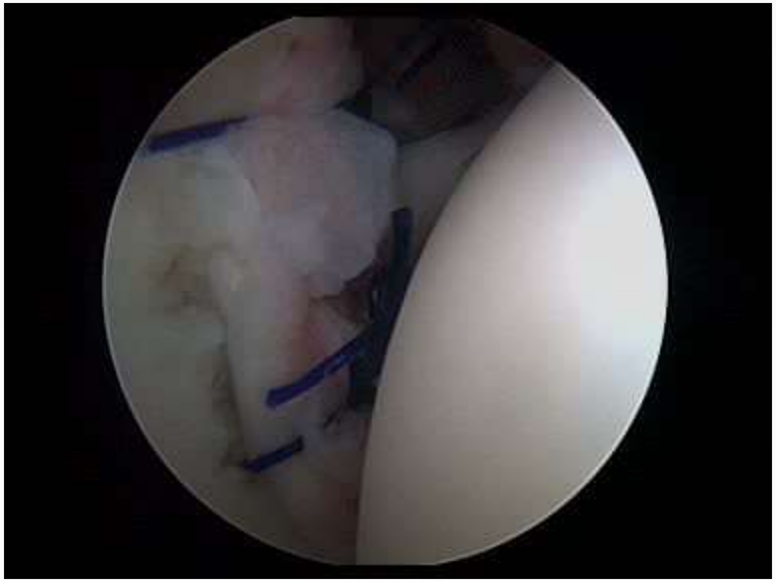
Biomechanical Basis of Common Shoulder Problems



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Definitions

- **Limited bony contact** between the humeral head and glenoid fossa allows extended range of motion at a cost of relative instability

- There must be a **balance** between mobility and stability to maintain proper function

Mechanical shoulder pathology

- overuse,
- extremes of motion, or
- excessive forces

Disruption of the delicate balance of the shoulder complex resulting in tears of the rotator cuff, capsule, and labrum

Mechanical shoulder pathology

- impingement
- instability
- overhead athlete (internal impingement)

IMPINGEMENT SYNDROME

Historical perspective

Jarjavay, 1867 : first description of «subacromial bursitis»

Duplay, 1872 : described the «periarthritis humeroscapularis»

Meyer, 1931 : he attributed that RC tears caused by the trimming of the supraspinatus tendon underneath the acromion

Codman, 1934 : described the "critical jone" of the supraspinatus tendon near the GT insertion

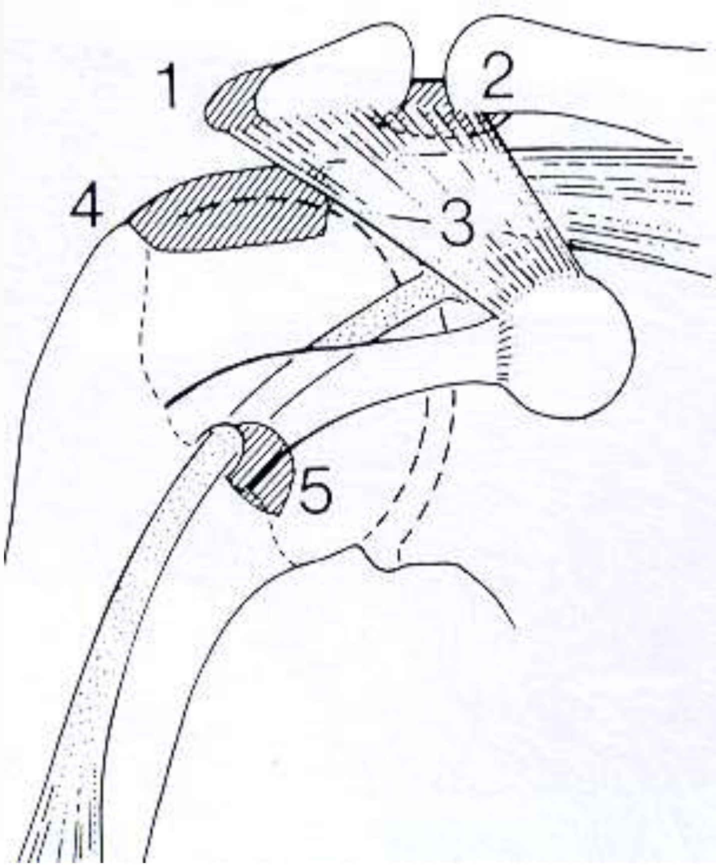
Amstrong, 1949 : he introduced the term "supraspinatus syndrome" and proposed «total acromionectomy»

McLaughin, 1951 : suggest the "lateral acromionectomy"

Etiology - pathogenesis

Narrowing of the "supraspinatous outlet" is the most frequent cause of impingement

Neer CS, 1972



Causes:

1. Anterior acromial spurs
2. Shape and slop of the acromion
3. AC joint spurs
4. Coracoacromial ligament

Etiology - pathogenesis

Three stages of impingement syndrome (Neer)

Stage I, characterized by subacromial edema and hemorrhage, was typical in symptomatic patients younger than 25 years of age.

Stage II included fibrosis and tendinitis and was more common in persons 25 to 40 years old.

Stage III characterized by partial or complete tendon tears typically in persons older than 40 years of age.

95% of all rotator cuff lesions to primary mechanical impingement.

Anatomy

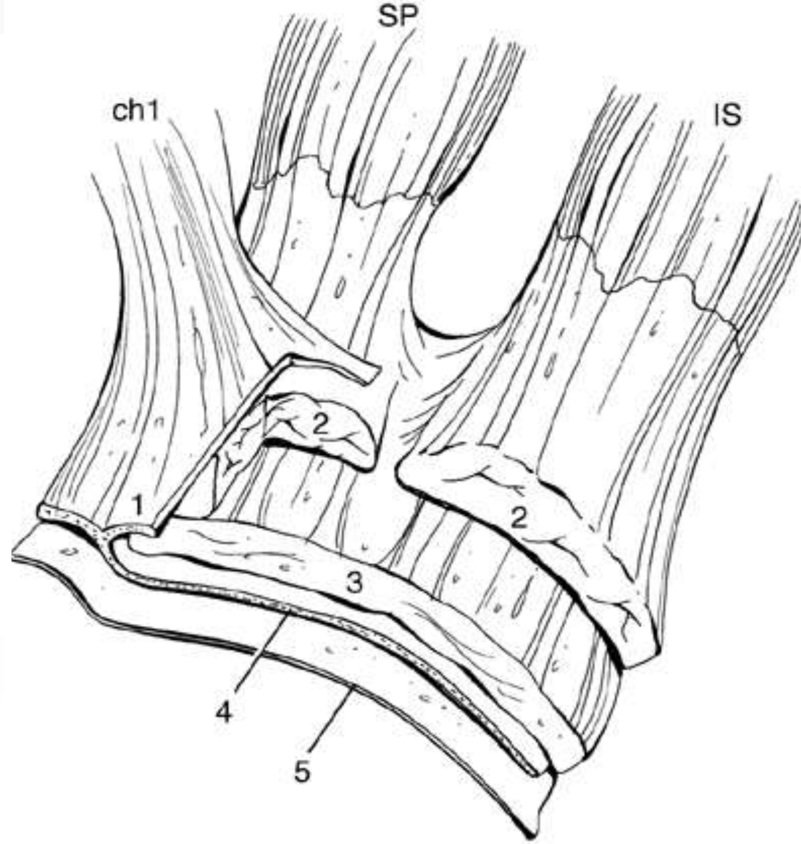
Layer 1: superficial layer CHL

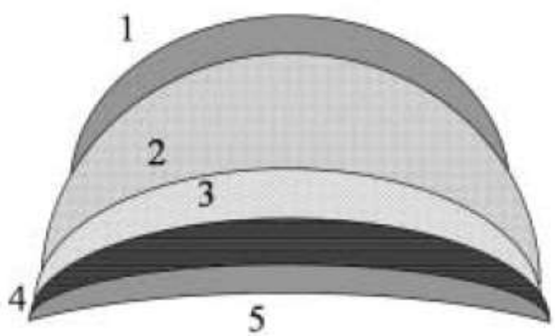
Layer 2: main portion of RC (// fibers)

Layer 3: oblique fibers merged

Layer 4: deep extension of the CHL

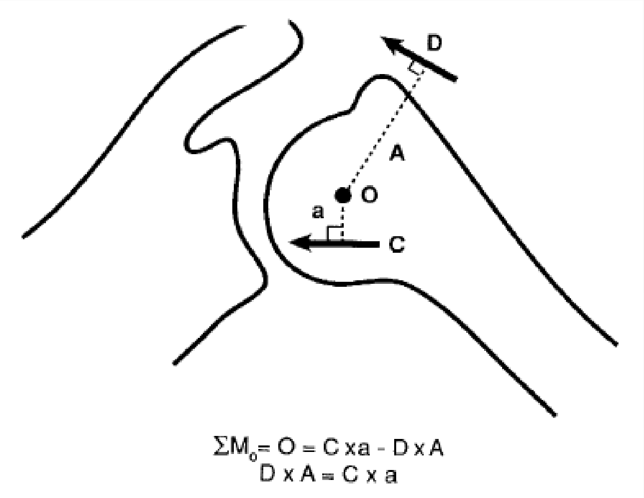
Layer 5: joint capsule



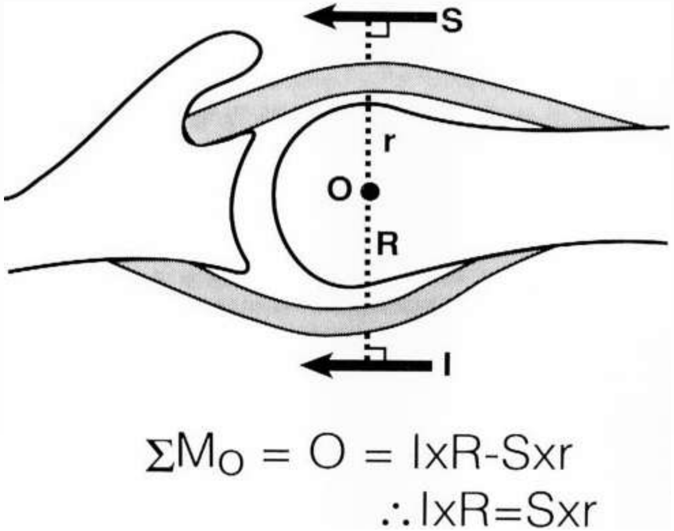


Biomechanics

Coronal plane force couple (Inman 1944): The inferior portion of the rotator cuff (below the center of rotation) creates a moment that must balance the deltoid moment.

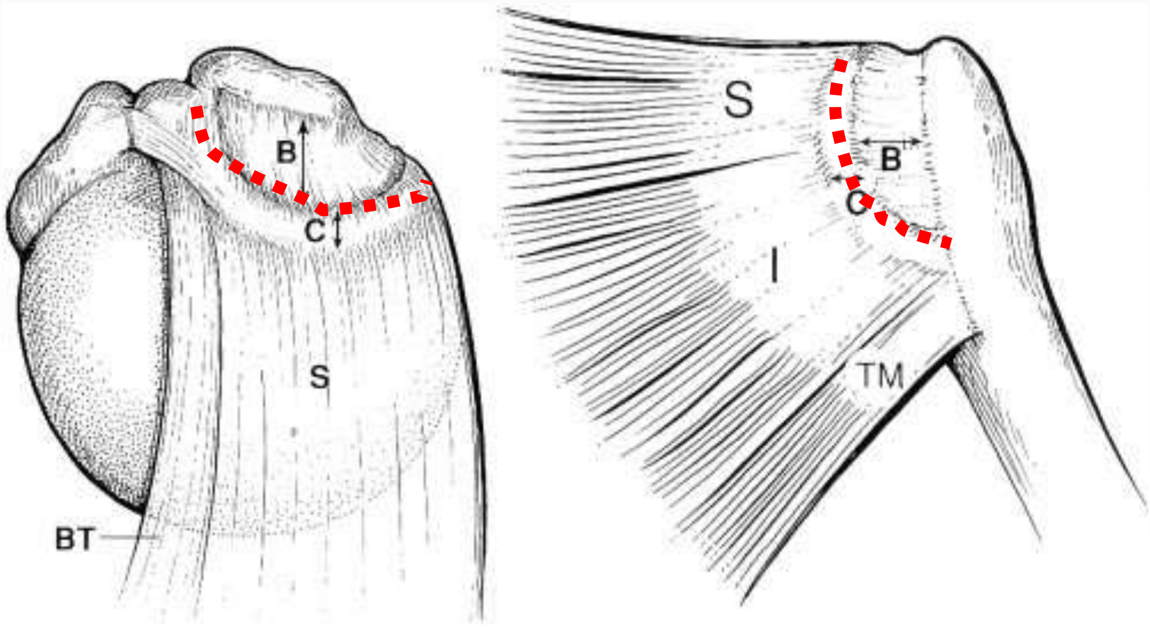


Transverse plane force couple, (Burkhart 1994) The subscapularis tendon anteriorly is balanced against the infraspinatus and teres minor tendons posteriorly.



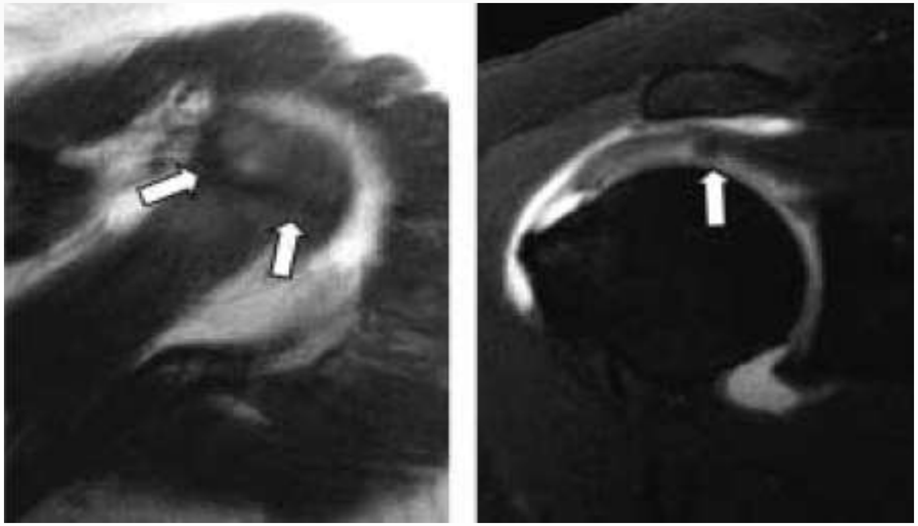
Biomechanics

"Rotator cable" extends from its anterior attachment just posterior to the biceps tendon to its posterior attachment near the inferior border of the infraspinatus tendon



Biomechanics

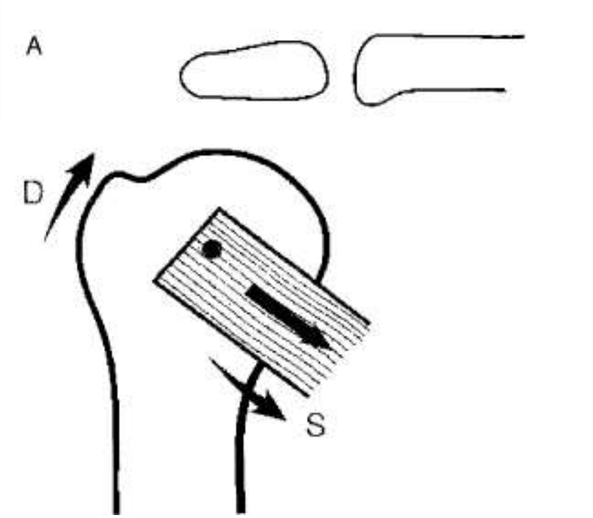
"Suspension bridge", with the free margin of the tear corresponding to the cable and the anterior and posterior attachments of the tear corresponding to the supports at each end of the cable's span



Tear size is less important than tear location in terms of force couple and kinematic preservation

Biomechanics

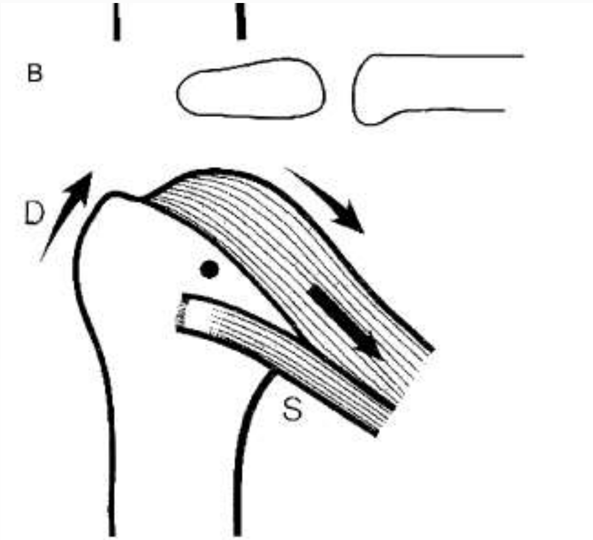
Detachment of 1/3 or 2/3 of the SS tendon (in the crescent area) has only a minor effect on the force transmission of the RC **(1% and 2%**) and that not until the entire supraspinatus tendon was detached was there a significant decrease **(11%)** in force transmission.



Halder AM, O'Driscoll SW, Heer G, et al: J Bone Joint Surg 84A: 780–785, 2002

Biomechanics

In small and medium-sized RC tears, the muscle forces are effectively transmitted along the **rotator cuff cable**, bypassing the tear in the crescent portion of the supraspinatus.

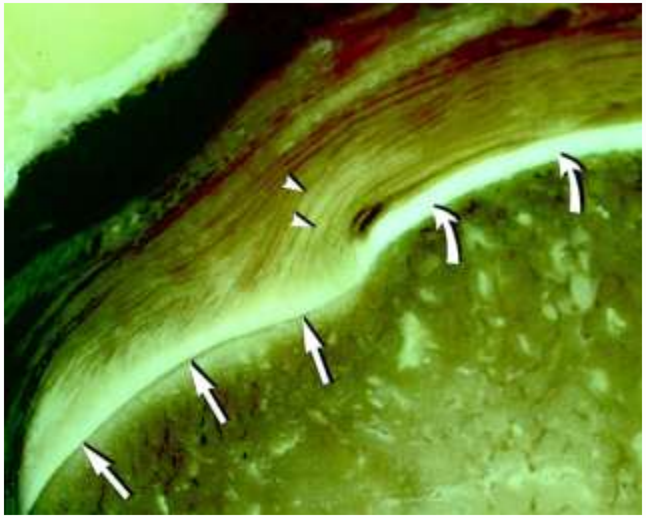


Halder AM, O'Driscoll SW, Heer G, et al: J Bone Joint Surg 84A: 780–785, 2002

Predominate mechanistic theories

Intrinsic impingement

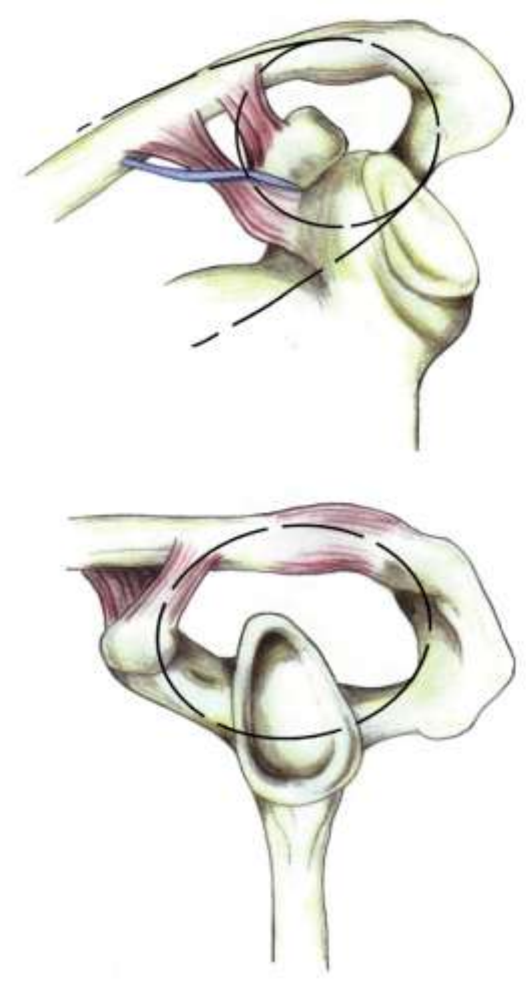
Degenerative process that occurs over time with **overuse**, **tension overload**, or **trauma** of the tendons. Aging, healing, and vascularity may predispose to tendonosis and ultimately tendon failure.



Osteophytes, acromial changes, muscle imbalances and weakness, and altered kinematics leading to impingement will subsequently follow

Predominate mechanistic theories

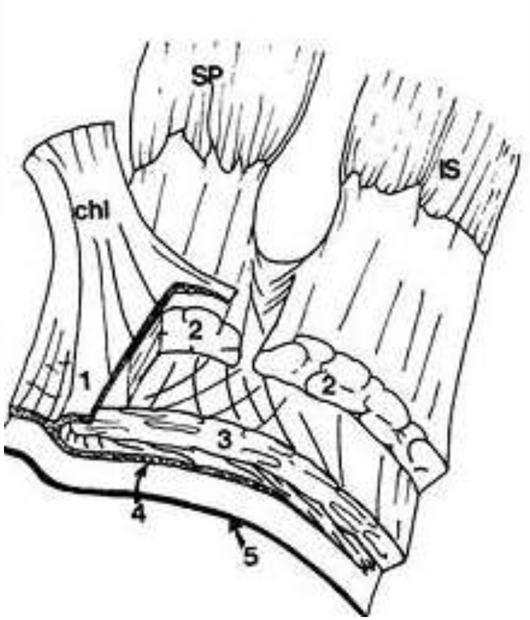
Extrinsic impingement



The Superior Shoulder Suspensory Complex (SSSC) is a bony–soft tissue ring made up by the glenoid, coracoid, and acromion processes, as well as the distal clavicle, the AC joint, and CC ligaments.

Intrasubstance RC tears

Horizontal partial tears of the rotator cuff (along the length of the tendon) have also been described and thought related to shear stresses.



Shear forces are probably directed to **layer four**, which is the site of development of intratendonous cuff tears. These tend to be degenerate tears of the cuff.

Etiology - pathogenesis

Review paper

Anatomical and biomechanical mechanisms of subacromial impingement syndrome

Lori A. Michener [a,*], Philip W. McClure [b], Andrew R. Karduna [c]

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CLINICAL BIOMECHANICS

…the question is, which comes first, **tendon degeneration or changes external to the tendon**?

By the time a patient with SAIS seeks health care, the typical examination findings reveal tendon pathology in some form and the presence of one or more extrinsic factors such as osteophytes or muscle weakness.

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Current Concepts Review

Débridement of Partial-Thickness Tears of the Rotator Cuff without Acromioplasty

LONG-TERM FOLLOW-UP AND REVIEW OF THE LITERATURE*

BY JEFFREY E. BUDOFF, M.D.†, ROBERT P. NIRSCHL, M.D.‡, AND ERIC J. GUIDI, M.D.‡, ARLINGTON, VIRGINIA

….we believe that 90 to 95 per cent of abnormalities of the rotator cuff are secondary to **tension overload, overuse, and traumatic injury**.

There is no objective evidence that primary extrinsic factors are involved in most disorders of the rotator cuff, as changes within the rotator cuff often occur without accompanying changes on the acromion

Histopathology

Journal of Orthopaedic Science
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J Orthop Sci (2003) 8:449–456

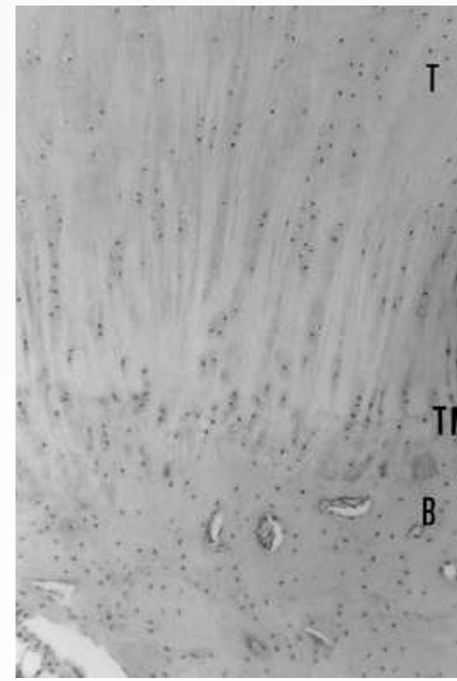
Relevance of pathology and basic research to the surgeon treating rotator cuff disease

Hans K. Uhthoff, Guy Trudel, and Ko Himori
Bone and Joint Research Laboratory, University of Ottawa, Ottawa, Ontario, Canada K1H 8M5

- **100 autopsy specimens** of SST with their bony attachment to tensile testing to failure.

- direct correlation between the **degree of degeneration** and the tensile strength: the higher the degree of degeneration, the lower the tensile strength needed to produce a tear.

- partial tears occur, more often on the **articular side** due to the higher tension to which the articular half of the supraspinatus tendon is exposed compared to the bursal half.



Collagen type

The **midsubstance** of SST contains mainly Type I collagen, small amounts of Type III collagen, decorin, and biglycan.

The **fibrocartilage** portion of the insertion it mainly contains Type II collagen and larger proteoglycans (aggrecan).

In RC tendinopathy, increased **collagen Type III**, a protein that plays a role in healing and repair. These compositional changes may be adaptive, pathologic, or both.

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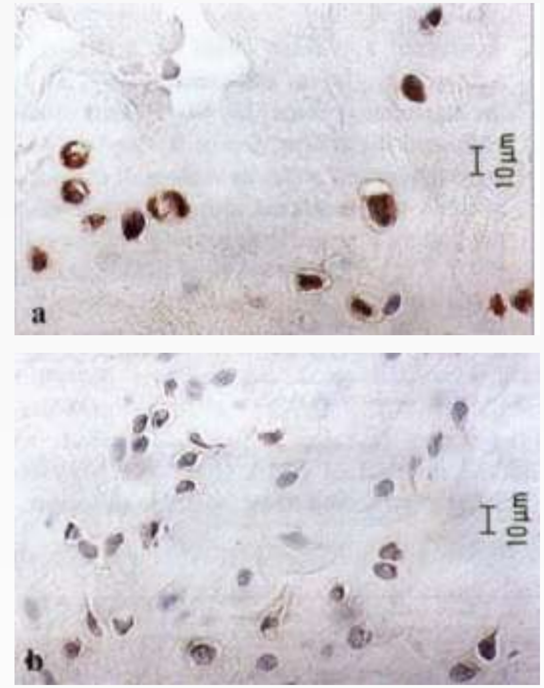
The presence of smooth muscle actin in fibroblasts in the torn human rotator cuff

J. Premdas, J.-B. Tang, J.P. Warner, M. Meaney Murray, M. Spector *

Department of Orthopaedic Surgery, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street, Boston, MA 02115, USA

Received 28 February 2000; accepted 13 June 2000



Increased levels of **smooth muscle actin** (SMA) in torn rotator cuffs.

SMA-containing cells in rotator cuff tears may react with the high levels of GAG and proteoglycan resulting in retraction of the ruptured rotator cuff and inhibition of potential healing.

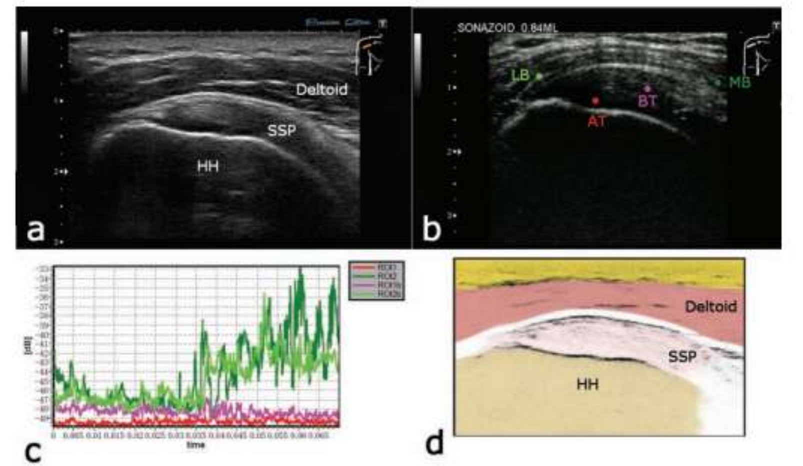
In Vivo Visualization of Vascular Patterns of Rotator Cuff Tears Using Contrast-Enhanced Ultrasound

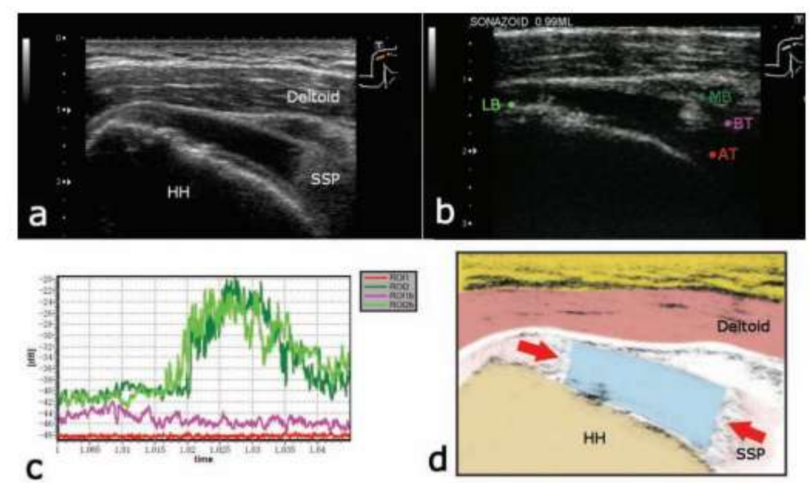
Tadanao Funakoshi,*† MD, PhD, Norimasa Iwasaki,† MD, PhD, Tamotsu Kamishima,‡ MD, PhD, Mutsumi Nishida,§ PhD, Yoichi Ito,‖ PhD, Makoto Kondo,¶ MD, and Akio Minami,† MD, PhD
Investigation performed at Hokkaido University, Sapporo, Japan

- hypovascular pattern in intratendinous tissue compared with the subacromial bursa

- the age-related decrease in intratendinous vascularity,

- and the hypovascular pattern in the tendon, regardless of rupture of the tendon





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Microcirculation Associated with Degenerative Rotator Cuff Lesions

In Vivo Assessment with Orthogonal Polarization Spectral Imaging During Arthroscopy of the Shoulder

By Peter Biberthaler, MD, E. Wiedemann, MD, A. Nerlich, MD, M. Kettler, MD, T. Mussack, MD, S. Deckelmann, and W. Mutschler, MD

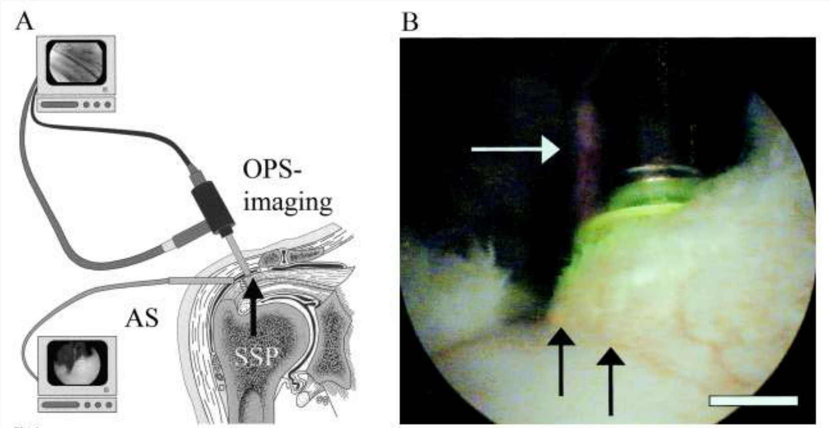
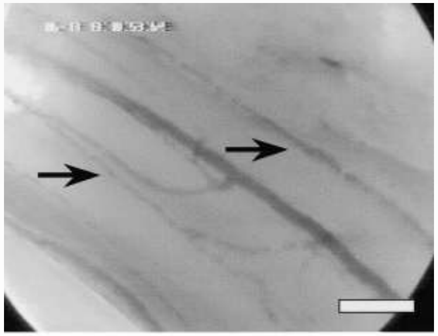
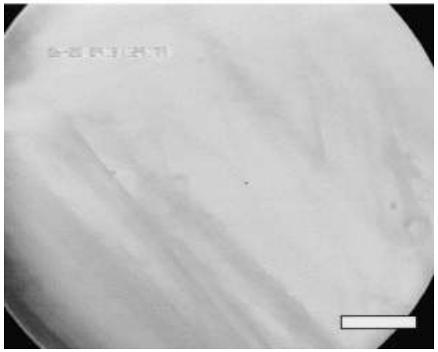
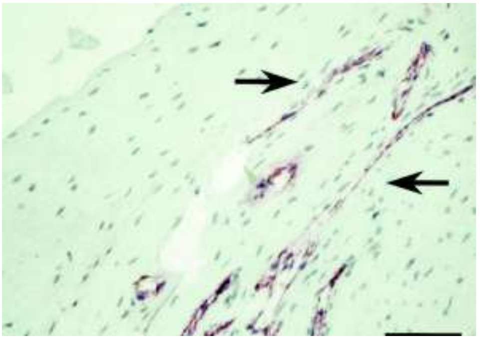


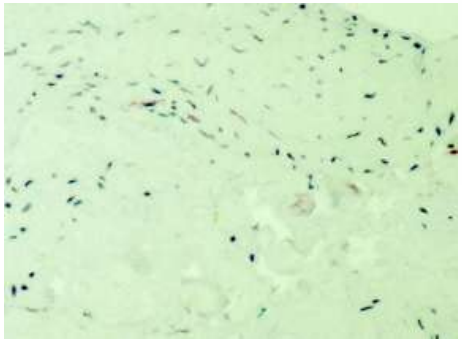
Fig. 1

The functional capillary density in areas close to rotator cuff lesions was found to be significantly reduced compared with that in control areas in the tendon insertion zone









Clinical examination

Painful arc sign

Drop arm sign

Neer's test

Hawkin's test

Speed's test

Cross adduction test

Infraspinatus strength

Supraspinatus strength

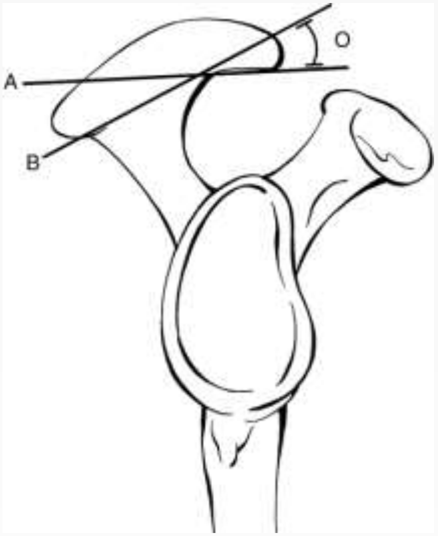
Radiological evaluation

anteroposterior

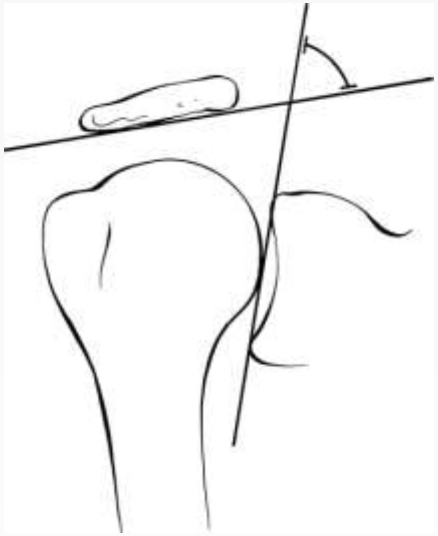
axillary

Anteroposterior with 30º caudal tilt

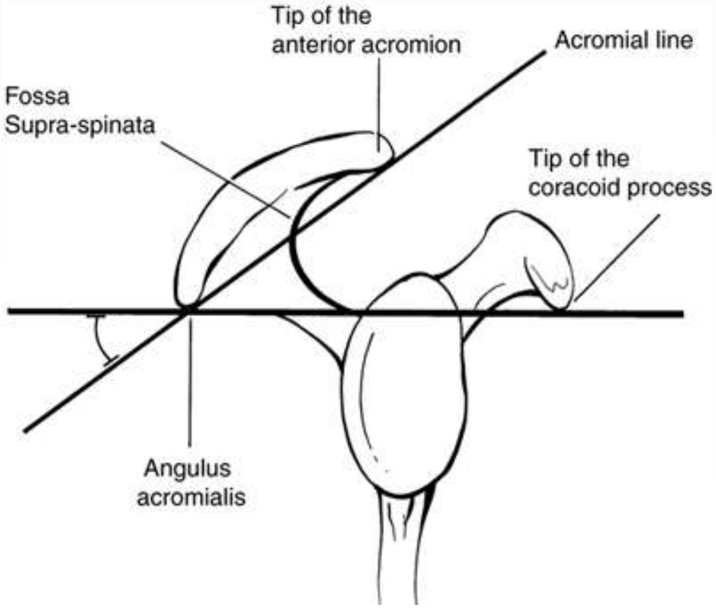
Radiological evaluation



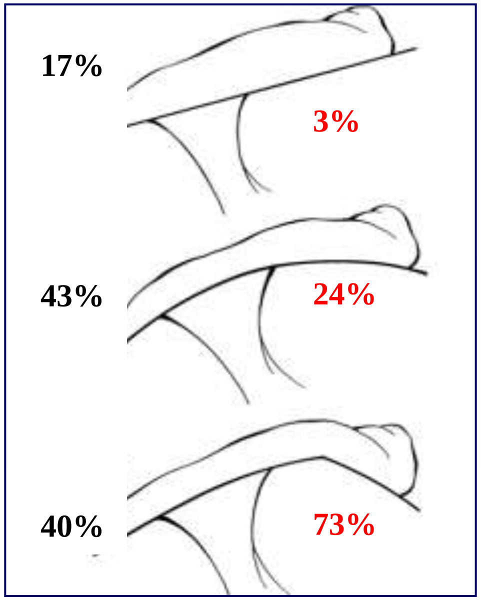
Acromial angle



Lateral acromial angle



Acromial slope



Acromial type

Rotator Cuff Tears
CLASSIFICATIONS

- **Partial thickness**
  *Articular side
  *Bursal side
  *Intratendinous
- **Full Thickness**

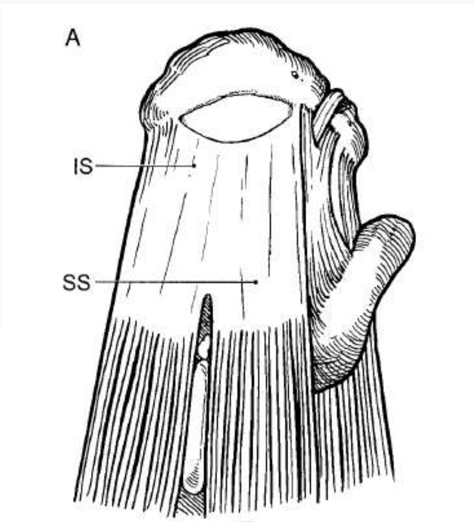
- Depth
- Size/Shape
- Number of tendons
- Topography
- Retraction

ASES

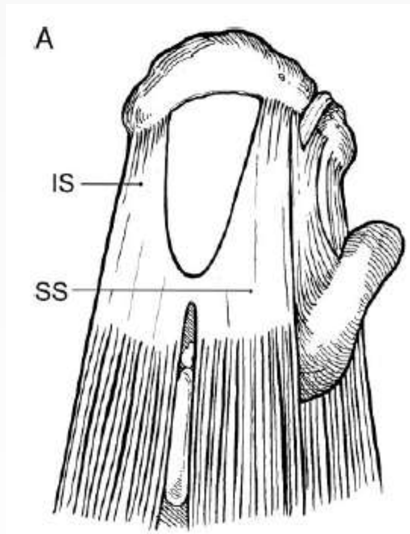
Small <1 cm
Medium 1-3 cm
Large 3-5 cm
Massive > 5 cm

Classification of large tears based on shape and retraction

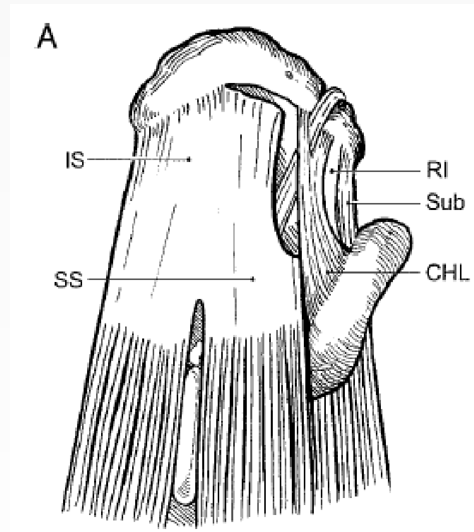
4 basic patterns



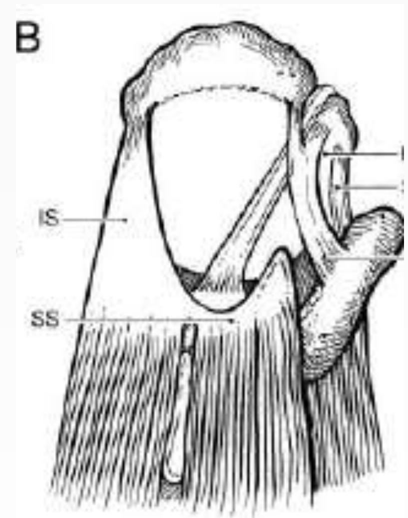
Crescent-shaped



U-shaped



L-shaped



Massive, contracted, immobile tears

Burkhart SS: Arthroscopic treatment of massive rotator cuff tears. Clin Orthop 390: 107–118, 2001

Conclusions

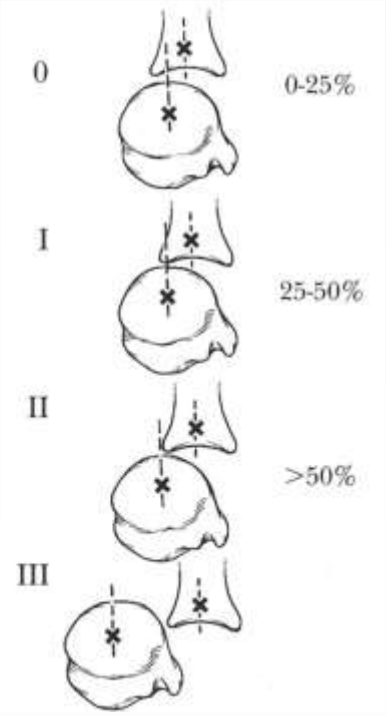
SIS and RC tearing appear to result from a **variety of factors**.

- anatomical factors of inflammation of the tendons and bursa,
- degeneration of the tendons,
- weak or dysfunctional rotator cuff musculature,
- weak or dysfunctional scapular musculature,
- posterior glenohumeral capsule tightness,
- postural dysfunctions of the spinal column and scapula and
- bony or soft tissue abnormalities of the borders of the subacromial outlet

GLENOHUMERAL INSTABILITY

Definition

- **Glenohumeral laxity** is the ability of the humeral head to be passively translated on the glenoid fossa
- **Glenohumeral instability** is "a clinical condition in which unwanted translation of the head on the glenoid compromises the comfort and function of the shoulder."



Matsen FA III, Harryman DT, II Sidles JA. Mechanics of glenohumeral instability. *Clin Sports Med.* 1991;10:783-788

Classification (Matsen)

TUBS or "Torn Loose"

Traumatic etiology
Unidirectional instability
Bankart lesion
Surgery is required

AMBRI or "Born Loose"

Atraumatic: minor trauma
Multidirectional instability may be present
Bilateral: asymptomatic shoulder is also loose
Rehabilitation is the treatment of choice
Inferior capsular shift: surgery may needed

Classification

Degree

Dislocation
Subluxation
Subtle

Frequency

Acute (primary)
Chronic
Recurrent
Fixed

Etiology

Traumatic (macrotrauma)
- Atraumatic
  - Voluntary (muscular)
  - Involuntary (positional)
- Acquired (microtrauma)
- Congenital
- Neuromuscular
- (Erb's palsy, cerebral palsy, seizures)

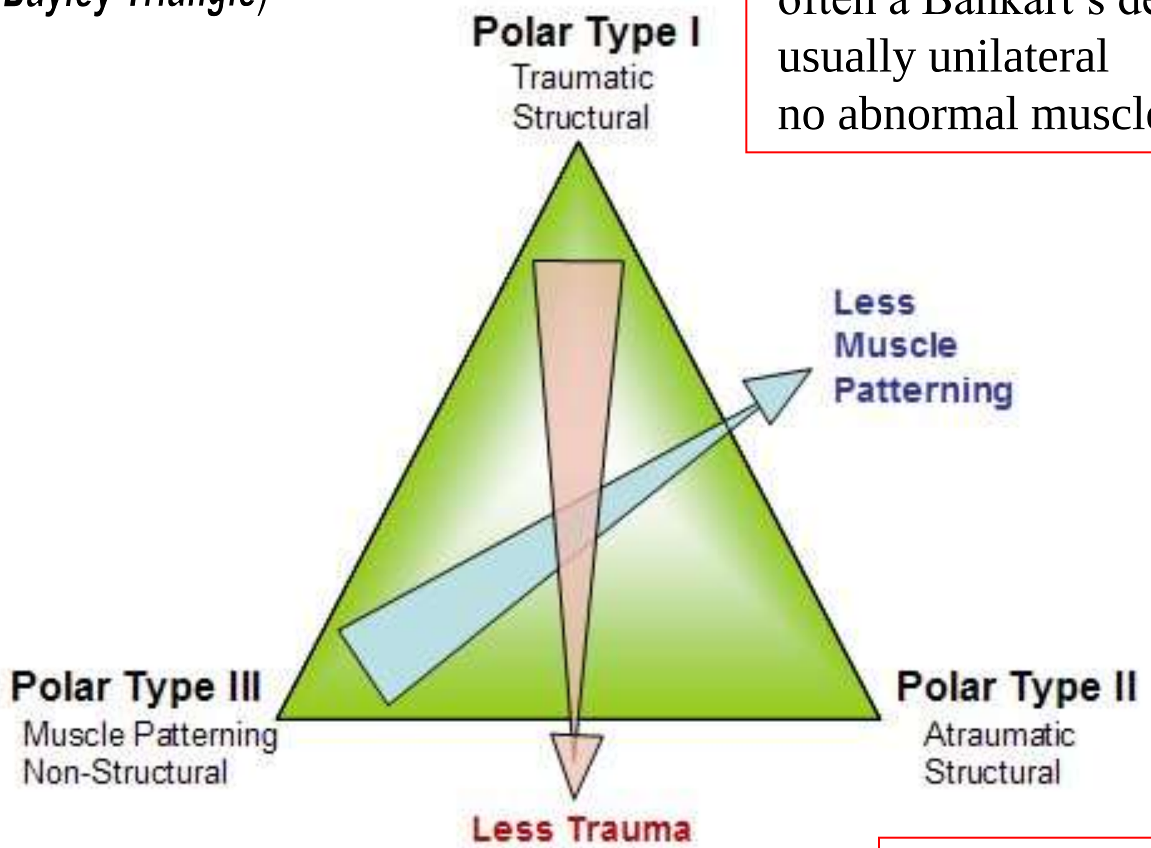
Direction

1.Unidirectional
-Anterior
-Posterior
-Inferior
2. Bidirectional
-Anteroinferior
-Posteroinferior
3. Multidirectional

Classification

Stanmore (Bayley Triangle)

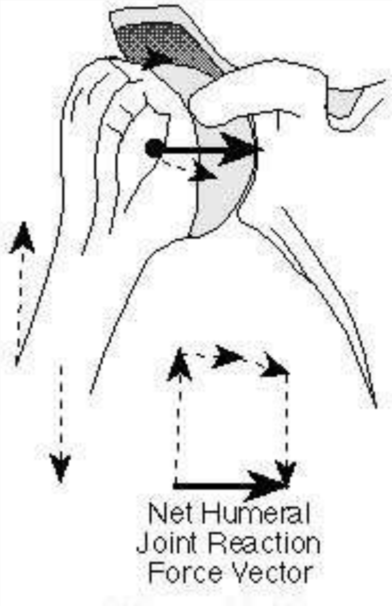
significant trauma
often a Bankart's defect
usually unilateral
no abnormal muscle patterning



no trauma (habitual)
no structural damage to joint surfaces
capsular dysfunction
abnormal muscle patterning
often bilateral

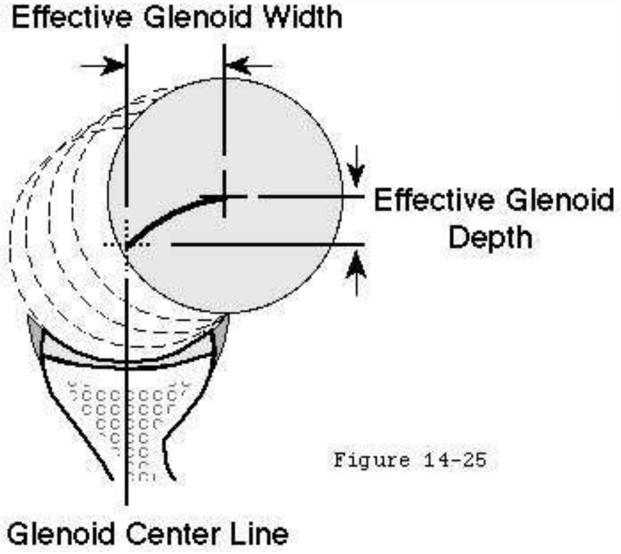
no trauma
structural damage to joint surfaces
capsular dysfunction
no abnormal muscle patterning
not uncommonly bilateral

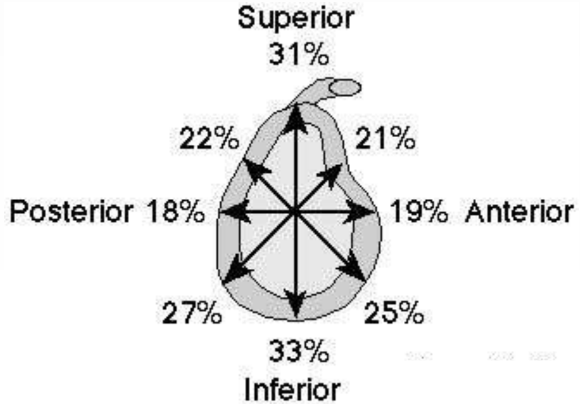
1st law of glenohumeral stability



The GH joint will not dislocate as long as the **net humeral joint reaction force** is directed within the effective glenoid arc

- This force is the resultant of all muscular, ligamentous, inertial, gravitational, and other external forces applied to the head of the humeral head (other than the force applied by the glenoid)

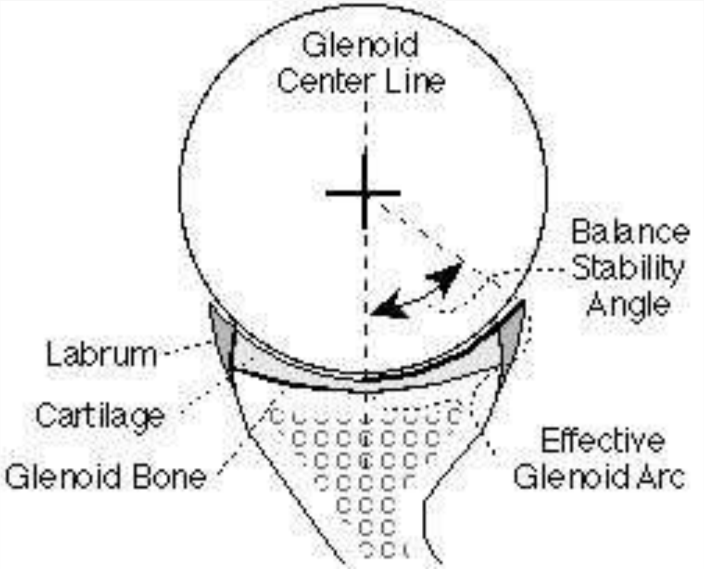




2nd law of glenohumeral stability

The humeral head will remained centered in the glenoid fossa if the glenoid and humeral joint surfaces are congruent and if the net humeral joint reaction force is directed within the effective glenoid arc.

- The **"effective glenoid arc"** is the arc of the glenoid available to support the humeral head under the specified loading conditions



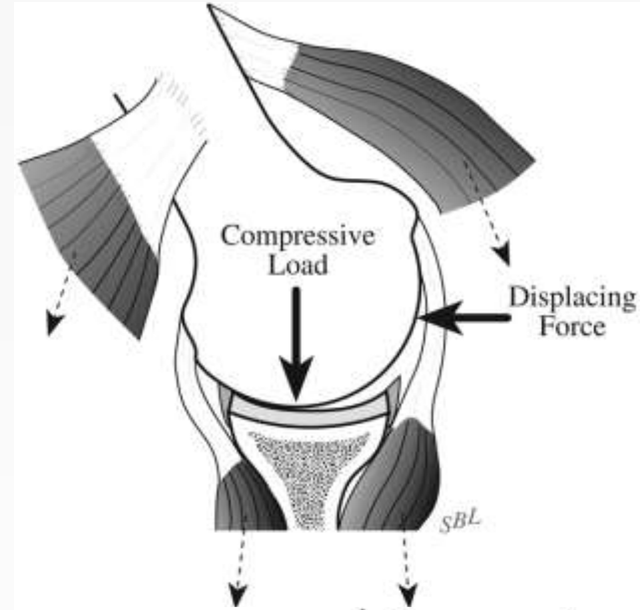
Balance stability ratio & angle

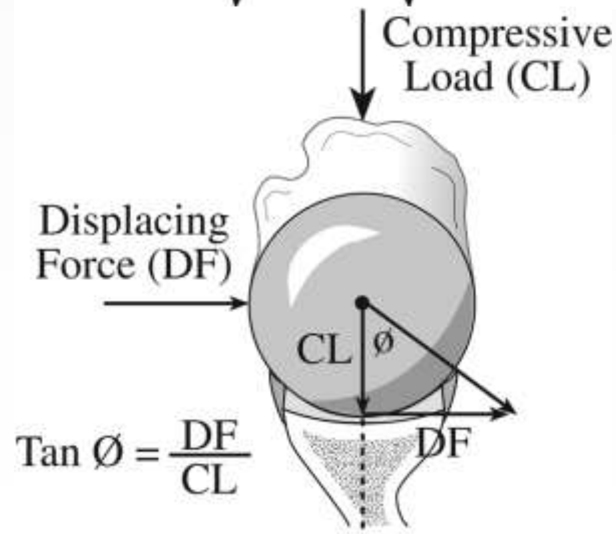
The **stability ratio** → is the force necessary to displace the head from the glenoid divided by the load compressing the head into the concavity. Clinically, the stability ratio can be sensed using the **"load and shift"** test

- **Resection of the labrum has been shown to reduce the stability ratio by 20 per cent. (Lippitt, Vanderhooft, Harris et al, 1993)**

The **balance stability angle** → is the maximal angle between the glenoid center line and the net humeral joint reaction force before the humeral head dislocates from the glenoid

- **A 3 mm anterior glenoid defect has been shown to reduce the balance stability angle over 25 per cent. (Matsen, Lippitt, Sidles et al, 1994)**





Factors maintaining shoulder stability

Static Factors

Articular version-conformity
Glenoid labrum
Capsule and ligaments
Adhesion–cohesion & suction cup
Negative intraarticular pressure
Rotator cuff (static contribution)

Dynamic Factors

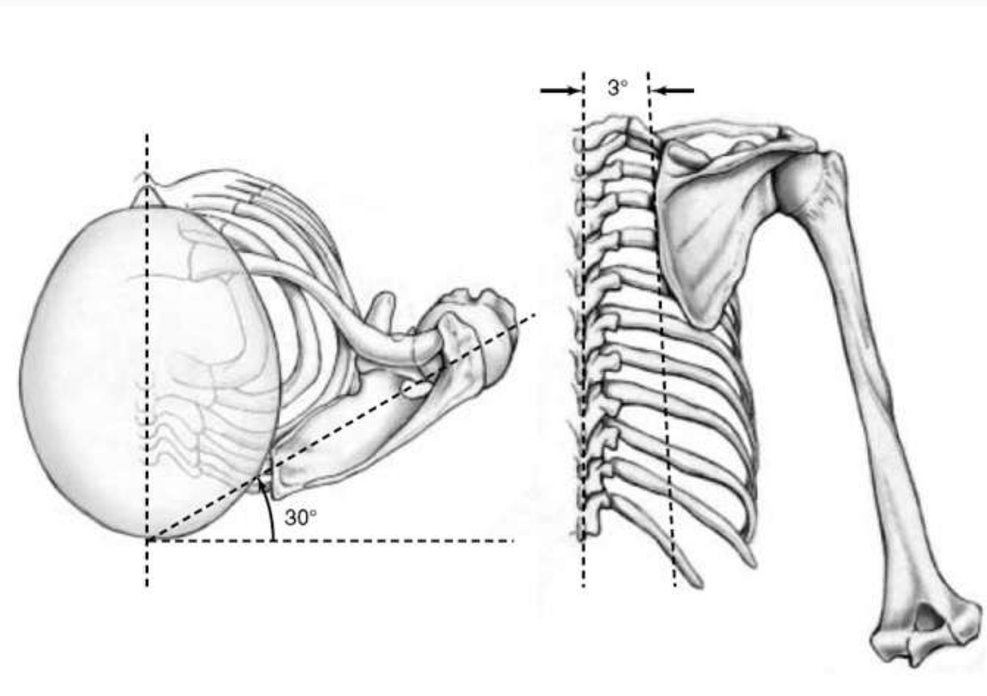
Rotator cuff
Coracoacromial arc
Biceps brachii
Proprioception

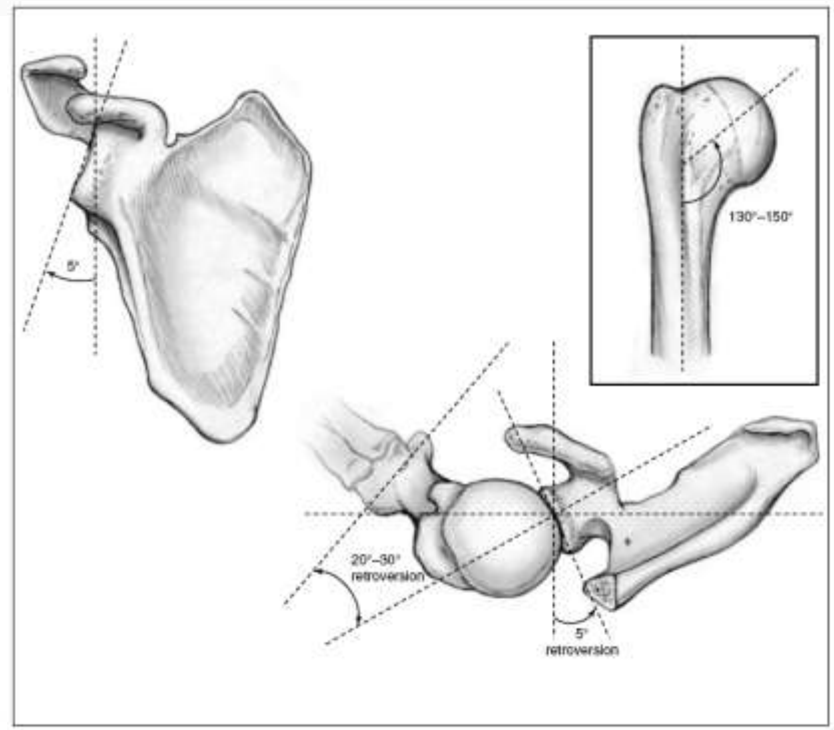
no single factor is responsible for glenohumeral joint stability and no single lesion is responsible for clinical instability

Articular version - conformity

Scapula: a. faces 30^0 anteriorly on the chest wall
b. tilts 3 degrees upward relative to the transverse plane
c. 20 degrees forward relative to the sagittal plane

Glenoid has a superior tilt of 5 degrees and 7^0 retroversion in 75% of patients

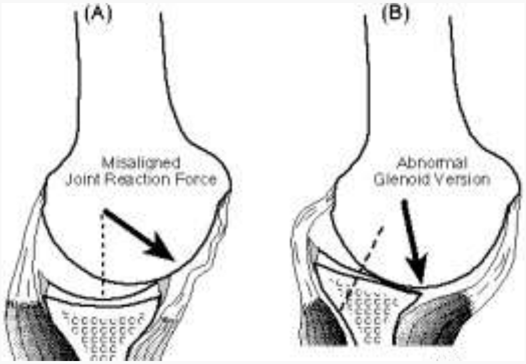




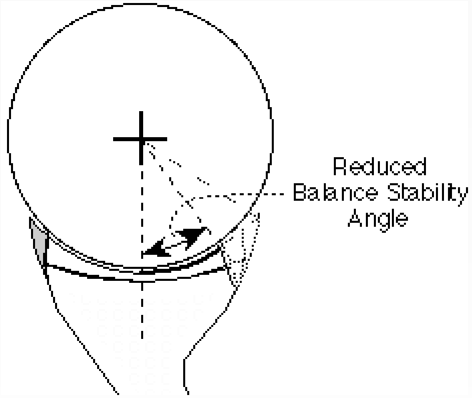
Scapular inclination may have a contributory role in controlling **inferior** stability.

Articular version- conformity

Dias et al (1993) & Dowdy and O'Driscoll (1994) found no difference or only minor variances in apparent glenoid version between normal subjects and recurrent anterior dislocators.

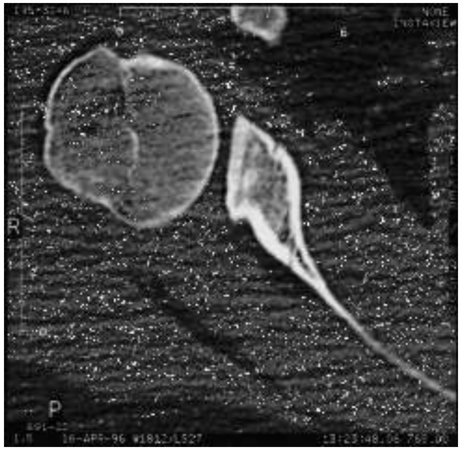


Hirschfelder and Kirsten (1991) found increased glenoid retroversion in both the symptomatic and unsymptomatic shoulders of individuals with posterior instability



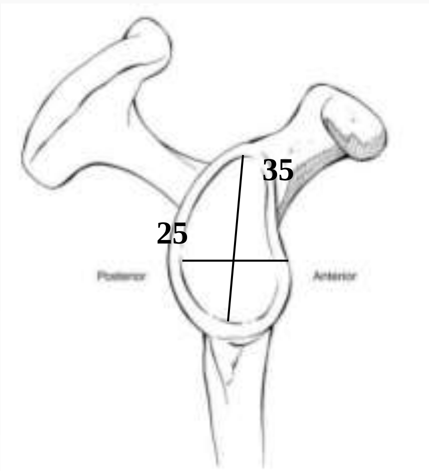
Grasshoff et al (1991) found increased anteversion in shoulders with recurrent anterior instability.

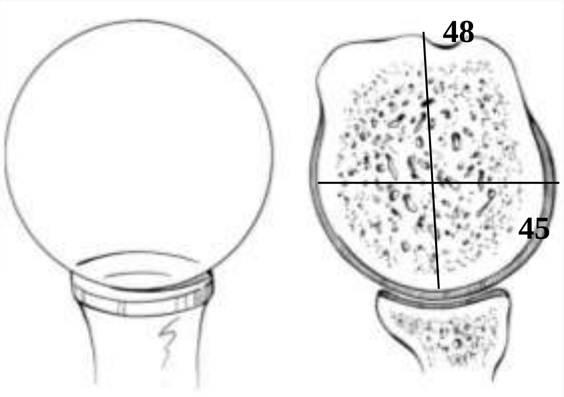
When it is important to know the orientation of the cartilaginous joint surface in relation to the scapular body a double contrast CT scan is necessary



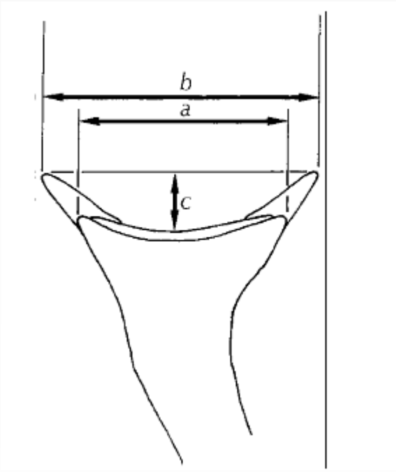
Articular version - conformity

the humeral head has a surface area that is three times that of the glenoid





golfball sitting on a tee

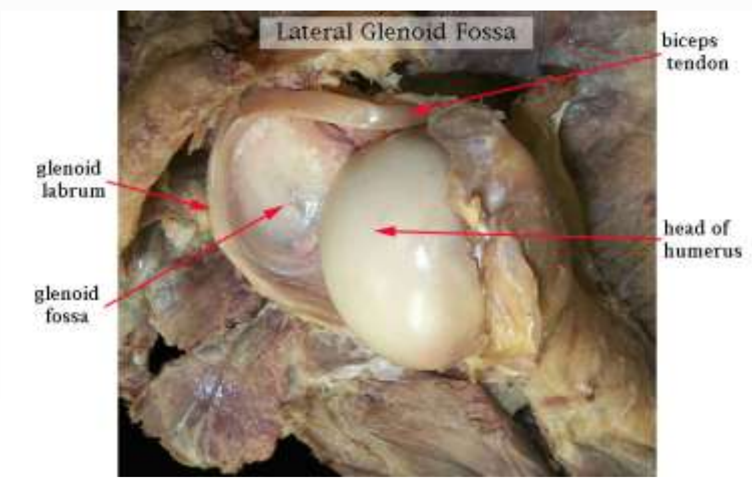


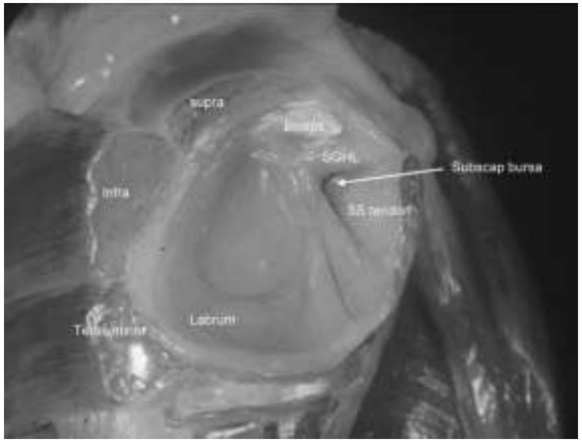
In fact, the articular surfaces of the humeral head and glenoid are almost perfectly matched with a congruence within 3 mm, with deviations from sphericity of less than 1%

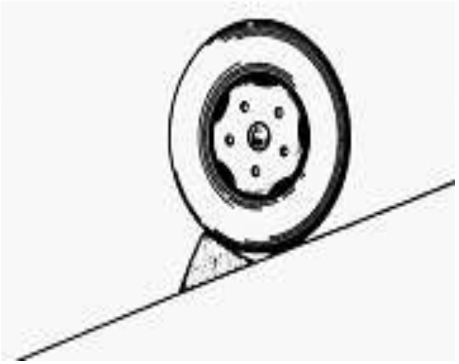
Soslowsky L, Flatow E, Bigliani L, et al. Articular geometry of the glenohumeral joint. Clin Orthop 1992;285:181–190.

Glenoid labrum

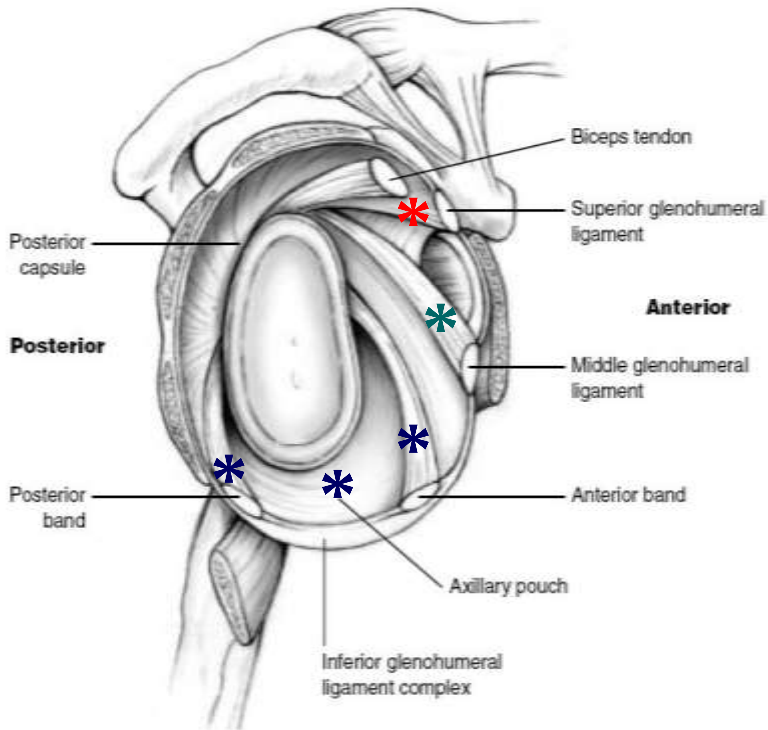
1. Anchor point for capsuloligamentous structures
2. It doubles the anteroposterior depth of the glenoid from 2.5 to 5 mm and deepens the concavity to 9 mm in the superior-inferior plane.
3. Enhances stability of the joint by increasing the surface area of contact for the humeral head.
4. The labrum is analogous to a chock-block preventing an automobile’s wheel from rolling downhill

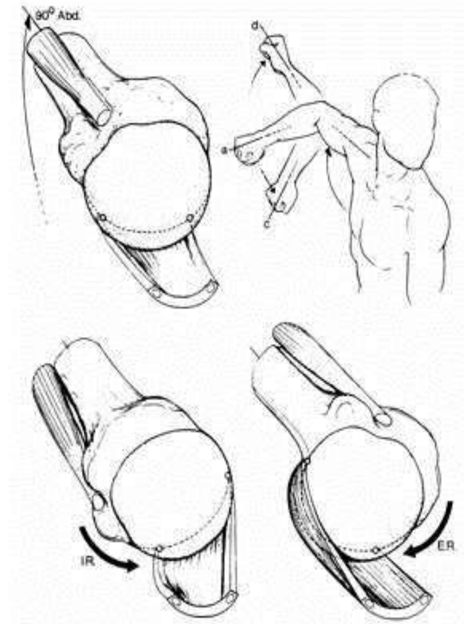






Capsule/Glenohumeral Ligaments





IGHL complex acts like a hammock in preventing increased translation of the humeral head on the glenoid.

- abduction moves beneath the humeral head and becomes taut

- internal rotation moves posteriorly and limits posterior translation

- external rotation moves anteriorly and limits anterior translation

Adhesion-Cohesion & the Suction Cup

Neither the adhesion-cohesion nor the suction-cup mechanism consumes energy, and both provide so called low-cost centering when the arm is at rest.

These mechanisms also have the convenient property of working in any position of the shoulder.

The suction-cup mechanism is enhanced by the slightly negative intra-articular pressure within the joint.

Muscles

Concavity compression is the primary mechanism by which the head of the humerus is centered and stabilized in the glenoid fossa to resist the upward pull of the deltoid. The cuff muscles provide stability by functioning as "compressors" than as depressors

- subscapularis muscle is the primary anterior compressor (lumbar push-off test)
- supraspinatus muscle is the primary superior compressor (supraspinatus test)
- infraspinatus is the primary posterior compressor, assisted to a degree by the teres minor (infraspinatus test)

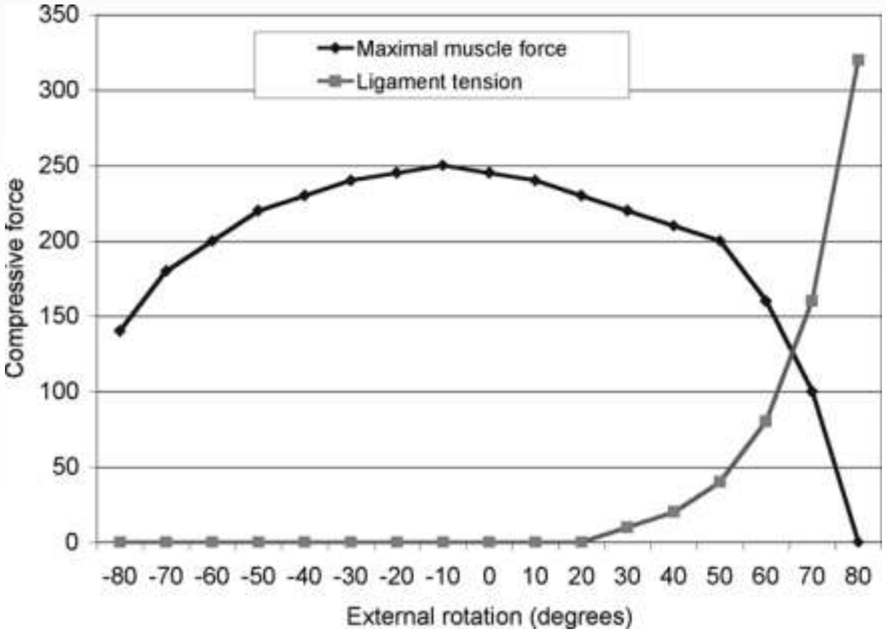
Muscles

The RC muscles they can function as head compressors in almost any position of the glenohumeral joint.

Other muscles, such as the deltoid, long head of the biceps, pectoralis, latissimus, teres major, and pectoralis major, can contribute to humeroglenoid compression in certain glenohumeral positions.

The interplay between muscular and capsular tension

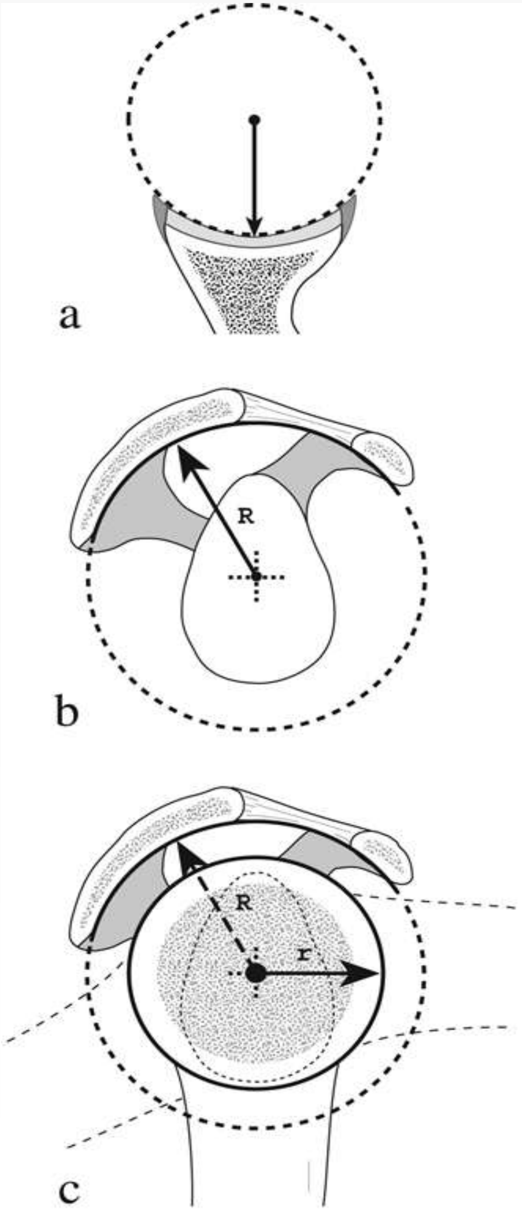
As the humerus is passively externally rotated, the force that the subscapularis can generate drops off while the force generated by the anterior capsular ligaments increases in a complementary manner.



The Coracoacromial Arch

The centers of rotation for the humeral head, the proximal humeral convexity, the glenoid fossa, and the coracoacromial arch are all superimposed in the normal stable shoulder

The critically important stabilizing effect of the the coracoacromial arch is demonstrated by the devastating anterosuperior instability that results when an acromioplasty is performed in the presence of rotator cuff deficiency



Biceps tendon

The biceps tends to stabilize the joint anteriorly with the arm in internal rotation, and it acted as a posterior stabilizer with the arm in external rotation.

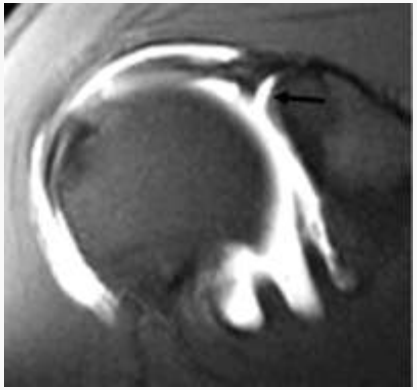
Pathoanatomy, diagnostic imaging and related lesions

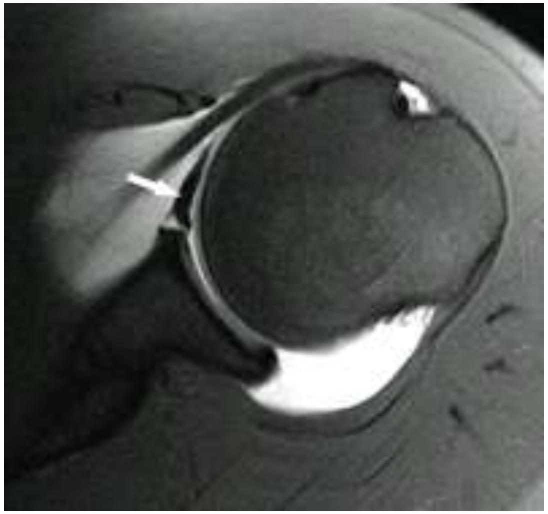
Normal labral variations (13.5-25%)

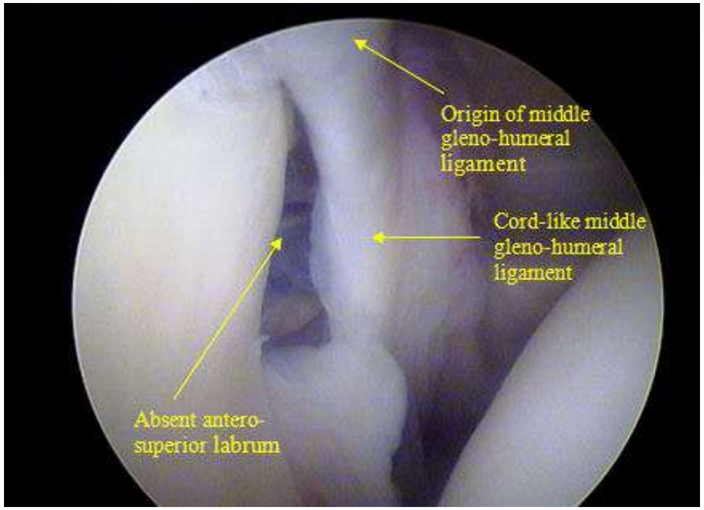
a. A cord-like middle glenohumeral ligament (MGHL)

b. Sublabral foramen in the anterosuperior quadrant of the shoulder.

c. The **Buford complex** (cord-like MGHL in conjunction with an absent anterosuperior labrum complex







Pathologic lesions in shoulder instability

a. Bankart, bony-Bankart

b. PERTHES

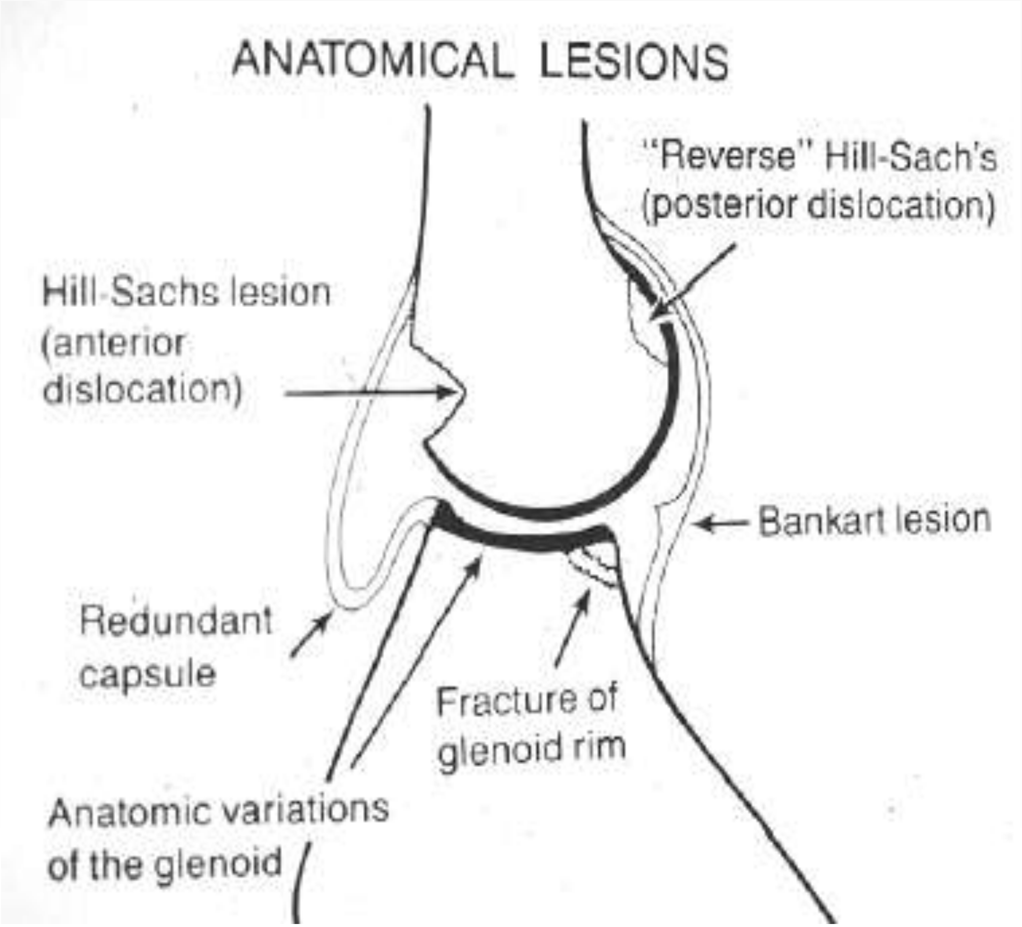
c. ALPSA

d. HAGL

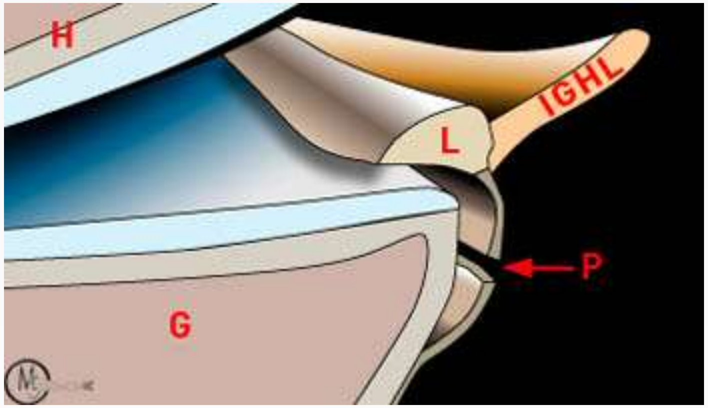
e. GLAD

f. SLAP

g. Hill - Sacks

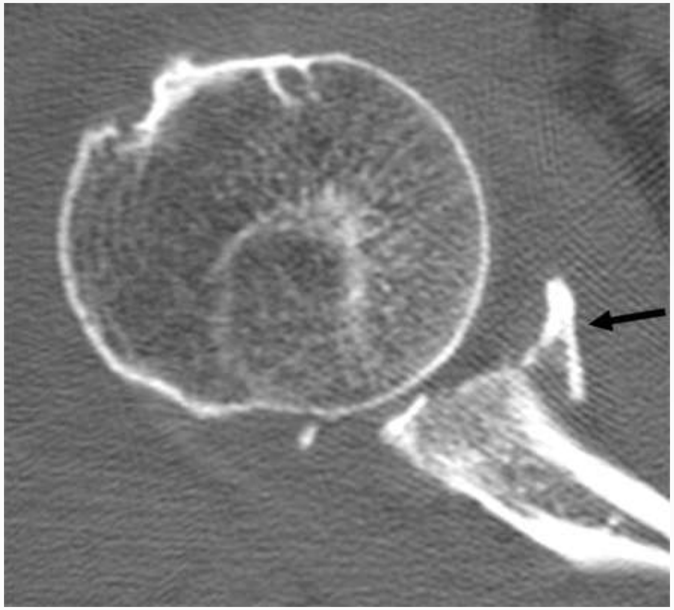


Bankart lesion



A Bankart lesion is a tear of the anterioinferior glenoid labrum with an associated tear of the anterior scapular periosteum, with or without associated fracture of the anterior inferior glenoid rim.

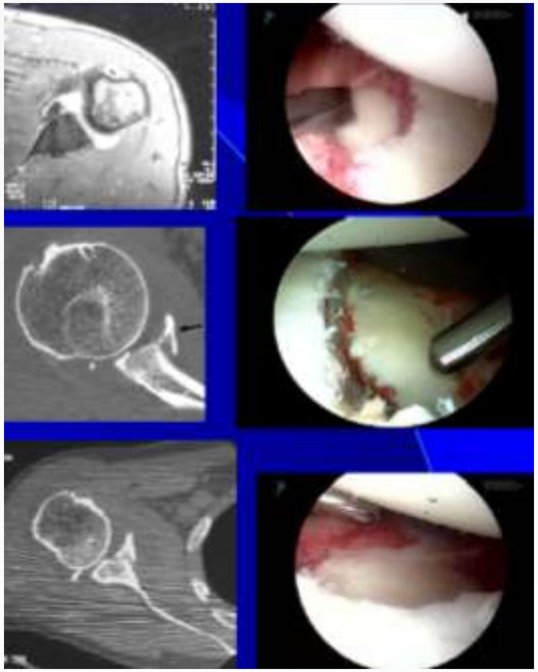
Bony - Bankart lesion



Type I: 0-12.5%

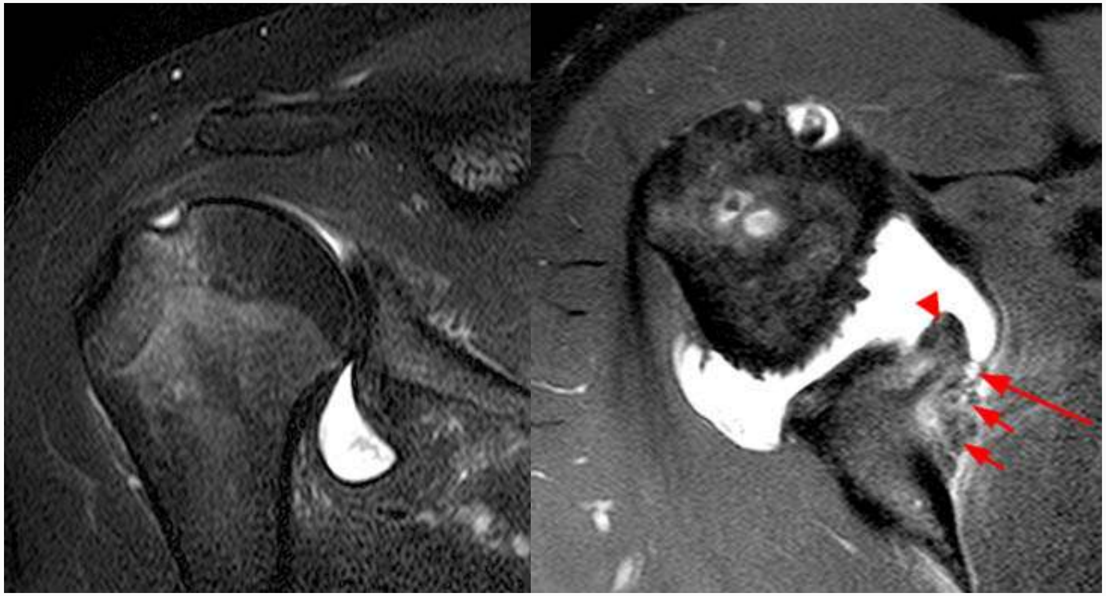
Type II: 12.5-25%

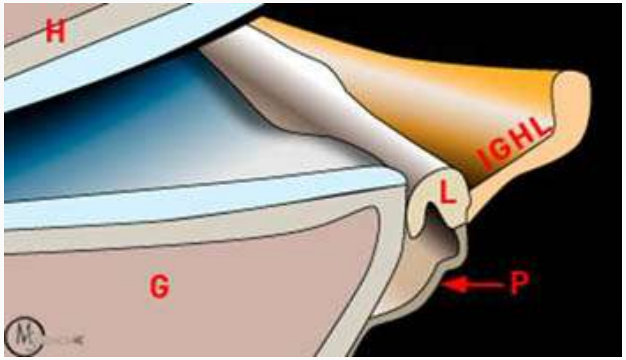
Type III: >25%



A Bony - Bankart lesion is a tear of the anterioinferior glenoid labrum with an associated tear of the anterior scapular periosteum, with associated fracture of the anterior inferior glenoid rim.

ALPSA lesion

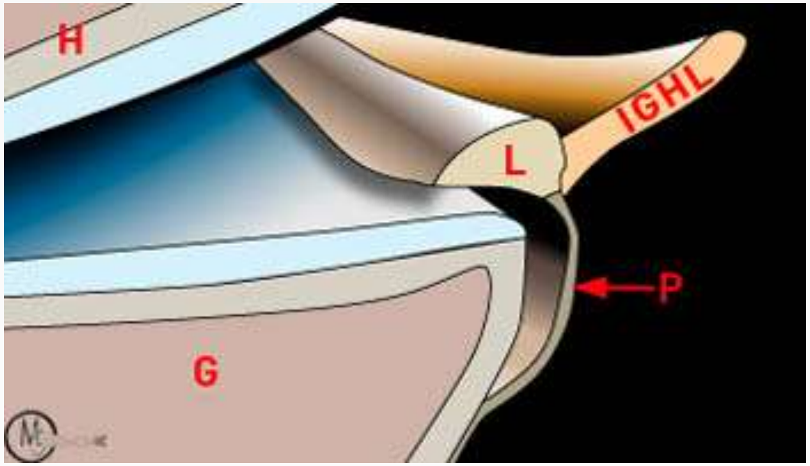




An ALPSA lesion is an anterior labroligamentous periosteal sleeve avulsion. ALPSA is a variation of the Bankart lesion where the anterior inferior labrum is torn and the labrum, inferior glenohumeral ligament and intact scapular periosteum are stripped and displaced medially on the glenoid neck.

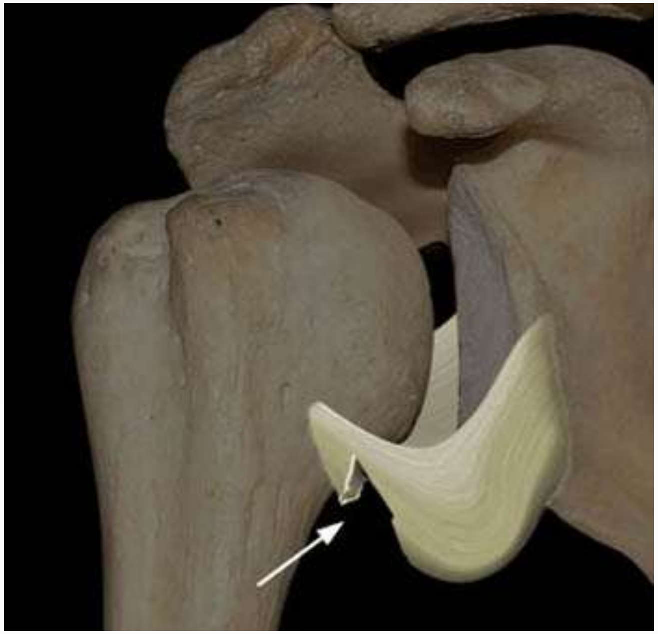
POLPSA is similar to ALPSA and is associated with posterior dislocation

Perthes lesion



An Perthes lesion is a variant of the Bankart, where the anterioinferior labrum is avulsed from the glenoid and the scapular periosteum remains intact but is stripped medially.

HAGL lesion



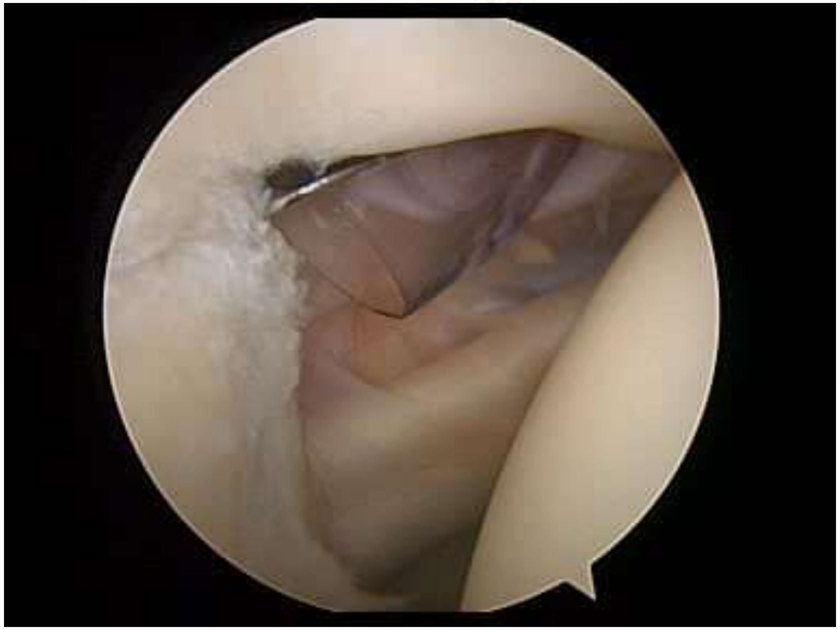
A HAGL lesion is humeral avulsion of the glenohumeral ligament that occurs from shoulder dislocation, with avulsion of the inferior glenohumeral ligament from the anatomic neck of the humerus **(J sign)**.

A BHAGL is a bony HAGL, or a HAGL lesion that involves a bone fragment

SLAP lesion

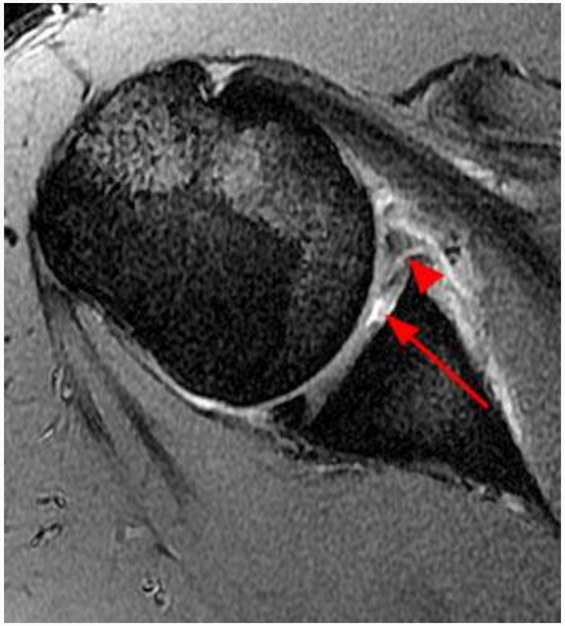
Type	Location (clock face)	Description
I	11-1	Fraying
II	11-1	Tear with biceps instability
IIA	11-3	Tear with biceps instability -associated with repetitive overhead motion -similar to Type X
IIB	9-11	Tear with biceps instability -associated with infraspinatus tear
IIC	9-3	Tear with biceps instability -associated with infraspinatus tear
III	11-1	Bucket-handle tear with intact biceps
IV	11-1	Bucket-handle tear with biceps extension
V	11-5	Bankart lesion with superior extension, or SLAP with anterior inferior extension
VI	11-1	Anterior or posterior flap tear, with tear of the bucket handle component
VII	11-3	Middle glenohumeral ligament extension
VIII	7-1	Similar to IIB, but more extensive -associated with acute posterior dislocation
IX	7-5	Globally abnormal labrum -likely post traumatic
X	11-1+	Rotator interval extension

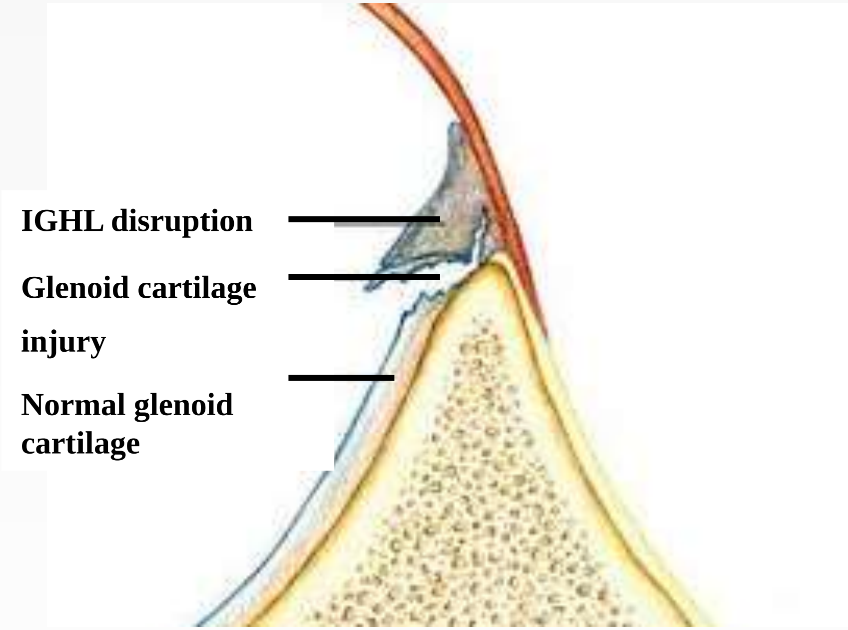
Type II SLAP



Additional categories of SLAP tears were described by Maffet et al , Morgan et al , Resnick and Beltran

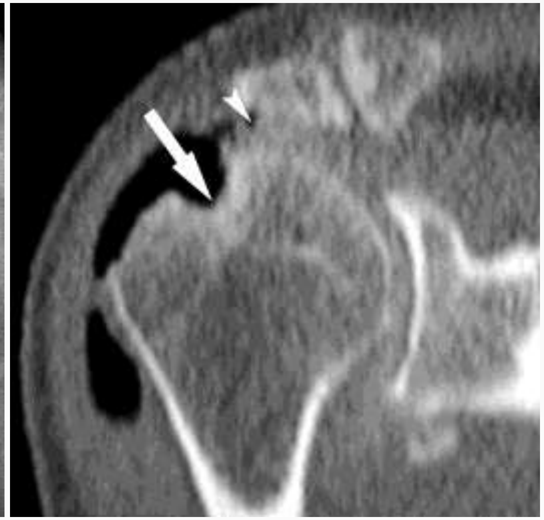
GLAD lesion

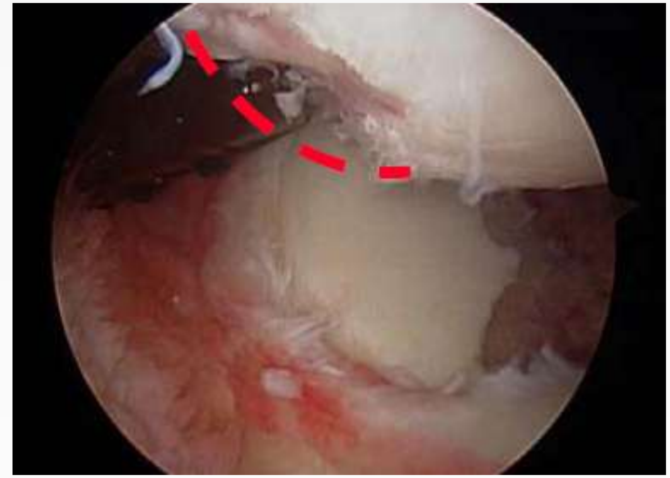




The GLAD lesion refers to glenolabral articular disruption, which involves a tear of the anterior inferior labrum with an associated glenoid chondral defect.

Hill-Sachs lesion





< 20% leave alone
20-40% grey zone
> 40% need to treat
Engaging Burkhart
engages in functional position

The Hill-Sachs lesion is a cortical depression in the humeral head. It results from its forceful impaction against the anteroinferior rim of the glenoid when the shoulder is dislocated anteriorly

(reverse Hill-Sachs in posterior dislocation).

Conclusions

A **delicate balance** between dynamic and static stabilizing factors allow the arm to be placed in extreme positions for athletic and work-related activities.

This concavity-compression mechanism is dependent on the integrity of the glenoid and the coracoacromial arch, muscular compression, and restraining ligaments of the shoulder.

Loss of any of these elements due to **developmental**, **degenerative**, **traumatic**, or **iatrogenic factors** may compromise the ability of the shoulder to center the humeral head in the glenoid.

Conclusions

The questions to answer during an evaluation of a patient with suspected instability are:

(1) Is the problem in the glenohumeral joint?
(2) Is the problem one of failure to maintain the humeral head in its centered position?
(3) What mechanical factors are contributing to this instability?
(4) Are the identified mechanical factors amenable to surgical repair or reconstruction?

This evaluation is based primarily on a carefully elicited history, a physical examination of the stability mechanics, plain radiographs and MRI scan

Conclusions

For surgical treatment of glenohumeral instability to be appropriate, the instability must be attributable to **mechanical factors** that can be modified by surgery.

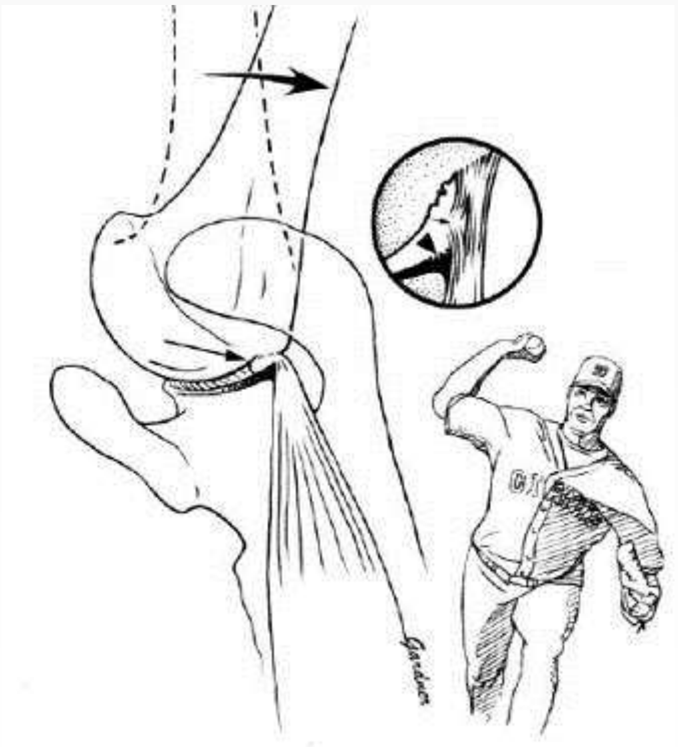
The causes may be deficiencies of the glenoid concavity, deficiencies in the muscles that compress the head into the socket, and/or deficiencies in the capsule and ligaments

INTERNAL IMPINGEMENT

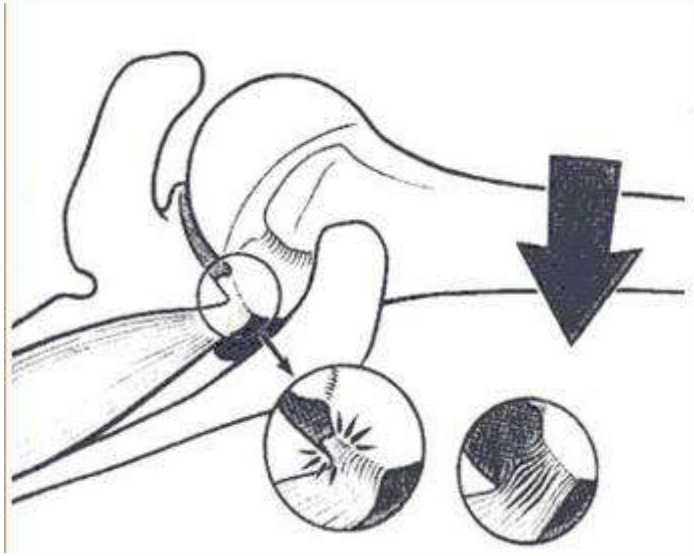
Definition

Injury and dysfunction due to **repeated contact** between the undersurface of the rotator cuff tendons and the posterosuperior glenoid

Walch JSES 1992



Some contact between these structures is **physiologic** but **repetitive contact** with altered shoulder mechanics may be **pathologic**



For undefined reasons this contact in some athletes become pathologic and produces symptoms

Internal Impingement

Normally

in abduction and external rotation (ABER) there is

obligate <u>posterior & inferior</u> translation

of the humerus that allows for

<u>more motion</u> and <u>less contact</u>

between the greater tuberosity and

the posterosuperior glenoid rim

Mechanisms

Two major theories:

- **Andrew**
- **Burkhart & Morgan**

May co-exist

Mechanism of Internal Impingement

Andrew Theory:

Repeated ABER → Dynamic stabilizers fatigue → Increase stress to anterior & IGHL → **Anterior capsule laxity** to allow max ABER → **Reduction of posterior & inferior translation of HH** → Increased contact of undersurface of RC and posterosuperior glenoid → **Internal Impingement**

Mechanism of Internal Impingement

Burkhart & Morgan Theory:

Repeated ABER

Tight posterior capsule

Superior translation of Humeral Head

Torsional stress to biceps anchor

Peel-off

Mechanism

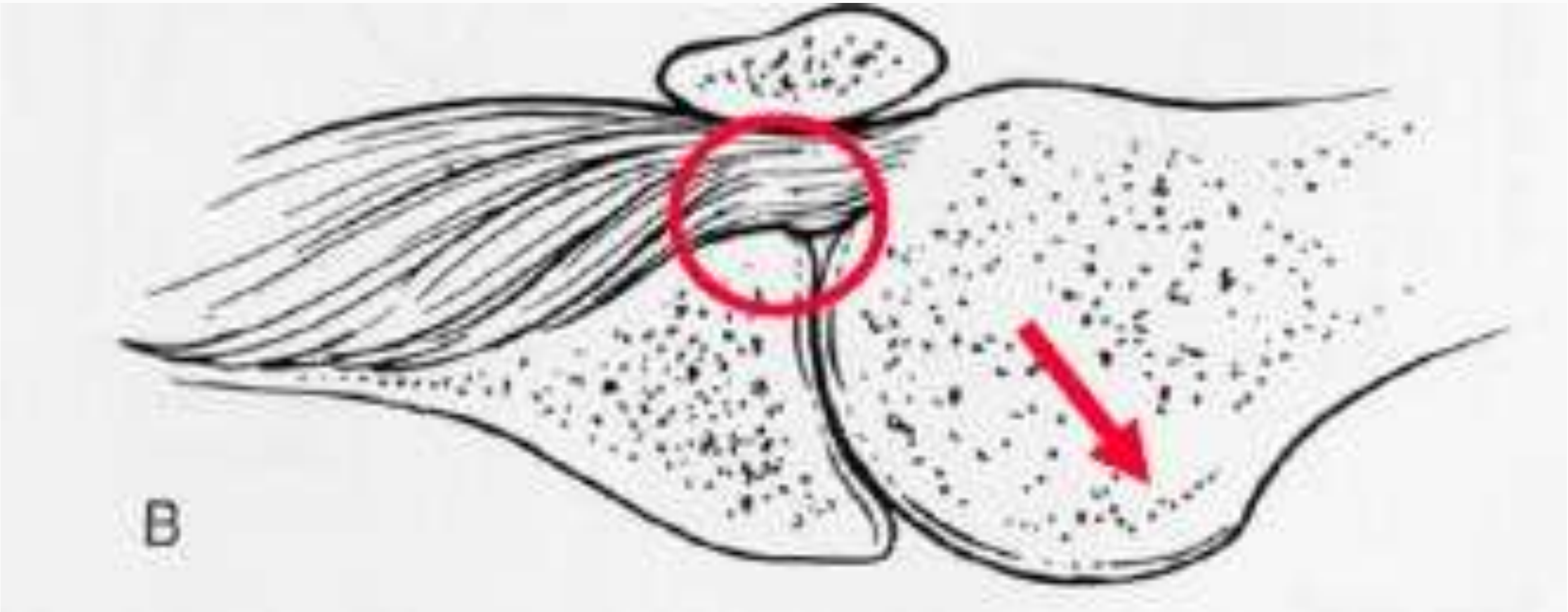
SLAP II and **Pseudolaxity**

Increased contact of undersurface of RC and posterosuperior glenoid

Internal Impingement

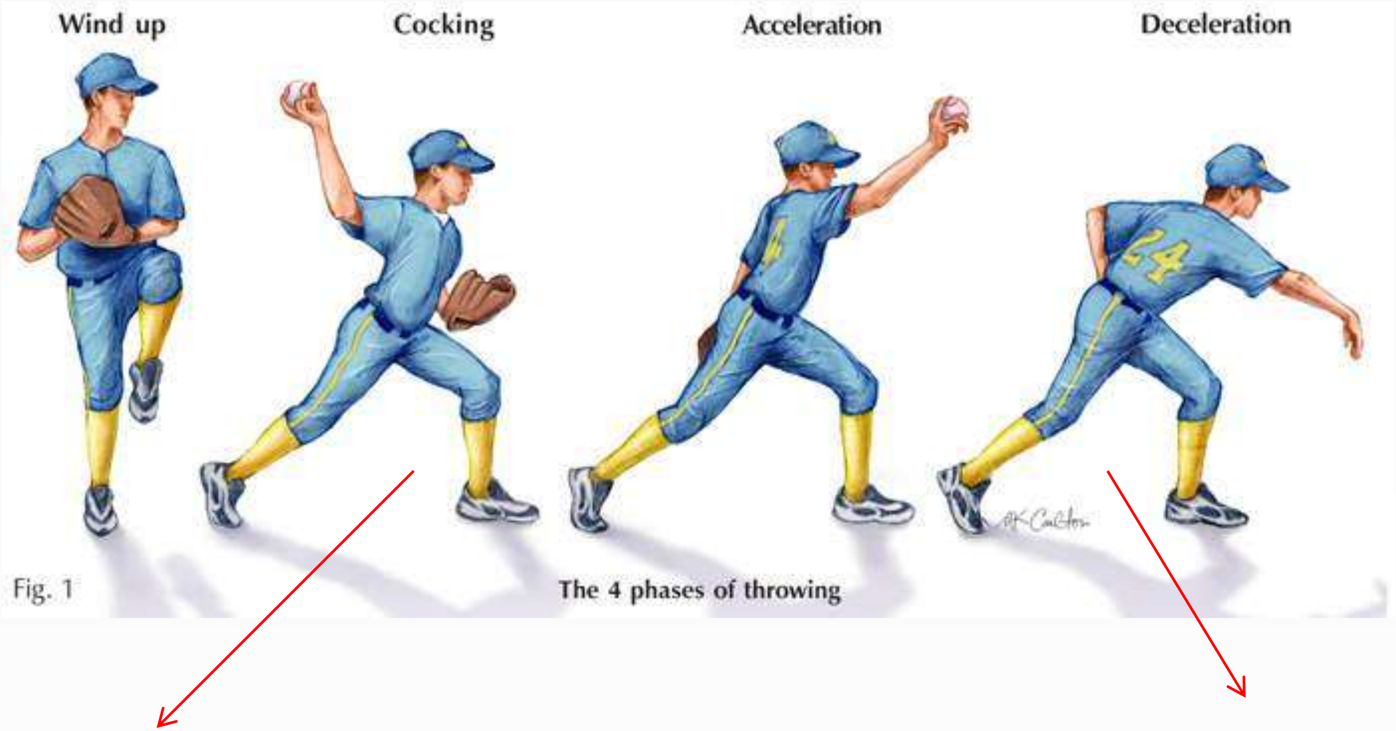
Internal Impingement

It is essentially an **overuse** injury associated with overhead athletes



Internal Impingement

- Typically symptoms are present **only while playing**
- **No symptoms** with activities of daily living
- Represents about **80%** of the problems seen in the **overhead athletes**



Consequently, these forces may lead to **subacromial impingement** (superior translation of humeral head from compressive forces), **labral tears** (torsional forces grinding the labrum), and **cuff failure** (large tensile forces with collagen failure).

History

- Insidious onset
- Increases as the season progresses
- Dull posterior pain
- Worse at late cocking phase
- Rarely can remember any traumatic episode
- Loss of control and velocity

Clinical Examination

Provocative tests:

- **Internal Impingement test** = positive

  (patient supine, 90 deg abduction and max external rotation. If pain experienced at the posterior part of the joint = positive, 90% sensitive)

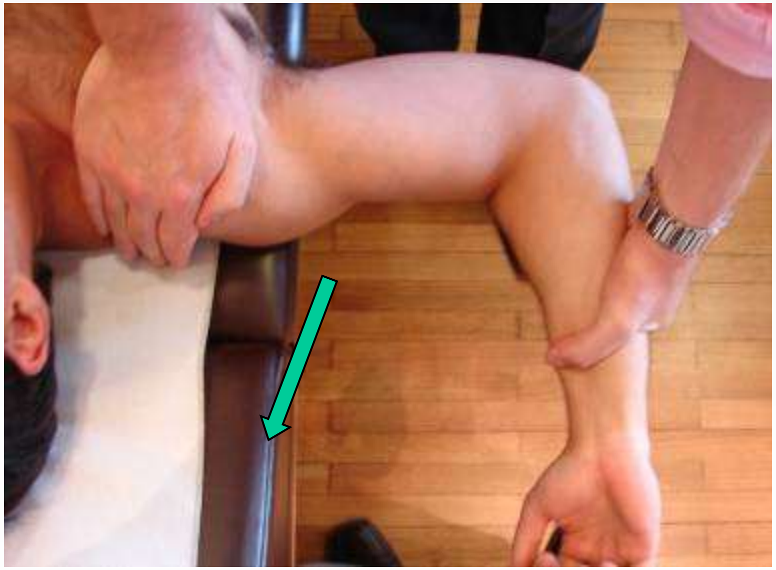
- **Relocation test** = positive,

  (different from relocation test for anterior translation)

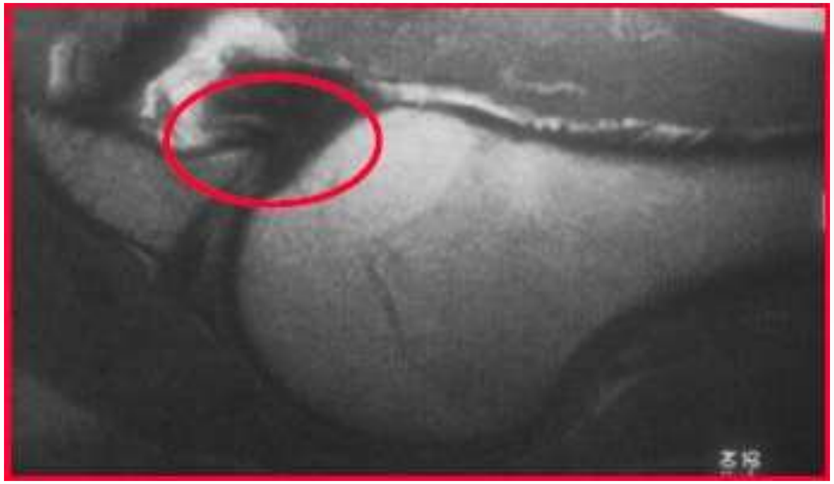
Clinical Examination

Relocation test of Jobe:

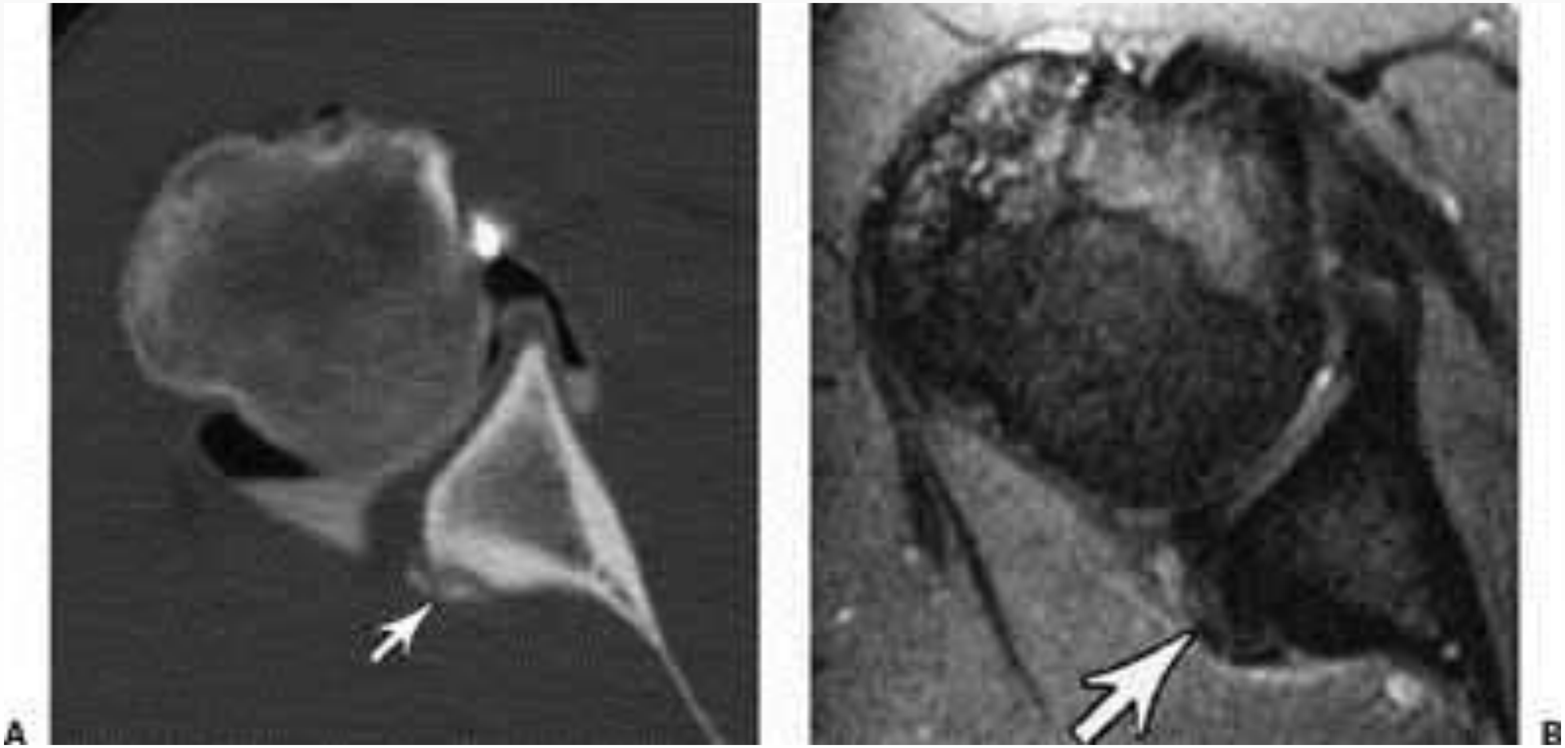
Pain in the posterior joint line when the arm is brought in abduction external rotation with the patient supine that is relieved when a posterior directed force is applied to the shoulder



MRI findings



Internal Impingement – Bennett’s Lesion



Differential Diagnosis

- **SLAP lesions**
  - Pain more anterior than Internal Impingement.
  - Positive O'Brien test and SLAPrehension test. These tests are negative for internal impingement.
  - Coronal oblique MRI can help

- **Isolated posterior labrum tear**
  - The most difficult to differentiate from internal imp.
  - Both posterior pain in the abducted and ext rotated position.
  - Arthroscopy can help

Conservative Treatment

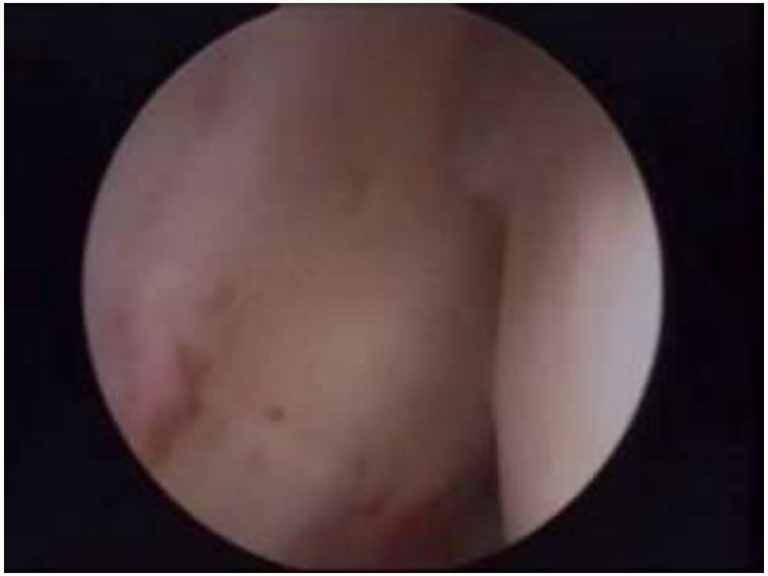
- **Rest** (complete stop of throwing is critical)
- **Rehabilitation** (physical therapy as soon as possible) to
  - improve posterior flexibility
  - improve dynamic stabilization
  - increase strength of rot cuff muscles

- Then gradual return to throwing
- Improvement of throwing technique
- +/- NSAID
- Most athletes return to sport

Surgical Treatment

- **Diagnostic arthroscopy**
  (other pathology found…SLAP, biceps tendonitis, rot cuff tears etc)

- **Arthroscopic Debridement**
  25-85% return to pre-injury activity => effective ?



Surgical Treatment

- **Open/Arthroscopic Capsulolabral Reconstruction**
  - Arthrolysis of posterior capsule tightness
  - Repair of SLAP lesions
  - Repair of the rot cuff
  - Address anterior capsule laxity

    (50 - 81% pre-injury level)

Conclusions

- Internal Impingement is a relatively common problem in overhead athletes
- Difficult to treat
- Caused by repetitive contact between the undersurface of the rot cuff and posterosuperior glenoid

- **Initial treatment**:
  - Complete REST + PHYSIOTHERAPY
- **If symptoms persists:**
  - Multiple surgical techniques
  - Repair all lesions if possible