fulfillment
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ABSTRACT

Scapular dyskinesis refers to abnormal movement patterns of the scapula, which have been associated with injury. Previous investigations have validated the scapular dyskinesis test as a visual assessment method using physicians, physical therapists, and certified athletic trainers. Through educational programs, athletic training students should be taught what scapular dyskinesis is and how to identify it. Therefore, the purpose of this investigation was to (a) evaluate entry-level graduate athletic training students' ability to identify scapular dyskinesis, (b) assess their reliability, and (c) determine if they were able to correctly identify the muscles involved in rehabilitating an individual with scapular dyskinesis. Follow-up questions were directed at the athletic training students' learning experiences and exposure to scapular dyskinesis. Forty-one graduate athletic training students volunteered to rate 15 videos of participants completing the scapular dyskinesis test. The raters exhibited 80% agreement in identifying scapular dyskinesis. Nineteen of those 41 completed the reliability component, which consisted of seven videos, and revealed moderate reliability (κ =.32 inter-rater; κ =.45 intra-rater). The raters also demonstrated an ability to identify the muscles involved, with 88% correct responses. The follow-up questions revealed that athletic training students perceive greater exposure to scapular dyskinesis and identifying scapular dyskinesis in the classroom setting compared to the clinical setting. Overall, the results indicated that entry-level graduate athletic training students are prepared and able to identify scapular dyskinesis during a scapular dyskinesis test. However, it also indicates a disparity in the clinical education component of the athletic training education program.

This dissertation is approved for recommendation
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To my family, who has always supported me. Thank you for always asking mom about me, and for understanding missed holidays and gatherings. I couldn't have completed this without your support and love.

DEDICATION

I dedicate this to my parents, Ed and Denise, and to my siblings, Melissa, Anastasia, and Eddie. Many years in the making, but I'm finally finished… I think! Thank you for all your support and love, no matter where my academic journey took me I knew I was just a phone call away from home.

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CHAPTER ONE

Introduction

Movement and stability at the glenohumeral (GH) joint are essential for activities of daily living, recreation, and sport. Due to the ball-and-socket nature of the GH joint, position and movement are based on muscles and ligaments from the surrounding structures. Due to the anatomy of the GH joint, the position and movement of the scapula are in direct relationship to the position and efficiency of the humerus. With inefficient and unstable movement of the scapula, the GH joint is at risk for injury. Therefore, the position and integrity of the scapula is crucial to the movement and stability of the GH joint. Clinicians who are able to observe and determine the presence of abnormal position and movement of the scapula are further able to address the deficits in muscle activation through rehabilitation programs.

The GH joint is relatively unstable requiring coordinated muscle firing patterns to secure the humeral head in the glenoid fossa (Kibler, 1991). Many of the muscles associated with the GH motion originate on the scapula, such as the biceps, triceps, deltoids, and the coracobrachialis. The rotator cuff tendons along with the anterior and posterior GH capsule and GH ligaments provide stability to the GH joint (Kibler, 1991; Saha, Das, & Dutta, 1983; Sarrafian, 1983). Predominately, the subscapularis tendon provides anterior stability with the infraspinatus and teres minor provide posterior stability (Sarrafian, 1983). When the scapula is in a stable position, the rotator cuff muscles provide effective dynamic stability at the GH joint.

Optimal GH muscle strength and stability occur when ideal length-tension relationships are present (Kibler, 1991; McClure, Michener, Sennett, & Karduna, 2001). An adequate combination of ligamentous, muscular, and capsular forces allow for a

stable GH joint, therefore any deficiency in the muscular forces acting on the scapula alters the stability and function of the GH joint. When the scapula is in the most stable position, the length-tension relationship is going to be most advantageous, similarly when the scapula is in improper position risks the integrity of the GH ligaments (Kibler, 1991). Commonly, the scapula will translate laterally due to hypertrophy of the anterior muscles of the shoulder complex, thereby altering the length-tension relationship of the GH muscles, specifically decreasing the length of the muscles originating on the scapula and inserting on the humerus. The length of the muscles originating on the thoracic wall and inserting on the scapula are increased (Kibler, 1991). When the scapula is tilted laterally and anteriorly, the subacromial space is compromised, which results in decreased space for the supraspinatus and other soft tissue structures, which may present as impingement (Ludewig & Cook, 2000).

Furthermore, abnormal movement and position of the scapula, or scapular dyskinesis as it is termed, is also associated with subluxations and dislocations (Kibler, 1991; Saha et al., 1983). Scapular dyskinesis is proposed to be a result of a variety of pathomechanics including muscular imbalances (Cools, Witvrouw, Mahieu, & Daniels, 2005) and inhibition (Kibler and McMullen, 2003). However, it is also present in non-pathologicial individuals (Kibler, 1998; Uhl, Kibler, Gecewich, & Tripp, 2009). Due to the association with a variety of GH injuries, many investigators have proposed to create a measurement tools for scapular dyskinesis using either static or dynamic assessments. One classification system for the patterns of scapular dyskinesis describes: Type I – prominent inferior angle; Type II – prominent medial border; Type III – elevated and anterior displaced superior border; and Type IV – symmetric scapulae (Kibler et al.,

2002). Other investigations have simplified the ratings to abnormal and normal (Tate, McClure, Kareha, Irwin, & Barbe, 2009). With the simplified classification system symmetric movement of the scapulae is considered normal, where Type I-III is considered abnormal.

From the static position, measures of scapula asymmetry can be conducted including the Lateral Scapula Slide test with asymmetry defined as a difference greater than 1.5cm (Kibler, 1991; 1998). This static assessment records scapular position at three GH positions; anatomical, hands on hips, and 90° abduction. The Scapular Dyskinesis Test is a dynamic assessment where the clinician analyzes scapular movement while the athlete raises their arms in abduction and scaption. The clinician rates the movement as normal, subtle abnormal, or obvious abnormal (Tate et al., 2009).

Because of the association of scapular dyskinesis and injury, an athletic trainer should have knowledge and the ability to identify this predisposing condition. Athletic trainers are individuals certified by the Board of Certification (BOC) who "collaborate with physicians to optimize activity and participation of patients and clients" (BOC, 2011). Athletic training educational programs (ATEPs) follow guidelines set by a variety of professional organizations including the National Athletic Trainers' Association (NATA) Executive Committee for Education and the Commission on Accreditation of Athletic Training Education (CAATE). The 4th edition of the Athletic Training Educational Competencies (NATA, 2006) defined 12 content areas that ATEPs must address. The Orthopedic Clinical Examination and Diagnosis content area identifies the shoulder girdle as a body area which athletic training students must be proficient in evaluating (NATA, 2006). Furthermore, the Conditioning and Rehabilitative Exercise

content area addresses that an athletic training student must be proficient in therapeutic techniques to improve joint range of motion (ROM), muscular strength, neuromuscular control, and muscular coordination.

Therefore, with the knowledge and ability to recognize scapular dyskinesis, athletic training students could then develop a rehabilitation program to correct for the mechanics of scapular dyskinesis. Researchers have identified rehabilitative exercises for the scapular stabilizers, and have demonstrated promising results in building strength and stability to the scapula and surrounding structures (Hardwick, Beebe, McDonnell, & Lang, 2006; Kibler, Sciascia, Uhl, Tambay, & Cunningham, 2008; Lehman, Buchan, Lundy, Myers, & Nalborczyk, 2004; Tucker, Armstrong, Gribble, Timmons, & Yeasting, 2010).

In much of the published research, the evaluators have been primarily physicians (Tate et al., 2009) and physical therapists (Tate et al., 2009; Uhl, et al., 2009), with a few using certified athletic trainers (Uhl et al., 2009). Based on NATA's competencies, athletic trainers should be individuals qualified to identify scapular dyskinesis; however previous investigations have not used athletic trainers as raters to the extent of other health care professionals. Therefore, the purpose of this investigation was to assess the ability of athletic training students enrolled in an entry-level graduate athletic training education program to determine scapular dyskinesis.

Research Questions

1. Are athletic training students able to identify scapular dyskinesis relative to expert ratings?
2. Are athletic training students reliable in identifying scapular dyskinesis?

3. Are athletic training students able to identify the implications of their observations of scapular dyskinesis; i.e. identify muscles that stabilize and support the scapula?

Research Design

Independent variables.

Expert's rating of scapular dyskinesis – normal or dyskinetic

Muscles involved in scapular dyskinesis for the following examples of dyskinesis:

- Type I – serratus anterior and lower trapezius (Burkhart et al, 2003b)
- Type II – rhomboids major and minor (Burkhart et al, 2003b)
- Type III – upper trapezius and pectoralis minor (Terry & Chopp, 2000)

Dependent variables.

Athletic training students rating of scapular dyskinesis – normal or dyskinetic

Athletic training students' perception of muscles involved in scapular dyskinesis for the following examples of dyskinesis

- Type I
- Type II
- Type III

Hypotheses

1. Athletic training students are valid in assessing scapular dyskinesis as compared to experts.
2. Athletic training students are reliable in assessing scapular dyskinesis.
3. Athletic training students are able to identify the muscles that stabilize and support the scapula.

Significance of the Study

The term 'scapular dyskinesis' describes abnormal position or movement of the scapula that affects individuals with and without GH pathologies (Kibler, 1998; Kibler, 1991; Cools et al., 2005; Uhl et al., 2009); however, individuals with impingement, rotator cuff tears, and other GH injuries often present with scapular dyskinesis (Uhl et al., 2009). Individuals with scapular dyskinesis may have muscular imbalances, which can be addressed via rehabilitation exercises. Therefore, individuals educated on assessing pathomechanics and injury risks, such as athletic training students should be able to identify scapular dyskinesis.

Operational Definitions

Dyskinesis: (a) alterations in position and/or movement of the scapula; (b) side-to-side asymmetry; (c) inferior or medial border prominence; and/or (d) elevated superior angle

Elevation: an increase in the angle between the torso and humerus in abduction, flexion, or scaption (Saha et al., 1983)

Experts: individuals who have demonstrated an understanding and competence in the cause, evaluation, or rehabilitation of scapular dyskinesis through peer-reviewed publication

Glenohumeral internal rotation deficit: GIRD; a difference >25° in internal rotation between affected and non-affected shoulders or <25° of absolute internal rotation (Kibler, 2006)

Participants: Individuals who volunteered for the Scapular Dyskinesis Test; while performing the Scapular Dyskinesis Test, these individuals were filmed

Raters: athletic training students enrolled in their last semester at a Commission on Accreditation of Athletic Training Education (CAATE) graduate program

Scaption: a plane of GH motion, where the humerus remains in line with the spine of the scapula; typically 30-40º anterior to the frontal plane (Ludewig & Cook, 2000; Tsai, McClure, & Karduna, 2003)

CHAPTER TWO

Review of Literature

The review of literature will focus on the anatomy of the scapular muscles and scapular movement, in particular scapular dyskinesis. Furthermore, the review of literature will address the competencies for Athletic Training Education Programs that address scapular positioning and movement.

Anatomy of the Scapula

The scapula is an irregular shaped bone with two bony articulations; the acromioclavicular joint and the GH joint (Terry & Chopp, 2000). The acromion is a relatively flat surface that connects with the lateral component of the clavicle. The acromion creates the superior bridge for the rotator cuff tendons to pass through and attach to the humerus. The GH joint is comprised of the glenoid fossa and the humeral head. The glenoid surface of the scapula is only one third to one fourth of the size of the articulating surface of the humeral head, predisposing the GH joint to instability.

The scapula also serves as a site of origin and attachment for numerous muscles. The dynamic stabilizers of the GH joint, the rotator cuff, originate on the scapula (Figures 1 and 2). The supraspinatus originates on the supraspinous fossa and inserts on the superior aspect of the greater tuberosity of the humerus acting as a primary elevator of the humerus. The infraspinatus originates on the infraspinous fossa and inserts on the middle aspect of the greater tuberosity, and works as an external rotator with the teres minor. The teres minor originates on the middle of the axillary border and attaches to the inferior aspect of the greater tuberosity. The subscapularis originates on the subscapular fossa and attaches to the lesser tuberosity of the humerus. The main function of the

subscapularis is an internal rotator of the humerus. Along with the rotator cuff, the long head of the biceps works to depress the humerus at the GH joint with its origin at the supraglenoid tuberosity and superior labrum and insertion on the bicipital tuberosity on the radius.

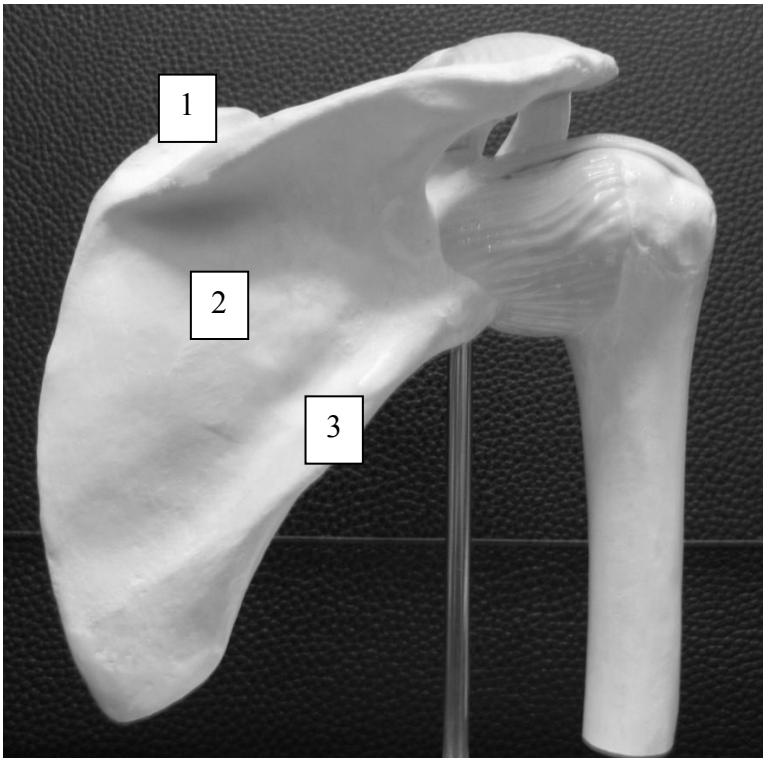

Figure 1. Posterior view of the scapula: supraspinatus (1), infraspinatus (2), and teres minor (3) origins.

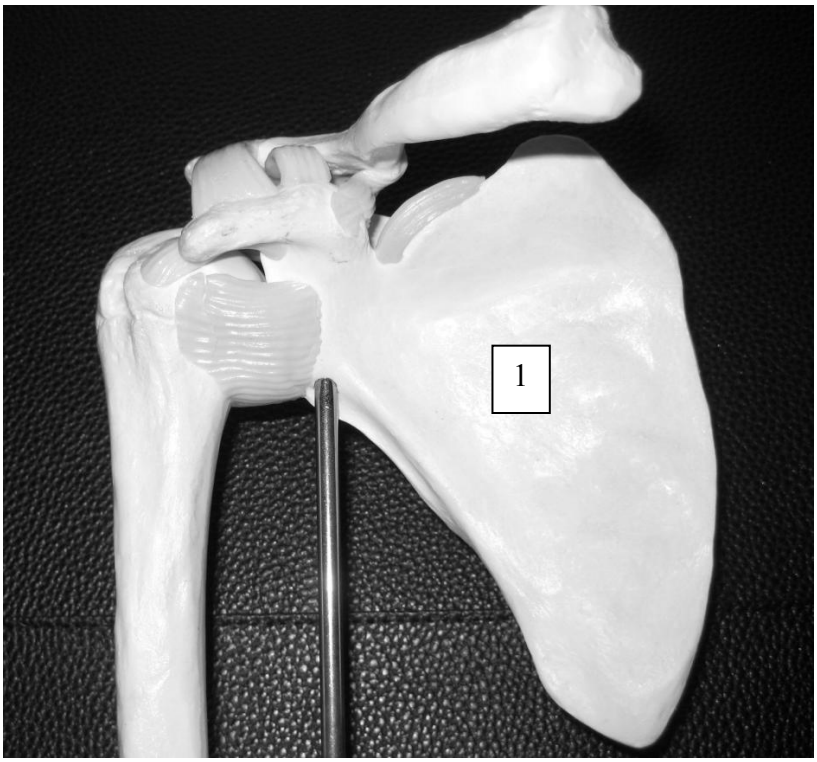

Figure 2. Anterior view of the scapula: subscapularis origin on the subscapular fossa (1)

Scapular kinematics

The scapula articulates around three axes of rotation, lateral, frontal, and vertical (Figure 3) (McClure et al., 2001; Kibler, 2006). The lateral axis of rotation allows for anterior and posterior tilting of the scapula. The frontal axis allows for upward and downward rotation of the scapula, while the vertical axis allows for internal rotation (IR) and external rotation (ER) of the scapula. Other common terms for IR and ER are medial and lateral rotation, respectively. The scapula also exhibits two translations based on the acriomioclavicular joint, superior/inferior and anterior/posterior (Kibler, 2006; Michener, 2005).

Scapular upward rotation is generated by contraction of the upper and lower trapezii, along with assistance from the serratus anterior (Glousman et al., 1988; Hardwick et al., 2006; Sarrafian, 1983). During elevation, the rotator cuff and deltoid are also highly active. Stability, in particular, is provided via the subscapularis until 130º of elevation; there after the GH ligaments take over (Sarrafian, 1983). Upon reaching maximal elevation, the infraspinatus and teres minor are activated to initiate ER of the GH joint.

Control and positioning of the scapula depend on coordinated function of the force couples of the muscles that act on the scapula and humerus (Rowe, Pierce, & Clark, 1973). The scapula rotates along the thoracic wall, with the serratus anterior pulling the scapula anteriorly, the trapezius controlling upward rotation and anterior movement. Any imbalances in this force couple or others may result in further weakness or instability.

Dyskinesis

A dyskinetic or abnormally moving scapula results in abnormal kinematics on the distal segments of the upper extremity (Burkhart, et al., 2003b). In a severe case of dyskinesis the individual may present with a SICK scapula, one that is exhibits **s**capular malposition, **i**nferior medial border prominence, **c**oracoid pain and malposition, and dys**k**inesis of scapular movement. The SICK scapula requires a clinician to palpate the shoulder girdle, as well as observe dynamic movements. During observation when viewing from the posterior, the inferior medial border will be noticeable, and from the anterior, the shoulder will appear to be lower than the non-affected shoulder due to the protraction of the affected shoulder. The SICK scapula is common in overhead-throwing individuals, especially in those who report with anterior shoulder pain without a history of a traumatic injury (Burkhart et al,, 2003b).

In throwing athletes, scapular dyskinesis and glenohumeral internal rotation deficit (GIRD) pose serious problems due to the unstable base of the scapula and the need for extreme movement and force production at the GH joint (Burkhart et al., 2003b). Although the etiology of GIRD is unclear, the association with decreased performance and injury are well identified. Glenohumeral internal rotation deficit is also associated with scapular dyskinesis (Kibler, 2006) and structural damage (Burkhart et al., 2003b). One study reported of the 124 individuals operated on for type 2 superior labrum anterior posterior (SLAP) lesions, all 124 individuals presented with GIRD (Burkhart, Morgan, & Kibler, 2003a). The authors suggest an aggressive stretching program may curve this link between GIRD and SLAP lesions.

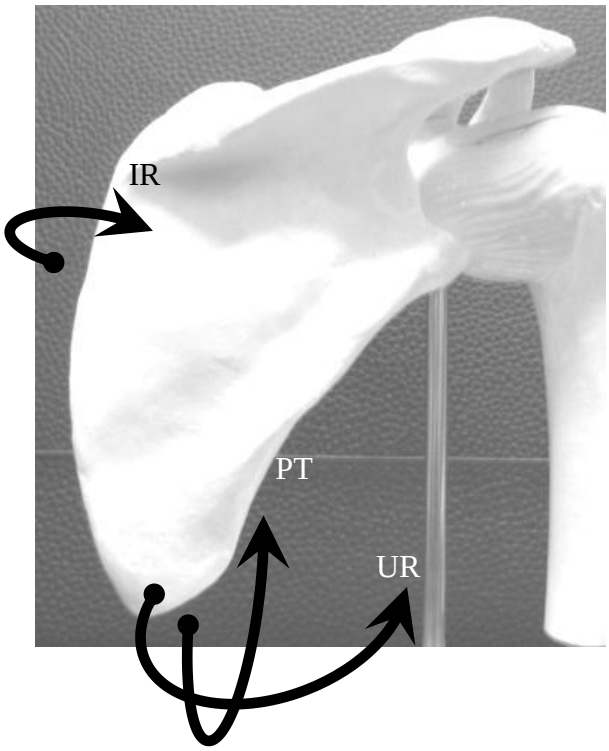

Figure 3. Movements of the scapula: IR – internal rotation of the scapula along the longitudinal axis; PT – posterior tilt of the scapula along the transverse axis; UR – upward rotation of the scapula along the frontal axis.

A variety of investigations have compared the scapular movement and muscle activation of individuals with and without pathologies. It is believed that scapular dyskinesis may be associated with impingement (Ludewig & Cook, 2000), instability (Kibler, 2006), osteoarthritis and frozen shoulder (Fayad et al., 2008), and muscle activation (Kibler, 2006; Ludewig & Cook, 2000).

Impingement. In individuals without impingement or other shoulder pathology, during GH elevation the scapula upwardly rotates, as well as posteriorly tilts and externally rotates (Ludewig and Cook, 2000; Tripp and Uhl, 2003). The authors suggested these movements prevent compression of the rotator cuff tendons and supporting structures while under the acromion (Ludewig and Cook, 2000; Tripp and Uhl, 2003). Individuals with impingement presented with less upward rotation at 60º of elevation and exhibited greater anterior tipping of the scapula (Ludewig and Cook, 2000). Both of these motions increase their risk of impingement.

Throwing athletes are at an increased risk of shoulder pathologies, possibly due to the increased GH ER and limited/decreased IR (Levine et al., 2006). An investigation of throwing athletes with internal impingement compared to non-injured throwing athletes revealed a greater degree of GIRD and posterior shoulder tightness in athletes with impingement (Meyers, Laudner, Pasquale, Bradley, & Lephart, 2006). The authors suggested a stretching program for the posterior structures may help reduce the deficit in IR. The authors however were unable to suggest whether GIRD is causative to impingement, but they were able to conclude the two are associated with one another.

In an attempt to identify exercises for individuals with dyskinesis and impingement, investigators have evaluated activity of the scapular stabilizers (Tucker et

al., 2010). Participants in this study were overhead throwing athletes, grouped based on history of impingement (with or without). The investigators collected electromyographic data on the middle trapezius, serratus anterior, upper trapezius, and lower trapezius during a cuff link push-up, push-up on an unstable surface, and standard push-up. The middle trapezius had greatest activation for both groups during the unstable surface push-up. The healthy participants elicited greater activation compared to the impinged on all exercises. The serratus anterior had greatest activity during the cuff link push-up compared to the other push-ups. Although not statistically significant, overall activation was greater in the healthy individuals compared to the impinged for the serratus anterior. The upper trapezius had greatest activation during the unstable surface push-up, however there were no differences noted between groups. The lower trapezius had similar activation during the traditional push-up and unstable surface push-up for both groups. The cuff link push-up did not elicit significant activation of the lower trapezius for either group. Because this study did not investigate kinematics, the authors were unable to explain the kinematic alterations that accompanied these forces. The authors suggested the commonly identified abnormal amount of upward rotation in individuals with impingement may have altered the activation of the scapular stabilizers.

Instability. Type I and II dyskinesis are associated with instability (Kibler, 2006). At the muscular level, the scapular muscles lose their effectiveness as dynamic stabilizers as the scapula loses its stable position (Kibler, 1991). Specifically, the glenoid is tilted anteriorly, increasing the risk of anterior displacement of the humeral head. In a study observing throwers with instability to throwers with stable shoulders, investigators recorded electromyographic and kinetic data while the participants pitched (Glousman et

al., 1988). The results revealed muscle activation differences across the two groups. Specifically, the unstable group exhibited greater biceps activation during acceleration and greater activation of the supraspinatus during all phases of the throw compared to the stable group. Infraspinatus activity had a similar pattern for the phases of throwing; however the unstable group exhibited greater activation during early cocking and acceleration, with less during late cocking. The authors commented that the increased activation of the biceps in the unstable group maybe a compensatory mechanism as the long head of the biceps acts as a dynamic stabilizer. With weakness or instability of the stabilizing structures, the biceps may have activated to assist.

Osteoarthritis/Frozen shoulder. During GH elevation, individuals with a stiff shoulder had greater amounts of ER of the scapula compared to individuals without pathology (Fayad et al., 2008). During rest, however, the two groups exhibited similar scapular positioning, supporting the need for dynamic evaluations (Fayad et al., 2008). In their investigation of 32 individuals with osteoarthritis or frozen shoulder, Fayad et al. (2008) quantified scapular kinematics during arm elevation. The investigators collected data using Polhemus Fastrack (SPACE FASTRAK, Colchester VT) electromagnetic tracking device with sensors placed on the sternum, acromion, and humerus. During the task of maximum elevation in the frontal and sagittal planes, kinematic data were recorded. The authors did not observe any differences in scapular kinematics at rest; however, during elevation scapular ER was greater in the affected shoulder compared to the non-affected shoulder in individuals with osteoarthritis and frozen shoulder. The authors suggest this difference in ER may be a compensatory change to allow for greater humeral elevation.

Muscular activation. The alteration in scapular movement decreases the efficiency of the length-tension relationship in the musculature surrounding the GH joint (Kibler, 2006). As stated previously, the primary GH stabilizing muscles originate off the scapula; therefore, as the position of the scapula is altered the line of pull is also changed. Anterior tightness of the pectoralis minor, coracobrachialis, and others may result in a protracted and anteriorly tilted scapula (McMullen & Uhl, 2000). Whereas posterior tightness of the rotator cuff and trapezius complex may result in a protracted, elevated, and anteriorly tilted scapula. In particular, Type I dyskinesis is associated with limited flexibility of the anterior structures, pectoralis major and minor, and weakness of the posterior structures, serratus anterior and lower trapezius (Burkhart, Morgan, & Kibler, 2003b). Type II dyskinesis is also associated with weakness of the posterior muscles, upper and lower trapezius and rhomboids major and minor.

In a comparison of impinged shoulders to non-impinged shoulders, the impinged shoulder demonstrated less protraction force output and strength suggesting a weakened or inhibited serratus anterior (Cools et al., 2005). In that particular investigation, individuals were classified as 'impinged' if they met two of the following criteria: positive Neer, positive Hawkins, positive Jobe, pain with apprehension, and/or a positive relocation test. The shoulders with impingement had less force output/body weight for protractors compared to shoulders without impingement. The authors suggested these results indicated serratus anterior weakness.

In a separate investigation, individuals with shoulder pain exhibited delayed subscapularis activity compared to individuals without shoulder pain (Hess et al., 2005). Similarly, individuals with shoulder pathologies demonstrated altered middle trapezius

activity compared to individuals without shoulder injury (Tucker et al., 2010). In an investigation of elite volleyball athletes, researchers assessed differences in dominant and non-dominant GH IR and ER (Wang & Cochrane, 2001). The investigators also conducted isokinetic tests on the internal and external rotators of the GH joint at 60 and 180° per second, as well as the Lateral Scapular Slide test. The results revealed dominant IR was less than the non-dominant measure; dominant mean peak strength was greater during both concentric and eccentric contractions of the internal rotators; and external rotators eccentric strength was weaker than internal rotators concentric strength creating a muscle imbalance. The scapular results were not associated with injury in this sample, however this could be due to the limited sample size of individuals with injury or pain (n = 7).

Assessment of Dyskinesis

Many investigations have assessed scapular dyskinesis using 3-dimensional tracking devices (Uhl et al., 2009), or clinical assessments and observations (Kibler, 1991; Kibler et al., 2002; Uhl et al., 2009). A comparison of the 3-dimensional and categorical assessments revealed a simplified yes/no response to scapular dyskinesis can provide clinicians with reliable and valid measures (Uhl et al., 2009).

Three-dimensional assessment. Some investigations have used 3-dimensional motion tracking to measure clavicular and scapular motion (Fayad et al., 2008; Ludewig & Cook, 2000; Tate et al., 2009). Using this method, investigators used receivers applied to the sternum, humerus, and the lateral scapular spine/acromion. Investigators digitized bony landmarks along the upper extremity and thorax so movement was recorded in regards to the global coordinate axis system. Participants completed the Scapular

Dyskinesis Test. The scapular kinematic results from Tate et al.'s assessment of individuals with and without scapular dyskinesis revealed less upward rotation and clavicular elevation at rest and throughout flexion in the dyskinetic group compared to the participants in the normal kinematics group (2009). Individuals with dyskinesis also demonstrated greater protraction values at rest and throughout flexion. During abduction however the differences in upward rotation and clavicular elevation were only significant at rest. The dyskinetic group also had greater posterior tilt at rest during abduction exercises compared to the normal kinematic group.

Clinical observation. There are few tools available in which clinicians view an individual's scapula and determine whether dyskinesis is present. These tools are easy to administer and quick to identify deficits or alterations in the movement patterns.

Lateral Scapular Slide. One easily administered measure of scapular movement is the Lateral Scapular Slide test (Kibler, 1991). During the assessment the patient stands with their arms in anatomical position, while the clinician measures from the seventh thoracic spinous process to the inferior border of the scapula. The clinician repeats the measure when the patient has their hands on hips and again when the patient's arms are raised to 90º. Asymmetry greater than 1.5cm is considered clinically significant (Kibler, 1998).

Scapular Dyskinesis Test. The Scapular Dyskinesis Test is a visual observational assessment where the scapular muscles are under stress, and the patient performs dynamic tasks (McClure et al., 2009; Tate et al., 2009). Specifically, the test is conducted with the patient performing repetitive elevation in scaption while holding a weighted dumbbell. The resistance is determined by the body mass of the patient. For a patient less

than 150 lbs a 3 lb dumbbell is used. Patients over 150 lbs use a 5 lb dumbbell (McClure et al., 2009). Raters have demonstrated moderate reliability in determining normal, subtle abnormal or obvious abnormal movement.

Scapular Dyskinesis System. The Scapular Dyskinesis System through visual assessment categorizes scapular dyskinesis into four categories: Type I – prominent inferior angle with limited acromial elevation and retraction; Type II – prominent medial border; Type III – elevated and anterior displaced superior border; and Type IV – symmetric scapulae (Kibler et al., 2002). Type I and II dyskinesis are common in individuals with labral pathologies, while Type III is common in individuals with impingement and rotator cuff pathologies (Burkhart, et al., 2003b). Impingement due to Type III dyskinesis impingement is correctable through rehabilitation, contrary to impingement caused by a hooked acromion. Therefore, clinical observation of the scapula is crucial in identifying the cause of the pain and the appropriate plan of action.

Using the Scapular Dyskinesis System categories (Type I-IV), investigators watched video recordings of individuals performing GH elevation (Kibler et al., 2002). The motions were filmed from a posterior view. The raters then watched the video recordings from a computer at a later date and determined a category for each individual's type of dyskinesis. Specifically the raters were two physicians and two physical therapists. In a similar study, the investigators condensed the four categories into abnormal or normal (Uhl et al., 2009). Both methods provided reliable measures of scapular dyskinesis; however a yes/no response exhibited better reliability.

Scapular Muscle Strengthening

It is well understood that the scapula plays a role in GH motion and stability; however exercises to strengthen the scapular stabilizers are not common in regular fitness programs. Re-establishing normal position and motion of the scapula, and strengthening the scapular stabilizers may decrease the risk of impingement and other pathologies (Voight & Thomson, 2000). The initial steps in rehabilitative exercises are to determine the irregular motion and the mechanism, with focusing on scapular control before loading the rotator cuff (McMullen & Uhl, 2000; Voight & Thomson, 2000). Before beginning the strengthening exercise, the clinician must address muscular tightness through an in-depth evaluation and stretching protocol (Kibler, 2006; Voight & Thomson, 2000).

In taking a kinetic chain approach to rehabilitation with the principles of proprioceptive neuromuscular facilitation, clinicians should understand five main principles (McMullen & Uhl, 2000). The first is that motor behavior is the sum of sequential movement patterns, often with force generated from the lower extremity through the core resulting in upper extremity force production and movement. The second principle is that antagonist muscles must function together to maintain balance for goal-directed tasks and posture. The third is that normal movement occurs proximal to distal. The fourth principle is that stronger movements activate weaker movement patterns, such as thoracic extension encourages scapular retraction. Finally, using biofeedback and positioning the clinician enhances the education and motor learning process.

The primary goal of the first stage of rehabilitation should be attaining scapular retraction. The supraspinatus has greater strength when the scapula is retracted (Kibler,

Sciascia, & Dome, 2006). In an investigation of supraspinatus strength in individuals with and without shoulder pathology, investigators controlled scapular protraction using the Scapular Retraction Test and reported greater strength when the scapula was stabilized in both groups. The Scapular Retraction Test is performed with the individual standing facing away from the clinician. The individual performs humeral elevation until the point of pain or inability to continue. Then the clinician, using their hand and forearm, stabilizes the scapula against the thoracic wall of the individual. The individual then performs humeral elevation; if ROM improves without pain the test is positive indicating weakness in scapular retractors is creating an unstable base resulting in inefficient muscle activation.

There is a variety of open and closed kinetic chain exercises available that address retraction. The shoulder dump exercise performed without arm movement emphasizes scapular retraction through thoracic extension and rotation (McMullen & Uhl, 2000). Other beginning stage open kinetic chain exercises are sterna lifts, fencing with tubing, lawnmower, and dumbbell punches (McMullen & Uhl, 2000; Paine & Voight, 1993; Voight & Thomson, 2000).

The lawnmower exercise requires the individual to rotate and extend the thorax which enhances and exaggerates scapular retraction (Figure 4). The positioning is similar to that of starting a traditional lawnmower, with the feet staggered, hips flexed, torso rotated away from affected side, and affected elbow extended. The end position is staggered feet, torso extended and rotated towards affected side, GH extension, and elbow flexion.

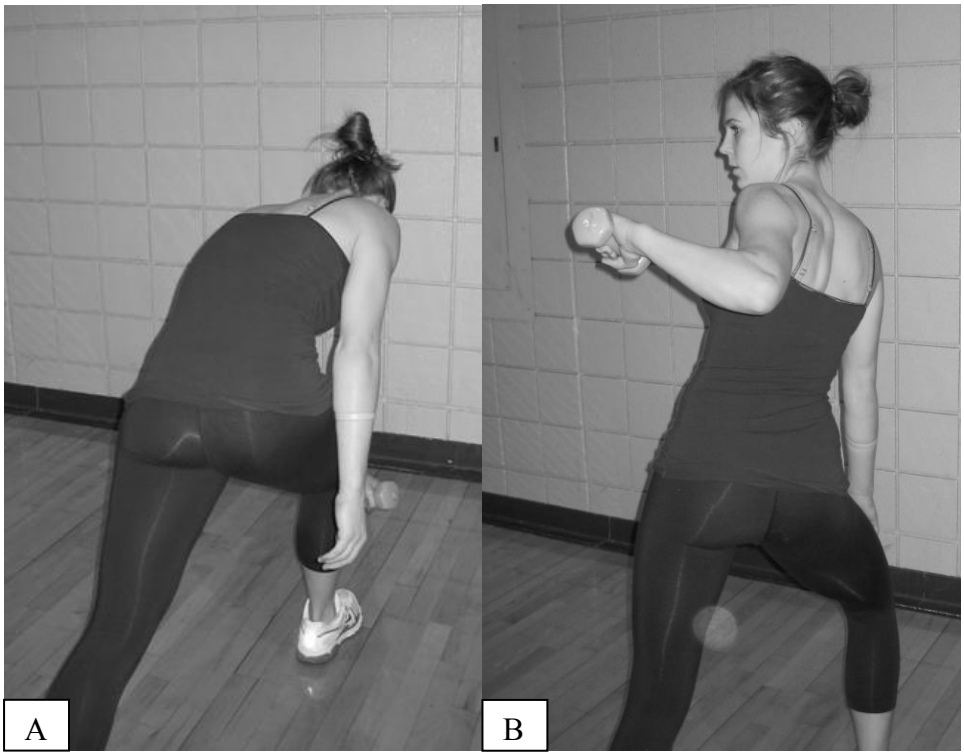

Figure 4. Lawnmower starting (a) and stopping (b) position.

Closed kinetic chain exercises are also beneficial in muscle and posture re-education. Examples of closed kinetic chain exercises are scapular clock, towel slide, and wall slides (Voight & Thomson, 2000). The scapular clock exercise is performed with the individual placing their hand on a ball on a table surface. The individual is to keep their hand in contact with the ball while moving their scapula into elevation (12 o'clock), depression (6 o'clock), retraction, and protraction (3 and 9 o'clock, respectively). As the individual is able to move into greater degrees of humeral elevation, the ball can then be held against the wall requiring stabilization as well as movement at the scapula.

Towel slides are performed on a table top in the early stages as well and can progress to the wall as rehabilitation continues. The individual stands at the end of a table, with a towel between their hand and the table top. The individual then flexes the trunk forward at the hips, while maintaining a 'flat back'. This should create a slight stretch into GH flexion. Upon feeling the stretch, the individual extends at the hips and emphasizes scapular retraction, while pulling the towel back along the table top.

Exercises should progress once retraction is achieved. The imbalance between lower trapezius with the upper trapezius is often observed in individuals with scapular dyskinesis (Cools et al., 2007). Therefore, exercises with low ratios between upper trapezius and lower trapezius activation are essential in correcting scapular dyskinesis. In an electromyographic investigation, Cools et al. (2007) identified such exercises: side-lying forward flexion, side-lying ER, and horizontal abduction with ER. The side-lying exercises did not elicit upper trapezius activation to maintain posture, leaving the lower trapezius with greater activation.

As the rehabilitation program continues multi-planar and dynamic movements should be implemented, such as rhythmic stabilization, push-up with a plus, GH proprioceptive neuromuscular facilitation D1 and D2 patterns, and plyometric throws (McMullen & Uhl, 2000; Paine & Voight, 1993; Voight & Thomson, 2000). The proprioceptive neuromuscular facilitation D2 pattern is more commonly practiced because it mirrors functional movements and requires the individual to extend the thorax and retract the scapula (Voight & Thomson, 2000). However to optimize the rehabilitation program, the clinician must provide biofeedback and repositioning of scapular neutral when the patient continues between sets and reps of exercises.

Content Areas for ATEPs

All ATEPs have to be accredited by CAATE in order for their students to sit for the BOC examination (BOC, 2011). The purpose of CAATE accreditation is promoting minimum standards of quality of entry level Athletic Training programs. Each ATEP has to follow the standards enforced by CAATE. Each ATEP has the responsibility to demonstrate compliance with the standards in order to maintain their accreditation. The standards only provide minimal academic requirements and it is up to the individual ATEP to develop the educational approach to the standards. Within content of the ATEP curriculum, the standards must include subject matter listed in the Athletic Training Educational Competencies (NATA, 2006). The educational competencies are minimal expectations for athletic training students enrolled in a CAATE-accredited college or university. The current, 2006-2011, competencies are divided into cognitive, psychomotor, and clinical proficiencies that cover 12 content areas.

In regards to scapular dyskinesis, the competencies address in the following two content areas support that certified athletic trainers are qualified clinicians in assessing scapular dyskinesis. Although there are competencies and standards listed for the ATEPs, each program has autonomy in determining the instructional methods and educational emphasis.

Orthopedic clinical examination and diagnosis. "Entry-level certified athletic trainer(s) must possess the ability to clinically examine and diagnose a patient for the purpose of identifying (a) common acquired or congenital risk factors that would predispose the patient to injury and (b) musculoskeletal orthopedic injuries to determine proper care" (NATA, 2006, pg 13). Based on those expectations, athletic training students are instructed on proper evaluation techniques for the shoulder girdle as well as other body areas. Specifically at the joint level, athletic training students are also expected to master the understanding of arthrokinematics, ROM, and skeletal muscles affecting the joints. Beyond the specific joints of the body, athletic training students are also expected to display mastery of evaluating posture, inspecting biomechanical abnormalities, and assess for normal or pathological characteristics.

Conditioning and rehabilitative exercise. The initial focus of rehabilitative exercises should be to address the scapular position and control of the core (Kibler & Sciascia, 2010). Numerous NATA competencies address components of general rehabilitation programs which can be incorporated into a scapular rehabilitation program, such as understanding the anatomical alterations from improper mechanics, interpretation of physical assessments, and criteria for exercise progression (NATA, 2006). With

mastery of these competencies, athletic trainers are qualified individuals to implement a rehabilitation program for an individual with scapular dyskinesis.

CHAPTER THREE

Methods

To assess the first hypothesis, 'athletic training students are valid in assessing scapular dyskinesis as compared to experts', athletic training students' ratings of scapular dyskinesis were compared to expert ratings. To assess the second hypothesis, 'athletic training students are reliable in assessing scapular dyskinesis', test-retest reliability measures were conducted. For the final hypothesis, 'athletic training students are able to identify the muscles that stabilize and support the scapula', raters completed a short questionnaire. Prior to any collection of the data, the University of Arkansas Institutional Review Board approved this study.

Participant protocol

Recruitment. Participants were individuals who volunteered to complete the Scapular Dyskinesis Test. Participants were recruited through convenience sample at the university. Participants (n = 52) were included in the study if they met the following inclusion criteria: minimum of 120º of active elevation in abduction and scaption, and no injury to the shoulder, head, neck, or spine in the past year.

Procedures. All participants signed the university approved consent form (Appendix 1) prior to participation. Participants were asked if they had any injury to the shoulder, head, or neck within the past year. If yes, the investigator thanked the individual for their interest, and they were excused from data collection. The investigator measured standing active flexion in scaption and abduction for each participant to ensure 120º of movement. According to the literature shoulder flexion is a primary movement of the glenohumeral joint through 120º, beyond 120º the flexion of the glenohumeral joint is aided by the scapulothoracic joint (Terry & Chopp, 2000). The investigator instructed

participants to “stand upright with shoulders back”; the investigator then used a goniometer to measure flexion in scaption, as well as abduction. The investigator placed the stationary arm along the participant's lateral thorax, perpendicular to the ground, and the moving arm along the participant's upper arm in line with the humerus. As the participant raised their arm, the investigator reminded the participant to avoid leaning their torso to the side. If the participant was able to reach 120º in both planes of motion for both arms, the participant was included in the study.

The investigator then instructed and demonstrated to the participant how to complete the Scapular Dyskinesis Test (Tate et al., 2009). Each participant lifted 3lbs (if participant <150 lbs) or 5lbs (if participant >150 lbs) for 5 trials in abduction as well as scaption to a metronome pace of 2 seconds up, 2 seconds down (Figure 5). The investigator randomized the order of the testing.

The investigator recorded the scapular movements from a superior and posterior view using FlipVideo™ (Cisco Systems, Inc., San Jose, CA) cameras. The superior camera provided a bird's-eye view of the participants' posterior head and top of shoulders. The investigator angled the camera between 45-60º to ensure the scapulae were in view. The posterior camera provided a view of the participants' head, shoulders, and upper back. There was no identifiable information video-recorded.

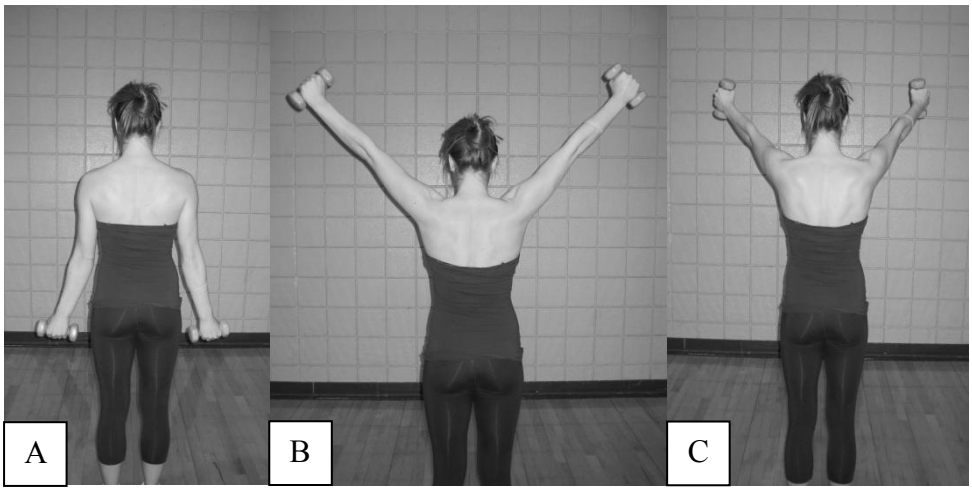

Figure 5. The Scapular Dyskinesis Test beginning position (a) and ending positions for abduction (b) and scaption (c).

Instrument

The investigator developed a web-based questionnaire using SurveyGizmo (www.surveygizmo.com, Boulder, CO). The questionnaire included embedded videos of both superior and posterior views for each participant completing the Scapular Dyskinesis Test. The survey included a statement of implied consent and instructions, which were the same for the raters as the experts. Both groups were able to view the films as many times as necessary by re-clicking on the play button.

For the experts' questionnaire 18 of the 52 participant files were removed from expert analysis due to lack of video clarity, improper form, or video trial error; resulting in 34 video files for expert analysis. For the raters, the questionnaire also included Likert-scale questions regarding academic and clinical exposure to scapular dyskinesis and a demographic section. The raters' questionnaire was then shortened to only video files where 5 of 6 experts had agreement (18 video files), and even further to 15 video files due to feedback from experts regarding the length of time for the questionnaire

The experts and raters watched two video files, superior and posterior, for each participant and checked which dyskinetic motions they observed (Appendices 2-4). The investigator set the response options so if normal was selected no other option could be checked; however more than one box could be checked if normal was not selected.

Expert recruitment and protocol

The investigator considered experts those who have demonstrated with peer reviewed publications an understanding and competence in the cause, evaluation, or rehabilitation of scapular dyskinesis. Experts (n = 8) were contacted via telephone and informed of the purpose of this study. If they agreed to participate (n = 6) in the study, the

investigator provided each expert the link to the web-based questionnaire and video files of the participants (n = 34) performing the Scapular Dyskinesis Test. The web-based questionnaire included a statement of implied consent as well as instructions (Appendix 2).

Rater recruitment and protocol

Raters for this investigation were graduating entry-level graduate athletic training students enrolled in an entry level master's program accredited by Commission on Accreditation of Athletic Training Education (CAATE). The investigator contacted program directors of the 23 schools listed on CAATE's website (http://caate.cyzap.net/dzapps/dbzap.bin/apps/assess/webmembers/tool) via telephone and informed them of the purpose of the study. The investigator attempted to contact the program directors on four separate occasions, to which only 15 were able to be contacted. The investigator verbally informed the program directors of the study including a brief statement addressing methodology and overall goal of the project. After confirming their interest in the study (n = 14), the investigator emailed the web-based questionnaire link. The email to the program director also included instructions on how to forward the link to the athletic training students. The investigator called two weeks after the initial email to follow-up with each program director in hopes to improve response percentages, as well as thank them for his/her help. The investigator also asked about the number of students in their 2011 graduating Entry Level Masters class. There were a total of 127 students forwarded the survey link.

In the initial questionnaire included 15 video files for the raters to evaluate (Appendix 3). There was also a demographic section of the survey for the raters included

their email addresses, which were saved in the web-based system. To assess intra-rater reliability the investigator sent a follow-up questionnaire 1 (Appendix 4) week after the completion of the initial survey to the compliant raters with randomly selected videos from the initial questionnaire (n = 7). In this follow-up questionnaire, the raters also completed an additional three questions regarding muscles associated with scapular dyskinesis. The inclusion of the three questions during the follow-up questionnaire instead of the initial was to limit any learning affect from the closed-ended questions.

Statistical Analysis

To assess the first hypothesis, 'athletic training students are valid in assessing scapular dyskinesis as compared to experts', the investigator calculated percent correct scores using the expert ratings as a fixed response. To assess the second hypothesis, 'athletic training students are reliable in assessing scapular dyskinesis', the investigator assessed agreement using SAS 9.2. The investigator calculated kappa coefficients using the MAGREE macro designed for multiple raters (Chen, Zaebst, & Seal, 2005). The traditional kappa analysis measures the amount of agreement between two raters beyond that expected by chance. The kappa statistic is a value between -1 and 1, with a 0 indicating no agreement beyond that of random chance. Due to the limitation of two raters for the traditional analysis, statisticians have developed alternative kappa values for multiple raters (Sim & Wright, 2005). A kappa value of 0.55 is expected based on previous results (McClure et al., 2009).To assess the third hypothesis, 'athletic training students are able to identify the muscles that stabilize and support the scapula' the investigator calculated percent incorrect/correct.

CHAPTER FOUR

Results

To assess the first hypothesis the investigator calculated the percent of correct respondents for each video then averaged the total percentage correct. Out of the 127 students who were provided the link, 41(32%) completed the first survey. Using the response of the experts as a fixed correct answer, 81% of respondents were correct on the 15 videos analyzed with a range of 61-100% (Table 1). Individual scores for each student rater ranged from 53-100% (Table 2).

To assess the second hypothesis, the investigator conducted a kappa analysis. The raters exhibited fair inter-rater reliability ($\kappa = 0.32$, $P < 0.001$). Out of the 41 respondents for the first survey, only 19 (46%) raters completed the second survey. The investigator conducted a kappa analysis for each rater (Table 3) and averaged the kappa statistic. The intra-rater reliability was moderate ($\kappa = 0.45$).

To assess the final hypothesis, the raters who completed the reliability survey also responded to multiple choice questions addressing the muscles involved with dyskinetic movement. For some questions, not all raters responded so the sample size is in parenthesis for clarification on the number of responses. For a Prominent inferior angle (Type I), serratus anterior and lower trapezius should be addressed, 88% of raters (n = 16:18) were correct. For a Prominent medial border (Type II), rhomboids major and minor should be addressed, 100% of raters (n = 18:18) were correct. For a superior migrating/elevated scapula (Type III), pectoralis minor and upper trapezius should be stretched, 77% of raters (n = 10:13) were correct.

The raters (n = 41) also completed descriptive questions addressing their educational exposure to scapular dyskinesis. Respondents (n = 41) answered Likert scale item questions regarding preparedness with 1= little preparedness, 5=strongly prepared. They reported a greater amount of exposure and instruction in identifying scapular dyskinesis in the academic setting compared to the clinical setting (Figure 6a-e). However, there were no relationships between preparedness and individual score (Table 4) or raters' reliability scores (Table 5).

Table 1

Percent of Student Raters Answering Correct for Each Participant Video

Video	Student % Correct
1	97.6
2	80.5
3	63.4
4	61.0
5	78.0
6	100.0
7	95.1
8	55.0
9	97.6
10	63.4
11	95.1
12	92.7
13	100.0
14	97.6
15	97.6

Table 2

Student Assessment Scores (15 videos analyzed)

Rater	Percent	Rater	Percent	Rater	Percent
1	67	16	87	31	87
2	67	17	67	32	80
3	93	18	80	33	87
4	87	19	100	34	93
5	93	20	93	35	93
6	93	21	87	36	87
7	87	22	87	37	93
8	80	23	87	38	93
9	67	24	60	39	87
10	93	25	53	40	80
11	87	26	100	41	93
12	93	27	93		
13	98	28	67		
14	93	29	93		
15	87	30	93		

Table3

Kappa Test-retest Values for Each Rater (n = 19)

Rater	Kappa	p-value
1	0.69	0.03
2	0.09	0.58
3	0.27	0.76
4	0.57	0.06
5	0.08	0.58
6	0.69	0.03
7	1	0.004
8	0.14	0.35
9	0.08	0.58
10	0.58	0.06
11	0.17	0.67
12	1	0.004
13	0.08	0.58
14	0.17	0.67
15	0.27	0.76
16	0.08	0.58
17	1	0.004
18	0.58	0.06
19	1	0.004
Average	0.45	

Table 4

Correlation Matrix: Academic and Clinical Instruction and Exposure to Scapular Dyskinesis With Individual Student Rater Scores

	Score	Clinical instruction	Academic instruction	Clinical exposure	Academic exposure
Score	1.00				
Clinical instruction	0.21	1.00			
	0.20				
Academic instruction	0.10	0.25	1.00		
	0.55	0.11			
Clinical exposure	0.04	0.34	0.06	1.00	
	0.83	0.03	0.70		
Academic exposure	-0.10	-0.03	0.25	-0.05	1.00
	0.53	0.84	0.12	0.76	

Table 5

Correlation Matrix: Academic and Clinical Instruction and Exposure to Scapular Dyskinesis With Student Rater Kappa Values

	Clinical Instruction	Academic Instruction	Clinical Exposure	Academic Exposure	Kappa value
Clinical Instruction	1				
Academic Instruction	0.22	1			
	0.37				
Clinical Exposure	0.28	-0.19	1		
	0.24	0.44			
Academic Exposure	-0.04	0.18	-0.1	1	
	0.86	0.46	0.76		
Kappa value	-0.05	-0.25	0.12	-0.09	1
	0.85	0.31	0.63	0.71	

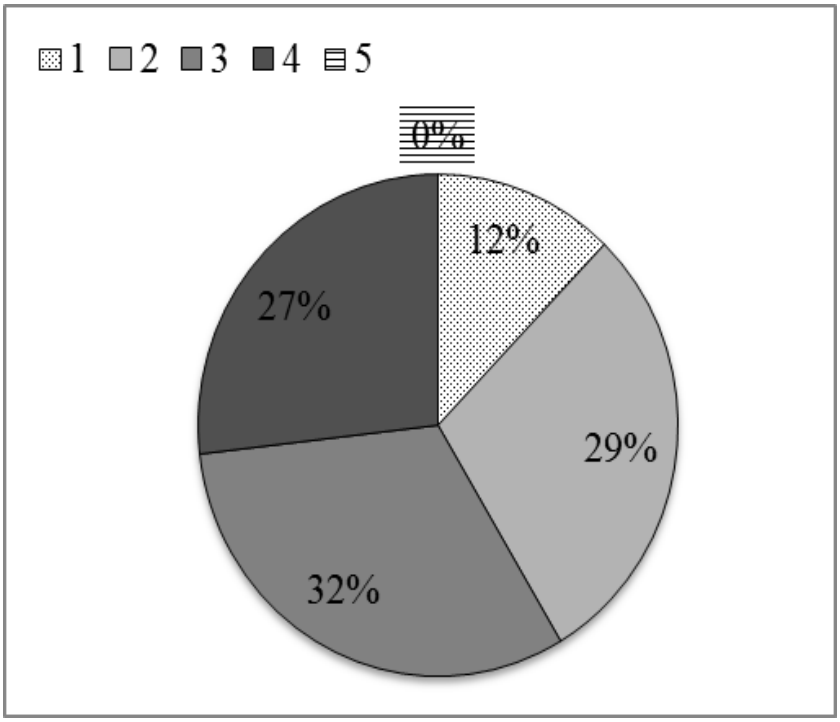

Figure 6a. Percentage of raters selecting 1= little preparedness to 5= strong preparedness to identify scapular dyskinesis via clinical instruction.

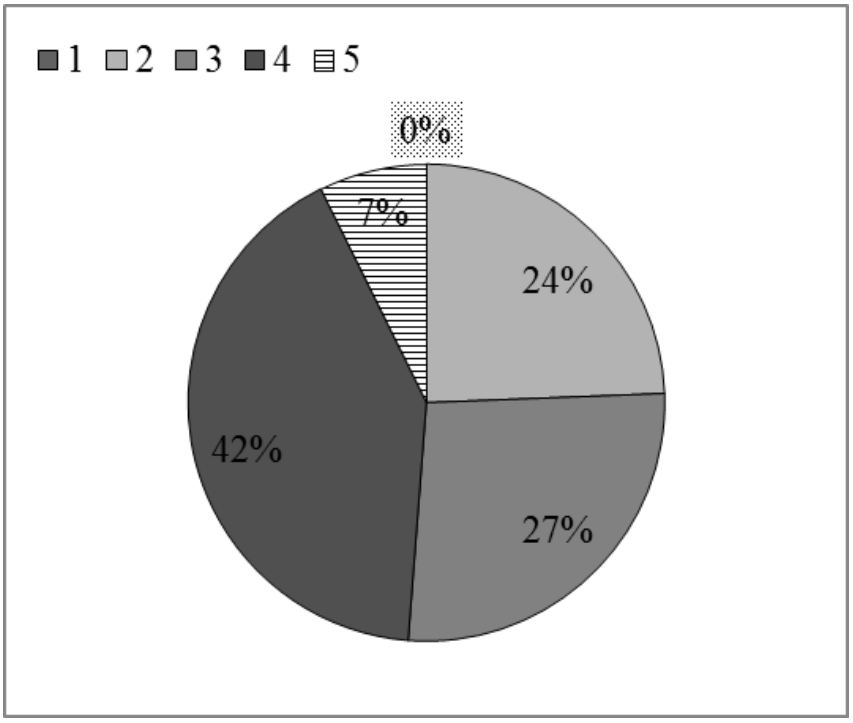

Figure 6b. Percentage of raters selecting 1= little preparedness to 5= strong preparedness to identify scapular dyskinesis via academic instruction.

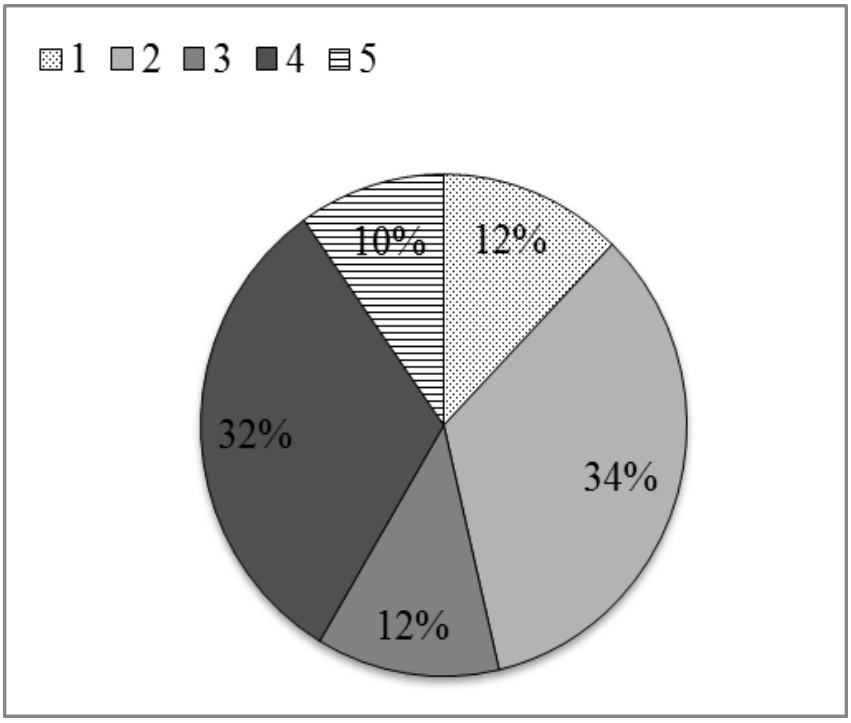

Figure 6c. Percentage of raters selecting 1= little to 5= strong clinical exposure of scapular dyskinesis.

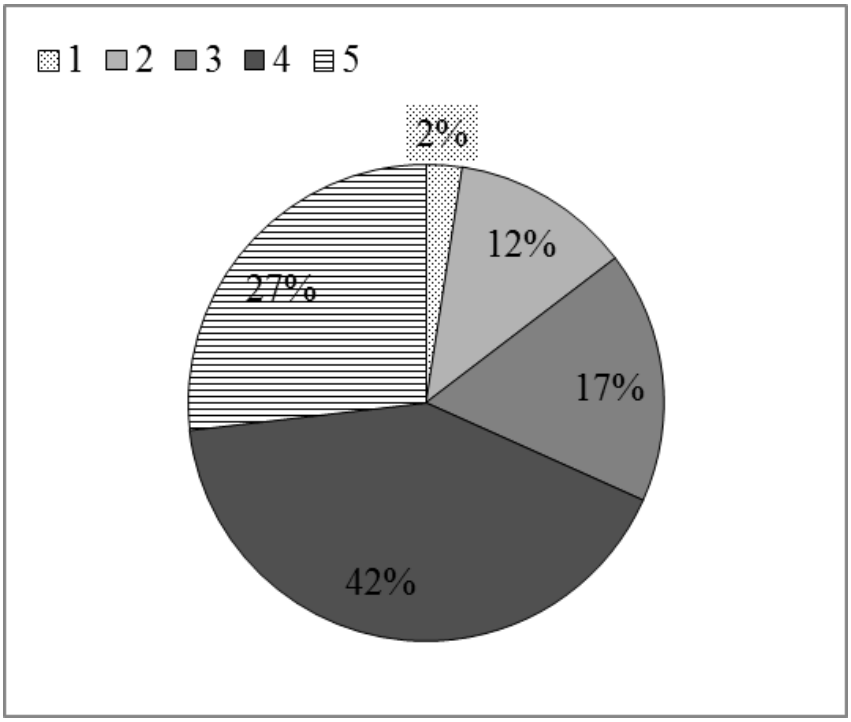

Figure 6d. Percentage of raters selecting 1= little to 5= strong academic exposure of scapular dyskinesis.

CHAPTER FIVE

Discussion

The ability to identify scapular dyskinesis is vital to the rehabilitation process of upper extremity injuries. Athletic training students, who have completed their coursework at a CAATE accredited institution, should have the ability to evaluate and treat musculoskeletal risk factors (NATA, 2006). There are currently a few assessment methods for identifying scapular dyskinesis, with the SDT being one recently validated against the gold standard of 3-dimensional kinematics (Tate et al., 2009). Their results revealed that individuals with visually determined dyskinetic motion have greater amounts of posterior tilt, less upward rotation, and clavicular elevation (Tate et al., 2009). This confirms that clinicians are able to identify differences in scapular motion, when differences are present. The current study supports their results, providing further evidence that athletic training students are able to recognize dyskinetic motion.

In looking closer at the data provided in this study, the raters clearly (>80%) identified scapular motion on 10 of the 15 videos. The remaining 5 videos had poor rater correct responses (<80%). Out of these five videos, two had a variety of responses from the experts on what dyskinetic motion they observed, with no more than 50% (n = 3) of experts agreeing on which type of dyskinesis they observed. However, the experts were in agreement that the motion was dyskinetic, whereas the students were split on determining normal or dyskinetic motion.

The results of this study also support Uhl and colleagues' (2009) investigation evaluating physicians' agreement in identifying scapular dyskinesis. The two physicians demonstrated 79% agreement when determining normal or dyskinetic motion with a $\kappa =$

0.41. The student athletic trainers revealed 80.5% agreement with $\kappa = 0.32$ for inter-rater reliability and 77% agreement with $\kappa = 0.45$ for intra-rater reliability. Based on their results, the normal/dyskinetic choice of determining scapular dyskinesis limits the possibilities of false-negatives, while increasing false-positive evaluations. Furthermore, they recommended clinicians use a visual observation method to determine normal/dyskinetic motion as a screening tool during shoulder evaluations.

Practical application

As athletic training students are moderately reliable and in agreement with each other, the use of the SDT to screen athletes is beneficial to athletic training and sport performance. Uhl and colleagues (2009) state that a normal finding may not provide much insight in a pathological individual, where a dyskinetic finding may help in the rehabilitation process. As scapular dyskinesis is described in a variety of terms with different observations, from medial border prominence, inferior angle prominence, or superior migrating scapulae, a common issue is the lack of retraction and external rotation (Kibler & Sciascia, 2010). Scapular retraction and elevation are key components to a stable base for GH movement and should be the focus of rehabilitation programs (Kibler & Sciascia, 2010).

Once dyskinesis is identified, the athletic trainer must attempt to first restore motion via muscular assessment, and then condition the muscles to enhance control and balance. In response to questions regarding the musculature affecting dyskinetic movement, athletic training students were able to correctly identify the appropriate muscles. According to the competencies set for this group of graduating athletic training students, they should be able to "plan, implement, document, and evaluate the efficacy of

therapeutic exercise programs for the rehabilitation and reconditioning of injuries" (NATA, 2006, p. 29). Exercises that incorporate trunk rotation, torso extension, and scapula retraction activate the kinetic chain and are useful in rehabilitating dyskinetic movement and GH injuries (McMullen & Uhl, 2000). Specifically, the activation of the kinetic chain focuses on depression and retraction of the scapula, while minimizing the activation of the upper trapezius and scapular elevators (McMullen & Uhl, 2000).

Activation of the serratus anterior is key to scapular control, and can be activated through inferior glide, low row, lawnmower, and robbery exercises (Kibler & Sciascia, 2010). The inferior glide exercise also activates the lower trapezius, which may, with conditioning help reduce impingement symptoms. The lower trapezius is highly utilized during the functional lawnmower exercise (Kibler et al., 2010), which also incorporates the key components of the kinetic chain: trunk extension, torso rotation, and scapular retraction (McMullen & Uhl, 2000). The rhomboid major and minor, primary scapular retractors are also key muscles in maintaining a stable scapula (Terry & Chopp, 2000).

Education application

In the current study, athletic training students responded on a 5-point Likert scale with poor to moderate instruction (2.71) during the clinical experience on identifying scapular dyskinesis, and with moderate to good instruction (3.32) academically. Furthermore, students reported similar exposure to scapular dyskinesis scores, 2.93 clinically and 3.78 academically. The results of these questions reveal a gap in ATEP clinical instruction component. As the course work is staying in tune with evidence-based practices and instruction, clinical instruction is lacking. Numerous investigations have addressed the importance and impact of clinical education and educators on athletic

training (Curtis, Helion, & Domsohn, 1998; Laurent & Weidner, 2001, 2002; Meyer, 2002; Rich, 2009; Weidner & Henning, 2002).

Clinical education is the connector between didactic instruction and professional field/clinical work. Certified athletic trainers have stated that more than 50% of their professional development came from clinical education (Laurent & Weidner, 2002). Specifically, the athletic trainers commented on opportunities to continue developing skills for rehabilitation, evaluation, and decision-making provided through clinical education (Laurent & Weidner, 2002). The perceived importance of the clinical education component of ATEPs indicated assessment of clinical settings and instructors are equally as important as assessing didactic settings and instructors. Weidner and Henning (2002) recommended that throughout the 21st century, ATEPs and clinical instruction should be evaluated with the goal of developing evidence-based clinical teaching.

Meyer (2002) stated "the role of athletic training clinical instructors … is to directly supervise and educate students through the development of cognitive, affective, and psychomotor skills, in all domains of athletic training" (p. 35). When student athletic trainers were asked their perception of clinical supervisors, they reported that clinical instructors' respect of their knowledge and supervisor explanation were helpful behaviors (Curtis et al., 1998). The students also identified two hindering behaviors, humiliation and unavailability. As revealed in Curtis and colleagues' (1998) investigation, clinical instructors have a large impact on the student athletic trainer's educational experience.

Teachable moments. Clinical instructors are encouraged to seize teachable moments (Rich, 2009). In athletic training, a teachable moment occurs "when a CI (clinical instructor) and ATS (athletic training student) actively participate and interact

with each other to enhance learning and foster intellectual curiosity in the clinical education environment" (p. 297). In a typical 20 hour clinical week, athletic training students and clinical instructors identified 18-19 teachable moments per day. The teachable moments were broken into themes such as professional discourse, skill development, and authentic experience. Although students reported many opportunities for teachable moments, only 20% of those were authentic experiences. Rich (2009) identified barriers to teachable moments: lack of time, other tasks or duties of the clinical instructor, lack of student initiative, and approachability of the clinical instructor. She also continues to state that students and clinical instructors only recognize 22% of the same teachable moments, and that the lack of action when a teachable moment arises is a problem in the clinical education of athletic training students.

Regarding scapular dyskinesis, the results of this investigation indicate athletic training educators in the classroom/academic setting are addressing the topic and means to evaluate scapular dyskinesis, however clinical settings are not providing the same level of preparedness. This result supports Rich (2009) where skill development and authentic experiences were being inhibited by numerous barriers. If a clinical instructor and student do not seize teachable moments, the effectiveness of clinical instruction is diminished. Rich (2009), however, noted that with awareness of the opportunities for teachable moments clinical instructors and students were more active in responding to the opportunity.

Educational competencies. Upon reviewing the history of educational competencies in allied health professions, specifically athletic training, Weidner and Henning (2002) suggested more focus and requirements on evidence-based practice. The

4th edition of Athletic Training Educational Competencies (NATA, 2006) states "program personnel should strive to include content and skills that reflect evidence-based knowledge and practice in all aspects of students' educational program, including students' clinical experiences" (p. 4). The 4th edition does not have a content area directly for evidence-based practice, as they stressed the importance of all content areas including evidence-based knowledge and practice in the introduction to the content areas. The current raters were educated under the guidelines set in the 4th edition. This however has changed for the 5th edition which will be in effect for the 2011-2012 academic year. As Weidner and Henning (2002) suggested, the NATA has developed a new edition of competencies where evidence-based practice is addressed and required as a content area in accredited ATEPs starting the 2011-2012 academic year (NATA, 2011).

Fourth edition. From 2006-2007 academic year until the completion of the 2010-2011 academic year, ATEPs were required to follow the guidelines and address the 12 content areas stated in the 4th edition. For each content area the competencies were broken down into cognitive, psychomotor, and clinical components, with specific competencies for each component. Two content areas in particular are related to this current investigation, the Orthopedic Clinical Examination and Diagnosis and Conditioning and Rehabilitative Exercise. The Orthopedic Clinical Examination and Diagnosis content area included requirements such as “identifying (a) common acquired or congenital risk factors that would predispose the patient to injury and (b) musculoskeletal orthopedic injuries to determine proper care” (NATA, 2006, p. 13). Based on this investigation, athletic training students were able to identify a risk factor for GH injuries through video observation. Furthermore, athletic training students were

able to correctly identify musculature that needs attention during rehabilitation programs. This knowledge and clinical skill is included in the Conditioning and Rehabilitative Exercise content area (NATA, 2006). Specifically, the Conditioning and Rehabilitative Exercise stated athletic training students should have a master understanding the anatomical alterations from improper mechanics, interpretation of physical assessments, and criteria for exercise progression (NATA, 2006).

Fifth edition. Most recently, the Professional Education Council of NATA revised the competencies and stated "all facets of the educational programs must incorporate current knowledge and skills that represent best practice" (NATA, 2011, p. 4). The 12 content areas in the 4th edition were reduced and revised to eight; in regards to this investigation Orthopedic Clinical Examination and Diagnosis was combined with Medical Conditions and Disabilities to create Clinical Examination and Diagnosis, Conditioning and Rehabilitative Exercise was combined with Pharmacology to create Therapeutic Interventions, and Evidence-Based Practice was added.

The Clinical Examination and Diagnosis includes knowledge and skill statements regarding anatomy, physiology, and biomechanics. Some specific competencies are: "CE-4 describe the principles and concepts of body movement, including normal osteokinematics and arthrokinematics; CE-5 describe the influence of pathomechanics on function; CE-20 use standard techniques and procedures for the clinical examination of common injuries, conditions, illnesses, and disease including, but not limited to: history taking, inspection/observation, palpation, functional assessment…" (p. 16-17). While the 4th edition was more specific on each competency, the 5th edition approaches the body and field of athletic training more holistically.

As the field of athletic training is evolving with new literature and research evidence published regularly, so must the instruction to students. The 5th edition of competencies hopes to incorporate more scientific methods and understanding of current literature into the ATEPs. Evidence-based practice "focuses on the knowledge and skills necessary for entry-level athletic trainers to use a systematic approach to ask and answer clinically relevant questions that affect patient care by using review and application of existing research evidence" (p. 10). With the inclusion of Evidence-Based Practice as a content area, ATEPs should continue to bring the research into the classroom and clinical settings. This should enhance the patient care with the athletic trainers using the most up-to-date approach to both evaluation and rehabilitation.

Limitations

This investigation included only upcoming 2011 graduates from accredited entry-level masters ATEPs. Entry-level masters athletic training students are graduate students in academic courses; however they are progressing through an accredited program similar to an undergraduate entry-level program. Both graduate and undergraduate entry-level programs must follow the competencies set by NATA, therefore there should be little differences on basic skills and knowledge and the results of this study are generalizable to graduating students from an accredited program.

The videos selected for student raters were those that experts were in agreement on, which eliminated the 'gray' area of normal or dyskinetic motion. This investigation mimicked the protocol of McClure et al. (2009), where the investigators selected only the obvious or normal individuals for further evaluation. The subtle dyskinesis or 'gray' area in identifying dyskinesis is still an issue, as observed in this study with little expert agreement on 16 of 34 videos.

Conclusion

This study is the first to include athletic training students' ability to evaluate scapular dyskinesis using the SDT. Based on these results, athletic training students are able to identify scapular dyskinesis and the muscles which need rehabilitation. This suggests that evidence-based knowledge and practice is included in ATEPs. Follow-up questions revealed athletic training students are better prepared academically compared to clinically in knowing and identify scapular dyskinesis. The step in understanding the process of educating athletic training students on scapular dyskinesis both academically and clinically is to assess the ability of certified athletic trainers who work as instructors or clinical instructors.

References

Board of Certification. (2011). Defining athletic training. Retrieved from http://www.bocatc.org/index.php?option=com_content&view=article&id=31&Itemid=33.

Burkhart, S. S., Morgan, C. D., & Kibler, W. B. (2003a). The disabled throwing shoulder: Spectrum of pathology part I: Pathoanatomy and biomechanics. *Arthroscopy: The Journal of Arthroscopic and Related Surgery, 19*(4), 404-420.

Burkhart, S. S., Morgan, C. D., & Kibler, W. B. (2003b). The disabled throwing shoulder: Spectrum of pathology part III: The SICK scapula, scapular dyskinesis, the kinetic chain, and rehabilitation. *Arthroscopy: The Journal of Arthroscopic and Related Surgery, 19*(6), 641-661.

Cools, A. M., Dewitte, V., Lanszweert, F., Notebaert, D., Roets, A., Soetens, B., Cagnie, B., & Witvrouw, E. E. (2007). Rehabilitation of scapular muscle balance: Which exercise to prescribe? *American Journal of Sports Medicine, 35*(10), 1744-1751.

Cools, A. M., Witvrouw, E. E., Mahieu, N.N., & Daniels, L. A. (2005). Isokinetic scapular muscle performance in overhead athletes with and without impingement symptoms. *Journal of Athletic Training, 40*(2), 104-110.

Curtis, N., Helion, J.G., & Domsohn, M. (1998). Student athletic trainer perceptions of clinical supervisor behaviors: A critical incident study. *Journal of Athletic Training, 33*(3), 249-253.

Fayad, F., Roby-Brami, A., Yazbeck, C., Hanneton, S., Lefevre-Colau, M-M., Gautheron, V., … Revel, M. (2008). Three-dimensional scapular kinematics and scapulohumeral rhythm in patients with glenohumeral osteoarthritis or frozen shoulder. *Journal of Biomechanics, 41*, 326-332.

Glousman, R., Jobe, F., Tibone, J., Moynes, D., Antonelli, D., & Perry, J. (1988). Dynamic electromyographic analysis of the throwing shoulder with glenohumeral instability. *Journal of Bone and Joint Surgery, 70*, 220-226.

Hardwick, D.H., Beebe, J.A., McDonnell, M.K., & Lang, C.E. (2006). A comparison of serratus anterior muscle activation during a wall slide exercise and other traditional exercises. *Journal of Orthopaedic and Sports Physical Therapy, 36*(12), 903-910.

Hess, S.A., Richardson, C., Darnell, R., Friis, P., Lisle, D., & Myers, P. (2005). Timing of rotator cuff activation during shoulder external rotation in throwers with and without symptoms of pain. *The Journal of Orthopaedic and Sports Physical Therapy, 35*(12), 812-820.

Kiber, W. B. (1991). Role of the scapula in the overhead throwing motion. *Contemporary Orthopaedics, 22*(5), 525-532.

Kibler, W. B. (1998). The role of the scapula in athletic shoulder function. *American Journal of Sports Medicine, 26*(2), 325-337.

Kibler, W. B. (2006). Classification and treatment of scapular pathology. In Ellenbecker, T.S (Ed.), *Shoulder rehabilitation: Non-operative treatment* (94-104). New York, NY: Thieme Medical Publishers, Inc.

Kibler, W.B. and McMullen, J. (2003). Scapular dyskinesis and its relation to shoulder pain. *Journal of American Academy of Orthopedic Surgery, 11*(2), 142-151.

Kibler, W. B. and Sciascia, A. D. (2010). Current concepts: Scapular dyskinesis. *British Journal of Sports Medicine, 44*, 300-305.

Kibler, W.B., Sciascia, A. D., & Dome, D. (2006). Evaluation of apparent and absolute supraspinatus strength in patients with shoulder injury using the scapular retraction test. *American Journal of Sports Medicine, 34*(10), 1643-1647.

Kibler, W. B., Sciascia, A. D., Uhl, T. L., Tambay, N., & Cunningham, T. (2008). Electromyographic analysis of specific exercises for scapular control in early phases of shoulder rehabilitation. *American Journal of Sports Medicine, 36*(9), 1789-1798.

Kibler, W.B., Uhl, T.L., Maddux, J.W.Q., Brooks, P.V., Zeller, B., & McMullen, J. (2002). Qualitative clinical evaluation of scapular dysfunction: A reliability study. *Journal of Shoulder and Elbow Surgery, 11*(6), 550-556. doi: 10. 1067/mse.2002.126766

Laurent, T. & Weidner, T.G. (2001). Clinical instructors' and student athletic trainers' perceptions of helpful clinical instructor characteristics. *Journal of Athletic Training, 36*(1), 58-61.

Laurent, T. & Weidner, T.G. (2002). Clinical-education – setting standards are helpful in the professional preparation of employed, entry-level certified athletic trainers. *Journal of Athletic Training, 37*(4), S248-254.

Lehman, G.J., Buchan, D.D., Lundy, A., Myers, N., & Nalborczyk, A. (2004). Variations in muscle activation levels during traditional latissimus dorsi weight training exercises: An experimental study. *Dynamic Medicine, 3*(4). doi: 10.1186/1476-5918-3-4

Levine, W.N., Brandon, M.L., Stein, B.S., Gardner, T.R., Bigliani, L.U., & Ahmad, C.S. (2006). Shoulder adaptive changes in youth baseball players. *Journal of Shoulder and Elbow Surgery, 15*(5), 562-566. doi: 10.1016/j.jse.2005.11.007

Ludewig, P.M. & Cook, T.M. (2000). Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. *Physical Therapy, 80,* 276-291.

Magarey, M. E. and Jones, M. A. (2003). Specific evaluation of the function of force couples relevant for stabilization of the glenohumeral joint. *Manual Therapy,* 8(4), 247-253.

McClure, P., Michener, L.A., Sennett, B.J., & Karduna, A.R. (2001). Direct 3-dimensional measurement of scapular kinematics during dynamic movements in vivo. *Journal of Shoulder and Elbow Surgery, 10*(3), 269-277.

McClure, P., Tate, A. R., Kareha, S., Irwin, D., & Zlupko, E. (2009). A clinical method for identifying scapular dyskinesis, part 1: Reliability. *Journal of Athletic Training, 44*(2), 160-164.

McMullen, J. & Uhl, T. L. (2000). A kinetic chain approach for shoulder rehabilitation. *Journal of Athletic Training, 35*(3), 329-337.

Meyer, L.S. (2002). Leadership characteristics as significant predictors of clinical-teaching effectiveness. *Athletic Therapy Today, 7*(5), 34-39.

Meyers, J. B., Laudner, K. G., Pasquale, M. R., Bradley, J. P., & Lephart, S. M. (2006). Glenohumeral range of motion deficits and posterior shoulder tightness in throwers with pathological internal impingment. *American Journal of Sports Medicine, 34*(3), 385-391.

Michener, L. (2005). Scapular kinematics: So how is the scapula supposed to move? Retrieved from http://www.orthopt.org/downloads/8752.pdf.

National Athletic Trainers' Association. (2006). *Athletic training educational competencies* (4th ed.) Dallas, TX: National Athletic Trainers' Association.

National Athletic Trainers' Association. (2011). *Athletic training educational competencies* (5th ed.) Dallas, TX: National Athletic Trainers' Association.

Paine, R.M. & Voight, M. (1993). The role of the scapula. *Journal of Orthopaedic and Sports Physical Therapy,18*(1), 386-391.

Rich, V. (2009). Clinical instructors' and athletic training students' perceptions of teachable moments in an athletic training clinical education setting. *Journal of Athletic Training, 44*(3), 294-303.

Rowe, C. R. , Pierce, D. S., & Clark, J. G. (1973). Voluntary dislocation of the shoulder. *Journal of Bone and Joint Surgery, 55A*(3), 435-460.

Saha A. K., Das A. K., & Dutta S. K. (1983). Mechanism of shoulder movements and a pleas for the recognition of "zero position" of glenohumeral joint. *Current Orthopaedic Practice, 173,* 3-10.

Sarrafian, S.K. (1983). Gross and functional anatomy of the shoulder. *Clinical Orthopaedics & Related Research,173*, 11-19.

Tate, A. R., McClure, P., Kareha, S., Irwin, D., & Barbe, M. F. (2009). A clinical method for identifying scapular dyskinesis, part 2: Validity. *Journal of Athletic Training, 44*(2), 165-173.

Terry, G. C. & Chopp, T. M. (2000). Functional anatomy of the shoulder. *Journal of Athletic Training, 35*(3), 248-255.

Tucker, W. S., Armstrong, C. W., Gribble, P. A., Timmons, M. K., & Yeasting, R. A. (2010). Scapular muscle activity in overhead athletes with symptoms of secondary shoulder impingement during closed chain exercises. *Archives of Physical Medicine and Rehabilitation, 91*,550-556.

Tsai, N-T., McClure, P.W., & Karduna, A.R. (2003). Effects of muscle fatigue on 3-dimensional scapular kinematics. *Archives of Physical Medicine and Rehabilitation, 84*(7), 1000-1005. doi: 10.1016/S0003-9993(03)00127-8

Uhl, T.L., Kibler, W.B., Gecewich, B., & Tripp, B.L. (2009). Evaluation of clinical assessment methods for scapular dyskinesis. *Arthroscopy: The Journal of Arthroscopic & Related Surgery, 25*(11), 1240-1248.

Voight, M. L.& Thomson, B. C. (2000). The role of the scapula in the rehabilitation of shoulder injuries. *Journal of Athletic Training, (35)*3, 364-372.

Wang, H-K. & Cochrane, T. (2001). Mobility impairment, muscle imbalance, muscle weakness, scapular asymmetry and shoulder injury in elite volleyball athletes. *Journal of Sports Medicine and Physical Fitness,* 41, 403-410.

Weidner, T.G. & Henning, J. M. (2002). Historical perspective of athletic training clinical education. *Journal of Athletic Training*, *37*(4), S222-228.

Appendices

1. Institutional review board forms

UNIVERSITY OF ARKANSAS
INSTITUTIONAL REVIEW BOARD PROTOCOL FORM

The University Institutional Review Board recommends policies and monitors their implementation, on the use of human beings as subjects for physical, mental, and social experimentation, in and out of class. . . . Protocols for the use of human subjects in research and in class experiments, whether funded internally or externally, must be approved by the (IRB) or in accordance with IRB policies and procedures prior to the implementation of the human subject protocol. . . Violation of procedures and approved protocols can result in the loss of funding from the sponsoring agency or the University of Arkansas and may be interpreted as scientific misconduct. *(see Faculty Handbook*)

Supply the information requested in items 1-14 as appropriate. **Type** entries in the spaces provided using additional pages as needed. In accordance with college/departmental policy, submit the original **and** one copy of this completed protocol form and all attached materials to the appropriate Human Subjects Committee. In the absence of an IRB-authorized Human Subjects Committee, submit the original **and** one copy of this completed protocol form and all attached materials to the IRB, Attn: Compliance Officer, OZAR 118, 575-3845.

1. Title of Project **Clinicians ratings for scapular dyskinesis**

2. (Students **must** have a faculty member supervise the research. The faculty member must sign this form and all researchers and the faculty advisor should provide a campus phone number.)

	Name	Department	Email Address	Campus Phone
Principal Researcher	Priscilla Dwelly	HKRD		
Faculty Advisor	Dr. Gretchen Oliver	HKRD		

3. Researcher(s) status. Check all that apply.

Faculty Staff X Graduate Student(s) Undergraduate Student(s)

4. Project type

Faculty Research Thesis / Dissertation Class Project X Independent Study / Staff Research M.A.T. Research Honors Project Educ. Spec. Project

5. Is the project receiving extramural funding?

X No Yes. Specify the source of funds

6. Brief description of the purpose of proposed research and all procedures involving people. Be specific. Use additional pages if needed. (**Do not** send thesis or dissertation proposals. Proposals for extramural funding must be submitted in full.)

Purpose of research: **The purpose of this research is to identify if practitioners/experts in glenohumeral and scapular motion are able to identify scapular dyskinesis. There are many definitions of scapular dyskinesis; therefore, this investigation will hopefully verify that although there are multiple definitions and interpretations, they are referring to the same abnormal scapular movement.**

Procedures involving people: **The investigators will recruit college-aged individuals from the University of Arkansas. Each participant will sign the informed consent prior to participating. We will ask men to take off their shirt and women to wear a bathing suit top or halter-top to allow raters to observe their shoulder blade and upper back. To help maintain modesty we will provide a wrap if participants request more coverage of their mid-section. We will place a video camera overhead and behind each participant. Only the upper back, shoulders, and upper arms will be in view of the cameras. No identifying information will be collected. After camera set-up, participants will raise and lower their arms while holding a 3-5lb dumbbell. Participants will complete 3 practice trials, and then 5 trials for recording.**

After collecting the video files, the investigator will upload the videos to a web-based survey site for raters to view video files and rate as either abnormal/normal (see attached). Raters will be contacted via email or telephone and provided with the link to the survey.

7. Estimated number of participants (complete all that apply)

_____	_____	**__150___**	**_50_**
Children under 14	Children 14-17	UA students	Adult non-students

8. Anticipated dates for contact with participants:
First Contact 11/20/2010 Last Contact 11/20/2011

9. Informed Consent procedures: The following information must be included in any procedure: identification of researcher, institutional affiliation and contact information; identification of Compliance Officer and contact information; purpose of the research, expected duration of the subject's participation; description of procedures; risks and/or benefits; how confidentiality will be ensured; that participation is voluntary and that refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled. See *Policies and Procedures Governing Research with Human Subjects*, section 5.0 Requirements for Consent.

X Signed informed consent will be obtained. **Attach copy of form**.
Modified informed consent will be obtained. **Attach copy of form**.
X Other method (e.g., implied consent). **Please explain on attached sheet**.
Not applicable to this project. **Please explain on attached sheet**.

10. Confidentiality of Data: All data collected that can be associated with a subject/respondent must remain confidential. Describe the methods to be used to ensure the confidentiality of data obtained. **All data will be stored in the faculty advisor's office in a locked filing cabinet. All raters and participants will be coded for data analysis to maintain anonymity.**

11.Risks and/or Benefits:
Risks: Will participants in the research be exposed to more than minimal risk? Yes X No
Minimal risk is defined as risks of harm not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests. Describe any such risks or discomforts associated with the study and precautions that will be taken to minimize them.

The risks to participation are no greater than those of performing minimal lifting (5lb weight maximum). If any participant would like to stop participation, they will be informed to let the investigator know. There are no penalties to stopping or refusing to participate, as all participation is voluntary. There is no risk to the raters.

Benefits:
Other than the contribution of new knowledge, describe the benefits of this research.

Benefits to the participants is limited. Benefits to the raters include a report of their percent agreement compared to the other raters.

12. Check all of the following that apply to the proposed research. Supply the requested information below or on attached sheets:

A. Deception of or withholding information from participants. Justify the use of deception or the withholding of information. Describe the debriefing procedure: how and when will the subject be informed of the deception and/or the information withheld?
B. Medical clearance necessary prior to participation. Describe the procedures and note the safety precautions to be taken.
C. Samples (blood, tissue, etc.) from participants. Describe the procedures and note the safety precautions to be taken.
D. Administration of substances (foods, drugs, etc.) to participants. Describe the procedures and note the safety precautions to be taken.
E. Physical exercise or conditioning for subjects. Describe the procedures and note the safety precautions to be taken.
Participants will be asked to complete raising and lowering of their arm while holding a 3 or 5lb dumbbell. At any time, participants may stop without consequence.
F. Research involving children. How will informed consent from parents or legally authorized representatives as well as from subjects be obtained?
G. Research involving pregnant women or fetuses. How will informed consent be obtained from both parents of the fetus?
H. Research involving participants in institutions (cognitive impairments, prisoners, etc.). Specify agencies or institutions involved. Attach letters of approval. Letters must be on letterhead with original signature; electronic transmission is acceptable.
I. Research approved by an IRB at another institution. Specify agencies or institutions involved. Attach letters of approval. Letters must be on letterhead with original signature; electronic transmission is acceptable.
J. Research that must be approved by another institution or agency. Specify agencies or institutions involved. Attach letters of approval. Letters must be on letterhead with original signature; electronic transmission is acceptable.

13. Checklist for Attachments

The following are attached:
Consent form (if applicable) or
Letter to participants, written instructions, and/or script of oral protocols indicating clearly the information in item #9.
Letter(s) of approval from cooperating institution(s) and/or other IRB approvals (if applicable)
Data collection instruments

14.Signatures

I/we agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects/respondents are protected. I/we will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I/we agree to request renewal of approval for any project when subject/respondent contact continues more than one year.

Principal Researcher _____ Date

Co-Researcher _____ Date

Co-Researcher _____ Date

Co-Researcher _____ Date

Faculty Advisor _____ Date

UNIVERSITY OF ARKANSAS
CONSENT TO PARTICIPATE IN RESEARCH

Clinicians' ratings for scapular dyskinesis

Investigators:
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Description: You are being asked to participate in a research study, which will assess whether clinicians are able to agree to a definition of abnormal shoulder blade movement. You are being asked to perform 8 repetitions of raising and lowering your arms while holding a 3 or 5lb dumbbell. There will be a video camera located over your head, and a camera behind you. Men are asked to remove their shirt for video recording, and women are asked to wear a bathing suit top/halter-top to allow the camera to see your upper back and shoulders. The investigator will provide women with a wrap for their mid-section if requested. No identifying information will be collected. The investigator will also secure a motion tracking sensors to your torso and shoulder blade using double sided tape. The investigator will then locate bony landmarks located on your shoulder, torso and arm.

Potential Risks: Potential risks related to your participation in the study include minimal muscle soreness but none greater than lifting a small weight (5 lb maximum).

Confidentiality: Confidentiality will be protected to the extent that is allowed by law. A code number will be given to all of your information. Only the investigators will have access to the data. All data will be stored in a locked filing cabinet in the faculty advisor"s office. It is anticipated that the results of this study will be published; however, no name or other identifying information will be included in any publication.

Right to withdraw: Your involvement in this research study is voluntary, and you may discontinue your participation in the study at any time without penalty.

Questions Regarding the Study: If you have any questions about the research study you may ask the researcher; the phone number is at the top of this form. If you have any questions about your rights as a participant in this research or the way this study has been

conducted, you may contact the University of Arkansas Office of Research and Sponsored Programs at 479.575.3845 or via e-mail at rsspinfo@uark.edu. You will be given a copy of this signed and dated consent form to keep.

Participant: I, _____, have read the description and information above. (please print) Each of these items has been read and explained to me by the investigator. The investigator has answered all of my questions regarding the study, and I believe I understand what is involved. My signature below indicates that I freely agree to participate in this experimental study and hat I have received a copy of this agreement from the investigator.

Signature: _____ Date: _____

2. Expert questionnaire
Scapular Kinematics

Implied Consent

You are being asked to participate in a research study by the University of Arkansas. The study is investigating raters' ability to identify scapular dyskinesis via video files. No identifiable information is available to you the rater. There are no risks to you by participating.

Confidentiality will be protected to the extent that is allowed by law. A code number will be given to all of your information. Only the investigators will have access to your email address, to respond to you with your percent agreement results. All data will be stored in a locked filing cabinet in the investigator/instructor's office. Your involvement in this research study is voluntary, and you may discontinue your participation in the study at any time without penalty by not submitting the questionnaire. By submitting the questionnaire, you are giving your consent to participate in the study as a rater.

If you have any questions about your rights as a participant in this research or the way this study has been conducted, you may contact the University of Arkansas Office of Research and Sponsored Programs at 479.575.3845 or via e-mail at rsspinfo@uark.edu.

Instructions
Throughout this survey you are being asked to rate the participants' scapular movement. You can view each video file as many times as necessary by clicking the "replay" button, please disregard any YouTube suggested videos as these do not pertain to the survey.

ID #1
1.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #2

2.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #3
3.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #4
4.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #5

5.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #6
6.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #7
7.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated(right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #8

8.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #9
9.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #10
10.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #11

11.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #12
12.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #13
13.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #14

14.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

#15
15.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #16
16.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #17

17.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #18
18.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #19
19.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #20

20.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #21
21.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #22
22.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #23

23.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #24
24.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID # 25
25.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #26

26.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #27
27.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #28
28.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #29

29.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #30
30.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #31
31.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #32

32.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #33
33.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

ID #34
34.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

Thank You!

3. Rater initial questionnaire

Student Scapular Assessment I

Implied Consent

You are being asked to participate in a research study by the University of Arkansas. The study is investigating raters' ability to identify scapular dyskinesis via video files. No identifiable information is available to you the rater. There are no risks to you by participating.

Confidentiality will be protected to the extent that is allowed by law. A code number will be given to all of your information. Only the investigators will have access to your email address, to respond to you with your percent agreement results. All data will be stored in a locked filing cabinet in the investigator/instructor's office. Your involvement in this research study is voluntary, and you may discontinue your participation in the study at any time without penalty by not submitting the questionnaire. By submitting the questionnaire, you are giving your consent to participate in the study as a rater.

If you have any questions about your rights as a participant in this research or the way this study has been conducted, you may contact the University of Arkansas Office of Research and Sponsored Programs at 479.575.3845 or via e-mail at rsspinfo@uark.edu.

Instructions
In the following pages, you will see videos of scapular movement from posterior and superior. Please watch the videos as many times as necessary and select the movements you see present.

It is best to press play and pause on the screen, and avoid clicking the YouTube "replay" option as that triggers the YouTube video to pop-up in a new screen.

1_20
1.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

2_23
2.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

3_24
3.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

4_2
4.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

5_3
5.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

6_5
6.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

7_6
7.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

8_8
8.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

9_10
9.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

10_12
10.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

11_26

11.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

12_29
12.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

13_30
13.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

14_34

14.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

15_13
15.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

Perceived knowledge and confidence: Aspects of ATEP
16.) My clinical experience prepared me to identify scapular dyskinesis.
( ) Strongly disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly agree

17.) My academic courses prepared me to identify scapular dyskinesis.
( ) Strongly disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly agree

18.) I have difficulty identifying scapular dyskinesis in a clinical setting.
( ) Strongly disagree

( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly agree

19.) During my clinical experience I was never exposed to what scapular dyskinesis is.
( ) Strongly disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly agree

20.) During my academic courses I was exposed to what scapular dyskinesis is.
( ) Strongly disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly agree

Below you are being asked to provide some demographic information about yourself. I am only asking for your email address to analyze person A to person A.

I will NOT send you any spam or junk mail. Your responses are again completely confidential and will not be shared with any additional party.

21.) What is your age?
_____

22.) Please provide the following information to help with demographic information for this study. Again your email address will not be provided to any additional party.
First Initial: _____
Last Initial: _____
State: _____
Zip: _____
College/University: _____
Email Address: _____

Thank You!
Thank you for taking our survey. Your response is very important to us.

---

4. Rater follow-up questionnaire
Student Scapular Assessment II

Implied Consent

You are being asked to participate in a research study by the University of Arkansas. The study is investigating raters' ability to identify scapular dyskinesis via video files. No identifiable information is available to you the rater. There are no risks to you by participating.

Confidentiality will be protected to the extent that is allowed by law. A code number will be given to all of your information. Only the investigators will have access to your email address, to respond to you with your percent agreement results. All data will be stored in a locked filing cabinet in the investigator/instructor's office. Your involvement in this research study is voluntary, and you may discontinue your participation in the study at any time without penalty by not submitting the questionnaire. By submitting the questionnaire, you are giving your consent to participate in the study as a rater.

If you have any questions about your rights as a participant in this research or the way this study has been conducted, you may contact the University of Arkansas Office of Research and Sponsored Programs at 479.575.3845 or via e-mail at rsspinfo@uark.edu.

Instructions
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It is best to press play and pause on the screen, and avoid clicking the YouTube "replay" option as that triggers the YouTube video to pop-up in a new screen.

3_24
1.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

9_10
2.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

5_3
3.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

1_20
4.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

7_6
5.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

14_34
6.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

12_29
7.) After viewing the videos, please check all that apply regarding scapular movement. You may replay the video as many times as necessary.
[ ] Normal/Symmetric movement
[ ] Asymmetric movement
[ ] Prominent medial border (right scapula)
[ ] Prominent medial border (left scapula)
[ ] Prominent inferior border (right scapula)
[ ] Prominent inferior border (left scapula)
[ ] Elevated (right scapula)
[ ] Elevated (left scapula)
[ ] Inconsistency between trials (right scapula)
[ ] Inconsistency between trials (left scapula)

Muscles Involved

8.) In response to a movement pattern with Prominent inferior angle, what muscles would you attend to in a strengthening program?
( ) Serratus anterior and subscapularis
( ) Lower and upper trapezius
( ) Serratus anterior and lower trapezius

9.) In response to a movement pattern with a Prominent medial border, what muscles would you attend to in a strengthening program?
( ) Teres major and subscapularis
( ) Upper trapezius and levator scapulae
( ) Rhomboids major and minor

10.) In response to a movement pattern exhibiting anterior displacement of the scapula, what muscles would you attend to in a STRETCHING program?
( ) Levator scapulae and subscapularis
( ) Upper trapezius and pectoralis minor
( ) Serratus anterior and latissimus dorsi

Demographics
Below you are being asked to provide some demographic information about yourself. I am only asking for your email address to analyze person A to person A.

I will NOT send you any spam or junk mail. Your responses are again completely confidential and will not be shared with any additional party.

11.) Please provide the following information to help with demographic information for this study. Again your email address will not be provided to any additional party.
First Initial: _____
Last Initial: _____
State: _____
Zip: _____
College/University: _____
Email Address: _____

Thank You!
Thank you for taking our survey. Your response is very important to us.
