



Unraveling Muscle Imbalances in the Shoulders

**Unraveling Muscle Imbalances
in the Shoulder**



with Rick Kaselj, MS


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My Story


Rick Kaselj

- Exercises and injuries
- BSc - 1997
- MS - 2008 / RC
- Work - physio, studio, gym, rec centre, rehab
- Courses - live, webinars, video presentations
- Writing - books, manuals
- Blog - ExercisesForInjuries.com




**Rick Hiking 4300 km/ 5 months
from Mexico to Canada**

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**Objectives of the MIRU Video
Presentation**



- **Part 1** - Structure & Movement
 - Bones
 - Joints
 - Movement
- **Part 2** - Exercise for Muscle Imbalances in the Shoulder


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Unraveling Muscle Imbalances in the Shoulders

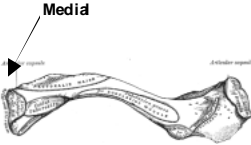
Bones of the Shoulder (Osteology)

- Sternum
- Clavicle
- Ribs
- Scapula
- Humerus




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Clavicle




Left Anterior Clavicle Inferior View

- 20 degree angle posterior from the frontal plane
- Elevates
- Posterior rotation for full abduction like a crank


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Scapula

- Glenoid Fossa - 5 degrees of upward rotation / not square on
- Scapular Plane - 35 degrees from the horizontal

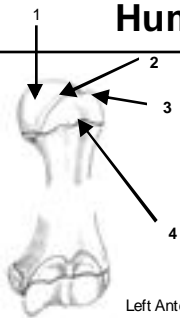


Left Scapular Lateral View

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Humerus




- **Head of the Humerus (1)**
 - contact with the glenoid fossa of the scapula to make of the glenohumeral joint
- **Anatomical Neck (2)**
 - separates the smooth head from the shaft of the humerus
- **Lesser tubercle (3)**
 - where subscapularis inserts
- **Greater tubercle (4)**
 - supraspinatus, infraspinatus, teres minor insert

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Joints of the Shoulder (Arthrology)

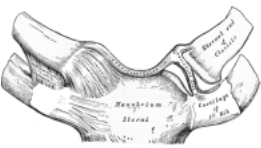
- **Sternoclavicular**
- **Acromioclavicular**
- **Scapulothoracic**
- **Glenohumeral**



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Sternoclavicular Joint



- **Structures**
 - Medial end of clavicle
 - Sternum
- **Stabilized**
 - Cartilage of first rib
 - ligaments
- **Injuries**
 - Arthritis is rare
 - Fracture of clavicle > SC dislocation

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SC Joint

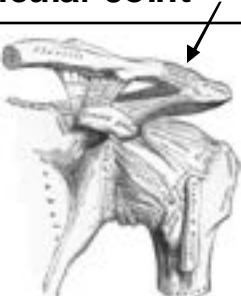
- **Movements Around the Joint**
 - Elevation (45°) / Depression (10°)
 - Protraction / Retraction
 - Axial rotation of clavicle (50°)
 - Allows for lots of movement of scapula

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Acromioclavicular Joint

- **Structures**
 - Lateral end of clavicle
 - Acromium of scapula
- **Stabilized**
 - capsule
 - ligaments
- **Injuries**
 - Degeneration is common
 - Susceptible to dislocation (falling or striking tip)




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AC Joint


- **Movement**
 - Upwards / Downward Rotation
 - Adjustment movement
 - Pivot (inferior angle side to side – horizontal/frontal)
 - Tilt (inferior angle forward or back - sagittal)
 - Fine tuning of scapula / Rotational adjustments
 - 10° to 30°
 - Allows for subtle movements of scapula

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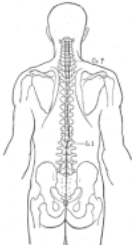
Scapulothoracic Joint




- **Structures**
 - Scapula
 - Thorax
- **Movements**
 - Elevation / Depression
 - Protraction / Retraction
 - Upward / Downward Rotation

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Scapulothoracic Joint




- Between 2nd (T2) and 7th rib (T7)
- 6 cm (2-3 inches / ~3 fingers) from medial border to spine
- **Spine of Scapula**
 - T3
- **Now You Do It!**

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Movement at Scapula

- **Elevation (Shoulder Shrug)**
 - Scapula follows path of clavicle at the SC joint
 - Downward rotation at AC joint to keep medial border of scapula vertical
 - Depression movement is the reverse


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Movement of Scapula

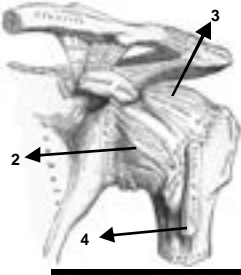
- **Protraction**
 - Rotation at the SC joint
 - Horizontal adjustment at the AC joint
 - If issue at one joint the other can compensate
 - Retraction is the reverse
- **Upward Rotation**
 - Clavicular elevation at SC joint
 - Scapula upward rotation at AC joint
 - 60° of scapular rotation
 - Downward Rotation is the reverse

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Glenohumeral Joint

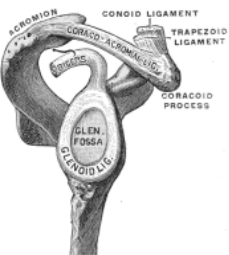
- **Structures**
 - Convex head of humerus
 - Shallow concave glenoid fossa
 - Golf ball on a coin
- **Stabilized**
 1. RC muscles
 2. Capsular ligaments
 3. Coracohumeral ligament
 4. Long head of biceps
 5. Glenoid labrum



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GH Joint




- **Glenoid Fossa**
 - Lined with hyaline cartilage
 - Glenoid labrum
 - Fibrocartilage ring
 - Long head of biceps originates here
 - Creates 50% of the depth

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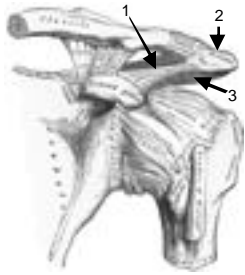
GH Joint




- Static Stability
 - Ligaments
 - Supraspinatus
 - Posterior deltoid
 - Negative intra-articular pressure of the capsule

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Coracoacromial Arch




- = coracoacromial ligament (1) and acromion process of the scapula (2)
- Roof of the GH joint
- 1 cm gap btw arch and humerus
- Subacromial Space (3) = supraspinatus muscle & tendon, subacromial bursa, long head of biceps, superior capsule

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GH Joint (Arthrokinematics)




- Movement
 - Abduction – 120 at GH / 60 upward rotation of scapula
 - Flexion – 120 at GH / 60 upward rotation of scapula
 - Extension – 45 to 55
 - IR 75 to 85 includes some scapular protraction / ER 60 to 70 includes some scapular retraction

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Gluteus Maximus Circulation Exercise

- Wall supported shoulder abduction ?
- Wall supported shoulder abduction in scapular plane (35°)?
- Now You Do It!




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What Did You Find?

- Limited by greater tubercle of the humerus compression contents of the subacromial space against the low point of the coracoacromial arch.
- In order to complete abduction in the frontal plane need to externally rotate humerus
- If move into the scapular plane greater tubercle moves under the high point of the coracoacromial arch


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Scapulohumeral Rhythm

- 2:1 ratio (Inman, 1944)
- 3 degrees of shoulder abduction
 - 2 degrees by GH joint abduction
 - 1 degrees occurs at scapulothoracic joint upward rotation

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What About Under Load?

- **(McQuade, 1999).**
 - 1) arm completely unloaded and passively elevated - 7.9:1 to 2.1:1 (GH:Scap)
 - 2) light load consisting of active elevation against the weight of the limb - 3.1:1 to 4.3:1
 - 3) heavy loading against maximal resistance - 1.9:1 to 4.5:1

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What About Under Fatigue?

- **(Szucs, 2009)**
 - Fatiguing out serratus anterior lead to:
 - Increase activation of upper trapezius
 - Altered serratus anterior and lower trapezius activation ratio
 - Could lead to shoulder pathology

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Shoulder Kinematics

0 ° to 90 ° Abduction	90 ° to 180 ° <small>Adduction</small>
<ul style="list-style-type: none"> • 60 ° GH joint • 30 ° scapulothoracic upward rotation - 20 to 25 ° from clavicular elevation at SC joint - 5 to 10 ° upward rotation at AC joint 	<ul style="list-style-type: none"> • 60 ° GH joint • 30 ° scapulothoracic upward rotation - 5 ° from clavicular elevation at SC joint - 20 to 25 ° upward rotation at AC joint


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Muscles of the Scapulothoracic Joint



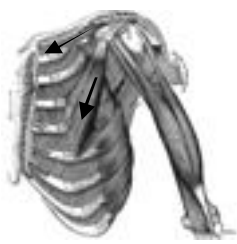
- **Elevators**
 - Upper trapezius
 - Levator scapulae
 - Rhomboids (2°)


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Depressors of the Scapulothoracic Joint




Lower trapezius
Latissimus dorsi
Pectoralis minor
Subclavius
Function can flip as in lifting seat of wheelchair




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Protractors of the Scapulothoracic Joint

- **Serratus Anterior**




Serratus anterior

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Retractors of the Scapulothoracic Joint



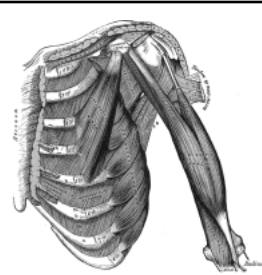
- Middle Trapezius
- Rhomboids (2°)
- Lower Trapezius (2°)

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Full Arm Elevation - Flexion -


- **GH Muscles**
 - Anterior Deltoid
 - Supraspinatus (2°)
 - Coracobrachialis
 - Biceps (long head)
- **Scapulothoracic Joint Muscles**
 - Serratus Anterior
 - Trapezius
- **Rotator Cuff**



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Full Arm Elevation - Abduction -



- **GH Muscles**
 - Anterior Deltoid
 - Middle Deltoid
 - Supraspinatus
- **Scapulothoracic Joint Muscles**
 - Serratus Anterior
 - Trapezius
- **Rotator Cuff**


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Supraspinatus & Deltoid


- Line of pull is same during abduction
- Most active until 90°
- Create equal amounts of torque
- If Deltoid Paralyzed
 - Supraspinatus can fully ABDGH
- If Supraspinatus Paralyzed
 - ABD difficult
- Both
 - ABD not possible



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Upwards Rotators at the Scapulothoracic Joint



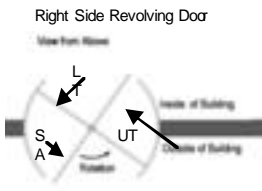
- **Proximal Stabilizers**
 - O @ spine, ribs, cranium -> I @ scap or clavicle
 - Serratus anterior
 - Trapezius
- **Distal Mobilizers**
 - O @ scap or clavicle -> I @ humerus or forearm
 - Deltoid
 - Supraspinatus

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Upward Rotation Force Couple

- UT = Upper Trapezius
- LT = Lower Trapezius
 - Most Active Later Stage
- SA = Serratus Anterior
 - Protraction force is countered by MT & Rhomboids
 - If weak SA scap retracted
 - If MT weak scap protracted



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Paralysis


- **Trapezius**
 - Difficulty lifting arm
 - important for serratus to be active
 - Frontal plane abduction the worst due to lack of MT
- **Serratus Anterior**
 - Can't elevate over 90
 - With resistance scapula will wing & deltoid with downwardly rotate scap

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Rotator Cuff

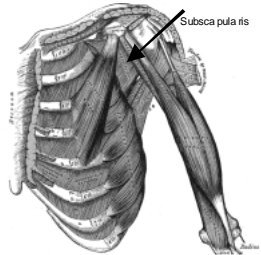
- **Supraspinatus**
- **Subscapularis**
- **Infraspinatus**
- **Teres Minor**
 - Rotator cuff muscles and capsular ligament blend into the fibrous capsule of the GH joint before attaching to Humerus



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Rotator Cuff




- **Distal Mobilizer**
 - Supraspinatus – moves humerus
- **Dynamic Stabilizer**
 - Stabilizes and centralizes humeral head against glenoid fossa

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Rotator Cuff




- Supraspinatus (7) produces a compression force into glenoid fossa which stabilizes humeral head
- Subscapularis, Infraspinatus (8), Teres Minor (6) produce inferior directed translation force on the humeral head
- Infraspinatus (8) & Teres Minor (6) external rotate humeral head & in frontal plane helps ER so greater tubercle cleared

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Rotator Cuff

- **External Rotation**
 - Infraspinatus, teres minor and posterior deltoid
 - Supraspinatus – assists between neutral and full ER
- **RC**
 - Small percentage of total muscle mass in the shld
 - Creates smallest isometric force of all shld muscles
 - High-velocity concentric contractions
 - Eccentric activation decelerating internal rotation

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Supraspinatus

- Most utilized muscle in shoulder
- Assists deltoid in ABD
- Dynamic stability
- Static stability (at times)
- Create 20 greater force than what is in the hand


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Dysfunction

- **Supraspinatus**
 - Counters deltoid superior force
 - therefore humeral head jammed into coracoacromial arch
 - Decrease shoulder abduction
- **Subscapularis/ Infrapinatus / Teres Minor**
 - Counters deltoid superior force
 - therefore humeral head jammed into coracoacromial arch
 - Decrease shoulder abduction


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RC Exercises to Fatigue


- **(Ebaugh 2006)**
 - Performed RC exercises to fatigue
 - Less external rotation
 - Less posterior tilt of the scapula at the start of arm elevation
 - More scapular upward rotation and clavicular retraction in mid ranges of arm elevation

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Adduction & Extension

- Latissimus Dorsi
- Pectoralis Major - sternocostal head
- Teres major
- Long head of triceps
- Posterior deltoid
- Teres minor
- **Rhomboids**
 - Main role is to stabilize scapula during ADD & Ext
- **Rotator Cuff**
 - Active during ADD & Ext




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Internal Rotation




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- Subscapularis
- Anterior Deltoid

Also ADD & Ext

- Pectoralis Major
- Latissimus Doris
- Teres Major


- **IR > EX by 1.75 torque**




Horizontal Extension

- Primarily posterior deltoid
- Lower Trapezius needs to stabilize scapula

- **Paralysis Deltoid**
 - Difficulty combining shld ext and horizontal ext (arm into a jacket)




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Other Exercises & Injuries

- Scapular Stabilization Exercises
- Plantar Fasciitis and Exercise
- The Most Effective Rotator Cuff Exercise Program
- Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries
- Corrective Exercises for Running Injury-free
- Lumbar Spinal Fusion and Exercise




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Objectives of the Video Presentation



- **Part 1** – Structure & Movement
 - Bones
 - Joints
 - Movement

- **Part 2** – Exercise for Muscle Imbalances in the Shoulder

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Thank You

- **Send me your questions!**

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