Massive Rotator Cuff Tears:
active management and rehab of the irreparable tear

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Learning Objectives

• Describe the structure of normal tendon, the healing phases following tendon repair, and the strength of the healing tendon repair at each phase of recovery

• Identify factors that effect rehabilitation strategies and expected outcome following tendon repair

• Utilize knowledge of tendon healing science to develop safe and appropriate rehabilitation practices following tendon repair

• Describe conditions for and implications of the inoperable rotator cuff tear.

• Develop rehab strategies for optimizing function in the shoulder with a massive inoperable rotator cuff tear based on evidence in literature as well as sound biomechanical principles of exercise progression.

Normal Tendon Structure

• Killian, Cavinatto, Galatz et al; JSES 2012

• Normal tendon properties are largely derived from Type 1 collagen arranged in dense, parallel arrays (raw spaghetti in a box)

• Creates stiffness in the direction of the fiber orientation to allow transmission of force

• Tendon to bone transition, the enthesis (insertion site) is a stress concentration due to tissue type difference.

• Stress concentration managed by grading tissue type transition; having a small attachment angle; and interdigitating the transitional tissue with the bone
Normal Tendon Structure

Tendon Injury and Repair

- Killian article cont’d
- Inflammatory phase (days): increased vascular permeability; influx of inflammatory cells (platelets, macrophages, monocytes and neutrophils); fibroblasts; and tenocytes
- Proliferative phase (weeks): fibroblasts multiply to produce collagen (preferably Type 1) (disorganized – cooked spaghetti in a pot)
- Remodeling phase (months): decreased cellularity, collagen crosslinks form and organize in parallel line to imposed stress (pull of muscle)

Rotator Cuff Tendon Healing

- Requires healing of the tendon into the bone
  - Different from concerns of adhesions, for example in long flexor tendons
  - Different from concerns of joint capsule stiffness, for example in immobilized knee joint after patellar tendon repair

Gerber et al 1999 JBJS Br
- Looked at rotator cuff tendon healing in sheep model
  - 6 weeks – tendon stump swollen; 30% load to failure
  - 3 months – healing to bone observed with scarring in gap formation or directly to bone; 50% load to failure
  - 6 months – tendon to bone looks normal; 80% load to failure
**Summary of Healing as Relates to Rehabilitation Stages**

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Histology</th>
<th>Load to Failure</th>
<th>Rehab Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 weeks</td>
<td>Inflammatory – influx of cells/fibroblasts and tenocytes</td>
<td>25% normal at 6 weeks</td>
<td>PROTECT REPAIR Staged PROM</td>
</tr>
<tr>
<td>6-12 weeks</td>
<td>Tenuous scar initially disorganized; Type 3 collagen</td>
<td>50% normal at 12 weeks</td>
<td>Restore normal motion – amount and quality</td>
</tr>
<tr>
<td>3-6 months</td>
<td>Sharpey’s fibers forming; reorganizing along line of stress</td>
<td>80% normal at 6 months</td>
<td>Restore normal strength and function</td>
</tr>
</tbody>
</table>

**Healing Over Time**

28 days post supraspinatus repair reveals abrupt fibrocartilaginous line...loss of gradual transition

**Effect of Mechanical Load**

- Mechanical load is related to tendon size; i.e. increased load causes increased tendon size
- Stress deprivation induces catabolic state in tendon cells and tendon atrophy results
- Would intuit that following rotator cuff repair, load would stimulate a large and strong tendon repair!
Effect of Mechanical Load

- Thomopoulos 2003 J Biomechanical Engineering
- Tested above hypothesis on rats looking at effect of immobilization versus cage activity versus exercise (running on treadmill) following cuff repair
- Assessed biomechanical properties (cross sectional area, stiffness, and stress relaxation under load); histology; and cellular composition of tendon at insertion site
- Found: tendon to bone fiber organization better with immobilized rats
- Cellular composition most normal (more Type 1 collagen) in the immobilized rats at week 2 and 8; no diff at 16 weeks

Effect of Mechanical Load

- Thomopoulos concludes:
  - “Early in (rotator cuff) repair, protection of the interface is necessary.
  - “Healing of tendon to bone may require a unique loading environment for optimal repair. Increased loading across the healing insertion may cause microdamage at the interface and prevent integration of collagen into bone.”

Effect of Mechanical of Load

- Galatz 2009 JSES
- Complete immobilization combined with paralysis of rotator cuff tendons using Botox in rats after rotator cuff repair
  - Assessment at 12 weeks:
    - Decreased structural properties with less cross sectional area of tendons
    - Decreased load to failure
- Conclusion: complete stress removal is detrimental
Images of Tendon with Botox

Thomopoulos Revisits Things...

- IBMS BoneKEy (2011) 8, 271-285

  “Mechanical loading is necessary for the maturation of the insertion into a functionally graded material. The role of loading tendon-to-bone during healing more complex; low levels of load are beneficial and high levels of load are detrimental to healing.”

Effect of Mechanical Load

- Parsons 2010 JSES

  - Looked at subjects immobilized completely in a sling for 6 weeks
  - 10/43 (23%) classified as stiff (elevation less than 100; ER less than 30) at 6 weeks
  - No difference in ROM, Constant and ASES scores better in the stiffer group at 1 year
  - Better healing evidenced on MRI in the immobilized group (70% of “stiff group” healed; 30% of “non-stiff group” healed)
Comparison of Rehab Protocols on Healing

- Lee, Cho and Rhee 2012 J Arthroscopic and Rel Surg
- N=64; Differences in 2 groups for 6 weeks – all in sling with abduction pillow; no small or massive tears in study
- Group A had “aggressive early passive rehab” including manual therapy and self selected elevation with ER to 30
- Group B had elevation to 90 max by CPM, NO ER for first 3 weeks and then only to 30 deg
- After 6 weeks both groups progress in active motion to tol with strengthening after 3 months

Comparison of protocols (cont)

- Pain – no diff between groups at one year
- Motion
  - Group A more elevation at 3 months; no diff 6 months
  - Group A more ER at 90 deg abd at 3 months; no diff 6 months
  - Group A more ER with arm at side and more IR at 90 deg at 3 and 6 months; ER no diff at 1 yr; IR still stiffer in Group B
- Strength – no differences between groups at one year
- Functional rating – no differences between groups
- MRI – Group A 7/30 (23%) retear; Group B 3/34 (8%) retear

Authors conclude

- “Postoperative rehabilitation can be as crucial as surgical technique for successful healing of the rotator cuff.”
- “the first 6 weeks after surgery is an important period for ingrowth of the tendon to the bone surface” ...so attention needs to be given to optimizing healing during this timeframe
- Biggest difference in the phases: Group B kept elevation to 90 deg and held ER for 3 weeks
Two additional RCT’s conclude

- No differences between groups at later time period (6 months – 1 year) for ROM
- ROM is better at 3 months in the early movement group
- Healing rates trend towards better in the groups with delayed movement, but no statistical diff
- We desire to provide the best rehab outcome with a “do no harm” approach!!!

Effect of Passive Motion

- Park 2008 Am J Sports Med
  - Cadaveric study – ER to 30 deg caused gap formation in the leading edge of the supraspinatus tendon repair
  - Low strain from 0-90 elevation as long as in neutral rotation
  - ER to 30 18N strain in anterior fibers of supraspinatus

Effects of Passive Motion

- A systematic literature review article
  - CPM with physical therapy better than physical therapy alone for pain, motion and strength in short term
  - Differences not observed by 6 months
  - Conclude that CPM may be beneficial and seems safe after rotator cuff repair
  - No healing
Effect of Joint Mobilization

- Muraki 2007 Manual Therapy
  - Cadaveric study on grade 3 joint mobilization
  - N=9
  - Assessed strain in repaired supraspinatus tendon at 0 and 30 deg abduction with gap distances measured during traction, ant, post and inf glides
  - Strain significantly less at 30 deg than at 0, and was the same as in relaxed position, except for with inferior glide
  - Gap distances were 0 mm at 30 deg; and were up to 1.5 mm at 0 deg
  - Conclude: joint mobs safe at 30 deg except for inferior glides

Balancing Act

- In the immediate post operative setting following rotator cuff repair there exists a need for a balance of rest and immobilization for an optimal healing environment, while providing some stress to facilitate a strong, well aligned tendon

Do RCR patients get stiff?

- Burkhart group (Huberty et al paper)
- Only 4.9% (24/489) patients post RCR had true recalcitrant stiffness requiring a second procedure. Having 1/5 of these risk factors increased risk for stiffness (defined as pt. dissatisfaction with ROM)
- Higher risk:
  - Adhesive capsulitis
  - Small, single tendon rotator cuff tears
  - Concommitant labral repair
  - PASTA lesions (partial articular surface avulsion)
  - Calcific tendinitis
  - < 50 years of age
High risk for stiffness managed with early motion!

  - 79/152 patients identified in high risk group for stiffness and placed into modified rehab program
  - Modified rehab: Began table slides as tolerated; E, W, H; ER to 0 for massive tears to 45 deg for small to large
  - Regular rehab as above but no table slides
  - No patient in either group developed stiffness
  - The 73 patients with massive tears did not get stiff although they had a very conservative rehab program

Conclusions from Burkhart’s work

- Stiffness is not a huge problem after arthroscopic rotator cuff repair
- Massive cuff tears in older folks are less likely to get stiff than smaller tears in young people
- Limiting ER to 0 for massive tears did not result in stiffness
- Limiting PFE for first 6 weeks of recovery did not result in stiffness
- Should we just wait to move the big ones????

Strengthening…when

Sonnabend, Howlett, Young 2010 JBJS

- Histological evaluation of repair of the rotator cuff in a primate.
- “middle aged” baboons 2 each s/p RCR at 4, 8, 12 and 15 weeks post repair; assessed bone-tendon repair zones
  - 4 weeks immature healing
  - 8 weeks macroscopic evidence of healing with low number of Sharpey fibers until 12 weeks
  - 15 weeks approaching maturation...so
  - DEFER strengthening until at least 3 months
Other Factors to Consider

- Tear size
  - Small (< 1 cm)
  - Medium (1-3 cm)
  - Large (3-5 cm)
  - Massive (>5 cm)

Galatz 2004 JBJS
Reports up to 90% failure to heal in massive cuff repairs as evidenced by follow up (although many did improve regardless clinically and functionally!)

Other Factors to Consider

- Age
- Tissue quality (Kleenex versus Blue Jeans)
- Muscle atrophy with fatty infiltrate (Goutallier 2009)
- Degree of retraction – a repair under tension is more vulnerable
- Revision?
- Double row versus single row fixation
- “BAS” – big arm syndrome!!

Important to realize...

- NOT ALL ROTATOR CUFF REPAIRS ARE CREATED EQUAL!!
- MUST COMMUNICATE WITH REFERRING
Sling Effect on Healing

• Purpose of sling
  – Protect the rotator cuff repair by supporting the weight of the arm, thereby minimizing traction stress across the repair
  – Prevent the patient from excessive passive tension (moving too far)
  – Prevent the patient from actively using the arm

Research on Slings

• Reilly 2004 JSES
  – Increasing abduction angle from 0 to 30 deg decreased passive tension in the repair by 34 N. This force (34 N) was applied to the arm for 24 hours in neutral position and a 9mm gap in the repair formed.
  – Conclude that the use of the abduction pillow in the early postoperative phase of healing is beneficial in minimizing gap formation across the repair.

• Park 2009 Am J Sports Med
  – Assessment on the contact area of the footprint in various positions of abduction and rotation
  – Increased adduction resulted in improved contact area
  – Position of 30 deg abduction and 60 deg IR provided good contact area for double row fixation repairs

Sling position – effect on cuff tension

• In review, JSES, 2012
• Authors assessed strain across the supraspinatus, infraspinatus, and subscapularis in various positions of elevation and rotation.
• Determined that the optimum position for immobilization varied dependent on the muscle involved due to its line of pull relative to the joint axis.
  – Supraspinatus isolated: immobilize in the scapular plane
  – Infraspinatus and SSP: immobilize posterior the scapular plane
  – Subscapularis and SSP: immobilize anterior the scapular plane
Sling Wean - Impact on Healing

• Saul 2011 Clinical Biomechanics
  – Simulated 3 cm supraspinatus tear with computational modeling to assess the passive tension in various postures
  – Determined that increased abduction angles resulted in reduced force across the repair site, but increased vulnerability of the repair when the arm is adducted.
  – So...must wean from sling slowly. Suggest pillow removal first, then a few hours at a time out of sling over a 2 week period weaning, with strict activity guidelines.

Summary

• Rotator cuff repair requirements of tendon into bone healing poses unique demands that mandate a balance of immobilization and passive motion through safe excursion that does not disrupt the healing process during the first 6 weeks.

• Rehabilitation strategies should be based on known healing timeframes, with very gradual increase in active and passive tension across the repair that honor these healing timeframes.

Summary

• Rehabilitation should NOT be based on the absence of pain, appearance, ROM, and each patient should be managed individually giving consideration to all variables involved (age, size of tear, type of tissue, presence of fatty infiltrate, etc...) 
• Consideration to sling position should be made with recommendation to use an abduction pillow, and plane of immobilization as well as a gradual wean from the sling.
Phase 1 0-6 weeks

- Sling immobilization with abduction pillow 24/7 except for PT

- PT involves: initially EDUCATION (see sheet in Appendix)
  - Initial post op visit: elbow, wrist and hand ex, scapular retraction, supported pendulum
  - 1-2 weeks later if pain is well controlled: table top step backs for elevation to 90; ER with well arm to 30 unless subscap then hold to neutral for first 3 weeks
  - Use closed chain elevation (table slide or step back)

Rehab continued

- 4-6 weeks
  - May advance elevation to 120 passively
  - ER to 45 passively
  - IR behind back not allowed in first 6 weeks to prevent passive tension on repair
  - May begin aquatic therapy at 4 weeks if incision well healed – cue “don’t let the water ripple!”
  - Arm is 1/8 weight in water, so can be passive
Rehab continued - Phase 2

- 6-12 weeks: Motion Restoration
  - Goal is to slowly increase PROM to normal
  - All motion should be relatively painfree
  - Exercise induced pain should resolve within an hour or two after home or clinic session and icing
  - May begin AAROM to AROM as PROM normalizes – supine to incline to vertical, short to long lever arm progression
    - ER in s/l
    - Prone ext to hip with scapular retraction/depression
    - Serratus Anterior punches in supine
  - Function: use arm for ADL’s with nothing heavier than a coffee cup and no reaching above shoulder height

Phase 3 – Strength restoration

- 12 weeks
  - May begin light theraband for ER, rowing, serratus punches...
  - Scaption initially with weight of the arm; ceiling weight is 3 lbs
  - ER ceiling weight is 5 lbs
  - Strengthen subscap with belly press and bear hug and D2...
  - Scapular stabilizer program (serratus anterior, middle and lower trap mm)

Phase 4 – functional and sport specific training

- Most overhead activity OK for short bouts and without much weight after 4-5 months
- No overhead throwing prior to 6 months
- Ergonomic assessment as needed
- Explain Gym Do’s and Don’ts!!
  - Never: Military press, long arm abduction, bench posterior the frontal plane, lat pull behind the neck...
Case Presentation

• RC – 54 yo right hand dominant female with atraumatic full thickness tears in supra and infra, and infra was atrophic filled with fatty infiltrate.
• Xrays negative for high riding humeral head
• Elected cuff repair with subacromial decompression; biceps not found pathologic so left intact
• PT initiated 5 days post op: ED (see handout), E,W,H, supported pendulum, scap retraction to neutral

Case continued

• Week 2: Pain 2 (to 5 with HEP); compliant with sling; GFR 40%
• Began table top step back and well arm assisted ER
• PROM: elevation 30; ER(0) 20

• Week 4: Return to work full time at desk
• Pain 2 (to 8 with HEP); GFR 40%
• Advised – remove sling for work; ice more; gentle with HEP
• PROM: elevation 90; ER(0) 40

Case continued

• Week 6: Sling discontinued
• Pain: 0 (up to 5 with HEP); GFR 40%
• New HEP for Phase 2: supine well arm assisted elevation as tolerated; ER(0), ER(90) and IR behind back – cane or well arm assisted all as tolerated toward normal
• Passive elevation 90; ER(0) 35; ER(90) 40; IR posterior hip
Case continued

• Week 8 (2 months)
• Pain: 0 (up to 8 with ex); GFR 40%
• Felt pain too high for this stage of recovery; felt inflammatory in biceps; discussed with Dr. G and assistant – they ordered oral steroid taper (NO injections prior to 3 months)
• PROM: elevation 140; ER(0) 60; ER(90) 50
• Begin aquatic program to facilitate ease of motion; signed up for transition program and used pool daily before work

Case continued

• 2.5 months
• Now began joint mobilization and use of Graston Technique for release of Subscap for 3 sessions
• Pain 2/10; GFR 70
• Home Program: STRETCH to end range as tol often; doorframe Passive elevation 150; ER(0) 70; ER(90) 65
  Much less reactive after oral steroids

Case continued

• 3 months
• Pain is returning in shoulder and along biceps
• Adhesive Cap vs Biceps tendinitis???
  Dr. G did intraarticular injection – excellent relief!!
• PROM: elevation 170; ER(0) 80; ER(90) 85; IR to T10
• Motion is sufficient to progress to strengthening with AROM against gravity
Case continued

- 4 months – 19 visits later...
- Pain: 2/10 with HEP transiently
- GFR 85%; able to vacuum; just weak in overhead positions
- A/P ROM: elevation 170/175
- ER(0) 45/85 (recall ISp atrophy with fatty infiltrate)
- ER(90) 100; IR T9
- Maintenance: stretch to end range daily all planes; tband for ER, belly press, low and mid row and 90 to end range in supine

Case Points

- Elevation and ER deferred to week 2 given size of tear
- Inflammation was a problem but discussed with MD, initiation of oral steroid taper at 8 weeks and then injection at 3 months headed off full adhesive capsulitis sequela
- Delayed progress until PROM was fully restored at 3 months, and then added AROM with weight of the arm
- Pool program very helpful when reactive!
- Recognize ER strength can’t be normal knowing atrophy/fatty infiltrate

THANK YOU!!

- QUESTIONS???
What is an inoperable rotator cuff tear?

- Patient too old with medical comorbidities that preclude surgery
- Tendon tear is too large and retracted to far to consider successfully restoring to footprint
  - Retraction to glenoid
- (can be single tendon, or 2 or 3)
- Advanced fatty infiltration and muscle atrophy in the rotator cuff mm

What’s wrong with this picture?

- Humeral head superior glide due to un-pull of the deltoid
  - Yamaguchi 2010 ICSES – >1.5 cm tear associated with humeral head superior migration
- Articulation with acromion
  - Acetabularization/femoralization
- Pseudoparalysis – can’t effectively elevate the arm
- Worse case scenario – rotator cuff arthropathy

Considering Incidence

- 50% of population with RCT by 50 years
- 80% of population with RCT by 80 years
- MANY of these are asymptomatic “copers”

- Worland 2003 J Southern Ortho Assoc
- 40% of 59 patients over 50 years old had asymptomatic full thickness rotator cuff tears

- What is working for them???
More to think about...

- Galatz 2004 JSES
- 90% operated massive tears showed failure to heal, but good clinical outcome with increased ROM and improved functional score
- Was rehab part of the reason for the clinical improv

The versatile deltoid

- Duchenne de Boulogne 1867
- Described that isolated electrical stimulation of the deltoid muscle caused an inferior subluxation of the humeral head on the glenoid
- Contrasts with the traditional model that the deltoid has an overall superior glide of the humeral head balanced by the rotator cuff

Traditional view of deltoid/cuff force couple

Unopposed deltoid pull with superior migration of humeral head with massive rotator cuff tear
A new look at deltoid function

• Gagey and Hue 2000 Clin Ortho Rel Res

• Developed a mathematical geometrical model of the deltoid that considers the fibers of the deltoid that wrap around the humeral head separately from the long fibers of the deltoid more near the insertion.

• VERY MATH-Y!!

• Arrives at a resultant vector that has these superior fibers around the humeral head exerting a downward vector that counteracts the upward pull for a net vector near zero – so compression into the glenoid.

Gagey concludes:

• “One of the deltoid’s functions is to prevent upward migration of the humeral head and compress it against the glenoid, even in the presence of a large cuff tear. Consequently, the reeducation of the deltoid is a major aspect of the rehabilitation of disabled shoulders with a cuff tear.”

Research to support this

• Levy, Mullet, Roberts, Copeland 2008 JSES

• Population with massive inoperable RCT

• N=17; 3 tendon tears with retraction to glenoid; all with pseudoparalysis

• Ex 3-5X/day for 12 weeks:
  – Place and hold in “balanced position”
  – Short arc from “balanced position” 5 min
  – Progress to FROM
  – Add hand weight
  – Progress to inclined position
  – Resisted isometric to ant. Deltoid during active elevation
Levy study cont’d

- Assessed at 6 wks; 12 wks; 6 and 9 months
  - Constant Score increased from 26-63
  - Active elevation increased from 40 to 160
  - All subjects except for 3 were on no pain meds
  - 1 subject progressed to a reverse TSA; 1 progressed to SAD

   Rationale for success: anterior deltoid retrained to compress the humeral head into the glenoid while also working as an elevator

More research

- Ainsworth 2006 Musculoskeletal Care

  - Proposes that even when the infraspinatus is torn, teres minor usually intact and can assist with ER to clear the greater tuberosity from under acromion

  - Program incorporated
    - Education – expect to be weak overhead; adapt function to short lever arm reaching
    - Postural correction – kyphosis, etc...to optimize glenoid and acromion position
    - Strengthen – anterior deltoid; teres minor
    - Stretch – existent tightness

Ainsworth study cont’d

- Anterior deltoid program same as Levy article (supine placement, short arc, long arc, reclined)
- Progressed to standing wall slides
- Progressed to seated “short lever arm” lifts
- Yellow theraband ER
- Postural correction exercises

- N=10; clinic visits once a week for 4 weeks then every 2-3 weeks for 12 total; HEP 2-3X/day
- Oxford Shoulder Disability Questionnaire and SF36 tests both showed significant improvement by 12 weeks Not tested over time
Comparing Ant Deltoid model to Traditional theraband model

- Patino, Ovenza, Shupak, et al ICSES 2010
- Compared the anterior deltoid model of supine to inclined to vertical to theraband resisted IR/ER and scapular exercises
- N=15 each group
- Ex 3-5x/day for 3 months out of pain and without compensatory movements
- Constant and VAS scores higher in the deltoid group compared to theraband group

Systematic Literature Review for ex for full thickness RCT

- Ainsworth and Lewis 2007 Br J Sports Med
- Included randomized controlled trials or observational studies on patients with full thickness, massive, or inoperable tears managed with exercise only, and assessed with one or more outcomes that considered shoulder impairment, disability, pain, patient-perceived effect/benefit, impact on quality of life
- Obtained 0 RCT; 10 observational studies – 2 single case; 8 case series; 2 prospective; none blinded

Conclusion of the Review

- Need randomized controlled trials to assess an exercise approach to the management of cuff tears with standardization of validated outcome measures in order to compare study results.
- “…the inclusion of exercise therapy, either in isolation or as part of a nonoperative package of care for full thickness tears of the rotator cuff, has benefit.”
Putting it all together

• Exercise for the massive inoperable cuff tear is a reasonable option that may help and should focus on:
  – Graded anterior deltoid reeducation/strengthening
    • Balanced position (90 deg elevation) – hold in place; short range from balanced position; write alphabet
    • supine to inclined to vertical
    • short to long lever arm movement
    • vertical supported on wall
    • vertical short lever arm
    • Engage isometric cuff contraction of SSc if present during elevation; engage isometric anterior deltoid

Forward elevation series

Also work on...

– Strengthening for any remaining cuff mm (teres minor, subscap fibers) may help with humeral head depression
– Exercises for postural correction should be incorporated: thoracic extension; scapular
  • Motion – lift
  • Motion – lift
Forward Elevation Series

• Seek Successful Movement

Other ways to get movement quality improved

Eliminate gravity

Gravity assistance with resistance

Supported arm on incline with weighted ball roll

If Subscapularis still on board...
Aquatic Program

- Very nice adjunct
- Progress from AROM for elevation, ER/IR, horizontal add/abd, scaption, pendulum
  - Add gloves
  - Add paddles
  - Add lapboard presses forward/back and downward

Home or aquatic program daily

MOON Shoulder Group

- Effectiveness of physical therapy in treating atraumatic full-thickness rotator cuff tears: a multicenter prospective cohort study. JSES 2013; Kuhn et al
  - Multi-center prospective study – 9 sites; 16 MD’s
  - 422 patients in project; 90% followed over 2 years
  - All had MRI-documented, atraumatic, full-thickness rotator cuff tear (not necessarily nonoperative...)
  - PT program from prior MOON program to determine the optimal PT program for patients with impingement syndrome (included ROM, posture, ant and post shoulder stretching, and tband or light weights for cuff and scapular mm)

MOON project cont’d

- Patients had PT supervised and/or HEP; kept a home log of ex
- At 6 weeks could opt to d/c PT if well; continue PT 6 more weeks if better but not fully recovered; choose surgery
- First 6 weeks: mean number PT visits 8 and 60% had supervised PT along with HEP
- Second 6 weeks: mean number PT visits 7 and 40% had supervised PT + HEP
- Chose sx: 15% by 12 wks; 21% by 1 yr; 26% by 2 yr.
MOON project cont’d

• ROM gains were made for elevation, ER(0), ER(90) and abduction by 6 weeks without much further change by 12 weeks

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>6 weeks</th>
<th>12 weeks</th>
</tr>
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<tbody>
<tr>
<td>ASES score</td>
<td>52</td>
<td>78</td>
<td>83</td>
</tr>
<tr>
<td>WORC score</td>
<td>47</td>
<td>62</td>
<td>69</td>
</tr>
<tr>
<td>SANE score</td>
<td>46</td>
<td>62</td>
<td>70</td>
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</table>

MOON conclusions

• “This large, multicenter prospective cohort study has shown that a specific physical therapy protocol can be very effective in treating symptoms in patients with atraumatic full-thickness rotator cuff tears.”
• “...averaging slightly more than 1 PT visit/wk”
• “...in most patients in whom nonoperative treatment failed, this occurred within the first 12 weeks.”
• If a patient avoids surgery in the first 12 weeks, he/she is unlikely to undergo sx up to 2 years later.

Case 1

• 70 yo runner fell onto outstretched arm and injured shoulder. Ignored advice to follow up with Ortho; 8 months later fell again and injured shoulder badly. MRI confirmed massive inoperable cuff tear of SSp and Isp due to fatty infiltraion
• Referred to PT
• Seen once a week for 6 weeks; Total 6 visits
## Clinic progression

<table>
<thead>
<tr>
<th>Visit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>Pain</td>
<td>7</td>
<td>3 (to 7)</td>
<td>0 (to 5)</td>
<td>0 (to sore)</td>
<td>0 (to 3)</td>
<td>0</td>
</tr>
<tr>
<td>GFR</td>
<td>50%</td>
<td>75%</td>
<td>85%</td>
<td>90%</td>
<td>95%</td>
<td>98%</td>
</tr>
<tr>
<td>DASH</td>
<td>34%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13%</td>
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<tr>
<td>AROM - elevation</td>
<td>140 pain</td>
<td>170 pain</td>
<td>170 no pain</td>
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<tr>
<td>AROM ER</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex progression</td>
<td>Supine bent elbow elevation ER supin Alphabet Prone ext to hip</td>
<td>Add pool 2-3x a week</td>
<td>Straight arm for supine elevation Add glove in pool</td>
<td>2 lb for supine elevation and alphabet and prone extension</td>
<td>No change</td>
<td>3 lbs Incline not supine</td>
</tr>
</tbody>
</table>

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**THANK YOU!!**

- **QUESTIONS??**