

Physical Therapy for Shoulder Pain: State of the Art

Shoulder Network Netherlands

Den Bosch, Netherlands

15 December 2017



American
Society of
Shoulder and
Elbow
Therapists

Lori A Michener, PT, PhD, ATC, SCS
Division of Biokinesiology & Physical Therapy
University of Southern California
Director of Clinical Outcomes & Research
Director – COOR Lab
lmichene@pt.usc.edu
<http://pt.usc.edu/COOR/>



@LoriM_PT



Moving helps to learn and appreciate different perspectives





Three topics

- Classification of shoulder pain for rehabilitation
- Outcomes measures
 - Demonstrate value of care
- Scapular dyskinesis – what is the value to evaluate?

Staged Approach for Rehabilitation Classification: Shoulder Disorders (STAR–Shoulder)

Philip W. McClure, Lori A. Michener

Shoulder disorders are a common musculoskeletal problem causing pain and functional loss. Traditionally, diagnostic categories are based on a pathoanatomic medical model aimed at identifying the pathologic tissues. However, the pathoanatomic model may not provide diagnostic categories that effectively guide treatment decision making in rehabilitation. An expanded classification system is proposed that includes the pathoanatomic diagnosis and a rehabilitation classification based on tissue irritability and identified impairments. For the rehabilitation classification, 3 levels of irritability are proposed and defined, with corresponding strategies guiding intensity of treatment based on the physical stress theory. Common impairments are identified and are used to guide specific intervention tactics with varying levels of intensity. The proposed system is conceptual and needs to be tested for reliability and validity. This classification system may be useful clinically for guiding rehabilitation intervention and provides a potential method of identifying relevant subgroups in future research studies. Although the system was developed for and applied to shoulder disorders, it may be applicable to classification and rehabilitation of musculoskeletal disorders in other body regions.



P.W. McClure, PT, PhD, FAPTA,
Department of Physical Therapy,
Arcadia University, 450 S Easton
Rd, Glenside, PA 19038 (USA).
Address all correspondence to
Dr McClure at: mcclure@arcadia.edu.

L.A. Michener, PT, PhD, ATC, SCS,
Division of Biokinesiology and
Physical Therapy, University of
Southern California, Los Angeles,
California.

[McClure PW, Michener LA.
Staged approach for rehabilitation
classification: shoulder disorders
(STAR–Shoulder). *Phys Ther*.
2015;95:791–800.]

© 2015 American Physical Therapy
Association



Why Classify?

- Direct Intervention:
 - What should be done with “this problem”?
- Prognosis : How should “this problem” go?
- Communication:
 - Research: Understanding “this problem”
 - Payers: What is usual care for “this problem”
- “This problem” usually means “diagnosis”
 - Does pathology adequately classify?

Key features



1- Pathology is first step

- But, pathology is not homogenous, thus rehab treatment is not

2- Then, Rehabilitation decision-making

a- Irritability

b- Impairments

- *- Match treatment intensity & interventions with further classification category*

Staged Approach for Rehabilitation of Shoulder Disorders

Complaint of "Shoulder Symptom"

Level 1: Screening
History, Basic Physical Examination, Red or Yellow Flags

Appropriate for
Physical Therapy

Appropriate for
Physical Therapy
and Referral

Not Appropriate for
Physical Therapy

Level 2: Pathoanatomic Diagnosis
Specific Physical Examination

Shoulder Origin of Symptoms

Nonshoulder Origin of Symptoms

Subacromial Pain
Syndrome

Adhesive Capsulitis

Glenohumeral
Instability

Other

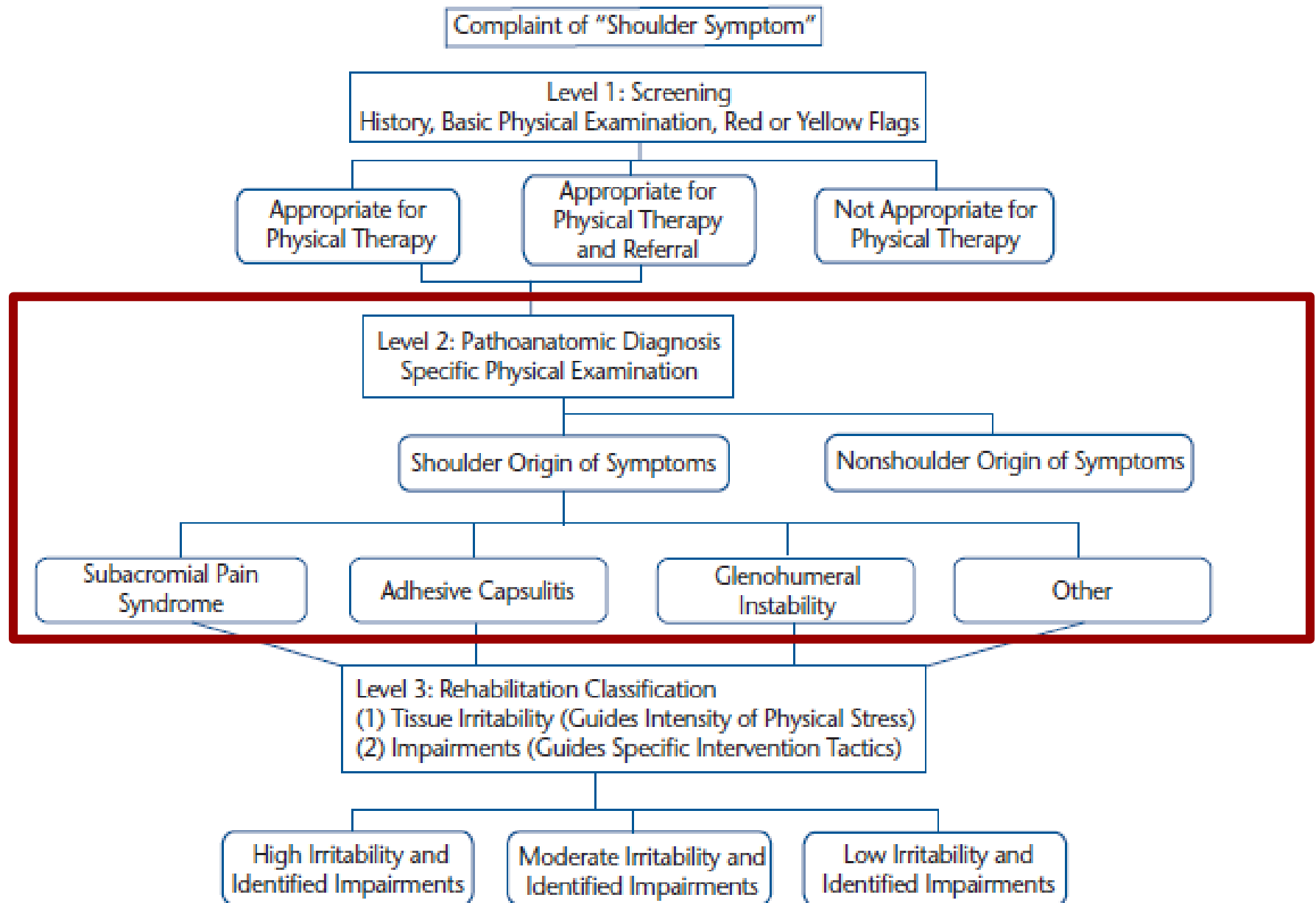
Level 3: Rehabilitation Classification
(1) Tissue Irritability (Guides Intensity of Physical Stress)
(2) Impairments (Guides Specific Intervention Tactics)

High Irritability and
Identified Impairments

Moderate Irritability and
Identified Impairments

Low Irritability and
Identified Impairments

Staged Approach for Rehabilitation of Shoulder Disorders



Level 2

Pathoanatomic Diagnoses

	Subacromial Pain Syndrome Rotator Cuff	Adhesive Capsulitis	Glenohumeral Instability	Other
“Rule in”	<u>Key positive findings</u> <ul style="list-style-type: none">•impingement signs•Painful arc•Pain w/ isom resist•Weakness•Atrophy (tear)	<u>Key positive findings</u> <ul style="list-style-type: none">•Spontaneous progressive pain•Loss of motion in multiple planes•Pain at end-range	<u>Key positive findings</u> <ul style="list-style-type: none">•Age usu < 40•Hx disloc / sublux•Apprehension•Generalized laxity	<ul style="list-style-type: none">•GH Arthritis•Fractures•AC jt•Neural Entrap•Myofascial•Fibromyalgia•Post-Op
“Rule Out”	<u>Key negative findings</u> <ul style="list-style-type: none">• Sig loss of motion• Instability signs	<u>Key negative findings</u> <ul style="list-style-type: none">• Normal motion• Age < 40	<u>Key negative findings</u> <ul style="list-style-type: none">• No hx disloc• No apprehension	

Pathoanatomic diagnosis based on specific physical examination (+/- imaging). Most diagnostic accuracy studies address this level. As examples, findings are listed for the three most common diagnoses only.



Diagnosis of Rotator Cuff Disease

Rotator cuff disease

- Full-thickness RC tear

- Partial thickness RC tear

- Bursitis

- Tendinitis

- Tendinopathy

- Subacromial impingement

Single clinical
Dx category:


- *Subacromial
pain syndrome*

Same general
approach, but
impairments and
irritability

considered for
staged approach
for rehabilitation



What's in a name....

-  'subacromial impingement'
 - Limited support for compression mechanism
 - Perpetuates flawed reasoning & treatment
- Rotator Cuff Tendinopathy
 - Is the tendon the pain generator?
- *Subacromial Pain Syndrome (SPS)*
 - Allows for uncertainty of the pain generator: tendons, bursae, biceps, CNS, other...
 - Allows for other mechanisms

Staged Approach for Rehabilitation of Shoulder Disorders

Complaint of "Shoulder Symptom"

Level 1: Screening
History, Basic Physical Examination, Red or Yellow Flags

Appropriate for
Physical Therapy

Appropriate for
Physical Therapy
and Referral

Not Appropriate for
Physical Therapy

Level 2: Pathoanatomic Diagnosis
Specific Physical Examination

Shoulder Origin of Symptoms

Nonshoulder Origin of Symptoms

Subacromial Pain
Syndrome

Adhesive Capsulitis

Glenohumeral
Instability

Other

Level 3: Rehabilitation Classification
(1) Tissue Irritability (Guides Intensity of Physical Stress)
(2) Impairments (Guides Specific Intervention Tactics)

High Irritability and
Identified Impairments

Moderate Irritability and
Identified Impairments

Low Irritability and
Identified Impairments

Level 3

Rehabilitation Classification

- **Tissue Irritability** (guides intensity of physical stress)
- *Impairments* (guides specific intervention tactics)

	Tissue Irritability: Pain , Motion, Disability		
	<u>High</u>	<u>Moderate</u>	<u>Low</u>
<i>History and Exam</i>	<ul style="list-style-type: none"> • High Pain ($\geq 7/10$) • night or rest pain <ul style="list-style-type: none"> • consistent • Pain before end ROM • AROM < PROM • High Disability <ul style="list-style-type: none"> • (DASH, ASES) 	<ul style="list-style-type: none"> • Mod Pain (4-6/10) • night or rest pain <ul style="list-style-type: none"> • intermittent • Pain at end ROM • AROM ~ PROM • Mod Disability <ul style="list-style-type: none"> • (DASH, ASES) 	<ul style="list-style-type: none"> • Low Pain ($\leq 3/10$) • night or rest pain <ul style="list-style-type: none"> • none • Min pain w/overpressure • AROM = PROM • Low Disability <ul style="list-style-type: none"> • (DASH, ASES)
<i>Intervention Focus</i>	Minimize Physical Stress <ul style="list-style-type: none"> • Activity modification • Monitor impairments 	Mild - Moderate Physical Stress <ul style="list-style-type: none"> • Address impairments • Basic level functional activity restoration 	Mod – High Physical Stress <ul style="list-style-type: none"> • Address impairments • High demand functional activity restoration

Matched Interventions

Impairment	High Irritability	Moderate Irritability	Low Irritability
Pain associated with local tissue injury	Activity modification Manual therapy Modalities	Activity modification Manual therapy Limited modality use	No modalities
Pain associated with central sensitization	Progressive exposure to activity Medical management		
Limited passive mobility: joint/muscle/neural tissues	ROM, stretching, manual therapy: pain-free only, typically non-end-range	ROM, stretching, manual therapy: comfortable end-range stretch, typically intermittent	ROM, stretching, manual therapy: tolerable stretch sensation at end-range, typically longer duration and frequency
Excessive passive mobility	Protect joint or tissue from end-range	Develop active control in mid-range while avoiding end-range in basic activity Address hypomobility of adjacent joints or tissues	Develop active control during full-range, high-level functional activity Address hypomobility of adjacent joints or tissues
Neuromuscular weakness associated with atrophy, disuse, and deconditioning	AROM within pain-free ranges	Light or moderate resistance to fatigue Mid-ranges	Moderate or high resistance to fatigue Include end-ranges
Neuromuscular weakness associated with poor motor control or neural activation	AROM within pain-free ranges Consider use of biofeedback, neuromuscular electrical stimulation, or other activation strategies	Basic movement training with emphasis on quality/precision rather than resistance according to motor learning principles	High-demand movement training with emphasis on quality rather than resistance according to motor learning principles
Functional activity intolerance	Protect joint or tissue from end-range, encourage use of unaffected regions	Progressively engage in basic functional activity	Progressively engage in high-demand functional activity
Poor patient understanding leading to inappropriate activity (or avoidance of activity)	Appropriate patient education	Appropriate patient education	Appropriate patient education

Level 1: Screening

*Hx, Basic Phys Exam,
Red or Yellow Flags*

Level 2: Pathoanatomic Dx

Specific Physical Exam

Level 3: Rehab

Classification

- *Tissue Irritability*
- *Impairments*

Key Decisions:

PT and/or Referral ?

Specific Tissue Disorder?

General Intervention strategy ?

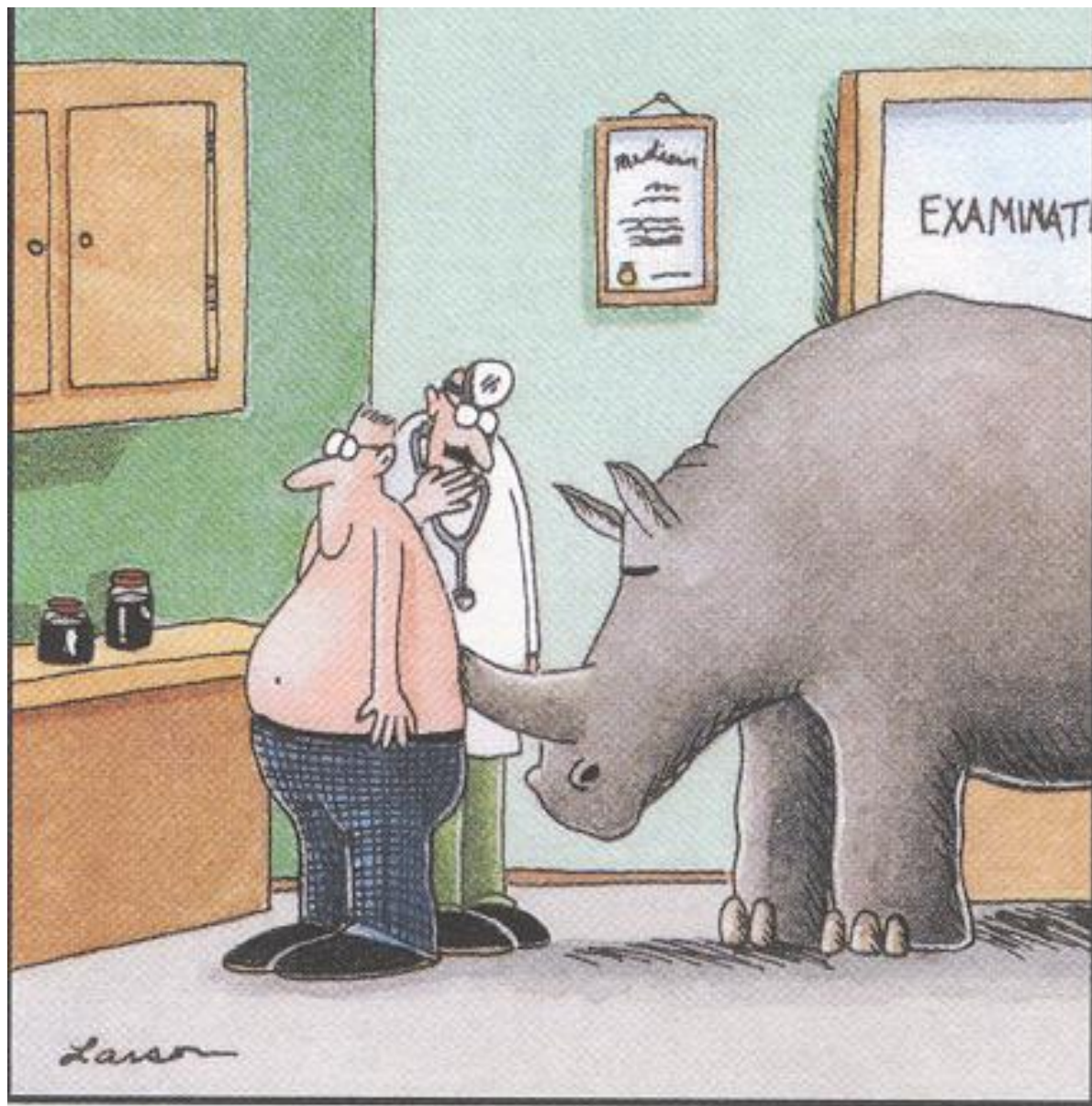
- Rehab vs Surgery
- Key tissue & movement precautions

Prognosis and Patient Education

What Physical Stress *Intensity*?

- Minimal
- Moderate
- High

What are the *Key Impairments* driving symptoms or functional loss?



"Wait a minute here, Mr. Crumbley. ... Maybe it isn't kidney stones after all."



One Impairment to Discuss

- Scapular Dyskinesis...

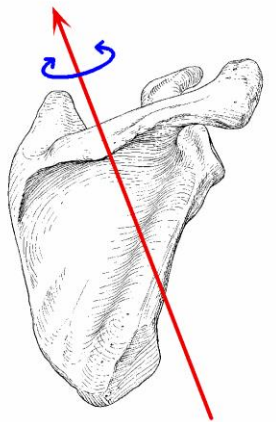
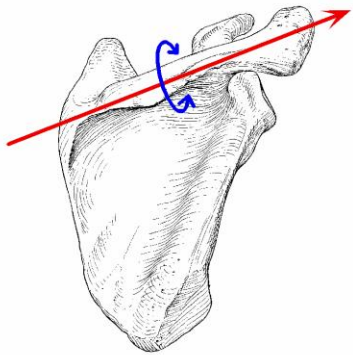
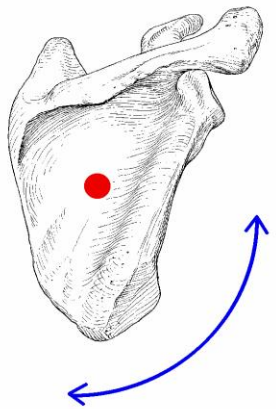






Scapular motion deficits & pain

Impingement (SPS): Meta-analysis & Systematic Review (Timmons MK et al, JSR, 2012) 9 studies



- ↓ Upward Rotation
- ↓ External Rotation
- ↓ Posterior Tilt
 - * Athletes → ↑ PT
- ↑ Clavicular Elevation
- ↑ Clavicular Retraction



Scapular kinematics Meta-analysis



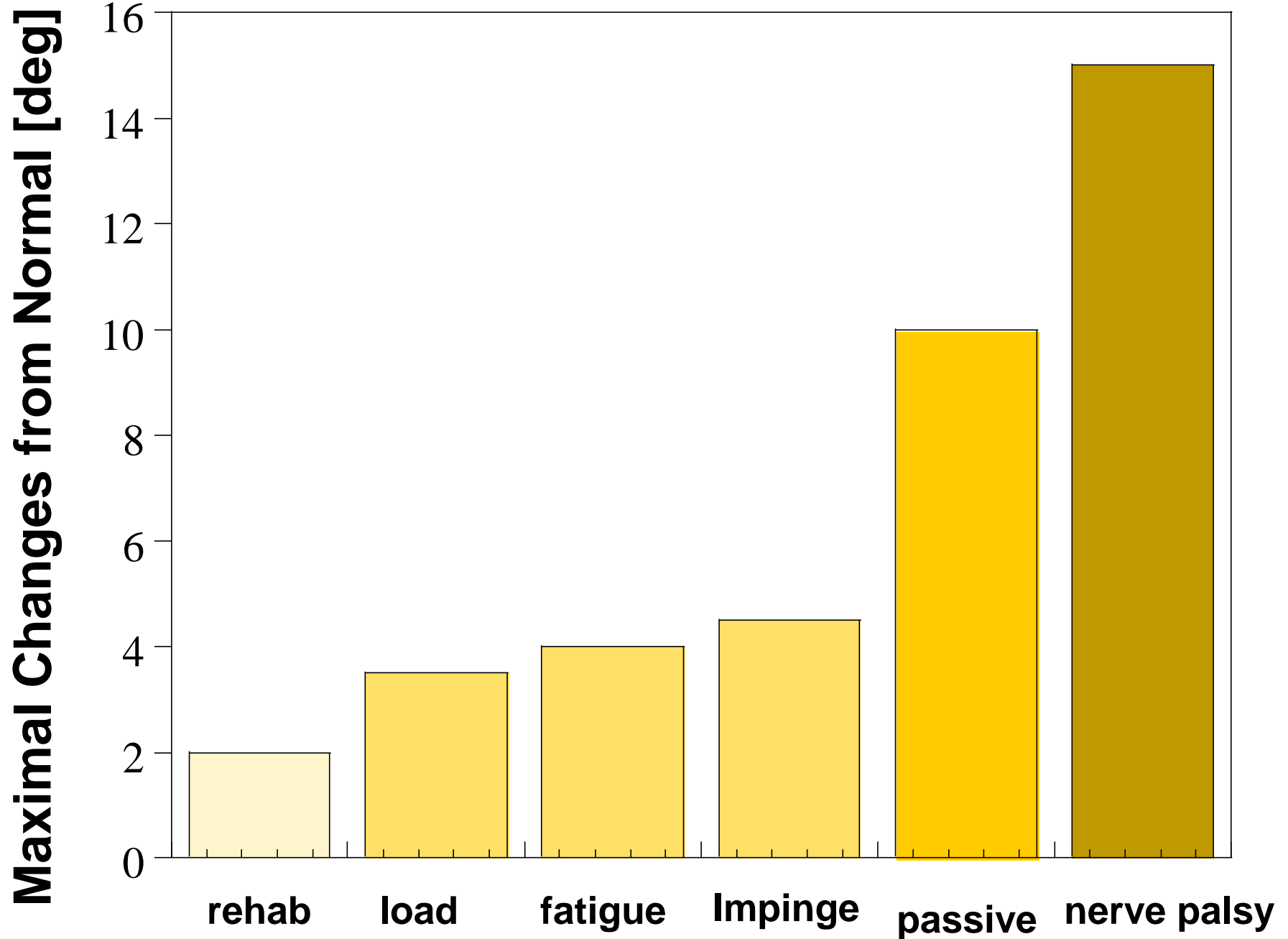
SAIS vs Healthy (Timmons M, JSR, 2012)

- Take home message:
 - Kinematics are VARIABLE across populations, planes
 - Scapular plane: largest changes in kinematics
 - ***However, small changes... meaning?***

Scapular Kinematics

- Thoughts....
 - So does scapular dysfunction lead to the pathology?
 - Chicken or the egg?
 - Meaningfulness of the kinematics differences... are these clinically important???

Scapular Upward Rotation



Scapular Dyskinesia



- How do we measure scapular position & motion?
 - **Consider how we measure it**
 - Lab measures – are reliable and valid, but are they good enough?
Answer: Only deviations over $4-10^\circ > \text{MDC}$
 - Clinic assessment – how do we measure it?
 - Observation: reliable & valid
 - But what does it mean when we see it?
Answer: Maybe nothing?

Scapular Dyskinesia

Could this mean something?



Scapular Rest Position?
Scapular Asymmetry?

Dynamic Motion testing?



Scapular Dyskinesis Test

(McClure PW et al, 2009; Uhl T et al, 2009)

- Test movements (5 reps)
 - Weighted flex (***F:3lb / M:5lb***)
 - Weighted abduction
- Potential Abnormalities
 - Winging
 - Post displacement- inf angle or medial border
 - Dysrhythmia
 - Lack of “normal” scapulohumeral rhythm during raising/lowering
 - “+” Dyskinesia: abnormality present 3 of 5 reps
 - Normal, Subtle, Obvious OR
 - Normal vs. Obvious



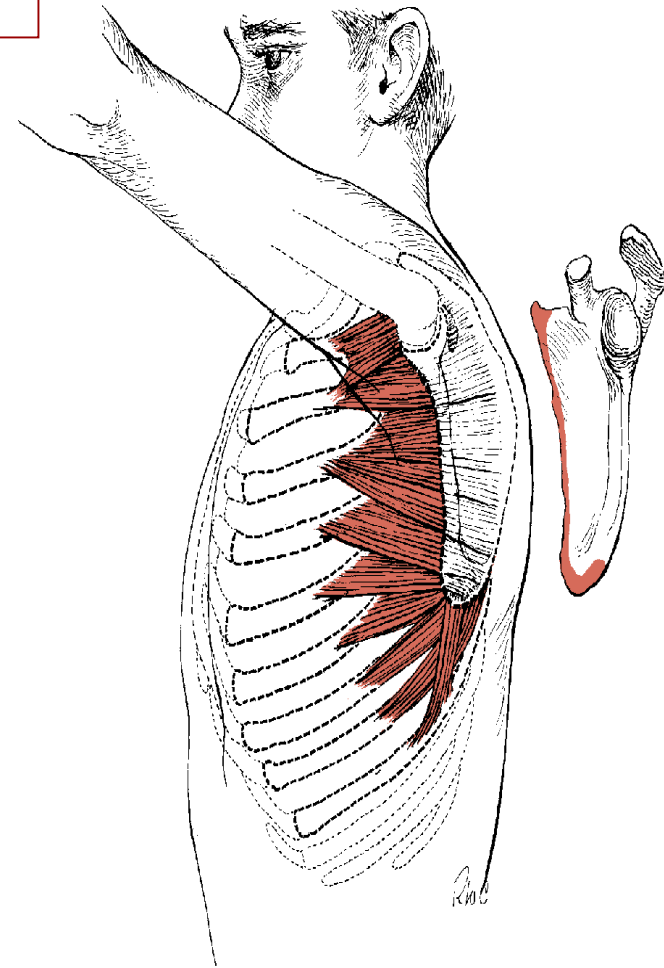
Scapular Dysrhythmia



Diagnostic accuracy of scapular physical examination tests for shoulder disorders: a systematic review

Alexis A Wright,¹ Craig A Wassinger,² Mason Frank,³ Lori A Michener,⁴ Eric J Hegedus¹

- Can scapular dyskinesis tests detect scapular impairments?
 - **YES**
 - **And they are reliable**
- Can scapular dyskinesis tests Dx shoulder pain or pathology?
 - **No**
 - Only a few studies, but they all indicate the same result- **No**
 - So what can a + test tell you?





Visual Scapular Dyskinesia

- Impairment *not* a Diagnosis ¹
- Present in those with and without shoulder pain ^{2,3,4,5}
- ASYMETRICAL scapular movement \approx equal ⁴
 - Shoulder pain: 71 – 76%
 - Control group: 71 – 77%

1 Wright AA, BJSM, 2012

2 Oyama S, J Athletic Train, 2008

3 Morais NV, Man Ther, 2013

4 Uhl TL, Arthroscopy, 2009

5 Struyf, Scand J Med Sci Sports, 2011

Observational Scapular Dyskinesia: Known-Groups Validity in Patients With and Without Shoulder Pain



HILLARY A. PLUMMER, PhD, ATC¹ • JONATHAN C. SUM, PT, DPT, OCS, SCS¹ • FEDERICO POZZI, PT, PhD¹
RINI VARGHESE, PT, MS¹ • LORI A. MICHENER, PT, PhD, ATC, SCS, FAPTA¹

JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY | VOLUME 47 | NUMBER 8 | AUGUST 2017 |

- NO diff in prevalence btw those with and without shoulder pain

<i>Blinded Examiner</i>	SDT – Abd	SDT – Flex
Shoulder pain (n=67)	67.2%	67.2%
Control (n=68)	52.9%	61.8%

Observational Scapular Dyskinesia: Known-Groups Validity in Patients With and Without Shoulder Pain



HILLARY A. PLUMMER, PhD, ATC¹ • JONATHAN C. SUM, PT, DPT, OCS, SCS¹ • FEDERICO POZZI, PT, PhD¹
RINI VARGHESE, PT, MS¹ • LORI A. MICHENER, PT, PhD, ATC, SCS, FAPTA¹

JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY | VOLUME 47 | NUMBER 8 | AUGUST 2017 |

- Examiner bias? Seems so – UN-blinded examiner rated higher levels of dyskinesia

<i>Shoulder Pain</i>		
<u><i>Involved Shoulder</i></u>	SDT – Abd	SDT – Flex
Blinded Examiner	66.2%	67.7%
UN-Blinded Examiner	78.5%	80%



Scapular Dyskinesia

- Asymmetrical or large deviations in motion may largely be normal variability in motion

**Critical and Theoretical Perspective on
Scapular Stabilization: What Does It
Really Mean, and Are We on the Right
Track?**

Kevin J. McQuade, John Borstad, Anamaria Siriani de Oliveira

Physical Therapy 2016

SDT / Scapular tests

- May help with differential dx of nerve injuries...

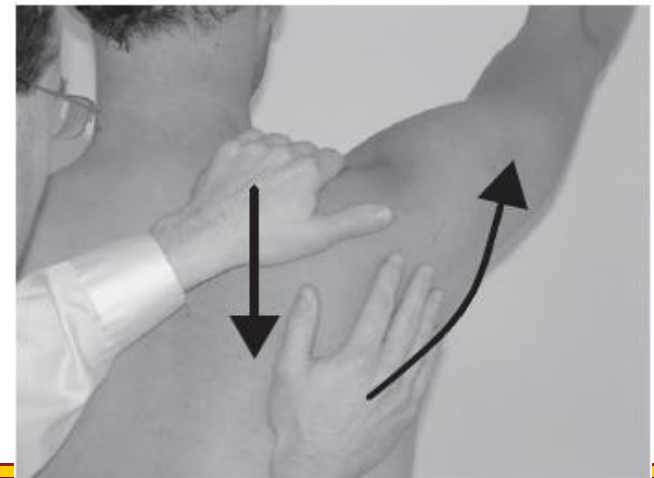


So, how do we know if scapular motion is related to the patient's pain?



Is treatment needed?

- Symptom Alteration Tests
 - Scapular Reposition Test
 - Scapular Assist Test
 - Change in pain by 2/ 10 pts is meaningful





Scapular Dyskinesia

- Predict if shoulder pain will occur?
- Pre-season scapular dyskinesia:
Is that athlete more likely to develop shoulder pain?

Scapular Dyskinesia: limited ability to predict development of shoulder pain

Scapular dyskinesia increases the risk of future shoulder pain by 43% in asymptomatic athletes: a systematic review and meta-analysis

Darren Hickey, Veronica Solvig, Vinicius Cavalheri, Meg Harrold, Leanda Mckenna

BJSM, 2017

Conclusions Athletes with scapular dyskinesia have 43% greater risk of developing shoulder pain than those without scapular dyskinesia.

Relative Risk (RR) = 1.43

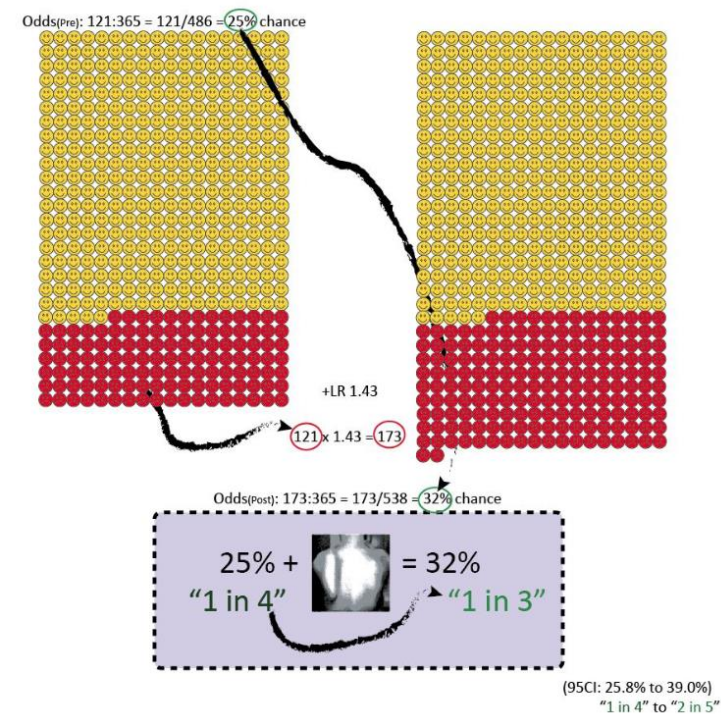
–SDT: 1 out 4 chance of sh pain

+SDT: 1 out 3 chance of sh pain

OR....

+SDT → 33% develop sh pain

--SDT → 25% develop sh pain





What does this all mean?

- Scapular position and motion tests, and symptom alteration tests are *reliable* and some evidence to indicate *if 'something is wrong'* (*validity for dyskinesia tests*)
- Scapular alteration tests *can alter symptoms* (more about that in lab)
- Limited ability to predict development of shoulder pain

Ability to drive clinical decision-making?

- Do the tests tell us:
 - 1- If this relates to their shoulder pain?
 - *Maybe* symptom reproduction tests can - *maybe*
 - What to do to correct/ the problem; i.e., enable treatment decision-making?
 - *No – evidence does not indicate*
 - Impairment tests of other deficits are needed
 - Flexibility, strength, motor control tests *may indicate why* scapular alterations exist



Is my patient getting better or not?

How do we demonstrate value of
our care?

How do we demonstrate **value** of our care?



Systematically track outcomes of care

- That means on every patient
- Evaluate outcomes of care on all patients

“Those who claim to know in the absence of evidence are, at best, proclaiming their faith, not their knowledge”

Jules Rothstein, Editor emeritus, *Phys Ther*



Determining VALUE

- Outcome measures – A MUST!
- Comprehensively assess *what is important to the patient*
- Open a *dialogue about*:
 - what is specifically difficult to do *and*
 - what is important to them



Is my patient getting better or not?

- Outcomes to use:
 - Disease-specific or body-part specific
 - Shoulder specific: e.g, DASH, PENN, etc...)
 - Disease specific: e.g., WORC
 - PSFS – Patient-specific functional scale

QuickDASH

		NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
Please rate	7. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	2	3	4	5
1. Open		NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
2. Do he	8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	5
3. Carry						
4. Wash	Please rate the severity of the following symptoms in the last week. (circle number)	NONE	MILD	MODERATE	SEVERE	EXTREME
5. Use a	9. Arm, shoulder or hand pain.	1	2	3	4	5
6. Recrea or imp (e.g.,	10. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
		NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
	11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? (circle number)	1	2	3	4	5

Penn Shoulder Score

- Pain
(0–30 pts)
 - Rest
 - Normal ADL
 - Strenuous
- Satisfaction
(0-10 pts)

The Penn Shoulder Score, Part 1: Pain and Satisfaction

Please circle the number closest to your level of pain or satisfaction												
Pain at rest with your arm by your side:												
0	1	2	3	4	5	6	7	8	9	10		
No pain									Worst pain possible			
Pain with normal activities (eating, dressing, bathing):												
0	1	2	3	4	5	6	7	8	9	10		
No pain									Worst pain possible			
Pain with strenuous activities (reaching, lifting, pushing, pulling, throwing):												
0	1	2	3	4	5	6	7	8	9	10		
No pain									Worst pain possible			
											Pain score:	
How satisfied are you with the current level of function of your shoulder?												
0	1	2	3	4	5	6	7	8	9	10		
No pain									Worst pain possible			

11. Carry a briefcase/small suitcase with affected arm.	3	2	1	0	X
12. Place a soup can (1-2 lbs.) on a shelf at shoulder level without bending elbow.	3	2	1	0	X
13. Place a one gallon container (8-10 lbs.) on a shelf at Shoulder level without bending elbow.	3	2	1	0	X
14. Reach a shelf above your head without bending your elbow.	3	2	1	0	X
15. Place a soup can (1-2 lbs.) on a shelf overhead without bending your elbow.	3	2	1	0	X
16. Place a one gallon container (8-10 lbs.) on a shelf Overhead without bending your elbow.	3	2	1	0	X
17. Perform usual sport/hobby.	3	2	1	0	X
18. Perform household chores (cleaning, laundry, cooking).	3	2	1	0	X
19. Throw overhand/swim/overhead raquet sports. (circle all that apply to you)	3	2	1	0	X
20. Work full-time at your regular job.	3	2	1	0	X

WORC- modified to numeric



Western Ontario Rotator Cuff Index (WORC)

Section B: Sports/Recreation

The following section concerns how your shoulder problem has affected your sports or recreational activities in the past week. Please circle the best number that describes you.

Section C: Work

The following section concerns the amount that your shoulder problem has affected your work around or outside of the home. Please circle the best number that describes you.

Section D: Lifestyle

The following section concerns the amount that your shoulder problem has affected or changed your lifestyle. Please circle the best number that describes you.

	None	Extreme
15. How much difficulty do you have sleeping because of		

Section E: Emotions

The following questions relate to how you have felt in the past week with regard to your shoulder problem. Please circle the best number that describes you.

	None										Extreme
19. How much frustration do you feel because of your shoulder?	0	1	2	3	4	5	6	7	8	9	10
20. How “down in the dumps” or depressed do you feel because of your shoulder?	0	1	2	3	4	5	6	7	8	9	10
21. How worried or concerned are you about the effect of your shoulder on your occupation?	0	1	2	3	4	5	6	7	8	9	10

■ The Patient-Specific Functional Scale

N

Please identify 3 important activities that you are unable to do or are having difficulty as a result of your problem. Please rate the level of difficulty you are having with the 3 activities that you are unable to do or are having difficulty with as a result of your problem, using the scale provided.

Activity:

Difficulty Level:

1. _____	0	1	2	3	4	5	6	7	8	9	10	
	unable to perform activity										able to perform activity at the same level as before	
2. _____	0	1	2	3	4	5	6	7	8	9	10	
	unable to perform activity										able to perform activity at the same level as before	
3. _____	0	1	2	3	4	5	6	7	8	9	10	
	unable to perform activity										able to perform activity at the same level as before	

Total: _____ / 30 = _____ ÷ 30 = final score ____ / 10 (10 = full function)

So, how do I know if my patient is getting better or not?



- Change:
 - Do they improve over MDC (measurement error) or MCID (Minimal clinically important change)?
 - Is that change ‘enough’ for the patient?

Error vs. Meaningful Change



- Change that is measurement error:
MDC = statistical error, change scores error
- Change that is *clinically important*:
 - Minimally Clinically Important Difference (MCID):
 - MCID = change that is important to the patient
MIC = minimal important change
 - External criterion determines pt status after treatment: better, worse, or same

How do I know if what the patient scores is “enough” for them?



- Outcomes to use:
 - Anchor for the patient's score
 - Patient satisfaction with body part

Satisfaction: How satisfied are you with the current use /function of your injured body part?

0 1 2 3 4 5 6 7 8 9 10
Not Satisfied Very Satisfied

- PASS – Patient acceptable symptom state
- GROC – Global Rating of Change

GROC –Global Rating of Change Global Perceived Effect



- “Overall, how would you describe the change in your ___?___ use since your first visit?”

- Ex: 15 pt scale

- 7, 9, 11 point/ ratings recommended for pt ease, psychometrics

- ___ A very great deal worse (-7)
- ___ A great deal worse (-6)
- ___ Quite a bit worse (-5)
- ___ Moderately worse (-4)
- ___ Somewhat worse (-3)
- ___ A little bit worse (-2)
- ___ A tiny bit worse, almost the same (-1)
- ___ About the same, no change (0)
- ___ A tiny bit better, almost the same (+1)
- ___ A little bit better (+2)
- ___ Somewhat better (+3)
- ___ Moderately better (+4)
- ___ Quite a bit better (+5)
- ___ A great deal better (+6)
- ___ A very great deal better (+7)

Feeling Good Rather Than Feeling Better Matters More to Patients

FLORENCE TUBACH,¹ MAXIME DOUGADOS,² BRUNO FALISSARD,³ GABRIEL BARON,¹
ISABELLE LOGEART,⁴ AND PHILIPPE RAVAUD¹

- Feeling good – PASS
 - “Taking into account your level of pain and also your functional impairment, if you were to remain for the next few months as you are today, would you consider that your current state is satisfactory?” “Yes” or “No”
 - Responders to treatment
- Feeling better – clinically important change (MCID)

Conclusion. Patients consider that they experienced an important improvement only if this improvement allowed them to achieve a state they consider satisfactory. The most appropriate means to assess the response to therapy seems to be to assess whether patients feel good (i.e., achieve the patient acceptable symptom state).



Evaluating Change – triangulating data

- Anchor of Change:
 - GROC
 - PASS
 - Patient satisfaction with use of body part
- Absolute Change
 - Pain
 - DASH, QuickDASH, PENN, WORC
 - PSFS



Systematic Collection of Outcomes

- Outcomes Registry
 - Outcomes
 - Process of Care
- Electronic data collection
 - FOTO
 - Others



Function/ disability Outcome measures



- Demonstrate ***value*** of care!

“In God we trust; all others must bring data.”

W. Edwards Deming



Questions?



USC Division of Biokinesiology
and Physical Therapy

University of Southern California



Key Metrics for Dx Accuracy

- Diagnostic Accuracy values:
 - ***Sensitivity***
 - ***Specificity***
 - PPV: Predictive value of a positive test
 - NPV: Predictive value of a negative test
 - ***LR+: Positive likelihood ratio***
 - ***LR- Negative likelihood ratio***



Sensitivity and Specificity

- Sensitivity
 - **SnNO**ut = When Sn is high, a Negative test rules Out the disease
- Specificity (**SpP**In)
 - **SpP**In = When Sp is high, a Positive test rules In the disease.
- Interpretation:
 - Indicates if a test ↓s or ↑s disease probability
 - BUT: No set cut-off to quantify shift in probability



Likelihood Ratios

- More helpful for Dx
- Indicate *by how much* a given diagnostic test result will ↓ or ↑ the probability of the disease.
- Quantify shifts in probability of the diagnosis/disorder for an individual patient
 - Ex: +LR= 5: a patient with a + test is 5x more likely in a patient with the disease as compared to a patient without the disease
- Minimal affect of prevalence

<u>Likelihood Ratio</u>		<u>Interpretation</u>
"+"	"—"	
>10	<0.1	Large & often conclusive changes from pre-test to post-test probability
5 – 10	0.1 – 0.2	Moderate shifts in pre-test to post-test probability
2 – 5	0.5 – 0.2	Small but sometimes important changes in probability
1 – 2	0.5 – 1	Small and rarely important changes in probability



Recommendation: Dx Interpretation

Screen (Rule/ Out)

– Sensitivity: SnNO_{Out}

* $Sn \geq 80\%$

– Likelihood ratio (– LR)

* $-LR \leq 0.5$

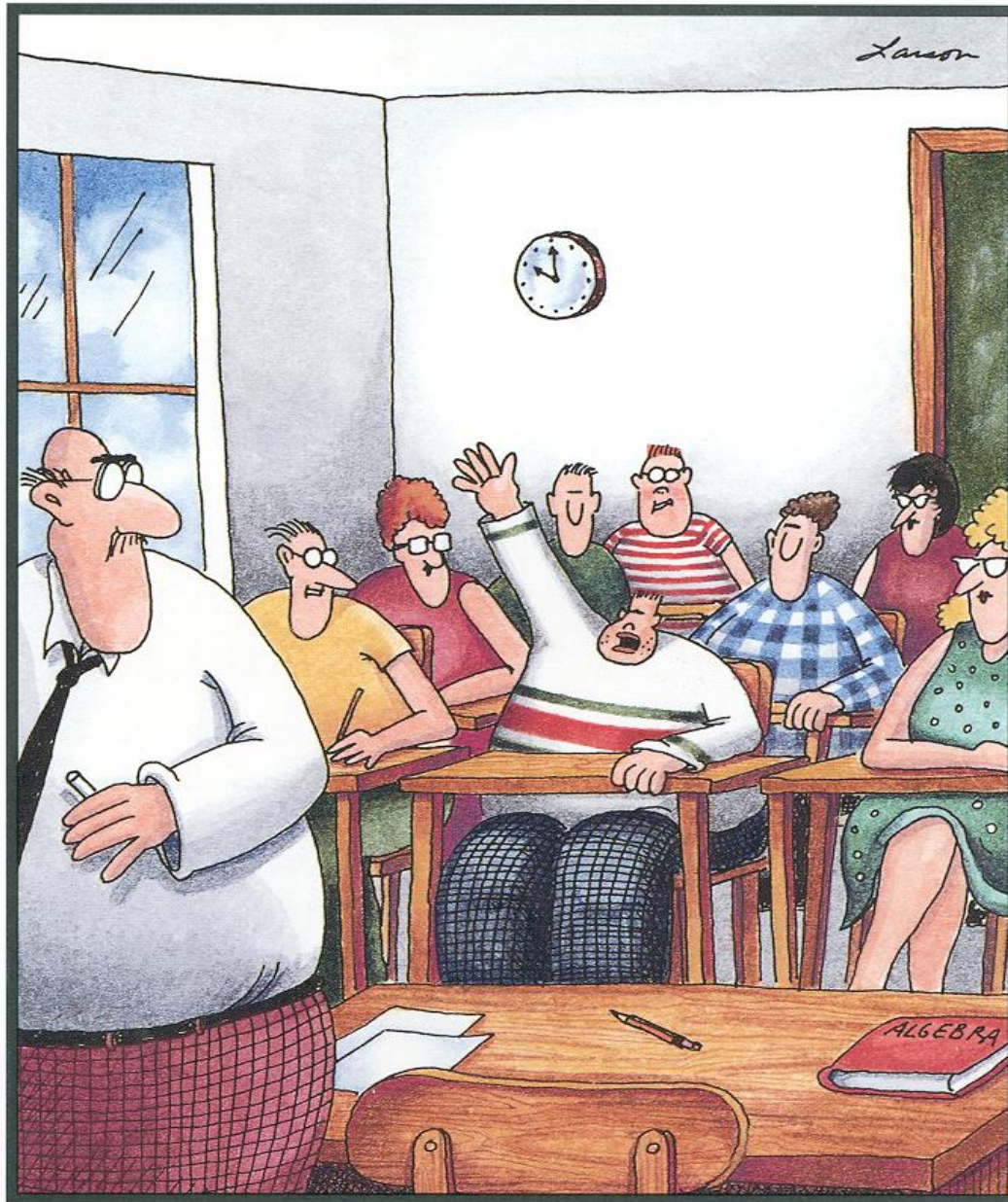
Confirm (Rule/ IN)

– Specificity: SpP_{In}

* $Sp \geq 80\%$

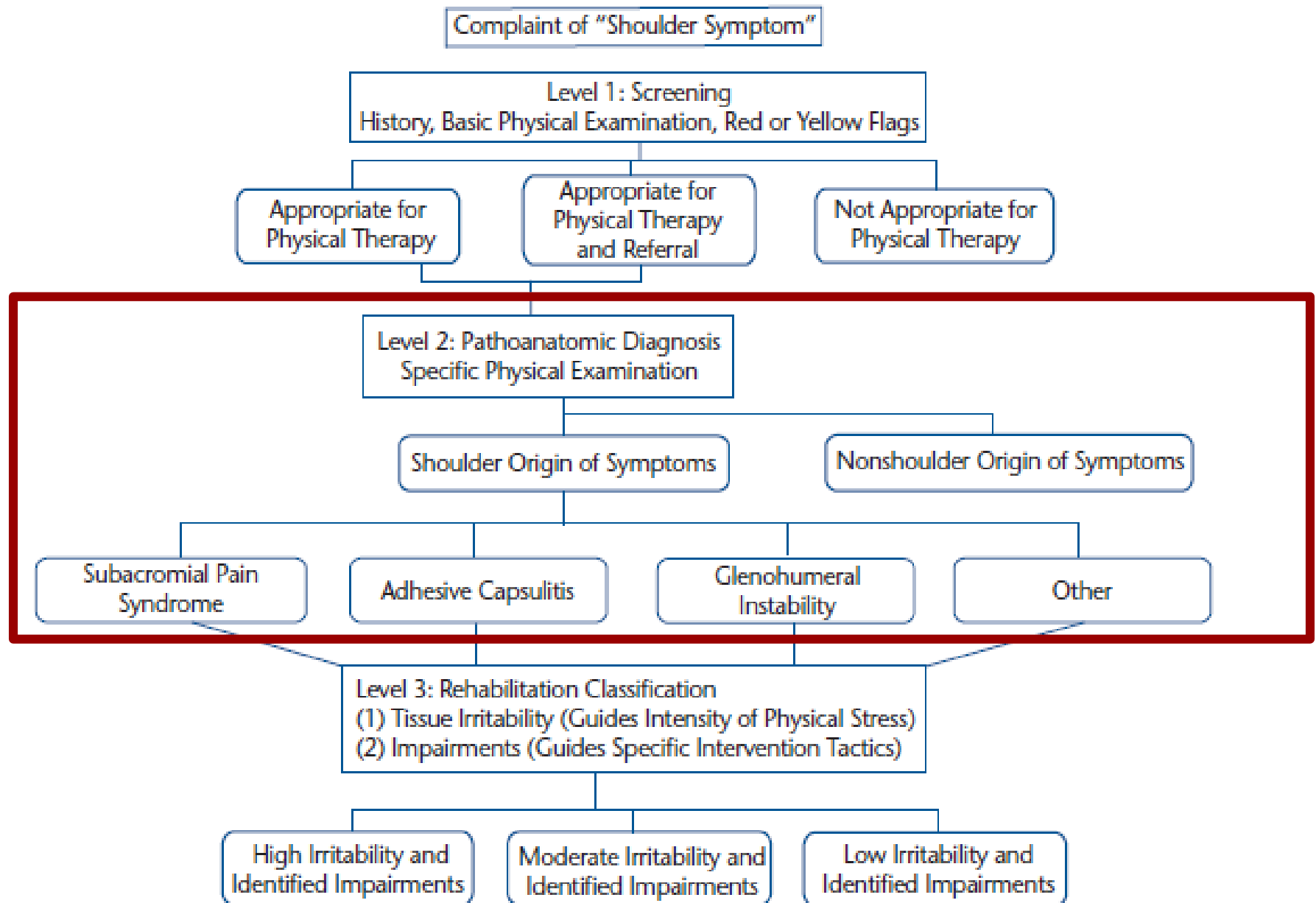
– +Likelihood ratio (+LR)

* $+LR \geq 2.0$



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

Staged Approach for Rehabilitation of Shoulder Disorders



Dx SA pain - Systematic Reviews

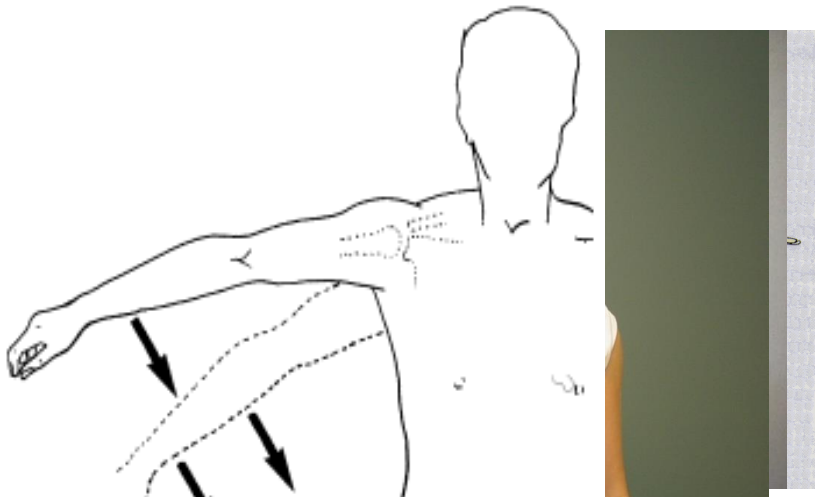
1. Hermans J, JAMA, 2013;
2. Hanchard NCA, Cochrane, 2013;
3. Hegedus EJ, BMJ, 2012;
4. Alqunae M, APMR, 2012

Confirm SA pain

(R/In) – single tests

- 1- Painful arc
- 2- Resisted ER (ERRT) – pain or weak
- 3- Full Can
- 4- Drop Arm

* Combo of tests too! *



Screen Out SA pain

(R/Out) – single tests

- 1- Painful arc
- 2- Resisted ER (ERRT) – pain or weakness
- 3- Hawkins
- 4- Neer
- 5- Full Can
- 6- Empty/ Jobe Can



Combo of Tests: SA Pain

3/3 tests: (Park HB, JBJS; 2005)

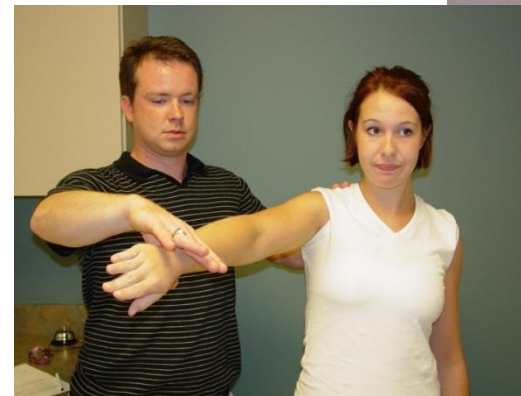
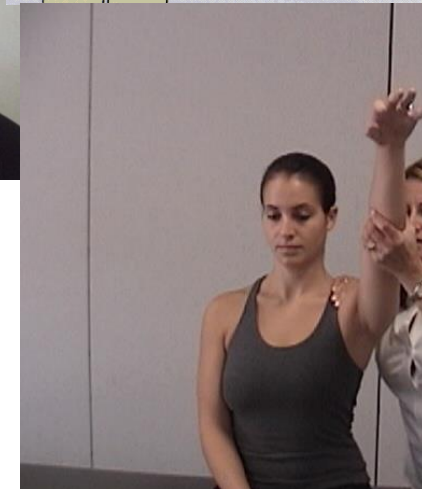
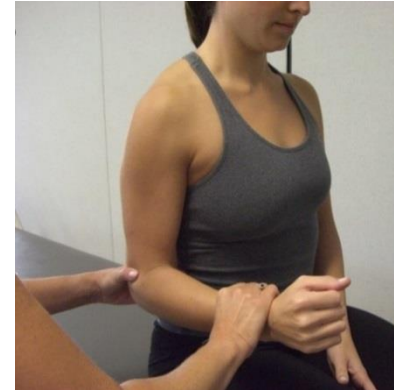
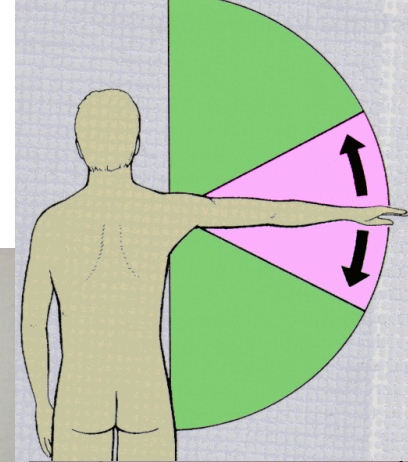
Hawkins, Painful arc,
ER resistance (Pain/Weak)

- All 3+: +LR of 10.56
- All 3-: -LR of 0.17

3/5 tests: (Michener LA, APMR, 2009)

– Hawkins, Neer, Painful arc,
Empty can, ER resistance

- If $\geq 3+ / 5$: +LR of 2.93
- If $< 3+ / 5$: -LR of 0.34





Speed's Test

- Biceps pathology / labrum / SAIS
- Resist sh. flex w/ elbow ext & forearm supinated
- +: ant/ sup shoulder pain
- NOT useful for Rin or Rout any pathology





Posterior Impingement

- Posterior / Internal impingement
 - Compression of the tendons between the posterior glenoid rim and the humeral head
 - Overhead athletes
 - Is this a potential in non-athletes??

Figure: Mary Albury Noyes

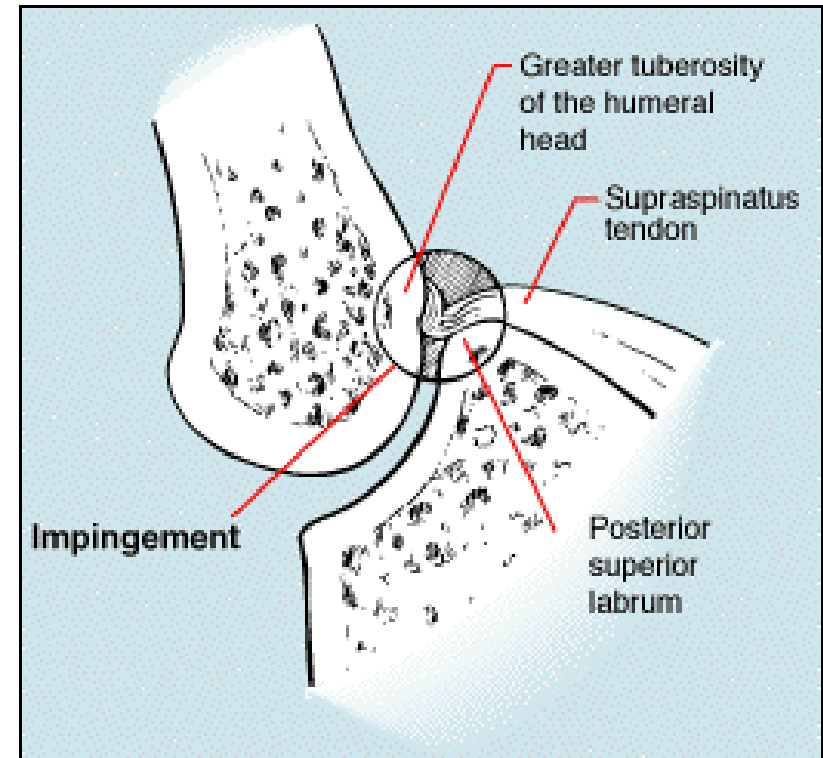


Figure 3. Posterior superior glenoid impingement occurs when the arm is abducted 90° and maximally externally rotated, and the posterior inferior aspect of the supraspinatus tendon is impinged between the greater tuberosity of the humeral head and the posterior superior labrum.



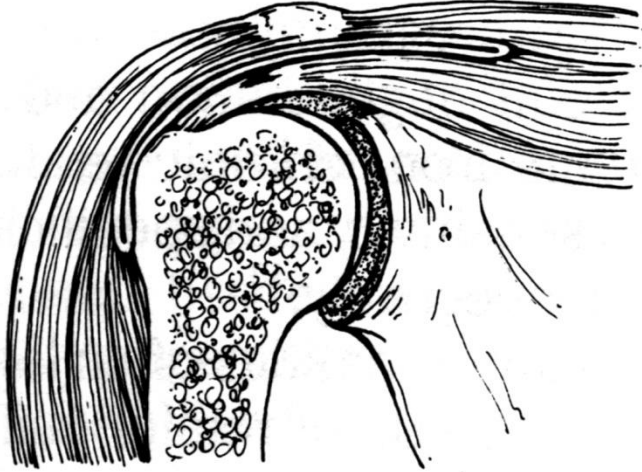
Posterior Internal Impingement

- Impingement of the internal/deep aspect of RC tendons on posterior superior edge of the glenoid
- May be associated with anterior instability
- Relocation test positive for reduction in POSTERIOR pain



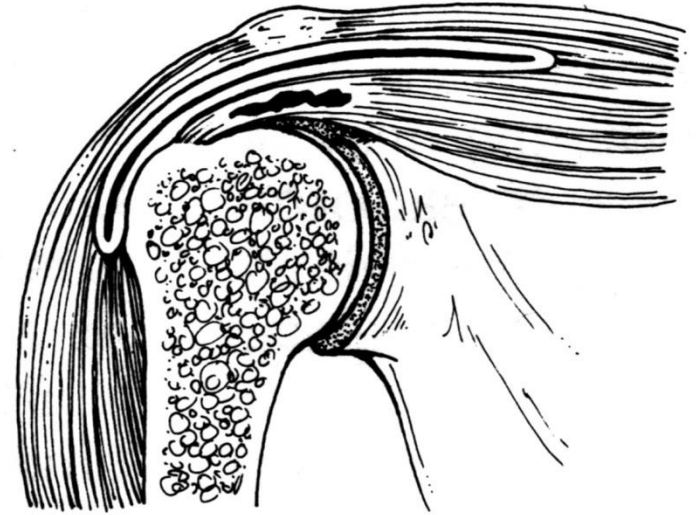
A

Partial tear, bursal side



B

Partial tear, midsubstance



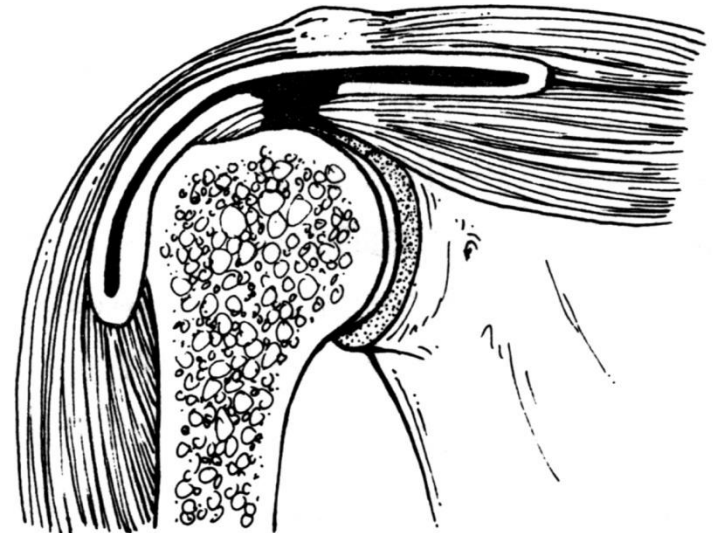
C

Partial tear, articular side
most common



D

Complete tear, full thickness





Rotator Cuff Tears

- Partial Thickness Tears
 - Impingement syndrome category
- Full Thickness Tears
 - Tears classified as (DeOrio & Cofield, 1984)
 - Small: < 1cm
 - Medium: 1 – 3 cm
 - Large: 3 – 5 cm
 - Massive: > 5 cm

Dx FT-RCT - Syst Reviews



1. Hermans J, JAMA, 2013;
2. Hanchard NCA, Cochrane, 2013;
3. Hegedus EJ, BMJ, 2012;
4. Alqunae M, APMR, 2012

Confirm FT-RCT

(R/In) – single tests

- 1- Painful arc
 - 2- Resisted ER – pain or weak
 - 3- ER lag test – supraspinatus
infrapinatus (massive tear)
 - 4- IR lag & Lift off
subscapularis (massive tear)
 - 5- Drop arm
 - 6- Atrophy of infrapinatus
 - 7- Belly off – Subscapularis
- **Combo of tests****

Screen Out FT-RCT

(R/Out) – single tests

- 1- Resisted ER (ERRT)
– pain or weakness
- 2- IR lag & Lift-off
subscapularis(massive)
- 3- Empty Can
- 4- Full Can

**History: Age \geq 60/ 65yo
and c/o night pain**

Lift Off and Lag Test

- Subscapularis tear
- Hand at sacrum/LB;
- - Lift-off: ask pt to lift hand away from the back
- - Lag: examiner positions hand off the back and asks to hold
- “+”: inability to “lift off” or “lags” back



External Rotation Lag Sign



Hertel, R et al, JSES, 1996

- At 0 deg abd, 90 deg elbow flex; passive ER & ask patient to hold
- “+”: “lags” back to less than full ER
- 2 tendon / massive tear





Combination of Tests: FT- RCT

- Test Combo (Litaker D, et al; J Am Geriatr Soc, 2000)

≥ 65 yo, ER weak (ERRT), night pain

All 3 +: R/In +LR: 9.84

All 3 -: R/Out - LR: 0.54

- Test Combo (Park HB, et al; JBJS, 2005)

3 Tests: Drop arm, Painful arc, ERRT

All 3 tests + R/In +LR: 15.57

All 3 tests - R/Out -LR: 0.16

3 tests & >60 yo:

All 3 tests & >60 yo + R/In +LR: 28.0

All 3 tests & >60 yo - R/Out -LR: 0.09



Rotator Cuff Disease: Review of Evidence for Treatment

Lori Michener, PhD, PT, ATC, SCS, FAPTA

Professor | Director of Clinical Outcomes and Research

Director – COOR Lab

University of Southern California

Los Angeles, CA



Diagnosis of Rotator Cuff Disease

Rotator cuff disease

- Full-thickness RC tear

- Partial thickness RC tear

- Bursitis

- Tendinitis

- Tendinopathy

- Subacromial impingement

Single clinical
Dx category:

- *Subacromial
pain syndrome*

Same general
approach, but
impairments and
irritability

considered for
staged approach
for rehabilitation

Staged Approach for Rehabilitation of Shoulder Disorders

Complaint of "Shoulder Symptom"

Level 1: Screening
History, Basic Physical Examination, Red or Yellow Flags

Appropriate for
Physical Therapy

Appropriate for
Physical Therapy
and Referral

Not Appropriate for
Physical Therapy

Level 2: Pathoanatomic Diagnosis
Specific Physical Examination

Shoulder Origin of Symptoms

Nonshoulder Origin of Symptoms

Subacromial Pain
Syndrome

Adhesive Capsulitis

Glenohumeral
Instability

Other

Level 3: Rehabilitation Classification
(1) Tissue Irritability (Guides Intensity of Physical Stress)
(2) Impairments (Guides Specific Intervention Tactics)

High Irritability and
Identified Impairments

Moderate Irritability and
Identified Impairments

Low Irritability and
Identified Impairments

Rehab Classification

- Tissue Irritability (*guides intensity of physical stress*)
- **Impairments** (*guides specific intervention tactics*)



Impairment	<u>High Irritability</u>	<u>Moderate Irritability</u>	<u>Low Irritability</u>
Pain: Assoc Local Tissue Injury	Modalities Activity modification	Limited modality use Activity modification	No modalities
Pain: Assoc with Central Sensitization	Progressive exposure to activity Medical Mgmt		
Limited Passive Mobility: joint / muscle / neural	ROM, stretching, manual therapy: Pain-free only, typically non-end range	ROM, stretching, manual therapy: Comfortable end-range stretch, typically intermittent	ROM, stretching, manual therapy: Tolerable stretch sensation at end range. Typically longer duration and frequency
Excessive Passive Mobility	Protect joint or tissue from end-range	Develop active control in mid-range while avoiding end-range in basic activity Address hypomobility of adjacent joints or tissues	Develop active control during full-range during high level functional activity Address hypomobility of adjacent joints or tissues
Neuromuscular Weakness: Assoc with atrophy, disuse, deconditioning	AROM within pain-free ranges	Light → mod resistance to fatigue Mid-ranges	Mod → high resistance to fatigue Include End-ranges
Neuromuscular Weakness : Assoc with poor motor control or neural activation	AROM within pain-free ranges Consider use of biofeedback, neuromuscular electric stimulation or other activation strategies	Basic movement training with emphasis on quality/precision rather than resistance according to motor learning principles	High demand movement training with emphasis on quality rather than resistance according to motor learning principles
Functional Activity intolerance	Protect joint or tissue from end-range, encourage use of unaffected regions	Progressively engage in basic functional activity	Progressively engage in high demand functional activity
Poor patient understanding leading to inappropriate activity (or avoidance of activity)	Appropriate patient education	Appropriate patient education	Appropriate patient education



Treatment for RC Tendinopathies

What do we know?



Surgery - SAPS

- SAPS
 - SAD: 70 – 92% success (Ellman & Kay, 1991; Spangehl, 2002)
 - Equal effects of SADS vs. Rehab (Brox, 1993, 1999; Haahr, 2005, 2006; Ketola, 2009, 2013)
 - **Bottom line:**
 - Surgery is helpful, BUT consider only after Rehabilitation
 - Rehab: 3-6 months, dependent on patient progression and goals



Rehabilitation – SAPS: *Exercise*

- **SAPS - Exercise**
 - LOTS of studies
 - Systematic Reviews (SR) of RCTs (11, 12, 16 individual studies) (Michener L, 2004; Kromer TO, 2009; Brudevig T, 2011; Braun C, 2010)
 - A SR of SRs (Littlewood C, 2013)
 - Overall findings:
 - Exercise (stretch & strengthen) is effective – but clinical significance is uncertain
 - All programs also consisted of some level of patient education

Effectiveness of conservative interventions including exercise, manual therapy and medical management in adults with shoulder impingement: a systematic review and meta-analysis of RCTs



Steuri R, *et al.* *Br J Sports Med* 2017;**51**:1340–1347.

Table 1 Inclusion criteria

Selected studies	Inclusion criteria
Study population	▶ 18 years and older
Complaints of shoulder pain (Based on Michener <i>et al</i>) ⁵	<ul style="list-style-type: none">▶ Painful arc between 40° to 120° in abduction, flexion▶ Pain with active arm elevation▶ Test by Neer, Hawkins-Kennedy, Speed or Jobe▶ Empty can test▶ Resisted painful or weak shoulder abduction▶ Resisted or weak shoulder external rotation▶ Diagnosis based on criteria according to Cyriax (ie, painful arc, or painful resisted abduction test)▶ Impingement test with lidocaine▶ Tenderness to palpation of rotator cuff tendons
Intervention/comparator	▶ At least one conservative intervention was compared with any kind of interventions (including surgery)
Reported outcomes	▶ Pain, function, active range of motion
Study design	▶ Randomised controlled trials
Controlled follow-up period	▶ Based on predefined criteria
Excluded studies	▶ Case reports, treatments after surgery, did not meet our specified outcome parameters, traumatic incidents, written in Chinese and Farsi language

Effectiveness of conservative interventions including exercise, manual therapy and medical management in adults with shoulder impingement: a systematic review and meta-analysis of RCTs



Steuri R, et al. *Br J Sports Med* 2017;**51**:1340–1347.

- Orange: uncertain effect; alternative treatments need to be considered if effect is not met

Exercise	Orange	Exercise was superior to doing nothing (pain -0.94 , 95% CI -1.69 to -0.19 ; function -0.57 , 95% CI -0.85 to -0.29). Specific exercise was superior to non-specific exercise (pain -0.65 , 95% CI -0.99 to -0.32 ; function -0.68 , 95% CI -1.26 to -0.10 ; AROM 0.59 , 95% CI 0.08 to 1.10). Exercise was less effective than surgery for pain but not for function (pain 31% risk difference, 95% CI 13% to 49%), supporting surgery if indication for surgery is given (ie, tears). Exercise was superior to non-exercise physical therapy (AROM 1.00 , 95% CI 0.25 to 1.76).
Manual Therapy	Orange	Manual therapy was superior to doing nothing for pain (-0.35 , 95% CI -0.69 to -0.01). Manual therapy plus exercise was superior to sham ultrasound and placebo gel for function (-0.42 , 95% CI -0.78 to -0.06). Manual therapy combined with exercise was superior to exercise alone only for shortest follow-up (pain -0.32 , 95% CI -0.62 to -0.01 ; function -0.41 , 95% CI -0.71 to -0.11). There were immediate effects (after one session) for manual therapy versus placebo for pain (-0.62 , 95% CI -0.97 to -0.28).

What are the new findings?

- ▶ Exercise therapy was effective in improving pain, function and active range of motion.
- ▶ Specific exercises were more effective than general shoulder exercises.
- ▶ NSAIDs, corticosteroid injections (with an advantage for ultrasound guided injections), manual therapy, tape in combination with exercise, extracorporeal shockwave therapy and laser were also effective.
- ▶ The quality of evidence was very low, therefore clinicians should apply this evidence cautiously when making clinical decisions.

Conclusion Although there was only very low quality evidence, exercise should be considered for patients with shoulder impingement symptoms and tape, ECSWT, laser or manual therapy might be added. NSAIDs and corticosteroids are superior to placebo, but it is unclear how these treatments compare to exercise.

COOR Lab

University of Southern California



Rehabilitation – SAPS: *Manual Therapy*

- **SAPS- Manual Therapy**
 - Exercise + manual therapy to upper quadrant (shoulder and spine) has a greater ↓ pain & disability than exercise alone
 - Some SRs report this, but some do not
 - SR of SRs reports no / limited benefits of manual therapy
 - Type of Manual Therapy – **Bottom line**
 - Spine + shoulder OR spine – effective, but limited
 - GH mobilizations alone – not effective

Rehabilitation – SAPS: *Manual Therapy*



Thoracic Manipulation

- Addition of manual therapy to an exercise program is some studies indicated effective as compared to exercise alone – *BUT what MT??*
 - Thrust & non-thrust manipulation to the shoulder girdle, cervical and thoracic spine.

Rehabilitation – SAPS: *Manual Therapy*

- ***Thoracic spine manipulation***

- ↓ shoulder pain in the short term (~ 1 wk) ... but no comparator, so results have limited efficacy (Mintken P, 2010; Strunce J, 2009; Boyles R, 2009; Bergman, 2004; Winters, 1997)

- Comparator study: PASS & GROC better (Mintken P, et al, JOSPT, 2016)

Cervicothoracic Manual Therapy
Exercise Therapy Versus Exercise
Alone in the Management of Ind
With Shoulder Pain: A Multic
Randomized Controlled Tri

PAUL E. MINTKEN, DPT^{1,2} • AMY W. MCDEVITT, DPT^{1,3} • JOSHUA A. CL
ROBERT E. BOYLES, PT, DSc⁵ • AMBER R. BEARDSLEE, DPT⁶ • SCOTT
MATTHEW D. HABERL, DPT⁹ • LAUREN A. HINRICH, DPT¹⁰ • LORI A. M

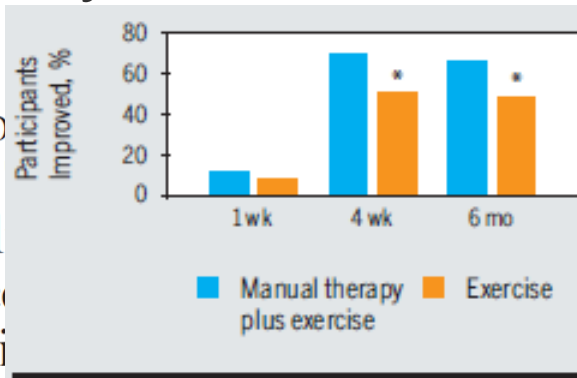


FIGURE 2. Global rating of change success (+5 or greater) by group and time. *Statistically significant

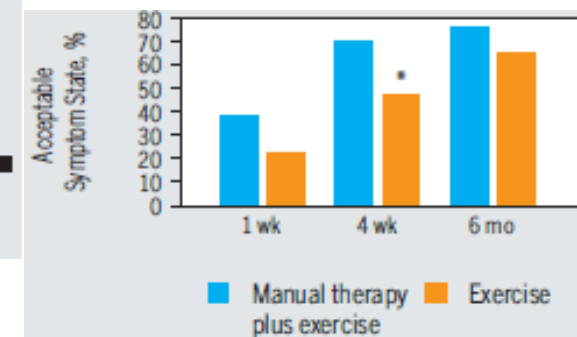


FIGURE 3. Patient Acceptable Symptom State success (response of "yes") by group and time.

🔴 **CONCLUSION:** Adding 2 sessions of high-dose cervicothoracic manual therapy to an exercise program did not improve pain or disability in patients with shoulder pain, but did improve patient-perceived success at 4 weeks and 6 months and acceptability of symptoms at 4 weeks. More



Seated thoracic spine thrust manipulation. The therapist uses his sternum as a fulcrum on the individual's middle thoracic spine and applies a high-velocity distraction thrust in an upward direction.



The treating therapist cradles the individual's head and neck and performs a lateral translation (Maitland grades III and IV) to the right and left in neutral and flexion, 3 bouts of 30 seconds from C5 to C7.



Supine cervicothoracic thrust manipulation technique. The therapist uses his body to push down through the individual's elbows to perform a high-velocity, low-amplitude thrust directed toward moving C7 on T1.

Rehabilitation – SAPS: *Manual Therapy*



GH mobilizations specifically

- 1 study: Addition of GH mobs YES, effective for pain (but not function) (Conroy DE, JOSPT, 1998)
- 1 study: Addition of MWM is *MAY BE* helpful– Both groups improved, but no diff btw groups (Kachingwe et al, 2008)
- 1 study (Large N): Addition of GH mobs *NOT helpful* in addition to Exercise (Yiasemides R et al, PTJ, 2011)

Bottom line: The addition of GH mobs likely *NOT* helpful to improve outcomes



Rehabilitation – SAPS: HEP & US

- **SAPS – HEP and US**
 - Home-based exercise – as effective as supervised PT (systematic reviews)
 - US: not effective, except with calcific tendinopathy (systematic reviews)
 - Note – imaging evidence needed

SAPS: pain meds & injection



Guidelines:

- 1st - Oral NSAIDs and acetaminophen
Effective for pain control short-term
- 2nd - If pain is not controlled: injections

Effective - improved pain & function in the short-term & somewhat in the long-term

SAPS: pain meds & injection



Corticosteroid injection: Sys Rev/ Meta-analysis

(Mohamadi A, 2017; Boudreault, J , 2013; Buchbinder R, et al., 2009; Arroll B, 2005)

- Subacromial injections
- No better effect than pain meds
- Small short-term and long-term benefit; NNT= 5
- Multiple injections no > benefit over 1 injection
- Tendon degeneration??



SAPS: Calcific tendonitis

- Calcific tendinitis
 - Dx: radiographic evidence or Diagnostic US evidence
 - US demonstrated to be effective
 - ▶ Removal: CA deposits dissolved with injected saline, & extracted (Serafini G, 2009): improved function & pain

Non-operative Treatment: how successful is it?



- Tendinopathy → partial-thickness tears
 - 85- 90% of patients report ‘successful’ outcomes after rehabilitation
- No benefit of acromioplasty vs. rehab only
(Brox et al; 1993, 1999; Haahr, 2005, 2006; Ketola S, 2009, 2013; Holmgren, 2012; Judge, 2014)
- Rehabilitation first

Non-operative Treatment: how successful is it?



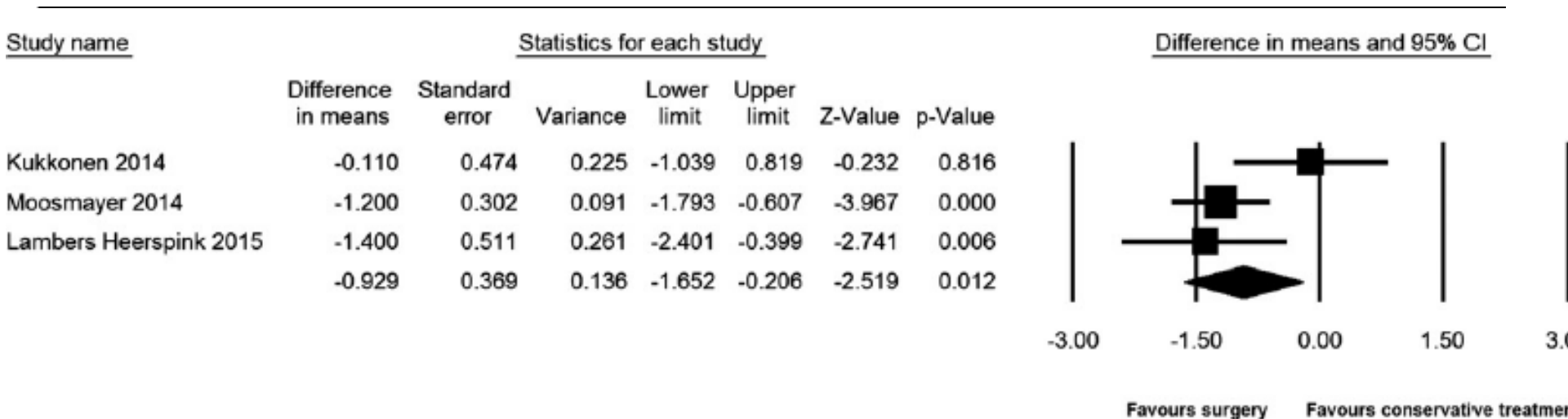
- Full-thickness tears
 - 75 – 80% of patients do not request surgery at 2 years follow-up (Moonsmayer; 2010, 2015; Kukkonen, 2014; Kuhn J, 2013; Cummins, 2012)
 - Limited evidence of substantial tear progression with non-surgical approach
 - Older, chronic tears, respond to rehab in 3 – 4 months:
** Rehab should be first option

Surgery or conservative treatment for rotator cuff tear: a meta-analysis

Ryosa A, et al, Disability and Rehabilitation, 39:14, 1357-1363, 2017.

► IMPLICATIONS FOR REHABILITATION

- There is limited evidence that surgery is not more effective in treating rotator cuff tear than conservative treatment alone.
- There was no clinically significant difference between surgery and active physiotherapy in 1-year follow-up in improving Constant score or reducing pain caused by rotator cuff tear.
- As physiotherapy is less prone to complications and less expensive than surgery, a conservative approach is advocated as the initial treatment modality to rotator cuff tears.



Follow-up 1 year

3. Forest plot of change in pain level on a visual analogue scale from 0 to 10 points in 1-year follow-up.



FT-RCT - Considerations

- Full-thickness tears
 - Pain does not correlate with (Dunn W, 2014; Unrah, 2014)
 - Size of the tear
 - Tendon retraction
 - Superior HH translation
 - Impairments
 - But - Are we ‘kicking the can down the road’?



Who should have surgery as the first option?

- Full-thickness tears
 - Age, acute tears, functional demands, goals

Young/ younger, acute tear, hi function, hi goals

Younger with chronic tears, and hi function/ goals

** Consider surgery as the first option?

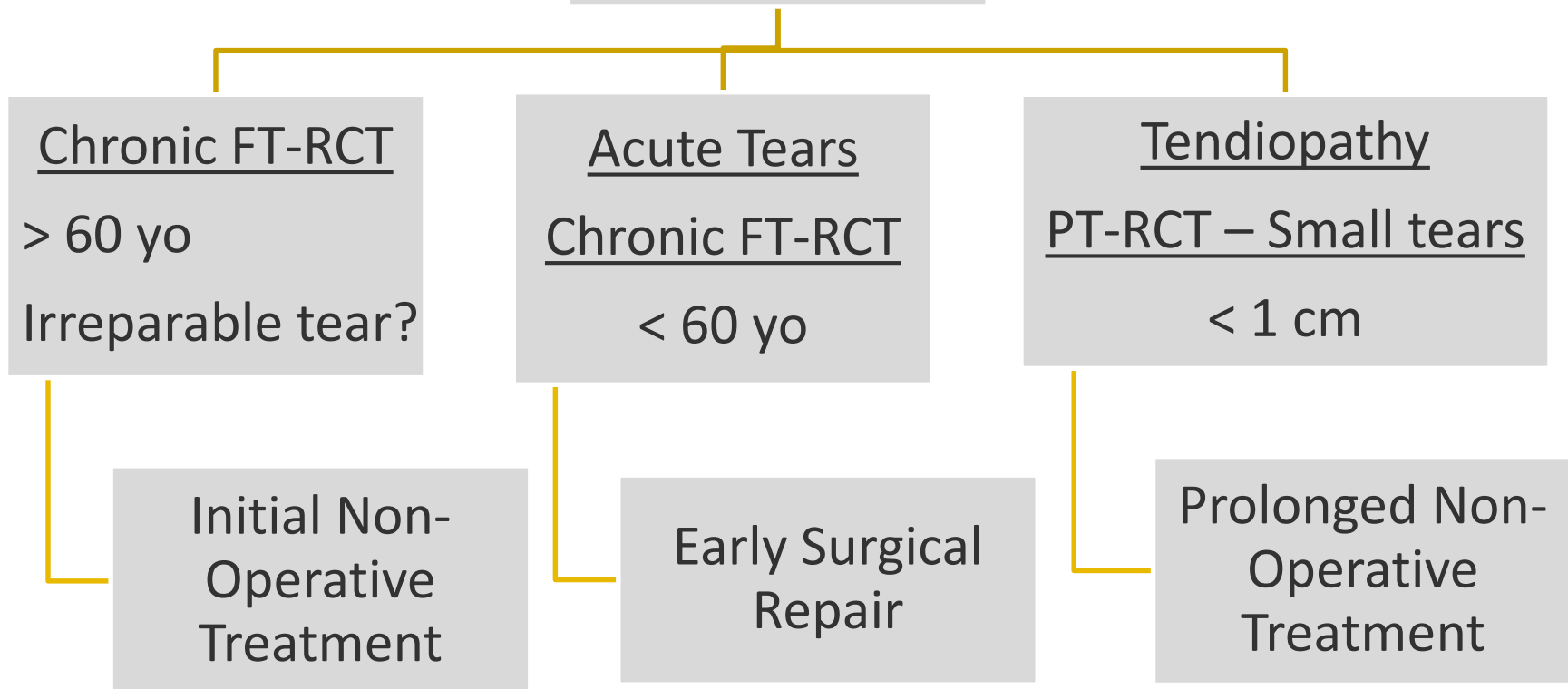


Surgical Treatment?

- Full-thickness tears – Surgical repair
 - Good outcomes generally (Moosmayer, 2010, 2015; Koh, 2014; Carr, 2012)
 - Re-tear rates – 22 – 48%
 - Difference in outcomes if re-tear vs. not? NO



Rotator Cuff Disease



Adapted from: Edwards P et al, IJSPT, 2016; ' Tashjian RZ, Clin Sports med, 2012

Questions?





USC Division of Biokinesiology
and Physical Therapy

University of Southern California