Best Treatment Approach for Subacromial Impingement Syndrome
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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 therapy 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
- Decreased Range of motion
- Hooked acromion
- Degenerative tendon
- Decreased subacromial space
- Oedema
- Calcinifying tendinitis
- Loss of arm function
- Scapular dyskinesia
- Ischemia within supraspinatus
- Joint hyperlaxity
- Increased subacromial pressure
- Coracoacromial impingement
- Night pain

HISTORY AND ANATOMY OF IMPINGEMENT

Dear Old Neer

- Impingement is the result of abrasion by 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 tissue mass externally involved are bursal side of the supraspinatus and long head of triceps 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 coracromial 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 acromioplasties 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

But Wait????

- 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

Could it be something else?

- Neer’s last surgical case… not 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 intratendinous.
- Argued that tears secondary to intrinsic degeneration rather than acromial irritation – mechanical abrasion may not play such an important role as we once thought.


Pathological Factors

<table>
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<th>Extrinsic Factors</th>
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<td>Anatomical/ossous</td>
<td>Tensile/shear overload</td>
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<td>Posture and muscle imbalance</td>
<td>Mechanical properties</td>
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<td>Glenohumeral or scapular kinematics</td>
<td>Morphology</td>
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<td>Ergonomic factors</td>
<td>Vascularity within the tendon</td>
</tr>
<tr>
<td>Sport specific factors</td>
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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.

Perhaps the pathoaetiology 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).

**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 ½ 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.

**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 coracromial 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.

**The Innocent have been set FREE!**

- Think of this as an association vs. causation.
- Increasing range of shoulder elevation incurs 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.
Primary vs Secondary Impingement

Subacromial Impingement Internal Impingement

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!

Maybe variation is normal!


Scapular dyskinesia: evolution towards a systems-based approach

| Elbow |

Table 1. Challenges to the evidence regarding scapular dyskinesia

<table>
<thead>
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<th>Challenge</th>
<th>Description</th>
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<tr>
<td>1.</td>
<td>In the absence of an identified normal, abnormal is an unknown entity</td>
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<tr>
<td>2.</td>
<td>What is perceived as abnormal may in fact be a normal adaptation strategy</td>
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<tr>
<td>3.</td>
<td>Tests used to supposedly identify abnormalities cannot be claimed to do so given that they lack construct validity</td>
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<tr>
<td>4.</td>
<td>Measurements are unreliable and prone to measurement error and bias</td>
</tr>
<tr>
<td>5.</td>
<td>A causal relationship between the existence of scapular dyskinesia and the presence of symptoms cannot be established</td>
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Is thoracic spine posture associated with shoulder pain, range of motion and function? A systematic review

Eva Barret 1, Mary O’Keeffe 1, Karen O’Sullivan 1, Jeremy Leppin 1, Karen McCrory 1

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.

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

Examination for Shoulder Impingement

And also Injections and Surgery

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Disclosures

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- Receive honorarium payments for educational presentations
- Royalty payments from the following companies
  - Medbridge
  - Pearson Education
  - Edcata

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

http://www.improvingpopulationhealth.org/blog/what-is-population-health.html
A Number of factors influence a patient’s recovery.

- Disease severity
- System exposure
- Intervention
- Personal aspects
- Clinician equipoise
- Placebo/expectations
- Natural history

It readily apparent that health care as it exists today is neither a system nor a system of systems.

Our current healthcare system involves Ad Hoc management processes with selected parties who have a vested interest

Recommended treatment pathways.

Systems management goes a step further and evaluates the influence of previous or current encounters

Systems Approach

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 Ad Hoc management processes with selected parties who have a vested interest

- Recommended treatment pathways.
- Systems management goes a step further and evaluates the influence of previous or current encounters

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)
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)

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

- 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

Region Specific-Red Flags

Left Shoulder
- Cervical Spine
- MI: 8-7% of patients reported shoulder pain during an acute myocardial infarction
- Ruptured Spleen (not common)
- Pancreatic Tumor

Right Shoulder
- Cervical Spine
- Liver Disease
  - Cirrhosis, Cirrhosis, Hepatitis
- Post Bariatric Surgery
- Gastric Perforation
- Peptic Ulcer
- Gall Bladder: Cholecystitis
  - Typically accompanied by fever or nausea/vomiting
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 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.

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 chronication of shoulder pain.

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

Patient Expectations (It matters)

- “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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- Does Order of Provider actually influence outcome?
- Who is best equipped to assess patients?
- What tools are best to use during initial assessment?
Synthesizing Findings (Differentiation)

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

Somewhat Underwhelming

Table 7: Comparison with the arthroscopists for the physiotherapist

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

References:
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 comorbidities.

- Predictors of low risk categorization were younger age, shorter duration of symptoms, no surgical history and payer type.

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

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

Clustering

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

"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"
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"


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

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
Injections are independent of accuracy

Erin L. MacIntosh, DPT, MSE, APTA, John Zawada, MD, PhD, Michael Eisenberg, MD, PhD, Chad Cecil, PT, MSc, Matthew Ogilvie, MD, Kyle Casson, MD, PhD, and Allison Tabata, MD

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*Denotes Equal Authorship

Constant Murley Score

Pain Score

Vitale et al. The rising incidence of acromioplasty.

Surgery
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

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
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.

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

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

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
- Incorporate 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
- 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

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

- 50% of 1RM
- 70% 1RM
- 2x/week x 8 weeks
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.

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
  - Greater age

- Predictors of greater improvement in disability were:
  - Shoulder surgery
  - Higher pain intensity
  - Shorter duration of symptoms
  - Younger age
  - Greater general physical health (measured using the 36-Item Short-Form Health Survey [SF-36])

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 outcomes, 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!

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.

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!