Advances in Shoulder Rehabilitation: Following ATS Surgery of the Shoulder

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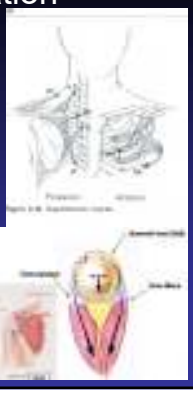
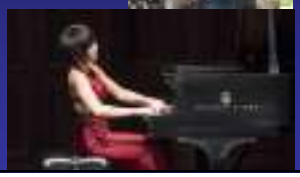
Shoulder Rehabilitation

- Very interesting and challenging
- Due to dependence on dynamic forces for stabilization – conservative rehab is often successful
- Must be able to be in-tune with patient response and alter program
- Must have knowledge of biomechanics and interplay between RC/Scapula



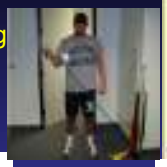
Shoulder Therapist

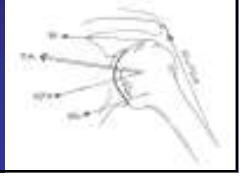
- Very difficult to find PT's that are proficient at shoulder rehabilitation
- ***Must** have better than average hands-on capabilities*
- Implement proper therapeutic exercise for progress



Rotator Cuff Strengthening

- ER strengthening helps almost all shoulder problems





Top Exercises for Posterior Cuff Strengthening

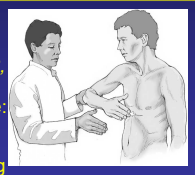
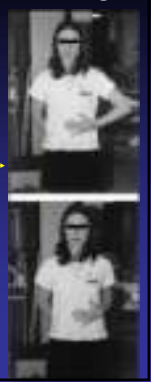
- Reinold/Wilk JOSPT '04
- ER EMG analysis
- Sidelying ER = 62%/67% MVIC

ER Strengthening

- ER Strengthening
- Both show similar emg activity

Subscapularis Firing

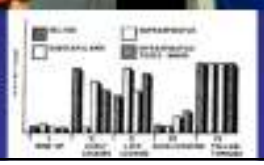
- Subscapularis testing, exercise
- Manual resisted belly off for subscapularis weakness. *Scheibel JORS '05*
- Belly Press = *Gerber JBJS '96, Burkhart Arthroscopy '02, Tokish JSES '03*
- ***IR=low activity for subscapularis*** – pect. Major, Latissimus, *Hintemeister AJSM '98, Moseley AJSM '92*
- Best Subscap exercise: Belly Press Manual Eccentrics
- DiGiovine = 90d During throwing Upper subsc.JSES'92

Subscapularis and Throwing

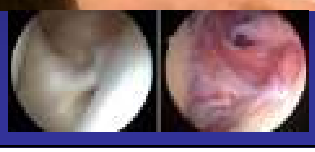
- *Mihata AJSM 2009*
- Simulated Subscap weakness increased ER and increased GH contact pressure


Rotator Cuff Strengthening Subscapularis Belly Press

Don't be a hero – Physical Terrorist

- Inform MD when you believe that PRP, cortisone injection may be of benefit
- Stiffness recovery can be accelerated with ATS release of adhesions
- Take relief from rehab if pain is not resolving
- Arthroscopic labral repairs can get stiff

Be careful when communicating with patients

- Respect what patient might repeat to referring physician
- 90% of time = inflates your comments
- Problem patient – you must communicate w/MD
- Be accurate with your predictions and err on conservative side
- Always provide factual information


Setting

- Weekly post-op recheck testing and MD visit
- Data collected On-Site
- Patients seen monthly until DC to RTP
- Approximately 20 patients/day
- Stratified based on healing timelines
- PT report includes the following factors:


Look for posterior cuff tightness in all your patients

- Restoring normal h.head will provide immediate relief
- Altered position = pain, RC weakness
- Must be to locate Infraspinatus, Teres Minor muscles

Assessment for Horiz ADD (Posterior soft tissue restriction)

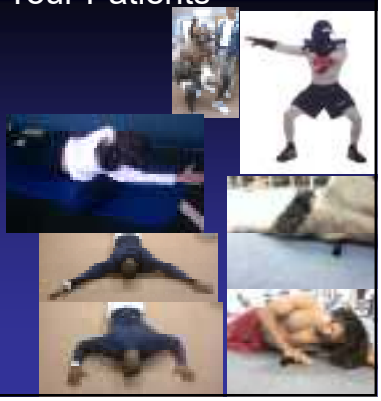
- Seated Exam
- Hold Scapula in retraction
- Look for medial border rotation

Why does this work?

- Tight posterior cuff = anterior/superior position of h.head
- Result = subacromial irritation and posterior cuff pinch with ER
- Restoration of normal hhead position = centralization of hhead

Learn From Your Patients

- Motivated patients can be creative
- Use the floor
- Rolling on inferior capsular recess/lats/improving S-H relationship
- Foam roller for posterior RC/internal impingement



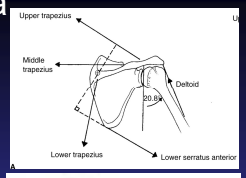
Release posterior soft tissue

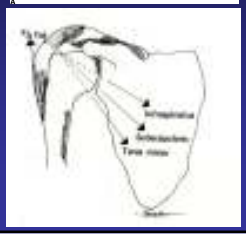
Learn from team approach

- Re-check clinic beneficial for all medical staff *and* patient outcomes
- Jack Houghston, MD Houghston Clinic – PT/ATC/MD interaction
- Andrews/Wilk continued tradition of “recheck” clinics with “team” approach to patient follow-up

Look to Scapula

- With stubborn shoulder pain (full ROM good RC strength) make sure that you are covering all bases
- Aggressive scapular strengthening may help reduce pain
- Slight re-positioning may be enough





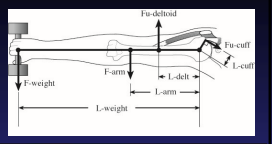
Swiss Ball Robbery

Strengthening Techniques

- ***Rhomboids***: Seated Rows, Cable Column Cocking, Manual Resisted Sideling
- Dynamic Hug: ***Serratus***, ***Subscapularis***
- ***Sobush JOSPT***

Rotator Cuff is Small Muscle Group

- Be careful with overloading RC with excessive exercise
- No more than 6 RC exercises for HEP
- T = F x r (lever arm)
- Maintain good technique



It's O.K. to strengthen overhead

- In past never allowed overhead strengthening
- Now perform on most all shoulder patients
- High EMG for supraspinatus, RC – may help S-H rhythm
- Standing snow angels = demanding, but effective ex

Advancement to overhead

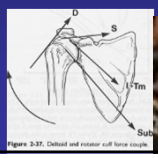
- Standing "snow angel"
- 3x20 reps light weight
- Only pain is muscle fatigue
- Back of hand touching wall throughout
- Cuff and Scapula

Pain inhibits RC strength

- Do not push through pain while strengthening rotator cuff
- Define pain for patients:
- Lingering pain, night pain

How does pain/stiffness effect Rotator cuff strength

- Determined RC strength before and after lidocane/cortisone injection in shoulder
- Measured strength using hand-held dynamometer



Testing – Rotator Cuff and Pain

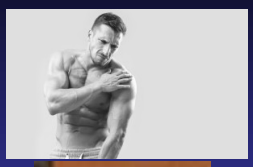
- Testing procedure: Subjects were tested prior to injection of cortisone and xylocane, then 5 minutes after injection
- Results: ***% Deficit***
  - ***Pre Injection***:
  - ABD 35% Scaption 12% ER ***37%*** IR 12%
  - ***Post Injection:*** 19% 8% ***13%*** 8%
  - ***Improvement***: 16% 4% ***24%*** 4%

Primary initial goal: control pain

Posterior Cuff = Greatest Inhibition

Possible Causes for Symptomatic RC Tears

- Which tears progress and become symptomatic?
- Not consistent
- *Impingement, LOM*
- Age
- Tissue Quality
- *Strength of RC/Scapula*
- *Instability*



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Recurrence of Abated Symptoms Possible Correlating Factors

- *Yamaguchi JSES* '01 58 RCT symptom free patients 2.8 years later *51% became symptomatic* Tear size *propagation*
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Sometimes the best rehabilitation is rest/break from all activity including rehab.

- Constant inflammatory response creates irritated shoulder
- Pain = RC inhibition, increased muscle tone/tension = loss of motion
- LOM = increased pain
- *No exercise*, anti-inflammatory meds, possible prp or steroid
- PT's are problem solvers = hard to resist intervention, but your expert advice may help with progression

MET more effective at increasing ROM

- MET's help with restoring normal muscle tone
- Helps to inhibit muscle splinting
- Distraction is important to reduce muscle splinting

Contract – Relax – 50%, quick stretch

Careful With Overaggressive Stretching in Conservative Management

- Increase in normal physiological motion – no Bueno

Conservative Rehabilitation (RCT, Internal Impingement)

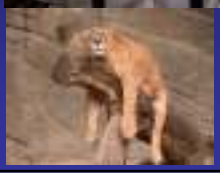
- Should see reduced symptoms within 2-3 weeks
- If no change, refer back to MD
- Improvement = continue with rehabilitation

Shoulder Pain Relief

- ICE application effective pain reliever
- Shoulder cold pack used at night may help alleviate night pain

Conclusion

- Shoulder rehabilitation requires good hands-on skills
- Combined with balance of dynamic forces of RC/Scap = happy outcome
- If its not working don't rehab patient to death

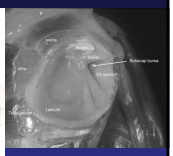


Labral Tear

- Pagnani et al JBJS 95 ***6 mm anterior translation*** 55N anterior force, 50N compressive force, 55N LHB force
- ***Partial*** tear of the superior labrum has (-) significant effect upon superoinferior or anteroposterior translation;
- ***Complete*** SLAP lesion results in significant increases in anterior and inferior translation at all arm elevations.

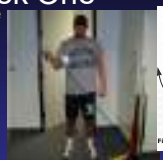
Stability Principles
What makes shoulder stable?

- GHL Complex taught at different positions of shoulder
- Labrum – "chock block" of shoulder
- Adhesion/Cohesion
- Negative Joint Pressure



Type I, II SLAP ***Repair***
Rehabilitation ROM Guidelines
Week One

- ROM = ***Avoid*** excessive Horiz. Adduction, ER
- Initial PROM = Supine Elevation, Gentle Horiz. Adduction, ER = 45d. @45d. ABD
- Active = Light (yellow) T-Band IR/ER initiate Force Couples
- Active = prefer over isometrics
- Isometrics may generate higher tensile force
- Sling – 4-6 weeks



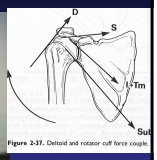


Figure 2-37. Deltoid and rotator cuff force couple.

Mechanism of SLAP Tear

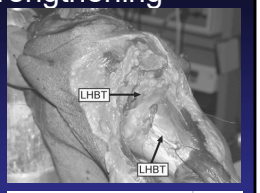
- Peel back phenomena
- Extreme ER biceps peels labrum from superior attachment
- Early Excessive PROM into extreme ER = avoid

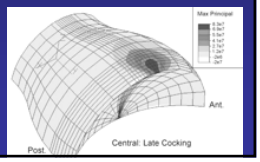
Type I, II 6 - 8 Weeks = Full PROM
Stiff Shoulder = Never Normal
Throwing Mechanics = Failure

- Full ROM all planes by 8 weeks
- Prior to standing active elevation

6 Weeks Post-op
Begin Active Strengthening

- Avoid 90/90 ER position early during ***active strengthening***
- No Biceps – 3 months
- Lintner AJSM '05 Highest stress superior glenoid = late cocking but greatest biceps force on labral complex during deceleration
- Makes sense to avoid active resisted strengthening in this position (Extreme ER/ABD, Biceps





Closed Chain and SLAP Be Careful

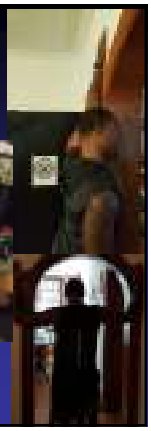
- Closed chain and poor RC function = superior migration h.head
- Superior migration with compression = loading of superior labrum
- Acute injury can occur with fall, be careful not to re-create

SLAP I & II Progression

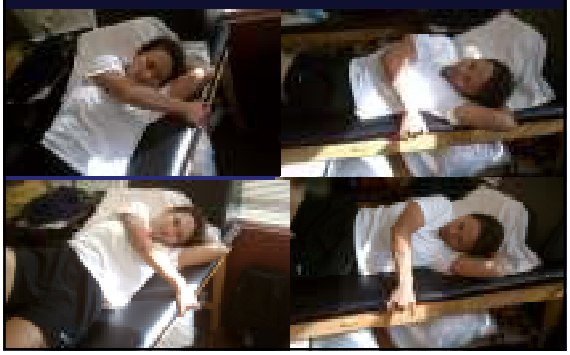
- Isotonic IR/ER/Flexion/ Scaption 4 weeks
- Plyometrics 8 weeks chest – single arm throw
- Interval throwing 14 weeks
- Posterior cuff stretching

360 degree Labral Tear

- 9 Anchors
- 4-5 mos before FROM
- Begin hands on day 2 post-op



I,II SLAP Repairs May Get Stiff



Work on Lattisimus/Subscap Release

- Foam Roller helps to address inferior capsular recess

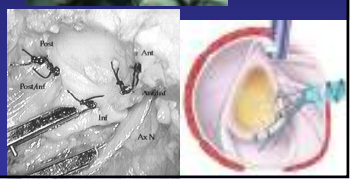
Release soft tissue

Labral Lesions
Lintner et al AJSM '14

- *Non-op*:
- 40% *pitchers* return to play, 22% return to play to previous level
- *SLAP repair*:
- 48% *pitchers* return to play, 7% return to previous level
- *Position players*: 39%, 26% (non-op), SLAPr = 85%, 54%

Post-op Recovery
Anterior Stabilization Procedures

- Elevation – 120d
- ER – 45d abd, 45 d ER
- Manual assessment key
- Full ROM by 10 weeks s/p
- RC strengthening elbow to side



Post-op Instability Precautions

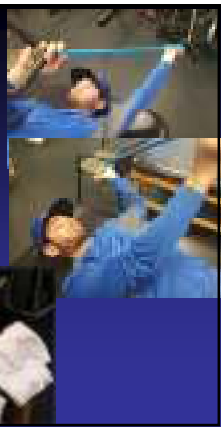
- *Anterior*: Excessive ER/elevation
- *Posterior*: Excessive Posterior Soft Tissue stretching/IR

Early post-op goals
Instablity

- Begin: elevation, gentle ER, posterior cuff stretch (ATS Bankhart)
- Elbow ROM
- Grip Strength
- Activate ER/IR

Immediate Post-op

- Pain control
- Initiate PROM
- Hands-on stretching MET's
- Gradual loading of repair
- Assessment for excessive scar formation
- Full PROM by 8 weeks



Hands-on Assessment Essential

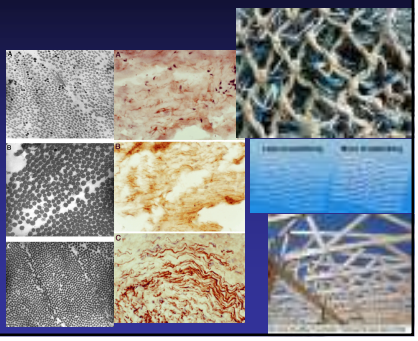
- Hands on determines speed of progression!

Treatment of Co-contraction MET

- *Contract-Relax* = contraction of antagonist muscle (IR contraction to increase ER passively) – mild splinting
- *Contract-Relax, Agonist Contract* = antagonist contraction followed by agonist contraction (IR contraction followed by ER

Rodeo AJSM '98 Collagen Profile Post-op Hands-on assessment

- Decreased fibril diameter
- Decreased fibril density
- ↑ Elastin density
- ↑ Reducible (unstable) intermolecular cross links



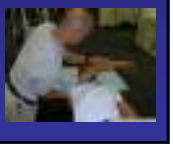
Don't Forget About Horiz ABD Pect. Minor Release for Elevation

- Plane of Scapula – Good for IR, ER
- Consider allowing elbow to drift into extension to achieve full cock position
- Avoid anterior soft tissue contracture
- Must restore elevation in throwers

Allow Healing Phase to Occur Post Instability/SLAP

- Pain resolves – 2 weeks – patient compliance?
- Must advise patient to ***avoid*** active exercise except rehab. prescription/extreme ER, horiz. ADD
- Arthroscopic Bankhart = Full PROM by 8 - 10 wks.
- ***6-8 weeks*** = begin 1lb. Dumbbell routine = standing: flexion, scaption, IR/ER GTBand
  supine: elevation, ER

Must be able to lift arm against gravity (standing) without "shrug" x return to supine



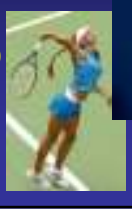
Active Standing

- Hold and lift

RC Tear Prevalence *Asymptomatic* Patients

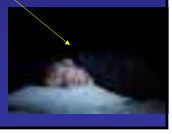
- Ultrasound: 50% partial *and* complete over age 60
- 80% over age 80
  Milgram JBJS '95

- MRI: 54% over 60
- 28% 40-60
- 4% < 40
  Sher JBJS '95



Why do Patients Seek Medical Attention

- 88% w RCT seek office visit due to Pain
- 11% weakness and pain
- Pain source = inflammation cortisone subacromial bursae = relief
- Diagnostic
- *Itoi AJSM 2006*



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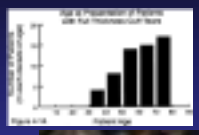
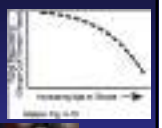
Elastin Function

- Acts to dampen effect of sudden jolt or lengthening of RC
- Elastin = protein that is responsible for elastic nature of soft tissue
- Allows tissues to resume shape after stretching or contracting
- Loss of elastin = inability to stress reduce impact of sudden lengthening of tendon

Increase in age = Decreased force required to tear RC

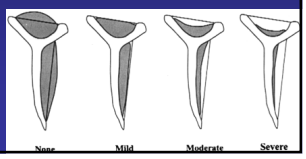
- Age = decrease in normal elasticity of tendon
- Elastin depleted tendon can't withstand continued eccentric follow through of throwing motion





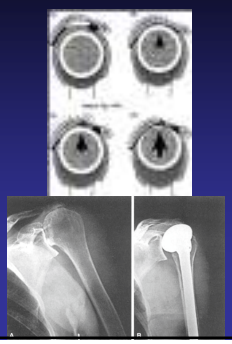
Not all RCRepairs Heal

- **Fatty Infiltration and Atrophy of the Rotator Cuff Do Not Improve After Rotator Cuff Repair and Correlate With Poor Functional Outcome**
- **James N. Gladstone, MD ,*, Julie Y. Bishop, MD , Ian K.Y. Lo, MD and Evan L. Flatow, MD** AJSM 2007
- Fatty/Atropic Tissue infraspinatus..effect outcome of result ER
- Failed repair = more degeneration of RC tissue



Superior Migration

- Leads to acriomal thickening and ossification of AC ligament
- Abnormal bony anatomy = increased wear on superior migrating RC tendon



Function of RC Humeral Head Centering Critical for Success

- Normal position of RC = humeral head center varies only 0.3mm
- Fatigue of RC = 2.5mm superior migration of hhead.
- *Chen JSES '99*

Overhead Athlete RC Tear

- Unbalanced ROM = Incr. ER, Decr. IR
- Increased mechanical stress of lengthening tendon
- Increased with age of athlete due to increased stiffness of tendon
- Some are lucky, mechanics, fittness level = reduce stress to eccentric load
- RC tear = ***most debilitating to throwing athlete*** – loss of compression = loss of mechanical advantage = loss or power

Full Thickness RCR Pitchers

- 1 of 12 pitchers able to return the previous level of pitching
- Position players slightly better outcome 4/4
- *Andrews 2006 AJSM*

Degenerative Tears Difficult to heal

- Muscle to which tendon is attached pulls to retract tendon away from tear
- Increases gap to be closed
- Places tension on blood supply
- RC tendon exposed to synovial fluid on articular and bursal sides (full thickness)
- Synovium may remove fibrin clot required for healing
- Lack of healing = full thickness, zippe phenomenon

RC Tear Progression

- Propogates to infraspinatus and teres minor
- Further tearing = bicipetal groove, subscapularis
- Biceps tendon resists migration = possibly rupture
- Wear also occurs to superior rim of glenoid and labrum
- RC tears occuring with no acute episode = poor chance of healing with repair due to poor tissue
- Acute tears = healthy tissue for healing = better result

Massive Cuff Tear Chronic

- Unrepairable = some have function others don't
- Propogation "Zipper" post. – ant
- Tendon attachment min. = low vector = Boutonnière deformity
- Tendons slide below h. head = no compression Force – Deltoid = upward shear

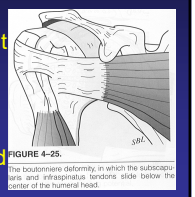


FIGURE 4–25.
The boutonniere deformity, in which the subscapularis and infraspinatus tendons slide below the center of the humeral head.

Progression ROM

- Early motion resulted in increased ROM no increase in re-tear (metanalysis)
- Stiffness more common among ATS versus Open RCR *Riboh Arthroscopy 2014*

How does pain/stiffness effect Rotator cuff strength

- Determined RC strength before and after lidocane/cortisone injection in shoulder
- Measured strength using hand-held dynamometer

Testing – Rotator Cuff and Pain

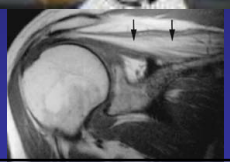
- Testing procedure: Subjects were tested prior to injection of cortisone and xylocane, then 5 minutes after injection
- Results: % Deficit –
  - ***Pre Injection***:
  - ABD Scaption ER IR
  - 35% 12% 37% 12%
  - ***Post Injection:***
  - 19% 8% 13% 8%
  - ***Difference***:
  - 16% 4% 24% 4%

RC Repair Exercise Progression Dependent On

- Age – activity level
- Tissue quality
- Size of RC tear

RC – Tissue Quality Activity level/Age

- Disuse = Decreased RC tendon fiber strength
- Less force to disrupt tendon = careful
- Aging = primary factor RC tears



Factors Governing RCR Rehabilitation

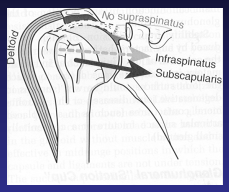
- Large tear multiple tendons
  - Healthy, active = aggressive approach 8-12 weeks FPROM
- Large tear multiple tendons
  - Retracted, sedentary, fatty infiltrated = go slow 12 weeks FPROM
- Small tear – healthy tissue = aggressive 4-8 weeks FPROM

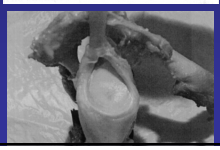
Most Common Mistake Rehabilitation RCR

- Lack of communication between M.D. & P.T.
- Activate RCR with too heavy load
- Too conservative = s/p adhesions

RC Function – Arm Elevation Post. cuff

- Colachis – APMR – selected nn. Blocks – Suprascapular nn.
- SS & IS provide:
  - 45% ABD
  - 90% ER
  - RC tear/SLAP avoid sup. migration





Function - RC

- Centering – h. head
- (-) compression = superior migration due to Deltoid = h. head degeneration
- Result = loss of function, pain

Early RCR Rehab "Passives" may be Active

- Dockery '98 Orthopedics - Supraspinatus
  - Rope & Pulley = 17% mEMG
  - Active Assistive = 8% mEMG
  - Bar Raise = 8% mEMG
  - CPM = 5% mEMG
- Careful with Rope & Pulley – begin with active assistive massive RCR

Progression RCR Rehab Size, Tissue Quality Dependent

- Active assist.
- Table Slide Supine well arm PROM = 1% MVC *Uhl ArchPhMed 2010*
- Supine balancing
- Sideling T
- D2 supine
- Standing assist
- Plyoball
- Dumbbells
- Biodex IR/ER

Case 1

- Competitive 58 y/o tennis player Nationally Ranked

RC tear SS, IS

- Post-op course immediate stiffness
- 3 mos
- ROM: Flexion 120, ER = 32, IR = 37, Horiz ADD = 35

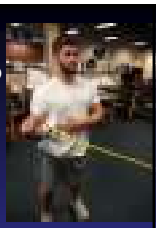
Case 1

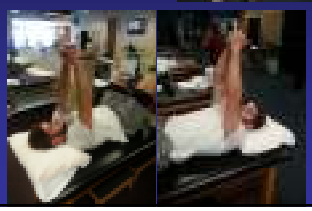
- Treatment protocol?
- MUA?
- ATS, MUA?
- Wait 2 years to loosen…maybe ?

Active ROM excellent

Case 3: 2 weeks s/p SLAP

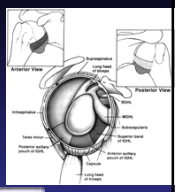
- Professional Baseball Pitcher
- SLAP Tear 3 anchors
- Needs ROM to throw
- Advance PROM protocol?





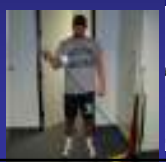
Stability Principles Strengthening Dynamic Stability RC

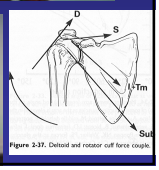
- Rotator cuff functions to compress humeral head into glenoid ***Focus on IR/ER***
- Scapular muscles position glenoid
- More compression = less shear = less stress to labrum



Improving Dynamic Compression

- Effective use of RC forces
- "Power Up" RC engine
- Begin lifting light weight proper technique – 2 sec. hold "up fast, down slow"
- Avoid Shrug sign

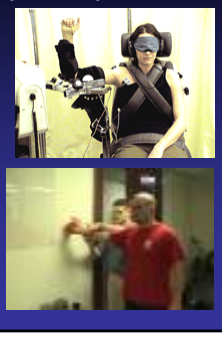




Rotator Cuff Strengthening Subscapularis Belly Press

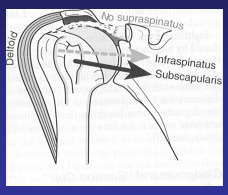
Stability Principles Co-contraction Proprioception

- **Reflexive Muscle Activation Alterations in Shoulders With Anterior Glenohumeral Instability**
- **Joseph B. Myers, PhD, ATC*, , Yan-Ying Ju, PhD, PT, ATC , Ji-Hye Hwang, MD, PhD , Patrick J. McMahon, MD , Mark W. Rodosky, MD and Scott M. Lephart, PhD, ATC**
- AJSM 2004
- Strength ***PLUS*** Smart RC



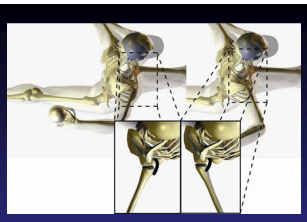
Advanced Stabilization Routine

OTIS 3 sets of 30 sec.



Abnormal Muscle Function Rhomboids

- Jobe JBJS '88 highest EMG of scapular muscles during follow through
- ***Fatigue*** = unable to fully retract/cock
- Scapular Axis in line with humeral axis
- If not, stress to anterior capsular structures

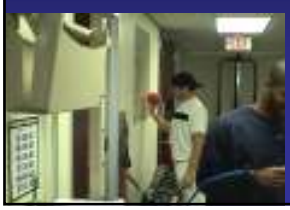


Closed Chain DS2 Gradual Progression

- Roland Ramirez Houston Texans PT/ATC
- Allows external compression to facilitate joint compression
- Stimulates co-contraction and endurance of UE.

Advanced Closed Chain Routine – be aware of direction of applied external force

- Bear crawl swiss ball
- Standing plyoball stabs - Wilk



Super 6 Tubing Routine

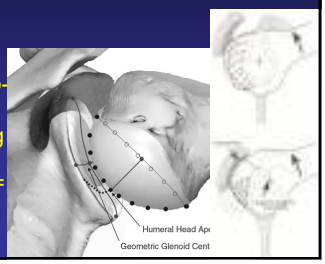
- Allows most specific form of training to mimic throwing motion
- 2 sets of 30 sec. each position

MR Systems Computerized Muscle Control

- Provides RC recruitment, proprioceptive input, endurance
- Allows specific positioning of arm/shoulder

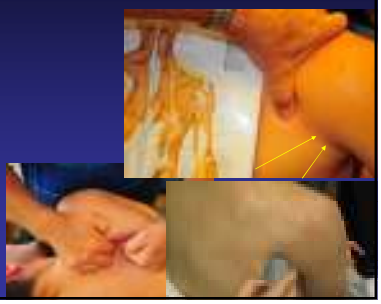
Importance of Restoring Normal IR/Horizontal ADD

- Normal Humeral Head Position ***With ER*** is Postero-inferior position
- Tight posterior cuff/capsule = Postero-superior position
- Progression with lifting and strengthening combined with GIRD = loading of labral tear/repair



Soft Tissue Heating, Release

- Apply US, manual release to teres minor, infraspinatus tendons
- Release along muscle belly
- Palpate below posterior deltoid to "find" teres minor tendon



Posterior Shoulder Tightness Anterior Instability

- Laudner/Meister *AJSM 2012*
- Increased G-H laxity = ↓IR ↑PST
- "Partial Predictor" Increased Laxity in Normal Throwers

Common Clinical Natural History Posterior Cuff Shortening

- 12-14 y/o throwers "Silent" Stiff Shoulder
- Initial symptom = loss of power
- Progression = pain and loss of power
- Medical referral = no power severe pain
- MDI? Symptoms PST restriction
- Reinold AJSM Loss or IR 24 Hrs.

Stretching Techniques Posterior Cuff Tightness

- Sleeper Stretch
- "Genie" Stretch cross body ADD Allows control of IR
- Door Stretch

Anterior shoulder instability in weight lifters

MICHAEL L. GROSS,* MD, STEPHEN L. BREMER, MS, IRA E. DIFORNIO, AND JOHN J. SOKOLOSKI, MD

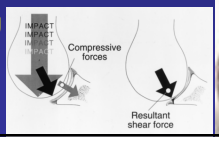
- 13 shoulders responded well to conservative measures
- 10 shoulders underwent stabilization procedures
- All were able to resume lifting

Bench Modifications

- Keep elbows to side, less than 45 deg. ABD
- Maintain extension less than 15 deg.
- Excessive bench = A/C DJD
- Fees AJSM '98

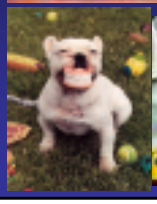
Push-ups

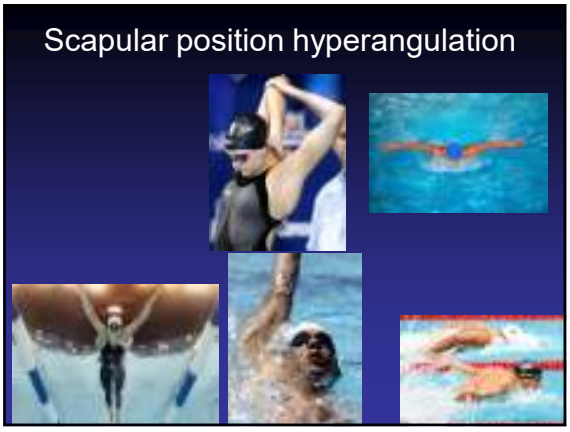
- No different than bench press
- O.K. if keep 45d. ABD and limit shoulder extension to 15d
- Be careful during rehab process w/closed chain exercises



Conclusion Post-op Rehab

- *Intelligent* early PROM is good
- Must be hands-on
- Fire-up RC
- Strengthen Scapula
- Stabilization Drills
- Focus on specific weakness of individual
- Education – key




Scapular position hyperangulation