



## Best Treatment Approach for Subacromial Impingement Syndrome

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Chad E. Cook PhD, PT, MBA, FAAOMPT





## Disclosure

- ◆ AAW receives honorarium for educational presentations


## Session Learning Objectives

- ◆ Paraphrase your understanding of the diagnosis of subacromial impingement syndrome
- ◆ Evaluate the role of system routing on the outcomes of individuals with SIS
- ◆ Compare and contrast best examination methods for SIS
- ◆ Analyze the effectiveness of injection therapies versus conservative care for individuals with SIS
- ◆ Analyze the effectiveness of surgery versus conservative care for individuals with SIS
- ◆ Interpret findings from presented material regarding your treatment approach
- ◆ Appraise whether you will change your practice patterns based on today's presentation


## Subacromial Impingement Syndrome

Pain with arm abduction	Loss of arm function
Decreased Range of motion	Scapular dyskinesia
Hooked acromion	Ischemia within supraspinatus
Degenerative tendon	Joint hyperlaxity
Decreased subacromial space	Increased subacromial pressure
oedema	Coracoid impingement
Calcifying tendinitis	Night pain

## HISTORY AND ANATOMY OF IMPINGEMENT

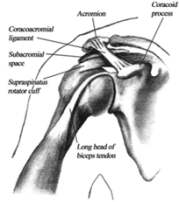


What is Shoulder Impingement?



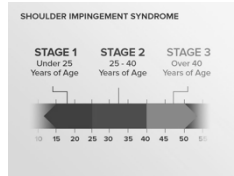
## Dear Old Neer

- ◆ Impingement is the result of abrasion by the under surface of the anterior margin of the acromion onto the soft tissues located anatomically in the space between the humeral head and acromion leading to... Subacromial Impingement Syndrome
- ◆ Soft tissues most commonly involved are bursal side of the supraspinatus and long head of biceps tendon which compress against acromion and coracoacromial ligament



## The 3 Stages

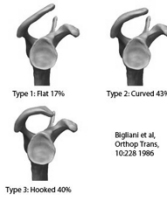
- Stage 1
  - < 25 years of age; tendinous oedema and haemorrhage; no surgery required
- Stage 2
  - 25-40 years of age; tendinitis; bursectomy and coracoacromial ligament division should be considered after 18 months of conservative treatment
- Stage 3
  - > 40 years; bone spurs and tendon rupture; acromioplasty required



## The Culprit?



The angle of the acromion (in red) can make you more or less prone to impingement.



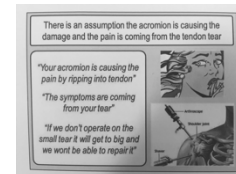
## The Cure? – Surgery!

- Prior to Neer's model, surgeons were performing complete acromiomectomies and lateral acromioplasties to alleviate the symptoms
- Neer asserted that removal of the inferior aspect of the anterior acromion had greater efficacy with a partial resection of the coracoacromial ligament



## Some numbers for you

- 746% increase in acromioplasties performed in the UK between 2001 to 2010
- 141% increase in RC repairs between 1996 to 2006
- US \$4860 – Average cost of acromioplasty and postsurgical rehab



Lewis J. Rotator cuff related shoulder pain: Assessment, management, and uncertainties. Manual Therapy 2016;23:57-68

## But Wait????

<p><b>Subacromial Impingement Syndrome</b> Exercise is as effective as Surgery ...at 1, 2, 4 and 5 year follow ups ...at a fraction of the cost of surgery</p> <p>Huath et al (2005) 1 year follow up Huath &amp; Anderson (2009) 4 year follow up Kettala et al (2009) 2 year follow up Kettala et al (2013) 5 year follow up</p>	<p><b>Subacromial Impingement Syndrome</b> Exercise significantly reduces the need for Surgery ...up to 80%</p> <p>Holmgren et al (2012) Effect of specific exercise strategy on need for surgery in patients with SIS: randomised controlled study. <i>BMJ</i></p>
<p><b>Rotator Cuff Partial Thickness Tears (&lt; 75%)</b> Exercise is as effective as Surgery ...at a fraction of the cost of surgery</p> <p>Treatment of non-traumatic RC tears. n=180 shoulders Group I Physiotherapy (n=10 treatments) Group II Acromioplasty &amp; physiotherapy Group III RC repair, acromioplasty &amp; physiotherapy Kukkonen et al (2014) <i>BMJ Journal</i></p>	<p><b>(Atraumatic) Full Thickness Rotator Cuff Tears</b> Exercise significantly reduces the need for Surgery (75%) @2 years</p> <p>Kuhn et al (2013) Effectiveness of PT in treating atraumatic FT RC tears: a multicentre prospective cohort study. <i>JSM&amp;Surg</i></p>

@JeremyLewisPT www.LondonShoulderClinic.com

## Could it be something else?

- So if surgery removed the culprit (acromion) but was found to be no more effective than structured rehab???
- To my knowledge, structured rehab does not remove the acromion



Neer's last surgical case...note the word LAST!

## Let's Discuss

- If the acromion is causing the problem, then theoretically the damage should be to the superior aspect or bursal side of the rotator cuff (supraspinatus)
- However, previous studies have shown that a majority (76%) of partial thickness tears occur on the inferior (articular side) aspect of the tendon or intra-tendinous
- Argued that tears secondary to intrinsic degeneration rather than acromial irritation – mechanical abrasion may not play such an important role as we once thought



Elhan H. Diagnosis and treatment of incomplete rotator cuff tears. Clin Orthop Relat Res 1990;64-74.

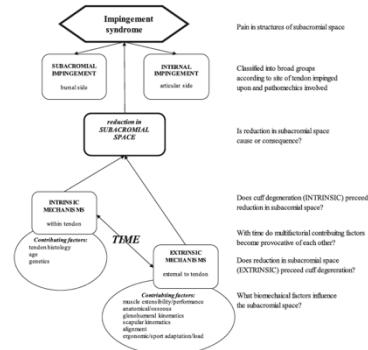


Fig. 3. Flow chart summarizing the state of knowledge with regard to impingement syndrome with specific focus on the role of the subacromial space. Mackenzie TA et al. An evidence-based review of current perceptions with regard to the subacromial space in shoulder impingement syndromes: Is it important and what influences it? Clin Biomech 2016;30:641-648.

## Pathological Factors

### Extrinsic Factors

- Anatomical/ osseous
- Posture and muscle imbalance?
- Glenohumeral or scapular kinematics
- Ergonomic factors
- Sport specific factors

### Intrinsic Factors

- Tensile/shear overload
- Mechanical properties
- Morphology
- Vascularity within the tendon

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## Tendon Histology

- Cuff degeneration precedes subacromial space reduction
- Degeneration may be secondary to progressive tendon failure and a part of the normal aging process!
- Histological changes within the tendons, alterations in biology, mechanical properties, morphology, and vascularity of the tendon are considered responsible for RC tendinopathy
- With age, the tendon becomes susceptible to intrinsic shear failure
- With age, tendon become less elastic and loses tensile strength

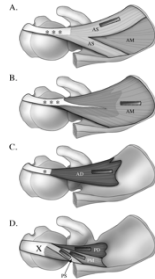
## Tendon Histology

- Perhaps the pathoetiology is explained better as intrinsic tendon failure as a consequence of excessive tissue load resulting in a swollen tendon and swelling pushing up in to the space rather than the acromion pushing down.
- Chronic strain under the coracoacromial ligament may result from swollen tendon as well as rotator cuff fatigue or failure resulting in superior translation of the humeral head during elevation.
- Uneven loads across the tendon may result in intratendinous shearing resulting in degeneration and tears
- If so, acromioplasty will not fix it (intrinsic tendon failure)

Lewis JS. Subacromial impingement syndrome: a musculoskeletal condition or a clinical illusion? Phys Ther Reviews 2011.

## Length-Tension Relationship?

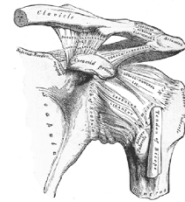
- It has been found that the joint sided fibres have decreased cross-sectional area than the superior sided fibres
- Additionally, when put on stretch (especially in positions of elevation), joint sided deeper fibres have been found to be more vulnerable to tensile load failing at 1/2 that of the superior sided fibres
- Deeper side fibres may pass their physiological failure point when subjected to unaccustomed activity or extra intensity
- Age doesn't help this process as we know the tendon becomes less elastic and loses tensile strength thus making it even more susceptible to intrinsic shear failure



Kim S.Y. et al. Fiber type composition of the architecturally distinct regions of human supraspinatus muscle: A cadaveric study. *Hand* 2013;28:1021-1028

## The Innocent have been set FREE!

- Think of this as an association vs cause
- Increasing ranges of shoulder elevation increase subacromial pressure and increased tension on the acromial insertion of the coracoacromial ligament
- Chronic strain on the ligament on the acromial side may result in Type II (curved) and Type III (hooked) acromion representing a degenerative process as opposed to a morphological variation

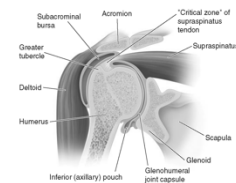


## Coracoacromial Ligament

- The coracoacromial ligament contains free nerve endings and neovascularity making it a potential source of symptoms
- Failure of the rotator cuff to stop superior translation of the humeral head during arm elevation places the ligament at risk of chronic strain
- Interesting that surgeons remove the ligament responsible for preventing superior translation of the humeral head when there is no evidence to support the existence of impingement from this structure

## Subacromial Bursa

- Also contains mechanoreceptors and free nerve endings making it a significant pain generator
- Studies demonstrating no difference between those undergoing subacromial bursectomy alone vs. bursectomy plus acromioplasty again suggesting this is an intrinsic disorder rather than external mechanical disorder



## Pathological Factors

### Extrinsic Factors

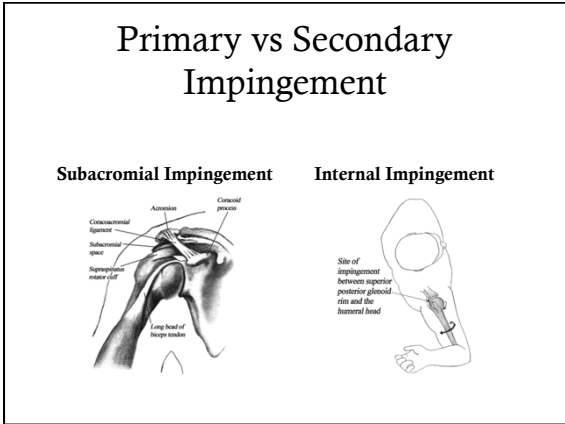
- Anatomical/osseous
- Glenohumeral or scapular kinematics
- Posture and muscle imbalance?
- Ergonomic factors
- Sport specific factors

### Intrinsic Factors

- Tensile/shear overload
- Mechanical properties
- Morphology
- Vascularity within the tendon

## Glenohumeral Joint

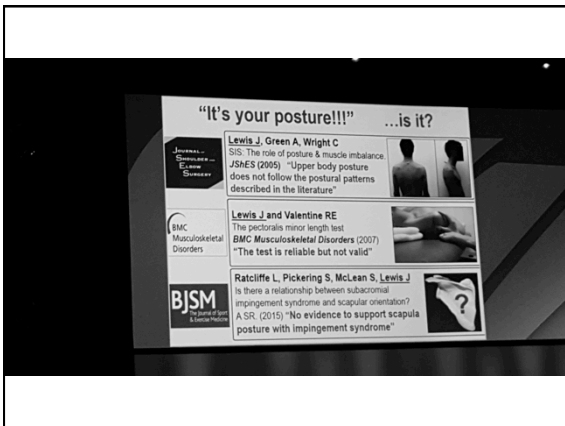
- Loss of flexibility in the posterior capsule of the GHJ interrupts optimal GHJ kinematics and can lead to increased superior translation of the humeral head and compromise subacromial space (primary impingement)
- Instability of the GHJ (weak RC/biceps tendon) can result in excessive humeral head translation, overloading the passive restraints of the GHJ resulting in GH laxity and secondary mechanical impingement of the RC by the coracoacromial arch (secondary impingement)
- Counterbalancing humeral head translation during the performance of specific movements is an important function of the RC. Alteration of the path of instant center of rotation of the GHJ is considered a factor compromising the subacromial space



## Posture and Muscle Imbalance

### Here's what we DON'T know!

- Limited evidence to support that thoracic kyphosis is a contributor
- Little evidence to support the existence of an ideal posture of the head, neck, thorax
- We don't know the ideal scapular position
- We don't know that uncontrolled scapular movement and dyskinesia is always a primary problem
- We don't know rehab can correct posture that is considered abnormal
- We don't know that the idea of correction leads to improved function and reduced pain
- One size does not fill all in assuming that all scapula have the same geometry, move in the same way, on the same shaped rib cage and thorax!



**Manual Therapy**  
 An International Journal of Musculoskeletal Science and Practice  
 December 2016 Volume 26, Pages 38-46

### Is thoracic spine posture associated with shoulder pain, range of motion and function? A systematic review

Eva Barrett, Mary O'Keefe, Kieran O'Sullivan, Jeremy Lewis, Karen McCreesh

#### Conclusions

Thoracic kyphosis may not be an important contributor to the development of shoulder pain. While there is evidence that reducing thoracic kyphosis facilitates greater shoulder ROM, this is based on single-session studies whose long-term clinical relevance is unclear. Higher quality research is warranted to fully explore the role of thoracic posture in shoulder pain.

**Scapular dyskinesia: evolution towards a systems-based approach**  
 Elaine G Willmore<sup>1</sup> and Michael J Smith<sup>2</sup>

**Table 1. Challenges to the evidence regarding scapula dyskinesia**

In the absence of an identified normal, abnormal is an unknown entity
What is perceived as abnormal may in fact be a normal adaptation strategy
Tests used to supposedly identified abnormalities cannot be claimed to do so given that they lack construct validity
Measurements are unreliable and prone to measurement error and bias
A causal relationship between the existence of scapular dyskinesia and the presence of symptoms cannot be established

## Maybe variation is normal!

Baseball games are like snowflakes and fingerprints, no two are ever alike.

— W. P. Risold —


Soni G et al. Morphometric analysis of the suprascapular notch. *Int J Biol Anthropol.*

## Ergonomic and Sport specific adaptation

- ◆ Overuse?
- ◆ Microtrauma of the subacromial bursa, rotator cuff tendons, and long head of the biceps
- ◆ Secondary to repetitive compressive and shear forces within the subacromial space

## So what's the answer?

- ◆ Time to abandon ship!
- ◆ Non traumatic shoulder pain is multifactorial





Cook AM & Michener L. Shoulder pain: can one label satisfy everyone and everything? Br J Sports Med 2016

## Examination for Shoulder Impingement

And also Injections and Surgery

Chad E. Cook PhD, PT, MBA, FAAOMPT  
Professor and Program Director  
Duke University Department of Orthopaedics

 @chadcookpt
 

## Disclosures

- ◆ Research Consultant for the Hawkins Foundation of the Carolinas
- ◆ Receive honorarium payments for educational presentations
- ◆ Royalty payments from the following companies
  - ◆ Medbridge
  - ◆ Pearson Education
  - ◆ Educata


## Outline

- ◆ Systems Management
- ◆ Examination of SIS
- ◆ Injection treatment of SIS
- ◆ Surgical treatment of SIS

## Population Health Concept

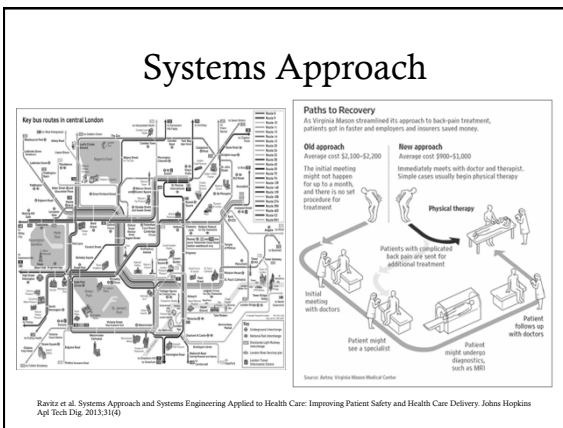
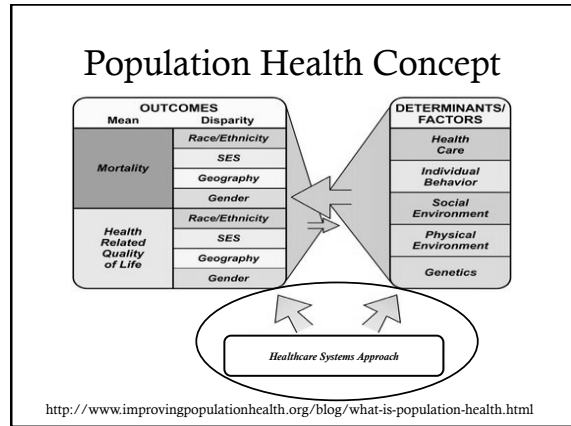
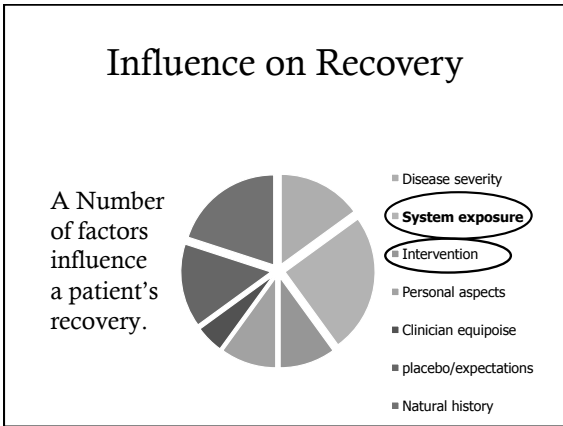
- ◆ Involves the integration of knowledge across the many factors that influence health and health outcomes.

OUTCOMES	
Mean	Disparity
Mortality	Race/Ethnicity
	SES
	Geography
	Gender
Health Related Quality of Life	Race/Ethnicity
	SES
	Geography
	Gender

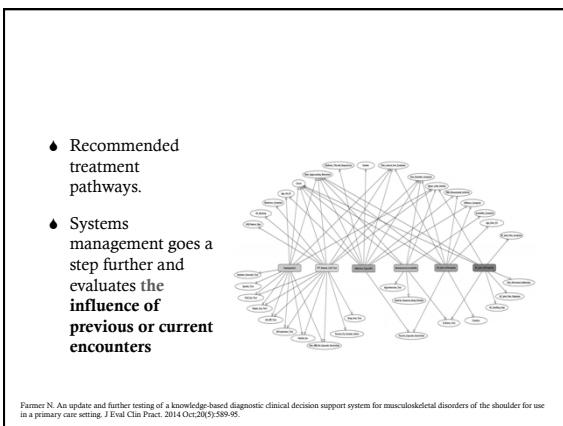


DETERMINANTS/FACTORS
Health Care
Individual Behavior
Social Environment
Physical Environment
Genetics

<http://www.improvingpopulationhealth.org/blog/what-is-population-health.html>



- ### Systems Approach in Medicine
- ◆ It readily apparent that health care as it exists today is neither a system nor a system of systems.
  - ◆ Our current healthcare system involves Ah Hoc management processes with selected parties who have a vested interest
- Ravitz et al. Johns Hopkins Appl Tech Dig. 2013;3(4) <http://www.evidencemotion.com/blog/2013/02/12/inconsistencies-in-value-focus/>



- ### Systems Management is About Optimizing Processes
- ◆ 1. (If) Should Patients be Seen (is care needed)?
    - ◆ A. If so, who should see them first?
    - ◆ B. If so, how much?
  - ◆ 2. (Then) What Care should be Provided?
    - ◆ A. Effectiveness?
    - ◆ B. Value (health outcomes achieved per dollar spent)
- 
- Peterson M. What is Value in Health Care? N Engl J Med 2010; 363:2477-2481


## Systems Management

- ◆ 1. (If) Should Patients with Shoulder Impingement Symptoms (SIS) be Seen (is care needed)?
  - ◆ A. If so, who should see patients with SIS first?
  - ◆ B. If so, how much should patients with SIS be seen?
  
- ◆ 2. (Then) What Care should be Provided to patients with SIS?
  - ◆ A. What treatments are Effective for patients with SIS?
  - ◆ B. What care has Value for patients with SIS? (health outcomes achieved per dollar spent)

Porter M. What Is Value in Health Care? N Engl J Med 2010; 363:2477-2481


## Step 1: Should Patients with SIS be Seen?

- ☑ ◆ To Rule out something else (Red Flags)
- ☑ ◆ If it impacts quality of life markedly
- ☑ ◆ If the patient has high expectations of the need for care



## Step 1: Should Patients with SIS be Seen?

- ◆ (Yes) To Rule out something else (Red Flags)
- ◆ (Yes) If it impacts quality of life markedly
- ◆ (Yes) If the patient has high expectations of the need for care



## Generic Red Flags


**Red flags**

- ◆ constant, progressive non-mechanical pain
- ◆ history: drug abuse, cancer, HIV
- ◆ weight loss
- ◆ violent trauma
- ◆ widespread neurological signs and symptoms
- ◆ soft-tissue mass on clinical examination

Bross JI. Regional musculoskeletal conditions: shoulder pain. Best Pract Res Clin Rheumatol. 2003 Feb;17(1):33-56.


## Region Specific-Red Flags

<p><b>Left Shoulder</b></p> <ul style="list-style-type: none"> <li>◆ Cervical Spine</li> <li>◆ MI 68.7% of patients reported shoulder pain during an acute myocardial infarction</li> <li>◆ Ruptured Spleen (not common)</li> <li>◆ Pancoast's Tumor</li> </ul>	<p><b>Right Shoulder</b></p> <ul style="list-style-type: none"> <li>◆ Cervical Spine</li> <li>◆ Liver Disease                             <ul style="list-style-type: none"> <li>◆ Carcinoma, Cirrhosis, Hepatitis</li> </ul> </li> <li>◆ Post Bariatric Surgery</li> <li>◆ Gastric Perforation</li> <li>◆ Peptic Ulcer</li> <li>Gall Bladder: Cholecystitis                             <ul style="list-style-type: none"> <li>◆ Typically accompanied by fever, or nausea/vomiting</li> </ul> </li> </ul>
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## Step 1: Should Patients with SIS be Seen?

- ◆ (Yes) To Rule out something else (Red Flags)
- ◆ (Yes) If it markedly impacts quality of life and occupation
- ◆ (Yes) If the patient has high expectations of the need for care





## How do we Measure Shoulder Severity (Impact)?

- For English, Norwegian and Turkish users, use the SPADI.
- Dutch users could use either the Shoulder Disability Questionnaire or the Simple Shoulder Test.
- In German, the DASH.
- In Tamil, Slovene, Spanish and the Danish languages, the evaluated PROMs were not yet of acceptable validity.
- None of these PROMs showed strong positive evidence for all measurement properties.

Thomes-de Graaf et al. Evaluation of measurement properties of self-administered PROMs aimed at patients with non-specific shoulder pain and "activity limitations": a systematic review. *Qual Life Res*. 2016 Sep;25(9):2141-60.

## If it is Worsening Chronification?



- There is strong evidence that high scores on the Shoulder Pain and Disability Index (SPADI), high scores on shoulder pain intensity, and a long duration of complaints are factors that contribute to the chronification of shoulder pain.

Straay F, Geertens J, Noten S, Meera M, Nijs J. A Multivariable Prediction Model for the Chronification of Non-traumatic Shoulder Pain: A Systematic Review. *Pain Physician*. 2016 Feb;18(2):1-10.

## Step 1: Should Patients with SIS be Seen?

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- (Yes) If the patient has high expectations of the need for care



*J Rehabil Med* 2014; 46: 1022-1028

ORIGINAL REPORT

PERCEIVED VALUE OF SPINAL MANIPULATIVE THERAPY AND EXERCISE AMONG SENIORS WITH CHRONIC NECK PAIN: A MIXED METHODS STUDY

Michele Malers, DC, MPH, Corrie Vinstadt, MEd, LAc, Linda Hanson, DC and Roni Evans, DC, MS, PhD

From the Wolfe-Harris Center for Clinical Studies, Northwestern Health Sciences University, Bloomington Minnesota, USA

Review

**ANZJP**

The nocebo effect: A clinicians guide

*Australian & New Zealand Journal of Psychiatry*  
47(7):617-623  
DOI: 10.1177/0004862113506471

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João Data-Franco<sup>1,2</sup> and Michael Berk<sup>3,4,5</sup>

SAGE

Abstract

## Patient Expectations (It matters)

*J Shoulder Elbow Surg* 2013; 23: 1300-1311



SHOULDER

2013 Near Award: predictors of failure of nonoperative treatment of chronic, symptomatic, full-thickness rotator cuff tears

Warren R. Dunn, MD, MPH<sup>1</sup>, John E. Kuhn, MD, MS<sup>1,2</sup>, Rosemary Sanders, BA<sup>1</sup>, Qi An, MS<sup>1</sup>, Keith M. Baumgarten, MD<sup>1</sup>, Julie Y. Bishop, MD<sup>1</sup>, Robert H. Brophy, MD<sup>1</sup>, James L. Carey, MD, MPH<sup>1</sup>, Frank Harrel, PhD<sup>1</sup>, Brian G. Holloway, MD<sup>1</sup>, Grant L. Jones, MD<sup>1</sup>, C. Benjamin Ma, MD, Robert G. Marx, MD, MS<sup>1</sup>, Eric C. McCarthy, MD<sup>1</sup>, Sourav K. Podder, MD<sup>1</sup>, Matthew V. Smith, MD<sup>1</sup>, Edwin L. Spence, MD<sup>1</sup>, Armando F. Viskal, MD<sup>1</sup>, Brian R. Wolf, MD, MS<sup>1</sup>, Rick W. Wright, MD<sup>1</sup>, for the MOON Shoulder Group



JOURNAL OF SHOULDER AND ELBOW SURGERY



- "A patient's decision to undergo surgery is influenced more by low expectations regarding the effectiveness of physical therapy than by patient symptoms or anatomic features of the rotator cuff tear"

## Step 1a: Who should see patients with SIS first?

- Does Order of Provider actually influence outcome?
- Who is best equipped to assess patients?
- What tools are best to use during initial assessment?

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### Importance of the type of provider seen to begin health care for a new episode low back pain: associations with future utilization and costs

Julie M. Fritz PhD PT FAPTA,<sup>1,2</sup> Jaewhan Kim PhD<sup>3</sup> and Josette Dorius BSN MPH<sup>4</sup>

<sup>1</sup>Professor, Department of Physical Therapy, College of Health, University of Utah, Salt Lake City, UT, USA

<sup>2</sup>Associate Dean for Research, College of Health, University of Utah, Salt Lake City, UT, USA

<sup>3</sup>Assistant Professor, Department of Family and Preventive Medicine, University of Utah, Salt Lake City, UT, USA

<sup>4</sup>Clinical Operations Director, University of Utah Health Plans, Salt Lake City, UT, USA

- “Entry setting for LBP was associated with future health care utilization and costs. Consideration of where patients chose to enter care may be a strategy to improve outcomes and reduce costs”

## The Influence of the Provider Type Seen First

	MD First	PT First	P value
Total Days in Care	44.4 (52.8)	34.33 (37.7)	0.02
Physical Therapy Costs	\$894.3 (860.5)	\$636.9 (677.6)	<0.01
Radiology Costs	\$384.1 (688.2)	\$238.8 (556.2)	0.01
Total Costs	\$3,124.7 (9,004.7)	\$1,637.6 (3,723.6)	0.04

Denninger T, Cook C, Thigpen C. In Review

## The Influence of Order of Care Received PT First Versus Opioids First

Variable	PT Before Opioids	Opioids Before PT	P value
Total Number of Opioid Prescriptions	4.7 (6.4)	9.9 (16.4)	<0.01
Total Days Supply of Opioids	53.1 (101.9)	134.1 (280.2)	<0.01
Number with Three or More Opioid Prescriptions	305 (54%)=yes 257 (46%)=no	295 (73%)=yes 111 (27%)=no	<0.01

Rhon D, Soodgrass S, Cleland J, Cook C. In review.

Table 2. Average Costs and Number of Unique Drug Products for Specialties with the Highest Number of Prescribers, 2013

Specialty	Number of Prescribers	Average Total Costs	Cost per Claim	Average Number of Unique Drug Products Prescribed
Internal Medicine	130,640	\$205,923	\$63	65.7
Dentist	124,322	\$855	\$14	2.1
Family Practice	105,413	\$211,977	\$56	74.9
Nurse Practitioner	97,722	\$67,708	\$78	24.2
Physician Assistant	69,180	\$47,405	\$70	18.7
Emergency Medicine	43,664	\$16,822	\$41	9.5
Organized Health Care Education/Training Program - Student	42,307	\$8,036	\$67	5.6
Obstetrics/Gynecology	35,979	\$15,953	\$85	6.2
Psychiatry	25,906	\$174,274	\$104	28.3
Optometry	25,654	\$17,501	\$99	4.8

<https://www.cms.gov/newroom/MediaReleaseDatabase/Fact-Sheets/2015-Fact-sheets-items/2015-04-30.html>

## Step 1a: Who should see patients with SIS first?

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## Synthesizing Findings (Differentiation)

- The diagnosis of SIS implies a spectrum of clinical findings, not injury to a specific structure.

Original article

**Does physiotherapy diagnosis of shoulder pathology compare to arthroscopic findings?**

Mary Elizabeth Magary,<sup>1</sup> Mark Alan Jones,<sup>1</sup> Chad E Cook,<sup>2</sup> Michael George Hayes<sup>3</sup>

**ABSTRACT**  
 Aims: To explore the ability of a physiotherapist using standardized musculoskeletal/physiotherapy assessment protocols to accurately identify the structure(s) primarily responsible for shoulder symptoms against a standardized arthroscopic shoulder diagnostic assessment, and to determine the physiotherapist's ability to reflect post-test diagnostic accuracy.  
**Study Design:** Comparative case-based cohort study.  
**Setting:** Private orthopaedic clinic.  
**Method:** All consenting participants selected for arthroscopic investigation were recruited for the physiotherapy prior to arthroscopy. Prevalence and primary etiology of diagnoses/diagnoses were recorded on a standardized form. Time and intra-rater reliability and diagnostic accuracy were calculated.

**Conclusion:** The ability of physiotherapists to accurately diagnose shoulder pathology using the shoulder has been reported in comparison to that of general practitioners. The use of comparison to structural pathology observed during arthroscopic investigation, as a result of the inclusion of general medical of shoulder symptoms with underlying clinical presentation, demonstrated diagnostic accuracy involves more than a simple evaluation of a single view or group of views in the context of a single identifiable pathology. Physiotherapy diagnosis accuracy involves identification of the structural source of symptoms, the pathology within the involved anatomical, and the extent of any processes contributing but not primary to the patient's symptoms. Such detailed evaluation has not previously been reported. Shoulder arthroscopic comparison to the 'normal' gold standard of shoulder

Magary ME, Jones MA, Cook CE, Hayes MG. Does physiotherapy diagnosis of shoulder pathology compare to arthroscopic findings? *Br J Sports Med.* 2016 Sep;50(18):1151-7. doi: 10.1136/bjsports-2014-094339. Epub 2015 Oct 28.

## Somewhat Underwhelming

Table 7 Comparison with the arthroscopists for the physiotherapist

	Broad	Strict
Subacromial impingement		
Sensitivity	0.26	0.38
Specificity	0.83	0.81
Accuracy	0.68	0.68
Positive predictive value	0.37	0.47
Negative predictive value	0.75	0.75
Positive likelihood ratio	1.52	2.0
Negative likelihood ratio	0.89	0.77

Overall diagnostic category subacromial and the subgroups, tendon ruptures, tendinopathy and tenosynovitis, all tendon lesions and subacromial impingement. Broad (agreement on presence of a condition); Strict (agreement on principal diagnosis). PT, physiotherapist.

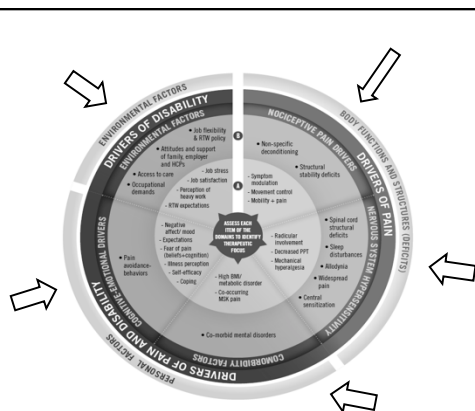
Magary ME, Jones MA, Cook CE, Hayes MG. Does physiotherapy diagnosis of shoulder pathology compare to arthroscopic findings? *Br J Sports Med.* 2016 Sep;50(18):1151-7. doi: 10.1136/bjsports-2014-094339. Epub 2015 Oct 28.

## Step 1a: Who should see patients with SIS first?

- Does Order of Provider actually influence outcome?
- Who is best equipped to assess patients?
- What tools are best to use during initial assessment?

## Examination of the Shoulder

1. Patient History
2. Contextual Factors
3. Tests for the shoulder



## Key Elements of Patient History (is this a shoulder problem?)

- Ask about pain with overhead movements
- Typical symptom is anterolateral shoulder pain that worsens at night and with overhead activity.
- Ask about pain lying on affected side at night
- Difficulty reaching up behind the back, pain when the arms are extended above the head, and weakness of the shoulder.

Bruce S. Shoulder injuries - management in general practice. *Aust Fam Physician.* 2012 Apr;41(4):188-94.

Buss DD, Frechill MQ, Marra G. Typical and atypical shoulder impingement syndrome: diagnosis, treatment, and pitfalls. *Interv Course Lect.* 2009;38:447-57.

## Risk Stratification

- ◆ Predictors of **high risk** categorization included older age, no surgical history, insurance designated as worker's compensation, litigation or automotive and three or more co-morbidities.
- ◆ Predictors of **low risk** categorization were younger age, shorter duration of symptoms, no surgical history and payer type.

Rodriguez JR, Cleland JA, Minkten PE, Cook CE. Risk stratification of patients with shoulder pain seen in physical therapy practice. *J Eval Clin Pract.* 2016 Jun 29. doi: 10.1111/jep.12591. [Epub ahead of print]

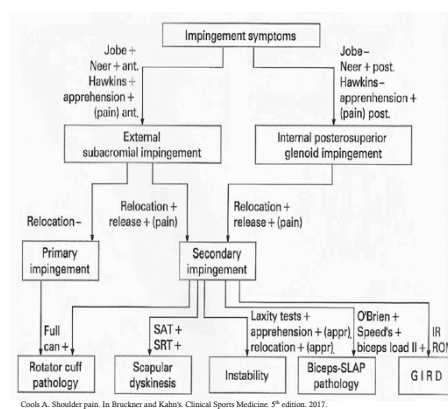
## REVIEW ARTICLE

### Central Pain Processing in Patients with Shoulder Pain: A Review of the Literature

Suzie Noten, MSc<sup>\*†</sup>; Filip Struyf, PhD<sup>\*</sup>; Enrique Llach, PhD, MSc<sup>‡,†</sup>;  
Marika D'Hoore, PT, MSc<sup>\*</sup>; Eveline Van Looveren, PT, MSc<sup>\*</sup>;  
Mira Meeus, PhD<sup>\*†,§</sup>

<sup>\*</sup>Department of Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp; <sup>†</sup>Pain in Motion International Research Group, Antwerp, Belgium; <sup>‡</sup>Department of Physical Therapy, University of Valencia, Valencia, Spain; <sup>§</sup>Department of Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium

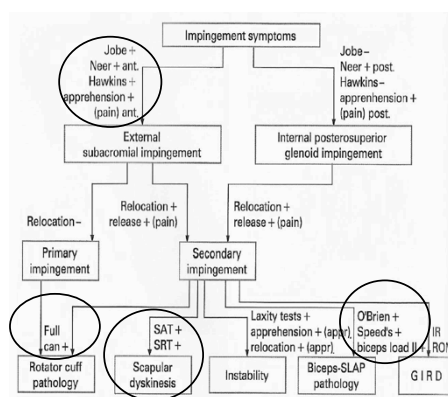
## The Physical Examination



Cools A. Shoulder pain. In Bruckner and Kahn's. *Clinical Sports Medicine*. 9<sup>th</sup> edition. 2017.

## The Physical Examination

- ◆ **Wright et al. BJSM. 2012:** Overall, no physical examination test of the scapula was found to be useful in differentially diagnosing pathologies of the shoulder
- ◆ **Hegedus et al. BJSM 2012:** For subacromial impingement, the meta-analysis revealed that the pooled sensitivity and specificity for the Neer test was 72% and 60%, respectively, for the Hawkins-Kennedy test was 79% and 59%, respectively, and for the painful arc was 53% and 76%, respectively.
- ◆ **MacKenzie et al. Clinical Biomechanics. 2015:** Based on the current evidence, the hypothesis that a reduction in subacromial space is an extrinsic cause of impingement syndromes is not conclusively established and the evidence permits no conclusion
- ◆ **Radcliff et al. BJSM. 2017:** Currently, there is insufficient evidence to support a clinical belief that the scapula adopts a common and consistent posture in SIS



## Physical Examination-Primary

- ◆ Observation
  - ◆ Forward head and rounded shoulder
  - ◆ Scapular Dyskinesis
- ◆ Active Physiological Movements
  - ◆ Painful arc
- ◆ Passive Physiological Movements
  - ◆ IR range of motion loss
- ◆ Passive Accessory Movements
  - ◆ Posterior capsule tightness
- ◆ Strength/Endurance Testing
  - ◆ Weak in abduction, rotation and flexion
- ◆ Palpation
  - ◆ Supraspinatus tendon tenderness

Reiman M. Orthopedic Clinical Examination. Human Kinetics, Champaign, IL, 2016.

## Physical Examination-Secondary

- ◆ Observation
  - ◆ Scapular Dyskinesis
- ◆ Active Physiological Movements
  - ◆ Excessive ER and overall mobility
- ◆ Passive Physiological Movements
  - ◆ May have IR range of motion loss
- ◆ Passive Accessory Movements
  - ◆ Posterior capsule tightness
- ◆ Strength/Endurance Testing
  - ◆ IRs are weak
  - ◆ Decreased overall shoulder endurance
- ◆ Palpation
  - ◆ Supraspinatus tendon tenderness

Reiman M. Orthopedic Clinical Examination. Human Kinetics, Champaign, IL, 2016.

## Clustering

Physical Therapy in Sport 36 (2015) 87–92

Contents lists available at ScienceDirect

Physical Therapy in Sport

journal homepage: www.elsevier.com/ptsp

Masterclass

Combining orthopedic special tests to improve diagnosis of shoulder pathology

Eric J. Hegedus<sup>a,\*</sup>, Chad Cook<sup>b</sup>, Jeremy Lewis<sup>c</sup>, Alexis Wright<sup>d</sup>, Jin-Young Park<sup>d</sup>

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<sup>b</sup> Physical Therapy Program, Duke University, Durham, NC, USA

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<sup>d</sup> Shoulder, Elbow & Sports Centre, Kocaeli University, Sogut, South Korea

**Table 2**  
Best test clusters from current literature.

Author(s)	Pathology	Test cluster	LR+	LR-
(Litaker et al., 2000)	Rotator cuff tear	1 Age > 65 and 2 Weakness in external rotation and 3 Night pain	9.84	0.54
(Park et al., 2005)	Rotator cuff tear (full thickness)	1 Age ≥ 60 and 2 + painful arc test and 3 + drop arm test and 4 + infraspinatus test	28.0	0.09
(Park et al., 2005)	Impingement	1 + Hawkins-Kennedy and 2 + painful arc test and 3 + infraspinatus test	10.56	0.17
(Farber et al., 2006)	Anterior instability (traumatic)	1 + apprehension test and 2 + relocation test	39.68	0.19
(Guanche & Jones, 2003)	Labral tear	1 + relocation test and 2 + active compression test	4.56	0.65
(Guanche & Jones, 2003)	Labral tear	1 + relocation test and 2 + apprehension test	5.43	0.67

## Step 1b: How much should patients with SIS be Seen?

## Consider Natural History

- ◆ "The natural course of SIS has not been fully revealed because of the limited literature, and although the risk factors for SIS and rotator cuff pathologic conditions have been investigated by many researchers, the factors that affect the outcome and the natural course are still unknown"

Journal of Back Musculos Rehabilitation, 2015, 28(1), 1-10



Medium-term natural history of subacromial impingement syndrome

Sema Erten, MD<sup>a</sup>, Egehan Ayhan, MD<sup>b</sup>, Mehmet F. Givenc, MD<sup>c</sup>, Nayeetin Kesmezacar, MD<sup>d</sup>, Kenan Aktun, MD<sup>e</sup>, Muharrem Babacan, MD<sup>f</sup>

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<sup>e</sup>Department of Physical Medicine and Rehabilitation, Celalhanım State of Medicine, Istanbul University, Istanbul, Turkey

## We Over-diagnose and Over-treat

◆ “Over-diagnosis is the finding of mild disease for which the harms in diagnosing and treating exceed the benefits”

Overdiagnosis

### Overdiagnosis and the Information Problem

Sarah Jha, MD

These are general findings which tend to be primarily for overdiagnosis, whereas the real cause of overdiagnosis is imperfect information and the tradeoffs as a result of that imperfection.

**Key Words:** Overdiagnosis, information problem, tradeoff, epidemiology, JGIM, 2015

Overdiagnosis is the finding of mild disease for which the harms in diagnosing and treating exceed the benefits. Overdiagnosis is a problem of imperfect information, in a sense, and is not a problem of imperfect information in a sense of imperfect information.

At the time of decision making, we do not know with an acceptable level of confidence, who will and who will not be harmed.

Jha S. Overdiagnosis and the information problem. Acad Radiol. 2015 Aug;22(8):947-8.

International Journal of Rehabilitation Research 28: 33-46 (2002)

### Taking a new course in research on the effectiveness of interventions. A study of physiotherapy interventions for people with musculoskeletal complaints

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*The Maastricht Health Research Institute for Prevention and Care, Netherlands School of Primary Care Research, Department of Health Organization, Policy and Economics, Faculty of Health Sciences, Maastricht University, The Netherlands.*

“there is no hard scientific evidence on positive effects of physiotherapy on recovery as a whole”

Physiotherapy is a commonly employed intervention for people with musculoskeletal complaints. However, due to (methodological) limitations in previous research, the effectiveness of physiotherapy interventions has not yet been proven. The aim of the present study is twofold. Firstly, to address a range of the methodological problems, of which the most important are selection and endogeneity, topic and size dependence. Secondly, the effect of a physiotherapy intervention on recovery from musculoskeletal complaints is investigated. The probability of receiving a physiotherapy intervention is estimated, as well as the probability of recovery as a result of this intervention. A longitudinal design is used. *Keywords:* musculoskeletal complaints, effectiveness, research, effectiveness, musculoskeletal complaints

Joling C, Groot W, Janssen PP. Taking a new course in research on the effectiveness of interventions. A study of physiotherapy interventions for people with musculoskeletal complaints. Int J Rehabil Res. 2002 Jun;25(1):33-46.

http://jghpm.com  
Int J Health Policy Manag 2015, 4(8), 559-560

10.15171/ijhpm.2015.108

Commentary

## The Difficult Choice of “Not Doing”

Comment on “Quaternary Prevention, an Answer of Family Doctors to Overmedicalization”

Giorgio Visentin\*

**Abstract**  
The article of Marc Jansoulle shows the importance of the contribution of general practitioners (GPs) in improving the quality and the efficiency of the health systems. Starting from the concept of quaternary prevention for reducing excessive costs in the preventive procedures, he suggests a change of paradigm in every daily activity of the GP in order to have a stronger ethical approach to the patient. This means spending more time in the consultation in order to better understand her/his real needs and share a common decision for minimizing the costs and solving the patient's problems in agreement with her/his beliefs and values.

**Keywords:** Quaternary Preventions, Overmedicalization, Consultation

Copyright: © 2015 by Kerman University of Medical Sciences

**Article History:**  
Received: 26 April 2015  
Accepted: 28 May 2015  
Published: 2 June 2015

## Step 2 Provided to patients with SIS?

◆ A. What treatments are Effective for patients with SIS?  
B. What care has Value for patients with SIS? (health outcomes achieved per dollar spent)

## Anesthetic and Cortisone Injections

Posterior                      Anterior                      Neviaser

J Rehabil (New York) 2013; 36: 1647-1654

**Table 10 Accuracy and outcomes associated with method of injection, experience, confidence level, and diagnosis**

Variable	Appropriately placed in the joint	Placed outside the joint	Accuracy %	P Value
Type of approach	22 = Anterior	12 = Anterior	64.7%	.19
	18 = Posterior	19 = Posterior	45.7%	
	15 = Suprapatellar	18 = Suprapatellar	41.9%	
Experience level	28 = Experienced	31 = Experienced	47.9%	.24
	28 = Inexperienced	28 = Inexperienced	50.7%	
Experience and approach	19 = Experienced	19 = Experienced	50%	
	12 = Inexperienced	2 = Inexperienced	81.7%	
	8 = Experienced	11 = Experienced	42.4%	
	8 = Inexperienced	8 = Inexperienced	50%	
	12 = Experienced	12 = Experienced	50%	
	9 = Inexperienced	8 = Inexperienced	38.9%	
Confidence level	16 = Confident	16 = Confident	68%	.06
	17 = Not confident	25 = Not confident	40.4%	
Diagnosis	12 = Osteoarthritis	9 = Osteoarthritis	57.7%	.83
	31 = Adhesive capsulitis	19 = Adhesive capsulitis	54.7%	

**Accuracy of glenohumeral joint injections: comparing approach and experience of provider**

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\*Shepherd Hawkins Clinic of the Carolinas, Greenville Hospital System, Greenville, SC, USA  
\*Department of Radiology, Greenville Hospital System, Greenville, SC, USA

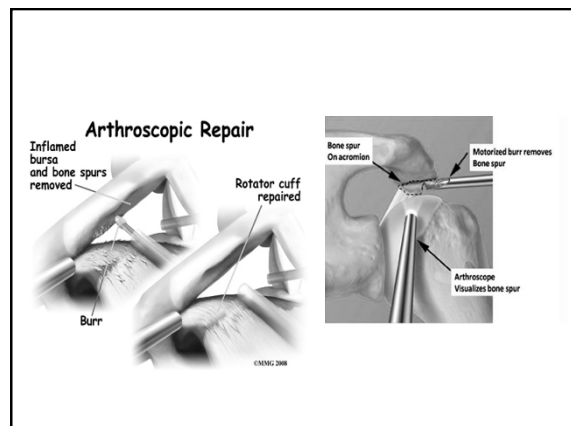
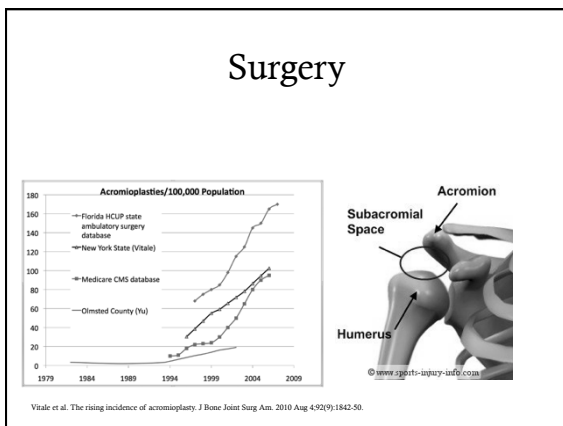
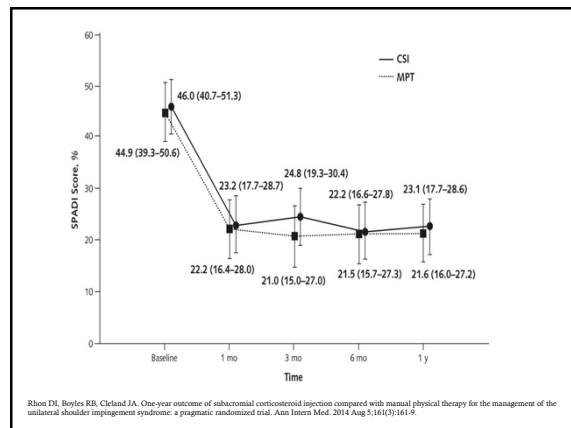
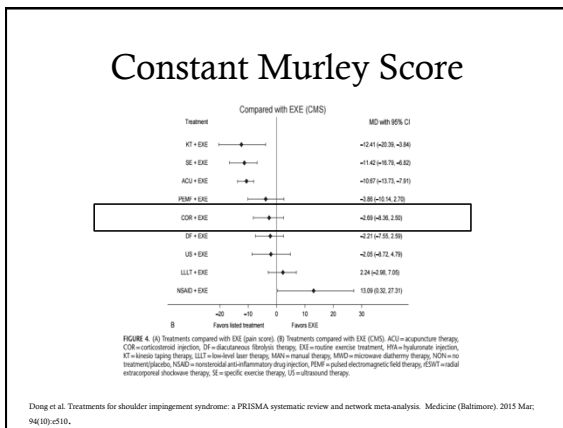
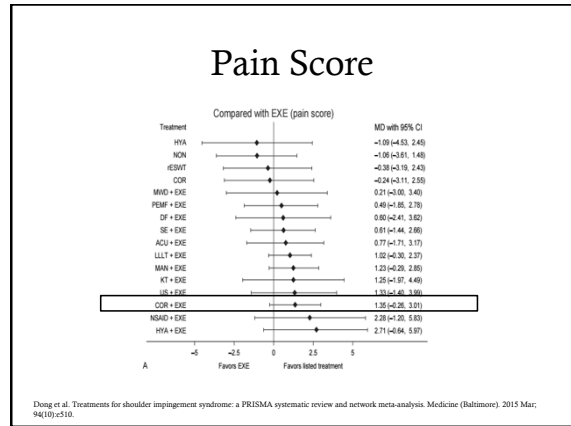
Variable	Appropriately placed in the joint	Placed outside the joint	P value
NPRS general pain intensity	3.1 (2.2)	2.9 (2.8)	.89
NPRS pain intensity during ADLs	2.5 (2.2)	2.9 (3.8)	.55
NPRS pain intensity during work	2.1 (4.4)	3.1 (4.2)	.26
NPRS pain intensity during sport	2.1 (4.5)	2.9 (4.9)	.39
NPRS pain intensity during sedentary activity	1.7 (3.1)	2.3 (3.4)	.33
SFMRQ pain adjective scale	8.1 (11.5)	8.9 (12.8)	.73
ISOR change score	13.3 (21.9)	13.3 (25.1)	.98

*J Shoulder Elbow Surg* (2010) 19, 765-661  
ELSEVIER

**Positive outcomes with intra-articular glenohumeral injections are independent of accuracy**

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<sup>a</sup>Physical Therapy Division, Department of Community and Family Medicine, Duke University School of Medicine, NC  
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<sup>g</sup>Trinity Mother Frances/University of Texas Health Science Center, Tyler Primary Care Sports Medicine Fellowship Program, Tyler, TX



**Table 4** Comparison of mean pain and dysfunction score and 95% confidence intervals (CI) by treatment group at baseline and 12 months follow-up

	Score value (mean 95% CI)		p Value*
	Physiotherapy (n=42)	Surgery (n=42)	
<b>Baseline</b>			
Visual pain and dysfunction score	7.1 (5.9 to 7.7)	7.1 (5.9 to 7.7)	0.22
<b>12 months</b>			
Average pain and dysfunction score	4.0 (3.1 to 4.8)	5.8 (4.9 to 6.7)	0.07
Improved activity level and ADL	6.2 (5.1 to 6.7)	5.7 (4.7 to 6.1)	0.48
Average pain and dysfunction score	6.1 (5.1 to 7.0)	5.7 (4.6 to 6.4)	0.18
<b>7 days</b>			
Visual pain score	25.8 (24.1 to 27.5)	25.8 (23.9 to 28.0)	0.96
<b>12 months</b>			
Visual pain and dysfunction score	5.1 (4.2 to 5.9)	5.2 (4.3 to 6.1)	0.87
Average pain and dysfunction score	3.9 (3.1 to 4.7)	3.2 (2.4 to 4.0)	0.03
Improved activity level and ADL	4.3 (3.4 to 5.0)	4.2 (3.1 to 5.1)	0.90
Average pain and dysfunction score	4.1 (3.1 to 5.1)	3.4 (2.4 to 4.1)	0.86
<b>7 days</b>			
Visual pain score	17.8 (16.4 to 19.2)	17.8 (16.1 to 19.5)	0.99
Visual pain and dysfunction score	17.8 (16.4 to 19.2)	17.8 (16.1 to 19.5)	0.99

\*One-way analysis of variance. ADL, activities of daily living. PAIN, pain score; score of four VAS subscale (scale 0-10) mentioned in the table. \*Given within the physiotherapy group were operated on a later time. \*p < .05, Analysis of variance. Higher score indicates more pain and poorer function.

Haahr et al., 2005 (1 year follow up)

**Table 2** Self-reported outcomes at 4-8 years' follow-up among 84 cases with subacromial impingement. Analyzed according to intention to treat.

Outcome	Physiotherapy with training (N=40)*	Arthroscopic surgery (N=42)	Difference between groups
<b>Global change from inclusion</b>			
Revised or improved	27 (67.5)	23 (54.8)	
Unchanged	13 (32.5)	19 (45.2)	
Worse or much worse	0	0	
<b>Pain score at baseline (scale 0-100)</b>			
Total PAIN score	28.0 (26.1-29.7)	29.5 (27.0-32.0)	-1.5 (-2.7 to -0.3)
Worst pain and discomfort in past 3 months	33.0 (30.7-35.3)	36.5 (34.1)	-3.5 (-5.0 to -2.0)
Average pain and discomfort in past 3 months	30.0 (28.4-31.6)	33.0 (31.4-34.6)	-3.0 (-4.5 to -1.5)
Improved activity level and ADL	33.0 (31.4-34.6)	36.5 (34.1)	-3.5 (-5.0 to -2.0)
<b>Average pain and discomfort in past 7 days</b>			
Decrease in PAIN score from baseline	6.5 (5.3-7.8)	5.8 (4.6-7.0)	0.7 (-0.3 to 1.4)
Total PAIN score	11.4 (10.2-12.6)	11.0 (9.8-12.2)	0.4 (-0.6 to 0.8)
Worst pain and discomfort in past 3 months	13.0 (12.2-13.8)	13.0 (11.8-14.2)	0.0 (-1.1 to 1.1)
Average pain and discomfort in past 3 months	10.0 (9.2-10.8)	11.0 (10.2-11.8)	-1.0 (-2.0 to 0.0)
Improved activity level and ADL	11.0 (10.2-11.8)	13.0 (11.8-14.2)	-2.0 (-3.0 to -1.0)
Average pain and discomfort in past 7 days	10.0 (9.2-10.8)	11.0 (10.2-11.8)	-1.0 (-2.0 to 0.0)
Self-rated work status working	21 (52.5)	20 (47.6)	1 (2.3)

\*Values are n (%), or mean (95% CI). PAIN, Pain score; score of four VAS subscale (scale 0-10) mentioned in the table. \*Given within the physiotherapy group were operated on a later time. \*p < .05, Analysis of variance. Higher score indicates more pain and poorer function.

Haahr and Andersen, 2006, 4 to 8 year follow up

**Table 9** Results in the intention-to-treat analysis (134 patients at enrollment and 121 months after randomization)

Variable†	Exercise group (n = 66 at 24 months)	Combined treatment group (n = 68 at 24 months)‡	95% confidence interval§ of the difference in mean¶
<b>Self-rated pain VAS 0 to 10</b>			
at enrollment (mean)	6.5	6.4	-0.01 to 0.17
at 24 months (mean)	2.8	2.8	-0.01 to 0.18
Change from baseline (mean)	-3.7	-3.6	-0.01 to 0.14
<b>Disability VAS 0 to 10</b>			
at enrollment (mean)	6.4	6.2	-0.13 to 0.75
at 24 months (mean)	2.6	2.6	-0.01 to 0.02
Change from baseline (mean)	-3.8	-3.6	-0.19 to 0.03
<b>Working ability VAS 0 to 10</b>			
at enrollment (mean)	6.0	6.7	-0.71 to 0.88
at 24 months (mean)	8.0	8.0	-0.01 to 0.89
Change from baseline (mean)	+2.0	+1.3	-0.70 to 0.32
<b>Pain at night VAS 0 to 10</b>			
at enrollment (mean)	6.5	6.2	-0.48 to 0.58
at 24 months (mean)	2.6	2.6	-0.01 to 0.01
Change from baseline (mean)	-3.9	-3.6	-0.30 to 0.17
<b>EQD score (0 to 100)</b>			
at enrollment (mean)	62.8	77.7	-14.4 to 4.47
at 24 months (mean)	82.9	84.2	-1.24 to 6.10
Change from baseline (mean)	+20.1	+7.5	-12.5 to 12.75
<b>Reported painful days</b>			
at enrollment (mean)	73.0	68.8	-4.16 to 8.84
at 24 months (mean)	39.7	33.8	-5.86 to 6.82
Change from baseline (mean)	-33.3	-35.0	1.67
<b>Proportion of pain-free patients</b>			
at enrollment (mean)	0.08	0.12	-0.04 to 0.20
at 24 months (mean)	0.64	0.68	-0.04 to 0.20

†VAS, visual analogue scale. EQD, shoulder disability questionnaire.  
 ‡Lancet's test was used to check whether the data for equal or unequal variance is applicable.

Kendall et al. Does arthroscopic acromioplasty provide any additional value in the treatment of shoulder impingement syndrome?: a two-year randomised controlled trial. J Bone Joint Surg Br. 2009 Oct;91(10):1326-34.

Same results on 5 year follow up too

## Summary

- Injections appear to provide no better benefit than conservative care
- Surgery appears to provide no better benefit than conservative care

## Management and Treatment

Exercise therapy!

## Does physical therapy work?

- Exercise therapy should be the first-line treatment to improve pain, function, and range of motion
- Supervised and home-based progressive shoulder strengthening and stretching are effective for the management of SIS.
- For low-grade non-specific shoulder pain, supervised strengthening and stretching are equally effective to corticosteroid injections
- The addition of mobilizations to exercise may accelerate reduction of pain in the short-term
- Low level laser therapy, Pulsed electromagnetic field, and taping should not be recommended

Haik MN et al. Effectiveness of physical therapy treatment of clearly defined subacromial pain: a systematic review of randomised controlled trial. Br J Sports Med. 2016; 50:1264-1334.  
 Abdulla et al. Is exercise effective for the management of subacromial impingement syndrome and other soft tissue injuries of the shoulder? A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMA) Collaboration. Manual Therapy 2015;20:646-656

## Tendinitis

- Little evidence to suggest that inflammatory cells are present in pathological tendon
- No inflammatory cells identified in specimens taken from 12 subjects with rotator cuff disease during surgery
- We don't know if inflammation is part of the continuum of bursal and tendon pathology.



**Randomised controlled trial**

Similar clinical outcomes but more healthcare use in shoulder impingement patients following corticosteroid injection compared with physical therapy

Original article

The addition of cervical unilateral posterior–anterior mobilisation in the treatment of patients with shoulder impingement syndrome: A randomised clinical trial

Chad Cook<sup>a,\*</sup>, Ken Learman<sup>b</sup>, Steve Houghton<sup>c</sup>, Christopher Showalter<sup>d</sup>, Bryan O'Halloran<sup>e</sup>

Hand Questionnaire (QuickDASH) from baseline. **This study found no value** when neck manual therapy was added to the treatment of SIS. Reasons may include the **lack of therapeutic dosage** provided for the manual therapy approach or the lack of benefit to treating the neck in subjects with SIS who do not have concomitant neck problems.

**Cochrane Library**  
Cochrane Database of Systematic Reviews

**Manual therapy and exercise for rotator cuff disease (Review)**

Page MJ, Green S, McBain B, Surace SJ, Deitch J, Lyttle N, Mrocki MA, Buchbinder R

- Manual therapy and exercise improved function only slightly more than placebo at 22 weeks, was little or no different to placebo in terms of pain.
- Low quality evidence suggested there may be little or no difference in overall pain and function when manual therapy and exercise is compared with glucocorticoid injection, there may be little or no difference in overall pain and function when manual therapy and exercise is compared with arthroscopic decompression.

Page et al. Manual therapy and exercise for rotator cuff disease (Review). Cochrane Database of Systematic Reviews 2016. DOI:10.1002/14651858.CD012224

### Why so many variable results

- Because like we said previously, we don't even know what the source of symptoms is and everyone gets grouped into "subacromial impingement" when in reality treatment needed to be individualized **based on patient presentation**
- There are also a number of other factors including:
  - Psychosocial, genetics, duration, comorbidities, lifestyle issue, compliance

### Tendon Continuum Model

Figure 4 Schematic representation of how we may phenotype patients with tendinopathy in relation to the continuum and target treatments. The aim of treatment is to push the tendon into the green section with relatively little pain and good function. Tendon structure can be normalised in the early stages of the continuum where rehabilitation can push the tendon 'up the continuum'. In the latter stages of the continuum, 'moving up the continuum' may not be possible, so interventions should be focused in 'moving the tendon sideways'. It is important to note that interventions directed solely at pain will not drive the tendon to a positive outcome as they do not address dysfunction, such as motor inhibition, strength and power deficits, or tendon load capacity. Interventions that target structure may improve tendon structure and direct the tendon 'upwards' along the continuum; however, it will not address functional deficits (effect on pain is inconclusive) or load capacity and may leave the tendon vulnerable to reinjury.

Cook JL et al. Revisiting the continuum model of tendon pathology: what is its merit in clinical practice and research? Br J Sports Med 2016;50:1187-1191.

- Restore local homeostasis by reducing pain
- Improve the tendon's capacity to sustain loading
- Re-establish humeral head control

**Table 3.**  
Operational Definitions for 3 Stages of Tissue Irritability Derived by Consensus\*

	High	Moderate	Low
History and examination findings	High pain (>7/10) Constant night or rest pain Non-functional at ROM Tenderness High disability	Moderate pain (<6/10) Intermittent night or rest pain Part of ROM at ROM Mild tenderness Moderate disability	Low pain (<5/10) Absent night or rest pain Normal pain with movements Full ROM Low disability
Intervention focus	<b>Moderate Physical Stress</b> Active medication Active movement Active range of motion	<b>Mild-Moderate Physical Stress</b> Active medication Active movement Active range of motion	<b>Moderate-High Physical Stress</b> Active medication Active movement Active range of motion

\*ROM=range of motion, MDM=median range of motion, MIM=median range of motion.

**Table 4.**  
Common Shoulder Impairments Associated With Progressively Intensive Intervention Tactics Across a Spectrum of Tissue Irritability\*

Impairment	High Irritability	Moderate Irritability	Low Irritability
Pain associated with local tissue injury	Activity modification Manual therapy Medication	Activity modification Manual therapy Limited mobility use	No medication
Pain associated with neural sensitization	Progressive exposure to activity Medication	Progressive exposure to activity Medication	
Global passive mobility (arthrofibrosis/trauma)	ROM stretching, manual therapy passive only, typically non-weight bearing	ROM stretching, manual therapy combining stretch structure at stretching, typically longer duration and frequency	ROM stretching, manual therapy stretching structure at stretching, typically longer duration and frequency
Executive passive mobility	Protect joint or tissue from end-range while avoiding end-range to heat activity Address hypomobility of adjacent joints or tissues	Overload active control in end-range while avoiding end-range to heat activity Address hypomobility of adjacent joints or tissues	Overload active control during full-range, high-level functional activity Address hypomobility of adjacent joints or tissues
Neurovascular weakness associated with strength, speed, and coordination	MDM within pain-free ranges	Light or moderate resistance to fatigue Mid-range	Moderate or high resistance to fatigue Include end-range
Neurovascular weakness associated with poor motor control or neural activation	MDM within pain-free ranges Control use of isometric, neuromuscular electrical stimulation, or other activation strategies	Basic resistance training with emphasis on quality without their resistance according to motor learning principles	High-intensity movement training with emphasis on quality without their resistance according to motor learning principles
Functional activity intolerance	Protect joint or tissue from end-range, encourage use of unaffected regions	Progressive exposure to high-demand functional activity	Progressive exposure to high-demand functional activity
Local patient understanding leading to inappropriate activity for evidence of injury	Appropriate patient education	Appropriate patient education	Appropriate patient education

\*ROM=range of motion, MDM=median range of motion.

McClure FW & Michener LA. Staged approach for rehabilitation classification: shoulder disorders (STAR-Shoulder). Phys Ther 2015;95:791-800.

Treatment Program	Exercise Options	Mechanical/Neuro-Muscular Load	Shoulder Muscle Recruitment Pattern
Global/shoulder motion program	Flexion in low (45°) ROM	No external resistance	<ul style="list-style-type: none"> <li>Posterior IC (suprascapular, infraspinatus, teres minor) in stabilizer role to counterbalance potential anterior/posterior humeral head translation by shoulder flexors</li> <li>Scapular muscles involved in stabilizer role to prevent posterior IC from moving scapula</li> </ul>
	Flexion with short lever to end ROM	Incremental increase in external resistance	<ul style="list-style-type: none"> <li>Posterior IC (suprascapular, infraspinatus, teres minor) in stabilizer role to counterbalance potential anterior/posterior humeral head translation by shoulder flexors</li> <li>Scapular muscles required to position scapula as well as prevent sagittal/medial muscle (lat and IC) from moving scapula. Increased load on stabilizer role of scapular muscles, with increased load and number of supraspinatous muscles contracting</li> </ul>
	Full ROM flexion with long lever	Incremental increase in external resistance and speed	As above
Shoulder EP program	EP with arm by side, in sitting and in walking	No external load, progressing to light elastic resistance or low load weight	<ul style="list-style-type: none"> <li>Posterior IC involved in mover (rotator) role</li> <li>Scapular muscles involved in stabilizer role to prevent posterior IC from moving scapula</li> </ul>
	EP in supported/active-flexion/extension in sitting (full ROM), in prone (over ER ROM), and in supine (over ER ROM)	Incremental resistance or low weight load as able	<ul style="list-style-type: none"> <li>Posterior IC involved in mover (rotator) role</li> <li>Scapular muscles required to position scapula as well as prevent posterior IC from moving scapula</li> </ul>
	EP in unsupported/abduction/ flexion, extending, hyper, and in supine	Increase elastic resistance or low weight load as able	<ul style="list-style-type: none"> <li>Posterior IC recruited in mover (rotator) role and stabilizer role to counterbalance potential anterior/posterior humeral head translation by shoulder flexors/abductors</li> <li>Scapular muscles required to position scapula as well as prevent sagittal/medial muscle (lat and IC) from moving scapula. Increased load on stabilizer role of scapular muscles, with increased number of supraspinatous muscles contracting and increased load</li> </ul>
	Full rotation ROM in unsupported abduction/ flexion in prone/ supine		<ul style="list-style-type: none"> <li>All IC recruited in complex reciprocal patterns in both mover and stabilizer roles</li> <li>Scapular muscles required to position scapula as well as prevent sagittal/medial muscle (lat and IC) from moving scapula. Increased load on stabilizer role of scapular muscles, with increased number of supraspinatous muscles contracting and changing IC recruitment pattern</li> </ul>

Progress in functional activities, being guided by individual functional impairments.


Lewis J et al. Rotator cuff tendinopathy: navigating the diagnosis-management conundrum. J Orthop Sports Phys Ther 2015;45:923-937.

## Exercise prescription

- ◆ Rotator Cuff and Scapular stabilizers
- ◆ High dosage!
- ◆ 3x15, 2x/day, 8 weeks
- ◆ Individualized and progressed with increased load every other week
- ◆ Pain <5 during exercises but expected to feel some pain

Holgren T et al. Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: randomized controlled study. BMJ 2012;

## You already know these exercises!



Kramer et al. Effectiveness of individualized physiotherapy on pain and functioning compared to a standard exercise protocol in patients presenting with clinical signs of subacromial impingement syndrome. A randomized controlled trial. BMC Musculoskelet Dis 2010;11:114

Efthymiou et al. Rehabilitation of shoulder impingement syndrome and rotator cuff injuries: an evidence-based review. Br J Sports Med 2010;44:319-327


## How do you define high dosage?

- ◆ 3 sets of 30 reps of 11 different exercises
- ◆ Progress with increased range of motion and increased resistance as pain decreases
- ◆ 3x/week x 12 weeks
- ◆ Incorporated 40 minutes of moderate to high aerobic exercise as well – stimulate pain modulating system in the posterior horn of the spinal cord and release of neuropeptides in the central nervous system
- ◆ This in comparison to a total of 6 exercises performed at 2 sets of 10
- ◆ High dosage group showed better pain and functional improvements at 12 weeks and sustained up to 1 year
- ◆ At 12 months the HD group continued to improve whereas the LD group was beginning to get worse

Ostera et al. High-dosage medical exercise therapy in patients with long-term subacromial shoulder pain: a randomized controlled trial. Physiother Res Int 2010;15:232-242

## Don't be afraid to push them while keeping track of pain response!

- ◆ 50% of 6RM
- ◆ 70% 6RM
- ◆ 2x/week x 8 weeks



Lombardi et al. Progressive resistance training in patients with shoulder impingement syndrome: a randomized controlled trial. Arth Rheum 2008;56:15-22

## Don't forget the Neurocognitive therapeutic exercise

- Based on the stimulation and improvement of higher cortical functions such as attention, awareness, memory, language
- Cognitive sensory motor training rehab focused on sensory retraining for the execution of fine motor skills



## Prognosis

- Duration of symptoms, marital status (single), long periods of sick leave, and lack of professional education appeared to increase the risk of persistent pain despite the treatment.

Acta Orthop. 2015;86(6):641-6. doi: 10.3109/17453674.2015.1033309. Epub 2015 Sep 24.

Which patients do not recover from shoulder impingement syndrome, either with operative treatment or with nonoperative treatment?  
Ketola S, Lehtinen J, Rönkä T, Niemen M, Hännäkä E, Arvola L.

## Contextual Factors and Shoulder Pain

- Predictors of greater disability at discharge were:
  - higher initial disability
  - therapist prediction of restricted activities at discharge, workers' compensation claim
  - older age
  - female
- Predictors of greater improvement in disability were:
  - shoulder surgery
  - higher pain intensity
  - shorter duration of symptoms
  - younger age
  - poorer general physical health (measured using the 36-Item Short-Form Health Survey [SF-36])

Kennedy CA, Manno M, Hogg-Johnson S, et al. Prognosis in soft tissue disorders of the shoulder: predicting both change in disability and level of disability after treatment. *Phys Ther*. 2006;86:1013-1032.


## Psychological factors and outcomes

- If you think you can determine prognosis with your clinical exam, think again!
- Psychological factors were consistently associated with patient-rated outcome, whereas clinical examination findings associated with a specific structural diagnosis were not!
  - Lower baseline pain and disability
  - Patient expectation of complete recovery
  - Higher pain self-efficacy
  - Being in current employment or education!

Chester et al. Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain: a multicentre longitudinal cohort study. *Br J Sports Med* 2016.

## Mental Health

- There is a stronger correlation between mental health and shoulder pain and disability than there is between tear size and shoulder pain and disability in patients with full thickness rotator cuff tears!!!!
- Greater levels of psychological distress, depression, and anxiety are correlated with inferior patient reported outcomes.



Wylie et al. Mental Health has a stronger association with patient-reported shoulder pain and function than tear size in patients with full-thickness rotator cuff tears. *J Bone J Surg* 2016;98:231-6.

## So what are motivational interventions?

- **Cognitive Behavioral Therapy**
- Motivational Interviewing
  - Includes patients belief in the consequences of their actions
  - If they believe it will help, they are more likely to adhere
- Social Cognitive Theory
- Self-determination Theory
- Significant improvement in perceived self-efficacy and activity limitations
- Decreased reports of fatigue
- Better adherence to exercise

## Motivation program

- ◆ 5 step plan
  - ◆ Extensive counseling and information
    - ◆ Emphasize the importance of regular and consistent exercise in reducing pain!
    - ◆ Enhance internal locus of control of the patient! - It's up to you to get better!
  - ◆ Reinforcement techniques
  - ◆ Treatment contracts between patient and therapist
  - ◆ Post the treatment contract in your home!
  - ◆ Exercise diary

## Future Direction

- ◆ Despite knowing that exercise is typically considered good, we still don't know the most appropriate exercises!!
- ◆ We still don't know how to dose
- ◆ We still don't seem to be able to identify those who may or may not respond to exercise
- ◆ Further trials of manual therapy alone or exercise alone for rotator cuff disease are needed

THANK YOU!

