Interventions and Management of Shoulder Rotator Cuff

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Outline

- EBM
  - Evidence, pt values, clinical expertise
- Management
  - General treatment approach
  - Specific Interventions
  - Judging improvement
- Consensus and Controversies
- Questions and Answer time…

Evidence Based Medicine

- Evidence
  - Study results - response of the majority
  - Evidence: 'first choice' of treatment
  - Pt not improving– your pt is in the minority?
- Clinical expertise
  - Valuable, however should not be used IN PLACE of evidence until evidence used
  - "Selective memory" – eyewitness to a crime
- Patient preference and values
  - More important than you think!

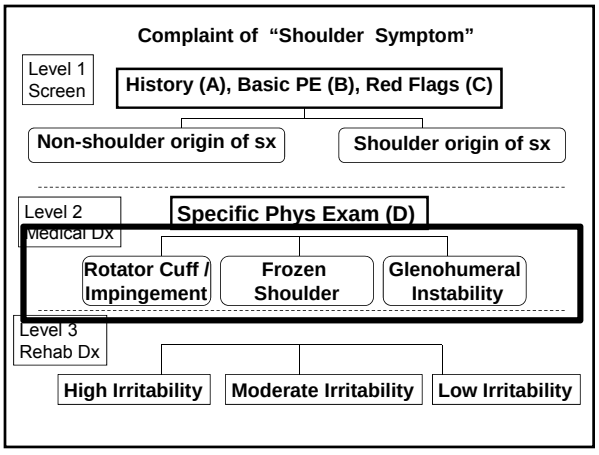
Not what you do, but how you sell it

(Scheele J, BMC MSK, 2011; Carroll LJ, J Rheumatol, 2009)

- Expectation of recovery
  - Your expectations for this episode of pain?
  - Do you think your injury will get better, worse, stay the same?
- Do you think PT will help this episode?
- Any interventions in particular helpful?

*** What to do with the answers?*

PT – a sales job – not 'what' you do, but how you sell it.



Treatment Categories

Impingement Syndrome	Instability	Adhesive Capsulitis	Other
"Control"	"Too loose"	"Too Tight"	e.g, fracture

- Subacromial Space Disorder
- Anterior – Superior Shoulder pain

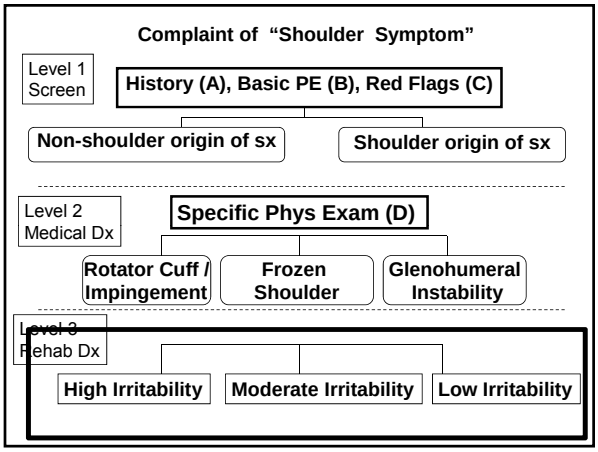
Systematic Reviews of SAIS/ Sh P

(Hanratty CE, 2012, Littlewood C, 2012, Brudvig TJ, 2011; Marinko LN, 2011; Kromer TO, 2009; Kuhn JE, 2009; Ainsworth, 2007; Michener LA, 2004; Desmeules, 2003)

- 9- 16 RCTs
- ↓ pain & ↑ function / disability:
  - Exercise- stretch & strengthen/ MC
  - Exercise + manual therapy to the glenohumeral joint and spine
  - Home exercise programs
- Passive treatments: not recommended
- US: not effective

Treatment Approach – Evidence-Based: Bottom Line Up Front

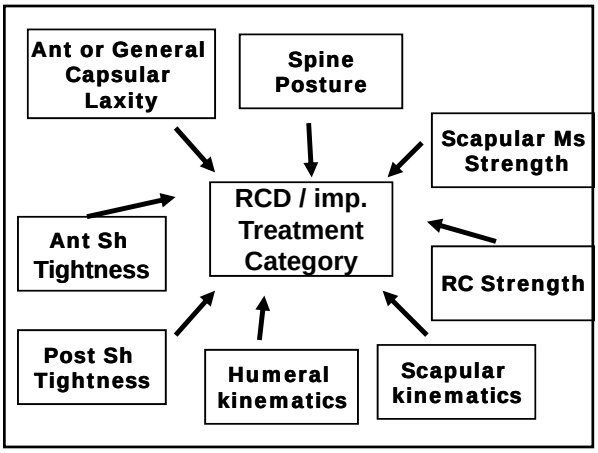
- Unsure (limited or no evidence):
  - Scapular taping –immed. effects only
  - Scapular motor control and stabilization exercise focus
  - Core stability training
  - Eccentrics focus
  - Frequency of treatment
  - Progression of treatment
  - Dose of exercise and manual therapy



High Irritability (3/5 to categorize)	Moderate Irritability (3/5 to categorize)	Low Irritability (3/5 to categorize)
• High Pain (≥ 7/10) • night or rest pain • consistent • Pain before end ROM • AROM < PROM • High Disability •(DASH, ASES)	• Mod Pain (4-6/10) • Night or rest pain intermittent • Pain at end ROM • AROM ≈ PROM • Mod Disability •(DASH, ASES)	• Low Pain (≤ 3/10) • Night or rest pain • none • Min pain with overpressure • AROM equal to PROM • Low Disability •(DASH, ASES)
Rx focus: • pain reduction	**Rx focus:** • pain reduction • improve impairments • improve basic functions (self-care, domestic tasks)	**Rx focus:** • restore higher demand functional activities (work demands, recreational and leisure activity)

Dose - Evidence

- High-dose vs low-dose chronic imping.
  (Osteras H, Open Ortho, 2010; Osteras H, Physiother Res Int, 2010)
- Hi-dose: ↑ pain & function 3, 6 & 12 months post
- High-dose:
  - 1-hr session, 9-11 exercises, 3 x 30 reps, 1000 reps per treatment, aerobic ex
- Low –dose: 2 x 10 reps/ exercise



Key Impairments

- Tightness
- Weakness
- Scapular Dysfunction

Clinical Trial of Rehab for Imping.

(Tate AR, McClure PW, Young IA, Salvatori R, Michener LA. JOSPT, 2009)

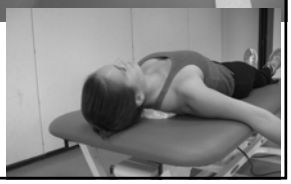
- Standardized impairment evidence-based Program:
  - Exercise
  - Manual therapy: shoulder and spine
  - Patient education
  - Home exercise program
- Standardized approach for dose, progression, and frequency
- Use this as the framework for defining the treatment approach

Tightness
Flexibility: Self Stretching

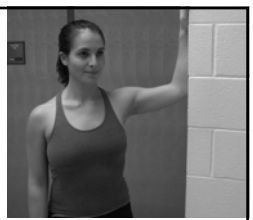
- Upper thoracic extension stretch
- Doorway pectoral stretch
- Crossbody stretch
- Shoulder flexion stretch
  - Supine (phase 1) → standing (phase 2,3)
- Shoulder ER stretch
- Shoulder IR stretch (towel)

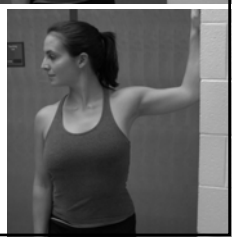
Upper thoracic extension stretch

- Lie on top of a vertically placed towel under the thoracic spine
- Shoulders ER



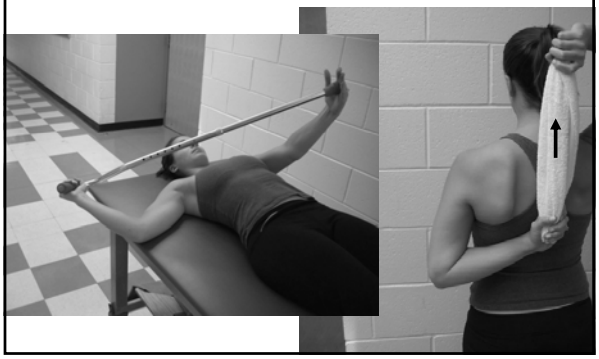
Crossbody and Pec stretch



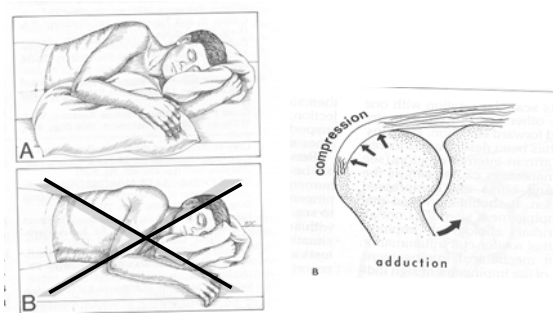


Shoulder flexion stretch

Shoulder IR and ER stretch



Patient Education: Sleeping posture



Strengthening and Motor Control

- Is it strengthening or motor control? Likely a combination
  - Rotator Cuff
  - Scapular Muscles
  - Other shoulder muscles – elevators, etc.

Scapular Muscle

- Upper Trapezius
  - REDUCE activity during arm elevation
  - Motor control can help – mirror, verbal feedback, manual
  - Exercises with more 'vertical orientation' increase UT activity

Scapular Muscle

- Lower trap and Serratus
  - INCREASE muscle activity at the right time during ROM
- Lower Trap
  - LT muscle test, rows, scaption, lower rows, 'down and back' command
- Serratus Anterior
  - Forward punch, scaption, knee push-up plus, supine punch, dynamic hug, push-up plus

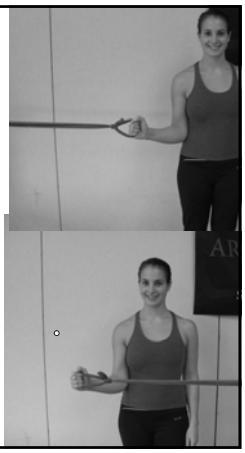
Rotator Cuff Muscle

- Exercise to best activate the cuff
  - IR and ER
  - Shoulder elevation – also hi levels of cuff
- Respect pain levels and muscle ability to determine start point and progression

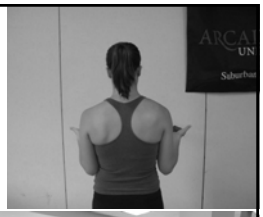
Maintain POSTURE & in non-painful ROM.

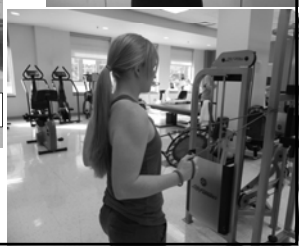
ER and IR at 0 deg

- Begin with arm at the side
- Pull away / towards your abdomen, then slowly release



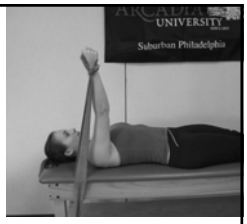
Scapular retraction





Scapular protraction

- Supine to reduce UT activity

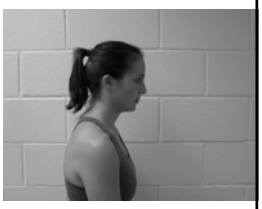


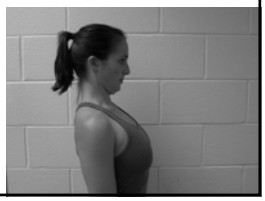
Active elevation with upper trap relaxation

- Lift your arm without shrugging

Upper quarter postural exercise

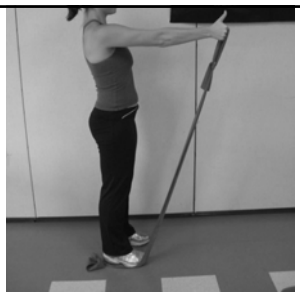
- Sitting or standing

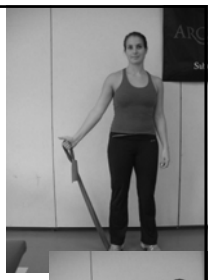


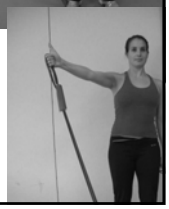


Criteria for progression to Phase 2

- Able to perform 3 sets of 10 reps with red non-latex or Green latex band without substantial pain or fatigue
- Strengthen rotators before progression to shoulder elevation

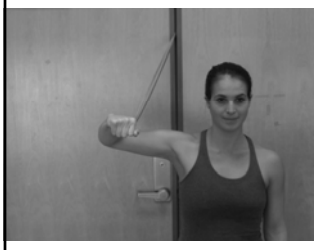


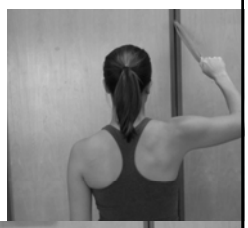


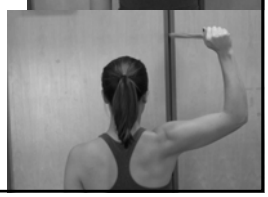


Scaption and Flexion

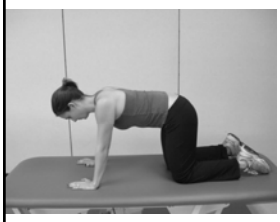
Shoulder ER and IR with abd (45º to 90º)

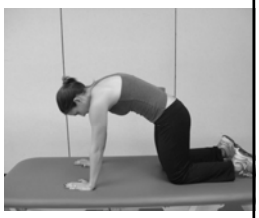






Quadruped push up plus (camel)





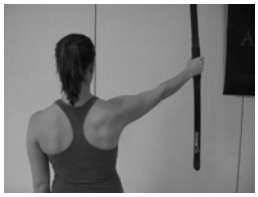
Prone shoulder scapular retraction "T" and "Y"

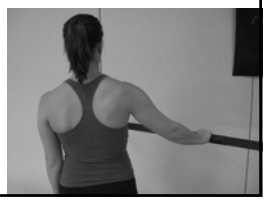
Phase 3 (not everyone will get to Phase 3)

- Progression: Perform Phase 2 (any color band) for 1 week without an increase in symptoms
- Continue exercises from phase 2 with progression of theraband resistance

Body blade

- 3 x 30 sec bouts
- Good scapular control!
- Start at ~ 60° then 90°





Forearm prone plank with plus Lawn mower pull

Treatment Approach – Limited Evidence

- Unsure (limited or no evidence):
  - Scapular motor control ex focus
  - Scapular taping
  - Core stability training
  - Eccentrics focus

Evidence – Scapular Dysfunction

- Motor Control:
  - Mechanistic evidence indicated scapular motion / kinematics and muscle activity can improve (Roy JS, Man Ther, 2009; Worsley P, JSES, 2012; DeMey K, JOSPT, 2012; Baybar, PTJ, 1998)
  - Pts reported ↓ pain & ↑ function with motor control focus
  - **Limitation: not RCTs

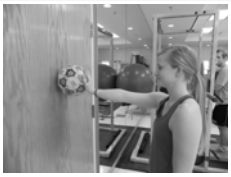
(Roy JS, Man Ther, 2009; Worsley P, JSES, 2012; Struyf F, Clin Rheumatol, 2012)

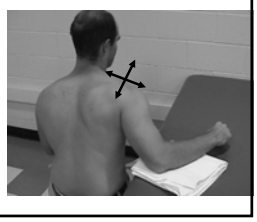
Evidence – Scapular Dysfunction

- Scapular Stabilization addition:
  - Addition of scapular stabilization exercises to the 'standard' ex program of stretch and strengthen
  - Improved muscle LT and elevation HHD strength and scapular dyskinesis

(Baskurt Z, J Back MSK Rehab, 2011)

Scapular Control and Mobility



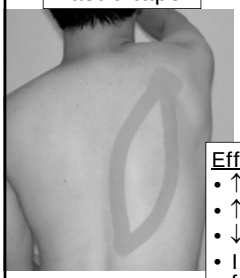


Scapular Taping

(Hsu, Yin-Hsin, 2009; Lewis J, JOSPT, 2005; Selkowitz DM, JOSPT, 2007)

Leukotape

Elastic tape



Effects in pts with SAIS:
- ↑ thoracic extension
- ↑ GH & scapular motion
- ↓ UT & ↑ LT ms activity
- Immediate effects only for patient-report

Core strength

- Assess core strength; can they do the following and maintain upright w/o deviations?
  - Single leg stance
  - Single leg squat
  - Single leg squat with arm movement (sport or work activity)

Non-thrust Manipulation (Mobs) & thrust Manipulations

General categories:

1- ↓ pain → evidence supports

2- ↑ spine motion → *NO* evidence ↑ motion, t-spine, ??? rationale for treatment ???

3- Central mechanisms via spinal cord to brain level → neurophysiological effects of manipulation that can improve ms activity, reduce pain locally and peripherally via central mechanisms

Evidence – Manual Therapy

- MT to GH, & or spine + ex vs exercise alone
  - Better than ex alone to improve function (Bang M, 2000; Bennell, 2010; Winters, 1999)
- GH mobs + ex or GH mobs alone vs. ex
  - No better outcomes (Chen J, 2009; Yiasemides R, 2011; Kachingwe A, 2008)
  - Better outcomes (Senbursa, 2011; Senbursa, 2007; Conroy, 1998)
  - Considering quality of trials and effect sizes…

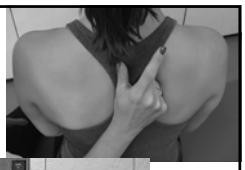
Evidence – Manual Therapy

- Spinal manipulation
  - Single-arm – 1-2 Rxs of t-spine manip to upper, middle, lower → improve shoulder AROM & patient-rated outcome (Strunce J, 2009; Mintken P, 2010; Boyles R, 2009)
  - RCT – improved outcomes with thoracic manipulation & HEP (Bergman, 2004; Winters J, 1999)
- Spinal manipulation appears to be beneficial. Active ingredient of Manual Therapy package?

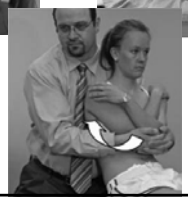
Thoracic PA glide

Thrust prone

Thoracic Thrust supine

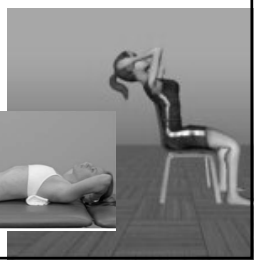


Mintken et al upper and mid



Spine Exercises/ Self- Mobilizations

- Supine over a towel
- Supine over a roller
- Seated thoracic and cervical extension over chair



GH mob: post glide during elevation

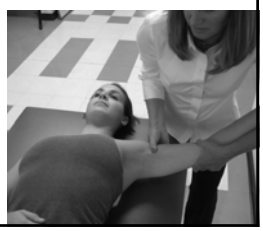
(Mulligan MWM)

- Posterior glide during arm elevation

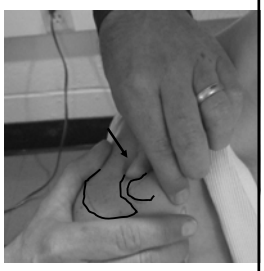
Posterior capsule stretch

- Stabilize scapula medially using thenar eminance of one hand
- Use other hand to apply a medially directed force
- 30 seconds x 3

GH mob / glides:

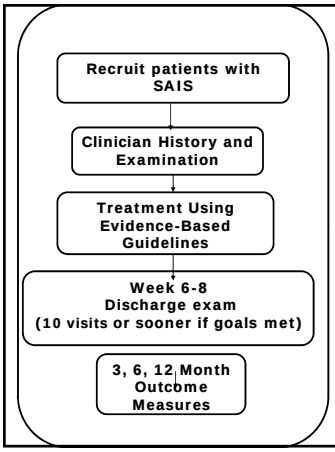


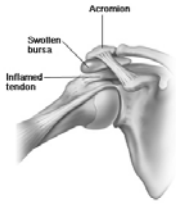
AC Joint: anterior and inferior glide



Evidence – HEP

- Home exercise programs can reduce pain and improve function Ludewig & Borstad, Occup Environ Med, 2003; Walther M JSES, 2004)
- This approach may be appropriate for some patients, but likely not all, as all patients did not resolve
- Consider this approach!





What predicts success with rehab?

Funded by the NATA-REF

Predictors of "Successful" Outcome

- 6 wks – 68% had a 'successful' outcome – 50% DASH ↑ & GROC – 'moderate better'
- Age- younger
- Stop sports or ex b/c of shoulder pain
- Regular exercise 3x/wk
- Symptoms 0-6 wks vs 12 wks
- Shoulder injection
- Some college education
- No pain at night

Predictors of "Successful" Outcome

- Less loss of active IR
- Less loss of passive flexion or abduction
- Shoulder pain reduced 2/10 pts with scapular reposition test
- Serratus anterior weakness
- What's else? Predictors of non-success and long-term outcomes… stay tuned!

RCD Management - Summary

- Treatment approach
  1. Strengthen /Motor Control – Rotator cuff, scapular, shoulder

     Motor control alone – unclear of effectiveness
  2. Flexibility –post cuff, pec minor, lats, CT spine
  3. Scapular Dysf –Scap taping + Motor Control, addition of scapular stabilization exercises
  4. Home exercise program
  5. Modalities – limited use, only in combination with active treatment

  6. Manual: Spine *OR* combined (GH, spine)
     - Pain, ↑ joint motion, other neurophysiological effects, ?? biomechanical at spine??
     - GH – alone -doesn't appear effective
  7. Use of impairments prn
- Guiding Treatment
  - Hi – Moderate – Lo irritability
  - Dose: Hi reps (dose)
  - Evidence 1st, then if not successful consider other interventions
  - Pt expectations- recovery, PT, PT interven.
  - Judge outcome- pt-report & performance

RCD Management

Consensus (evidence):

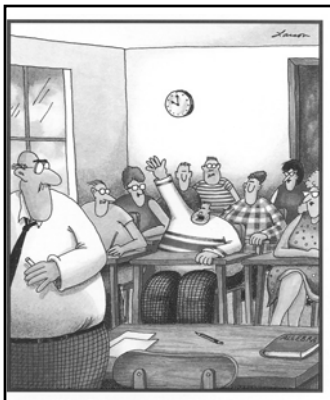
- PT helps the majority
- Exercise – stretch, strengthen, MC, HEP
- Addition of manual therapy to Exercise – Combined or spine
- US – not effective
- HEP may be enough for some folks

Controversy (weak/ no evidence):

- Guiding treatment- irritability?
- Hi dose (reps)
- Motor Control
- Scapular taping – only immediate effects
- Other modalities – ice, acupuncture, etc…
- Spine MT – can impair. drive decision-making?
- Core stability training

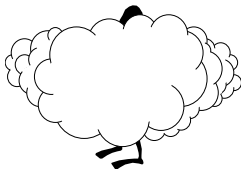
Thank you for your kind attention!

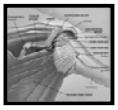
VCU



"Mr. Osborne, may I be excused? My brain is full."

Question and Answer Time





Consensus and Controversies in Rehabilitation of Rotator Cuff Disease:
Examination

ARCADIA UNIVERSITY

Phil McClure PhD, PT
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Rotator Cuff Tendinopathy: Diagnosis

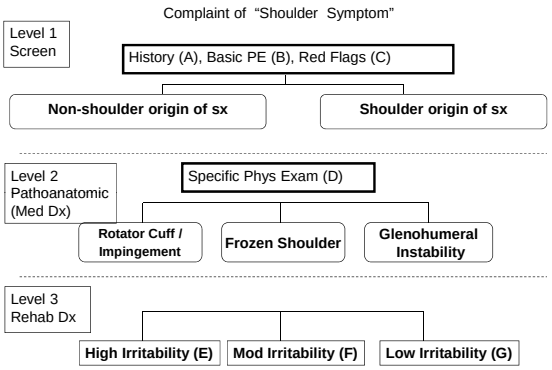
Does it matter ?

- **Guide Intervention**
  - Is "rotator cuff tendinopathy" a **homogeneous** group?
  - If not, how do we subgroup?
- **Inform Prognosis**

Does the classic ***pathoanatomic*** model work for ***rehabilitation?***

Orthopaedic Section: Shoulder Guideline Group

Diagnostic Classification Scheme
- Screening
- Pathoanatomic Dx (Medical Dx)
- Rehab Dx (Irritability)



Pathoanatomic Dx vs "Rehab" Dx

- Pathoanatomic Dx
  (Medical Diagnosis)
  - Pathoanatomic
  - Primary Tissue Pathology
  - Stable over episode of care
  - Guides general Rx strategy
  - Informs prognosis
  - Important for *Surgical Decisions*
- Rehab Diagnosis
  - Sx Severity / Impairment
  - "Irritability"
    - Current intensity
  - Often changes over episode of care
  - Guides specific rehab Rx
  - May inform prognosis

Rotator Cuff Tendinopathy: Examination Overview

- Differential Dx (Pathoanatomic/Medical Dx)
  - Be sure we have a problem that we can treat
  - Puts us in the "ball park"
- Identification of Key Impairments (Rehab Dx)
  - Guides specific rehab treatment
  - Weakness(Motor control, inhibition, disuse atrophy, tears)
  - Mobility (tightness or laxity… shoulder girdle & spine)
  - Scapular Dysfunction (due to weakness or mobility)
  - Environmental factors leading to overuse
- Outcome Measures (How do we keep score?)

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

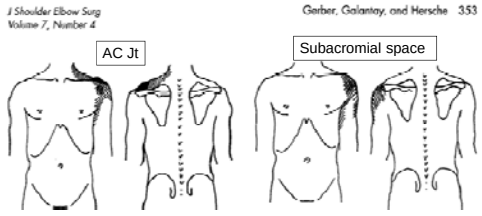
- Things that may look like RC tendinopathy… but are not
  - Cervical spine
    - Pain location, ROM, Upper Limb tension test, Spurlings, Traction test
  - Thoracic Outlet
    - Pain location, Upper Limb tension test, palpation brachial plexus @ Erb's point, Adson's
  - Frozen shoulder
    - LOM in multiple planes, females, 40-60 yo
  - Nerve injury (suprascapular, axillary, long thoracic)
    - Hx: traction or direct blow, weakness, palpation
  - Red Flags (Cardiac, Pancoast's tumor)
    - Pain location, males > 50, smoking

Reliability and Diagnostic Accuracy of the Clinical Examination and Patient Self-Report Measures for Cervical Radiculopathy

Test	- LR	+ LR
ULTTa	.12 (neg helps r/out)	1.3
Involved Cerv Rot <60 deg	.23 (neg helps r/out)	1.8
Distraction Test	.62	4.4 (pos help r/in)
Spurling's	.58	3.5 (pos help r/in)
2 of 4		.88
3 of 4		6.1
4 of 4		30.3

Wainner et al, Spine 2003 (NCS/EMG as criterion)

Pain Location

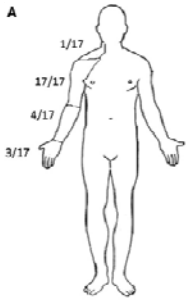


Hypertonic saline under flouroscopic guidance

- Anterolateral pain in all
- Posterior pain 3/10
- No pain above acromion or in supraspinatus muscle / scapular area

Gerber, 98, JSES

Pain Location



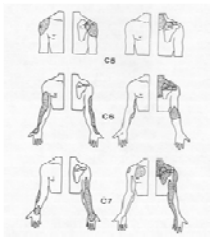
Subacromial injection of 1.5 ml of 5% hypertonic saline

- Anterolateral shoulder pain
- Pain above acromion rare
- Pain below elbow possible 4/17

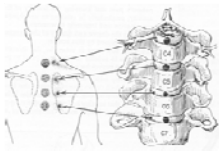
Stackhouse et al. 2012 JSES

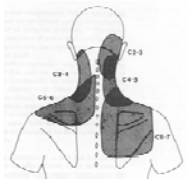
Kellgren Clin Sci, 1939
Feinstein JBJS, 1954

Interspinous Ligaments



Cloward, 1959
Annals of Surgery
Discogenic pain

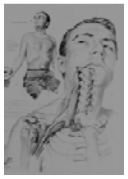




Dwyer et al Spine 1990

Facet pain

Brachial plexus entrapment/TOS
Special tests



Adson's

Costoclavicular compression

Direct palpation

- Elevated Arm Stress Test
- ULTT
- Others

Positive test = *reproduce chief complaint* sx

Diagnostic accuracy uncertain because gold standard is lacking

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may look like RC tendinopathy… but are not
  - Cervical spine
    - Pain location, ROM, Upper Limb tension test, Spurlings, Traction test
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    - Hx: traction or direct blow, weakness, palpation
  - Red Flags (Cardiac, Pancoast's tumor)
    - Pain location, males > 50, smoking

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

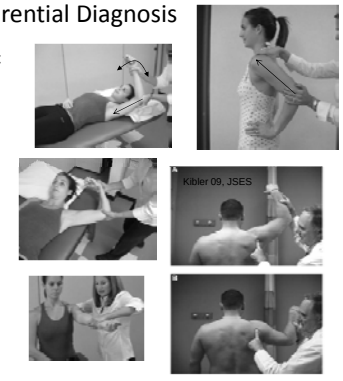
- Things that may *mimic or accompany* RC tendinopathy
  - Reasons why the patient may not respond well
- Full thickness RC tear
  - Age, weakness w/empty can, ER lag signs, Drop Arm
- SLAP lesion
  - Hx (click,pop,catch) + multiple tests
  - Biceps load, crank test, dynamic shear, Ant Slide, Speed's
- GH Instability
  - Hx, Apprehension/Relocation test, Sulcus
- AC joint
  - Pain location, palpation, horiz adduction, O'brien's
- Myofascial Trigger Points
  - Palpation of muscle belly

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may mimic or accompany RC tendinopathy
- Full thickness RC tear
  - Age, weakness w/empty can, ER lag signs, Drop Arm
  - All 3 tests tend to show :
    - High specificity
    - Mod sensitivity
    - **Helpful to r/in**
    - Not as helpful to r/o

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may mimic or accompany RC tendinopathy
- SLAP lesion
  - Hx (click,pop,catch) + multiple tests
  - Crank test, Biceps load, Speed's, Anterior Slide, Dynamic shear
  - Dx Accuracy Variable
  - Specificity: Mod-High
  - Sensitivity : Low-Mod



Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

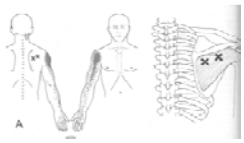
- Things that may mimic or accompany RC tendinopathy
- GH Instability
  - Hx, Apprehension/Relocation, Sulcus
  - Dx Accuracy
  - Specificity : High
    - (apprehension, not pain)
  - Sensitivity : Mod
  - Sulcus?

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may mimic or accompany RC tendinopathy
- AC joint
  - Pain location, palpation, horiz adduction, active compression (O'brien)
  - High Specificity
  - Variable sensitivity

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may mimic or accompany RC tendinopathy
- Myofascial Trigger Points
  - Palpation of muscle belly
  - Repro CC pain, taut band



Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Things that may *mimic or accompany* RC tendinopathy
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- GH Instability
  - Hx, Apprehension/Relocation test, Sulcus
- AC joint
  - Pain location, palpation, horiz adduction
- Myofascial Trigger Points
  - Palpation of muscle belly

??? Do these negatively affect prognosis?

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

- Rotator Cuff Tendinopathy
  - aka subacromial impingement
  - Neer's
  - Hawkin's
  - Jobe's Empty can (isom resist elev w/IR in plane of scap)
  - Painful Arc (60-120 deg)
  - Isom resist ext rot (Infraspinatus test)
  - Speed's
  - Horizontal adduction
  - palpation

Review

Physical examination tests of the shoulder: a systematic review with meta-analysis of individual tests

E J Hegedus,[1] A Goode,[1] S Campbell,[1] A Morin,[1] M Tamaddoni,[1] C T Moorman III,[1] C Cook[2]

BJSM 2012

…**more than you ever wanted to know about diagnostic accuracy!**

Conclusion Based on data from the original 2008 review and this update, the use of any single ShPE test to make a pathognomonic diagnosis cannot be unequivocally recommended. There exist some promising tests but their properties must be confirmed in more than one study. Combinations of ShPE tests provide better accuracy, but marginally so. These findings seem to provide support for stressing a comprehensive clinical examination including history and physical examination. However, there is a great need for large, prospective, well-designed studies that

Diagnostic Accuracy of Clinical Tests for the Different Degrees of Subacromial Impingement Syndrome
Park et al, JBJS, 2005

- Large Series, n= 359
- Physical Exam findings compared with Diagnostic Arthroscopy
- 8 tests
  - Neer's
  - Hawkin's
  - Painful Arc
  - Speed's test
  - Cross-body Adduction

  } Pain

  - Drop Arm test
  - Supraspinatus (empty-can position)
  - Infraspinatus (Arm at side)

  } Weakness

Diagnostic Accuracy of Clinical Tests for the Different Degrees of Subacromial Impingement Syndrome
Park et al, JBJS, 2005

- <u>High Sensitivity</u>
- Negative test helps <u>rule out</u>
  - Neer's
  - Hawkin's
  - Painful Arc

<u>Best Overall Combination</u>
•Hawkin's
•Painful Arc
•Infraspinatus test

- <u>High Specificity</u>
- Positive test helps <u>rule in</u>
  - Speed's test
  - Cross-body Adduction
  - Drop Arm test
  - Supraspinatus (empty-can position)
  - Infraspinatus (Arm at side)

Reliability and Diagnostic Accuracy of 5 Physical Examination Tests and Combination of Tests for Subacromial Impingement

Lori A. Mackenzie, PhD, PT, ATC; Matthew K. Walsworth, MD, PT, William C. Doukas, MD, Kevin P. Murphy, MD

N=55, Surgical Dx was gold standard
16/55 confirmed impingement, 39/55 negative

	+ LR	- LR
Neer	1.8	0.35
Hawkins	1.6	0.61
Painful Arc	2.3	0.36
Empty can (weakness)	3.9	0.57
Ext Rot Resist (weakness)	4.4	0.5
≥3/5 positive	2.9	-
< 3/5 positive		0.34

Diagnosis of Rotator Cuff Tendinopathy
(aka subacromial impingement)

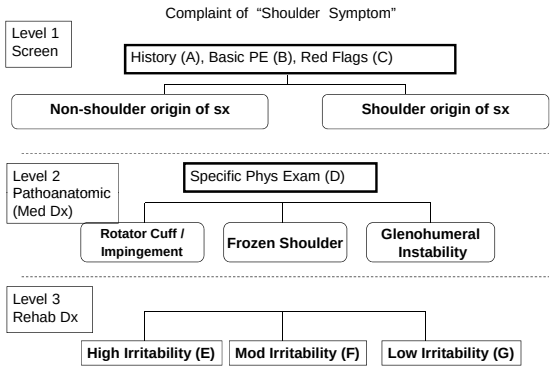
My bottom lines:

- ***Always*** some degree of uncertainty
- Correlate with hx and sx's
- Look for multiple tests to be positive/negative
- Try to identify other coexisting pathology
  - Do these affect outcome?
- ***Pathoanatomic diagnosis*** may not be critical to directing rehab treatment

Rotator Cuff Tendinopathy: Examination
Differential Diagnosis

Summary: Pathoanatomic/Medical Dx

- Rule Out Other Diagnoses
  - C-spine / TOS / FrozenShdr / Nerve Injury / Red Flag
- Identify Additional problems
  - RC Tear / SLAP / Instability / AC Jt / Trigger Pts
- Rule In RC tendinopathy
  - (+) Neer or Hawkins
  - (+) Pain/weakness with resisted Empty can or Ext Rot
  - Painful arc



Rotator Cuff Tendinopathy: Examination
"Rehab Diagnosis"

- Identify Stage of Irritability
- Identify specific impairments that guide treatment
  - Weakness (Cuff)
  - Tightness (post capsule, pec minor, lats, t-spine)
  - Scapular Dysfunction

Rotator Cuff Tendinopathy: Examination
Irritability Classification

	Irritability		
	High	Moderate	Low
History and Exam	• High Pain (≥ 7/10) • night or rest pain • consistent • Pain before end ROM • AROM < PROM • High Disability •(DASH, ASES)	• Mod Pain (4-6/10) • night or rest pain • intermittent • Pain at end ROM • AROM ~ PROM • Mod Disability •(DASH, ASES)	•Low Pain (≤ 3/10) • night or rest pain • none • Min pain w/overpressure • AROM = PROM • Low Disability •(DASH, ASES)
Treatment Focus	• pain reduction • activity modification	• pain reduction • impairments • basic function	• High demand functional activity restoration

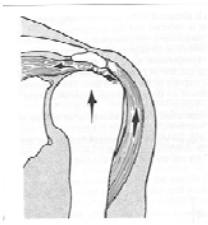
Kelley et al JOSPT 09

Matched Treatment Strategy

	High Irritability	Moderate Irritability	Low Irritability
Patient Education	+	+	+
Activity Modification	+	+ / --	--
ROM/ Stretch	Pain-free passive AAROM	AAROM → AROM	End-range/ overpressure
Manual Techniques	Low grade	Low / High grade	High grade
Neuromuscular Performance	--	Light → mod resistance Mid-ranges	Mod → high resistance End-ranges
Functional Activities	--	Basic	High demand
Modalities	+/-	+/-	--
Taping / functional support (brace / external)	+ / --	+ / --	+ / --

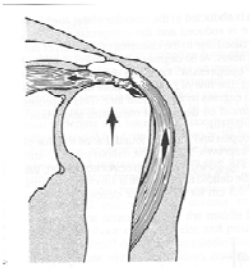
Rotator Cuff Tendinopathy: Examination
Specific Impairments: Cuff Weakness

- Cuff "weakness" (? inhibition) allows superior migration which may perpetuate impingement



Mechanisms of Impingement
Muscle Performance

- Several studies have documented abnormal superior glide under different conditions:
- Cuff tear:
  - 100% with full RC tear
  - 14% after cuff repair
  - Paletta JSES '97
- Cuff tear or Stage II impingement
  - Deutsch JSES '96
- Muscle fatigue
  - Chen JSES '99



"Gaps" related to ***muscle performance***

- Does an isometric test of peak force adequately capture "*muscle performance*"?
  - Motor control during dynamic activity?
  - Deltoid/cuff balance?
  - Endurance ?
  - What is the ***source*** of weakness?
    - Poor motor control => quality vs quantity in exercise
    - Poor neural activation from CNS => estim, biofeedback or better pain control to avoid inhibition
    - Disuse atrophy => traditional PRE
    - Tear => surgery or compensatory strategy

Rotator Cuff Tendinopathy: Examination
Specific Impairments: Posterior Tightness

- Posterior Capsule
  (Harryman, 1990)

increased posterior shoulder tightness
⇩
HH sup translation & ↓ed GH IR AROM
⇩
decreased subacromial space
⇩
mechanical compression of SA tissues

Glenohumeral
Internal
Rotation
Deficit

Decreased IR ROM on side of impingement compared to unaffected side
Tyler et al, 2000 AJSM

An increase in IR ROM correlated well (r=0.54) with improved outcome following rehab at 6wks
McClure 04, PTJ

Posterior Shoulder Tightness:
What do we measure?

Tyler et al; JOSPT, 1999

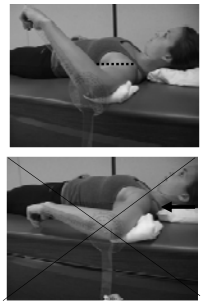
Awan et al APMR, 2002

ASES: Richards et al JSES 94

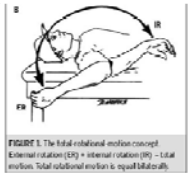
Mallon et al JSES, 1996
Edwards et al JSES 2002

PROM: Internal Rotation 90° abduction

- Supine
- Humerus 90° abduction, elbow flexed 90°
- Fulcrum at olecranon process
- Stationary arm perpendicular to floor
- Align moveable arm with ulnar styloid
- End the movement when the acromion elevates anteriorly (beyond dashed line in top picture)

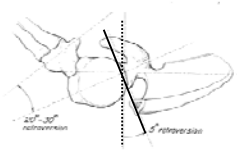


Total Arc of Rotational Motion

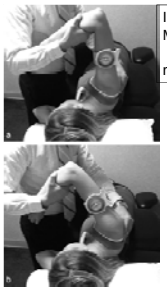


From Wilk 09 JOSPT

Throwers
- Increased ER
- Decreased IR
- may be attributable to bony changes in glenoid or humeral retroversion



PROM: Horizontal adduction



ICC= 0.79
MDC_{90}=8 deg

r= 0.54 w/IR_{90}

Salamh, IJSPT, 2012

ICC= 0.94
MDC_{90}=4.2 deg

r= 0.35 w/IR_{90}

Myers, AJSM 2007

Accessory Motion: GH and AC jts

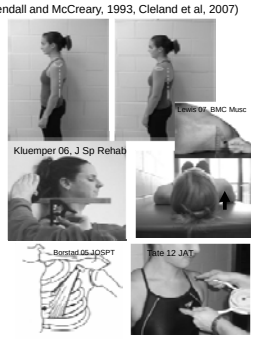
- Pain
- End-Feel
- Motion
- *Reliability?*

Rotator Cuff Tendinopathy: Examination

Specific Impairments: Posture, Thoracic Spine, Pec minor Tightness

(Kendall and McCreary, 1993, Cleland et al, 2007)

- Posture
  - Thoracic kyphosis and protracted shoulder may decrease subacromial space and put rot cuff at mechanical disadvantage
    - Kebeatse 99 APMR, Solemn-Bertoft 93 CORR
  - **No good evidence suggesting posture is strongly related to sx's**
- Pec Minor tightness
  - may alter scapular kinematics
  - Less post tilt, less scap ext rot
    - Borstadt 05 JOSPT
  - Shorter in symptomatic HS swimmers (Tate 2012, JAT)
  - **No good evidence suggesting pec minor is strongly related to sx's**



Lewis 07, BMC Musc

Kluemper 06, J Sp Rehab

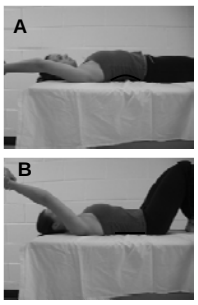
Borstad 05 JOSPT

Tate 12 JAT

Rotator Cuff Tendinopathy: Examination

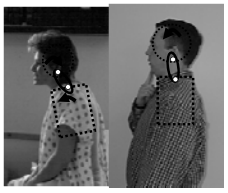
Specific Impairments: Tightness (Latissimus)

- Reduced latissimus length indicated by obviously decreased flexion in B compared to A



Rotator Cuff Tendinopathy: Examination
Specific Impairments: Tightness (Thoracic mobility)

- Spring testing
  - Based on examiners perception of mobility at a level relative to those above and below and examiner's experience and perception of normal
  - Hypomobile/Hypermobile
  - ? Pain
- Biomechanic vs Neurophysiologic Mechanisms
- If *not stiff*, do we still manipulate?

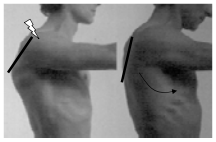


Rotator Cuff Tendinopathy: Examination
Specific Impairments: Scapular Dysfunction

- Visual Classification
  - Scapula Dyskinesis Test (McClure 09 J Athl Tr)
- Symptom Altering Tests
  - Scapula Reposition Test (Tate 08, JOSPT)
  - Scapula Assistance Test (Rabin 06, JOSPT)
- Force Measures
  - Trap
  - Serratus

Scapular Dysfunction

- Is it related to common shoulder pathologies?
  - *Maybe*
  - Most studies show small (but stat sig) motion differences between groups (sx vs asymp)
  - Large variability in "normal" or asymptomatic subjects
  - Strong evidence showing scap dysfunction causing shoulder pain / pathology is lacking
  - Must try to relate sx's to scap dysfunction in specific patient



Scapular Examination: Specific Impairments

- Is there "Dysfunction"?
  - Visual Classification
    - Scapula Dyskinesis Test (McClure 09 JAT, Tate 09, JAT)
    - "Yes /No" test (Uhl , 09, Arthros)
  - Symptom Altering Tests
    - Scapula Retract/Reposition Test (Kibler 06 AJSM, Tate 08, JOSPT)
    - Scapula Assistance Test (Rabin 06, JOSPT)
- If there is Dysfunction…Why?
  - Muscle Strength / Motor Control
    - Trap
    - Serratus
  - Flexibility of Key Structures: Pec Minor, T-spine, Post Cap

Classifying scapular motion: the scapula dyskinesis test (SDT)

- 5 repetitions::
  - Flexion (weighted)
  - Abduction (weighted)
- Rate scapular motion on each test as:
  - **Normal (N)** motion: no evidence of abnormality
    - Medial border and inferior angle relatively flat
  - **Subtle (S)** dyskinesis: mild/questionable evidence of abnormality, not consistently present
  - **Obvious (O)** dyskinesis: striking, clearly apparent abnormalities, evident on at least 3/5 trials
    - Winging 1" or greater displacement of scapula from thorax
    - Dysrhythmia
- Subjects may repeat test

Dyskinesis: Winging

- Movement of medial border and/or inferior angle away from the thorax, **becoming more prominent** during arm motion with a sulcus/gap between the scapula and the thorax:
  - ≥1" is considered abnormal
  - May be unilateral or bilateral

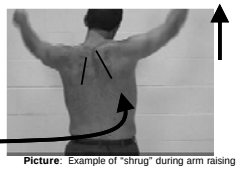
Picture: Posterior view of winging

Picture: Superior view of winging

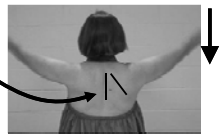
Dyskinesis: Dysrhythmia

Describes a lack of "smooth" scapulohumeral rhythm

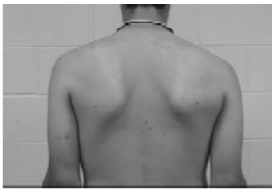
- A "hitch or a jump in the otherwise smooth motion." (Kibler, 2003)
- Most common pattern is early/excessive scapular elevation (**shrug**)
- Another common pattern: rapid downward rotation during lowering (**dump**)



Picture: Example of "shrug" during arm raising



Picture:"Dumping" during arm lowering



Winging

Dysrhythmia: "Dumping"

Are Symptoms Related to Dyskinesis?

- Penn Shoulder Score (Leggin et al 06)
  - Pain Sub-Scale
    - Total 30
  - Sx's at rest (0-10)
  - Sx's with normal use (0-10)
  - Sx's with strenuous use(0-10)
- n = 104
  - Only subjects rated as obvious or normal by two raters
  - Rater disagree or subtle discarded
- Odds ratios (95% CI)
  - **Does having dyskinesis increase your odds of having sx's? … NO**

Pain ≥ 3/30	**-Sx's**	**+ Sx's**
- Dyskinesia	39	37
+ Dyskinesia	16	12

OR = 0.79 (0.33 -1.89)

Pain ≥ 6/30	**-Sx's**	**+ Sx's**
- Dyskinesia	61	15
+ Dyskinesia	24	4

OR = 0.68 (0.2 -2.25)

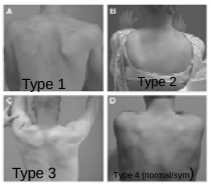
Evaluation of Clinical Assessment Methods for Scapular Dyskinesis

Arthros 09

Tim L. Uhl, Ph.D., P.T., A.T.C., W. Ben Kibler, M.D., Ben Gecewich, M.S., A.T.C., and Brady L. Tripp, Ph.D., A.T.C., L.A.T.

Compared asymmetry in 3D testing -sx's (n=35) vs no sx's (n=21)

- Flexion probably most sensitive
- Asymmetry common



no asymmetry, single-plane asymmetry, and multiple-plane asymmetries. The Pearson χ^2 analysis for flexion motion showed significant differences in the frequency of asymmetrics between the 2 groups, with more multiple-plane asymmetrics for the symptomatic group (54.3% [19 of 35]) compared with the asymptomatic group (14.3% [3 of 21]) ($P = .002$) (Table 4). There was no significant difference in the frequency of asymmetries between the 2 groups for elevation in scaption ($P = .97$). The overall prevalence of scapular asymmetry in any plane was not different for the asymptomatic and symptomatic subjects, with 27 of 35 (77%) and 16 of 21 (76%), respectively, in scaption ($P = .87$) and 25 of 35 (71%) and 15 of 21 (71%), respectively, in flexion ($P = .66$).

Symptom Altering Tests

- Modified Scapular Assistance Test
  - Posteriorly tilt and upwardly rotate scapula (Rabin et al, JOSPT 2006)
  - Documented reliability (77-91% agreement)
  - 40-49% tested "positive" (≥ 2pt change)
- Scapula Retraction Test
  - Kibler et al AJSM, 2006
  - Patients and healthy
  - increased strength with scap stabilization
  - No sig change in pain
- Scapula Reposition Test
  - Tate, McClure, Kareha, Irwin (JOSPT 2008)
  - Overhead athletes, Empty can test
  - 26-29% had significant increase in strength
  - 48% had decrease in pain

Measuring Shoulder Outcome: Keeping Score!

Shoulder Pain

Michener et al, JSR, 2010

- Ave of 3 Pain items
- NPRS 0-10
  - Rest
  - Normal ADL
  - Strenuous
  - 4-6 wk Rx
- MCID: 2.2

Mintken et al JSES 2009

- Ave of 3 Pain items
- NPRS 0-10
  - Current
  - Least 24 hr
  - Worst 24 hr
  - 2-4 wk Rx
- MCID 1.1
- MDC 2.5

Bottom Line: Look for at least a 2 pt change in pain

Shoulder Outcome Scales

- DASH (Disabilities of the Arm, Shoulder, Hand)
- Quick DASH
- ASES (American Shoulder and Elbow Surgeons)
- PENN Shoulder Scale
- Lots of others!

Shoulder Outcome Scales

Scale	Content	MDC	MCID
DASH	30 questions sx's (5), & function (25) 0-100 scale	12.8	10.2
Quick DASH	11 questions sx's (3)& function (8) 0-100 scale	11.2	8.0
ASES	10 function (50%) Pain (50%) 0-100 scale	9.7	6.4
Penn SS	30 Pain 10 Satisfaction 60 function 100 Total	12.1	11.4

DASH/Quick DASH Sports/Performing Arts Module

Please circle the number that best describes your physical ab

Did you have any difficulty:	NO DIFFICULTY
1. Using your usual technique for playing your instrument or sport?	1
2. Playing your musical instrument or sport because of arm, shoulder or hand pain?	1
3. Playing your musical instrument or sport as well as you would like?	1
4. Spending your usual amount of time practicing or playing your instrument or sport?	1

Evaluate/Manage Patient Expectations

Questions

- Do you expect to get better?
- Do you think PT will be helpful?
- Any specific treatment you think will be most effective?

- Use to *evaluate and influence* patient expectations.

Rotator Cuff Tendinopathy: Examination Summary

- Differential Dx (Medical Dx)
  - C-spine, TOS, Frozen Shdr, Nerve Injury, RedFlags
  - RC Tear, labral injuries, GH instab, AC jt, Trigger pts
- Rehab Dx
  - Irritiability (guides Rx strategy and intensity)
  - Key Impairments
    - "Weakness" (cuff & scapula)
    - Tightness (post capsule, pec minor, lats, cervicothoracic)
    - Scapular Dysfunction (motion and sx altering tests)
- Outcome Measures (keeping score)
  - DASH, Quick DASH, ASES, Penn Scale, others

Rotator Cuff: *Examination*

Consensus (evidence):

- r/o other pathology
- Key Sx's
  - Ant/lat arm pain
  - Often overuse
- Key Signs
  - Multiple should be present
- Key Impairments:
  - Cuff "weakness"
    - Source? Endurance?
  - Posterior tightness
- Use an Outcome scale

Controversy (weak/no evidence)

- Does co-existing pathology predict worse outcome or require different treatment?
- What impairments are truly related to sx's ? (causal or perpetuate)
  - Scapular Dysfunction
    - Motor control / weakness
    - Tightness
  - Pec tightness (clinical measure?)
  - Thoracic mobility