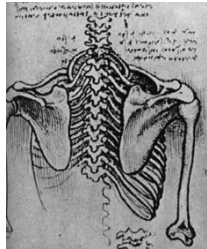


Movement Impairment Syndromes of the Scapula

Presented by:
Witaya Mathiyakom, PT, PhD

Based upon:
Diagnosis and Treatment of Movement Impairment Syndromes
Shirley A. Sahrmann, PT, PhD



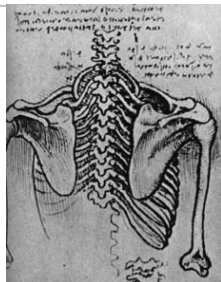
Normal Alignment of the Shoulder Girdle



- Alignment is an indicator of
 - possible muscle length changes
 - joint alignment that need to be corrected to allow for optimal motion.

Normal Alignment of the Scapula

- Vertebral border is parallel to the spine
- Vertebral border is ~ 3" from midline
- It's located between 2nd and 7th T-spine
- Scapula is flat against the thorax
- Scapula is rotated ~30° anterior to the frontal plane – scapular plane



Normal Alignment of the Humerus

- Less than 1/3 of humeral head protruding in front of the acromion
- Neutral rotation should be present
 - antecubital crease faces anteriorly
 - Olecranon faces posteriorly
- Proximal and distal ends are in the same vertical line



Normal Alignment of the Humerus relative to the Scapula

- Subacromion space ~ 1 – 1.5 cm¹
- Small space – no room for errors
- Pt with subacromion impingement demonstrated 3 mm decrease in subacromion space at 90° abduction²



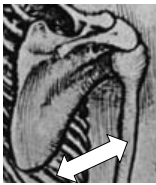
¹ Flatow et al., 1994
² Graichen et al., 1999

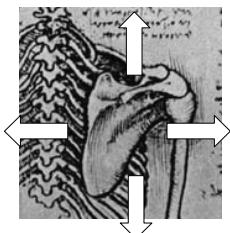
Acromial Morphology

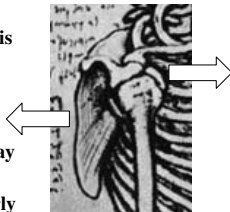
- Type I - Flat
- Type II - Curved
- Type III – Hooked¹
 - related to the degree of the rotator cuff tear^{1,2}
 - Increased subacromion pressure in inferior, anterior, lateral³



¹Bigliani & Levine, 1997
²Toivonen et al., 1995
³Payne et al., 1997

Scapular Motions	
<ul style="list-style-type: none"> ■ Upward rotation <ul style="list-style-type: none"> - The inferior angle moves laterally - The glenoid cavity moves cranially ■ Downward rotation <ul style="list-style-type: none"> - The inferior angle moves medially - The glenoid cavity moves caudally 	

Scapular Motions	
<ul style="list-style-type: none"> ■ Elevation <ul style="list-style-type: none"> - Scapula glides cranially ■ Depression <ul style="list-style-type: none"> - Scapula glides caudally ■ Abduction <ul style="list-style-type: none"> - Scapula glides laterally ■ Adduction <ul style="list-style-type: none"> - Scapula glides medially 	

Scapular Motions	
<ul style="list-style-type: none"> ■ Anterior tilt <ul style="list-style-type: none"> - Movement about coronal axis - Coracoid process moves anteriorly ■ Winging <ul style="list-style-type: none"> - Vertebral border moves away from the thorax - Glenoid fossa move anteriorly 	

Scapular Motions

- **Internal Rotation**
 - Movement about superior-inferior axis
 - Lateral border moves anteriorly
- **External Rotation**
 - Movement about superior-inferior axis
 - Lateral border moves posteriorly



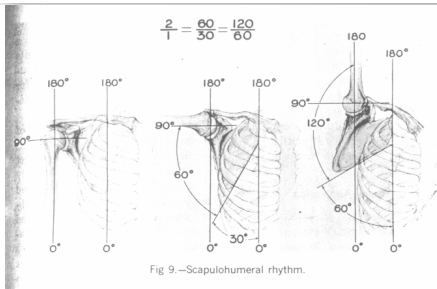
van der Helm & Pronk, 1995

Shoulder Girdle Movement Patterns

- **Starting position**
 - If the starting position is not correct, the fault must be corrected during movement
- **Scapulohumeral Rhythm**
 - **Setting phase** - 60° flexion and 30° abduction, the movement of scapula is **highly variable**
 - **Constant 2:1 ratio** after the setting phase
 - Upward rotation ~ 46 - 50° *in vivo*¹

¹McClure et al., 2001

Scapulohumeral Rhythm



Lucas D, Arch Surg, 1973

	Shoulder Girdle Movement Patterns
	<ul style="list-style-type: none"> ■ Timing and range of scapular motion <ul style="list-style-type: none"> – Scapula stops moving at 140° – 60° upward rotation at end of arm elevation – Inferior angle is less than ½ inch from the thorax ■ Scapular winging <ul style="list-style-type: none"> – Scapula should not wing during flexion/abduction and during the return from flexion/abduction phase

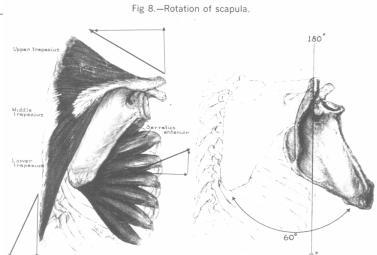
	Shoulder Girdle Movement Patterns
	<ul style="list-style-type: none"> ■ Scapular Elevation <ul style="list-style-type: none"> – There should be some scapular elevation during arm elevation – If the shoulder girdle is depressed at rest, scapular elevation is particularly important ■ End Range <ul style="list-style-type: none"> – Scapula should slightly depress, adduct and posterior tilt (30°)¹ ■ Spine – minimal movement <p style="text-align: right; font-size: small;">¹McClure et al., 2001</p>

	Muscle Groups of the Shoulder
	<ul style="list-style-type: none"> ■ Axioscapular - trunk to scapula <ul style="list-style-type: none"> – Must move the scapula correctly for the humerus to move correctly relative to the glenoid ■ Scapulohumeral – scapula to humerus <ul style="list-style-type: none"> – Control the GH joint but attach to the scapula ■ Axiohumeral – trunk to humerus <ul style="list-style-type: none"> – By pass the scapula

Axioscapular
<ul style="list-style-type: none"> ■ Serratus Anterior – abducts & upwardly rotates ■ Trapezius - adducts & upwardly rotates <ul style="list-style-type: none"> – UT – elevates; LT - depresses ■ Rhomboids – adducts & downwardly rotates ■ Levator scapulae – adducts & downwardly rotates ■ Pectoralis Minor – anteriorly tilts

Force couple acting on the scapula

Fig 8.—Rotation of scapula.

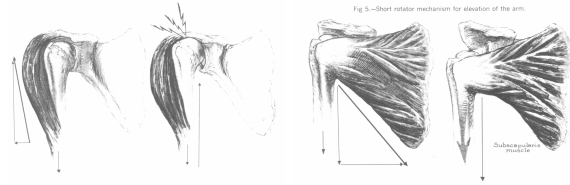


- Initially, Upper Trapezius and Lower Serratus Anterior form a force-couple
- Lower trapezius increases its contribution during the mid range
- All three contribute equally during the last phase

Lucas D, Arch Surg, 1973
Bagg & Forrest, 1986
Wadsworth & Bullock-Saxton, 1997
Filho et al., 1997

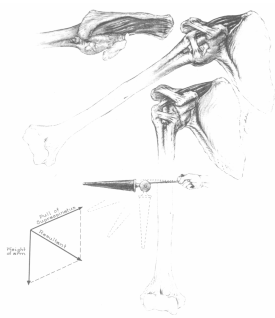
Scapulohumeral
<ul style="list-style-type: none"> ■ Deltoid – superior glides <ul style="list-style-type: none"> – AD – flexes & medially rotates – MD – abducts – PD – extends & laterally rotates ■ Supraspinatus – depresses, abducts, laterally rotates, ability to rotation decline after 60°^{1,2} ■ Infraspinatus and Teres Minor – depresses <ul style="list-style-type: none"> – laterally rotates ■ Subscapularis – depresses & medially rotates ■ Teres Major – medially rotates
¹ Reddy et al., 2000 ² Kuechle et al., 1997

Coordination of Deltoid and Rotator Cuff allow smooth movements of the humeral head under the acromion



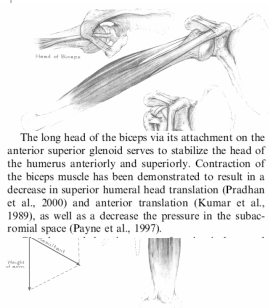
*Lucas D, Arch Surg, 1973
McMahon et al., 1995
Inmann et al., 1944
Alpert et al., 2000*

Scapulohumeral - Supraspinatus



Lucas D, Arch Surg, 1973

Biceps Brachii



The long head of the biceps via its attachment on the anterior superior glenoid serves to stabilize the head of the humerus anteriorly and superiorly. Contraction of the biceps muscle has been demonstrated to result in a decrease in superior humeral head translation (Pradhan et al., 2000) and anterior translation (Kumar et al., 1989), as well as a decrease the pressure in the subacromial space (Payne et al., 1997).

Contraction of the long head biceps decrease humeral head translation in superior¹ and anterior² directions and decrease the subacromion pressure³

Lucas D, Arch Surg, 1973

¹Pradhan et al., 2000
²Kumar et al., 1989
³Payne et al., 1997

Forces acting on the GH joint

FORCES ACTING ON THE GLENO-HUMERAL JOINT 1

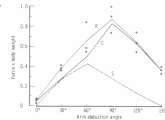
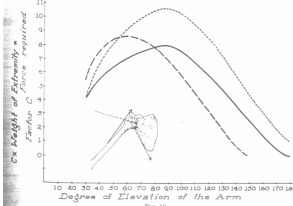


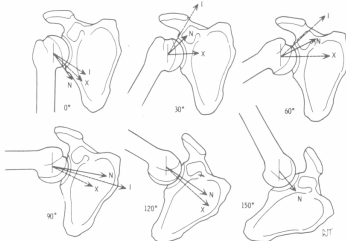
FIG. 4. The resultant force (R) glenohumeral joint, the compressive component (C) perpendicular to the face of the glenoid, and the shear force (S) up the face of the glenoid. The three points at each angle are the results for the three specimens.

FIG. 18. The weight of the upper extremity, suspended as the glenohumeral joint, is approximately 9 per cent of the weight of the body.

¹Inman et al., *J Bone Joint Surg*, 1944
²Poppen & Walkers, *J Bone Joint Surg*, 1976
 Nordt et al., 1999
 Payne et al., 1997
 Wuelker et al., 1994

Force acting on the GH joint

FIG. 5. The resultant force vectors superimposed on the average orientations of the humerus and the scapula during abduction. The vectors for neutral (N), external rotation (X) and internal rotation (I) are shown.




Poppen & Walkers, *J Bone Joint Surg*, 1976

Axiohumeral


- **Pectoralis Major**
 - Medially rotates
 - Adducts
 - Horizontally adducts
 - Upper Fibers - flexes
- **Latissimus Dorsi**
 - Medially rotates
 - Extends
 - Contributes to inferior translation of the humeral head¹



¹Healder et al., 2001

Factors Contributing to Movement Impairment of the Scapula	
<ul style="list-style-type: none"> ■ Single attachment to axial skeletal – Sternoclavicular joint ■ Small glenoid fossa with a relatively large humeral head ■ Freely moving scapula – Scapulothoracic articulation ■ Requirement of precise control and timing of scapular and humeral movement ■ Lack of true reciprocal activity 	

Impairments of the Scapular Motion	
<ul style="list-style-type: none"> ■ Affect the precision of the humeral head motion in respect to the glenoid <ul style="list-style-type: none"> – Excessive superior glide causes impingement <ul style="list-style-type: none"> ■ on acromioclavicular ligament ■ Supraspinatus tendon ■ Coracoid process ■ Stress at subacromion increased if scapula does not lead the motion 	

Movement Impairment Diagnoses - Scapular	
<p style="text-align: center;">Based upon:</p> <p style="text-align: center;">Diagnosis and Treatment of Movement Impairment Syndromes</p> <p style="text-align: center;">Shirley A. Sahrmann, PT, PhD</p>	

Movement Impairment Diagnoses - Scapular

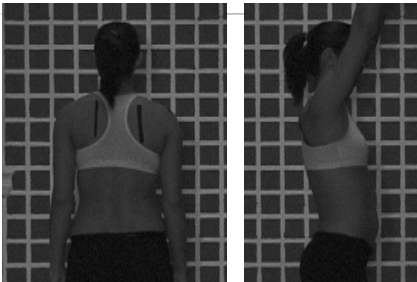
■ Criteria:

- The primary problem is faulty scapular movement
- The faulty scapular movement often causes or is associated with humeral movement
- The correction of faulty movement reduces symptoms
- The diagnosis is named for the direction of faulty movement
- Relationships between alignment and movement

Relationships between alignment and movement

- Faulty alignment and movement
- Faulty alignment, normal range of movement but not correct/compensate for faulty alignment
- Faulty alignment, but movement compensates for the faulty alignment
- Correct alignment, but faulty movement

Faulty alignment and movement



Movement Impairment of the Scapula

- Scapular Downward Rotation / Adduction
- Scapular Depression
- Scapular Abduction
- Winging/tilt

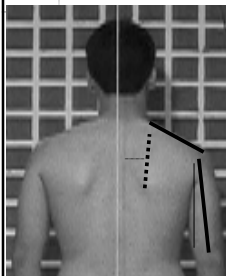
Named for movement direction that causes pain and needs to be corrected.

Scapular Downward Rotation/Adduction



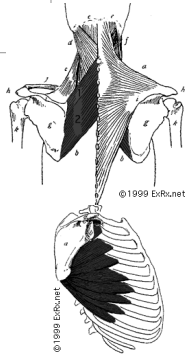
- **Movement Impairment:**
 - Insufficient scapular upward rotation and abduction during shoulder flexion and abduction

Scapular Downward Rotation/Adduction



- **Alignment Faults:**
 - Increased slope of the shoulders
 - Scapula is less than 3" from the midline
 - Vertebral border of scapula is not parallel to the spine
 - Humerus is in an abducted position relative to the scapula

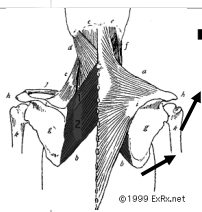
Scapular Downward Rotation/Adduction



■ Impairment of muscle length and recruitment:

- Long / insufficient upward rotators
 - *Upper Trapezius*
 - *Serratus Anterior*
- Short and dominant downward rotators
 - *Rhomboids*
- Short /dominant Pectoralis major & Latissimus Dorsi
- Short/dominant Scapulohumeral m.

Scapular Downward Rotation/Adduction



■ Confirming tests:

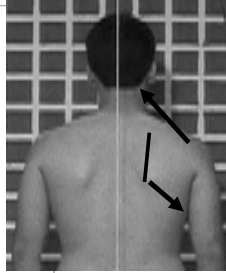
- Observation of insufficient upward rotation of scapula during GH flexion/abduction
- Manual correction of the scapular motion decreases the symptoms
- Assess passive resistance of motion

Scapular Downward Rotation/Adduction

■ Pain Problems:

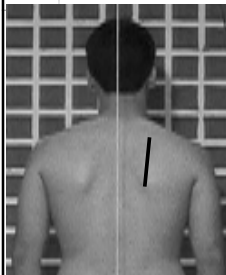
- GH impingement – supraspinatus tendinitis
- Rotator Cuff tear
- Humeral subluxation
- Thoracic outlet syndrome
- Neck pain with/without radiating pain
- Pain in Levator scapulae, rhomboids, upper trapezius

Scapular Downward Rotation/Adduction



- **Emphasis of Treatment:**
 - Correcting muscle length and recruitment patterns and strength faults of:
 - Serratus Anterior
 - Upper trapezius

Scapular Downward Rotation/Adduction



- **Treatment Ideas:**
 - Shoulder flexion facing wall
 - bring the scapula around
 - Prone shoulder flexion
 - Quadruped rocking
 - Focusing on push back by SA
 - Stretching
 - Latissimus Dorsi
 - Pectoralis major
 - Pectoralis minor

Scapular Depression



- **Movement Impairment:**
 - Scapula fails to elevate sufficiently during GH abduction and flexion

Scapular Depression



■ Alignment Faults:

- Scapula is lower than T2-T7
- Horizontal clavicles
- Increased slope

Scapular Depression



Passive Scapular Elevation

Scapular Depression

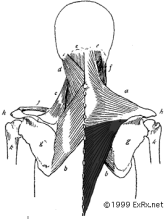


■ Structural considerations:

- Long arms
- Heavy arms
- Large breasts
- Long neck

The arms exert a downward pull on the scapula.

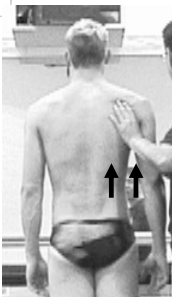
Scapular Depression



■ Impairment of muscle length and recruitment:

- Long/weak scapular elevators
Upper Trapezius, Levator Scapulae
- Dominance/shortness of scapular depressors: Lower Trapezius
- *Dominance of lower over upper trap*
- Short Lats, Pect Maj - depressors

Scapular Depression



■ Confirming Tests:

- Manually elevate scapula decreases symptoms in neck, UT, Levator Scapulae
- Passive scapular elevation allows increased neck rotation and/or decreased symptom

Scapular Depression

■ Pain Problems:

- Neck pain with/without radiation
- Pain in UT and Levator scapulae
- GH impingement
- AC joint pain

Scapular Depression



- **Emphasis of Treatment:**
 - Correcting length, recruitment and strength faults of the **Upper Trapezius**

Scapular Depression



- **Treatment Ideas:**
 - Standing facing wall, shoulder flexion with shrugging
 - Prone Middle Trapezius
 - Stretching of Lats, pectoralis major
 - Support arm while sleeping, sitting and standing
 - Correct height of desk
 - **Scapular Taping**

Scapular Depression

- **Treatment Ideas:**



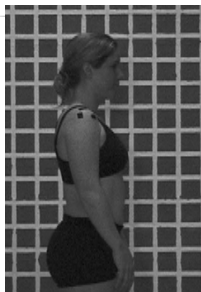
Scapular Abduction



■ Movement Impairment:

- Excessive scapular abduction during shoulder flexion

Scapular Abduction



■ Alignment Faults:

- Medial border > 3" from spine
- >30 degree anterior to frontal plane

■ Movement Faults:

- Scapula and humerus move in 1:1 ratio
- Scapula abducts in prone position during shoulder lateral rotation with arm abducted

Scapular Abduction



■ Structural Considerations :

- Thoracic Kyphosis
- Scoliosis
- Large Breasts
- Large Abdomen

Scapular Abduction



- **Impairment of muscle recruitment and lengths:**
 - Dominance/shortness of the scapular abductors (SA, Pects)
 - Lengthen and weak of the adductors (Traps, RB)
 - Dominance/shortness of SH muscles


Scapular Abduction

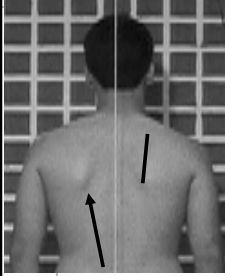
- **Confirming Test:**
 - Correction of scapular abduction faults decrease symptoms and improve shoulder and neck impairment

Scapular Abduction

- **Pain Problems:**
 - Posterior impingement of GH
 - Thoracic outlet syndrome
 - Humeral subluxation (anterior/inferior)
 - Interscapular pain (RB, Trapezius, thoracic pain)
 - Tendinitis, bursitis
 - SC joint pain

	Scapular Abduction
	<ul style="list-style-type: none"> ■ Emphasis of Treatment: <ul style="list-style-type: none"> – Correcting length, recruitment and strength fault of the Middle Trapezius and rhomboids

	Scapular Abduction
	<ul style="list-style-type: none"> ■ Treatment Ideas: <ul style="list-style-type: none"> – Prone Middle Trapezius Strengthening – Pectoralis minor and major Stretch – Scapulohumeral muscles Stretch <ul style="list-style-type: none"> ■ Supine internal rotation ■ Horizontal adduction – Correct sitting position: <ul style="list-style-type: none"> ■ trunk support, ■ scapular taping

	Scapular Winging/Tilting
	<ul style="list-style-type: none"> ■ Movement Impairment: <ul style="list-style-type: none"> – Scapular winging or tilting during the return from flexion ■ Alignment Faults: <ul style="list-style-type: none"> – Prominence of medial border – Scapular winging – Prominence of inferior angle – Scapular tilting – Heavy and flat thoracic spine

	Scapular Winging/Tilting
	<ul style="list-style-type: none"> ■ Impairment of Muscle Recruitment Length and Strength: <ul style="list-style-type: none"> – Scapular winging during GH elevation <ul style="list-style-type: none"> • Weakness of Serratus Anterior – Scapular winging during GH depression <ul style="list-style-type: none"> ■ Scapulohumeral muscles do not elongate as fast as the axioscapular muscles – Shortness of Biceps and Pectoralis Minor

	Scapular Winging/Tilting
	<ul style="list-style-type: none"> ■ Pain Problems: <ul style="list-style-type: none"> – Anterior impingement of GH joint – Thoracic outlet syndrome – Tendinitis, bursitis – Rotator cuff tear

	Scapular Winging/Tilting
	<ul style="list-style-type: none"> ■ Emphasis of Treatment: <ul style="list-style-type: none"> – Correcting length, recruitment and strength faults of Lower Trapezius

	Scapular Winging/Tilting
	■ Treatment Ideas <ul style="list-style-type: none">- Lower Trapezius strengthening- Pec minor stretching- Wall shoulder flexion (dissociation of GH from ST motion)- Wall shoulder flexion with arm lift- Stretching of SH muscles- Use short moment arm – bend elbow
