

# Impingement

# Definition

- Compressive load of structures between the acromion and acromial arch (coracoacromial ligament) and the head of humerus.

# Definition

Many shoulder pathologies can involve a degree of impingement.

- Soft tissue rupture
- Tendon pathology
- Instability
- Inflammatory conditions
- Degenerative changes
- Poor glenohumeral and scapular mechanics

# Neer Classification (1972)

## Impingement from above

### I: Edema, inflammation and haemorrhage

- Reversible tendon based changes (tendonitis)
- Less than 25yrs of age
- Reversible with Conserv. Mx

### II: Fibrosis and tendonitis

- Permanent scarring, no tears, severe tendonitis
- 25-40yrs of age
- Sub-acromial decompression

# Neer Classification (types)

III: Bony spurs and tears of the rotator cuff tendons

- 40yrs +
- Small tear
- Sub-acromial decompression with debridement/repair

IV: Cuff tear/arthropathy

- 40yrs +
- Large cuff tear
- Joint replacement

# Whats wrong with Neers?

- Neglects biomechanical causes external to sub-acromial space model
- Doesn't address the pathogenesis of tendon based condition and the more recently proposed “spectrum” of tendon degeneration.
- Minor instability
- Internal impingement was not identified
- Supraspinatus and the sub-acromial bursa where the main structures addressed

# Modern Classification

- Identifies different
  - Structures of impingement
  - Sites of impingement
  - Pathogenesis of impingement
- Insight for conservative management

**SITE**

Impingement

Internal

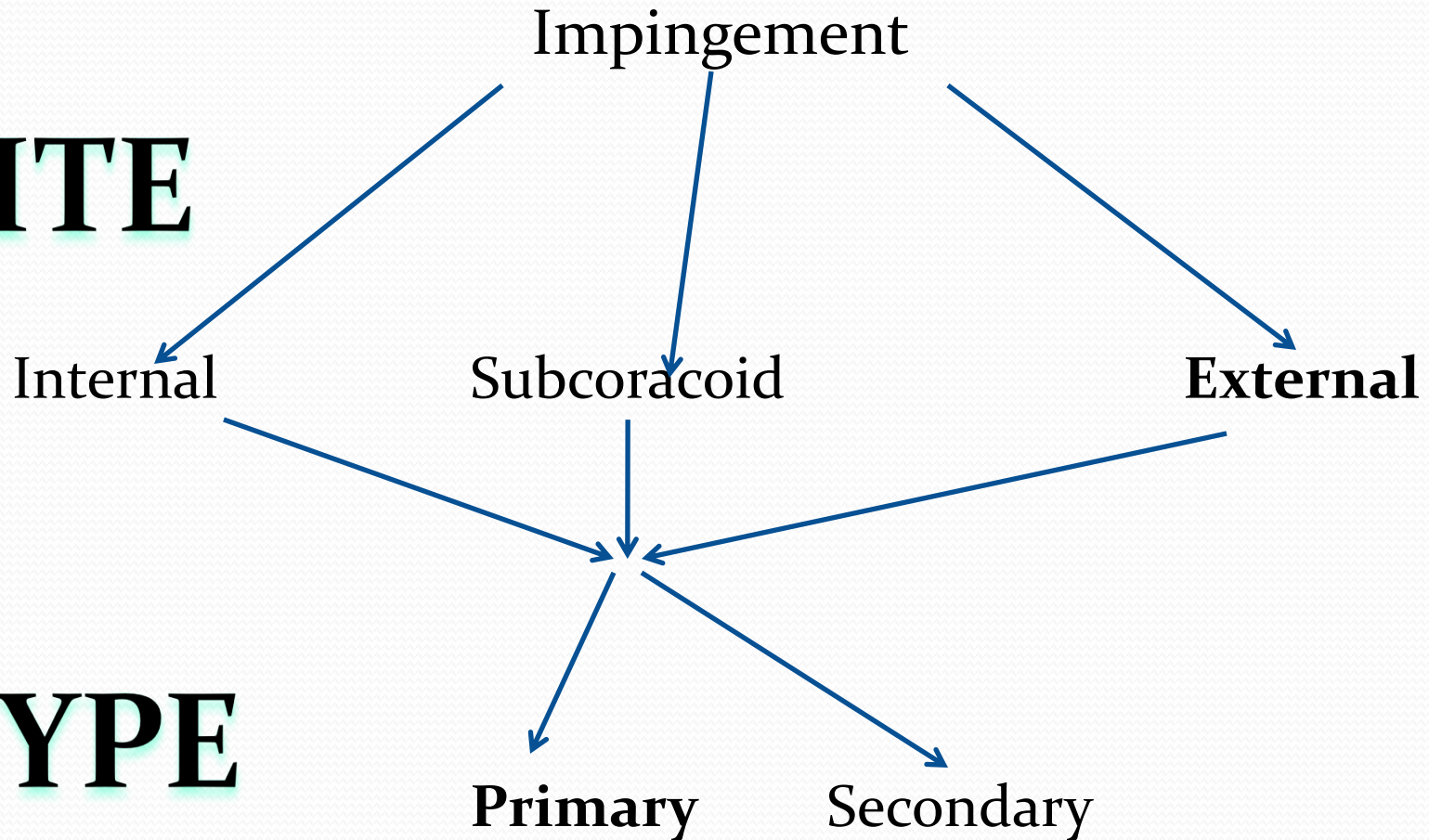
Subcoracoid

External

**TYPE**

Primary

Secondary





# External impingement

- Sub-acromial space is **between**
  - Acromion, distal clavicle and Coraco-acromial ligament (coraco-acromial arch)
  - & Humeral head
- Sub-acromial space **consists of**
  - Sub-acromial bursa
  - Supraspinatus tendon
  - Infraspinatus tendon
  - LHB

# Primary Impingement

- **Primary:** Impingement through structural abnormality (causing decreased volume and higher compressive forces under the acromion)

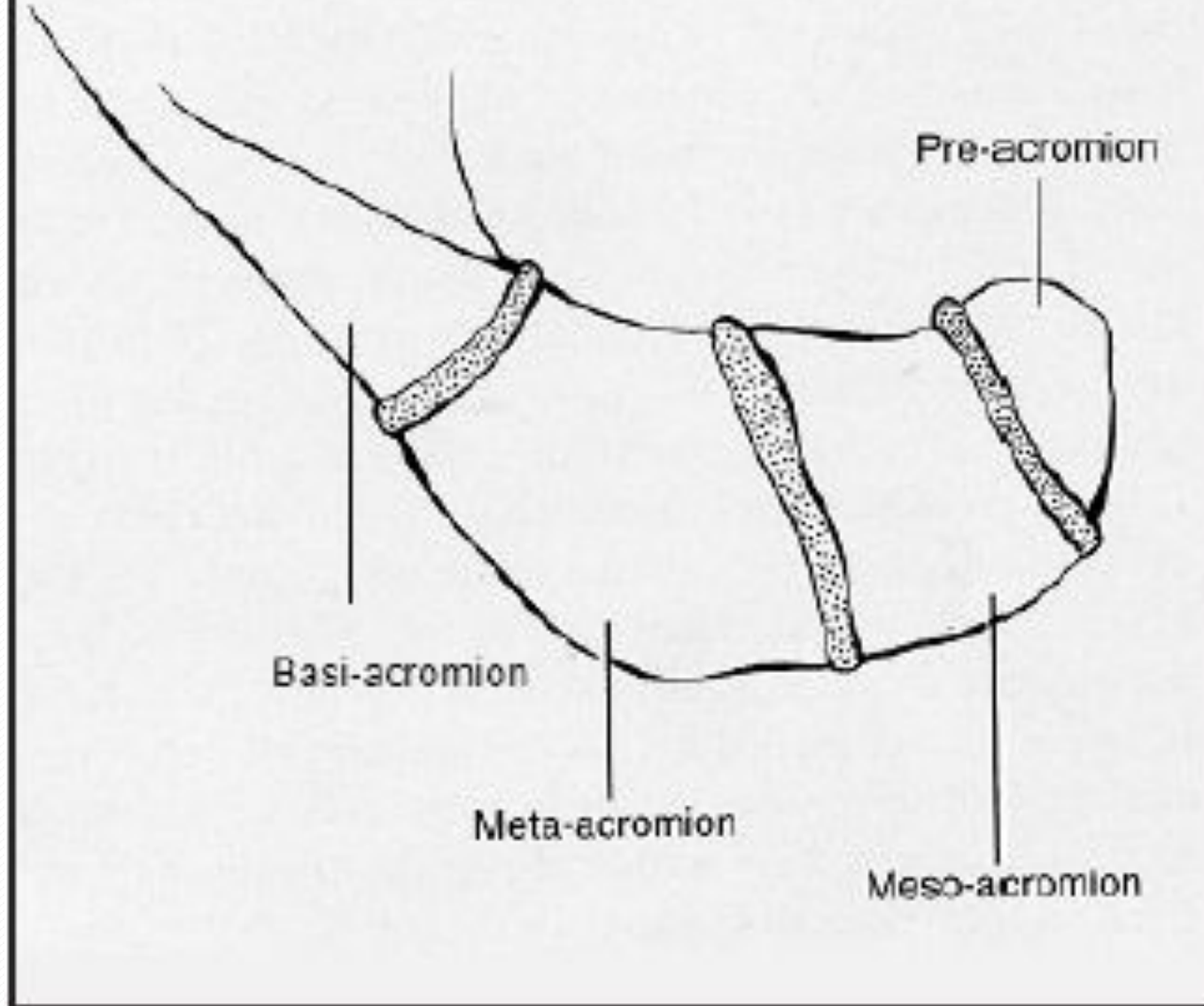
# Primary Impingement

- No biomechanical abnormality is required
- Uncommon to not develop altered movement patterns in the presence of pain.
- Will be the end result of many secondary impingements
- So what can decrease space below the sub-acromial or coraco-acromial arch?

# Some Space Occupying Anomalies

- Os Acromiale
- Acromial/Clavicular Exostoses
- Acromial Type
- Outlet impingement
- Coracoacromial calcification (thickening and congenital)
- OA of AC jnt
- SA Bursa

# The acromial growth plates

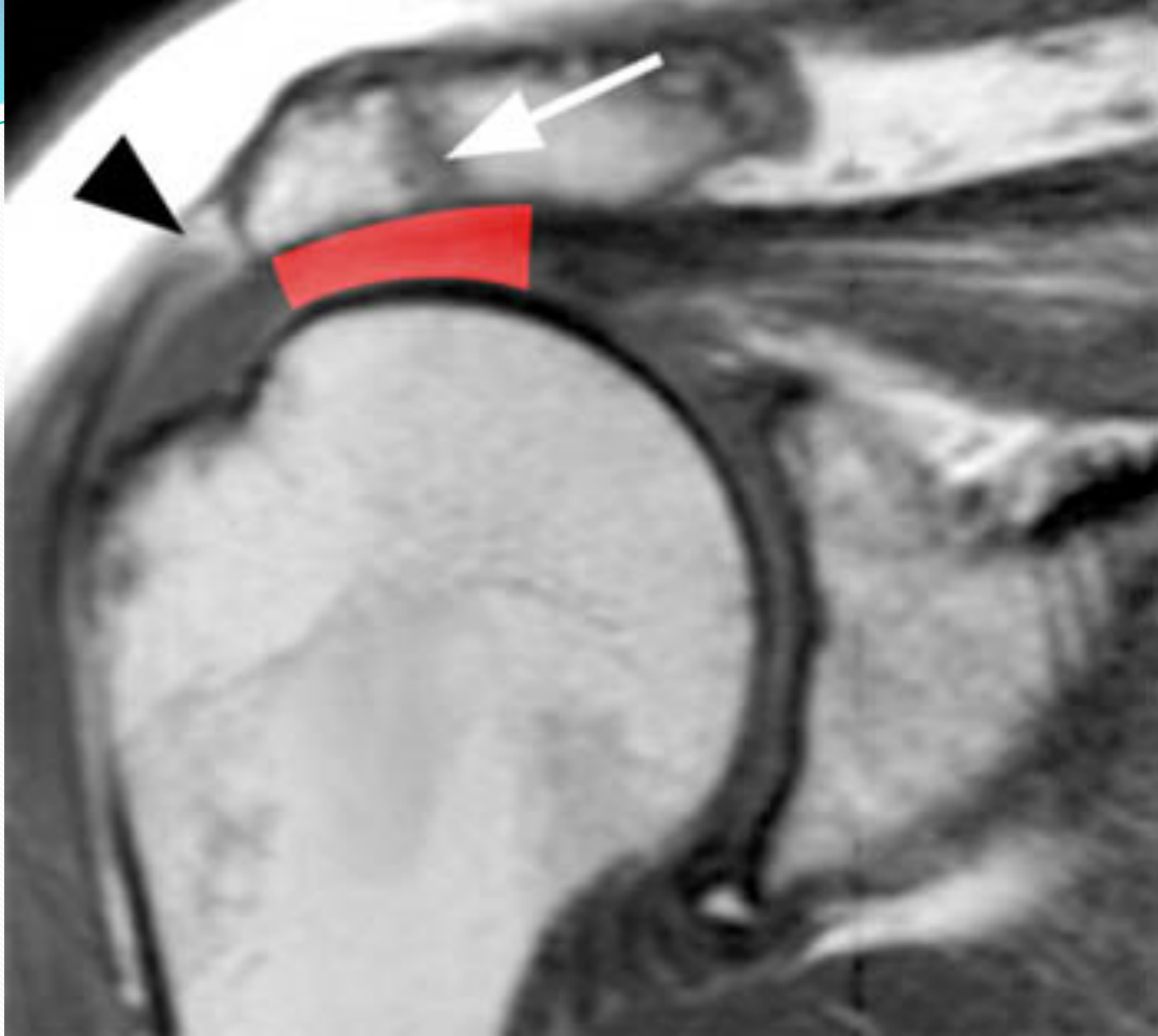


# Os Oculomiale

- Plates should fuse by 22-25
- Separate ossicles develop due to failure to fuse
- 6% of pop
- 33% are bilaterall
- Impingement signs and local tenderness, pain sleeping on that side
- Deltoid pulls piece slightly inferior when not ossified and decreases relative space
- **Won't always cause impingement**

# Os Ochromiale

- Pain generator
  - Impingement from above
  - Concurrent cuff tear
  - Sometimes gross motion at site
- Conservative M(x) usually
  - Physio + cortiosteriod to settle if required
- Surgical
  - Fragment excision
  - ORIF
  - Decompression





RD  
P



# Exostosis

- Formation of new bone often on acromion, AC joint or insertion of the coraco-acromial ligament.
- Can arise with degenerative changes or repetitive loading of bone surface
- Will create physical change in sub-acromial space
- Often mis-diagnosed as a type 3 acromion on a radiograph
- Not reducible without surgery
- Not always symptomatic

# Acromial Type, Bigliani (1986)



- ▣ Flat
- ▣ Curved
- ▣ Hooked
  
- ▣ Hooked acromion are observable in 80% of the population of rotator cuff tears
- ▣ Cause or effect of impingement?
- ▣ Hooked may cont to bony exostosis?

# Coraco-Acromial Calcification

- Increased tensile loading due to contact with coraco-acromial ligament thought to create a boney spur at its insertion into the acromion
- May occur secondary to anterior/superior instability
  - Migration of humeral head
- Will increase chance of impingement under the coraco-acromial arch.
- Most arise from direct trauma or renal failure

# OA of AC joint

## Acromioclavicular Osteoarthritis



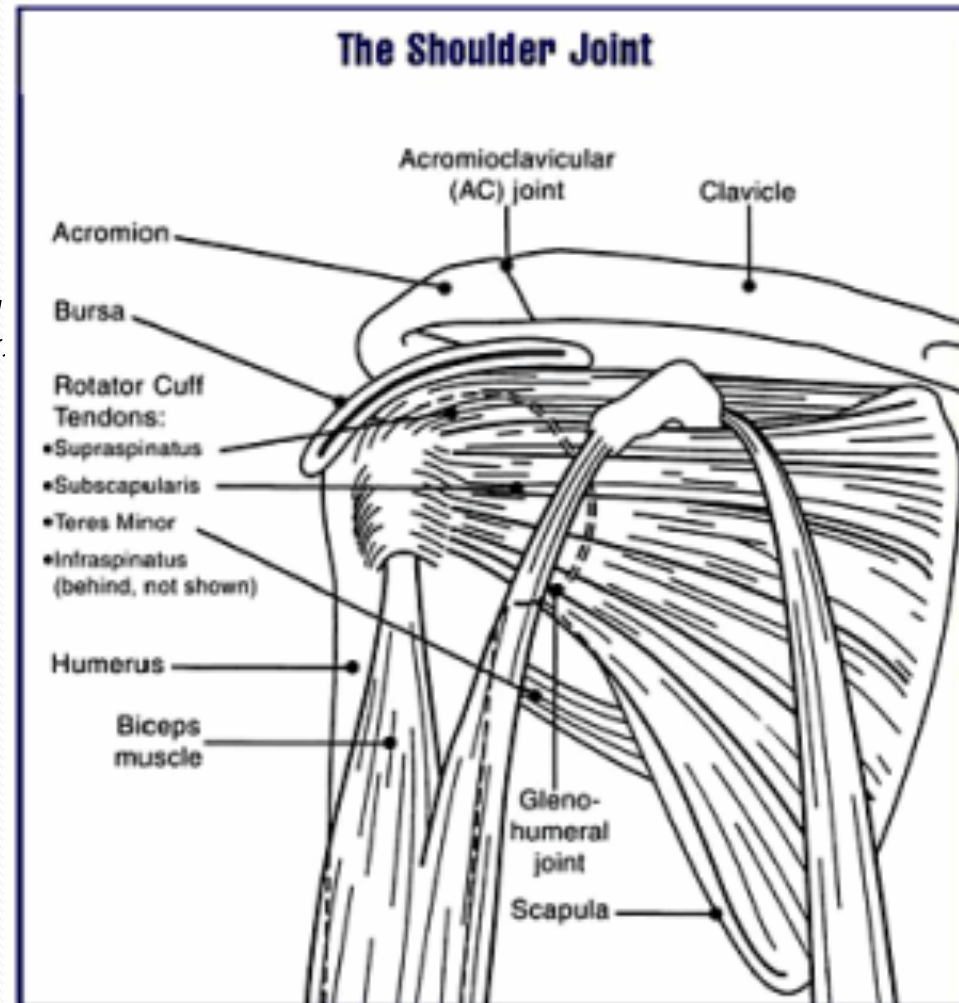
# OA of the shoulder

- OA of the AC joint far more common than GHJ OA
- Usually older than 35
- Overuse or trauma
- X-ray to diagnose



# OA of the shoulder

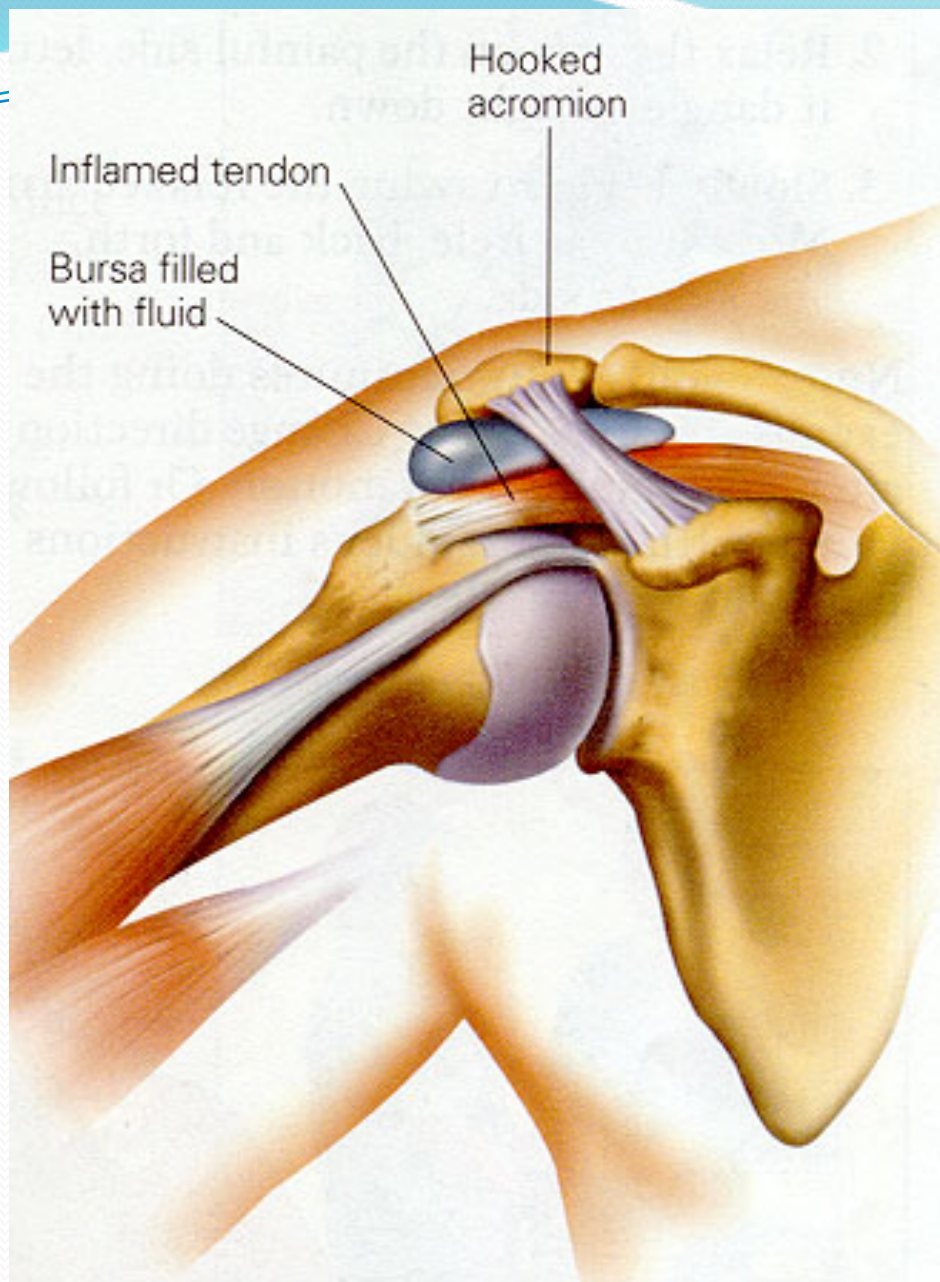
- Can be contributed to by muscle dysfunction
  - Upper Trap dysfunction
  - Increased shearing of the AC



# Sub-acromial Bursa

- Thickening of the sub-acromial bursa is often seen in conjunction of with other pathology (ie rotator cuff disease)
- Wont present with swelling unless there is an underlying joint arthropathy
- With movement clicking and clunking of sub-acromial bursa can sometimes be felt





**SITE**

Impingement

Internal

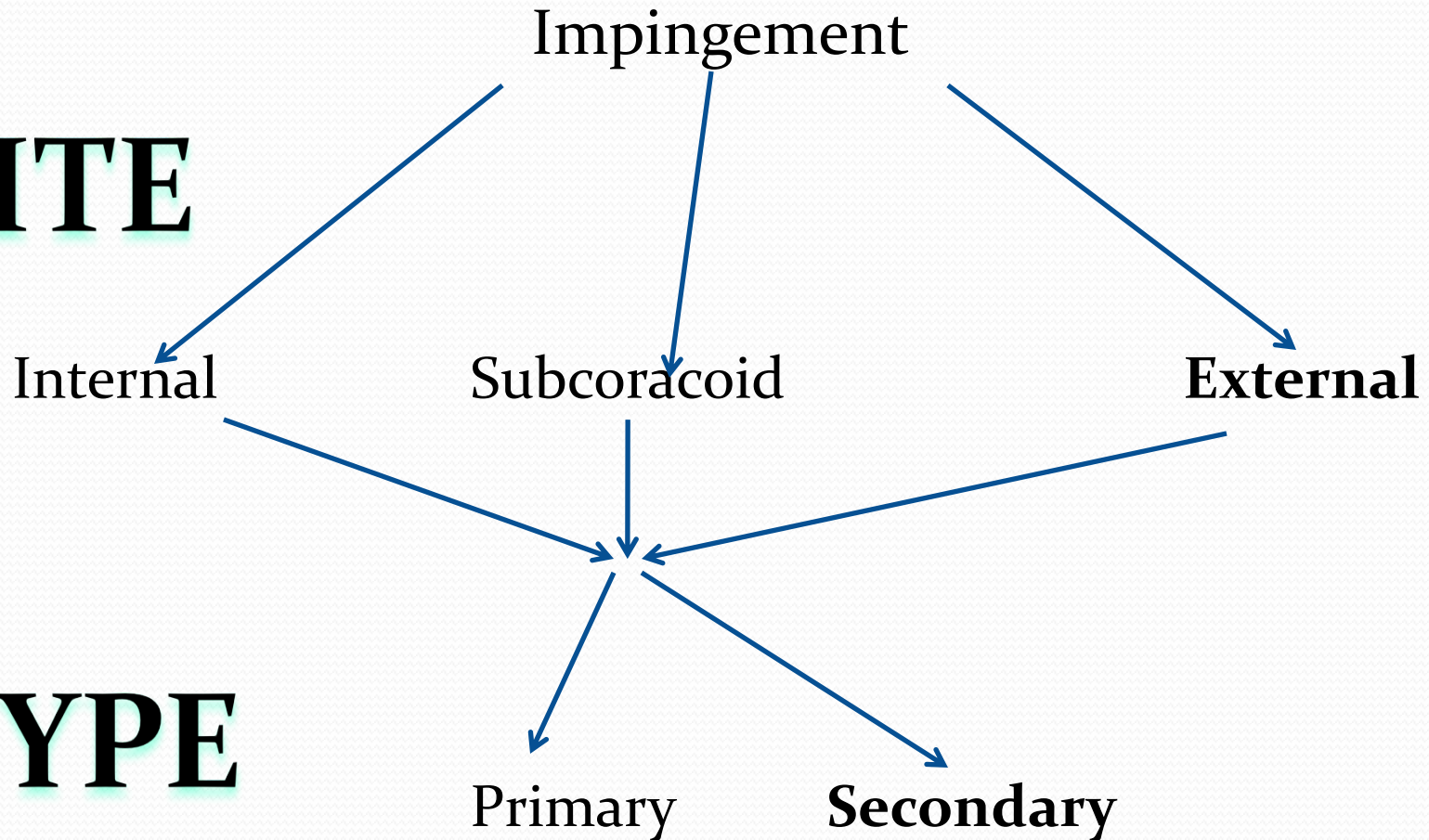
Subcoracoid

External

**TYPE**

Primary

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# Secondary Impingement

- Decrease in outlet space due to instability and altered mechanics (either GH or Scapulo-thoracic).
  - Weak muscles
  - Tight muscles
  - General muscle imbalance
  - Poor motor patterns
  - Instability

Can quite easily progress to a primary impingement.

# Common Muscle Imbalance

- Humeral Head Elevators
  - Deltoid
  - Supraspinatus (min)
- Humeral Head Depressors
  - Infraspin
  - Teres Major
  - Subscap

# Common Muscle Imbalance

- Upward Scap Rotators
  - Serratus Anterior
  - Upper Trapezius
- Downward Scap Rotators
  - Levator Scapulae
  - Pec Minor
  - Rhomboids
- In the presence of pain serratus anterior becomes inhibited
- Levator scap is commonly dominant in impingement with upper traps becoming long and weak (gives ant/inf glenoid presentation)

# Common Muscle Imbalance

- Internal Rotation
  - Lats
  - Pec Major
  - Teres Major
  - Subscap
  - Short head bicep
  - Brachioradialis
  - Anterior Delt
- External Rotation
  - Teres Minor
  - Infraspinatus
  - Posterior Delt
- Internal rotators vastly outnumber and can overpower the external rotators

**SITE**

Impingement

Internal

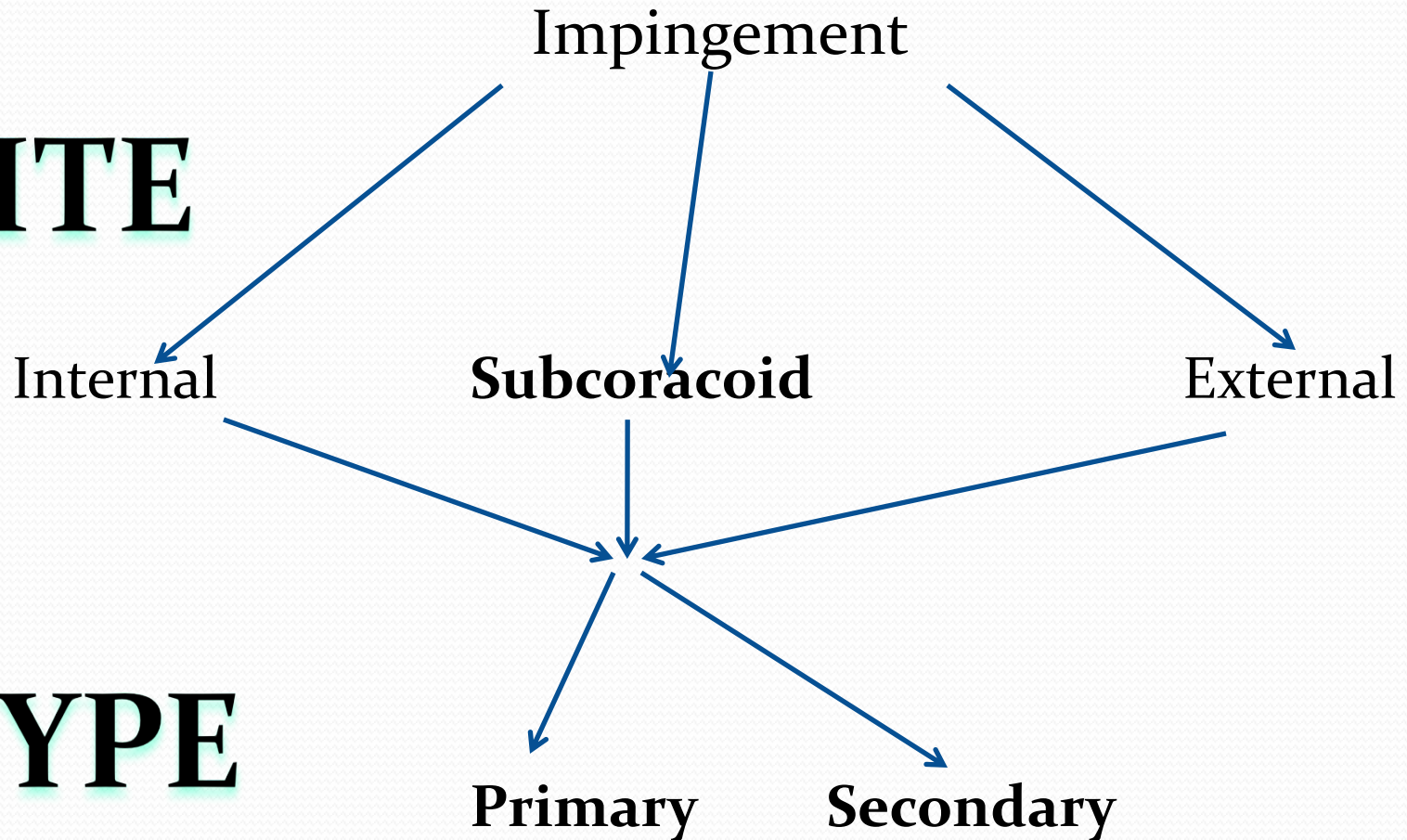
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# Subcoracoid Impingement

- The area under the coracoid and medial to the lesser tuberosity (attachment of subscapularis)
- Corocoid can compresses structures into the lesser tuberosity
- Can be primary or secondary
- Structures involved
  - Subscapularis tendon
  - Subcorocoid bursa
  - Long head of biceps



# Subcoracoid Impingement

- Predispositions
  - Posterior capsule tightness (causing anterior HH translation)
  - Excessive scapula protraction
  - Excessive scapula anterior tilting
  - Anterior instability

**SITE**

Impingement

Internal

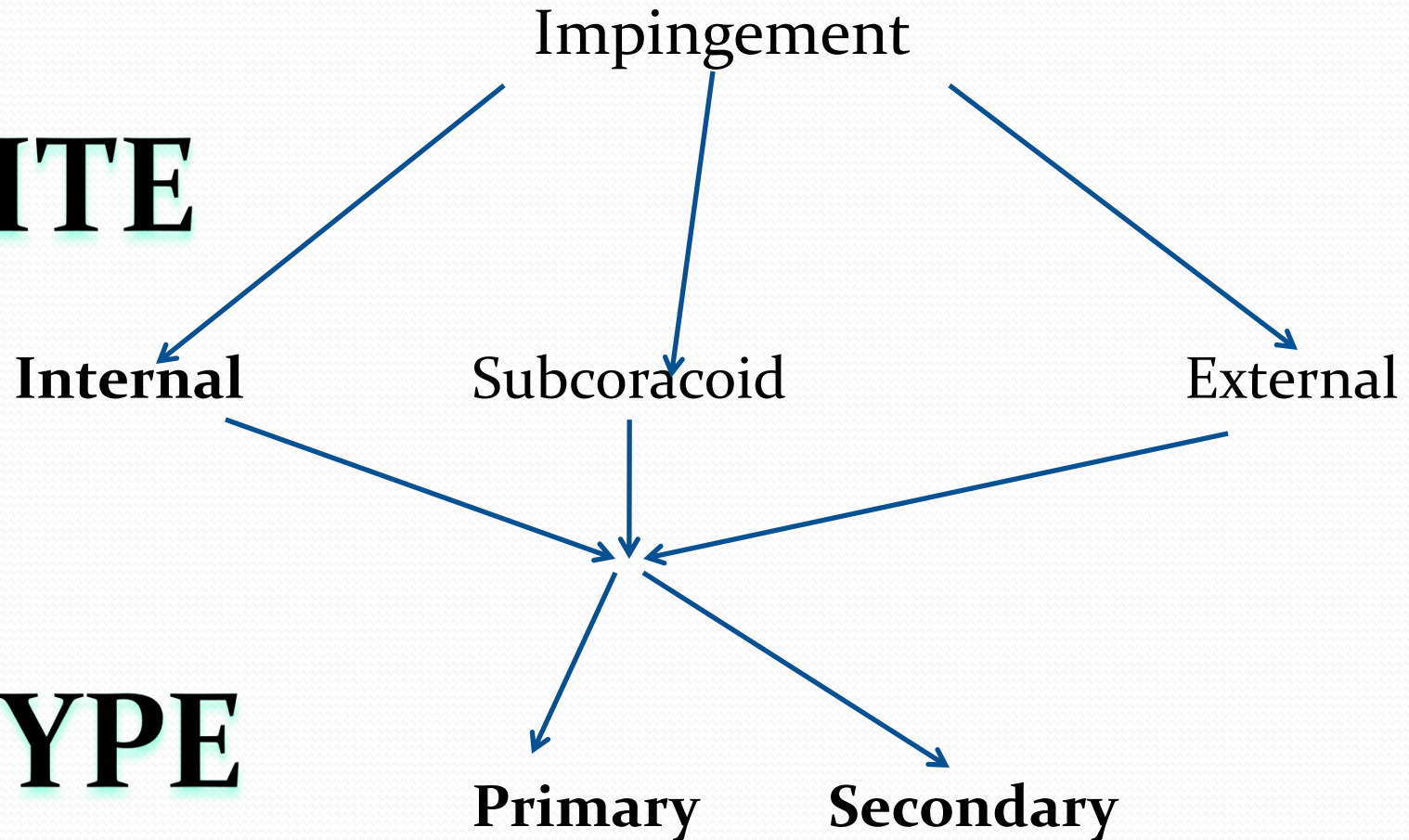
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**TYPE**

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# Internal Impingement (posterior impingement)

- Large cause of posterior shoulder pain
- Common in throwing athletes and repetitive overhead activities
- Often mis-diagnosed as a posterior tendonitis

# Internal Impingement (posterior impingement)

- Impingement of posterior supraspinatus and anterior infraspinatus and the superior posterior glenoid labrum.
- Associated with anterior instability (minor instability allows the humeral head to migrate forward and give space for the supraspinatus tendon to descend into)

# Internal Impingement (posterior impingement)

- Mechanism is shoulder extension, abduction and external rotation.
- Weakness or tears of subscapularis can lead to poor eccentric external rotation control and occur before symptom onset
  - Anterior instability which will create a gap
  - Supraspinatus becomes pinched in the gap



# Testing the Shoulder

- SUBJECTIVE

- Pain usually lateral upper arm
- Usually repetitive loading in overhead activities
- Overuse in lower ranges
- Painful “catching sensation”
- Worse at night
  - inflammatory mediators
  - direct mechanical compression
  - Passive HH translation, nill muscle guarding
- Sport specific (throwing, racquet sports, butterfly)

# Testing the Shoulder

- OBSERVATION:
  - Postural
    - Anterior inferior glenoid
    - Kyphotic TS, forward head posture
    - Limited Thoracic Spine Extension/Lateral flexion
    - Shoulder girdle protraction
    - Lengthened upper trap, weak upper trap
    - Medial Border of scapula



# Assessment

- Active
  - Hand Position (thumb position)
  - Scapular Movements (poor eccentric medial rotation)
    - 90 GH flex, 60GH abd
- Passive
  - Usually less or no pain
  - If large anatomical abnormality (gross bursal swelling or acromion) may still impinge but unlikely for secondary impingement

# Testing the Shoulder

- PALPATION

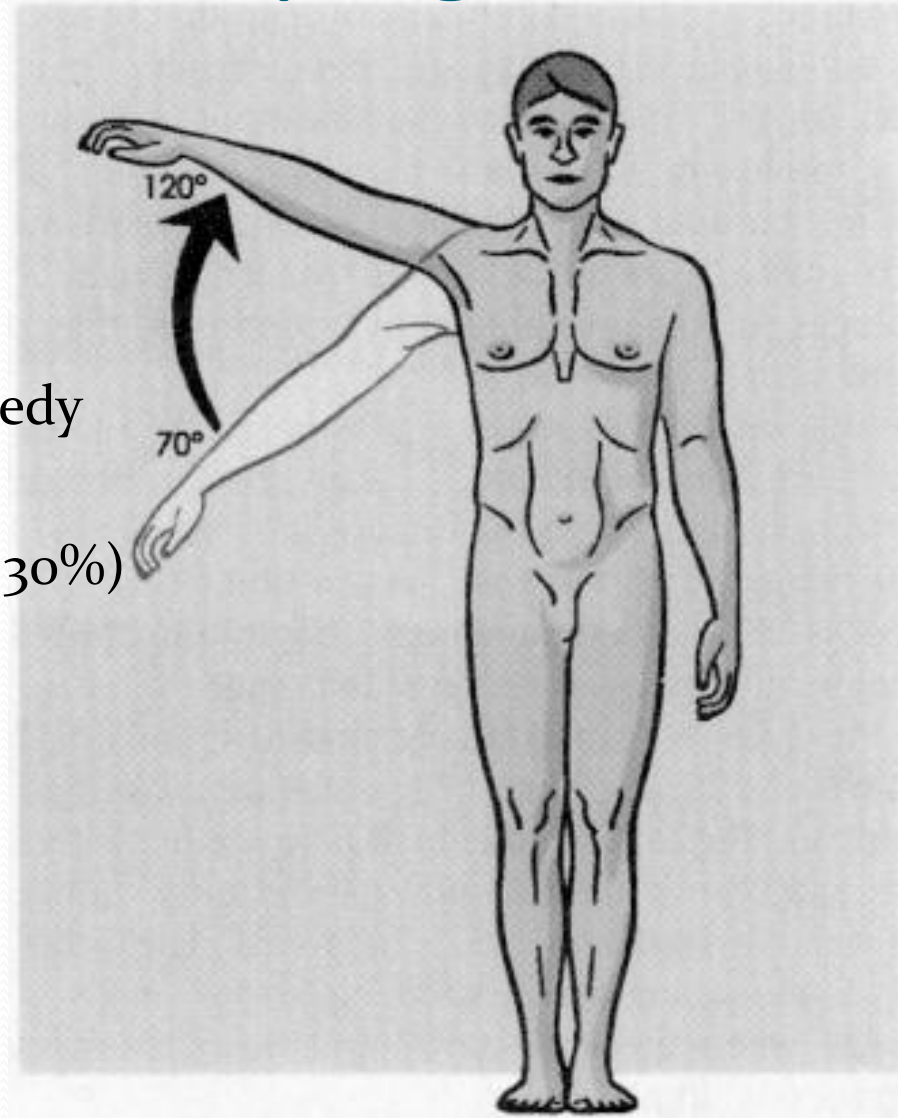
- Resting Position of the head of humerus
- Resting position of the scapula
- Areas of tenderness (supraspinatus, biceps, posterior GH jnt, corocoid)

- Hands on non-specific tests

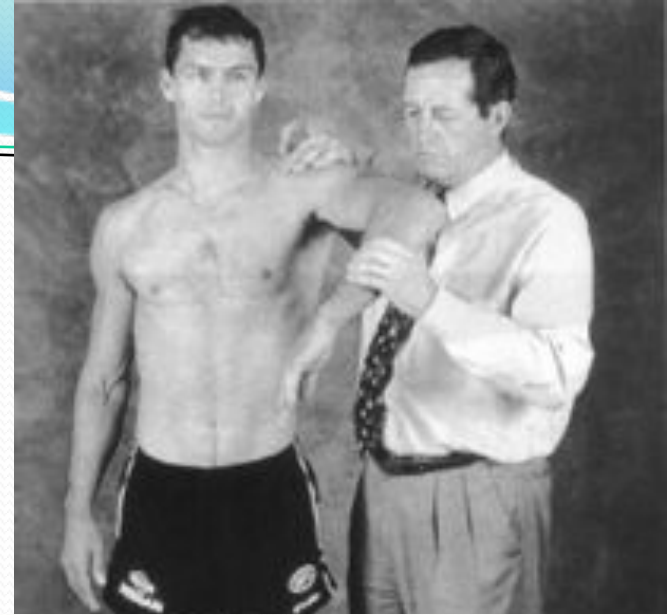
- External rotation strength
- **Scapula or humeral head repositioning to decrease pain**

# Testing the Shoulder (impingement specific)

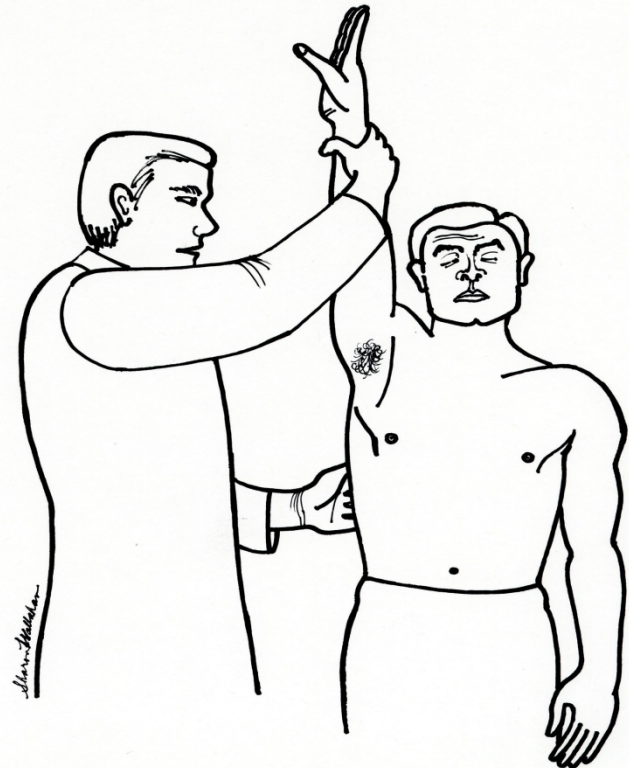
- Specific Tests/Signs
  - Arc of pain
    - 81% specific (>hawkins/kennedy and neer)
    - Very poor sensitivity (approx 30%)
  - Arc of pain into flexion for subcoracoid impingement



# Hawkins/Kennedy & Neer



- These tests both have **poor specificity** (approx 40%)
- Quite **descent sensitivity** (85% and 75%)
- If negative to both tests minimal chance of subacromial impingement being present
- **USE TO CLEAR SUBACROMIAL IMPINGEMENT**



# Coracoacromial Compression Test

- Used to test Coraco-acromial impingement/Subcoracoid impingement

- For this diagnosis also seek:

- Antero-medial pain
- Painful arc in flexion
- HBB limited by anterior Shoulder pain
- Long head of biceps usually Palpably tender



THERAPIST PULLS  
THIS DIRECTION

# Internal Rotation Resisted Strength Test

- Used to test for internal impingement
  - Patient standing in 90 abd, 80 ER.
  - Resist IR and ER
  - In normals IR should be stronger
  - If ER stronger suggests internal impingement
  - 88% sensitive and 96% specific

# Impinging or Unstable?

- Many tests may give a false positive to minor instability disorders (however quite debatable as these are closely associated with secondary impingement)
- There are a ways to determine whether the patient has a minor instability or impingement



# Impinger

- Palpable tenderness (SS, IS)
- Mid Range arc pain
- Positive impingement tests
- Kinetic control (corocoid moves)
- Scapula dysfunction through movement

# Instability

- Pain limits of range (active movements)
- Instab tests (appre, AP, PA, ER relocation test, sulcus)
- Kinetic Control (HOH moves)
- HOH dysfunction/translational defects with movement
- Good mid range strength in impingement zones



# Kinetic Control Internal Rotation Test

- Dissociation test: Impingement or Instability
- Determine compensatory movement into IR
  - Position patient supine, 90 shoulder abd, 90 elbow flexion
  - Palpate HOH and Corocoid
- Active internal rotation (should achieve 70 degrees)
- Should get to 60 degrees before any HOH translation or corocoid movement (representing anterior tilting and protraction)
- Corocoid compensation is related to decreased lateral and anterior outlet space and will be a common compensation of the impinger

# Posterior Relocation Test

- Patient sitting elbow at side and flexed to 90 degrees
- Active ER observing both movement amount and symptoms
- Positive test if posteriorly translating HOH increases ROM and/or decreases symptoms
- Is an instability test used for differential diagnosis
- NOTE: SECONDARY IMPINGEMENT AND INSTABILITY ARE OFTEN PRESENT AT THE SAME TIME

# Imaging

- Crucial to determine
  - Primary impingement sites
  - Cuff Tears (tie in with objective findings for  $M(x)$ )
  - Fractures
  - Prognosis (large gross defects, type of tears)

# Ultrasound

- Bursitis
- Chronic tendon or bursal thickening
- Tendonopathy or tear
- Anteversion/Retroversion of humerus
- Calcific tendonitis

# X-RAY Views: Routine Impingement

- **True AP view**
  - Superior subluxation
  - GHJ osteoarthritis
- **AP view with ER**
  - Calcification of Supra
  - Degenerative changes in the greater tuberosity
- **AP view with IR**

# X-RAY Views: Routine Impingement

- **Axial view**
  - GH alignment
  - Os Acromiale
  - Localise Calcification
  - ACJ alignment
- **Outlet view**
  - Acromial type
  - Exostosis
  - ACJ spurring
- **AP with 30degrees of caudal tilt**
  - Anterior acromial spur

# Surgery or Rehabilitation

- Does the patient have good ROM?
- Does the patient have large anatomical impediments upon imaging?
- Is the patient young?
- Does the patient require high level of function?
- Is external rotation strength responsive to treatment?

# Cortisone/Subacromial Decompression

- Cortisone injection
  - MUST BE GUIDED
  - 1/3<sup>rd</sup> will be missed otherwise
  - Excellent for bursal irritation
- Sub-acromial decompression
  - Good outcome if primary pain source is from anatomical variance (ie acromial spurring)
  - Cuff tears, instability, secondary impingement must be fixed as well
  - Decompressing instability will create more space for the humeral head to move in



# Management of the impingements

- Education
  - Should be covered in Statement of advice
    - Expected timeframes and outcomes
    - Simple explanation of pathology
    - Justification of the exercises and how they will work
    - Pain free HEP
    - Role of imaging if required

# Management of the impingements

- Motor Retraining
  - Feedback given through
    - Hands on
    - Mirror
    - Theraband
    - Tape
    - Biofeedback

# Management of the impingements

- Scapular retraining
  - Many impingements will have a degree of movement dysfunctions in the scapula
  - Positional re-education in lower ranges
  - Start in shoulder adduction with supine/standing/prone (ie V,W,Y in prone)
  - Progress to close chain exercises (ie wall push up & prone serratus work)

# Management of the impingements

- Scapular retraining
  - Add in rotator cuff exercises as appropriate (utilise theraband for both cuff resistance and scapula setting)
  - Once pain free active range of movement and movement dysfunction has diminished commence strength/hypertrophy based exercises
  - Sports specific if required, vary speed, resistance and direction of general strengthening movements

# Management of the impingements

- Rotator Cuff Re-training
  - Pain free exercise (correct scap first if required)
  - Will require fine control of internal and external rotation (use KCIRT to test)
    - Low load to higher loads, avoid loading if instability is present and patient is using larger compensatory muscles with low loads
    - Side lying good position to start, work slowly through eccentric phase, physio can palpate for compensatory movements and muscles activation

# Management of the impingements

- Scapular retraining
  - Muscle Imbalance
    - External rotator are commonly dominated by internal rotators
    - IR: Lats-Pecs-Teres Maj-Sub Scap
    - ER: Teres Min- Infra Spin
  - Work in low ranges and increase to abduction, use pulleys

# Management of the impingements

- Manual Therapy
  - Myofascial release
    - Pec Minor (will ant tilt scap, decrease SA space)
    - Lev Scap (will down rot scap, overload cuff, decrease SA space)
    - Post Cuff (will push HOH ant further into impingement zones)
  - GHJ mobilisations (for capsular restrictions)
    - AP , pec minor at corocoid
  - Stretching
    - Lev Scap
    - Post Cuff
    - Pec Minor (???)
    - Pec Major (be wary of anterior capsule stretching!!!)
    - Lat Dorsi