2015 Annual Meeting, October 8-11, 2015
Asheville, NC, USA

American Society of Shoulder and Elbow Therapists

Thursday October 8, 2015

5:30-8:00 ASES President's Welcome Reception

Friday October 9, 2015 (Presenting Author is underlined)

Session	Time	Event	Type of Presentation
	6:30	Registration	
	7:00	Breakfast/Registration	
	8:00	Welcome /Introductions	
Swimming Injuries: Moderator – Angela Tate			
	8:15	Prevalence of shoulder pain and disability in youth male and female competitive swimmers and the relationship between training exposure and shoulder symptoms Sum JC, Tate AR, Chang J, Wyberg G	Research
	8:30	The effect of an in-season muscular strengthening based injury prevention program on adolescent swimmers strength and rate of injury. Brooks, GB	Research
	8:45	Discussion	
Training Effectiveness: Moderator – Angela Tate			
	9:00	Glenohumeral Arthrodesis and Hypermobility Disorders. Kokmeyer, DJ	Case Report
	9:15	Blood Flow Restrictive Training and its Relevance in Rehabilitation. Hamersly S.	Education
	9:45	Discussion	
	10:00	Break	
Biceps Tendon Pathologies: Moderator – Alan Tyson			
	10:15	Adaptations to the Morphology of the Bicipital Groove in Professional Baseball Players Thomas SJ, Sarver JJ, Ebaugh DD, Soloff L, Genin J, Quinlin J, Kelly JD	Research
	10:30	TITLE: A Progressive Rehabilitation Protocol and Outcomes Following Biceps Tenodesis or Tenotomy in an Active Duty Military Population at a Large Military Hospital. Pniewski JE, Dickston ML, Mueller TL, Abell BE, Jackson KL, Bojescul JA: .	Research
	10:45	Discussion	
	11:00	Advances and Theories on treatment for proximal bicep lesions - Dr. Donald D'Alessandro	Physician Presentation
	11:30	Post-operative management and return to sport - Alan Tyson	Education
	12:00	Questions/ Discussion	
	12:15-1:40	Lunch/ASSET Board Meeting	

American Society of Shoulder and Elbow Therapists

Session	Time	Event	Type of Presentation
Movement Assessment and Kinetic Chain Assessment: Moderator – Saba Kamal			
	1:45	Latissimus Dorsi and the Pelvic Girdle: Is it the "missing link" in the kinetic chain shoulder evaluation? Burke, W:	Education
	2:15	Elbow contracture: The broken kinetic chain Kamal, S	Case Report
	2:30	Discussion	
	2:45	An Introduction to the Humeral Movement System Impairment Diagnoses Ivens RA:	Education
	3:30	Title: Use of a Movement Diagnosis and the Concept of Regional Interdependence in Managing a Patient with Lateral Epicondylalgia: a Case Report. Caldwell CA:	Case Report
	3:45	Discussion	
	4:00	Break	
Patient Reported Outcomes: Moderator – Aaron Sciascia			
	4:15	Patient-Reported Upper Extremity Outcome Measures Used in Breast Cancer Survivors: A Review Harrington, SE*, Michener, LA†:	Education
	4:45	Results of Recurrent Shoulder Instability Treated with Arthroscopic Bankart Repair at a Minimum of Five Years Follow-Up R. Brandon Burris MD, Tim Tyler PT, ATC, Dan Hogan MS, Malachy McHugh PhD, Stephen Nicholas MD	Research
	5:00	Preliminary Results of Patient Defined Success Criteria in Shoulder and Elbow Patients in Outpatient Physical Therapy Settings. Zeppieri Jr. G, MPT, SCS; George SZ, PT PhD	Research
	5:15	Discussion	
	5:30	Adjourn	
	6:30-8:30	Founders Reception	

Saturday October 10, 2015 (Presenting Author is underlined)

Session	Time	Event	Type of Presentation
	6:45	Registration	
	7:00-8:00	Breakfast/Registration	
Scapular Pathologies: Moderator – Tim Uhl			
	7:45	Effects of scapular stabilization taping on three-dimensional scapular in subjects with arthroscopic Bankart repair. Duzgun Irem, Turgut Elif, Huri Gazi, Yildiz Ibrahim Taha, Turhan Egemen, Eraslan Leyla, Baltaci Gul, Doral Mahmut Nedim	Research
	8:00	Effects of kinetic chain exercise training on three-dimensional scapular kinematics pain and disability in impingement syndrome.Turgut Elif, Duzgun Irem, Baltaci Gul	Research
	8:15	Scapular Muscle Clinical Tests and Examination Algorithm Kelley, MJ,	Case Report
	8:30	Discussion if time permits	

2015 Annual Meeting, October 8-11, 2015
Asheville, NC, USA

American Society of Shoulder and Elbow Therapists

Session	Time	Event	Type of Presentation
	8:50 – 9:20	*ASES Presidential Address*	*ASES Meeting*
	9:30	Scapular Muscle Detachment Diagnosis and Surgical Management - W. Ben Kibler MD	Physician Presentation
	10:00	Scapular Muscle Rehabilitation - Aaron Sciascia	Education
	10:30	Discussion	
Baseball Rehabilitation Moderator – Ellen Shanley			
	10:45	Preliminary results of primary repair of the UCL in overhead athletes. Sanders K	Case Report
	11:00	Descriptive Analysis of KJOC Scores in Healthy High School Baseball Players. Clark W.	Research
	11:15	Rehabilitation of a Baseball Pitcher's Shoulder Ivashenko A:	Case Report
	11:30	Discussion	
Shoulder Arthroplasties Considerations: Moderator – Stephen Thomas			
	11:45	Arthroscopic Repair of Massive Cuff Tears: How to Reverse Reversomania - John Kelly MD	Physician Presentation
	12:15	Questions/ Discussion	
Lunch	12:30-2:00	ASSET Annual Meeting/ Lunch	
	2:3s0	Shoulder Arthroplasty: A Need for Preoperative Patient Education Minardo, DM, Bondoc, S	Research
	2:45	Which Patient-Reported Outcome Measure Best Correlates with Patient Satisfaction Following Total Shoulder Arthroplasty? Morris BJ, Sciascia AD, Jacobs C, Edwards TB	Research
	3:00	Effect of Arm Dominance on outcomes in patients undergoing anatomic Total Shoulder Arthroplasty. Shanley E, Tolan S. Kissenberth M, Hawkins RJ, Tokish J	Research
	3:15	Biological Resurfacing of the glenohumeral joint: A Case Report. Mark Ramsey PT, OCS, CHT	Case Report
	3:30	Discussion	
	3:45	Break	
Debate on Conservative Treatment of Stiff Shoulders: Moderator – Craig Wassinger			
	4:00	Primary Glenohumeral Instability Resulting in Secondary Frozen Shoulder. Kelley, MJ: Good Shepherd Penn Partners, Philadelphia, PA, USA.	Case Report
	4:15	Clinical Approaches to adhesive capsulitis and post-manipulation management – Discussants June Kennedy- Will Clark	Education
	5:00-5:45	EMG –Lab Session – Show how you turn on your patients muscles with your favorite exercise using Biofeedback from Noraxon Desktop DTS system. Uhl TL	Education

American Society of Shoulder and Elbow Therapists

Sunday October 11, 2015 (Presenting Author is underlined)

Session	Time	Event	Type
	7:00	Breakfast/Registration	
Treatment of Pain: Moderator – Brian Phillips			
	8:00	Targeted Pain Education as an Adjunct to Traditional Multimodal Interventions in a Patient with Persistent Shoulder Pain Wassinger, CA*†, Wolbert, C†: *	Case Report
	8:15	Treatment of Ulnar Nerve Distribution Pain: An Unusual Case Presentation. Hooks TR:	Case Report
	8:30	Discussion	
	9:00-10:00	*ASES Session VIII - Elbow*	ASES Meeting
Mobility Interventions: Moderator- Wendy Burke			
	10:15	Sternoclavicular and Acromioclavicular Joint Mobilization Can Dramatically Increase Shoulder Girdle Elevation. Gaunt BW	Education
	10:45	Techniques that assist with evaluation and restoration of shoulder range of motion by restoring pure glenohumeral mobility in patients with shoulder stiffness. Sanny WA	Education
	11:15	Discussion	
	11:30	Effects of a Single Bout of Shoulder Horizontal Adduction Contract Relax Stretching. Manske RC, Buckles A, Cox J, Laochinda D, Snodgrass J, Smith BS	Research
	11:45	Changes in Mobility Following Instrumented-Assisted Soft Tissue Mobilization of the Posterior Shoulder Musculature. Moore-Reed SD, Kerins CM, Uhl TL	Research
	12:00	Discussion	
	12:15	Adjourn	

Prevalence of shoulder pain and disability in youth male and female competitive swimmers: a multicenter survey

Jonathan C. Sum, PT, DPT, OCS, SCS[1]
Angela R. Tate, PhD, PT, Cert MDT[2]
Jocelyn Chang, PT, DPT[3]
Garin Wyberg, PT, DPT[1]
[1]University of Southern California, Los Angeles, CA
[2]Arcadia University, Glenside, PT
[3]Stanford University, Palo Alto, CA

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Financial Disclosures

- Jonathan Sum
  - Hygieia Medical Equipment
    - Advisory board

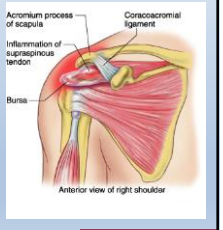
USC Division of Biokinesiology and Physical Therapy

Background: Pain and Injury Prevalence in Competitive Swimmers

McMaster, 1993,
- 1262 US competitive swimmers
- 10% age group – 26% US national team with current shoulder pain

Sein et al, 2010
- 91% pain, 80 Australian elite swimmers aged 13-25
- MRI 69% supraspinatus tendinopathy, 5.7% RCT
  - 54% of 12-14 y.o. had tendinopathy
  - 100% of 17-18 y.o. had tendinopathy
- 19% labral tear on imaging
- 13% ACJ arthritis
- Tendinopathy predicted by yardage and duration

Tate et al, 2012
- 236 female swimmers aged 8-77
  - Pain @ rest 7-29%
  - Pain w/ normal activities (dressing, eating) 5-43%
  - Pain w/ strenuous (sports) 31-81%
- Pain associated with high swimming exposure, instability, history of trauma, lack of cross training



ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Background

- Female collegiate shoulder pain found to be 3x greater than males Sallis et al 2001
- Shoulder pain may be related to specific male and female developmental stages Becker et al 2011

- *Investigation of prevention programs is needed*
- *Symptom prevalence with respect to gender/age is necessary to identify at-risk individuals*
- *Is pain related to quantity of swimming exposure in current large scale US trial?*

USC Division of Biokinesiology and Physical Therapy

Purposes

(1) Determine prevalence of shoulder pain and swimming-related disability in youth swimmers.

(2) Determine if report of prior shoulder injury or instability are related to shoulder pain.

(3) Determine if weekly training yardage/hours are related to shoulder pain.

(4) To explore coaches education, beliefs about shoulder pain and opinions on pain prevention

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Design: Single Measure Dual Survey Design

Swimmers aged 9-17
- Competitive history
  - yrs swum, h/o injury, instability, other sport participation
- Shoulder pain (Penn Shoulder)
- Self reported swimming related disability (DASH sports)

Coaches (Olivos and Tate, in review)
- Years experience & formal coaching education
- Inquiry
  - ? prevalence of swimmers with shoulder pain
  - ? methods would reduce shoulder pain
- Report yardage& hours swum/week

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Procedure / Analysis

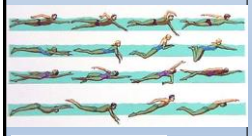
- Study verbally explained to swimmers and coaches
- Information sheet distributed
- Surveys distributed

→ 1 week →

- Survey collection from swimmers and coaches
- Reminder given to those not returning survey

→ 1 week →

Survey collection from remaining swimmers and coaches



Descriptive Statistics
- Subject demographics
- Pain and disability

Chi-Square Tests
- Were there differences in reported history of trauma or instability or participation in another sport between those with and without pain?

T-Tests
- Were there significant differences yardage and time practices among those with and without pain?

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Results: 190 swimmers

Age Group	Number of subjects	Percentage
9-10	27	14.1
11-12	46	24.1
13-14	57	29.8
15+	59	31.4

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Coaches N= 8

Sex	Years coaching
4 Male 4 Female	2.7+/- 1.4 years

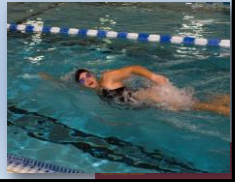
ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Was the presence of shoulder pain related to hours practiced or yardage ?

T tests (n = 190)

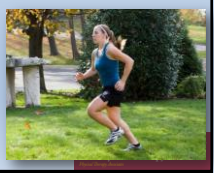
- Statistically significant difference for hours practiced/week (p=.006) but 9.9 vs 9.2 may not be clinically significant
  - No differences found in specific age groups
- No difference for yardage (27,500 vs 24,000 meters, p=.119)
- Why?
  - Mean hours and yardage are low
    - Time of season- May
    - Coaches beliefs
    - Single team lacks variability



Was a history of prior traumatic injury, report of instability, or other sport participation related to shoulder pain?

Chi Square

- Other sport participation p= .529
  - Prior data: soccer, walking, running assoc w less pain (Tate, 2012) but only n=10 in this sample
- Prior traumatic injury
  - 8/87 pain, 4/103 no pain, p= .321
- Does shoulder ever "slip"?
  - P=.000, consistent with prior data
  - Relevance for screening



Pain and Swimming Disability

Age group	9-10	11-12	13-14	15+
Pain Rest	4%	20%	17%	24%
Pain Normal activities (dressing, eating)	12%	20%	19%	27%
Pain Strenuous activities (sports)	27%	30%	64%	54%
Disability DASH sports	15%	40%	53%	51%

* No significant differences males vs females

and Physical Therapy

Coach Attitudes Towards Pain

What percentage of your swimmers would you estimate have shoulder pain lasting >4 days or have had a shoulder injury *limiting their practice or performance* within the past year?

% swimmers	% of coach's response
0-10%	100
11-25%	0
26-50%	0
51-100%	0

Highest Level of Formal Coaching Education

Course8	N	%
Level 1: Foundations of Coaching 101 and 201*	3	37.5%
Level 2: The Stroke School	1	12.5%
Level 3: The Physiology School	2	25%
Level 4: The Leadership School	1	12.5%
Level 5: The Administration School	1	12.5%

* Required online courses by American Swim Coaches Association (ASCA)

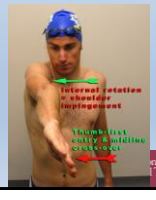
Implications of Formal Education

37.5% NOT taken the Stroke School

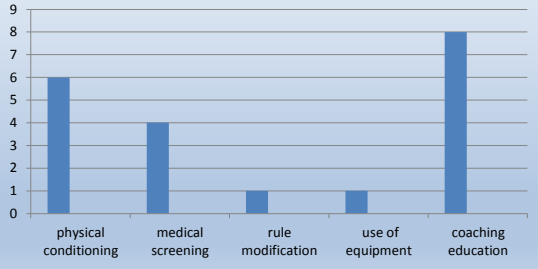
- Prevalence of Freestyle Biomechanical Errors in Elite Competitive Swimmers (Virag, 2014)
  - 61-53% dropped elbow during pull through or recovery associated with thumb first entry or incorrect hand entry
  - "These errors highlight the need for proper stroke instruction and evaluation to decrease the risk of shoulder injury"

50% NOT taken the Physiology School

- Should this be required?
- 75% coaches said physical conditioning would reduce pain/injury



Which of the following practices would best reduce shoulder injury or pain in swimmers? (Olivos and Tate, in review)



Conclusions

- High frequency of shoulder pain and disability
  - 12-27% ADLs
  - 27-54% Sport / swimming
  - 40-51% Swimming related disability (technique, performance, hours practice) of among 11-15+
- Stark contrast to coach report **0-10%** swimmers had pain >4d or injury limiting practice or performance

Key: Coaching Education

ALL (100%) coaches reported that additional COACHING education on optimal exercises and training would reduce injury

Education on prevalence of pain and effects of fatigue and pain on the rotator cuff

Pain inhibits muscle activity

- Decline in voluntary activation and **32.8% reduction in cuff force production** with experimentally induced subacromial **pain** (Stackhouse et al, 2013)
- **Fatigue** contributes to **reduced activation and force production** (Stackhouse et al, 2010)
- So **PAIN** and **FATIGUE** may **MAKE SWIMMERS SLOWER!**
- **High yardage reduces sprint capacity.** (Costill et al, 1991)

USC Division of Biokinesiology and Physical Therapy

Future Research

- Plan
  - Enroll 1000 swimmers
  - Multiple teams: greater variability in data
  - Define cut points for training volume/hours associated with pain and disability for safe training guidelines
- Use current data as baseline measures to study efficacy of a prevention program which should include coaching education

ARCADIA UNIVERSITY

USC Division of Biokinesiology and Physical Therapy

Thank you

Questions?

Angela Tate tatea@arcadia.edu
Jonathan Sum sum@usc.edu

The effect of an in-season muscular strengthening based injury prevention program on adolescent swimmers strength and rate of injury.

Brooks, GB*: Texas Children's Hospital. Houston, TX. USA

Background: The prevalence of shoulder pain among competitive swimmers is high, but no guidelines exist to reduce the incidence of shoulder injury in young athletes. To date, the optimal shoulder injury prevention program for competitive swimmers has not been established.

Purpose The purpose of this study was to assess the effectiveness of a 12-wk injury prevention program to improve glenohumeral and scapular muscle strength as well as reduce the incidence of shoulder injury in adolescent swimmers.

Design and Setting: A non-randomized pretest-posttest experimental design was used. The study was conducted at a competitive swimming club in the Houston, TX area.

Participants: 15 healthy, adolescent swimmers who were asymptomatic in their shoulders and had no history of shoulder surgery were enrolled in the study.

Methods and Materials: 30 shoulders in 15 competitive, swimming athletes underwent pre and post intervention testing using a standardized shoulder evaluation conducted by a board certified sports physical therapist.

The evaluation included passive range of motion, peak isometric muscle strength, joint stability testing, and shoulder impingement testing.

Bilateral isometric strength was assessed using a handheld dynamometer to test the trapezius muscle (upper, middle, and lower portions), abduction, internal rotation, external rotation, protraction, and extension. The higher of two efforts was taken for each strength test.

Shoulder pain and function were assessed pre and post intervention using the Kerlan-Jobe Orthopedic Clinic shoulder questionnaire.

Participants completed a 12 -week supervised, strengthening program for both shoulders including the scapular upward rotator muscles, scapular stabilizers, and the glenohumeral external rotators.
Additional exercises included standard pull ups, bench press, bridges, and planks.

The swimmers' usual training volume and intensity were not modified. Swimmers swam weekly yardage between 60-70K yards.

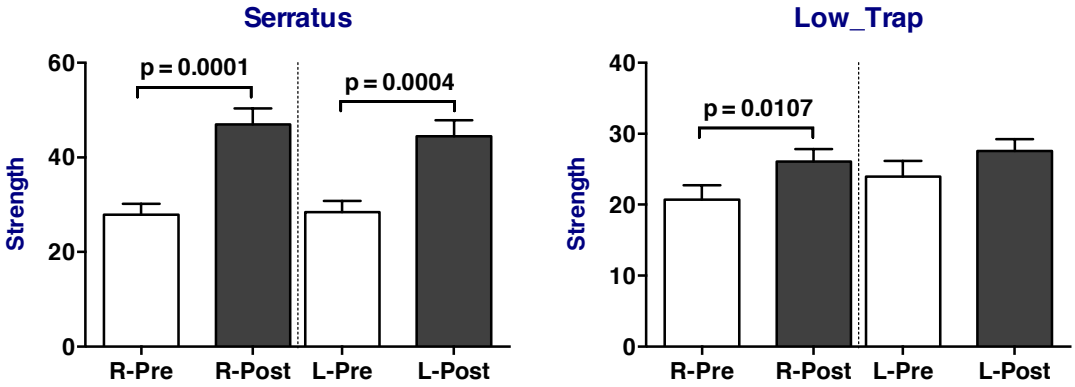
Injury surveillance was conducted during the season to monitor for development of shoulder pain and compared to the season prior to the intervention period.

Results: No swimmers developed shoulder pain during the competitive season.

KJOC: There was no decrease in shoulder function scores.

Strength: Strength gains were significant for the serratus anterior (*P* =.0001),
The shoulder extensors (*P* =.007) of both shoulders,
The external rotators (*P* =.001) on the dominant arm, and the lower trapezius (*P* =.009).

ROM: There was a reduction in shoulder flexion ROM on the dominant arm (p=0.0104), but no loss was observed for the non dominant arm or for either arm in coronal plane abduction, external rotation, or internal rotation.



Conclusions: This model of in-season injury prevention program was effective in strengthening key muscles associated with optimal shoulder function and it was effective to prevent injury in adolescent competitive swimmers.

Clinical Relevance: These results may be valuable for coaches, athletic trainers, physical therapists, and physicians when designing injury prevention programs for swimmers.

Bilateral Shoulder Arthrodesis:
A complex solution for a complex problem

Dirk Kokmeyer, PT, DPT, SCS, COMT
Howard Head Sports Medicine
Vail, Colorado

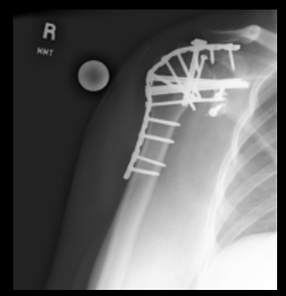
Vail Valley Medical Center

Howard Head Sports Medicine Center,
Vail, Colorado

THE STEADMAN CLINIC

Keeping People Active

HOWARD HEAD SPORTS MEDICINE



Case Description

- 24 year-old, active female with end-stage, multi-directional instability.

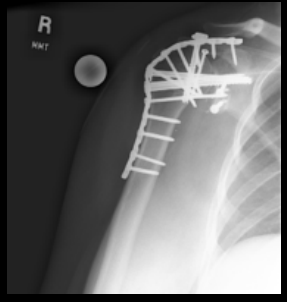
- Diagnosis of hypermobility type Ehlers-Danlos Syndrome

The patient was an active 24 year-old female with the diagnosis of EDS-HT and severe multi-directional shoulder instability secondary to EDS-HT. The patient was a nursing student who participated in activities such as, running, ice hockey, rock climbing, and playing the cello. With the exception of playing the cello, her leisure preferences often changed due to injuries she sustained as a consequence of EDS-HT.

Objectives

- Describe a unique case example
- Review diagnostic criteria of hypermobility syndromes
- Discuss surgical procedure and post-operative care and outcomes

HOWARD HEAD SPORTS MEDICINE



Surgical History

- 2005 right capsular shift
- 2006 revision right capsular shift
- 2008 right capsulolabral reconstruction
- 2009 left capsulolabral reconstruction
- 2009 right Latarjet
- 2010 left shoulder arthrodesis
- 2012 right shoulder arthrodesis

HOWARD HEAD SPORTS MEDICINE

History of EDS

1657 – first reported case of EDS

1880 – first photograph

1891 – Tschernogubow presents 1st case

1901 – Edvard Ehlers

1908 – Alexandre Danlos

1949 – classified at autosomal dominant inheritance

1955 – discovered that genetic disorder affects collagen

1960's – Classification systems suggested

1986 – Berlin Nosology

1997 – Villefranche Nosology

1998 – Brighton Criteria for BJHS

HOWARD HEAD SPORTS MEDICINE

1657 – Job Janszoon van Meek'ren (1611–1666) – described a "spaniard" who could pull his skin over his head.

Tschernogubow – Russian dermatologist who present a case in a conference with all the characteristics of EDS.

Ehlers – from Copenhagen – described a patient with "loose-jointedness"

Danlos – from Paris describes a patient

Patients described as: vulnerable skin, hyper elastic skin, molluscoid pseudo tumors,

Classifications of Ehlers-Danlos Syndrome
Villefranche Nosology

Typical Findings:

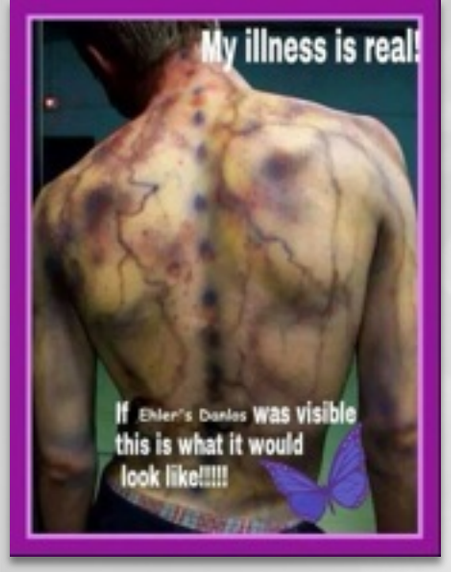
- Skin hyper-extensibility
- Joint hyper mobility
- Bruising
- Tissue fragility
- Mitral valve prolapse
- Chronic joint pain.

Types:

1. Classical
2. Hypermoblity
3. Vascular
4. Kyphoscoliosis
5. Arthrocholasia
6. Dermatopraxis
7. Other (V, VIII, X, XI, Progeroid)

All underlined types have joint hyper mobility as a characteristic, however the genetic findings, molecular basis and clinical presentations set these types apart from each other.

EDS-III is the previous classification of hyper mobility type



Hypermobility Type Ehlers-Danlos Syndrome
Villefranche Nosology

<u>Major Diagnostic Criteria</u>

Generalized Hypermobility

Beighton scale 5/9

Hyperenxtensibility or smooth, velvety skin

<u>Minor Diagnostic Criteria</u>

1.Recurring joint dislocations

2.Chronic joint/limb pain

3.Positive Family history

Skin hyper extensibility is variable. Typically tested on the forearm.

Joint hyper mobility is the dominant manifestation

MSK pain generally wide distribution and tender with 4kg of pressure from fingers

Case relevance: As a child she began walking at the age of nine months, but fell frequently according to her mother. Her mother also reported that while seated she was “floppy” (muscle hypotonia) compared to other children. Her first reported injury was an ankle sprain at the age of three. Her first shoulder subluxation was at age seven and she suffered a grade 1 anterior cruciate ligament and concomitant grade 2 medial collateral ligament injury to the knee at age 14. She experienced several other injuries, such as finger dislocations, ankle sprains, patellar subluxations, repeated 5th metatarsal fractures, temporomandibular joint instability which required she be sedated for dental procedures, an elbow dislocation with fracture of the conoid process, C5-7 cervical disc herniations, and a tendency to bruise easily with subsequent atrophic scarring. Between the ages of three to 13 years of age, she participated in ballet with the ability to perform splits earlier than the rest of her class and she could also place her legs behind her head.

EDS

vs

Benign Joint Hypermobility Syndrome (BJHS)

"From the clinic perspective there is compelling evidence that hypermobility EDS and BJHS are one in the same…"

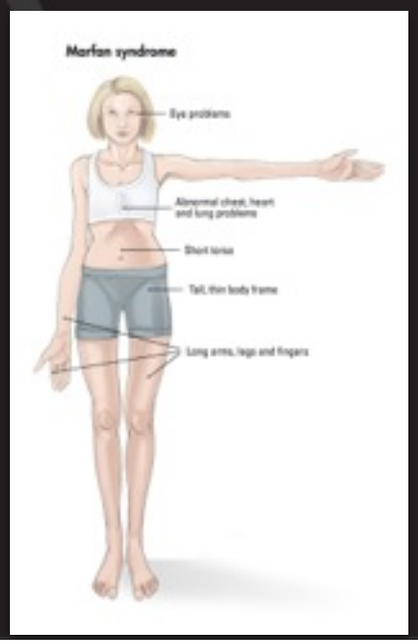
1998 Brighton Criteria for Diagnosis of BJHS

Major Diagnostic Criteria

- Beighton score = 4/9
- Arthralgia in 4+ joints > 3 months

Minor Diagnostic Criteria

- Beighton score 1-3/9 (0-3/9 if > 50 yrs)
- Arthralgia > 3 mo
- dislocation in > 1 joint or >2 in one joint
- Soft tissue rheumatism > 3
- Marfanoid Habitus
- Abnormal skin
- Eye signs
- Varcose veins/hernia/rectal or uterine prolapse



Criteria put to the test to determine accuracy (40 case controlled subjects vs 40 with BJHS). 93% sensitivity and specificity reported (not a true diagnostic study.

Criteria not validated in children

arthralgia includes spondylolisthesis, -losis or lysis

soft tissue rheumatism = bursitis, tenosynovitis, tendonitis.

Eye signs: blepharoptosis, myopia, antimongoloid slant

Beighton score

Ehlers-Danlos Support UK

Registered Charity 1157027

Give yourself 1 point for each of the manoeuvres you can do, up to a maximum of 9 points

Can you bend your thumb back onto the front of your forearm?

left thumb 1 point

right thumb 1 point

Can you bend your knee backwards?

left knee 1 point

right knee 1 point

Can you put your hands flat on the floor with your knees straight?

1 point

left hand 1 point

right hand 1 point

Can you bend your little finger up at 90º (right angles) to the back of your hand?

Can you bend your elbow backwards?

right arm 1 point

left arm 1 point

MAKING OUR INVISIBLE VISIBLE

www.ehlers-danlos.org
T: 020 8736 5604

Case Example

Beighton Scale	Right	Left
Passive dorsiflexion of little finger beyond 90°	1	1
Passive apposition of the thumb to the flexor aspect of the forearm	1	1
Hyperextension of elbow beyond 10°	1	1
Hyperextension of knee beyond 10°	1	1
Forward flexion of the trunk with knees fully extended so that the palms rest flat on the floor	1	
Total	9/9	

+ joint arthralgia
+ multiple joint dislocations
+ soft tissue rheumatism (soft tissue MSK conditions)
+ abnormal skin: hyperextensibility/striae

Beighton Joint Mobility Index

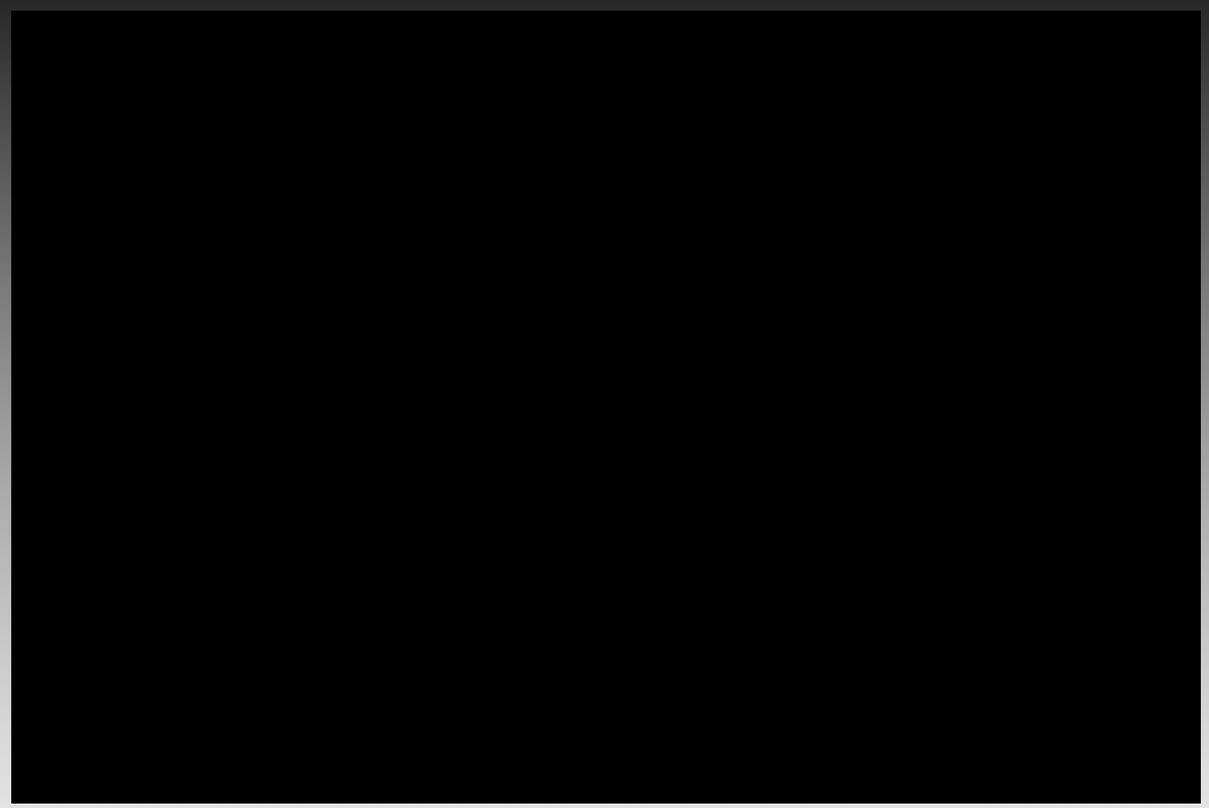
- 0-2 = low suspicion of Generalized Joint Laxity (GJL)
- 3-4 = moderate
- 5-9 = high
- 7/9 considered cutoff for children (Smits-Engelsman, 2011)
- Good to excellent intra- and interrater reliability (Boyle, 2003)
- Moderate to substantial Inter-rater reliability in children (Junge et al, 2013)
- Villefranche Nosology: 93% sensitivity & specificity

HOWARD HEAD SPORTS MEDICINE

Smits and Engelsman: validated in 551 children 6-12 years
- too many children met inclusion with cut-off 5/9. the Authors suggested 9/9

Junge - tested two different methods of posture when testing. Did not find a significant difference in testing methods

Surgical Procedure



1. Dissection to deltoid > axillary nerve identified and protected
2. Tenotomies of the supraspinatus, infraspinatus
3. Removal of biceps anchor and labrum
4. Acromioplasty + decotrication of the humeral head and glenoid
5. 3.5 mm locking plate along spine of scapula
6. Arm placed in 20-30° IR at the side
7. packed with bone graft

Post-operative care

- 0-6 weeks:
  - relative immobilization
  - Pain management interventions
  - 2-6 weeks: active assisted/ active scapular exercises
- 6+ weeks per radiograph
  - d/c sling
  - functional & strength exercises
    - open chain -> closed chain
    - Scapular force couples

Outcomes

- Scalise & Iannotti - 2008: Failed TSA
- Chammas et al 2003 - Brachial Plexus Palsy
- Rybka et al - Rheaumatoid Arthritis
- Cofield & Briggs - various conditions
- Thangarahah et al - shoulder instability + epilepsy

scalise - patients with fails TSA treated with arthrodesis - improved Penn score (2 non-unions)

Chammas - used in patients with brachial plexus palsy and recovered elbow activity

Rybka (1979) - 41 cases, all who were satisfied, good pain relief and satisfactory function

Cofield 79 cases: good pain relief and good function

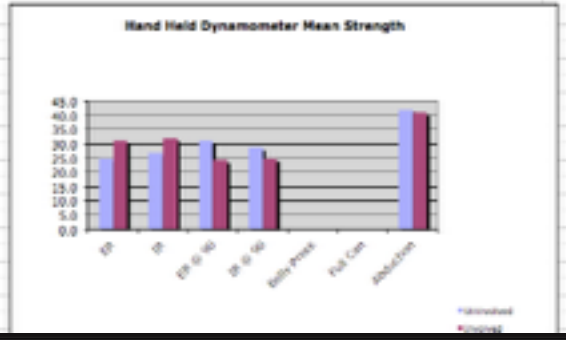
Outcomes

Date Tested:	2/22/2013	DPDx	Other		
DOB:		PTDx	Multi Directional Instability		
DOI:		Handedness:	Right		
Trauma	Yes	Involved side	Left	DASH SCORE	11.6
DOS:	see notes	Contralateral Hx	Yes	WORK	0
				SPORT	25
PROM	ER	IR (T1-12)	ER @ 90	IR @ 90	FE	Gerdy's	Total Arc	FABQ	
Uninvolved	Right							Tester Initials	djk
Involved	Left							Male/Female	Female
AROM						ABD		Height (inches)	66
Uninvolved	Right	20	side			80	85	Weight	150
Involved	Left	28	side			115	95	BMI	29.05

	Uninvolved	Right					Involved	Left					Mean
Force (lbs)	Trial 1	Trial 2	Trial 3	Max	Mean	STD	Trial 1	Trial 2	Trial 3	Max	Mean	STD	Diff
ER	24.7	25.9	23.6	25.9	24.7	1.2	28.3	31.3	33.9	33.9	31.2	2.8	-6.4
IR	27.3	27.0	26.4	27.3	26.9	0.5	30.6	30.2	34.8	34.8	31.9	2.5	-5.0
ER @ 90	31.8	30.6	31.0	31.8	31.1	0.6	27.0	27.2	19.2	27.2	24.5	4.6	6.7
IR @ 90	31.9	27.4	28.7	31.9	28.7	2.8	24.9	24.2	25.2	25.2	24.8	0.5	3.9
Belly Press													
Full Can													
Abduction	41.9	42.3	42.1	42.3	42.1	0.2	44.6	45.2	34.0	45.2	41.3	6.3	0.8

% Force Diff (Inv / Uninvolved)	
ER	-26.0
IR	-16.5
ER @ 90	21.4
IR @ 90	13.6
Belly Press	
Full Can	
Abduction	2.0

Shoulder ER/IR Force Ratio (%)	
Uninvolved	106.6
Involved	98.8



Right = 15 mo

Left = 24 mo

DASH:

R=13%

L=12%

Sport/arts = 25%

Outcomes

- 5 patients (2005-2013)
- All successfully fused
- No episodes of recurrent instability
- Significant decrease in pain
- Significant improvement in function
- Mild postoperative tenderness in one patient

HOWARD HEAD SPORTS MEDICINE

American Society of Shoulder and Elbow Therapists

2015 Annual Conference

Blood Flow Restriction Training and it's Relevance to Rehabilitation

Scott F. Hamersly PT, SCS, ATC, CSCS

Methodist Sports Medicine
THE ORTHOPEDIC SPECIALISTS

The World of "Sports Medicine"

- The "latest"…..
  - Research
  - Products
  - Techniques
  - Trends
  - Tag Lines/marketing
  - Rumors
  - Word of Mouth
  - New stuff?
  - Revitalized "old stuff" ?

Recent Fitness Products/Programs

- AB Roller
- CrossFit
- TRX Straps
- Pilates
- P90X, Insanity
- Spinning
- Boot Camps
- "core" training
- Kettlebells
- "Functional Fitness

Time Mag 2013

Strength Training Trends

- H.I.T. = High Intensity Training
- "Super Slow" = one set to failure
- Mask = oxygen restriction
- Muscle Confusion
- Body-weight training
- CrossFit
- Blood Flow Restriction Training

B.F.R.T.

"PUMP YOU UP!"

Other names

- Kaatsu
- Occlusion Training
- Restriction training
- Hokenson

"Street Cred"

- BFRT may actually have merit
- 163 articles
- Blood Flow Restriction Training: A Unique and Novel Rehabilitation Modality
  - Johnny Owens, MPT
  - Chief, Human Performance Optimization
  - Center for the Intrepid
  - Brooke Army Medical Center

What is It?

- Restriction of return venous blood flow without arterial restriction
- Creates a metabolic environment similar to "overloading" without the overloading stress on the anatomy

History

Kaatsu
1950's japan
1990's

Physiology

- Must perform at least 70% of 1 rep max "to failure" to create "metabolic stress" and maximize protein synthesis (overload principle)

ACSM

Physiology

- Can change other variables to achieve similar "stress" and get to fatigue or failure
  - i.e. – decrease rest period
- Must lift heavy, and to failure…
- BUT, what if "heavy" is not warranted?
  - i.e. - injured or fatigued
- Can we adjust a the load variable?
  - Decrease load to a smaller percentage of the 1 RM and still get strength/hypertrophy gains?

Physiology– "Metabolic Stress"

- Upregulation in specific growth factors (IGF-1)
- Specific Metabolic enzymes (creatine phosphokinase - CPK)
- Increase in anabolic effects
  - increase in Growth Hormone – GH
  - Rapamycin (mTOR) pathway
- Preferential recruitment of larger, fast-twitch motor units (type II fibers)
- Decrease in O2
- Increase in cellular swelling
- Increase in lactic acid, lactate, H ions
- Increase signaling for protein synthesis
- Increase in glucose 6 phosphate
- Downregulation of proteolytic transcripts

Credeur

Physiology

- LIT with BFR stimulates growth in type I and II muscle fibers
- HIT only stimulates type II
- Contraction type:
  - Traditional training
    - Must have a mechanical stimulation = muscle damage, from controlled lowering of a heavy weight (eccentric > concentric)
  - Not so with BFRT
    - Concentric > eccentric
      - With only 20% load

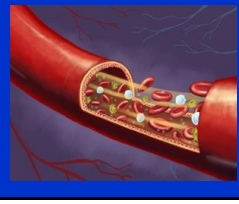
- Yasuda
  - 10 men
  - BFRT Arm curls
    - One concentric, one eccentric
  - 30% 1RM
  - 3x/week for 6 weeks, 4 sets for 75 reps
  - Conc arm had greater increase in:
    - iEMG
    - Acute muscle thickness (US)
    - CSA – 12% (MRI)
    - Strength – 8% (MVC)

- Yasuda
  - Conclusion:
    - Concentric BFRT had a greater impact than eccentric BFRT on muscle size, an index of muscle cell swelling, which is an important factor in promoting hypertrophy with resistance training

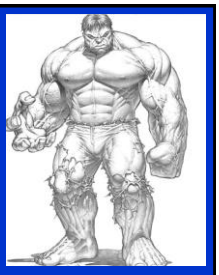
- Yasuda
  - Well documented that in traditional strength training eccentric loads produce greater gains in size and strength than concentric.
  - The mechanisms underlying muscle hypertrophy may differ between low-intensity resistance training with BFR vs. traditional high-intensity training

Physiology

- Vascular adaptations
  - Changes in function (flow)
  - Changes in structure (diameter)
  - Hyperemia
  - capacity



Safety



- "decrease" in arterial dilation?
  - Credeur

How does it work?

- Must get to diastolic pressure
  - 100 mgHG for legs
  - 80 mgHg for arms
- 20% compression
- 7/10 "tightness"
- Wrap as high as possible
  - Groin, axilla
- Keep on the entire duration

Parameters

- Volume: 3-5 sets, 15-30 reps
- Rest: 30-60 seconds
- Load: 20-50% 1RM
- Frequency: 2x/day to 3x/week

NSCA

- Not comfortable
- Endure discomfort

Application

- Elderly
- Diseased state
- Acute post-op
- Amputees
- Bed rested
- "Load-restricted" protocols

- Maintain muscle mass during period of unloading
  - Injury, rehab
- Increase hypertrophy

- Bed rest
- Walking
- Resistance training

- Arms
- Legs
- Proximal muscle groups?
  - Pecs – Yasuda #14
  - gluts

Products

- Width
  - 13cm – 145 mm Hg
  - 5-7cm – 240 mm Hg
    - Point at which arterial occlusion begins

NSCA

- Elastic vs. non-elastic
- Rogue bands
- BFR Straps
- Standard knee wraps

Summary

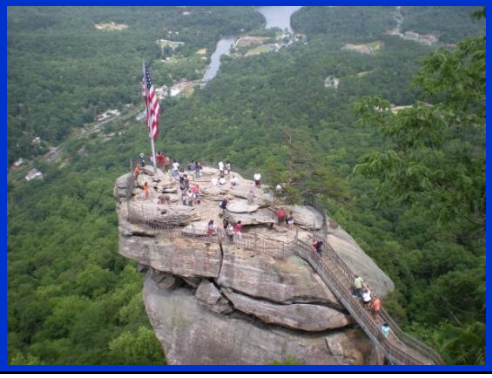
- When incorporated into supervised rehabilitation programs, BFR training allows for an additional modality to help patients achieve strength gains in musculature with post-traumatic and/or post-surgical dysfunction.
- In patients who cannot participate in high resistance exercise, BFR training is an option that leads to effective muscle strength gains at low resistance levels.

Owens

References

- Yasuda T, Leonneke JP, Thiebaud RS, Abe T. Effects of Blood Flow Restricted Low-Intensity Concentric or Eccentric Training on Muscle Size and Strength. PLOS ONE. 2012; 7(12): 1-7
- Credeur DP, Hollis BC, Welsch MA. Effects of Handgrip Training With Venous Restriction on Brachial Artery Vasodilation. Med. Sci. Sports Exerc. 2010 ; 42(7): 1-16.
- Loenneke JP, et. al. Effects of Exercise With and Without Different Degrees of Blood Flow Restriction on Torque and Muscle Activation. Muscle and Nerve. 2015; 51: 713-721
- Manini TM, et. al. Growth Hormone Response to Acute Resistance Exercise with Vascular Restriction in Young and Old Men. Growth Horm IGF. 2012; 22(5): 167-172
- Hunt JEA, et. Al. Time Course of Regional Vascular Adaptations to Low Load Resistance Training with Blood Flow Restriction. J Appl. Physiol. 2013; 115: 403-411

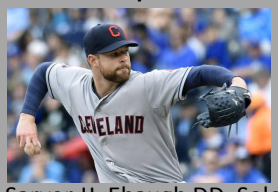
ASSET 2015



Abstract

- Blood Flow Restriction Training and its Relevance in Rehabilitation
- Hamersly SF: Methodist Sports Medicine, Indianapolis, IN, USA
-
- Educational Topic Presentation:
- Purpose: To explain the theories and science behind a growing trend in strength training that could prove beneficial in the field of rehabilitation.
- Description: Blood Flow Restriction Training (BFRT) is a novel approach to enhance skeletal muscle strength and size at lower loads of resistance than traditional strength training methods. Research has shown to induce muscle hypertrophy and promote strength gains, one must lift at loads of at least 70% of their 1-repetition maximum (1RM). This can prove problematic, if not impossible and potentially dangerous, for the injured or recovering patient in a rehabilitation program.
- Summary of Use: Recent studies have shown that BFRT may allow for the same metabolic reactions stimulating similar muscle adaptations as high resistance training while utilizing loads of only 20-30% of 1RM. Applying this method of strength training to the rehabilitation program of a wide variety of patients could potentially decrease muscle atrophy and allow for a quicker and safer recovery progression.
- Importance: This could have profound effects on the strategies used to rehabilitate patients with debilitating disease processes or orthopedic injuries.

Adaptations to the Morphology of the Bicipital Groove in Professional Baseball Players



Thomas SJ, Sarver JJ, Ebaugh DD, Soloff L, Genin J, Quinlin J, Kelly JD
Temple University
ARMS Lab

Introduction

- Baseball is a popular sport with over 2 million adolescents participating every year
- Most players begin participating between the age of 5 and 9 years old

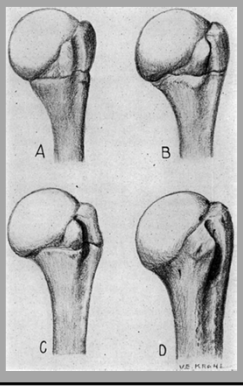
Introduction

- Overuse injuries are very common among both adolescent and adult players
- The bicep tendon is a common source of pathology in baseball
- The underlying mechanism of these pathologies is not well understood
- Interestingly, the anatomy of the bicep tendon is unique with a bony groove, which may contribute to injury

Introduction

Normal Development (Krahl, 1947)

- Bicipital groove
  - Vertical & shallow at birth
  - Curve & depth with development
  - Related to humeral retroversion (Johnson, 2013)



Introduction

Bony Adaptations

- Stress of throwing has been found to affect humeral retroversion (Crockett, 2002; Osbahr, 2002)
  - Related to elbow injury (Myer, 2011)
- Increased cortical thickness & trabecular density (Neil, 2008)
- The bicipital groove can develop stenosis in rotator cuff patients (Sakurai, 1998)

Introduction

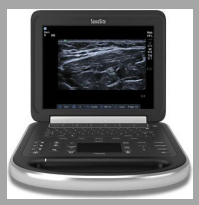
- However, the specific adaptations that occur to the bicipital groove in mature baseball players is currently unknown
- Therefore, the objective of the study was to assess the bilateral bony morphology of the bicipital groove in professional baseball players
- Secondary objectives are: (1) to determine if the amount of humeral retroversion correlates with the bicipital groove morphology, (2) to determine if bicipital groove morphology is different in players with a history of biceps injury compared to those without a history of biceps injury.

Methods

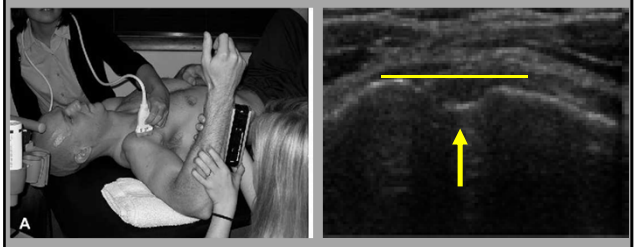
- 41 professional baseball pitchers with no current injury or surgery in the past six months
- Testing occurred during spring training from one organization
- Informed consent & health history questionnaire
- Bilateral measurements were taken

Humeral Retroversion

- Sonosite Edge Diagnostic Ultrasound Scanner
  - 15 MHz linear transducer
- Digital Inclinometer
- Validated technique to CT (Myers et al, 2012)



Humeral Retroversion

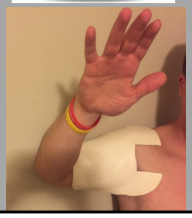


(Myers et al, 2009)

Bicipital Groove Morphology

- Sonosite Edge Diagnostic Ultrasound Scanner
  - 15 MHz linear transducer

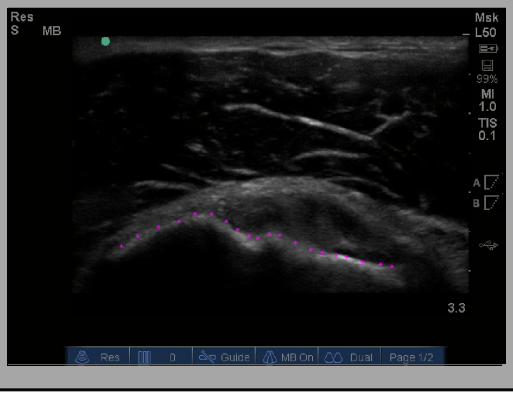
- Custom made plastic cuff to guide 2-D US images



Bicipital Groove Morphology

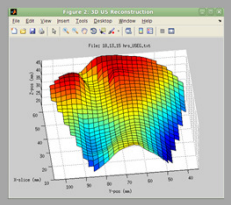
- Cuff positioned over anterior shoulder
- Bicipital groove identified
- Probe positioned inferior to the humeral head
- 2-D images every 0.5cm (~10-12 images)

Bicipital Groove Morphology

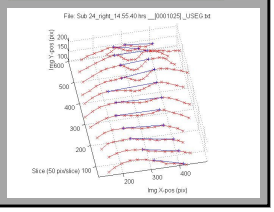


Bicipital Groove Morphology

- Create 3-D reconstruction with data interpolation

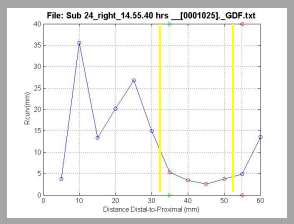


- Determine medial & lateral boundaries of groove



Bicipital Groove Morphology

- Determine superior & inferior boundaries of groove based on radius of curvature

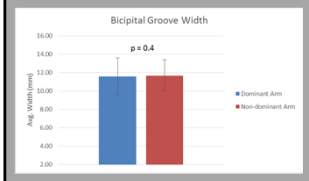


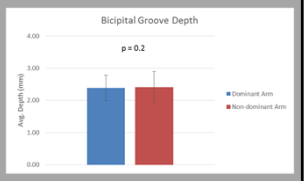
- Measure average depth, width, area, & radius of curvature

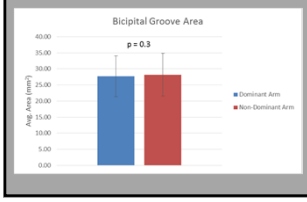
Statistics

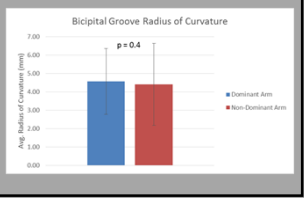
- Bi-lateral comparison
  - Paired sample t-tests were performed for depth, width, area, & radius of curvature
- Correlation analysis
  - Pearson correlation coefficients assessed the relationships between HR & depth, width, area, & radius of curvature

Results









Results

Dominant Arm				
	Width	Depth	Area	Radius
Humeral Retroversion	-0.20	0.14	-0.06	-0.08

Non-Dominant Arm				
	Width	Depth	Area	Radius
Humeral Retroversion	-0.07	-0.07	-0.12	0.07

Results

Examining both extremes retrospectively

- Groove area 2 SDs larger on dominant arm
  - 6/41 subjects
- Groove area 2 SDs smaller on dominant arm
  - 8/41 subjects
  - 2/8 had bicipital tendinitis followed by SLAP lesion

Discussion

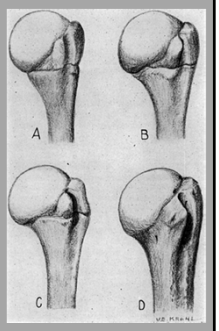
Side-to-side comparison

- No significant differences
  - Width, depth, area, radius of curvature
  - Against hypothesis
- Development & adaptive processes
  - Throwing may not affect these morphological characteristics
  - Healthy players were examined
- Future research
  - Retrospectively examine players with bicep injury
  - Soft tissue characteristics

Discussion

Correlations with humeral retroversion

- No significant correlations
  - Width, depth, area, radius of curvature
  - Against hypothesis
- Previous research found correlation with HR & transepicondylar axis rotation
- The development of HR & groove dimensions are not related
- Future research
  - Measure the transepicondylar axis rotation
  - Retrospectively examine players with bicep injury



Clinical Relevance

Bony morphology can directly impact tendon properties

- Tendons that wrap around bone have increased collagen II & aggrecan (Haradis, 1998)
- Changes the stress environment from tensile to compressive
- Lead to tendon degeneration/ injury
- Identify players at increased risk to minimize damage

Conclusion

No side-to-side differences

- 2/8 with smaller area did have history of biceps injury

No correlation with HR

- Development process of HR not related to dimensions of groove

Thank you

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

2015 ASSET Annual Conference
Asheville, NC
October 9-11th

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

2015 ASSET Annual Conference
Asheville, NC
October 9-11th

Joshua Pniewski PT, DPT
Staff Physical Therapist
Dwight D. Eisenhower Army Medical Center
Department of Orthopedics, Neurosciences and Rehabilitation

Georgia Regents University
College of Allied Health Sciences
Doctorate of Physical Therapy Program
Adjunct Faculty

GRU GEORGIA REGENTS UNIVERSITY AUGUSTA

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Acknowledgements

Co-Authors:
COL John Bojescul MD
LTC Terry Mueller DO
CPT Jeremy Jacobs MD
Michelle Dickston PT, DPT
MAJ Keith Jackson MD
LTC Brian Abell DO

Statistical Analysis:
Richard Topolski PhD
Georgia Regents University
Department of Statistics

IRB Approval:
Dwight D. Eisenhower Army Medical Center
Department of Clinical Investigation

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Acknowledgements

Mentorship, find it!
COL Greg Weaver PT, DPT
COL John Bojescul MD

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Acknowledgements

American Society of Shoulder and Elbow Therapists

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Disclosures

There is nothing to disclose as it pertains to this presentation and the research conducted at Dwight D. Eisenhower Army Medical Center.

Title

Outcomes of Biceps Tenodesis in an Active Duty Population

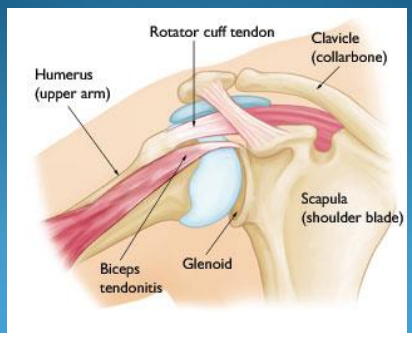
U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Purpose

The purpose of this study was to evaluate functional outcomes of subpectoral tenodesis in an active duty population.

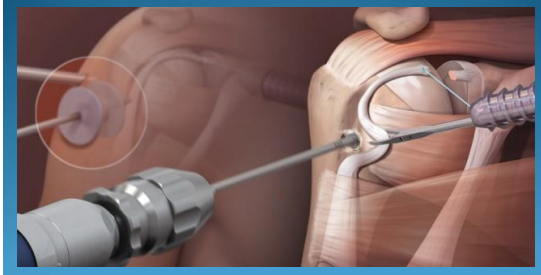
U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Quick Procedure Overview



U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Quick Procedure Overview

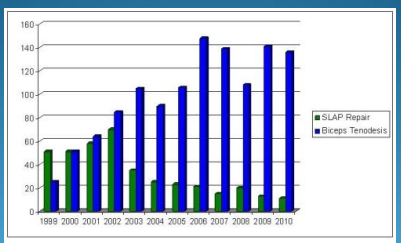


U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Quick Procedure Overview

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Quick Procedure Overview



Experience at MGH & BWH with Biceps tendon tenodesis vs arthroscopic S.L.A.P. lesion repair.

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Materials and Methods

-22 Active Duty Service Members (ADSM) met the inclusion criteria.
-3 Orthopedic Surgeons Performed all Procedures
-1 Physical Therapist guided the rehabilitation
-Documentation of:
- qDASH
- SPADI
- APFT outcomes

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Materials and Methods

-Quick Disability of the Arm, Shoulder, and Hand (qDASH), Pre-op and 6 months post-op

-Shoulder Pain and Disability Index (SPADI), Pre-op and 6 months post-op

-Army Physical Fitness Test (APFT), 6 months post-op.

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Materials and Methods

All patients were progressed following a progressive sling weaning criteria developed by our institution.

Hire JM, Pniewski JE, Dickston ML "*A Criterion Based Sling Weaning Progression (SWEAP) and Outcomes Following Shoulder Arthroscopic Surgery in an Active Duty Military Population.*" IJSPT 2014;9:179-186.

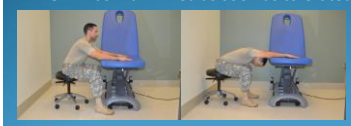
This was presented at the 2013 ASSET National Conference in Las Vegas.

IJSPT INTERNATIONAL JOURNAL OF SPORTS PHYSICAL THERAPY

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Materials and Methods

All patients were progressed by a single physical therapist using a progressive/accelerated rehabilitation guideline.
-Initial visit within 3-5 days of surgery
-PROM was maximized as soon as tolerated/possible.



-Once initial inflammatory phase was controlled cuff/scap stabilization was initiated.

Demographics

MOI: Mechanism of injury either trauma or repetitive

BT: Biceps Tenodesis

SLAP: SLAP debridement

Failed SLAP Repair: History of prior arthroscopic SLAP repair

Restrictions: APFT Restrictions with permanent profiling of the 3 tested events: Push-up, Sit-up, 2 mile run. All were allowed to do push-ups at their own pace.

Patient	Age	MOI	Post-op Diagnosis	Restrictions
1	57	Trauma	BT, SLAP	Push-up, Run
2	42	Repetitive	BT, SLAP	Push-up
3	45	Repetitive	BT	Push-up
4	43	Repetitive	BT, SLAP	Push-up
5	46	Repetitive	BT, SLAP	None
6	26	Trauma	BT, Failed SLAP Repair	None
7	30	Repetitive	BT, SLAP	None
8	27	Repetitive	BT, SLAP	None
9	42	Repetitive	BT	None
10	24	Trauma	BT	None
11	30	Repetitive	BT, SLAP	None
12	55	Repetitive	BT, SLAP	Push-up
13	37	Repetitive	BT, SLAP	None
14	21	Repetitive	BT, SLAP	None
15	30	Repetitive	BT, Failed SLAP Repair	None
16	26	Repetitive	BT	None
17	42	Repetitive	BT	None
18	48	Repetitive	BT, SLAP	None
19	38	Repetitive	BT, SLAP	None
20	38	Repetitive	BT, SLAP	None
21	39	Repetitive	BT, SLAP	None
22	27	Repetitive	BT, SLAP	None

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Results

-No patients lost to follow up.

-Mean age: 36.9 years (21-57)
- -2 were between 19-25 years old
- -16 were between 26-45 years old
- -4 were >46 years of age

-20 male and 2 female

-15 SLAP tears were identified
-2 had prior failed SLAP repairs

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Results

SPADI:
-Mean pre-op = 47.9
-Mean post-op = 4.7
-Mean improvement = 43.2
-CI = 3.6

qDASH:
-Mean pre-op = 40.4
-Mean post-op = 2.7
-Mean improvement = 37.7
-CI = 2.7

Both outcomes had a high power analysis of 1.0 and effect size of >2.5

This indicates a high overall impact of the surgery.

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Results

-When comparing the pre and post results there was a significant difference

-Subgroups analysis [<45 years old (n=17) and >45 years old (n=5)]
- -SPADI no significant difference in outcomes
- -qDASH only <45 had a statistically significant improvement

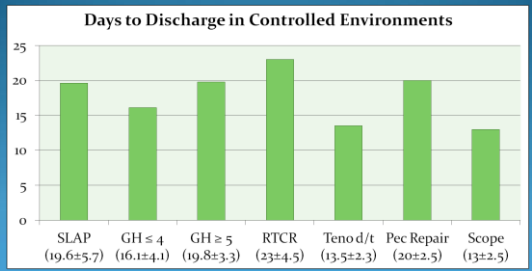
(WHY

-No reported complications to include:
- -infection
- -rupture of the long head biceps tendon
- -"popeye" deformity
- -loss of fixation
- -no neurovascular injuries during subpectoral approach

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Results
(from SWEAP Study)



U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Conclusion/Discussion

-Demonstration of significant improvements at 6 months in a young active duty population undergoing biceps tenodesis

-Very few APFT restrictions

-All patients were retainable at 6 months

-All patients were deployable at 6 months

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Conclusion/Discussion

-Demonstration of significant improvements at 6 months in a young active duty population undergoing biceps tenodesis

-Very few APFT restrictions

-All patients were retainable at 6 months

-All patients were deployable at 6 months

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Further Discussion

-Subpec biceps Tenodesis has also been investigated as a salvage procedure for failed Type II SLAP tear repairs.
- -Gupta et al (Ortho 2013):
  - 11 subsequent Tenodesis procedures following SLAP repair noted statistically significant differences in pre and post outcomes scores

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Further Discussion

Type II SLAP tears, subpec Tenodesis may provide improved outcomes versus SLAP repair with suture anchors.
- -Boileau et al (AJSM 2009)
  - Patients undergoing SLAP repair were:
    - -significantly less satisfied
    - -lower likelihood of returning to their previous level of sport participation.

This is important when treating active duty service members as SLAP lesions are more prevalent in the military than the civilian population. (2)

Our study had an N=2 with failed SLAP repair.

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Further Discussion

Complications following subpectoral biceps tenodesis:

- -Nho et al (JSES 2010)
  - -353 patients (2% had complications)
    - -Persistent bicepital pain (.57%)
    - -Failure of fixation (.57%)
    - - 1 patient developed musculocutanteous neuropathy (resolved at 6 months)

U.S. Army Medical Department
Dwight D. Eisenhower Army Medical Center

Questions?

Again I would like to thank ASSET for the privilege of being a member and the opportunity to present this information.

References

DOR-SWeaP Justification

1. Sano H, Yamashita T, Wakabayashi I, et al. Stress Distribution in the Supraspinatus Tendon After Tendon Repair. Am J Sports Med. 2007;35:542-546.
2. Park MC, Jun BJ, Park CJ, et al. The Biomechanical Effects of dynamic External Rotator Cuff Repair Compared to Testing With the Humerus Fixed. Am J Sports Med. 2007;35:1931-1939.
3. Haktakeyama Y, Itoll E, Pradhan RL, et al. Effect of Arm Elevation and Rotation on the Strain in the Repaired Rotator Cuff Tendon. Am J Sports Med. 2001;29:788-794.
4. Park MC, Pirolo JM, Park CJ, et al. The Effect of Abduction and Rotation on the Footprint Contact for Single-Row, Double-Row, and Modified Double-Row Rotator Cuff Repair Techniques. Am J Sports Med 2009;37:1599-1608.
5. Peltz CD, Sarver JJ, Dourte LM et al. Exercise following a Short Immobilization Period Is Detrimental to Tendon Properties and Joint Mechanics in a Rat Rotator Cuff injury Model. J Orthop Res 2010;28:841-845.
6. Gerber C, Schneeberger AG, Beck M et al. Mechanical Strength of Repairs of the Rotator Cuff. J Bone Joint Surg. 1994;76:371-380.
7. Gates JJ, Gilliland J, McGarry MH, et al. Influence of Distinct Anatomic Subregions of the Supraspinatus on Humeral Rotation. J Orthop Res 2010;28:12-17.
8. Hsu AT, Chang JH, Chang CH. Determining the Resting Position of the Glenohumeral Joint: A Cadaver Study. JOSPT 2002;32:605-612.
9. Schneeberger AG, Von Roll A, Kalberer F, et al. Mechanical Strength of Arthroscopic Rotator Cuff Repair Techniques. J Bone Joint Surg Am. 2002;12:2152-2160.
10. Culp LB, Romani WA. Physical Therapist Examination, Evaluation, and Intervention Following the Surgical Reconstruction of a Grade III Acromioclavicular Joint Separation. Phys Ther. 2006;86:857-869.
11. Penna J, Deramo D, Nelson CO. Determination of Anterior Labral Repair Stress During Passive Arm Motion in a Cadaveric Model. Arthroscopy 2008;8:930-935.
12. Kakwani RG, Mathews JJ, Kumar KM, et al. Rupture of the pectorlis major muscle: Surgical treatment in athletes. International orthopedics. 2007;31:159-163.

Early ROM Evidence

1. Sano H, Yamashita T, Wakabayashi I, et al. Stress Distribution in the Supraspinatus Tendon After Tendon Repair. Am J Sports Med. 2007;35:542-546.
2. Park MC, Jun BJ, Park CJ, et al. The Biomechanical Effects of dynamic External Rotator Cuff Repair Compared to Testing With the Humerus Fixed. Am J Sports Med. 2007;35:1931-1939.
3. Park MC, Pirolo JM, Park CJ, et al. The Effect of Abduction and Rotation on the Footprint Contact for Single-Row, Double-Row, and Modified Double-Row Rotator Cuff Repair Techniques. Am J Sports Med 2009;37:1599- 1608.
4. Koo SS, Parsley BK. Burkhart SS, et al. Reduction of Postoperative Stiffness After Arthroscopic Rotator Cuff Repair: Results of a Customized Physical Therapy Regimen Based on Risk Factors for Stiffness. J Arthrop Relat Surg. 2011;2:155-160.
5. Kakwani RG, Mathews JJ, Kumar KM, et al. Rupture of the pectorlis major muscle: Surgical treatment in athletes. International orthopedics. 2007;31:159-163.

Proximal Biceps Lesions

New Theories & Advances in Treatment

Donald F. D'Alessandro, MD

OrthoCarolina
SHOULDER & ELBOW CENTER

Chief, Sports Medicine
Shoulder & Elbow Service
Carolinas Medical Center
Charlotte, NC

Team Physician:
Davidson College
Queens University
MLL Charlotte Hounds

Disclosures

Donald F. D'Alessandro

- Product developer - Biomet
- Research support - Biomet
- Fellowship support
  - Smith-Nephew
  - Arthrex
  - Mitek

Introduction

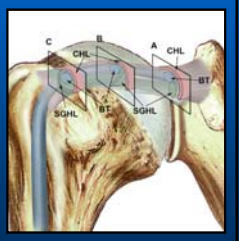
Proximal Biceps Lesions

Pathoanatomy

- Superior labrum
- Rotator interval
- Bicipital groove

Treatment

- Biceps "savers"
- Biceps "killers"



Ding, JBJS '14

Proximal Biceps Lesions

Anatomy

Biceps Attachment

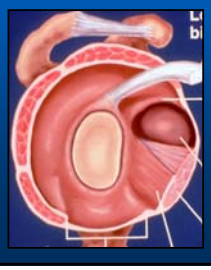
- Supraglenoid tubercle
- Fibrocartilaginous
- Medial to articular surface
- Subsynovial recess
- Meniscoid variants

Proximal Biceps Lesions

Arthroscopic Anatomy

Antero-Superior Quadrant

- Biceps anchor to mid-glenoid
- Variable
- Confusing
- Normal variants

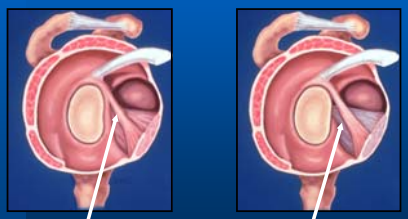


Arthroscopic Anatomy

Normal Variants

Sublabral Foramen

Arthroscopic Anatomy

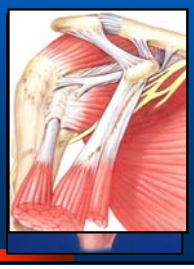


Arthroscopic Anatomy

Rotator Interval

Intra-articular

- SGHL
- MGHL
- Subscapularis
- Bicipital groove



Extra-articular

- Supraspinatus
- Subscapularis
- Bicipital groove
- Coracohumeral

SLAP Lesions

Superior

Labral

Anterior and

Posterior

Snyder, JSES '90

Proximal Biceps Lesions

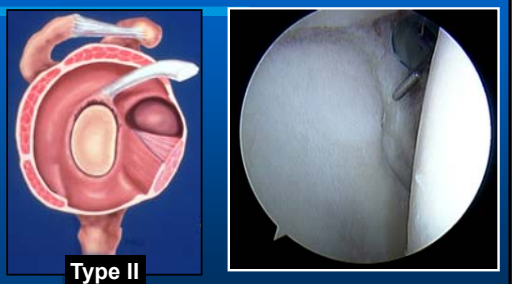
SLAP Lesions

Classification

- Types I-IV
  (Snyder, Arthro '90)
- Type V-IX
  (Maffet, AJSM '95)

Type I

SLAP Lesions



Type II

SLAP Lesions


Type II


Type III

SLAP Lesions


Type IV

SLAP Lesions

Mechanism of Injury

- Superior compression
  - Fall outstretched arm
  - Dysfunctional RC
  - Dips! ("Cross-fit shoulder")
- Inferior traction
  - Lifting heavy object
  - GH instability
  - Overhead athletes

Sports & SLAP Lesions

SLAP Lesions

MOI Throwers

- "Internal impingement"
  (Jobe)
- "Peel back"
  (Burkhart & Morgan)
- "Weed pulling"
  (Conway)

Internal Impingement

MOI Overhead Athletes

- Explains posterior superior labral and undersurface cuff tears
- Can extend into biceps anchor
- Treatment …
  SLAP repair & anterior capsule tightening

SLAP Lesions

Physical Examination

Provocative Tests

Compression rotation

O'Brien sign

SLAP Lesions

Provocative Tests

Cook et al, JSES '12

- N=87, +MRI, 5 clinical tests
- Arthroscopic confirmation
- No test reliable – sensitivity, *poor* specificity

- Compression rotation (Snyder)
- Active compression (O'Brien)
- Biceps load II (Kim)

SLAP Lesions

Clinical Evaluation

Imaging

- Non-contrast MRI ...
  - Unreliable: 34% sensitivity!
- MRA > MRI
  - *Connoly, JBJS '13 Phillips, JSES '13 Be*
- MRI Asymptomatic throwers
  - 21 MLB pitchers
  - 48% + SLAP tear !?!
  - Correlated w/ innings pitched

Lesniak, AJSM '13

SLAP Lesions

Treatment

Type I, III
- Debridement

Type II, IV
- Arthroscopic repair

Type V
- Arthroscopic repair and stabilization

Type I

SLAP Lesions

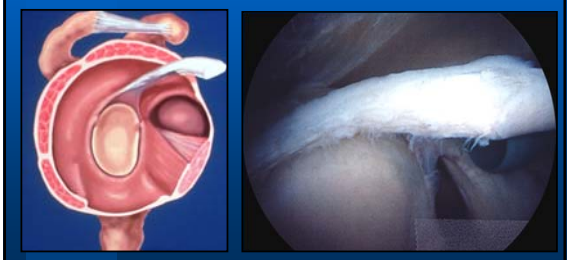
Type II Repair

SLAP Lesions

Type IV

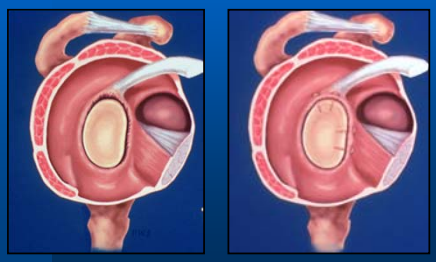
SLAP Lesions

Type IV



SLAP Lesions

Type V



SLAP Repair

Clinical Outcomes

Provencher, AJSM '13

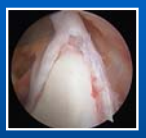
- N=179, Type II SLAPs
- High demand - Navy Seals
- Age 31 (18-45)
- Failures: 37%!
- Risk factors …
  - Age >36 yrs
  - Smoking
  - Traumatic etiology

SLAP Repair

Clinical Outcomes

Erickson, AJSM '15

- Systematic review
- N=14 studies
- SLAP > 40 y/o
- SLAP Repair vs Tenodesis
  - No diff ASES scores
- SLAP w/ RCT
  - Tenodesis > SLAP Repair



SLAP Repair

Return to Play ☹

Garantla, Arthroscopy '10

- Type II: Sytematic rev- 5 studies
- Baseball: 22 – 64% RTP

Neri, AJSM '11

- N=23 Type II: Elite overhead
- No RCT – 84% RTP
- w/ PRCT – 57% RTP

Fedoriw, AJSM '14

- Pitchers N=27 … only 48% RTP
- Position N=13 … 85% RTP

Proximal Biceps Lesions

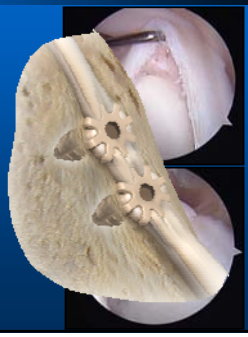
SLAP Repair vs Tenodesis

When to repair

- Younger < 35 y/o
- Throwers – good tissue
- Small anchors / knots

Biceps tenodesis

- Type II SLAP > 35 y/o
- Type IV SLAP
- *Poor labral tissue or LHB tendon pathology …..*



Proximal Biceps Lesions

LHB Pathophysiology

- LHB tenosynovitis
- Mechanical irritation
- Tendinosis
- End-stage degeneration …
  - Hourglass thickening
  - Medial or longitudinal fraying
  - Degeneration & rupture

Nho, JAAOS '10
Mazzocca, Arthroscopy '13

Proximal Biceps Lesions

LHB Pathophysiology

- LHB tenosynovitis
- Mechanical irritation
- Tendinosis
- End-stage degeneration …
  - Hourglass thickening
  - Medial or longitudinal fraying
  - Degeneration & rupture

Nho, JAAOS '10
Mazzocca, Arthroscopy '13

Proximal Biceps Lesions

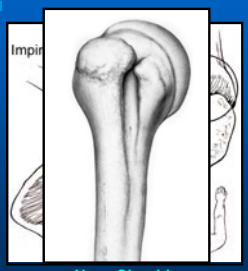
LHB Pathophysiology

Impingement …

- Medial acromion
- Hypertrophic AC
- Coracoid

Results in …

- Upper subscap tear
- Excrescence on LT
- Narrowing of groove



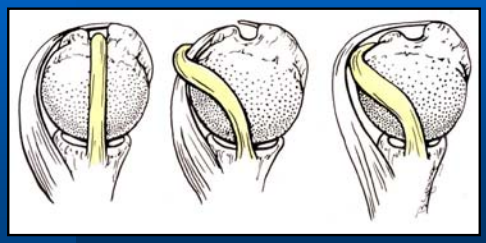
Neer, Shoulder Reconstruction '90

Proximal Biceps Lesions

LHB Pathophysiology

Proximal Biceps Lesions

LHB Medial Dislocation



Neer, Shoulder Reconstruction '90

Proximal Biceps Lesions

LHB: Overhead Athlete

Biceps Instability

- Young overhead athlete
  - Volleyball, swimmer, baseball
- Acute event: clicking, popping
- Chronic: pain, snapping w/ throw
- Attenuation of medial buttress or partial tear of subscap
- Treatment: Tenodesis

Proximal Biceps Lesions

LHB: Overhead Athlete

Biceps Incarceration

- Arthroscopic "passive" compression test
- Humeral chondromalacia
- Treatment: Tenodesis

Proximal Biceps Lesions

LHB Pathology

Physical Examination

- Point tenderness in groove
- Yergason's …
  - resisted supination
- Speed's …
  - resisted flexion
- O'Brien's sign
- Contour asymmetry
  - medial dislocation
- Popeye deformity

Proximal Biceps Lesions

LHB Pathology

Surgical Management

- Debridement
- Tenotomy
- Tenodesis …
  - Articular margin
  - Suprapectoral
  - Subpectoral

Proximal Biceps Lesions

Biceps Tenotomy vs Tenodesis

- Systematic review (N=19)
  - No diff satisfaction
  - No diff functional scores
  - Minimal rehab

Frost, AJSM '09

- But …
  - Some don't like "Popeye"
  - Young active … cramping
  - Newer techniques relatively easy & predictable

Proximal Biceps Lesions

Biceps Tenotomy

Clinical Results

- N=54 pts
- Overall good pain relief
- 35% - poor ASES <70
- Cramping: 19%
- Fatigue ache: 38%
- Popeye sign
  - Men 83%, Female 37%

Kelly, AJSM '05

Proximal Biceps Lesions

Biceps Tenotomy

My Indications

- Obese arm
- Older low demand
- Cosmesis unimportant
- Unable to comply w/ rehab

My Contra-indications

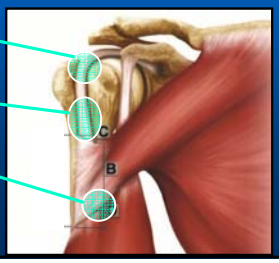
- Athlete, heavy laborer
- WC population
- Cosmesis important

Proximal Biceps Lesions

Biceps Tenodesis

Location Controversial !!!

- Articular margin
- Suprapectoral
- Subpectoral



Proximal Biceps Lesions

Tenodesis @ Articular Margin

Advantages

- Arthroscopic
- Relatively easy
- Revisable if fails

Disadvantages

- Bicipital groove pain … fixation vs residual pathology?
- PITT: Subacromial sutures
- Rotator interval irritation … difficulty gaining ER!

Proximal Biceps Lesions

Tenodesis @ Articular Margin

High is bad

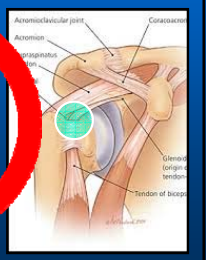
- N=25 proximal t[illegible]esis
- 45% revised fo[illegible]Al[illegible]

Sa[illegible]ers, Wa[illegible]ISES '12

High is Ok

- N=1083, seven [illegible]geons
- Fixation: interfere[illegible]crew
- Only 4 (0.4%) revised

Brady, Burkhart, AJSM '15



Proximal Biceps Lesions

Suprapectoral Tenodesis

Advantages

- All arthroscopic
- Below rotator interval
- Newer fixation methods easier

Disadvantages

- Hard to judge tension
- Some have stiffness
- "Non-whipped" tendon

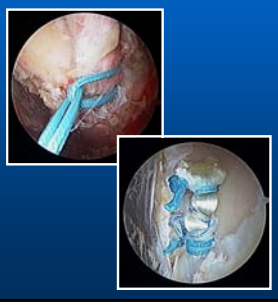
Werner, Brockmeier, AJSM '14

Proximal Biceps Lesions

Suprapectoral Tenodesis

Fixation Methods

- Suture anchors
- Interference screw
- Rivot device

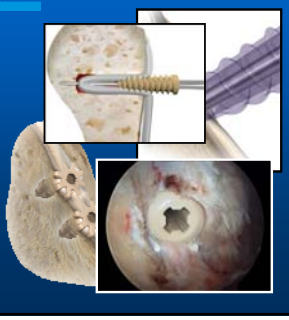


Proximal Biceps Lesions

Suprapectoral Tenodesis

Fixation Methods

- Suture anchors
- Interference screw
- Rivot device



Proximal Biceps Lesions

Subpectoral Tenodesis

Advantages

- Good results reported
- Reliable – whipped tendon
- Complication rate low

Disadvantages

- Open technique
- Wound complications
- Neurovascular concerns
- Humeral fxs reported
- Difficult to revise

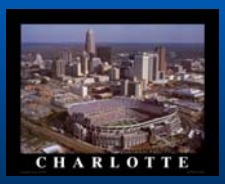
Mazzocca, Romeo, AJSM '08

Proximal Biceps Lesions

Summary

- Biceps often a PAIN generator !!!
- Arthroscopy …
  - Identify pathoanatomy
  - Determine surgical plan
- SLAP lesions controversial
  - Dx: Normal vs lesion?
  - TX: Fix or Not to fix?
- LHB Pathology
  - Tenodesis reliable
  - Location controversial?

Thank You



American Society of Shoulder and Elbow Therapists

Post Operative Management and Return to Sport After Proximal Biceps Lesions

Alan Tyson PT, SCS, ATC, CSCS

architech sports & PHYSICAL THERAPY

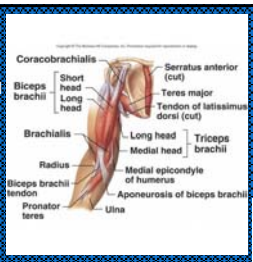
Anatomy

LHBT originates 50% from superior glenoid tubercle and 50% from superior labrum

Proximal tendon is richly innervated with sensory fibers containing substance P and calcitonin peptides

Responsible for vasodilation as well as transmitting pain

Blood supply from ascending branch of the anterior circumflex humeral artery

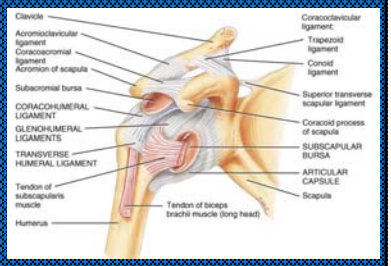


Anatomy

Exits the joint and passes through the rotator interval to intertubercular groove between greater and lesser tuberosities

Surrounded by tendoligamentous sling CHL, SGHL, fibers from supraspinatus and subscapularis make up sling

Consider for post-operative rehab

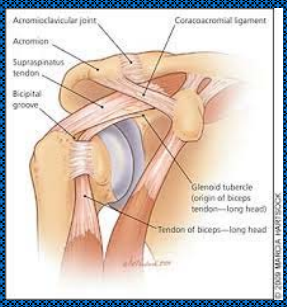


ANATOMY

LHBT passes underneath transverse ligament

No longer believed to secure LHBT given most of stability is provided by SGHL and CHL

Groove – medial depth of 4.3mm with average medial wall angle of 56 deg



FUNCTION

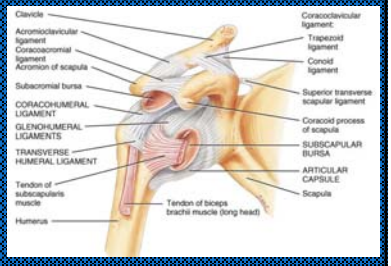
Controversial

Neer – Humeral Head Depressor

Andrews – Hum Head compression with glenoid

Kumar 1989 - superior head migration occurred with tenotomy performed but no scapular mm forces were simulated

Warner 1995 – sup head migration during active abd radiographically with isolated LHBT compared with intact contralateral shoulders



FUNCTION

Sethi 1999 – HH depression role would be unlikely in most shoulder positions except in full ER

Rodosky 1994, Yocum 2009 – simulated contraction of LHBT increases stability of GH jt by increasing the shoulder's resistance to torsion on Abd/ER

Pagnani 1995 – injury to biceps anchor results in increased strain on IGHL and increase antero-inferior GH translation

Giphart 2012 - LHBT minimal effect on GH kinematics

FUNCTION

- Proprioception influence by LHBT not studied
- Significant biceps activity seen after ball release during follow through as forearm is decelerated
- This eccentric force transfer to the anchor has been postulated to cause SLAP lesion
- Anchor issues could also occur through "peel back" mechanism during late cocking phase
- The change of the force vector of biceps causes torsional force at insertion – Burkhart 1998, Yocum 2009

DISORDERS

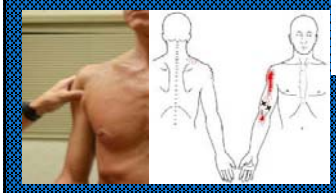
3 categories

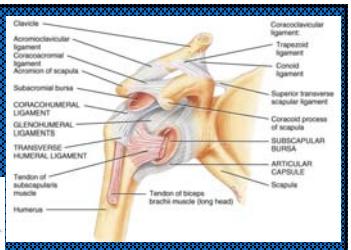
- Inflammatory/degenerative conditions
- Instability
- SLAP lesions/biceps anchor abnormalities

DISORDERS

3 categories

- Inflammatory/degenerative conditions
- Isolated pain





DISORDERS

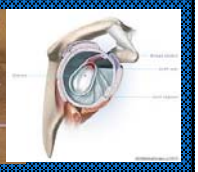
3 categories

- Instability
- soft tissue sling that secures biceps within groove
- Receives contribution from CHL, SGHL, and subscapularis
- Stressed during throwing motion and must be disrupted to cause instability
- Shallow groove may predispose biceps to instability

DISORDERS

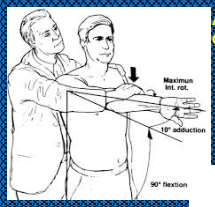
3 categories

- SLAP lesions/biceps anchor abnormalities
- Shearing mechanism – compression of superior glenoid rim due to fall on outstretched arm abducted and flexed forward
- Traction mechanism – eccentric firing of LHBT



CLINICAL EXAM

- Tenderness over bicipital groove that stays with ER and IR compared to anterior deltoid
- +/- impingement with post capsule tightness
- Yergason's specific for biceps but lacks sensitivity (Holt 2004)
- O'Brien's 3 pack
- Kibler – upper cut and dynamic labral test



Active Compression

Dynamic Labral Shear Test

- O'Driscoll 2012
- Standing
- Arm AB in scapular plane to 120 deg
- Shear load applied by max ER
- Arm lowered from 120 to 60deg
- Pain, click or catch between 120 and 90 deg
- If +tve, LR=32

REHAB PRINCIPLES

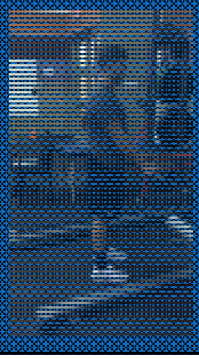
- Avoid "popeye deformity
- Tendons have 7.5 x lower oxygen update than skeletal muscles – Sharma 2006
- Decisions to advance based on protecting healing tissue, applying controlled loads, and monitoring patient response **(more assertive with less assertive patients)**
- Focus on post and inf capsule mobility as tightness can lead to impingement

REHAB PRINCIPLES

- Sling wear 1-2 weeks
- Full PROM 1-2 weeks post op
- Promote being out of sling at rest with arm on chair in neutral rotation
- Stay away from prolonged IR (hand on abdomen)
- Initiate scapular stabilization
- Scapula retraction with arms immobilized shown to produce low level of biceps activity (Smith 2006)

REHAB PRINCIPLES

- 2-4 weeks – Full PROM should be achieved
- Begin RC and ST exercises
- Start gentle rhythmic stabilization with hand contacts proximal to elbow



REHAB PRINCIPLES

4-8 weeks

- Progress RC and ST exercises (Cools 2007, 2014)
- UBE for light resistance
- 6 weeks may begin light resistive elbow flexion exercises
- Emphasize concepts of frequency, duration, and intensity of training

Supination progression

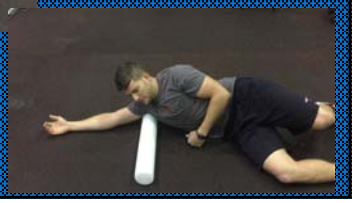
REHAB PRINCIPLES

8-12 weeks

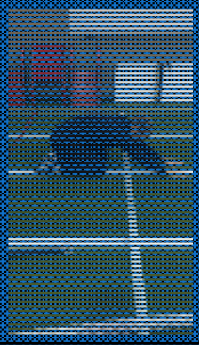
- Equal strength bilaterally by 12 weeks
- Progress PREs as tolerated
- Begin low level plyometrics 2 hand chest pass, ball dribbling, etc
- 10-12 weeks can initiate sport-specific activities

Soft Tissue Mobilization

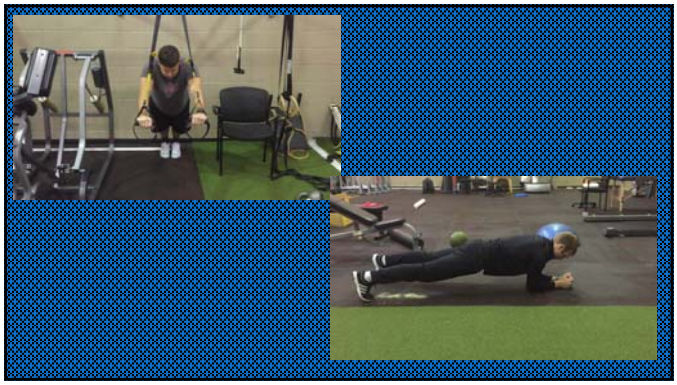
- "Think Late Cocking and Deceleration" for return to sport
- Chalmers 2014 AJSM – altered thoracic mechanics in SLAP repairs
- Diminished ER

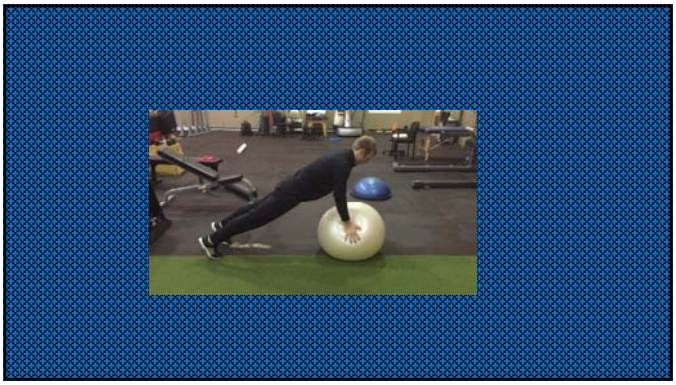


Thoracic Spine Self Mobilizations - General



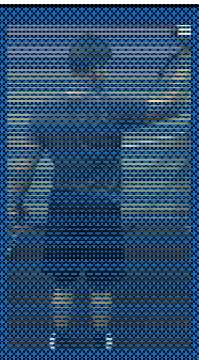
Soft Tissue Assessment and Release

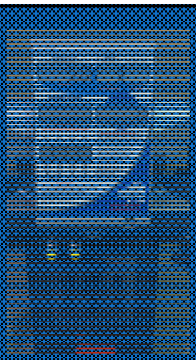


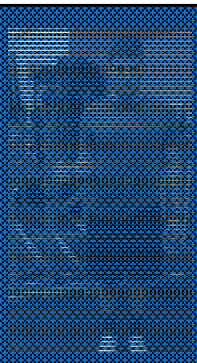


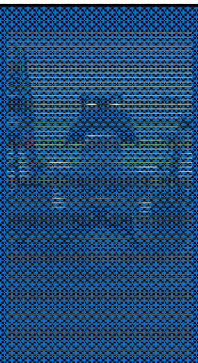

Rhythmic Stab – Sport specific

Rhythmic Stabilization –
Sport Specific

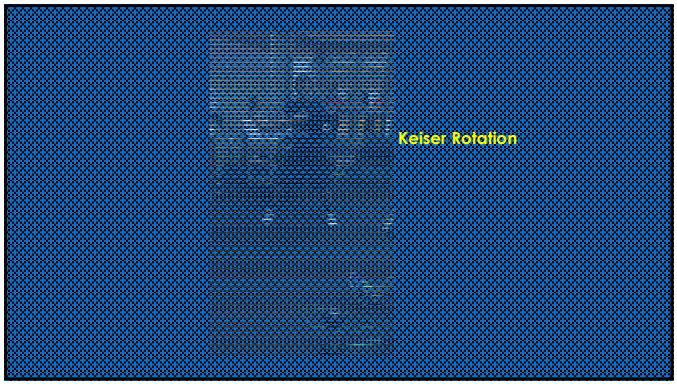


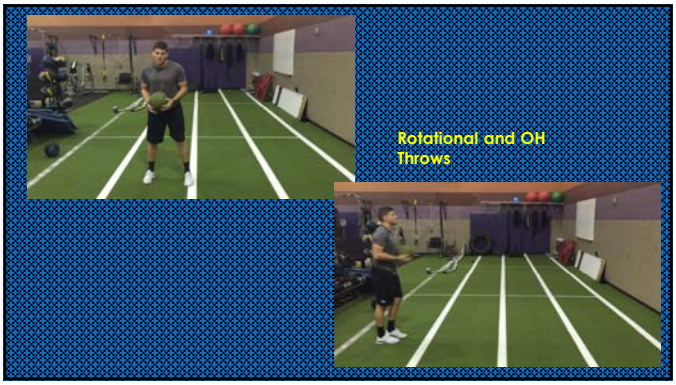




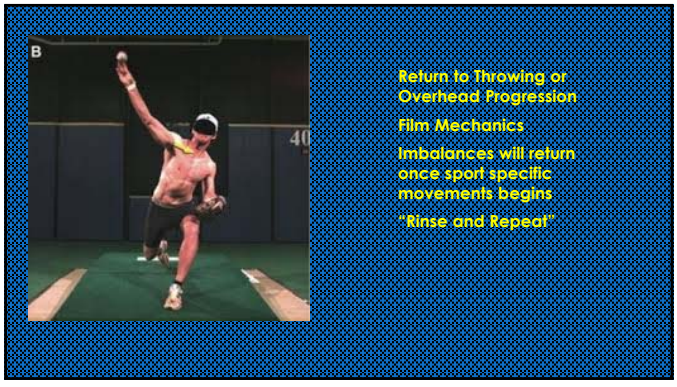


Thoracic Rotation with
Glute-Ham emphasis


Keiser Rotation


Rotational and OH Throws


Ice Skaters


Return to Throwing or Overhead Progression
Film Mechanics
Imbalances will return once sport specific movements begins
"Rinse and Repeat"


THANKS!!
architech sports
PHYSICAL THERAPY

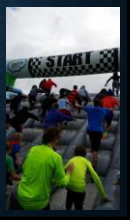
LATISSIMUS DORSI: IS IT THE "MISSING LINK" IN THE KINETIC CHAIN SHOULDER EVALUATION?

ASSET 2015 Asheville, North Carolina

By: Wendy S. Burke PT, DPT, MS, OCS, CCRC
CGH Medical Center
Sterling, IL

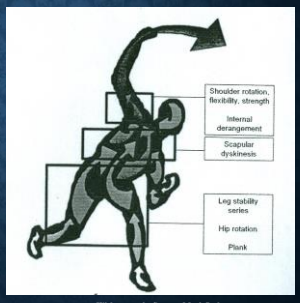
OBJECTIVE

- Propose using the March test as a standard clearance test with upper extremity evaluation.
- Show, though anatomical studies the latissimus dorsi role in the kinetic chain
- Demonstrate with video how quick and easy it is to test and treat
- Show the immediate affect that treatment has on the scapula and shoulder motion



BACKGROUND

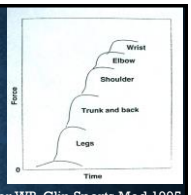
- The kinetic chain links multiple body segments
  - in order to develop,
  - funnel and
  - regulate the forces
- The LE generates more than 50% of the energy that is transferred via the kinetic chain through the
  - lumbo-pelvic-hip complex,
  - the scapula, shoulder
  - elbow, hand and ultimately the ball. (Kibler, 2001)



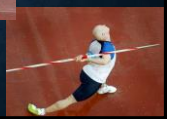
Kibler et al., Sports Med Arthrosc 2012

BACKGROUND

- Lack of proper function or weakness along the kinetic chain causes or leads to injury in the shoulder
- DTS (disabled throwing shoulder)
  - virtually every overhead athlete (with shoulder injury) demonstrated **scapular dyskinesis.**
  - (Warner 1992, Clin Orthop Rel Res)



Kibler WB, Clin Sports Med 1995



BACKGROUND

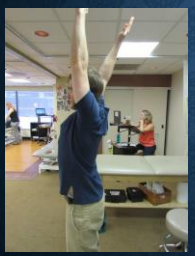
S-I-C-K Scapula

Scapular malposition
Inferior medial border prominence
Coracoid pain
dys**K**inesia of scapula

Burkhart SS et al., Arthroscopy 2003

SICK scapula: right side (pre-treatment)

BACKGROUND



List of kinetic chain dysfunctions seen in UE throwers with shoulder problems

TABLE 1. Physical Findings Commonly Seen in Throwers

Thoracic and lumbar hypomobility
Incompletely rehabilitated ankle sprain, especially on stance leg
Scapular malpositioning and dyskinesis
Glenohumeral internal rotation deficit
Tight pectoralis minor, latissimus dorsi, serratus anterior, subscapularis, pectoralis major
Stance leg (dominant side)
Weak hip abductors
Weak external rotators (gluteus medius)
Stride leg
Decreased hip internal rotation
Quadriceps tightness

Sewick et al, Sports Med Arthro 2012

Latissimus dorsi tightness with compensation with LS extension.

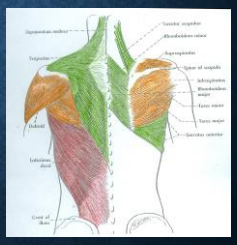
EVALUATION WITHIN THE CONTEXT OF THE KINETIC CHAIN (KIBLER ET AL, CLIN SPORTS MED 2013)

Proximal to Distal Kinetic chain evaluation

Examination Emphasis	Normal	Abnormal	Result	Evaluation
One Leg Stability: Stance	Negative Trendelenburg	Positive Trendelenburg	Decreased force to shoulder	Gluteus medius strength
One leg Stability: Squat	Control of knee varus/valgus during decent	Knee valgus or corkscrewing during decent	Alters arm position during task	Dynamic postural control
Hip Rotation	Bilateral symmetry within known normal limits	Side-to-side asymmetry and/or not within normal limits	Decrease trunk flexibility and rotation	Internal and external rotation of hip
Plank	Ability to maintain body position for at least 30s	Inability to maintain body position	Decreased core stability and strength	Dynamic postural control in suspended horizontal position
Scapular Dyskinesia	Bilateral symmetry with no inferior angle or medial border prominence	Side-to-side asymmetry or bilateral prominence of inferior angle and/or medial border	Decreased rotator cuff function and increased risk of internal and/or external impingement	Scapular muscle control of scapular position ("yes/no" clinical evaluation, manual corrective maneuvers)
Shoulder Rotation	Side-to-side symmetry or internal and external rotation values less than 15° or less than 5°	Side-to-side asymmetry of 15° or more in internal and/or external rotation or 5° or more of total range of motion	Altered kinematics and increased load on the glenoid labrum	Internal and external rotation of glenohumeral joint
Shoulder Muscle Flexibility	Normal mobility of pectoralis minor and latissimus dorsi	**Tight pectoralis minor and/or latissimus dorsi**	Scapular protraction	**Palpation of pectoralis minor and latissimus dorsi**
Shoulder Strength	Normal resistance to testing in anterior and posterior muscles	Weakness and/or imbalance of anterior and posterior muscles	Scapular protraction, decreased arm elevation, strength, and concavity-compression	Muscle strength from a stabilized scapula
Joint internal derangement	All provocative and stress testing negative	Pop, click, slide, pain, stiffness, possible "dead arm"	Loss of concavity-compression and functional stability	Labral injury, rotator cuff injury or weakness, glenohumeral instability, biceps tendinopathy

COMPLETE *SHOULDER* EVAL

- 17 muscles attach to the scapula
- **Gleno (scap)-humeral**
  - **Supraspinatus**
  - **Infraspinatus**
  - **Texes major**
  - **Subscapularis**
  - **Deltoid**
  - **Biceps (long head)**
  - **coracobrachialis**
- **Trunk – scap (SC-TH)**
  - **Trapezius (upper, middle, lower)**
  - **Rhomboid major, minor**
  - **Pectoralis minor**
  - **Serratus anterior**
  - **Levator scapula**
- **Trunk – humeral**
  - **Pectoralis Major**
  - **Latissimus Dorsi**



Textbook of Anatomy Third Ed. Hollingshead 1974 (colored by WSB)

PT: 101 CLEAR THE JOINTS ABOVE AND BELOW THE ONE THAT IS INVOLVED

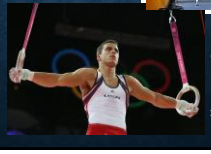
- Latissimus Dorsi and Trapezius
  - Have origin from midline of the back that extends from the
    - external occipital protuberance of the skull
    - To the sacral region
- GHJ🍀Shoulder Joint🍀 Shoulder Girdle
- Therapists evaluate the shoulder girdle ?
- Upper quadrant?

Fig. 12-26. Origin and insertion of the trapezius and the latissimus dorsi.

Textbook of Anatomy Third Ed., Hollingshead 1974

LATISSIMUS DORSI

- Short linear attachment on the humerus and widespread to sp.proc of TH/LS/ilium



- Lats serve to lift the trunk against a braced upper extremity.

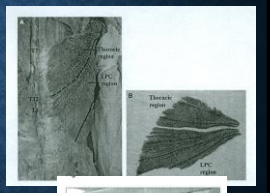
(Bogduk et al, 1998, Clinic Biomech)

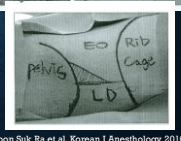
ANATOMY OF LATS IN THE KINETIC CHAIN

PCSA

- Sarcomere length same in stretched and non stretched muscle
- Low number of sarcomeres in parallel
- 64% of the force generation capacity came from the Lumbar region of the muscle
- 36% came from the thoracic region.
- 2/3 of the force generating capacity is from the lumbar portion of the muscle; not including the passive tension of the fascia.

Gerling ME et al, J Anat 2013

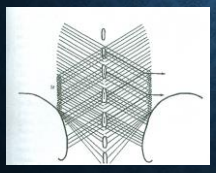




Yoon Suk Ra et al, Korean J Anesthology 2010

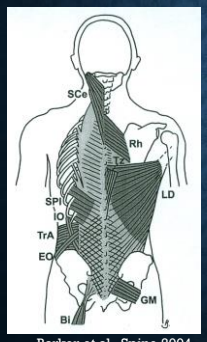
ANATOMY OF LATS IN KINETIC CHAIN

- The aponeurosis crosses midline to reach the contralateral PSIS



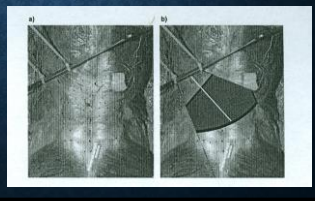
Vleeming et al, Spine 1995

ANATOMY OF LATS IN KINETIC CHAIN



8 cadavers dissected and 10 N tension placed on muscles, measured the fascial displacement.

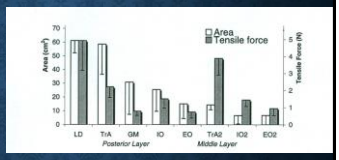
Tension on LD, TrA, IO, EO, GM



Barker et al., Spine 2004

ANATOMY OF LATS IN KINETIC CHAIN

- Every muscle tested produced fascial displacement
- Contralateral effects were observed with GM
- Posterior Lumbar Fascia
  - Tension on LD and TrA ALWAYS resulted in BILATERAL fascial motion T12-S1
- Middle Lumbar Fascia
  - Tension on muscles moved ipsilateral



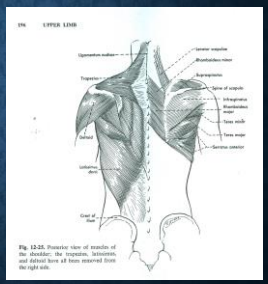
Concluded:

•LD and GM tend to be recruited in a phasic fashion for particular activities and could tolerate the highest tensions

Barker et al, Spine 2004

PURPOSE

1. To demonstrate a quick and easy screening tool for pelvic girdle mobility in patients with shoulder dysfunction.
2. Illustrate how treatment intervention for pelvic mobility affects shoulder motion.



Textbook of Anatomy third Ed., Hollingshead 1974

DESCRIPTION

PG mobility screening test for UE

- Gillet test
- March test
- Stork test

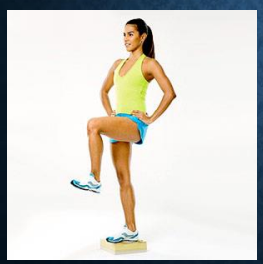
- Palpate for ilial rotation compared to the sacrum
- Thumbs at sacrum and PSIS across from one another

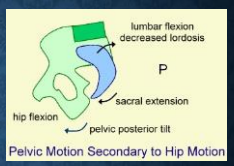
RJ disclaimer

Palpation placement

Sequence of Motion

Active Hip Flexion





- Active Hip flexion
- ➢ Posterior ilial rotation
- ➢ Posterior sacral motion (counter nutation)
- ➢ Lumbar spine flexion

MARCH TEST (R) POSTERIOR ILIAL ROTATION

Thumb placement

Sacrum and Right PSIS

- ➢ Right hip flexion
- ➢ Right posterior ilial rotation
- ➢ Sacral extension
- ➢ NORMAL motion:
  - ➢ PSIS thumb moves inferior compared to Sacral thumb
- ➢ Test is + if there is no motion (both thumbs move together)
- ➢ + if poor quantity or quality of motion

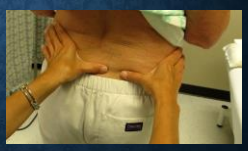
Normal smooth motion

Assess for quality and quantity

MARCH TEST
(R) ANTERIOR ILIAL ROTATION

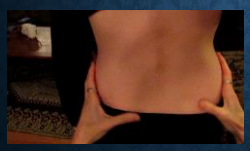
Thumb placement
Sacrum and RIGHT PSIS

- Left hip flexion
- Left posterior ilial rotation
- Sacral extension (counter –nutation)
- And RELATIVE RIGHT ANTERIOR ILIAL ROTATION
- NORMAL motion:
  - Sacral thumb moves inferior compared to PSIS thumb
- Test is + if there is no motion (both thumbs move together)
- or poor quality of motion

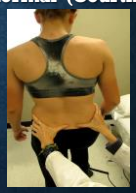


MARCH TEST
CLEARANCE / SCREENING TEST

Normal (Makalah)



Abnormal (Courtney)



Clearance testing tells you **WHETHER** or not it needs to be addressed. **NOT HOW.**

TREATMENT
FOR POSTERIOR ILIAL ROTATION

Treatment decisions are made via PALPATION

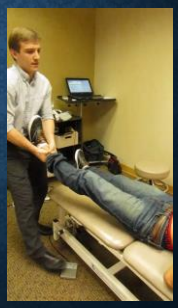
- Palpate ASIS
  - Eye dominance
- (+) if one side significantly more superior than the other
  - About 1- 1 ½ inches

Pull that leg to bring ilium down

Position for treatment

- **Abd and flexed**
- **Look for opp shoulder motion**

REASSESS



TREATMENT
FOR ANTERIOR ILIAL ROTATION

Treatment Via palpation

- Palpate PSIS and iliac crest
  - Eye dominance
- (+) if one side significantly more superior than the other
  - About 1- 1 ½ inches

Pull that leg to bring ilium down

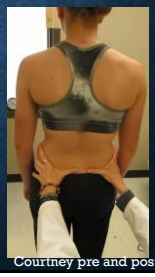
Position for treatment

- **Abd and Extension**
- **Look for opp shoulder motion**

ASSESSMENT PG PRE-POST TX

PG assessment PRE treatment

PG assessment POST treatment



Courtney pre and post

SCAPULAR POSITION: STATIC
SICK SCAPULA (RIGHT)

PRE treatment static scapular position

Post treatment static scapular position

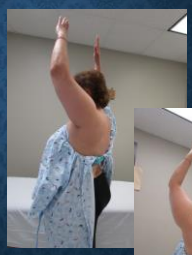
SCAPULAR STATIC POSITION PRE/POST ILIAL TREATMENT

PRE treatment:
Left Scapula abducted, anterior tilt, downward rotated

Post treatment improved scapular symmetry

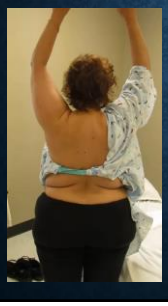
PRE – TREATMENT ROM

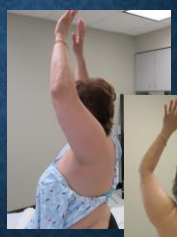
Olivia – pre treatment

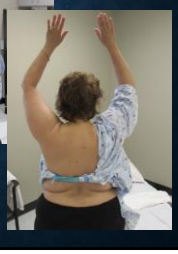


POST – TREATMENT ROM

Olivia post treatment PG exam







PRE treatment: ROM 130

POST treatment: ROM 150

CHANGES OF ROM WITH PATIENT EVALUATIONS WITHIN A VISIT

Patien t #	Initial/age	Dx	Pre ROM	Post ROM	Difference	comments
1	DC (74yo)	TSA LEFT	131	142	11 AROM	Up post R
2	JG (32yo)	Imping LEFT	10	30	20 AROM	Horiz abd-ext
3	GA (64yo)	Left RCR massive 13 weeks	60	90	30 PROM	Massive
4	FW (58yo)	RCR Right 10 weeks	93 F/ 45 ER	113 F/60 ER	20 Elev / 15 ER	10 weeks
5	Paula (60yo)	Left Sho Strain	95	110	15	Up post Left
6	Grace (81yo)	Left massive RCR 8 weeks	130	145	15	
7	Kerry (65yo)	Right RCR 6 weeks	90	110	20	
8	Amanda (43yo)	Right UE rad / Scap dyskinesia	110	130	20	Up post Left
9	Joe B (23yo)	Right SLAP	180	180	0	Poor scap /GIRD
10	Lynn G (49yo)	Right RCR 4 weeks p/o	65 FE 45 Abd	82 FE 60 Abd	17 FE 15 Abd	PROM
11	Wesley S (57yo)	Left RCR 2 weeks p/o Revision	-5 ER 20 Abd	10 ER 55 ABD	15 35	PROM no pain with abd at range
12	Patricia C (61yo)	Bilat UE LBP	145 Right 150 Left	160 Right 155 Left	15 right 5 left	
13	Deanna (52yo)	DDD L4S/ shoulder limits	155 bilat	160 bilat		Motion ok, position treat
14	Kent (47yo)	Right sho/UT	140 *P 120	155 no pain	15 (*35 no pain)	
15	Linda M (39yo)	Right sho pain	130 *P 90	155 no pain	25 *65 no pain	MVA/ mult trauma Spine fx femur fx
16	Dan M (56yo)	Right RCR 7 weeks	120	148	28	PROM supine
17	Grace S (53yo)	Bilat Shoulder Pain	100 R* 100 L*	130 R 130 L	30 R 30 L	Painful eccentric right
18	Olivia B (47yo)	L shoulder LBP	130*	150	20	No pain after in back or shoulder

SUMMARY OF USE

- Standard practice for evaluations is to clear the joint above and below
- Latissimus Dorsi is anatomically connected to the contra-lateral hip
- The LD is an integral part of the kinetic chain
- Kinetic chain deficits contribute to shoulder injury and pain
- Assessment for the lats mobility at the proximal attachment using the March test to clear the joint is easy
- Treatment is quick
- Affects the shoulder ROM

EVALUATION WITHIN THE CONTEXT OF THE KINETIC CHAIN (KIBLER ET AL, CLIN SPORTS MED 2013)

Proximal to Distal Kinetic chain evaluation

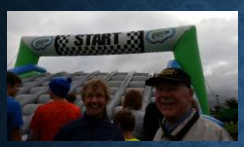
Examination Emphasis	Normal	Abnormal	Result	Evaluation
One Leg Stability: Stance	Negative Trendelenburg	Positive Trendelenburg	Decreased force to shoulder	Gluteus medius strength
One leg Stability: Squat	Control of knee varus/valgus during decent	Knee valgus or corkscrewing during decent	Alters arm position during task	Dynamic postural control
Hip Rotation	Bilateral symmetry within known normal limits	Side-to-side asymmetry and/or not within normal limits	Decrease trunk flexibility and rotation	Internal and external rotation of hip
Plank	Ability to maintain body position for at least 30s	Inability to maintain body position	Decreased core stability and strength	Dynamic postural control in suspended horizontal position
Scapular Dyskinesia	Bilateral symmetry with no inferior angle or medial border prominence	Side-to-side asymmetry or bilateral prominence of inferior angle and/or medial border	Decreased rotator cuff function and increased risk of internal and/or external impingement	Scapular muscle control of scapular position ("yes/no" clinical evaluation, manual corrective maneuvers)
Shoulder Rotation	Side-to-side symmetry or internal and external rotation values less than 15° or less than 5°	Side-to-side asymmetry of 15° or more in internal and/or external rotation or 5° or more of total range of motion	Altered kinematics and increased load on the glenoid labrum	Internal and external rotation of glenohumeral joint
Shoulder Muscle Flexibility March test	Normal mobility of pectoralis minor and latissimus dorsi	**Tight pectoralis minor and/or latissimus dorsi**	Scapular protraction	**Palpation of pectoralis minor and latissimus dorsi**
Shoulder Strength	Normal resistance to testing in anterior and posterior muscles	Weakness and/or imbalance of anterior and posterior muscles	Scapular protraction, decreased arm elevation, strength, and concavity-compression	Muscle strength from a stabilized scapula
Joint internal derangement	All provocative and stress testing negative	Pop, click, slide, pain, stiffness, possible "dead arm"	Loss of concavity-compression and functional stability	Labral injury, rotator cuff injury or weakness, glenohumeral instability, biceps tendinopathy

FUTURE

- Determine the incidence
- Determine who/ what types of diagnosis may be more susceptible
- Assess if intervention early on is more effective than later .
- Compare early PG assessment to other treatments

THANK YOU

- ASSET and ASES members
  - For the years of support
- Richard Jackson PT,OCS
  - Making me a better clinician and teaching me about PG
- Daniel Alcorn DPT,OCS and Michael Kecman DPT,OCS
  - Data collection



Elbow contracture: The broken Kinetic Chain in the Upper Quadrant

Saba Kamal
Occupational Therapist/ Certified Hand Therapist
Director Hands-On-Care
Annual Conference Chair Hand Therapy Association of California

Elbow joint

- The elbow joint is critical to upper extremity function as it positions the hand in space.
- Stabilizes the upper extremity linkage for power to lift heavy objects and for fine motor activities

In a stiff elbow, the entire upper extremity range of motion is impaired and function suffers.

Contracted Elbow

- Functional range of motion for the elbow is between **30 to 130** deg
  - Most activities require a **100 degree arc of motion** at the elbow to be functional
  - A 30 degree loss of extension is well tolerated by most patients
  - Most ADLs require 50° supination and 50° pronation
- Flexion contractures greater than 45 deg in extension will significantly limit ADLs;
- Loss of full flexion is more disabling than the same amount of extension
- However, extension is difficult to gain than flexion

Elbow Contracture

- Loss of motion due to soft tissue contracture or due to osseous impingement;
- Loss of the normal 30° anterior tilt of the distal humeral articular surface;
- Narrowing or distortion of the trochlear articular surface;
- Obstruction of the coronoid and olecranon fossae;
- Ulnohumeral arthrosis;
- Heterotopic Ossification

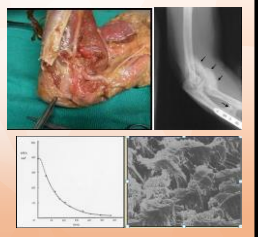
Reasons for contracture

Intrinsic causes

- Joint incongruity
- Synovitis
- Loose bodies
- Intra-articular fractures
- Osteochondritis dissecans
- Post-traumatic arthritis

Extrinsic causes

- Formation of eschar following a burn
- Heterotopic ossification
- Adhesions/contraction of the capsule
- Myositis ossificans
- Ligament contractures
- Scarring of posterior oblique portion of medial ulnar collateral



- Increased edema, late start to rehab, poor rehab

Case Study

60 year female
Occupation: Minister at church
DOI: 9/13/12 fell at work and landed on right elbow
Impression:
- Fx proximal ulna (displaced)
- Radial head fx fragments
- Radial head dislocation (post)

Surgery:
DOS: 9/17/12
- ORIF right olecranon
- Radial head replacement
- Repair of LUCL

X-Rays



Case Study

9/21/12: ROM within brace was started
10/5/12: Referred to PT
10/31/15: PT started
5 sessions of Land therapy
Then **Aquatic** therapy was started
Pt. received a total of **24** sessions of therapy, **12** in pool
DASH score improved from 93 – **81**
Surgeon concerned she may be developing **CRPS** referred her to pain management.
After which she was referred to us

Therapy started at HOC: **1/25/13**
4+ months after injury
Pain 3-8 on VAS
Ulnar nerve involvement
Pitting edema from above elbow to hand
Moderate tenderness at med/ lat epi

Case Study

Severely limited Shoulder motion
ROM: elbow:
flexion: 90,
Extension: -40
Supination: -46
Pronation: 74

Diffuse stiffness in the entire UE, pitting edema in the elbow to the hand

Strength wasn't assessed due to pain and lack for full ROM

ROM: Wrist:
flexion: 30
Extension: 32
Radial dev: 12
Ulnar dev: 12
Finger tips more than 5cm from palm

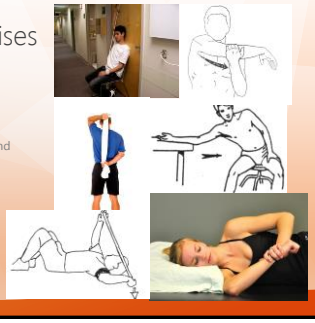
NO HAND FUNCTION
Hand stuck with fingers and thumb in extension
Having no hand function prevented the patient from using the extremity and allowing for swelling reduction

Case Study: Swelling reduction and ROM

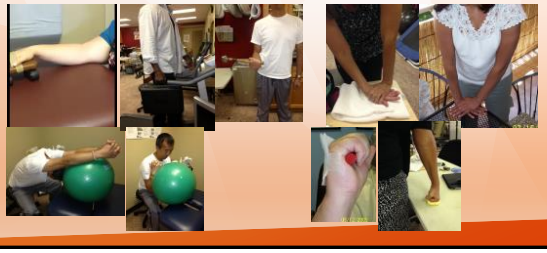
Plan:
- Swelling reduction:
  - HP in elevation
  - Joint / Soft tissue Mobilization (should to hand)
- Improving ROM
  - HP with stretch (Principle of creep)
- Maintaining ROM achieved in Rx
  - Exercises
  - Custom Splinting
- Decreasing pain
  - H-Wave (Swelling / pain)
  - Ice

Case Study: Exercises

- Followed by
  - Exercises
    - Pulley (swelling/ ROM)
    - PROM shoulder/ Elbow/ hand
    - Elbow Trolley
    - Stress loading
    - Wrist ex
    - Hand ex



Case Study: Exercises



Case Study: Splints

Plan

- Splinting:
  - Night extension splint (fabricated after mobilization) and progressively extended as ROM gains were main
  - JAS day splint (Shoulder, elbow/ forearm)
  - Dynamic finger flexion splint

Myofascial with nerve glide

Before gliding the nerve we start with myofascial techniques to release any adhesion

Once adhesions are released then start with gentle nerve glide while continuing to perform myofascial technique (no increase in sensory complaints)

Case Study

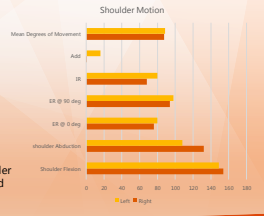
Swelling / pain reduction:

H-wave and Ice

Pt. was given for home use, used it until the end to avoid using pain meds (per doctors records)

End Result: Shoulder

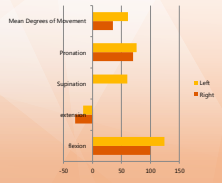
Shoulder	Right	Left	Ratio
Shoulder Flexion	154	149	1.033557047
shoulder Abduction	132	108	1.222222222
ER @ 0 deg	76	80	0.95
ER @ 90 deg	94	98	0.959183673
IR	68	80	0.85
Add	1	16	.0625
Mean Degrees of Movement	87.33333	88.5	0.986817326



The graph here is shows an increase in motion in shoulder flexion and abd in the affected dominant arm. This could be indicative of compensatory patterns due to lack of elbow motion

End result elbow

Elbow ROM	Right	Left	Ratio
flexion	100	124	0.806451613
extension	-30	-16	1.875
Supination	0	60	0
Pronation	70	76	0.921052632
Mean Degrees of Movement	35	61	0.573770492



Case Study

Wrist ROM: WFL

Hand: Full thumb ROM

Improved fist: able to touch finger to palm, in a straight fist

Small and ring lack motion

Fine coordination lacking

Functional activities:

Able to eat without difficulty but with some compensation

Able to comb hair

Put mascara on

Difficulty with wiping reaching behind the back

Difficulty with putting earrings on due to coordination issues

Functional limitations – activity analysis

Lack of elbow flexion:
Activity eating

Lack of elbow extension:
Reaching/ lifting

Lack of pronation:
Writing

Lack of Supination:
Carrying

Results in forward flexion and abduction of the shoulder

Results in trunk flexion, retraction of scapula with shoulder extension

Results in shoulder abduction and internal rotation

Results in shoulder adduction, wrist extension and radial deviation

Functional Activities current

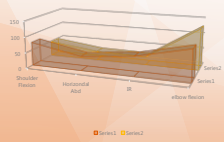
Eating

Right

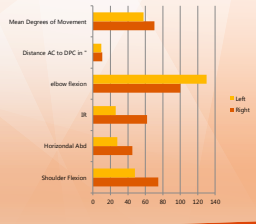
Left:

Eating	Right	Left		Ratio
Shoulder Flexion	**75**	48	27	1.5625
Horizontal Add	45	28	17	1.607142857
IR	62	26	36	2.384615385
elbow flexion	**100**	130	-30	0.769230769
Distance AC to DPC in "	10.5	9.5	1	1.105263158
Mean Degrees of Movement	70.5	58		1.215517241

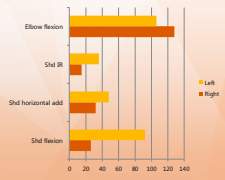
Eating



Increased compensatory pattern noted in all ranges of shoulder motion to get the hand to the mouth.



Eating



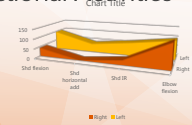
Eating

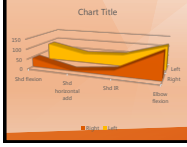
Eating	Right	Left		Ratio
Shd flexion	26	**92**	66	0.282609
Shd horizontal add	32	48	16	0.666667
Shd IR	15	36	21	0.416667
Elbow flexion	128	**106**	-22	1.207547
Mean Degrees of Movement	50.25	70.5	84	0.712766

Current Elbow ROM	Right	Left
flexion	140	115
extension	-1	-15
Supination	70	88
Pronation	80	82
Mean Degrees of Movement	72.25	62.5

Current Shoulder ROM	Right	Left
Shoulder flexion	165	145
Abd	160	102
ER @ 90	70	80
IR @ 90	80	75
Adduction	30	35
Mean Degrees of Movement		

Functional Activities

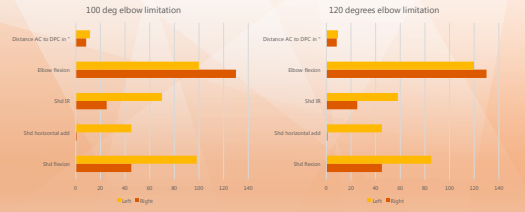




Eating	Right	Left		Ratio
Shd flexion	45	98	53	0.459184
Shd horizontal add	1	45	44	0.022222
Shd IR	25	70	45	0.357143
Elbow flexion	130	**100**	-30	1.3
Distance AC to DPC in "	8.5	11.5	3	0.73913
Mean Degrees of Movement	50.25	78.25	115	0.642173

Eating	Right	Left		Ratio
Shd flexion	45	85	40	0.529412
Shd horizontal add	1	45	44	0.022222
Shd IR	25	58	33	0.431034
Elbow flexion	130	**120**	-10	1.083333
Distance AC to DPC in "	8.5	9.5	1	0.894737
Mean Degrees of Movement	50.25	77	108	0.652597

Eating: Elbow motion limited to 100 and 120



Shoulder motion	Elbow flexion	Normal Shoulder motion	Normal Elbow Flexion
92 (L)	**106**	26	128
98 (L)	**100**	45	130
85 (L)	**120**	45	130
75 (R)	**100**	48	130

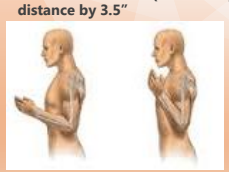
130 deg

110 deg

Drop	Lift		Drop
Elbow flexion	Shoulder Flexion	Shoulder abd	Shoulder IR
130	54	12	26
120	72	36	50
115	100	50	86

Drop	Lift		Drop
Elbow flexion	Shoulder Flexion	Shoulder abd	Shoulder IR
130	18	24	24
120			
120	28	14	36
115			

For every 15 deg ROM limitation at the elbow there is an increase in the hand to mouth (AC to DPC) distance by 3.5"



The total angulation to get the hand to mouth is a **combination of shoulder flexion and wrist radial deviation totaling to a 100 degree**

100 deg of total functional motion to make up for the lack of elbow motion

---

$\Delta\Theta = \frac{3.5}{15} = 0.23$ rad = 13.5 deg

3.5 is the distance of DPC to mouth

15 is length of lateral epi to DPC

AC to DPC

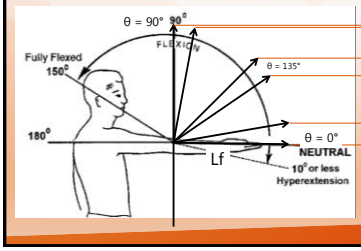
Position of spoon in normal: 8"

Position of spoon in alt rot: 11.5"

Different = 3.5

Compensation is roughly 13 – 15 deg to move the spoon around

Elbow Flex Drop = Lf * (1-sin(θ))

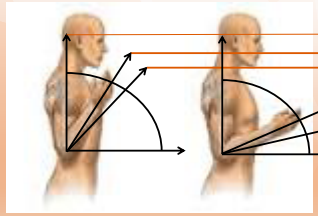


Small Change No Drop
sin(90) = 1

Medium Drop

Largest Drop Sin(0) = 0

Drop Accelerates with Increasing Restriction



Smaller Drop

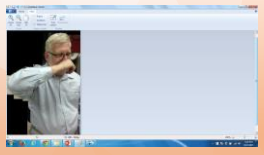
Bigger Drop

When the elbow angle is limited the position of the spoon drops,

The arm goes into abd to lift the spoon up,

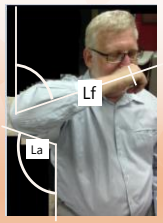
However lifting is not enough to get the spoon to the mouth so it compensates more by going into horizontal abd and internal rotation to get the hand to the mouth

So the spoon has to lift up and the angle at the shoulder has to drop to get the hand to the mouth



Drop due to Internal Rotation
DIr= Lf * (1-sin(θIr))

Lift due to Abduction and/or flexion
LAb= La * (1-sin(θab))



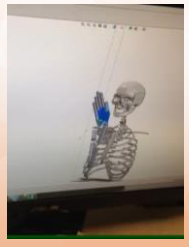
Sin is measured from vertical
Cos is measured from horizontal

Drop due to elbow flexion limitation
DFl= Lf * (1-sin(θfl))

To get the spoon to the mouth,
Drops = Lifts, or
DIr + DFl = Dab

(too simple—left as exercise for the reader to work out correct formula)

3D model

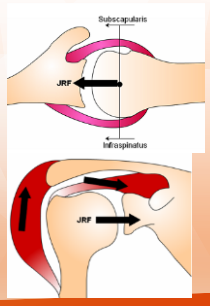


Other functional activities measured

- **Putting mascara on** *(increased shoulder motion noted)*
- **Brushing hair** *(decrease in shoulder motion since not as much elbow motion was required)*
- **Arm behind for cleaning self** *(Increased shoulder motion)*
- **Reaching overhead** *(humeral dominant shoulder)*
- **Holding 5 lb. wt.** *(shortening lever arm, poor endurance)*

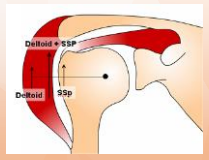
Normal Shoulder motion

Normal activities require the shoulder to depress / scapular retraction when performing most ADL's

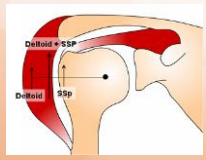


Shoulder motion

With lack of motion at one joint for e.g.: elbow, increases the overall movement at the shoulder and wrist to make up the 100 deg of functional ROM



Hypothesis



Here we are proposing

- The degrees of lack of motion at the elbow will result in
  - increase in shoulder motion (deltoid action) shearing motion which over time will result in impingement of the shoulder

Hypothesis

- For every 15 deg contracture the object moves by 3.5" away from its destination
- In the case of the spoon: this causes a drop in the level of the object getting to its destination
- This drop has to be compensated by the shoulder having to compensate to finish the activity
- The shoulder motion is brought on by deltoid
- This positions the shoulder in the impingement position

Which may over the period of time cause impingement of the shoulder due to shearing motion

Thus causing problems with the shoulder.

If this is compounded by

- Dominance
- Repetitive nature of the work
- Weighted activity or
- Overhead activity

It may result increase in the percentage of shoulder problems s/p elbow injury/ contracture.

Contracture and its consequences

Thus it is in the best interest of the

- Patient
- Physician
- Insurance company

To get the maximum range of motion at the elbow to prevent future problems thusd

- Saving money (cost of added care)
- Lost wages
- Pain (associated complications)

To achieve this

- ***Great surgeon***
- ***Early referral***
- ***Good planned rehab/ quality rehab***
- ***Patient education***
- ***Strengthen proximal structures (RTC) for it to withstand the added strain longer.***

References

J Bone Joint Surg Am. 1990 Apr;72(4):601-18.

Post-traumatic contracture of the elbow. Operative treatment, including distraction arthroplasty.

Morrey BF[1].

J Bone Joint Surg Am. 1979 Oct;61(7):1092-5.

Turnbuckle orthotic correction of elbow-flexion contractures after acute injuries.

Green DP, McCoy H.

J Bone Joint Surg Am. 1992 Sep;74(8):1229-34.

Anterior capsulotomy and continuous passive motion in the treatment of post-traumatic flexion contracture of the elbow. A prospective study.

Gates HS 3rd[1], Sullivan FL, Urbaniak JR.

J Shoulder Elbow Surg. 1999 Jul-Aug;8(4):351-4.

A standardized method for assessment of elbow function. Research Committee, American Shoulder and Elbow Surgeons.

King GJ[1], Richards RR, Zuckerman JD, Blasier R, Dillman C, Friedman RJ, Gartsman GM, Iannotti JP, Murnahan JP, Mow VC, Woo SL.

The Elbow and Its Disorders

By Bernard F. Morrey, Joaquin Sanchez-Sotelo

Injury. 2005 Apr;36(4):468-76.

Outcome instruments for the assessment of the upper extremity following trauma: a review.

Dowrick AS[1], Gabbe BJ, Williamson OD, Cameron PA.

Rotator Cuff Biomechanics *Lennard Funk For MSc Orthopaedic Engineering, 2005*

Rehabilitation Research and Practice
Volume 2012 (2012), Article ID 853037, 9 pages
http://dx.doi.org/10.1155/2012/853037

Review Article
Kinetic Chain Rehabilitation: A Theoretical Framework
Aaron Sciascia and Robin Cromwell
Lexington Clinic, Shoulder Center of Kentucky, 1221 South Broadway, Lexington, KY 40504, USA

JSR Volume 5, Issue 1, February
The Significance of Closed Chain Kinetics in Upper Extremity Injuries From a Physician's Perspective 1996, 5, 64 – 70

An upper body model for the kinematical analysis of the joint chain of the human arm Sybele Williams, Ralf Schmidtx, Catherine Disselhorst-Klug, Günter Raux

Department for Biophysical Measurement Techniques, Helmholtz-Institute for Biomedical Engineering, RWTH Aachen University, Pauwelsstrasse 20, D-52074 Aachen, Germany Accepted: July 27, 2005; Published Online: September 13, 2005

J Hand Ther. 2001 Apr-Jun;14(2):105-14.

Outcome evaluation in patients with elbow pathology: issues in instrument development and evaluation.

MacDermid JC[1].

Sports Health. 2013 Jul;5(4):360-2. doi: 10.1177/1941738112475122.

Development and validation of the elbow demand rating scale.

Nissen CW[1], O'Hara EA[2], McCarthy M[2], Kostyun R[2].

JSR Volume 3, Issue 4, November

Clinical Applications

Principles and Techniques of Open Kinetic Chain Rehabilitation: The Upper Extremity1994, 3, 319 – 330

Thank You

Special Thanks to

David Adler, Ph.D.
Physicist,
DLA Instruments

Ben Adler,
Mechanical Engineer
SVXR, INC.

Kate Bergeron
Vice President, Hardware Engineering at Apple, Inc.

Movement System Impairment Syndromes of the Humerus

Shirley Sahrmann, PT, PhD, FAAPT
& Associates
Presented by Renee Ivens, PT, DPT, MHS

Washington University in St. Louis
School of Medicine

Outline

- Explain the value in using movement diagnoses
  - Humeral diagnoses
- Background
- Overview of the humeral movement diagnoses

**Diagnosis = syndrome in this presentation

Introduction

- Humeral diagnoses
  - Based on MSI (Movement System Impairment)
    Sahrmann S 2002
  - Patient with shoulder pain may be assigned a humeral & scapular diagnosis
- Benefits of using MSI labels
  - Directs treatment by providing a basis for decision making
  - Label or syndrome identifies the principal impairments that must be addressed
  - Terms are familiar to health professions

Classifying Shoulder Dysfunction Based on Movement

- APTA calls for PTs to diagnosis conditions they are treating
  - A health profession responsible for the prevention, diagnosis, and treatment of **movement-related** dysfunctions
    APTA HOD 1983
- Vision statement passed by HOD 2013: PT identify = experts in movement
- MSI diagnoses are 1 example of classification system

Example

Patient with shoulder pain

- History of traumatic dislocation

Right shoulder is involved

Introduction

- Diagnoses = pattern recognition
- MSI syndrome
  - Based on identified principal impairment
  - Tissue and motor control impairments that are contributing factors
  - Founded on anatomy and kinesiology
  - Directs treatment at the presumed cause of tissue injury

MSI Syndromes

- MSI system can be applied to any condition seen in the clinic
- Do not require the knowledge of the pathoanatomical source

nor

- does use of MSI diagnosis preclude use of pathoanatomical source, if known

Classifying Shoulder Dysfunction Based on Movement

- Often the pathoanatomic source of symptoms is not readily identifiable & validity of the clinical tests has been questioned
  - Adhesive capsulitis (MJ Kelley 2013)
  - SLAP tear (Hegedus EJ 2012)
  - Rotator cuff tendinopathy/Impingement (Papadonikolakis A 2011)
  - The rotator cuff footprint has cleared the subacromial space by 60° (Bey MJ 2007)
  - In normal shoulders there is contact btwn rotator cuff and acromial arch (Lee SB 2001)

Classifying Shoulder Dysfunction Based on Movement

- Definition of terms inconsistent btwn practitioners, esp impingement (Vitale 2010, Braman JP 2013, de Witte PB 2014)
  - Impingement applied to variety of pathoanatomical abnormalities Michener LA 2009
- Diagnosing pathoanatomical dysfunction may require tests that are not in PT's scope of practice

Classifying Shoulder Dysfunction Based on Movement

- Several pathoanatomical structures can be a source of symptoms at the same time
- Treating the pt based on the principal movement impairment should reduce stress all involved tissues
- During the exam, impairments of movement or alignment are performed to assess the effect on sx

Classifying Shoulder Dysfunction Based on Movement

….. if during the exam, correcting the movement impairment immediately alleviates the symptoms, then treatment may be most effectively directed by a *movement diagnosis*

Ludewig PM 2009; Kibler WB 2013

Classifying Shoulder Dysfunction Based on Movement

Systematic Examination

- There is an ideal movement pattern
- Purpose is to identify how the movement system components & interaction of the components are impaired
- Patient's *preferred* alignment and movements are analyzed & correlated with symptoms
  - Secondary test
  - Combination of test findings lead to the diagnosis

Humeral Diagnoses

- **Humeral Anterior Glide**
- Humeral Superior Glide
- Glenohumeral Medial Rotation
- Glenohumeral Hypomobility
- Glenohumeral Multidirectional Hypermobility

Humeral Anterior Glide

- Movement Impairment
  - Excessive or abnormal anterior motion of the humeral head during shoulder motions

    Lawrence RL 2014, Caldwell 2007, Ludewig PM 2002, Harryman DT 1990
  - May decrease the volume of subacromial space

Humeral Anterior Glide

Resting Alignment: humeral head relative to anterolateral corner of acromion

Humeral head more anterior relative to acromion during active abduction

Humeral Anterior Glide: Abduction

Humeral Anterior Glide

- Impairments in Muscle Activation
  - Dominance of posterior deltoid over infraspinatus & teres minor during lateral rotation resulting in:
    - GH extension or horizontal abduction during lateral rotation
    - Associated with scapular internal rotation/anterior tilt
  - Dominance of pectoralis major over rotator cuff muscles

Jaggi A 2012

Humeral Anterior Glide

- Impairments in Muscle Strength, Stiffness, and Length
  - weak or lengthened subscapularis > teres major

    Turkel SJ 1981, Pennock 2011
  - short or stiff posterior capsule & scapulohumeral lateral rotators: infraspinatus, teres minor, posterior deltoid
  - Short or stiff pec major

Netter

Sahrmann S 2002

Humeral Anterior Glide

Key Tests:

- Standing shoulder abduction- GHJ in horizontal abduction
- Supine GHJ LR – ROM excessive and anterior glide humeral head
- Supine GHJ MR – ROM limited and impaired pattern of movement
- Horizontal adduction – ROM limited

Shoulder Medial Rotation

- ROM may be limited
- Humeral head translates anterior or anterior-inferior

Humeral Anterior Glide

Key tests: Prone

- GHJ medial rotation
  - weak in shortened range;
  - ROM limited and associated with scapular IR
- GHJ lateral rotation
  - palpate anterior glide
  - horizontal abduction of GHJ
  - associated with scapular IR and ↑'d prominence of posterior deltoid
- Middle trapezius test
  - Anterior glide

Prone Shoulder Rotation

Corrected

Prone Middle Trapezius Test Monitoring Humeral Head

Treatment

Diagnosis directs treatment:

- Corrective exercise program- individualized to the patient
- Practice performing movements using the corrected or modified movement strategy
- Correction of alignment & movement during functional activities

Humeral Anterior Glide

Treatment Overview

- Patient education and practice regarding how to avoid excessive anterior glide during daily activities
- Specific exercises to address contributing factors

Humeral Anterior Glide - Treatment

Emphasis

- Training for precise humeral rotation pattern before strengthening
  Falla A 2003
- Lengthen lateral rotators & posterior capsule
  Harryman DT 1990; Ludewig PM 2002 2003; Bang MD 2000; Budoff JE 2005; McClure PW 2004, 2007; Tyler TF 2000; Wilk KE 2002

Humeral Anterior Glide - Treatment

Emphasis

- Correct scapular motion during glenohumeral motion: elevation, posterior tilt, upward rotation or external rotation/adduction
  McMahon PJ 1996
  - Associated with these scapular syndromes
    - Scapular Internal Rotation Syndrome
    - Scapular Depression Syndrome
    - Scapular External Rotation/Adduction Syndrome

Humeral Diagnoses

- Humeral Anterior Glide
- **Humeral Superior Glide**
- Glenohumeral Medial Rotation
- Glenohumeral Hypomobility
- Glenohumeral Multidirectional Hypermobility

Humeral Superior Glide

- Movement Impairment
  - Insufficient inferior glide or relative superior glide of the humeral head during arm motion
    Deutsch A 1996, Chen SK 1999, Teyhen DS 2008
    - Most notable during arm abduction

Decreases volume of subacromial space.

Rotator Cuff and Deltoid Force Couple

Normally the rotator cuff offsets the superior force of the deltoid vector

Norkin & Levangie

Humeral Superior Glide

More common in
- post-op patients
- middle-aged or older patients
- weight-lifters
- obese individuals

Imprecise Movement

Neumann DA 2010

Humeral Superior Glide

Impairments in Muscle Activation, Strength, Stiffness, and Length

- Dominance, shortness or stiffness of deltoid
- Shortness &/or weakness of infraspinatus, teres minor & subscapularis
- Increased activation of axiohumeral medial rotators, latissimus & pectoralis major over subscapularis

Humeral Superior Glide

Key Tests:
- Superior glide is observed more readily during arm abduction than flexion
- Passive humeral abduction

Superior Glide During Passive Abduction

Humeral Superior Glide

Key Tests:
- Humeral rotation in prone & supine
  - May have mild loss of range, compression into glenoid
  - Long axis traction during rotation decreases symptoms
  - Manual inferior glide of humeral head decreases symptoms
- Superior glide may be observed during muscle length testing as well

Humeral Superior Glide - Treatment

Emphasis

- Correct strength, stiffness, &/or length of rotator cuff muscles
  - Exercises aimed at improving the performance of rotator cuff must be done with precision and good alignment of scapula and humerus
- Decrease activation and stiffness of deltoid
  - Practice shoulder flexion leading with fingers and shoulder in LR
- Correction of scapular alignment and movement
  - Most commonly associated with these scapular syndromes
    - Scapular Internal Rotation Syndrome
    - Scapular Depression Syndrome
    - Scapular Elevation

Humeral Diagnoses

- Humeral Anterior Glide
- Humeral Superior Glide
- **Glenohumeral Medial Rotation**
- Glenohumeral Hypomobility
- Glenohumeral Multidirectional Hypermobility

Glenohumeral Medial Rotation

- Movement Impairment
  - Insufficient lateral rotation of the humerus during shoulder flexion or abduction
    - MR decreases volume of subacromial space
      Flatow 1994, Werner 2006, Yanai 2006
  - Can occur with or without humeral superior glide

Glenohumeral Medial Rotation

- Occurs typically in wt-lifters, swimmers, laborers
- Alignment of humeral MR
  - MR position is maintained during arm elevation

Glenohumeral Medial Rotation

Impairments in Muscle Activation, Strength, Stiffness, and Length

- Dominance, shortness or relative stiffness of the humeral medial rotators
  - Axiohumeral mm & teres major > subscapularis
- Weakness or insufficient activity of the lateral rotators

Glenohumeral Medial Rotation

Key tests

- Shoulder flexion
  - 1° test- excessive humeral MR with increased symptoms
  - 2° test- increasing humeral LR decreases symptoms
- Muscle length tests: latissimus, teres major & pectoralis major
  - Short or stiff
  - Humeral MR observed during length test

Glenohumeral Medial Rotation

Preferred movement pattern is humeral MR

Glenohumeral Medial Rotation-Treatment

- Focus is on retraining movement pattern: humeral LR during upper extremity activity
  - i.e. Shoulder flexion with lateral rotation
- Correction of resting alignment of both scapula and humerus
  - Most commonly associated with scapular internal rotation syndrome
- Exercises to address length or stiffness impairments noted during the exam

Humeral Diagnoses

- Humeral Anterior Glide
- Humeral Superior Glide
- Glenohumeral Medial Rotation
- **Glenohumeral Hypomobility**
- Glenohumeral Multidirectional Accessory Hypermobility

Glenohumeral Hypomobility

- Movement Impairments
  - Limited glenohumeral motion in all directions
    - Passive and active motion restrictions
  - Scapular movement substitutes for GH movement
    - Scapular anterior tilt vs. GH MR (Borich MR 2006)
    - Scapular adduction vs. GH LR
    - Scapular elevation/upward rotation vs. GH flexion and abduction

Glenohumeral Hypomobility - Treatment

Emphasis

- Increase GH movement
- Promote precise GH movement within the patient's available range - do not encourage substitution
- Do not emphasize scapulothoracic motion before GH motion has improved
- Passive shoulder flexion - no muscle contraction - this is helpful when pain > loss of motion

Humeral Diagnoses

- Humeral Anterior Glide
- Humeral Superior Glide
- Glenohumeral Medial Rotation
- Glenohumeral Hypomobility
- **Glenohumeral Multidirectional Hypermobility**

Glenohumeral Multidirectional Accessory Hypermobility

- Movement Impairment
  - Excessive humeral glide observed with arm elevation or rotation
  - Increased physiological GH motion
  - Insufficient scapular movement

Glenohumeral Multidirectional Accessory Hypermobility

Symptoms/History
- Younger population
- General hypermobility
- GH joint pain
- C/o instability at GHJ
  - Not usually associated with trauma
  - May report dislocations anterior & posterior

Glenohumeral Multidirectional Accessory Hypermobility

Impairments in Muscle Activation and Strength
- Weak or decreased activation of rotator cuff

Impairments in Length
- Increased length and extensibility of rotator cuff and GH joint capsule

Glenohumeral Multidirectional Accessory Hypermobility - Treatment

Emphasis
- Avoid end range GH motions
- Address muscle activation impairments
- Improve the performance and hypertrophy the rotator cuff
  - Possibly deltoid
- Correct scapular movement impairments

Thank you for the opportunity to share this information with you.

Use of a Movement Diagnosis and the Concept of Regional Interdependence in Managing a Patient with Lateral Epicondylalgia: a Case Report.

Presented by:
Cheryl Caldwell, PT, DPT, CHT
Associate Professor in Physical Therapy and Orthopaedic Surgery

Objectives

- Describe lateral epicondylalgia and the recommended treatment
- Describe the rationale behind using a movement related named diagnosis.
- Describe the key features of the diagnosis assigned.
- Discuss how the analysis of movement was incorporated into the examination and treatment of the patient in this case.
- Challenge the clinician to think in a new way about routine tests used in the examination of movement of the elbow.
- Discuss how the diagnosis guides treatment including addressing functional activities.
- Describe the concept of Regional Interdependence and the rationale for application of that concept in this case.

Background

- Lateral epicondylalgia is a tendonopathy of the muscles that attach at the lateral epicondyle, primarily the ECRB, with secondary involvement of the ED and ?? ECRL
  Nirschl RP 2003; Plancher KD 1996
- Incidence:
  - 1-3% of the population — Martinez-Silvestrini JA 2005
  - Onset usually in 3rd, 4th, or 5th decades — Nirschl RP 2009
  - more common in dominant extremity — Whaley AL 2004
  - Occurs equally in men and women — Nirschl RP 2003
- Prognosis:
  - self limiting in 18 months - 2 years — Buchbinder R 2007

Background - Evidence for Treatment

- Many treatments have been described but to date there is no consensus regarding the best treatment.
- Patient education
  - Little evidence pertaining specifically to lateral epicondylalgia related to ergonomics. McDermid J, Fedorczyk J, Lucado A, Yao J 2015
  - There is evidence for the association between risk factors such as force, repetition, and posture and lateral epicondylalgia.
- Exercises — McDermid J, Fedorczyk J, Lucado A, Yao J 2015
  - Strong evidence
    - for resisted exercises to forearm and wrist extensors
  - Weak evidence
    - for strengthening the entire UE - may be beneficial
    - Insufficient evidence to support or refute stretching

Background - Evidence for Treatment

Eccentric Exercise for elbow tendonopathies

- Results from studies may still be inconclusive
  Fedorczyk JM 2012
- Including eccentric exercise in a multimodal treatment program may help to decrease pain, improve grip strength, and function in patients with lateral epicondylalgia.
  Cullinane FL 2014

Background – Evidence for Treatment

- Splinting/orthoses or straps
  - Conflicting Evidence - report of CPG in process
    - Use of wrist, elbow, or forearm orthosis may be of benefit in the short term — McDermid J, Fedorczyk J, Lucado A, Yao J 2015
  - No definitive conclusions — Cochrane Review 2005
- Modalities — McDermid J, Fedorczyk J, Lucado A, Yao J 2015
  - Conflicting or weak evidence – US, phonophoresis, low level laser, accupuncture, iontophoresis, TENS, dry needling
  - Moderate evidence – ice in first 6 weeks
- Joint mobilization
  - Conflicting evidence — McDermid J, Fedorczyk J, Lucado A, Yao J 2015
- Other:
  - Astym — Slaven EJ 2014
  - Taping — Vincenzino B 2003
    - weak evidence — McDermid J, Fedorczyk J, Lucado A, Yao J 2015

Background

- Why might there be no consensus regarding the best treatment?
  - Do our treatments address the *source* without adequately addressing the *cause* of symptoms?
  - Are we missing something in our examination?
  - Would assigning a movement diagnosis help direct treatment better than the pathoanatomic diagnosis alone?

Program in Physical Therapy

Background

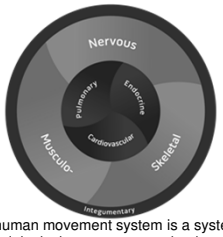
- The purpose of a diagnosis is to guide treatment.
  Sahrmann SA 1988, Norton BJ 2007
- A group of expert PT's in a series of meetings called Diagnosis Dialog have recommended that when naming Movement System conditions "recognized anatomical, physiological, or movement related terms" should be used.
  http://dxdialog.wusm.wustl.edu
- The APTA said in 2013 that the body system for which PT's are responsible is the human movement system.

Program in Physical Therapy

The Movement System

- Movement is an essential function of life at all levels of living organisms.
  - From ions moving through membranes to moving your limbs to moving in your environment

The Human Movement System



The human movement system is a system of physiological organ systems that interact to produce movement of the body and its parts.
http://pt.wusm.wustl.edu/AboutUs/Pages/HumanMovementSystem.aspx

Program in Physical Therapy

Movement System Impairment Syndromes (MSI): What are they?

Musculoskeletal pain conditions (syndromes)

- Collection of impairments based on observable abnormalities, primarily kinesiological, and their relationship to symptoms
- Syndrome because multiple impairments contribute to the altered motion.
- Subtle alteration in the precision of joint movement is believed to be the **cause** of the pain.
  - Correction decreases or eliminates the symptoms
- Named for principal impairment – the movement direction most consistently affecting the symptoms
- Other impairments are contributing factors

Program in Physical Therapy

Identifying the MSI May Decrease Recurrence

- Recurrence is common
  - Pathoanatomic structures are often considered the cause
  - The impaired movement not considered as the cause
    - Therefore it has not been adequately identified & addressed.
- To minimize recurrence
  - identify the movement cause & contributing factors

Program in Physical Therapy

Background

- To my knowledge no classification system with movement related labels has been reported in the peer reviewed literature for patients with lateral epicondylalgia (LE).
- The movement diagnosis is used in this case to direct treatment addressing alignment and movement impairments at the elbow, wrist and hand.
- The movement system diagnosis (MSI) for the elbow are a work in progress which is why I am presenting this case here today.

Program in Physical Therapy

MSI Diagnoses of the Elbow

- Wrist Extension (with Forearm Pronation) Syndrome (Lateral epicondylalgia)
- Elbow Hypomobility
- Elbow Flexion Syndrome (Cubital Tunnel Syndrome)
- Elbow Valgus Syndrome (valgus extension overload syndrome)
  - With or without extension
- Elbow Extension Syndrome
- Anterior and Posterior Forearm Entrapment Syndromes
  - Pronation Syndrome vs. AINS
  - Radial tunnel syndrome vs. PINS
- Wrist Flexion with Forearm Pronation (medial epicondylalgia)
- Ulnohumeral and radiohumeral multidirectional accessory hypermobility
- Elbow Impairment

Caldwell CA, Khoo-Summers L. Movement system syndromes of the elbow. In: Sahrmann SA, ed. *Movement System Impairment Syndromes of the Extremities, Cervical, and Thoracic Spines*. 2011

Wrist Extension (with Forearm Pronation) Syndrome (Lateral Epicondylalgia)

This syndrome is characterized by lateral elbow pain provoked by **gripping with reaching and lifting** activities resulting in overuse of the wrist extensors.

- The lateral elbow pain is usually aggravated most when the wrist extensors are used with the forearm pronated and the elbow extended. This may also implicate the ECRL (Kendall).
- *Correction: reaching and gripping with forearm supinated decreases symptoms.*
- In this syndrome the biceps and supinator may be underused and wrist extensors and pronators overused.
  - Supinating the forearm decreases the symptoms by increasing performance of the biceps brachii and decreasing the overuse of the ECRL.

Activities Associated With or That Aggravate Symptoms

- Aggravated by gripping activities such as:
  - Lifting or pouring a gallon of milk, lifting a coffee cup, carrying a brief case, intensive manual labor Nirschl RP 2009; Piligian G 2000
  - Performance related movements in musicians Pascarelli EF 2001
  - Computer keyboard use Nirschl RP 2009
- These activities are also associated with lateral epicondylalgia:
  - Intensive manual labor Nirschl RP 2009; Piligian G 2000
  - Sports
    - golf, baseball, tennis, swimming, racquetball, squash, fencing, and weight lifting Nirschl RP 2009
    - Writing Nirschl RP 2009

Wrist Extension (with Forearm Pronation) Syndrome

- Observation of functional activities is most helpful in identifying key alignment and movement impairments compared to AROM.
- AROM provides helpful information regarding movements that are painful that can be retested subsequent visits

Wrist Extension (with Forearm Pronation) Syndrome

Movement/Function

- Watch for habits that may incorporate frequent use of wrist and finger extensors:
  - Example:
    - Expressing self with hand gestures while talking
    - Constant contraction of finger extensors: Holding fingers off mouse instead of relaxing fingers on mouse

- Movement impairments
  - Reaching and lifting is performed with forearm pronated and during this motion, the humerus medially rotates and abducts more readily than the forearm pronates

Wrist Extension (with Forearm Pronation) Syndrome

Muscle Length Tests

- May have stiffness or shortness of finger and wrist extensors relative to opposite side.
- Associated muscles that are may be short or stiff
  - Finger flexors
  - Pronator teres
- Assess stiffness, not just length.
- Observe and feel for what joint moves most easily.
  - During wrist extensor length test resistance to forearm pronation is felt as the elbow is extended with the wrist flexed. The humerus medially rotates more readily than the forearm pronates.

Wrist Extension (with Forearm Pronation) Syndrome (Lateral epicondylalgia):

Muscle Strength/Performance Impairments

Resisted tests:

- Wrist and finger extensors
  - Resisted wrist extension is often more painful with elbow extended vs. flexed Nirschl RP 2009
- Elbow flexors and extensors
  - Elbow flexion is more likely to increase pain with forearm pronated than supinated.
- Watch for shoulder impairments during resisted tests

Program in Physical Therapy

Subjective History

- **Chief complaint:** 59 y/o right hand dominant male with constant left lateral elbow pain of insidious onset.
- **Pain Behavior -** The patient reported the pain was aggravated with:
  - lifting, elbow flexion in the a.m.
  - gripping, twisting doorknobs, removing jar lid
  - sleeping with his elbow flexed and hand under his head.
- **Pain Intensity -** Initial pain rating on **VNS** at the time of the initial visit:
  - 7/10 at worst
  - 4/10 at best
  - 5/10 at rest.

Program in Physical Therapy

Subjective History

- **Job:** Job involved a lot of computer work and travel.
- **Fitness:** The patient played tennis which was not limited by his left elbow pain.
- **Previous episodes:** one previous episode a few years prior which resolved.
- **PMH:** General health was good. Non-smoker. History of thumb trigger finger.
- **Meds**: Atorvastatin and Tamsulosin

Program in Physical Therapy

Standing Shoulder, Elbow, and Forearm Alignment - Video

Scapular internal rotation with anterior tilt, and abduction; Humerus is medially rotated.

Program in Physical Therapy

Standing Trunk, Shoulder, and Distal UE Alignment - Video

- Thoracic kyphosis
- Elbow flexion (20-25°) and finger flexion

Program in Physical Therapy

Standing Normal Carrying Angle – Feel Resistance to Supination

Program in Physical Therapy

Objective Examination – Initial Visit

- **AROM:** no significant limitations and painfree for fingers, wrist, forearm, and elbow.
- **Length Tests First Visit**:
  - Wrist extensors stiff and short on left and painful - 50 degrees wrist flexion compared to 60 degrees on right.
  - Finger extensors stiff and short bilaterally and painful - 40 degrees wrist flexion.
  - Wrist flexors stiff but not short
  - Finger flexors and pronator teres notably stiff.
- **Palpation**: tender over the left common extensor tendon origin.

Program in Physical Therapy

Objective Examination – Initial Visit

- **Resisted testing**:
  - Wrist extensors and elbow extensors on left reproduced pain but strong.
- **Pain free grip strength** (PFGS) right 65; left 50 lbs.
- **Quick DASH**: 27% Sub-total; 12% work.

Program in Physical Therapy

Function

Functional testing:

- Laptop positioned diagonally on right side with no support to arm when typing on the computer. Does not use external mouse.

Program in Physical Therapy

Function

Primary test: Lifting with forearm pronated is painful
Secondary Tests: lifting with forearm supinated not painful

Lifting box here today with forearm pronated was painful; with supination pain decreased.

Program in Physical Therapy

Diagnosis

- **Movement Diagnosis**: Wrist Extension Syndrome with Forearm Pronation**.**

Program in Physical Therapy

Treat-ment	Visit #1	Visit #2	Visit #3	Visit #4	Visit #5	Visit #6	Visit #7
Patient Education	Alignment at computer	Lifting with short lever and supinated Sitting close to desk so shoulders and forearm are supported Take frequent breaks to stretch					
	Forearm Strap						
	Ice						

Program in Physical Therapy

Treat-ment	Visit #1	Visit #2	Visit #3	Visit #4	Visit #5	Visit #6	Visit #7
Exercises	*Wrist and Finger Ext stretch*	Cues to avoid humeral rotation and pain	avoid pushing into symptoms with stretches		Cued to avoid wrist UD during stretch		
		Standing back to wall shoulder flexion - cues to avoid wrist extension	Cued patient to avoid wrist extension during this exercise and increase shoulder LR			Reported some pain with exercise. Cues to LR but avoid forcing LR ↓'d symptoms	Yellow theraband
		Finger Flexor stretch palm flat on table	perform finger flexor stretch passively without actively holding fingers extended and to relax elbow during stretch				
		Frequent active supination	Cued to relax wrist and fingers & elbow extension		Resistance with theraband	Increase elbow extension	
				eccentric wrist extension using 2 lb	3 lb	5 lb	Green theraband per patient preference
				Prone scapular adduction level 2	½ lb level 2		
							Grip strengthening with hand gripper

Program in Physical Therapy

Treat-ment	Visit #1	Visit #2	Visit #3	Visit #4	Visit #5	Visit #6	Visit #7
Mob			AP glide RH joint decreased symptoms with grip				
			MWM lateral glide no change				
Taping			Taped left elbow for posterior glide				

Program in Physical Therapy

Visit 4

- Further examination:
  - Pec minor length- short and stiff.
  - Middle trap strength 2/5
  - Lower trapezius 2/5
  - Rhomboids 5/5
  - Serratus anterior ??

Program in Physical Therapy

Standing Shoulder Flexion

Scapular internal rotation and insufficient upward rotation
Glenohumeral medial rotation

Program in Physical Therapy

Shoulder ROM and Length Tests

ROM normal for glenohumeral medial and lateral rotation.
Horizontal adduction limited greater with lateral than medial rotation.
Latissimus length test – difficult to maintain glenohumeral lateral rotation.
Pectoralis Minor – stiff.

Program in Physical Therapy

Exercise: Shoulder Flexion with Back to Wall with Cues to ↑ Shoulder LR

Visit #6 -Reported some shoulder pain with shoulder exercises. When performed correctly, patient able to do the shoulder exercises without pain. Initially patient was forcing too much shoulder LR (potentially causing superior glide??).

Program in Physical Therapy

Outcomes – 7 visits over 3 Months

Outcomes	Visit #1	Visit #2	Visit #3	Visit #4	Visit #5	Visit #6	Visit #7	2.5 MO after discharge
Average pain		5/10			2/10	2/10	0/10	
Pain at rest	5/10 constant		constant	3/10			0/10	0/10
PFGS		R 65 L 50 lbs. (77%)				R 75 L 60 lbs. (80%)		
Pain with Grip		7-8/10						Painfree grip
Function			Pain after stretching. Carries suitcase on right.					Painfree function and grip.
Q-DASH	27% subtotal				16% subtotal		5% subtotal	4.5% subtotal; 0% for work and sport
Overall decrease in symptoms				60%	80%	80%	99%	

Discussion

- This case illustrates the use of a movement diagnosis of Wrist Extension Syndrome with Forearm Pronation, to guide individualized treatment for a middle aged patient with lateral epicondylalgia.
- Treatment included modification of alignment and movement of the hand to the trunk during functional activities.
  - Support to arms while at computer with forearm in pronation to decrease use of wrist extensors as elbow flexors
  - Lift with forearm supinated instead of pronated when possible
  - Avoid wrist and finger extension actively during shoulder exercises
  - Take stretch breaks frequently during the day
  - Increasing performance of forearm supinators, traps, shoulder LR's, wrist extensors.
  - Improving shoulder mechanics to improve proximal alignment and movement to decrease need for excessive distal force.
  - Improve flexibility of: shoulder MR's, wrist and finger extensors, finger flexors, forearm pronators

Discussion: Concept of Regional Interdependence

- There is limited but an increasing amount of evidence supporting addressing impairments at the shoulder when treating patients with lateral epicondylalgia.
  Day JM 2015, Bhatt JB 2013, Lucado AM 2012, Alizadehkhaiyat O 2007, Mandalidis D 2008
- Impairments that are remote from the anatomical region and may not seem to be related to symptoms may contribute to the patient's symptoms.
  Wainner RS et al 2007
- Proximal impairments may affect:
  - The amount of force required distally to perform a task
    Furuya S 2013
  - Distal alignment

Discussion

- The patient in this case had significant impairments at the shoulder which were addressed in treatment in addition to the treatment provided distally.
- Treatment was based on individual exam findings and was multimodal
  - Focus on proximal and distal alignment, movement, and associated impairments
  - Eccentric wrist extensor exercises
  - Joint mobilization – used more as assessment than treatment
- Positive outcomes were achieved lasting at least 2.5 months after discharge.
- Outcomes could have been due to a variety of factors

Patient-Reported Upper Extremity Outcome Measures Used in Breast Cancer Survivors: A Review

Shana Harrington, PT, PhD, SCS, MTC
Associate Professor
Creighton University

Creighton UNIVERSITY

Acknowledgements

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

- Professor of Clinical Physical Therapy
- University of Southern California
- Division of Biokinesiology and Physical Therapy

Creighton UNIVERSITY

Purpose

- Provide an *overview* of upper extremity patient-reported outcome measures (PROs) commonly used in women diagnosed with breast cancer.
  - Who gets cancer?
  - Breast Cancer overview
  - PROs

Creighton UNIVERSITY

Who gets cancer?

- Most commonly develops in older people
- 78% of all cancers ≥55 years
- In US, lifetime risk of developing cancer:
  - Men (slightly less than 1 in 2)
  - Women (slightly more than 1 in 3)

http://www.cancer.org/acs/groups/content/@editorial/documents/document/acspc-044552.pdf

Creighton UNIVERSITY

2015

Estimated numbers of new cancer cases for 2015, excluding basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder.
Note: State estimates are offered as a rough guide and should be interpreted with caution. State estimates may not add to US total due to rounding.

5

Cancer as a chronic disease

- 1.7 million NEW cases will be diagnosed in 2015
- 5-year survival rate for **all** cancers is 68% (2004-2010)
  - Improved screening and early detection
  - New and improving treatments

6

www.cancer.org
ACS Facts and Figures 2015

Creighton UNIVERSITY

Cancer as a Chronic Disease

- Economic burden of cancer morbidity
  - Direct US medical costs for cancer in 2011 = $88.7 billion
  - World-wide cancer morbidity creates the largest economic burden on society
  - 20% > heart disease
  - Greater than morbidity with HIV/AIDS and TB

7

ACS and LAF *The Global Economic Cost of Cancer.* Presented at UICC Cancer Congress 2010
http://www.cancer.org/AboutUs/GlobalHealth/global-economic-cost-of-cancer-report

Creighton UNIVERSITY

2015

- CVA = 795,000
- SCI = 11,000
- Cancer = 1,658,370

www.strokeassociation.org
www.aans.org
www.cancer.org

Creighton UNIVERSITY

Breast Cancer Overview

- Estimated >2.9 million breast cancer survivors in the U.S.
- Estimates in 2015 (cancer.org)
  - New cases: 231,840
  - Deaths: 40,290

Stage	5-year Relative Survival Rate
0	100%
I	100%
II	93%
III	72%
IV	22%

www.cancer.org

Trends in Five-year Relative Cancer Survival Rates (%), 1975-2010

Site	1975-1977	1987-1989	2004-2010
All sites	49	55	68
Breast (female)	75	84	91
Colon	51	60	65
Leukemia	34	43	60
Lung & bronchus	12	13	18
Melanoma of the skin	82	88	93
Non-Hodgkin lymphoma	47	51	71
Ovary	36	38	45
Pancreas	3	4	7
Prostate	68	83	100*
Rectum	48	58	68
Urinary bladder	72	79	79

5-year relative survival rates based on patients diagnosed in the SEER 9 areas from 1975-1977, 1987-1989, and 2004-2010, all followed through 2011.
*99.6%
Source: Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2014.

Who Are Cancer Survivors?

- Any person who has been dx. with cancer, from the time of dx. through the balance of life.
- At least 3 distinct phases associated with cancer survival:
  - Time from dx. to the end of initial treatment,
  - Transition from treatment to extended survival, and
  - Long-term survival
- In practice, however, the term "survivor" is often used to mean someone who has finished active treatment.

www.cancer.org
ACS definition from Cancer Treatment & Survivorship Facts & Figures 2014-2015

Creighton UNIVERSITY

Breast Cancer

- Women treated for breast cancer continue to experience significant deficits in shoulder function that directly impact quality of life.
  - ↓ ROM, shoulder girdle weakness
  - Loss of shoulder function months & years after primary treatment

Harrington S, Padua D, Battaglini C, et al. Comparison of shoulder flexibility, strength, and function between breast cancer survivors and healthy participants. J Cancer Surviv 2011;5:167-74.

Creighton UNIVERSITY

Impairment common to breast cancer

- Scar Adhesion
  - Secondary to surgical intervention
  - Fascial cording (Axillary web syndrome)

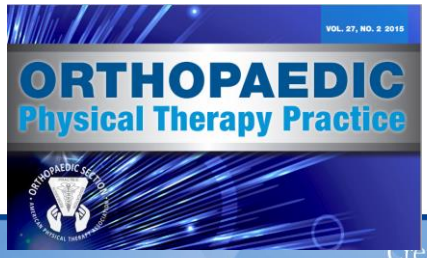
PT intervention: Scar mobilization, prevention of hypertrophy and adhesion, Myofascial release

13

Creighton UNIVERSITY

Axillary Web Syndrome, A Complication of Breast Cancer: What the Orthopaedic Physical Therapist Needs to Know

James Walrath, PT, DPT[1]
Amy J. Litterini, PT, DPT[2]
J. Adrienne McAuley, PT, DPT, MEd, OCS, FAAOMPT[3]



14

Creighton UNIVERSITY

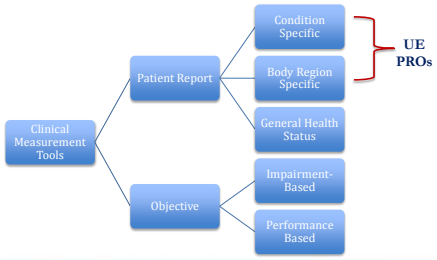
Patient Reported Outcome Measures (PRO)

- Provides "patient-centered" information
- Captures the patient's own opinion on the impact of their impairment
- ~30 disease or region specific upper extremity PROs with documented psychometric properties

Harrington, S., Michener, L. A., Kendig, T., Miale, S., & George, S. Z. (2014). Patient-reported upper extremity outcome measures used in breast cancer survivors: a systematic review. *Archives of physical medicine and rehabilitation*, *95*(1), 153-162.

Creighton UNIVERSITY

Classification of Clinical Measurement Tools



16

Stout, Harrington, Pfalzer & Fisher. Breast Cancer Rehabilitation: Clinical Examination and Outcomes Assessment. *Topics in Geriatric Rehabilitation*. 2015 [in Press]

Creighton UNIVERSITY

Systematic Reviews

ACRM Archives of Physical Medicine and Rehabilitation

Oncology Section Task Force on Breast Cancer Outcomes: Clinical Measures of Upper Extremity Function

Susan Miale, PT, DPT, PCS[1]
Shana Harrington, PT, PhD, SCS, MTC[2]
Tiffany Kendig, PT, DPT, MPH[3]

[1]Department of Physical Therapy, School of Health Technology and Management, Stony Brook University, Stony Brook, NY
[2]Department of Clinical and Applied Movement Sciences, The University of North Florida, Jacksonville, FL
[3]Rehabilitation Medicine Service, Department of Neurology, Memorial Sloan-Kettering Cancer Center, New York, NY

of Virginia Campus, Richmond, VA; [4]Rehabilitation Medicine Service, Department of Neurology, Memorial Sloan-Kettering Cancer Center, New York, NY; [5]Department of Physical Therapy, School of Health Technology and Management, Stony Brook University, Stony Brook, NY; and [6]Department of Physical Therapy, University of Florida, Gainesville, FL.

EDGE Task Force Recommendations

Table 2. Outcome Measures Sorted by Task Force Rating

Rating	*Measure*
4	Disabilities of the Arms, Shoulder, and Hand (DASH)
4	Shoulder Pain and Disability Index (SPADI)
4	Shoulder Rating Questionnaire (SRQ)
4	University of Pennsylvania Shoulder Score (PSS)
3	QuickDASH

4 = Highly recommended
3 = Recommended

DASH

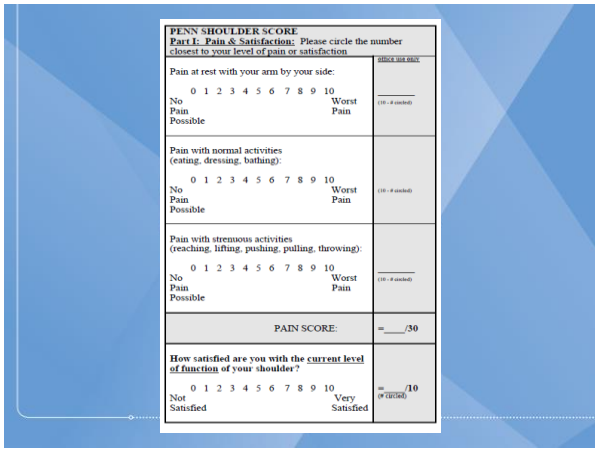
- 30 questions relating to symptoms (5 items) & functional tasks (25 items)
- MCID = 10.2.
- 0-100, higher score = greater disability.
- Most commonly used PRO in women diagnosed with breast cancer.

Susan Miale, P. T., Shana Harrington, P. T., SCS, M., & Tiffany Kendig, P. T. (2013). Oncology Section Task Force on Breast Cancer Outcomes: clinical measures of upper extremity function. *Rehabilitation Oncology*, *31*(1), 27

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5

Pennsylvania Shoulder Score

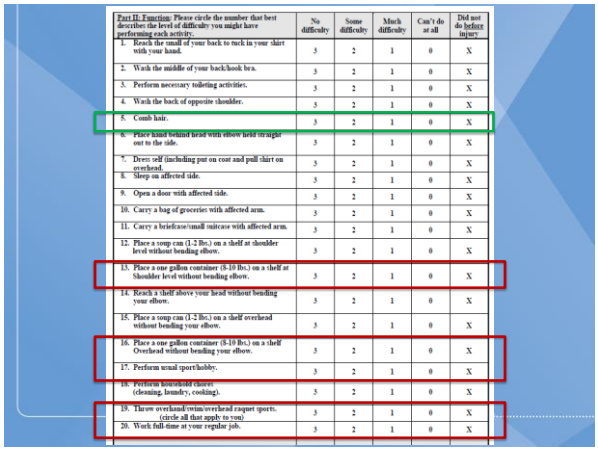
- 3 subscales
  - Function (20 items), pain (3 items) & satisfaction (1 item)
- 0-100, lower score = greater disability



PENN SHOULDER SCORE

Part I: Pain & Satisfaction: Please circle the number closest to your level of pain or satisfaction

	circle one only
Pain at rest with your arm by your side: 0 1 2 3 4 5 6 7 8 9 10 No Pain Possible — Worst Pain	_____ (10 – # circled)
Pain with normal activities (eating, dressing, bathing): 0 1 2 3 4 5 6 7 8 9 10 No Pain Possible — Worst Pain	(10 – # circled)
Pain with strenuous activities (reaching, lifting, pushing, pulling, throwing): 0 1 2 3 4 5 6 7 8 9 10 No Pain Possible — Worst Pain	_____ (10 – # circled)
PAIN SCORE:	=____/30
How satisfied are you with the current level of function of your shoulder? 0 1 2 3 4 5 6 7 8 9 10 Not Satisfied — Very Satisfied	=____/10 (# circled)



Part II: Function: Please circle the number that best describes the level of difficulty you might have performing each activity.

	No difficulty	Some difficulty	Much difficulty	Can't do at all	Did not do before injury
1. Reach the small of your back to tuck in your shirt with your hand.	3	2	1	0	X
2. Wash the middle of your back/hook bra.	3	2	1	0	X
3. Perform necessary toileting activities.	3	2	1	0	X
4. Wash the back of opposite shoulder.	3	2	1	0	X
5. Comb hair.	3	2	1	0	X
6. Place hand behind head with elbow held straight out to the side.	3	2	1	0	X
7. Dress self (including put on coat and pull shirt on overhead.	3	2	1	0	X
8. Sleep on affected side.	3	2	1	0	X
9. Open a door with affected side.	3	2	1	0	X
10. Carry a bag of groceries with affected arm.	3	2	1	0	X
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 racquet 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

Construct Validity

- DASH & PSS distinguished between a group of BCS & healthy controls. (ES=1.47 & 1.46)
- DASH – distinguish between BCS who were diagnosed with lymphedema and those BCS who were not. (ES=1.63)
- DASH – distinguish between BCS who had pain and normal US of the shoulder vs. BCS who had pain and an abnormal US of the shoulder. (ES=1.57)

Harrington, S., Michener, L. A., Kendig, T., Miale, S., & George, S. Z. (2014). Patient-reported upper extremity outcome measures used in breast cancer survivors: a systematic review. *Archives of physical medicine and rehabilitation*, *95*(1), 153-162.

Responsiveness

- DASH – BCS and controls, RCTs
- PT intervention
  - Beurskens et al (n=29)
    - 3 months (ES=1.13)
    - 6 months (ES=0.94)
- Lymphedema intervention
  - Lau et al (n=21)
    - 2 months (ES=0.71)

Beurskens et al The efficacy of physiotherapy upon shoulder function following axillary dissection in breast cancer, a randomized controlled study. BMC Cancer 2007.
Lau RW, Cheing GL. Managing postmastectomy lymphedema with low-level laser therapy. Photomed Laser Surg 2009.

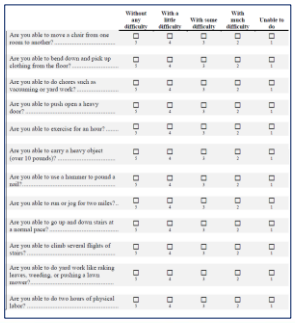
Recommendations Based on Psychometric Properties

- DASH
- Pennsylvania shoulder score

Future Directions

- Outcomes specific to breast cancer?
  - Upper limb disability questionnaire (ULDQ)
- CAT?
- PROMIS tools?
  - Upper extremity
  - Physical function (also in short form)

Physical function - cancer

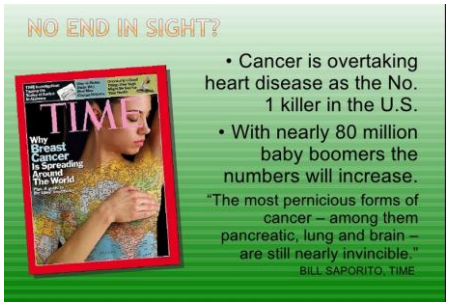


	Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
Are you able to move a chair from one room to another?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to bend down and pick up clothing from the floor?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to do chores such as vacuuming or yard work?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to push open a heavy door?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to exercise for an hour?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to carry a heavy object (over 10 pounds)?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to use a hammer to pound a nail?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to run or jog for two miles?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to go up and down stairs at a normal pace?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to climb several flights of stairs?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to do yard work like raking leaves, weeding, or pushing a lawn mower?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Are you able to do two hours of physical labor?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Importance

- Third-party payers increasingly require health care providers to measure clinical outcomes.
- More survivors of breast cancer will receive treatment in community centers vs specialized treatment centers

Importance



Creighton UNIVERSITY

Results of Recurrent Shoulder Instability Treated with Arthroscopic Bankart Repair at a Minimum of Five Years Follow-Up

R. Brandon Burris MD, Tim Tyler PT, ATC, Malachy McHugh PhD, Stephen Nicholas MD

Disclosures

- Brandon Burris MD, Dan Hogan MS, Tim Tyler PT, ATC, and Malachy McHugh PhD have no financial disclosures
- Stephen Nicholas MD is a consultant for Arthrex

Presented @ 2015 AAOS Meeting

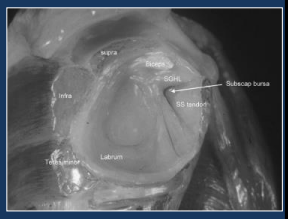
Shoulder Instability

- Mostly commonly dislocated joint
  - 2-8% of the population
- Direction of acute dislocation
  - Anterior: 95-98%
  - Posterior: 3-5%
  - Inferior: 0.5%
- Recurrent instability and age
  - <20: >90%
  - 20-40: 60%
  - >40: 10%

Hovelius, JBJS 1987
McLaughlin, J Trauma 1967

Shoulder Stabilizers

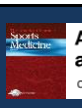
- Static
  - Labrum
  - Capsule
  - Glenohumeral ligaments
- Dynamic
  - Rotator cuff
  - Deltoid
  - Biceps
  - Scapular rotators



Levine et al, AJSM 2000

Glenohumeral Articulation

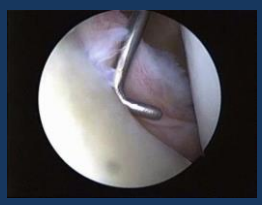
- Glenoid
  - "Pear-shaped" (wider inferiorly)
  - 30% humeral coverage
- Labrum
  - "Chock block"
  - Deepens the glenoid by 50%
  - Increases GH contact by 75%
  - Attachment site for GHLs



Arthroscopic evaluation of acute initial anterior shoulder dislocations*

CHAMP L. BAKER,†‡ MD, JOHN W. URIBE,§ MD, AND COURTENAY WHITMAN,‖ MD

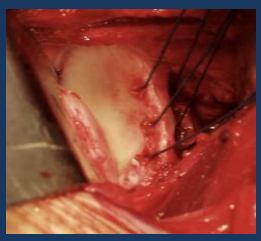
- Arthroscopic evaluation of initial shoulder dislocations
- 39/45- (86%) of patients had evidence of labral lesions at anterior inferior labrum



Baker et al, AJSM 1990

Bankart Repair

- Originally preformed opened
- Repair anterior inferior labrum to glenoid
- Can be combined with inferior capsular shift to re-tension the IGHL



NISMAT | North Shore LIJ | LenoxHill Hospital

Bankart Repair: Historical Arthroscopic

- *Johnson, 1982*
  - Metal staples
  - 33% recurrence rate
- *Morgan and Bodenstab, 1987; Caspari and Savoie, 1991*
  - Transglenoid sutures
  - Variable success rates
  - Multiple fixation points, capsular shift
  - Technically difficult, risk to suprascapular nerve
- *Speer et al, 1996*
  - Bioabsorbable tack (Suretac)
  - 21% recurrence rates; 6% reaction to implant material
  - Unable to address capsular laxity

NISMAT | North Shore LIJ | LenoxHill Hospital

Arthroscopic Bankart Repair: Suture Anchors

- Osseous anchors vs. transglenoid fixation *(Kandziora et al. Arthroscopy 2000, Tauro et al. Arthroscopy 2000)*
  - Lower rates of recurrent instability with anchors
- Open vs. arthroscopic repair of Bankart lesions using suture anchors *(Cole et al. JBJS 2000, Fabbriciani et al. Arthroscopy 2004, Kim et al. JBJS 2003)*
  - no differences in recurrent dislocation rates or clinical outcome scores

NISMAT | North Shore LIJ | LenoxHill Hospital


Arthroscopic Versus Open Shoulder Stabilization: Current Practice Patterns in the United States

Alan L. Zhang, M.D., Scott R. Montgomery, M.D., Stephanie S. Ngo, B.S., Sharon L. Hame, M.D., Jeffrey C. Wang, M.D., and Seth C. Gamradt, M.D.

- 23,096 cases between 2004-2009 reviewed
- Arthroscopic stabilization percentage
  - 2004- 71%
  - 2009- 89%
- Open Bankart incidence:
  - 2004: 4.5/10,000
  - 2009: 2.2/10,000

NISMAT | Zhang et al, Arthroscopy 2014 | North Shore LIJ | LenoxHill Hospital

Arthroscopic Bankart Repair Outcomes

Study	Average F/U
Petrera et al., KSSTA 2010	30 months
Marquardt et al, Arthroscopy 2006	44 months
Carreira et al, AJSM 2006	46 months
Tjoumakaris et al, CORR 2006	42 months
Fabbriciani et al, Arthroscopy 2004	24months

Similar recurrence to open techniques

NISMAT | North Shore LIJ | LenoxHill Hospital


Systematic Review

Long-Term Outcomes After Bankart Shoulder Stabilization

Joshua D. Harris, M.D., Anil K. Gupta, M.D., M.B.A., Nathan A. Mall, M.D., Geoffrey D. Abrams, M.D., Frank M. McCormick, M.D., Brian J. Cole, M.D., M.B.A., Bernard R. Bach Jr., M.D., Anthony A. Romeo, M.D., and Nikhil N. Verma, M.D.

- 12 studies reporting on Open Bankart Repair
- Mean f/u 5.4-29 years (avg 13.1)
- # Patients- 731
- Avg age-25.3
- Failure Rate- 13%
  - Dislocation- 8%
  - Subluxation- 5%

NISMAT | North Shore LIJ | LenoxHill Hospital

- 5 studies reporting on Arthroscopic Bankart Repair with Suture Anchors
- Mean f/u 5.6-10.9 years (avg 7.3)
- # Patients- 200
- Avg age-28.7
- Failure Rate- 12.5%
  - Dislocation- 8.5%
  - Subluxation- 4%

NISMAT | North Shore LIJ | LenoxHill Hospital

Research Question

- Can Arthroscopic Shoulder Stabilization Successfully Treat Recurrent Shoulder Instability with Lasting Long Term Results?

NISMAT | North Shore LIJ | LenoxHill Hospital

Methods

- Retrospective Review of Single Surgeon's experience
- Charts reviewed by CPT code for bankhart repair, labral repair, and capsulorrhaphy
- Patients who underwent surgery within the last five years excluded

NISMAT | North Shore LIJ | LenoxHill Hospital

Methods

- Patient's demographics recorded
  - Age, Sex, Dominant extremity
  - Number of preoperative dislocations
  - Traumatic vs. Nontraumatic
- Surgical Technique
  - Tacks
  - # Suture Anchors
- Previous Surgeries

NISMAT | North Shore LIJ | LenoxHill Hospital

Methods

- Postoperative Office Notes reviewed for complications/failures
- Patient's contacted for telephone interview for final follow-up
- Patients completed Western Ontario Shoulder Instability Index

NISMAT | North Shore LIJ | LenoxHill Hospital

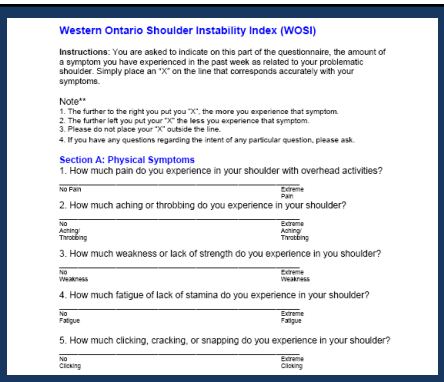
Telephone Interview

- **1. Since your shoulder surgery on xx/xx/xxxx, have you dislocated your shoulder? If so, when and how did you do it?**
- **2. Have you had any further surgery on your shoulder since your last office visit?**
- **3. Were you able to return to your preop activities/sports following your shoulder surgery? If not, why?**
- **4. On a scale of 0-100, how would you rate your satisfaction with your results following surgery?**

NISMAT | North Shore LIJ | LenoxHill Hospital

Western Ontario Shoulder Instability Index (WOSI)

- Developed in 1998
- Consists of four domains
  - Physical Symptoms
  - Sports, Recreation, and Work
  - Lifestyle
  - Emotions
- 21 self administered questions with 0-100 VAS scale
- Reported as raw score or percentage of maximum score



Western Ontario Shoulder Instability Index (WOSI)

Instructions: You are asked to indicate on this part of the questionnaire, the amount of a symptom you have experienced in the past week as related to your problematic shoulder. Simply place an "X" on the line that corresponds accurately with your symptoms.

Note**
1. The further to the right you put you "X", the more you experience that symptom.
2. The further left you put your "X" the less you experience that symptom.
3. Please do not place your "X" outside the line.
4. If you have any questions regarding the intent of any particular question, please ask.

Section A: Physical Symptoms

1. How much pain do you experience in your shoulder with overhead activities?

No Pain — Extreme Pain

2. How much aching or throbbing do you experience in your shoulder?

No Aching/ Throbbing — Extreme Aching/ Throbbing

3. How much weakness or lack of strength do you experience in you shoulder?

No Weakness — Extreme Weakness

4. How much fatigue of lack of stamina do you experience in your shoulder?

No Fatigue — Extreme Fatigue

5. How much clicking, cracking, or snapping do you experience in your shoulder?

No Clicking — Extreme Clicking

Inclusion Criteria

- Arthroscopic Shoulder Stabilization
- Isolated Anterior Instability
- Minimum of 3 dislocations
- Minimum 5 years follow-up

Exclusion Criteria

- Open Procedures
- Less than 5 years follow-up
- Less than 3 dislocations
- Dislocations associated with massive RTC tears
- SLAP repairs
- Posterior Labral Repairs

Results

- 58 shoulders with minimum of 3 anterior dislocations identified
- 5 patients underwent open procedures
- 1 excluded for associated massive RTC tear
- Total 52 shoulders met Inclusion Criteria

Results

- 42 shoulders (80.7%) in 39 patients were successfully contacted and available for final follow-up
- Average F/U- 8.75 years

Demographics

Average Age	27.0 (15-46)
Sex M:F	34:5
Dominant Extremity	19 (49%)
Average Preoperative Dislocations	8.7 (3-50) median- 5
Previous Shoulder Surgery	12 (28%)
Traumatic Dislocations	33 (79%)

Surgical Technique

- All patients treated with arthroscopic Bankart repair
- All surgery preformed in Beachchair Position
  - 3 patients labral tacks
  - 1 patient single suture anchor
  - 25 patients 2 suture anchors
  - 11 patients 3 suture anchors
  - 2 patients with 3 knotless anchors

Results

- 34/42 (81%) patients with Stable shoulders at Final Follow-up
  - 5/42 (11.9%) failed by dislocations (3 traumatic)
  - 3/42 (7.1%) failed by symptomatic subluxations
  - Average time to failure 37 months (2-108 months)

Results

- All patients treated with labral tacks failed 3/3 (100%)
- Success rate with modern suture anchor technique 34/39 (87.1%)
- 5 patients underwent subsequent revision
  - 3 open, 2 arthroscopic
- 3 failures successfully treated nonoperatively
  - 1 dislocation, 2 subluxations

Results

- 36/42 (85%) report ability to return to preoperative activities/sports
- Satisfaction rating 86.9 (range 20-100)
- Average WOSI score at final follow-up: 86.1% (range 25-100)

Conclusion

- Arthroscopic Shoulder Stabilization with modern suture anchor techniques can successfully treat patient with recurrent shoulder instability with durable results.

Thank You

Preliminary Results of Patient Defined Success Criteria in Shoulder and Elbow Patients in Outpatient Physical Therapy Settings

Giorgio Zeppieri Jr. PT, SCS, CSCS
Steven Z. George PT, PhD

UF Health Orthopedic and Sports Medicine Institute
University of Florida Physical Therapy Department

Introduction

- What is a patient centered outcome?
  - Any outcome that represents a treatment success based on the patient's self determined criterion for success.
  - "Consumer Sovereignty"
- Clinically important changes
  - Minimal Clinically Important Difference Score (MCIDs)

Purposes

- To identify patient centered criterion for success post treatment levels for pain, fatigue, emotional distress, and interference with daily activities in an outpatient physical therapy population of individuals with musculoskeletal shoulder and elbow pain.
- To investigate if these levels were influenced by selected demographic and clinical data.

Purposes

- To investigate if patient's with complaints of shoulder and elbow musculoskeletal pain criterion for treatment success changed.
- To examine the relationship between patient's individual criterion for a successful outcome and accepted group criterion (MCIDS) for success.

Subjects

- 71 patients(40 male, 31 female) referred to outpatient physical therapy with complaints of musculoskeletal shoulder and elbow pain.

Mean age = 34.4 years (range= 13-74, SD= 16.9).
Mean duration of symptoms = 66 weeks (SD=268.2).
Post surgical patients = 24%

Methods

- At the intake physical therapy session,
  - ✧A standard demographic and clinical questionnaire
  - ✧Patient Centered Outcome Questionnaire (PCOQ)
  - ✧Shoulder Pain and Disability Index (SPADI)
  - ✧Tampa Scale for Kniesophobia (TSK-11)
  - ✧Short Form (SF)-8 Survey

Methods

- Patient Centered Outcome Questionnaire (PCOQ)
  - ✧ Four Constructs
    - ✧Pain
    - ✧Fatigue
    - ✧Emotional Distress
    - ✧Interference with Daily Activities
  - ✧ Four Outcome Domains
    - ✧Usual Levels
    - ✧Expected Levels
    - ✧Successful Levels
    - ✧Desired Levels

Methods

- Shoulder Pain and Disability Index (SPADI)
  - ✧13 item questionnaire with two outcome subscales (pain and disability)
  - ✧Higher scores equated to higher dysfunction
  - ✧MCID = 8 points
  - ✧Sample Question:
    "Rate how difficult it is to do the following activities:"

Methods

- Tampa Scale for Kinesiophobia (TSK-11)
  - ✧11-item, 44 point questionnaire adapted from the original form
  - ✧Measure of pain-related fear of movement
  - ✧Higher score indicates increased fear
  - ✧MCID = 4.8 points
  - ✧Sample question:
    "I wouldn't have this much pain if there weren't something potentially dangerous going on in my body"

Methods

- The short form of the medical studies 8 (SF-8)
  - ✧8-item health related quality of life survey adapted from the SF-36
  - ✧Higher scores equate to higher quality of life and increased health
  - ✧MCID = 10 points
  - ✧Sample Question
    "Overall how would you rate your health the past 4 weeks"

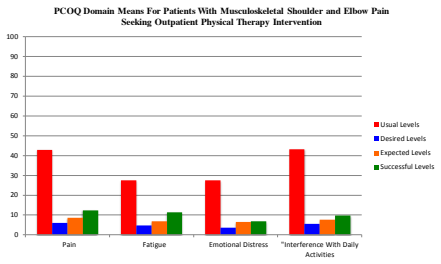
Purpose 1- Statistical Analysis

- Descriptive statistics were calculated to see how much change was needed for each subject to indicate physical therapy interventions as successful.

Purpose 1- Results

- Participant defined success criteria included mean reductions in
  - ✧Pain intensity of 39.9 points (61.3%)
  - ✧Fatigue of 26.9 points (48.8%)
  - ✧Emotional Distress of 30.6 points (55.1%)
  - ✧Interference with Daily Activities of 41.7 points (67.8%)

Patient Centered Outcome Questionnaire Domain Means



Purpose 2- Statistical Analysis

- Independent T-test/ANOVA models were used to determine differences in PCOQ domains based on demographic and clinic variables

Purpose 2- Results

- Lack of statistical significance across all PCOQ domains (P> 0.01) indicating that desired and successful treatment outcomes, treatment expectations, and overall importance of treatment improvements were similar.

✧ Sex
✧ Post operative rehabilitation
✧ Prior physical therapy intervention
✧ Other healthcare intervention
✧ Age
✧ Duration of symptoms

Purpose 3- Statistical Analysis

- Paired sample T-test

✧Difference between Pre to Post PCOQ success criterion in each domain.

Purpose 3- Results

- Patient's target values of treatment did not change during the course of physical therapy

✧ Pain P=0.766
✧ Fatigue P=0.352
✧ Emotional Distress P=0.628
✧ Interference with Daily Activities P=0.538

Purpose 4- Statistical Analysis

- Chi-Squared tests were used to determine if individual success criteria for treatment outcome differed from accepted MCIDs

Purpose 4- Results

- Patient's individual success outcomes were independent of group criteria when using the MCIDs ($P > .01$)

Conclusion

- Treatment success did not differ on key demographic or clinical factors.
- The data also indicates this patient population do not modify their absolute success criteria throughout the course of physical therapy treatment even though relative values changed.

Clinical Relevance

- Patients may require a greater reduction in outcomes than what has been reported as "clinically meaningful" in order for them to consider their physical therapy intervention as successful.

Clinical Relevance

- Clinicians interested in a broader assessment of outcome need to consider patient established criterion in addition MCIDs

Clinical Relevance

- Patient's seeking physical therapy interventions may have success criteria that do not change much during course of treatment, despite improvements in outcome domains.

Thank you

Effects of scapular stabilization taping on three-dimensional scapular in subjects with arthroscopic Bankart repair.

Duzgun Irem*, Turgut Elif*, Huri Gazi†, Yildiz Ibrahim Taha*, Turhan Egemen† Eraslan Leyla*, Baltaci Gul‡, Doral Mahmut Nedim†.

* Hacettepe University, Faculty of Health Sciences, Physiotherapy and Rehabilitation Department, Ankara, Turkey.
† Hacettepe University, Faculty of Medicine, Department of Orthopedic and Traumatology, Ankara, Turkey.
‡ Guven Hospital, Physiotherapy and Rehabilitation Department, Ankara, Turkey.

- Scapular orientation and position is important to optimize rotator cuff function and glenohumeral stability.

- More internally rotated scapular position was reported in shoulder instabilities.

- To be able to control scapular position scapular taping is commonly applied in shoulders disorders;

- However, there is not enough evidence for scapular taping in subjects with surgical anterior glenohumeral stabilization techniques in shoulder instabilities.

Purpose

- To investigate the effect of scapular stabilization taping on scapular kinematics in subjects with arthroscopic Bankart repair

Design and Setting

- Single group pre-test post-test design.

Patients or Other Participants

- 14 subjects with arthroscopic Bankart repair at 12th week postoperatively were participated to the study.
- All subjects were followed postoperatively in standard rehabilitation program.

AGE (years)	22.9±6.5
WEIGHT (kg)	78.5±13.3
HEIGHT (m)	175.6±8.1

Rehabilitation Program Phase 1

- 0-6 week
- Permitted tissue healing
- Protection surgery
- Controlled to inflamation
- Prevention of the muscular atrophy
- Maintain to surrounding tissue

Timothy F. Tyler 2006

Arthroscopic versus open treatment of Bankart lesion of the shoulder: A prospective randomized study

Carlo Fabbriciani, M.D.[a], Giuseppe Milano, M.D.[a], Antonio Demontis, M.D.[a], Salvatore Fadda, M.D.[a], Fabio Ziranu, M.D.[a], Pier Damiano Mulas, M.D.[a]

Available online 30 April 2004

Original article

Accelerated rehabilitation after arthroscopic bankart repair for selected cases: a prospective randomized clinical study

Seung-Ho Kim, M.D.[a], Kwon-Ick Ha, M.D., Ph.D.[b], Min-Wook Jung, M.D.[a], Moon-Sup Lim, M.D.[c], Young-Min Kim, M.D.[a], Jong-Hyuk Park, M.D.[a]

J Bone Joint Surg Am. 2001 May;83-A(5):661-7.

Position of immobilization after dislocation of the glenohumeral joint. A study with use of magnetic resonance imaging.

Ito E[1], Saeki R, Minagawa H, Shimizu T, Wakabayashi I, Sato K.

TABLE 2 STAGED RANGE-OF-MOTION GOALS FOLLOWING ARTHROSCOPIC ANTERIOR CAPSULOLABRAL REPAIR

	PFE	PER at 20° Abd	PER at 90° Abd	AFE
POW 3	90°	10°-30°	Contraindicated	NA
POW 6	135°	35°-50°	45°	115°
POW 9				
POW 12				

BRYCE W. GAUNT, PT, SCS[1] • MICHAEL A. SHAFFER, MSPT, OCS, ATC[2] • ERIC L. SAUERS, PhD, ATC[3] LORI A. MICHENER, PT, PhD, ATC, SCS[4] • GEORGE M. MCCLUSKEY III, MD[5] • CHUCK A. THIGPEN, PT, PhD, ATC[6,7]

The American Society of Shoulder and Elbow Therapists' Consensus Rehabilitation Guideline for Arthroscopic Anterior Capsulolabral Repair of the Shoulder

The maintenance of shoulder stability is the result of a complex interplay of static and dynamic factors. Shoulder instability

store shoulder stability by suturing back to the glenoid the detached or unstable

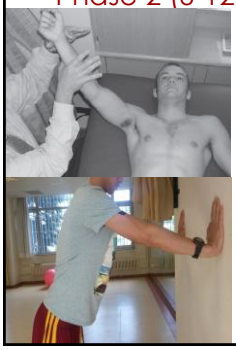
Phase 1

- Use sling for 6 weeks
- Cold application

- Passive flexion-abduction near the table
- Flexion-abduction with Swissball
- Active movement of elbow and cervical

- Wand exercises
- Active movement at 4. weeks
- Scapula retraction exercises
- Wand- repeated contractions
- ROM !!!
- Begin proprioceptive input

Phase 2 (6-12 weeks)



- Scar tissue remodelling
- Full ROM
- Scapular stability

- Strengthening
- Stretching
- Scapula stabilisation
- Proprioceptive exercises

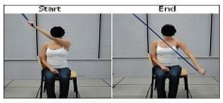


Figure 3. D1 Extension with Elastic Resistance.

Figure 4. D2 Extension with Elastic Resistance.

If the wound itching sweetly it means healing…

Tatlı tatlı kaşınıyorsa iyileşiyor demektir.

HIPOKRAT

Data Collection and Analysis

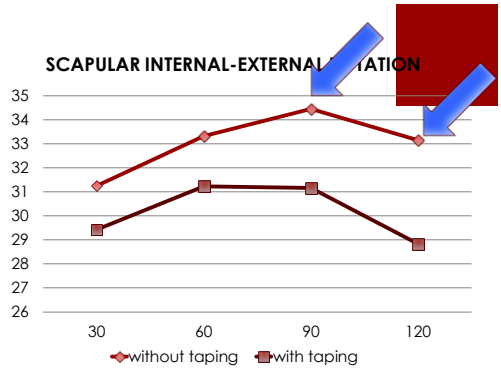
- All participants underwent motion analysis using electromagnetic tracking device with and without taping.

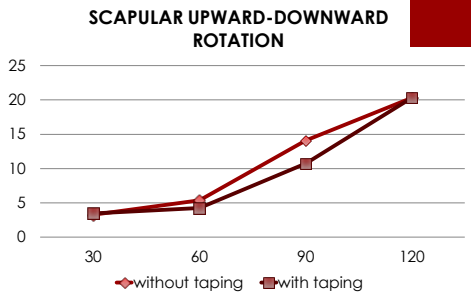
Taping

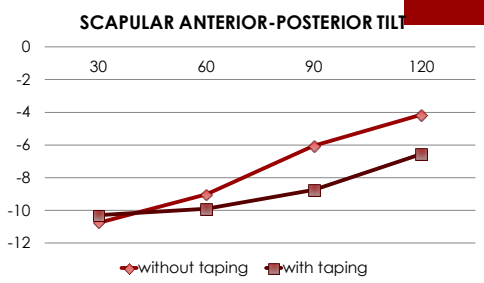
- Scapular stabilization taping was applied using elastic tape to be able to provide scapular retraction.

- Kinematic recording of
  - scapular internal-external rotation,
  - upward-downward rotation
  - anterior-posterior tilt were assessed during scapular plane
- 30°, 60°, 90° and 120° elevation based on ISB recommendations.
- Student-t test was used for statistical comparisons.

RESULTS







Limitations

- NO control group
- Sample size is small
- Need to long term results

Conclusions

- Scapula stabilization taping was found effective to control scapular internal-external rotation at especially higher levels of elevation requires more muscular activity for shoulder stability.

Clinical Relevance

- Scapular stabilization taping can be recommended to apply in postoperative rehabilitation following arthroscopic Bankart repair; however, there is need for studies with more focus on long-term results.

American Society of Shoulder and Elbow Therapists

Effects of kinetic chain exercise training on three-dimensional scapular kinematics pain and disability in impingement syndrome.

Elif TURGUT, PT PhD;
Irem DUZGUN, PT PhD; Gul BALTACI, PT PhD.

Hacettepe University, Faculty of Health Sciences, Physiotherapy and Rehabilitation Department, Ankara, Turkey.
Guven Hospital, Physiotherapy and Rehabilitation Department, Ankara, Turkey.

ASSET Annual Conference 2015
Asheville, NC

HACETTEPE UNIVERSITY

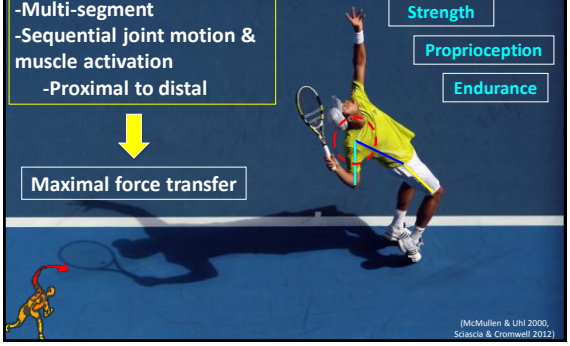
redcord

Kinetic Chain

-Integrated
-Multi-segment
-Sequential joint motion & muscle activation
-Proximal to distal

Maximal force transfer

Flexibility
Strength
Proprioception
Endurance



(McMullen & Uhl 2000, Sciascia & Cromwell 2012)

Kinetic Chain Rehabilitation

"Rehabilitation of entire neuromuscular system"

Kinetic link biomechanical model

Proximal-to-distal motor-activation patterns

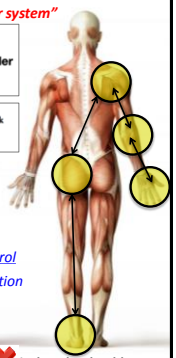
Proprioceptive neuromuscular facilitation

Closed-kinetic chain exercise

A Kinetic Chain Approach for Shoulder Rehabilitation
John McMullen, MS, ATC*; Timothy L. Uhl, PhD, ATC, PT†

Review Article
Kinetic Chain Rehabilitation: A Theoretical Framework
Aaron Sciascia and Robin Cromwell

1. *Consider Postural Influences*
2. *Establish Proper Motion*
3. *Facilitate Scapular Motion*
4. *Retraction for Protraction Control*
5. *Early Closed Chain Implementation*
6. *Work in Multiple Planes*
7. *Maintenance Programs*



isolate the shoulder
incorporate the whole body

Scapular Control

Mechanic Stability at GHJ

Concavity-Compression at GHJ

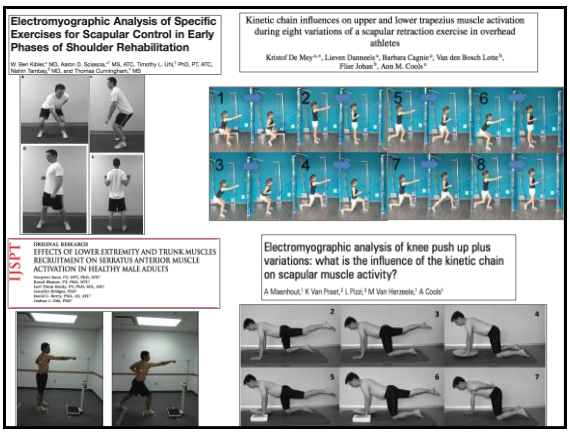
Rotator Cuff Function
(Smith 2006)

Does trunk & lower extremity integration facilitate FC activation?

Subacromial Space
"impingement Symptoms"
(Solem-Bertoft 1993)

Force Couple Muscles
(UT, MT, LT, SA)

Scapular Position & Orientation



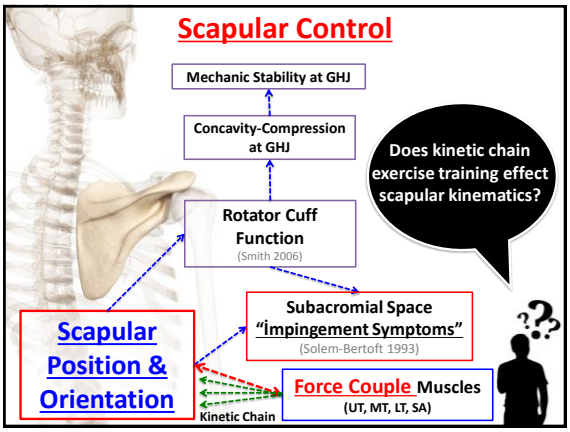
Electromyographic Analysis of Specific Exercises for Scapular Control in Early Phases of Shoulder Rehabilitation
W. Ben Kibler, MD, Aaron D. Sciascia, MS, ATC, Timothy L. Uhl, PhD, PT, ATC, Nalini Tambay, MD, and Thomas Cunningham, MS

Kinetic chain influences on upper and lower trapezius muscle activation during eight variations of a scapular retraction exercise in overhead athletes
Kristof De Mey, Lieven Danneels, Barbara Cagnie, Van den Bosch Lotte, Filer Joban, Ann M. Cools

IJSPT
ORIGINAL RESEARCH
EFFECTS OF LOWER EXTREMITY AND TRUNK MUSCLES RECRUITMENT ON SERRATUS ANTERIOR MUSCLE ACTIVATION IN HEALTHY MALE ADULTS

Electromyographic analysis of knee push up plus variations: what is the influence of the kinetic chain on scapular muscle activity?
A Maenhout, K Van Praet, L Pizzi, M Van Herzeele, A Cools

Scapular Control



Purpose

To investigate the effects of kinetic chain exercises on scapular kinematics and disability status in subjects with subacromial impingement syndrome.

Participants

	Participants n=15
Age (years)	33.4±9.3
Gender (n)	7 Female 8 Male
Body mass index (kg/m²)	23.7±2.19
Dominant side affected (n)	11 (81.8%)
Duration of symptoms (months)	6.5±6.7
Neer Classification (n)	Grade 1: 10 (33.3%) Grade 2: 5 (66.6%)
Scapular Dyskinesis (n)	Type 1: 6 (40%) Type 2: 9 (60%)

- Diagnosed with grade 1 or 2 **subacromial impingement syndrome** according to MRI/Ultrasound and who show up at least 2 positive;
  - Painful arc during flexion or abduction,
  - Neer or Hawkins-Kennedy test,
  - Painful resisted external rotation, abduction or painful Jobe's test
  - Positive Apprehension-Relocation test (without no posterior pain)

(Neer 1983; Hawkins & Kennedy 1980; Magee 1997; Tzannes 2004)

Inclusion/ Exclusion Criteria

- Type 1-2 **scapular dyskinesis** based on observational exam.
- Positive scapular assistance or reposition tests

- History of **surgery, fracture or dislocation** and **traumatic** onset
- Existence of;
  - **Type 3 acromion**
  - Massive **rotator cuff tear** > 1 cm
  - Long head of **biceps tendon tear**
  - **Degenerative joint disorder** at shoulder complex
- **Rheumotological, systemic or neurological** disorders
- Neuro-musculo-skeletal disorder in all kinetic chain including **cervical radiculopathy**
- Body mass index > **30 kg/m²**
- **Pregnancy**

(Uhl 2009; Rabin 2006; Kibler 2006)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | **RC strengthening**

- Supervised
- **Pain-free** 10 (→15 →20) Reps x 3 Sets daily
- Progression
  - **Elastic band** (red→green→blue)
  - Closed-kinetic → Open-kinetic chain
  - Low range → Higher range
  - Proximal → Distal
    - **Scapular stabilization → Rotator cuff strengthening**

(McMullen & Uhl 2000, Sciascia & Cromwell 2012)

Kinetic Chain Exercises

Stretching


Pectoralis minor


Posterior shoulder


Levator scapula


Latissimus dorsi

Scapular stabilization


Wall-slides with squat


Wall push-ups+ with ipsilateral leg extension


Lawnmower with diagonal squat


Resisted scapular retraction with contralateral one-leg squat


Robbery with squat

RC strengthening


Resisted shoulder internal rotation with step

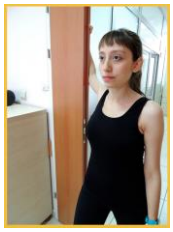

Resisted shoulder external rotation with step


Resisted full-can with step

Kinetic Chain Exercises

Stretching | Scapular stabilization | RC strengthening

- Pectoralis minor
- Posterior shoulder
- Levator scapula
- Latissimus dorsi



(Borstad 2006)

Kinetic Chain Exercises

Stretching | Scapular stabilization | RC strengthening

- Pectoralis minor
- Posterior shoulder
- Levator scapula
- Latissimus dorsi

(McClure 2007)

Kinetic Chain Exercises

Stretching | Scapular stabilization | RC strengthening

- Pectoralis minor
- Posterior shoulder
- Levator scapula
- Latissimus dorsi

(McEvoy 2011)

Kinetic Chain Exercises

Stretching | Scapular stabilization | RC strengthening

- Pectoralis minor
- Posterior shoulder
- Levator scapula
- Latissimus dorsi

(Paine 2009)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | RC strengthening

- Wall-slides with squat
- Wall push-ups+ with ipsilateral leg extension
- Lawnmower with diagonal squat
- Resisted scapular retraction with contralateral one-leg squat
- Robbery with squat

(McClure 2012, Sciascia 2013)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | RC strengthening

- Wall-slides with squat
- Wall push-ups+ with ipsilateral leg extension
- Lawnmower with diagonal squat
- Resisted scapular retraction with contralateral one-leg squat
- Robbery with squat

(Maenhout 2010)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | RC strengthening

- Wall-slides with squat
- Wall push-ups+ with ipsilateral leg extension
- Lawnmower with diagonal squat
- Resisted scapular retraction with contralateral one-leg squat
- Robbery with squat

(Kibler 2008)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | RC strengthening

- Wall-slides with squat
- Wall push-ups+ with ipsilateral leg extension
- Lawnmower with diagonal squat
- Resisted scapular retraction with contralateral one-leg squat
- Robbery with squat

(DeMey 2013)

Kinetic Chain Exercises

Stretching | **Scapular stabilization** | RC strengthening

- Wall-slides with squat
- Wall push-ups+ with ipsilateral leg extension
- Lawnmower with diagonal squat
- Resisted scapular retraction with contralateral one-leg squat
- Robbery with squat

(Kibler 2008, Sciascia 2013)

Kinetic Chain Exercises

Stretching | Scapular stabilization | **RC strengthening**

- Resisted shoulder internal rotation with step
- Resisted shoulder external rotation with step
- Resisted full-can with step

Kinetic Chain Exercises

Stretching | Scapular stabilization | **RC strengthening**

- Resisted shoulder internal rotation with step
- Resisted shoulder external rotation with step
- Resisted full-can with step

(Sciascia 2013)

Kinetic Chain Exercises

Stretching | Scapular stabilization | **RC strengthening**

- Resisted shoulder internal rotation with step
- Resisted shoulder external rotation with step
- Resisted full-can with step

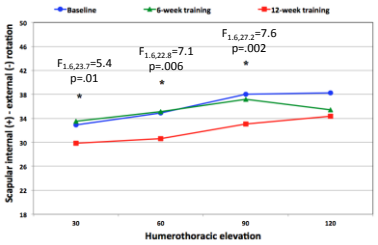
(McMullen 2000)

Outcome measures

- Baseline, after 6 and 12 weeks training -

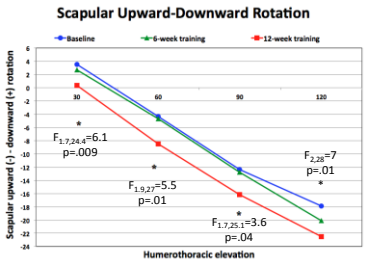
- **3-D Scapular Kinematics**
  - *Electromagnetic tracking device*
    Ascension Technologies Inc, Motion Monitor software program
    - 3 Reps, full scapular plane elevation
    - Metronome at 60 bpm
    - Analyzed at 30˚ , 60˚ , 90˚ and 120˚ humerothoracic elevation
    - ISB recommendations (Wu 2005)
- **Self-reported disability status**
  - *Shoulder Pain and Disability Index (SPADI)*

Results
3-D Scapular Kinematics



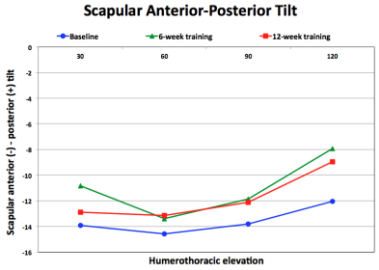
More externally rotated after 12-week training.

Results
3-D Scapular Kinematics



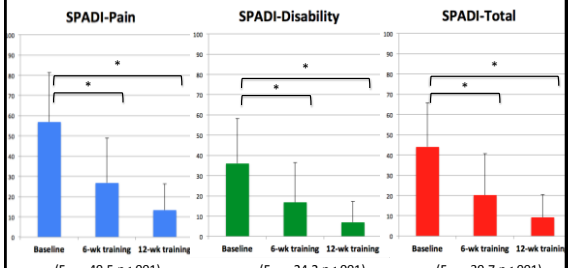
More upwardly rotated after 12-week training.

Results
3-D Scapular Kinematics



No significant differences for scapular anterior-posterior tilt (p>.05).

Results
Shoulder Pain & Disability Index



($F_{2,28}$=49.5 p<.001) ($F_{2,28}$=24.2 p<.001) ($F_{2,28}$=39.7 p<.001)

Clinical Relevance/Conclusions

- Kinetic chain scapula-based rehabilitation was effective;
  - To control pain and disability status
  - To alter scapular kinematics
- Pain disability were found less at 6th week
  - To be able to gain more scapular control, exercises should be maintained
- Future studies;
  - Symptom relapse and secondary injury rates during longer follow-ups.
- Kinetic chain scapula-based rehabilitation can be recommended to use clinically in patients with scapular dyskinesis and shoulder impingement syndrome.

American Society of Shoulder and Elbow Therapists

Elif TURGUT, PT PhD.
elifcamci@hacettepe.edu.tr

Let's meet in 8th Congress of Turkish Sports Physiotherapy in 6-8 November 2015 - Istanbul

Thank you.

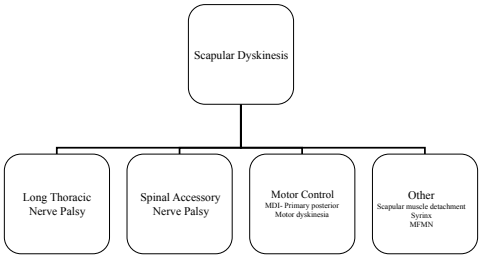
Scapular Muscle Examination Algorithm

Martin J. Kelley, PT, DPT, OCS
Good Shepherd Penn Partners
Penn Presbyterian Medical Center

Purpose

- Discuss an examination algorithm to identify the cause of significant scapular dyskinesis
- Implications toward clinical diagnostic accuracy

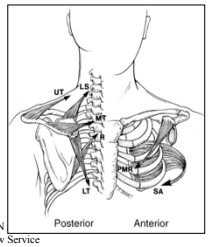
Scapular Examination Algorithm

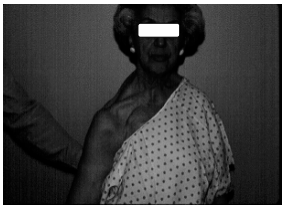


Scapular Muscle Function

Static

- Maintains shoulder girdle elevation in adduction





Scapular Muscle Function

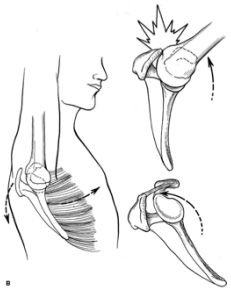
Static Abnormalities

- Osteochondroma
- Scoliosis

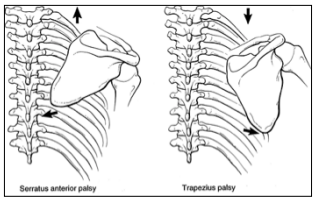
Scapular Muscle Function

Dynamic

- Stable base
- Subacromial space



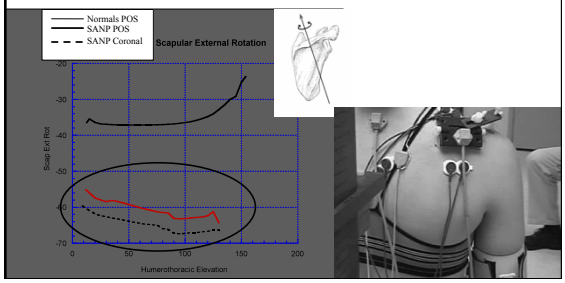
Medial vs. Lateral Winging



Lateral Winging is a MYTH

- Increased IR not ER

  Kelley-unpublished, Roren, Clin Biomech, 2013



Scapular Mechanics- Simplified

- Serratus Anterior - Sagittal Plane
- Trapezius- Coronal Plane

Electrodiagnostic Studies

- Rarely is NCS performed on the LTN or SAN
- Rarely are the lower and middle trapezius muscles tested
- Technically demanding when muscle atrophied
- Operator dependent and subject to interpretation
- Bigliani et al. (1996) reported that 50% of SAN palsy cases had incomplete testing or misdiagnosed

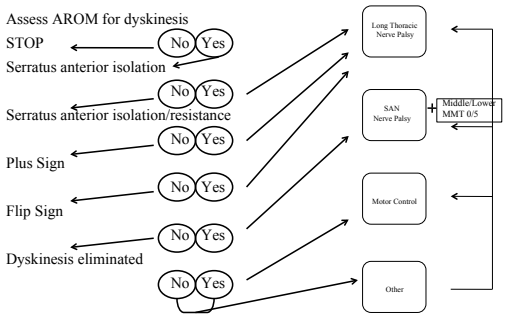
Dyskinesis Literature

Dyskinesis – altered scapular motion

- McClure and Tate, 2009
- Kibler, 2002
- Ludewig, 2000

- If we think it is present what causes it?

Examination Algorithm



Scapular Muscle Examination Algorithm

- AROM assessment

Scapular Muscle Examination Algorithm

- Serratus anterior isolation without/with resistance
  - Patient protracts and elevates the scapula

Scapular Muscle Examination Algorithm

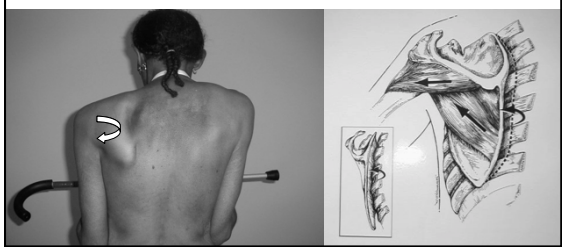
- Plus sign
  - Place the arm at 90 sagittal plane and reach (protract)

Scapular Muscle Examination Algorithm

- Flip Sign- **Kelley, 2008, JOSPT**
  - Resist shoulder ER and assess medial border

Scapular Muscle Examination Algorithm

- Scapular Flip sign



Scapular Muscle Examination Algorithm

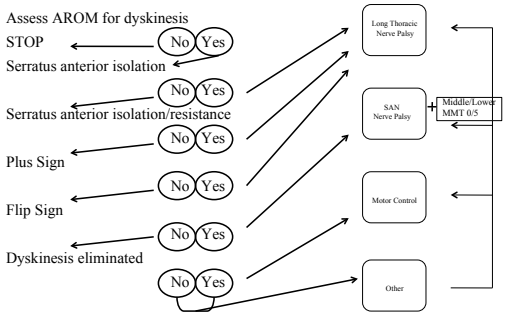
- Can you fix dyskinesis?
  - Attempt serratus anterior isolation and elevate shoulder
  - History of instability- MDI (primary posterior)

Other- Case

Multifocal Motor Neuropathy

Baseline 1 year later

Examination Algorithm



Summary

- Diagnosing the cause of significant scapular dyskinesis can be a challenge
- The algorithm is simple and improves diagnostic accuracy
- The algorithm test's effectively monitor nerve regeneration through muscle activation

Thank You

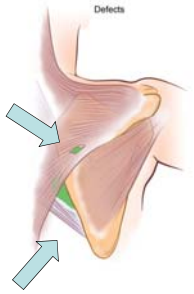
Post-Surgical Outcomes Following Scapular Muscle Re-Attachment

Aaron Sciascia,
MS, ATC, PES
Coordinator
Shoulder Center of Kentucky

Lexington Clinic
Orthopedics – Sports Medicine

Patient Instructions

- No driving for 4 weeks
  - DWI possible
- No text messaging, video games, or other repetitive use activities allowed
  - Includes non-involved arm
- Limit computer use to 20 min/hour

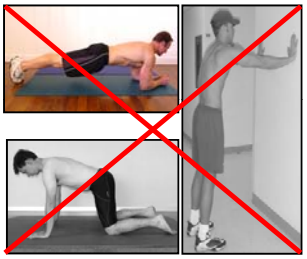


Limitations

- Sling time = 4 weeks
- Motion
  - No Abduction 3 weeks
  - No IR 3 weeks
  - No Forward Flexion 6 weeks
- Physical therapy does not begin until after week 4 (following 1st follow-up)

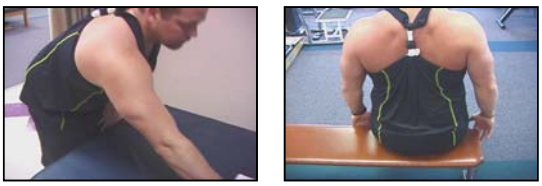
Closed Chain Emphasis

- What do you consider closed chain for the scapula?



Closed Chain Emphasis

Closed Chain Emphasis



Guidelines

- Closed chain exercise only for 6-8 weeks
- Scapular retraction/depression with kinetic chain focus
- May perform GH joint mobilizations if needed

Guidelines

- May go up to 90° forward flexion at weeks 9-10 post-op
- Progress to open chain short lever exercises
- Open chain exercise past 90° may be implemented after week 12

Beware of Trigger Points at/around Infraspinatus

Work on Endurance

- Muscle endurance is the hardest to restore
- Can be addressed early with closed chain maneuvers

Patient Comments

- Can perform light house work after 6-8 weeks but be prepared to be tired
- Ask PT to rehab patients for mobile device use
- Inform future patients that maintenance exercises are a permanent part of life after surgery

Post-Surgical Outcomes

Results of 78 patients

	Initial	Discharge	Mean Difference	Result
Pain Score	18 ± 12	35 ± 12	17	P < .001

From Kibler et al JSES 23: 58-67 2014

Results of 78 patients

	Initial	Discharge	Mean Difference	Result
Pain Score	18 ± 12	35 ± 12	17	P < .001
Function Score	20 ± 11	28 ± 11	8	P < .001

From Kibler et al JSES 23: 58-67 2014

Orthopedics – Sports Medicine

Results of 78 patients

	Initial	Discharge	Mean Difference	Result
Pain Score	18 ± 12	35 ± 12	17	P < .001
Function Score	20 ± 11	28 ± 11	8	P < .001
ASES Score	38 ± 17	62 ± 21	24	P < .001

From Kibler et al JSES 23: 58-67 2014

Orthopedics – Sports Medicine

Response to Surgery

	Responder (58)	Non-Responder (20)
Initial Pain	16 ± 11	27 ± 12*
Initial Function	18 ± 11	24 ± 9
Initial ASES	34 ± 16	50 ± 12*

*Significant difference p < .001

Orthopedics – Sports Medicine

Response to Surgery

	Responder (58)	Non-Responder (20)
Initial Pain	16 ± 11	27 ± 12*
Initial Function	18 ± 11	24 ± 9
Initial ASES	34 ± 16	50 ± 12*

*Significant difference p < .001

	Responder (58)	Non-Responder (20)
Discharge Pain	38 ± 10	26 ± 12*

*Significant difference p < .001

Orthopedics – Sports Medicine

Response to Surgery

	Responder (58)	Non-Responder (20)
Initial Pain	16 ± 11	27 ± 12*
Initial Function	18 ± 11	24 ± 9
Initial ASES	34 ± 16	50 ± 12*

*Significant difference p < .001

	Responder (58)	Non-Responder (20)
Discharge Pain	38 ± 10	26 ± 12*
Discharge Function	31 ± 11	21 ± 10*

*Significant difference p < .001

Orthopedics – Sports Medicine

Response to Surgery

	Responder (58)	Non-Responder (20)
Initial Pain	16 ± 11	27 ± 12*
Initial Function	18 ± 11	24 ± 9
Initial ASES	34 ± 16	50 ± 12*

*Significant difference p < .001

	Responder (58)	Non-Responder (20)
Discharge Pain	38 ± 10	26 ± 12*
Discharge Function	31 ± 11	21 ± 10*
Discharge ASES	69 ± 18	42 ± 16*
Change from Initial	**35 ± 18**	**-8 ± 14***

*Significant difference p < .001

Orthopedics – Sports Medicine

Most Recent Follow-up (n=41)

Age	Sex	F/U	MD#	Sx Duration	PT Duration	MOI
39±14 years	F=21 M=20	2.3 years (1.5-4)	3.5 (1-35)	4.5 years	7 months	Athletic: 6 Other: 8 MVA=11 Traction=16

Most Recent Follow-up (n=41)

ASES	Pre	Post	P-Value
Pain	20 ± 13	37 ± 12*	P < .001
Function	20 ± 11	34 ± 12	P < .001
Total	40 ± 22	72 ± 21	P < .001

GROC: 2 ± 1.5

Pain Catastrophizing Scale (PCS)

	Cut Points*		
PCS Total	30		
Rumination	11		
Magnification	5		
Helplessness	13		

*75th percentile, N=851

Sullivan et al Psychol Assess 1995

Pain Catastrophizing Scale (PCS)

	Cut Points*	Above	Below
PCS Total	30	10	20
Rumination	11	9	21
Magnification	5	14	16
Helplessness	13	8	22

*75th percentile, N=851

Sullivan et al Psychol Assess 1995

PCS Most Recent Follow-up

ASES	Non-Catastrophizer (20)	Catastrophizer (10)	P-Value
Pain	43 ± 8	27 ± 12	P < .001

PCS Most Recent Follow-up

ASES	Non-Catastrophizer (20)	Catastrophizer (10)	P-Value
Pain	43 ± 8	27 ± 12	P < .001
Function	40 ± 10	27 ± 12	P = .005

PCS Most Recent Follow-up

ASES	Non-Catastrophizer (20)	Catastrophizer (10)	P-Value
Pain	43 ± 8	27 ± 12	P < .001
Function	40 ± 10	27 ± 12	P = .005
Total	83 ± 16	54 ± 18	P < .001

PCS Most Recent Follow-up

ASES	Non-Catastrophizer (20)	Catastrophizer (10)	P-Value
Pain	43 ± 8	27 ± 12	P < .001
Function	40 ± 10	27 ± 12	P = .005
Total	83 ± 16	54 ± 18	P < .001
Number <10 MDC	1*	6	P =.047

*Patient initial ASES=90, MR Follow-up=88

No difference in pre-op ASES scores between groups

Concerns

- Discharge from PT has ranged from 4-12 months (219 ± 227 days)
  - Not age specific
  - Not gender specific
  - Not based on severity of detachment
- 25 states, 3 countries
  - Follow-up difficult

Concerns

- Length of time from injury/symptom onset to surgical intervention
  - Secondary issues prior to surgery may extend therapy post-operatively
  - Pain processing changes
- Concurrent procedures can extend therapy time as well

Other Observations

- Early drastic reduction in pain causing patients to use arm more than recommended
- Pain reduction “Too good to be true” so patients become over protective of arm motion
- 8 patients pain increased from 1 to 6 VAS once thoracic mobilizations introduced (3 months post-op)

Summary

- Traumatic arm injury can result in damage to scapular stabilizers
- Restoration of anatomy via dorsal advancement provides improvement in pain
- Pain improvement is more predictable than functional improvement yet remains stable at 2 year follow-up
- Pain perception may need to be assessed pre-operatively

THANK YOU

DESCRIPTIVE ANALYSIS OF HEALTHY HIGH SCHOOL BASEBALL PLAYERS

William A. Clark, MSc, PT, AT

ATI Rehabilitation

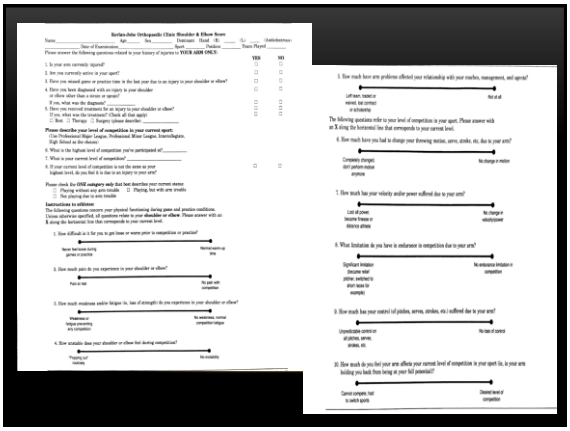
INTRODUCTION

- Tremendous forces are generated at the shoulder resulting in injury from high school through professional baseball players
- Multiple outcomes tools exist for the upper extremity but few are designed for the shoulder and elbow in overhead athletes
  - DASH
  - SST
  - ASES
  - Penn Score

KERLAN-JOBE ORTHOPAEDIC CLINIC SHOULDER & ELBOW SCORE

- Demographic information age, sex, dominant hand, sport, position, years played
- 8 questions on medical history of arm injuries
- 1 0f 3 Categories playing w/o any arm trouble, playing with arm trouble, not playing due to arm trouble.
- 10 item questionnaire
- Each item scored by VAS (visual analog scale) 10 cm liine

- Am J Sorts Med (2010) 38:903-911.
- 282 intercollegiate and professional overhead athletes
- 55 injured overhead athletes (responsiveness)
- Established validity, reliability and responsiveness



Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score

Name: _____ Age: ____ Sex: _____ Dominant: Hand: RI _____ LI: _____ Ambidextrous:

Date of Examination: _____ Sport: _____ Position: _____ Years Played: _____

Please answer the following questions related to your history of injuries to YOUR ARM ONLY.

	YES	NO
1. Is your arm currently injured?	☐	☐
2. Are you currently active in your sport?	☐	☐
3. Have you missed game or practice time in the last year due to an injury to your shoulder or elbow?	☐	☐
4. Have you been diagnosed with an injury to your shoulder or elbow other than a strain or sprain?	☐	☐
If yes, what was the diagnosis? _____		
5. Have you received treatment for an injury to your shoulder or elbow?	☐	☐
If yes, what was the treatment? Check all that apply:		
☐ Rest ☐ Therapy ☐ Surgery (please describe): _____		
Please describe your level of competition in your current sport:		
(1st Professional Major League, Professional Minor League, Intercollegiate, High School as the choices)		
6. What is the highest level of competition you've participated at?_____		
7. What is your current level of competition? _____		
8. If your current level of competition is not the same as your highest level, do you feel it is due to an injury to your arm?	☐	☐

Please check the **ONE category only** that best describes your current status:

☐ Playing without any arm trouble ☐ Playing, but with arm trouble

☐ Not playing due to arm trouble

Instructions to athletes

The following questions concern your physical functioning during game and practice conditions. Unless otherwise specified, all questions relate to your **shoulder or elbow**. Please answer with an X along the horizontal line that corresponds to your current level.

1. How difficult is it for you to get loose or warm prior to competition or practice?

Never feel loose to my games or practice — Normal warm-up time

2. How much pain do you experience in your shoulder or elbow?

Pain at rest — No pain with competition

3. How much weakness and/or fatigue (ie, loss of strength) do you experience in your shoulder or elbow?

Weakness or fatigue preventing any competition — No weakness, normal competition fatigue

4. How unstable does your shoulder or elbow feel during competition?

"Popping out" frequently — No instability

5. How much have arm problems affected your relationship with your coaches, management, and agents?

Left team, limited or wanted, but contract or scholarship — Not at all

The following questions refer to your level of competition in your sport. Please answer with an X along the horizontal line that corresponds to your current level.

6. How much have you had to change your throwing motion, serve, stroke, etc, due to your arm?

Completely changed, don't perform motion anymore — No change in motion

7. How much has your velocity and/or power suffered due to your arm?

Lost all power, become freeze or Minimize athlete — No change in velocity/power

8. What limitation do you have in endurance in competition due to your arm?

Significant limitation (become relief pitcher, switched to short races for example) — No endurance limitation in competition

9. How much has your control (of pitches, serves, strokes, etc.) suffered due to your arm?

Unpredictable control on all pitches, serves, strokes, etc. — No loss of control

10. How much do you feel your arm affects your current level of competition in your sport (ie, is your arm holding you back from being at your full potential)?

Cannot compete; had to switch sports — Desired level of competition

INTRODUCTION

- The KJOC Score has be further validated in several studies
- Domb BG et al Am J Sports Med 2010;38:1558-63. (injured professional baseball players)
- Neri BR et al Am J Sports Med 2011;39:114-20. (injured overhead elite athletes)
- Kraeutler MJ et al J Shoulder Elbow Surg 2013;22:329-32. (healthy professional pitchers)
- Fronek J et al J Shoulder Elbow Surg 2015;24:17-23 (minor league pitchers)
- No studies to date have used the KJOC score on youth baseball players.

PURPOSE

- Descriptive analysis utilizing the KJOC score in healthy high school baseball players
- Compare the mean score obtained in this cohort to previous scores found in healthy professional baseball players
- Add to growing evidence that the KJOC score is a valid and effective tool for assessing overhead athletes of different ages and positions

METHOD

- 33 high school baseball players
- No reported injuries/all participating
- Part of a preseason screening
- Questionnaire administered with general instructions and stand-by assistance
- Demographic information collected on the same form.

RESULTS

- 33 players
- Mean age - 15.55 (14-18) years
- Mean height - 69 (62-72) inches
- Mean weight - 135 (110-250) lbs
- Hand dominance - 30/33 right hand dominant
- 17 multiple position / 12 pitchers

- Mean KJOC score 93.01(SD=5.96)

DISCUSSION

- Present study included pitchers and position players
- Questionnaire included the elbow as well the shoulder
- Do high school baseball players interpret the questionnaire in a similar way as collegiate and professional baseball pitchers/players

DISCUSSION

- 33 healthy high school baseball players
  - Mean score 93.01

Kraeutler MJ, JSES,2013

- Mean score 94.82

Fronek J, JSES, 2015

- Mean score 93.5

CLINICAL RELEVANCE

- KJOC score is an appropriate tool to use as a preseason screening measure on healthy high school baseball players
- KJOC can be used a baseline measure for future comparison of high school baseball players following injury, surgery and rehabilitation.
- Future studies should look at pre-adolescent and adolescent healthy and injured players as well as non-English speaking players

CURRENT THINKING

- TRADITIONAL OBJECTIVE MEASURES OF RANGE OF MOTION, STRENGTH AND RADIOGRAPHIC VARIABLES HAVE BEEN CALLED INTO QUESTION .
- PATIENT-REPORTED MEASURES OF QUALTIY OF LIFE GENERATED BY THE PATIENT HAVE BEEN SHOWN TO BE MORE RELIABLE AND VALID.
- IT HAS BEEN CLEARLY DEMONSTRATED THAT THE PHYSICIAN IS A POOR JUDGE OF PATIENT OUTCOME
- PATIENT/ATHLETE IS THE BEST JUDGE OF HIS OR HER OUTCOME

THANK YOU

- Athletic Director, coaches and players of Oley Valley High School Oley, PA.
- Athletic Training Staff of ATI

- ASSET members
  - Ellen Shanley, Tim Uhl, Stephen Thomas and Marty Kelley

- Olivia Clark for assistance/patience in creating power point presentation

Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score

Name_____ Age_____ Sex_____ Dominant Hand (R) _____ (L) _____ (Ambidextrous) _____ Date of Examination_____ Sport _____ Position _____ Years Played _____

Please answer the following questions related to your history of injuries to **YOUR ARM ONLY:**

	YES	NO
1. Is your arm currently injured?	☐	☐
2. Are you currently active in your sport?	☐	☐
3. Have you missed game or practice time in the last year due to an injury to your shoulder or elbow?	☐	☐
4. Have you been diagnosed with an injury to your shoulder or elbow other than a strain or sprain?	☐	☐
If yes, what was the diagnosis? _____	☐	☐
5. Have you received treatment for an injury to your shoulder or elbow?	☐	☐
If yes, what was the treatment? (Check all that apply)	☐	☐

☐ Rest ☐ Therapy ☐ Surgery (please describe): _____

Please describe your level of competition in your current sport:
(Use Professional Major League, Professional Minor League, Intercollegiate, High School as the choices)

6. What is the highest level of competition you've participated at?_____
7. What is your current level of competition? _____
8. If your current level of competition is not the same as your highest level, do you feel it is due to an injury to your arm? ☐ ☐

Please check the ***ONE category only*** that best describes your current status:

☐ Playing without any arm trouble ☐ Playing, but with arm trouble
☐ Not playing due to arm trouble

Instructions to athletes:
The following questions concern your physical functioning during game and practice conditions. Unless otherwise specified, all questions relate to your **shoulder or elbow**. Please answer with an **X** along the horizontal line that corresponds to your current level.

1. How difficult is it for you to get loose or warm prior to competition or practice?

2. How much pain do you experience in your shoulder or elbow?

3. How much weakness and/or fatigue (ie, loss of strength) do you experience in your shoulder or elbow?

4. How unstable does your shoulder or elbow feel during competition?

(continued)

5. How much have arm problems affected your relationship with your coaches, management, and agents?

The following questions refer to your level of competition in your sport. Please answer with an **X** along the horizontal line that corresponds to your current level.

6. How much have you had to change your throwing motion, serve, stroke, etc, due to your arm?

7. How much has your velocity and/or power suffered due to your arm?

8. What limitation do you have in endurance in competition due to your arm?

9. How much has your control (of pitches, serves, strokes, etc.) suffered due to your arm?

10. How much do you feel your arm affects your current level of competition in your sport (ie, is your arm holding you back from being at your full potential)?

Rehabilitation of a High School Baseball Pitcher's Shoulder

Alex Ivashenko PT DPT OCS AHC
October 10 2015
Asheville North Carolina

American Society of Shoulder and Elbow Therapists

Introduction

- **Literature Review**

  Sports Med. 2006;36(3):189-98. The role of core stability in athletic function. Kibler WB, Press J., Sciascia A

  Regional Interdependence of the Hip and Lumbo-pelvic region in Division II Collegiate Level Baseball Pitchers: A Preliminary Study
  Kathryn Kumagai Shimamura PT DPT NCS OCS CSCS FAAOMPT, Scott Cheatham PT DPT PhD OCS ATC CSCS, Wendy Chung PT DSc, Daniel Fanwell PT DPT Francisco De la Cruz PT DPT OCS, Jennifer Goetz DPT, Kaleigh Lindblom DPT and Darcy Powers DPT

  Lower body mechanics bolster overhead throws B Gretchen D. Oliver, PhD FACSM ATC LAT, Hillary Plummer MAT ATC, Lisa Henning

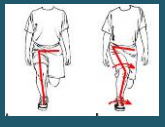
John Doe the Pitcher Examination

- 18 Year Old Right Hand Dominant Pitcher
- 12 months ago: sudden onset of shoulder pain and weakness throwing on or about 9/2013
- Shut Down 4/1/2014
- Pediatric Orthopedic Consult 7/14
- Physical Therapy at another clinic: 8/14; no change over 1 month
- Consult with Detroit Tigers Orthopedist, MRI and Exam: 2mm SLAP Lesion, GIRD
- Referred to JCPT
- Initiated PT 9/20/2014

- Examination-findings:
  - SPADI: Pain Scale 22%, Disability Scale: 0%, Total: 8.46%
  - Type II Scapula (Medial Border Elevated)
  - Flexion 175*, abduction 170*, ER at 0: 75*, at 90: 110*
  - IR at 90: 20*. *Pain: ↓Total Arc
  - MMT: upper, middle and lower traps, rhomboids, serratus anterior: weak
  - flexion, abduction, ER, IR: weak and painful.
  - +O'Brien's Test, +Biceps Load II Test

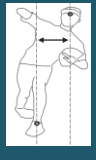
John Doe the Pitcher

- Shoulder Joint: painful and tight posterior capsule
- Core control & strength: poor (abdominals, back extensors
- Lower Extremity ROM: WNL.
- Lower Extremity MMT:
  - Trail Leg:
    - Abductors, extensors, ER 4/5
  - Plant Leg
    - Abductors, extensors, ER: 4-/5
    - Poor endurance
- Special Tests: +Hop Test Test, +Step Down Test



The Pitch

Core Breakdown



Should we be concerned about hip symmetry in an Asymmetrical Sport?

- **We know there are rotational adaptations at the shoulder-is the hip any different?**
- **Studies show hip rotation adaption in Pitchers**
- **RHP: Stance Leg- increased IR**
- **Stride Leg- increased ER**
- **Weak hip abductors: decreased flexibility & strength appears to increase UE workload**
- **Should we treat weaknesses but do we to be concerned with the hip asymmetry? Burkhart et al, McCulloch P et al, Young et al**
- **"The Serape Effect" on overhead motion**
- **Rhomboids, SA, EO, IO, Thoracolumbar fascia**
- **Diagonals crossing in front/back of the body like a blanket**
- **Serape work like a unit: Transfers internal force generated by LE/pelvis to throwing arm**
- **Shoulder total ROM associated with LE flexibility**
- **The Throwers Paradox**
- **Criteria for Return to Sport**
  - **Structural Kinematics**
  - **Functional Movement Control**
  - **Skill Development**
  - **Competition Integration**

Interventions

- **Specific interventions (26 visits over 6 months)**
  - Manual Therapy: Instrument Assisted Soft Tissue Mobilization
  - Joint Mobilization of T4-8 & GH Jt Restoration (+any other restrictions)
  - Warm Up Exercises to increase flexibility of the LE's, hip, trunk & UE's
  - Proximal to Distal Motor Control Program
  - Restoration of normal UE, trunk, core, hip and LE ROM, strength
  - Endurance Training for concentric and eccentric phases of Throwing
  - Progressive Resistive Strengthening and Endurance Training Program to Restore Normal Kinetic Chain Function
  - Simulated Game Conditions (ex. Windmills with pitching)
  - Modalities as Needed
  - Home Program

6 months of Therapy

- Discharge findings:
  - SPADI: Pain Scale 0%, Disability Scale: 0%, Total: 0%
  - Scapula position resolved
  - Shoulder ROM: Flexion 180, abduction 180, ER at 0: 85, at 90: 120, IR at 90: 60. All motions: painfree
  - Restoration of Total Arc of Motion
  - MMT: upper, middle and lower traps, rhomboids, serratus anterior, shoulder flexion, abduction, ER, IR: strong & painfree
  - Core and Lower Extremity ROM and Strength: normal
  - Special Tests: -O'Brien's Test, -Biceps Load II Test, - Step Down Test, +Double and Single Leg Hop Tests
  - Full Plank: 3 minutes, Side Plank 90 seconds

Treatment Considerations

Rationale

- Understand the medical diagnosis & associated physical therapy diagnosis related to trauma and degenerative pathologies
- Identify and describe impairments and functional losses as a consequence of pathology.
- Be able to choose appropriate evidence-based therapeutic interventions for rehabilitation based on findings from self-report measures and the examination process.
- Understand the role of clinical prediction rules and classification based treatment strategies.
  - APTA Orthopedic Section: Current Concepts of Orthopaedic Physical Therapy, 3rd Edition

Conclusion

- **Proper Diagnosis**
- **Communication: Collaborated with Patient's Trainer to return pitcher back to his prior level of painfree throwing**

HSS Rehabilitation
HOSPITAL FOR SPECIAL SURGERY

SHOULDER ARTHROPLASTY: A NEED FOR PREOPERATIVE EDUCATION

Diana M. Minardo, OTD, OTR/L

HSS educational activities are carried out in a manner that serves the educational component of our Mission.

As faculty we are committed to providing transparency in any/all external relationships prior to giving an academic presentation.

Diana M. Minardo
Hospital for Special Surgery

Disclosure: I DO NOT have a financial relationship with any commercial interest.

BACKGROUND

- American Academy of Orthopedic Surgeons (AAOS) ~53,000 individuals undergo a TSA per/yr
- 3rd most common following after hip & knee
- Aging U.S. population increasing the demand
- Current research supports efficacy of preoperative education for LE arthroplasty however, the same cannot be stated about shoulder arthroplasty

RESEARCH QUESTION

- Explore current practitioner's perceptions of preoperative TSA patient education and best practices.
  - Describe therapists perceptions about the value of pre-operative education for patients with TSA
  - Describe therapists practices in the provision of preoperative TSA patient education

METHODS

- Design: Cross sectional survey
- Recruitment: Licensed therapist who treat the upper extremity
  - a) Convenience sampling of ASSET members
  - b) Snowball sampling
- Instrument: Investigator designed survey

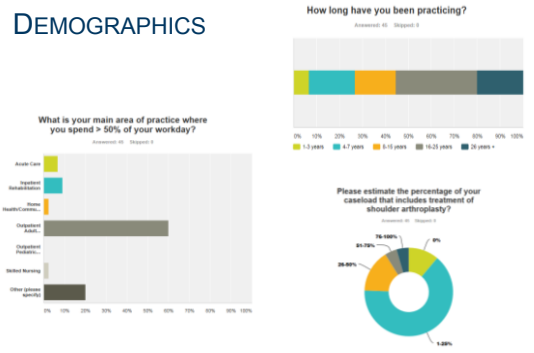
PROCEDURES

- A survey was developed through SurveyMonkey®
- The initial survey was piloted and revised based on expert feedback
- Email was sent containing consent letter and link to survey
- Completion of survey constituted consent for participation
- Survey widow open for 2 months

DATA ANALYSIS

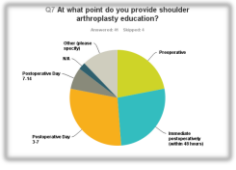
- Descriptive analysis of data
- Categorical analysis of open ended questions
- Participants: 24 ASSET members & 21 outside of ASSET
  - 10 OTs, 34 PTs, & 1 OTA representing 18 U.S. States and 2 additional countries

DEMOGRAPHICS



RESULTS

- **95% of respondents agreed or strongly agreed that**…
  "Preoperative shoulder education is a necessary component of standard of care."
- However, only **24%** report being directly involved in providing it



RESULTS

Top 3 Rated

- Therapists rated most important:

1. **Surgical precautions**
2. **Healing process**
3. **Pain management**

- Therapeutic exercises* are also addressed most of the time

Bottom 3 Rated

- Therapists rated least important:

1. **Caregiver support**
2. **Work, leisure, or recreational**
3. **Cryotherapy***

- Compared with infection control, self-care, positioning, & sling management

DISCUSSION

- TSA education is perceived as important but not consistently provided by therapists.
  - Factors cited that influence provision:
    - Time management
    - Reimbursement
    - Multidisciplinary team communication
- Recommendations for best practice
  - Multiple approaches
  - Visual/Auditory Media via handouts
  - Preoperative therapy visit 1:1 or group

Bottom line…

Increase therapy presence at the preoperative level!

Limitations

- Need formal follow-up interviews to clarify data
- Small time window
- Sample characteristics limit generalizability

(mostly PTs and outpatient clinics)

HSS Rehabilitation HOSPITAL FOR SPECIAL SURGERY

Implication on Practice

- Educate surgical team on rehab therapists role and importance of preoperative education
- Develop comprehensive protocol for education
- Use various media
- Delivery of preoperative education need not be limited in the outpatient setting

HSS Rehabilitation HOSPITAL FOR SPECIAL SURGERY

Special thanks to my advisor and mentor
Salvador Bondoc, OTD, OTR/L, FAOTA

HSS Rehabilitation HOSPITAL FOR SPECIAL SURGERY

Questions?
minardod@hss.edu

HSS Rehabilitation HOSPITAL FOR SPECIAL SURGERY

Which Patient-Reported Outcome Measure Best Correlates with Satisfaction Following Total Shoulder Arthroplasty?

Aaron Sciascia, MS, ATC, PES
Brent J. Morris, MD
Cale Jacobs, PhD, ATC
T. Brad Edwards, MD

FONDREN ORTHOPEDIC GROUP L.L.P.
Lexington Clinic
Orthopedics – Sports Medicine

Background

- Patient satisfaction more important than ever
  - Public reporting
  - Pay-for-performance
  - Biopsychosocial model of healthcare
    - Adams and Drake Comm Men Health 2006
    - Barratt Patient Educ Couns 2008
- Patient-reported outcomes processes need to be of highest quality

Background

- Anatomic Total Shoulder Arthroplasty (TSA) procedures increasing
  - 27,000 performed in 2008
  - 77% of TSA performed for primary osteoarthritis
    - Kim et al JBJS 2011
  - Estimates now around 50,000+/ year
    - AAOS website
- The relationships between commonly used upper extremity outcome tools and patient satisfaction anatomic TSA have not been evaluated

Methods

- Prospective patient database
  - Fondren Orthopedic Group, Houston, TX
- Anatomic TSA performed by single surgeon
- Patient-Reported Outcomes
  - Constant score
  - Age/Sex Adjusted Constant Score
    - (Raw Score/Normal Score) x 100 from Katolik et al JSES 2005
  - ASES
  - WOOS
  - SANE
  - Satisfaction

Methods

- Summary
  - Demographic variables
- T-Test
  - Pre-op vs. Post-op change in measures
- Pearson Correlation
  - Satisfaction and outcome instrument
- Z-transformation
  - Compare correlations
    - Compares 2 dependent correlations measured on same subject
      - Steiger Psychological Bulletin 1980

Results

- 234 patients
  - 81 females, 153 males
  - Age: 67±10 years
  - Weight: 198±41 lbs
  - Height: 68±4 inches
  - BMI: 30±6
- Smoking
  - 46 previous, 5 current
- Back Pain (35%)
- Pre-Op Narcotics (26%)
  - 53% had LBP
- Diabetes (7%)
- Depression (6%)
- **Satisfaction (88%)**

Results

	Pre-Op	Post-Op	P-Value
Constant Pain (0-15)	4 ± 3	13 ± 4	<.001
Constant Activity (0-20)	8 ± 4	17 ± 4	<.001
Constant Mobility (0-40)	11 ± 8	36 ± 6	<.001
Constant Strength (0-25)	5 ± 8	14 ± 7	<.001
Constant Total (0-100)	29 ± 17	80 ± 15	<.001
Constant Adj.	37 ± 21	106 ± 20	<.001
ASES (0-100)	41 ±19	89 ± 17	<.001
WOOS (100-0)*	66 ± 18	13 ± 19	<.001
SANE (0-100)	32 ± 25	69 ± 36	<.001

*Reported as a percentage

Orthopedics – Sports Medicine

Results

ASES and Satisfaction N=234

Instrument	Pearson	P-Value
ASES	.62	--------

Orthopedics – Sports Medicine

Results

ASES and Satisfaction N=234

Instrument	Pearson	P-Value
ASES	.62	--------
WOOS	.60	.42

Orthopedics – Sports Medicine

Results

ASES and Satisfaction N=234

Instrument	Pearson	P-Value
ASES	.62	--------
WOOS	.60	.42
Constant Total	.53	.01

Orthopedics – Sports Medicine

Results

ASES and Satisfaction N=234

Instrument	Pearson	P-Value
ASES	.62	--------
WOOS	.60	.42
Constant Total	.53	.01
Constant Adj.	.54	.03

Orthopedics – Sports Medicine

Results

ASES and Satisfaction N=234

Instrument	Pearson	P-Value
ASES	.62	--------
WOOS	.60	.42
Constant Total	.53	.01
Constant Adj.	.54	.03
SANE	.29	<.001*

Orthopedics – Sports Medicine

Results

WOOS and Satisfaction N=234

Instrument	Pearson	P-Value
WOOS	.60	-------
Constant Total	.53	.054
Constant Adj.	.54	.09
SANE	.29	<.001

Results

Constant Components and Satisfaction N=234

Instrument	Pearson	
Constant Pain	.65	Subjective
Constant Activity	.57	
Constant Mobility	.27	Objective
Constant Strength	.24	

Discussion

- ASES
  - Known psychometric properties
    - Michener et al JSES 2002
    - Angst et al Arthritis Rheum 2004
    - Placzek et al AJSM 2004
    - Kocher et al JBJS 2005
    - Tashjian et al JBJS 2010
  - Utilized frequently as part of shoulder arthroplasty outcomes collection
  - ASES most responsive patient assessment in TSA patients
    - Angst et al Arthritis Rheum 2004

Discussion

- Constant-Murley Shoulder Score
  - Adequately correlated with satisfaction (r=.53)
  - Significantly lower than ASES (p≤.03)
- Subcomponents differed
  - Subjective more correlated with satisfaction
  - Similar to previous report in arthroplasty patients
    - Chen et al JSES 2007

Discussion

- WOOS
  - Second highest correlation with satisfaction (r=.60)
  - Not different from Constant or Adjusted Constant
- Patient/clinician burden consideration
  - WOOS: 19 VAS questions = 10 min + manual scoring
  - ASES: 11 Likert scale questions = 5 min + 2 min scoring

Discussion

- SANE
  - Convenient single question
  - Lowest correlation with satisfaction (r=.29)
  - All other measures significantly higher
- But Why?
  - 11% unsatisfied patients: 86 or higher
  - 14% satisfied patients: 10 or lower

Key Points

- Large single surgeon prospective registry (N=234) with adequate follow-up (2 year min, 3 year avg.)
- ASES greatest correlation with satisfaction
- SANE inferior compared to all other instruments
- Patient satisfaction after TSA for primary osteoarthritis appears to be driven by subjective rather than objective factors

Lexington Clinic

Orthopedics – Sports Medicine

How We Have Changed Our Practice

- Ortho and PT in same group
- To enhance communication about outcomes, we now use the Penn Shoulder Score (PSS)
- ASES can be extracted from PSS and includes satisfaction
- Separate analysis:
  - <12 point change on ASES associated with 19x increase of being dissatisfied

Lexington Clinic

Orthopedics – Sports Medicine

THANK YOU

ARM DOMINANCE AND ANATOMIC TSA

AMERICAN SOCIETY OF SHOULDER AND ELBOW THERAPISTS
ASHEVILLE, NC
OCTOBER 2015

Ellen Shanley PhD, PT, OCS[1]- Director, Athletic Injury Research, Prevention and Education

Co-Authors

- Stephan Tolan[2], Michael Kissenberth, MD[2], Richard Hawkins, MD[2], John Tokish, MD[2]

1. Proaxis Therapy a Division of ATI
2. Greenville Health System, Steadman Hawkins Clinic of the Carolinas

Total Shoulder Arthroplasty

- Primary Goal: Pain relief and improved function patients with GH joint diseases
- Current Evidence: Result of PRO's + short & long term outcomes in setting of TSA- Deshmukh 2005; Carter 2012; Raiss 2014

Outcomes in Clinical Practice

- Represent patient specific perception of function
  - Instrument type
  - Influenced by numerous factors
  - Mode of Administration
    - Patient Instruction
- Longitudinal Use***
  - Interpretation

Hand Dominance effects

- Shown to have strong influence on daily activity- Beaule- 2000, Torrens 2015
- Evidence that Fractures of Dominant UE negatively impact HRQL-Beaule- 2000, Slutsky 2005
- Throwing athletes & clinical measures
- Cvetanovich et al (2015)- TSA & extremity dominance

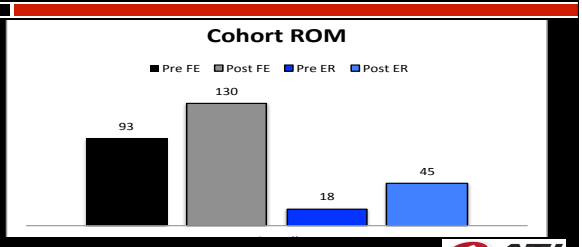
Questions

- Does ROM recover differently in patients having D TSA vs ND TSA?
- Do patients undergoing D arm TSA present with poorer outcomes @ 2 years post arthroplasty than those undergoing ND TSA?
- Does having TSA on the D arm impact the patients ability to RTS?

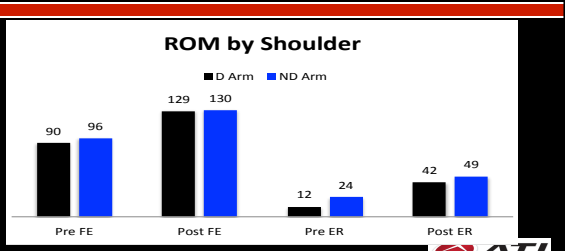
Methods

- Data collected prospectively
  - 60 patients- TSA within 1 year
  - 44 patients available @ 2 year follow up
  - 32 females & 12 males
- Cohort divided-21 D TSA & 23 ND TSA
- 2 year shoulder specific outcome measures
  - Penn; ASES shoulder score & SANE

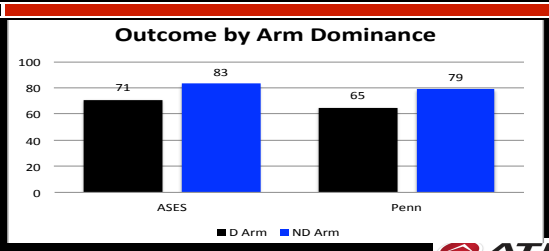
Our experience…



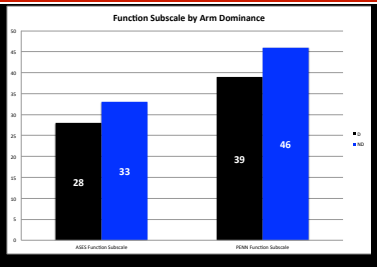
Does ROM recover differently in patients having D TSA vs ND TSA?



Do patients undergoing D arm TSA present with poorer outcomes?

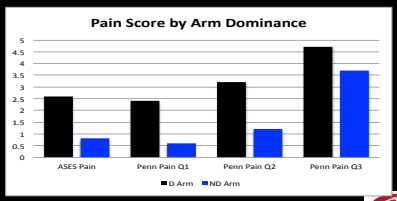


Do patients undergoing D arm TSA present with poorer outcomes @ 2 years?



Big Difference in D vs ND arm

NOT ROM or Function…..



⇧ Patients want ⇧activity Level

SPORT OUTCOMES

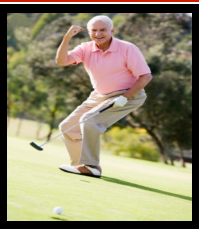
52 -89% RTS*

TYPES OF SPORT - VARIABLE

SURGEON OPINION

Low Load

Does having TSA on the D arm impact the patients ability to RTS?



Pre Op ROM
- FE < 90- NO
- ER ≤ 0- YES, but OH

Arm Dominance- NO

Resiliency score (< 17)
- 6.7 x's > odds px RT usual sport

Subjectively, reason for not RTS

Limitations in ROM
Limitations in strength
Limitations secondary to pain

Discussion

- Our cohort demonstrated similar post operative ROM regardless of arm dominance
- ≅ ROM approx 10°different for both FE &ER comparing D & ND TSA @ 1-9 years post operatively (Cvetanovich CORR 2015)
  - Pre operative ROM between cohorts similar for FE but not ER

Discussion

- Our cohort - 2 year outcomes scores for ASES, PENN, and SANE regardless of arm dominance
  - Statistical- Trend
  - Clinically- Different
- Similar 2 year functional scores for ASES, SST, and VAS regardless of arm dominance @ 1-9 years post operatively (Cvetanovich CORR 2015)

Discussion

- ASES & PENN pain scores- significant difference with consistently > pain when the D shoulder was replaced
- This finding agrees with 2010 JSES study of pts with Rotator cuff pathology noting a strong association between pain and dominant hand pathology (Kenner 2010)

More Questions

- Mirror others experience?
- Are patient expectations different based on Arm Dominance?

@EShan327

QUESTIONS?

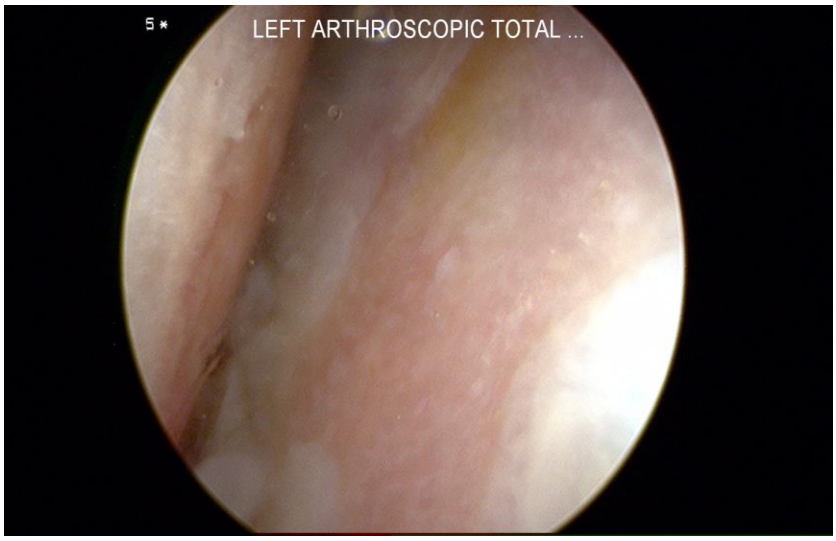
proaxistherapy

BACKGROUND: Glenohumeral arthritis in the young or active patient is a challenging problem. Previously options have included joint debridement and capsular release, humeral hemiarthroplasty with interposition arthroplasty of the glenoid side and, finally, total shoulder arthroplasty. Total shoulder arthroplasty has been by far the most consistent procedure in terms of pain relief and improved function, however, in the younger or more athletic patient, concerns about glenoid problems down the road limit its usefulness for a young or very athletic population. In recent years humeral arthroplasty with some type of biological glenoid resurfacing has been performed more, however, recent papers show high clinical failure rate at intermediate follow-up. This has led some investigators to recommend humeral head arthroplasty only. A review of the literature shows poor consensus regarding management of glenohumeral arthritis in a young or active patient and treatment options continue to evolve. This case study presents an uncommon method for management involving osteochondral allograft of both the humeral and glenoid sides.

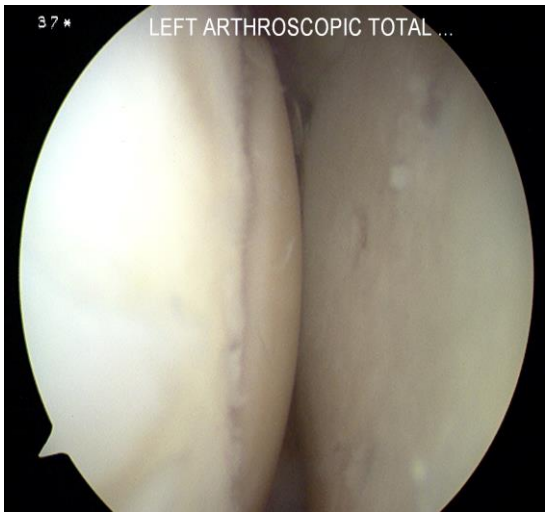
SUBJECT: The patient was a 59-year-old very active male physician. He was a collegiate swimmer and continued to swim throughout his adult life and also lifted weights. As his shoulder OA progressed over the last several years he was exploring his options and came across this particular surgical procedure and after consulting with Dr. Thomas Kovac, DO, he decided to go forward with the procedure. To the best of our knowledge, the only other place this procedure has been performed has been at The Cleveland Clinic with Dr. Reuben Gobezie.

METHODS: The surgery was performed arthroscopically and, while he had other procedures performed at that time, such as some capsular releases, MUA and subpectoral tenodesis, the primary part of the procedure was a biological total shoulder replacement using osteochondral allograft humeral head and allograft from the tibial plafond for the glenoid component. This procedure was performed through the rotator interval so there was no violation of the rotator cuff musculature which allowed for earlier rehab.

Initial findings



Post Op



The patient was kept in a sling for 4 weeks and he was not allowed to externally rotate beyond neutral for that 4 weeks to prevent sheer stress across the glenohumeral surfaces. He was also not allowed to have any type of closed kinetic chain strengthening or joint compression activities for 8 weeks post-operatively.

One month before surgery he had no pain at rest, however, he had 3-5/10 pain with any activities involving elevation of the shoulder. He was still lifting weights as best he could with significant modifications. He had 145 degrees of passive functional elevation and 65 degrees of external rotation at 90 degrees of abduction. In standing he had 90 degrees of active functional elevation with significant compensation and IR-ADD was to the back pocked. His pre-operative PENN shoulder score was 52/100 and his DASH was 41.
His first post-op visit was 2 weeks after surgery. At that point he had 0/10 pain

at rest although he had significant night pain. He had 90 degrees of passive functional elevation and on that initial evaluation we started him off on Phase I gentle range of motion exercises and he was performing them 4 times per day. He was seen on a QW basis and one week after the initial evaluation he had 125 degrees of passive functional elevation. We took him out of his sling at 4 weeks post-op and progressed into some Phase II cane and pulley exercises, as well as some light short arc Theraband strengthening. At 4 weeks post-op he had 40 degrees of external rotation in neutral, 60 degrees when measured at 90 degrees of abduction, and 160 degrees functional elevation passively. Actively he could elevate to 110 degrees with minimal scapular substitution. By 6 weeks post-op he had almost full passive functional elevation and his external rotation at 90 degrees of abduction was 75 degrees, compared to 95 on the uninvolved side. Manual muscle testing in the neutral position was quite strong and not pain provocative. At that point we had him start to work on some very light weights for standard rotator cuff/scapular stabilizer strengthening and he did quite well. At 10 weeks post-op I met him at his gym and we went over how he could utilize some of the machines in the gym, with modifications, in addition to his previously given rotator cuff/scapular stabilizer strengthening exercises. At that point he had 150 degrees functional elevation in standing and passively he had 170 degrees functional elevation and 85 degrees external rotation. His last formal physical therapy visit was at 16 weeks post-op and he was doing quite well. He had a little bit of tightness with passive external rotation at 80 degrees when measured at 90 degrees of abduction but he felt that he had functional motion in all planes and was pleased with his result at that point.

RESULTS: Currently, this patient has returned to swimming and light weight-lifting and feels like his shoulder is at least 95% back to normal and he continues to work on a home program of stretching and light strengthening. His final PENN shoulder score was 99/100 and DASH was 3.

CONCLUSION AND DISCUSSION: This patient is only 1½ years out from surgery but the initial results are very encouraging. This method appears to be very infrequently performed and it is my understanding that the Cleveland Clinic physician has now stopped performing it and is trying other methods.

BIOLOGICAL RESURFACING OF THE GLENOHUMERAL JOINT: A CASE REPORT

Mark E Ramsey, PT, OCS, CHT

BACKGROUND AND PURPOSE: Biological resurfacing of the glenohumeral joint has had limited success up to this point. Previous cases have shown high failure rate at intermediate follow-up. This case involved osteocartilaginous allograft of both the glenoid and humeral head.

SUBJECT: This patient is a 59-year-old active male who is generally quite athletic and healthy and had a long-standing history of high mileage swimming and weight-lifting throughout his life.

METHODS: Patient underwent left shoulder arthroscopy with biological total shoulder replacement using fresh allograft humeral head and fresh allograft from distal tibial plafond. He also underwent open proximal biceps tenodesis, capsular releases and MUA, synovectomy, and subacromial decompression. The patient was rehabilitated with infrequent visits in the clinic and in consultation with his referring surgeon.

RESULTS: The patient was discharged with full range of motion and excellent strength and subjectively feels 95 percent back to a completely normal shoulder and is swimming and lifting weight with no complaints of pain.

CONCLUSION AND DISCUSSION: Although this case is only 1½ years out from surgery, the initial results are highly encouraging and this resurfacing method appears to be very infrequently performed based on our literature search and discussions with other orthopedic surgeons.

Primary Glenohumeral Instability Resulting in Secondary Frozen Shoulder: A Case Study

Martin J. Kelley, PT, DPT, OCS
Good Shepherd Penn Partners

History

- 32-year-old female who sustained a traumatic anterior dislocation when falling down the steps
- History of one-time traumatic dislocation 10 years previously with no subsequent events
- The shoulder was reduced in the emergency room and she was placed in a sling
- She saw an orthopedic surgeon two weeks post injury and began physical therapy 4 weeks post injury
- Considering Bankart repair

Examination

- IE (4 weeks post dislocation)
- Range of motion

	ER-20°	Elevation	ER-90°	IR
AROM	15	65	unable	Lower buttocks
PROM	15	70	unable	Lower buttocks

- Strength

	ER	IR	FE
Right	4/5	4-/5	3+/5
Left	5/5	5/5	5/5

- Penn shoulder score

  37/100 (pain-10/satisfaction-0/function-27)

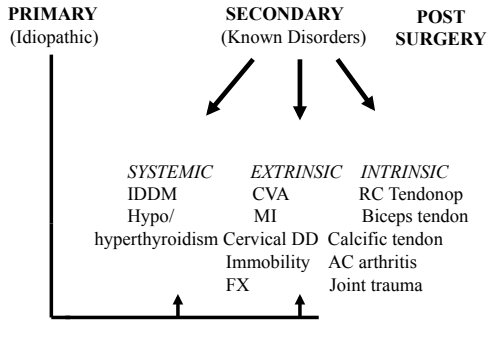
Intervention

- The patient was seen 6 times over 5 weeks doing ROM exercises with emphasis on scapular muscle activation and glenohumeral strengthening into extension

Physician Assessment

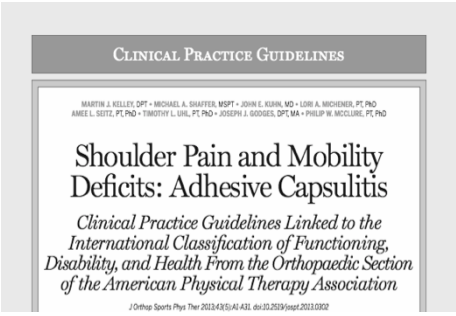
- Concerned about lack of progress
- Developed a secondary frozen shoulder and he felt range of motion should be emphasized
- Still considering surgery but sent to another physical therapist due to excessive stiffness

Frozen Shoulder/Adhesive Capsulitis



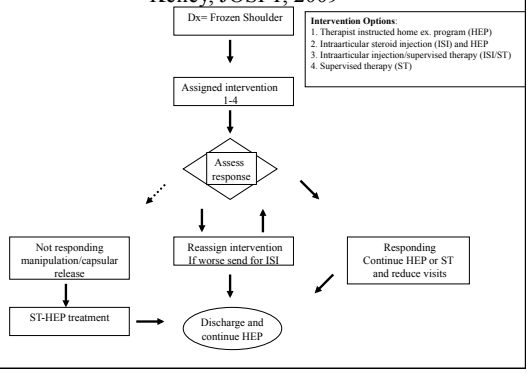
Interventions

- What is the evidence



Kelley, JOSPT- 2013

Frozen Shoulder Algorithm
Kelley, JOSPT, 2009



Examination

- New therapist IE (10 weeks post dislocation)
- Range of motion

	ER-20°	Elevation	ER-90°	IR	IR @ 45
AROM	5	90 w/sub	45 POS	L5	----
PROM	15	80	30	L4	20

- Strength

	ER	IR	FE
Right	4/5	4/5	4-/5
Left	5/5	5/5	5/5

- Penn shoulder score

  36/100 (pain-10/satisfaction-0/function-26)

Intervention

- Heat combined with external rotation stretch
- ROM/Pulley
- Joint mobilization, grade II – IV

  Used sequence of:

  - hold relax technique
  - mobilize
  - movement with mobilization
- Soft tissue mobilization of rotator cuff, deltoid and pectoral muscles
- Mid-range to end range neuromuscular education

Response to Treatment

- The patient was seen 7 times over 4 weeks
  - Active forward elevation-100 °
  - External rotation at 90° (POS) to 55
  - Functional internal rotation was to L3

Decision-making

- Spoke to surgeon after three weeks (@ 13 weeks post injury) of treatment with concerns:
  - significant established contracture
  - impairments with self-care and functional activity
- Discussed the possibility of a capsular release otherwise recovery would be extremely slow
- The patient, therapist and surgeon decided a capsular release was appropriate even with primary glenohumeral instability

Surgery

- Capsular release was performed with 360° release
- The surgeon was concerned about primary instability so did a repair of the inferior glenohumeral ligament- this is unusual

Post-surgery Intervention

- Therapy is typically scheduled the same day as surgery so that the therapist can assess range of motion while the brachial plexus block is still in effect
- Unfortunately patient discharged from SPU to late.

Examination- 1 Day Post-op

- Range of motion

	ER-20°	Elevation	ER-90°	IR @ 45
Pre-Tx PROM	10	100	40 POS	**20**
Post –Tx PROM	20	135	60POS	30

Intervention

- Continued emphasis on joint mobilization
- Passive range of motion
- Progressive active assistive and active range of motion
- The patient was seen 4 days a week and continue to perform HEP (similar to Watson, JSES, 2000)

Response to Treatment

- No response after 2 weeeks
- Exact same motion as pre-release but **less** discomfort/muscle guarding and firm end feel
- This is very unusual post release Le Lievre- JBJS, 2013Waston-JSES, 2000
- Appeared to be related to repair of inferior glenohumeral ligament

Post-op day 2

Post-op day 6

Decision-making

- It was a again clear that recovery would be protracted
- Decision to perform closed manipulation
- Because of poor response post release we required her to start home CPM for six hours a day and physical therapy daily
- CPM representative and therapist discussed range of motion settings

Post-manipulation Examination

- Patient could not be dislocated on the OR table
- Range of motion assessed under brachial plexus block.

	ER-20°	Elevation	ER-90°	IR	IR @ 90
PROM	60	165	90POS 75Cor	NT	60

Intervention

- CPM same day surgery and for 7 days
- The patient was see 4X a week for 2 weeks and then 3 x a week for 2 weeks.

Intervention

- Initial and progressive settings:
  - 130 POS abduction/30 ER → 145/40 → 155/60 as tolerated
  - 6 hours a day
  - Perform Phase 1 and 2 ROM (10 sec x 10, 1-3 x a day)
  - Pulley (15 sec x 10, 3 x a day)

Intervention

Supervised therapy

- Joint mobilization
- Therapeutic ex- ROM
- NM education
- Strengthening with bands and weights
- Basketball dribble/Plyoball

Examination

- 5 weeks post manipulation
- Range of motion

	ER-20°	Elevation	ER-90°	IR	IR @ 90
AROM	65	150 - 165	90	T 10-T9	----
PROM	70	160-165	90cor	T8	45

- Strength

	ER	IR	FE
Right	4/5	4+/5	4/5
Left	5/5	5/5	5/5

- Penn shoulder score

  73/100 (pain-23/satisfaction-6/function-44)

Discharge- Examination

- 8 weeks post manipulation- (24 visits from release, 13 from manipulation)
- Range of motion

	ER-20°	Elevation	ER-90°	IR	IR @ 45
AROM	80	170	95	T8	----
PROM	80	170	90cor	T7	65

- Strength- Hand Held Dynamometry

	ER	IR	FE
Right (#) Involved	14.7	28.2	21.9 (31% deficit)
Left (#)	15.8	32.8	31.5

- Penn shoulder score

  81/100 (pain-26/satisfaction-8/function-47)

Discharge

Summary

- This was a challenging patient demonstrating both glenohumeral instability and secondary recalcitrant frozen shoulder
- She did not respond to the capsular release but probably related to IGHL repair
- Had a positive response to the manipulation without instability
- By acting as a team (patient, surgeon and therapist), appropriate decision-making was achieved resulting in an excellent outcome in a reasonable timeframe

Targeted Pain Education as an Adjunct to Traditional Multimodal Interventions in a Patient with Persistent Shoulder Pain

Craig Wassinger
Chris Wolbert

DEPARTMENT of PHYSICAL THERAPY
College of Clinical and Rehabilitative Health Sciences
EAST TENNESSEE STATE UNIVERSITY

Physical Therapy Services Inc.

Pain

- Pain is the primary reason why patients seek medical care
- Chronic pain affects ~100 million Americans
- Cost of chronic pain is exceedingly high (~635B)
- Most common areas for musculoskeletal pain: back, neck, knee, shoulder

Introduction

AAPM, Gereau 2014

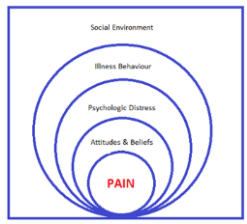
Persistent Shoulder Pain

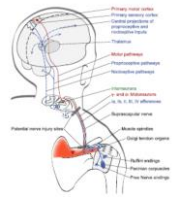
- Predictors associated with persistent shoulder pain
  - Manual labor, heavy loading
  - Overhead occupational exposure
  - Monotonous work
  - Initial pain intensity
  - Length of time in pain prior to treatment
  - Pain catastrophizing
  - Psychological complaints (stress, anxiety, etc.)

Introduction

Kuijpers 2004, 2007
George 2008
Fletcher 2015
Mayer 2012
Harkness 2003

Biopsychosocial Model





Introduction

Gifford, 1998

Treatment for Shoulder Pain

- Multimodal interventions addressing tissues contribution are generally utilized in rehab of musculoskeletal (shoulder) pain
- The role of thoughts, beliefs, and emotions are less often formally included in rehab programs by PT, OT, ATC
- Given complex nature of contributors to chronic pain, a more holistic approach to treatment may benefit these patients
  - Psychologically informed treatment

Introduction

Nicholas, 2011
McClure, 2015
Michener, 2003

Psychologically Informed Treatment

- Context: the notion that the treatment is not directed solely at [shoulder] pain and possible musculoskeletal contributors but also considers the person who has the [shoulder] pain, contextual factors, and their combined contribution to the problem before developing an intervention plan

Treatment Components:

- Patient Education:
  - Pain Neuroscience Education
  - Activation Philosophy
- Graded Activity/Exposure:
  - Planned hierarchical progression of increased activity or exercise

Nicholas, 2011

Educational Interventions

- Neuroscience Pain Education: clinical intervention that attempts to change how patients perceive their pain
- Activation Philosophy: a general recommendation for resuming normal activities and advice that it was safe

Nicholas, 2011
Louw, 2013
Moseley, 2002

Introduction

Neuroscience Pain Education: Contents

- Neurophysiology of pain
- Nociception and nociceptive pathways
- Neurons
- Action potentials
- Spinal inhibition and facilitation
- Peripheral and/or central sensitization
- Plasticity of the nervous system
- Role of environment on pain
- No reference to anatomic or pathoanatomic models
- No discussion of emotional or behavioral aspects of pain

Louw, 2011

Introduction

Evidence

- A recent systematic review has indicated that pain neuroscience education has been shown to have positive effects on pain, disability, catastrophization and physical performance in:
  - Low back pain
  - Chronic Fatigue Syndrome
  - Whiplash Associated Disorders
- The purpose of this case study is to describe patient management and clinical reasoning of a patient seeking treatment for persistent shoulder pain using therapeutic neuroscience pain education

Louw, 2011

Introduction

Case Description

History

- 60 year old, female
- Retired teacher, fixed income
- 5 month history shoulder pain following a FOOSH mechanism (ND shoulder)
- Increasing pain over the past month with decreased/modified physical activities
- MRI: Posterior/superior SLAP

PMH

- MI- 3 years prior
- Hypertension
- OA
- DM type II
- Crohn's disease
  - Recent flair up

Meds

- Amlodipine
- Aspirin
- Losartan
- Humalog
- Metformin
- Lantus

Introduction > Case Description

Physical Examination

QuickDash Score	Level of Difficulty	Functional Outcome
1 Up to 11	No difficulty	Excellent
2 12-22	Mild difficulty	Good
3 23-33	Moderate difficulty	Fair
4 34-44	Severe difficulty	Poor
5 45-55	Unable	Disable

vere screened and cleared **

Introduction > Case Description

Diagnosis, Prognosis, & Goals

Diagnosis

- SLAP tear
- Frozen shoulder?
- Moderate irritability

Prognosis

- Good → Fair
- 2x/week, 4 weeks

PT Goals

- Improve QuickDASH <15%
- Decrease max pain <3/10
- Improve pain free AROM to allow normal dressing and grooming

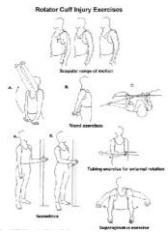
Patient Goals

- Pain free use of her shoulder
- Avoid surgery

Introduction > Case Description

Interventions

- Initiated generic cuff program
  - UBE
  - Cuff isometrics
  - Scapular mobility, retraction
  - Education
    - Postural
    - Utilization of arm within pain limits
    - Role of PT vs surgery
  - Game Ready, E-Stim



McClure, 2015

Progression (Lack of)

- Patient had minimal change in symptoms over 3 weeks
- Some cues became apparent that additional psychosocial factors may be involved
  - Frustration with lack of improvement
  - Concern for $ for PT and impending surgery
  - Decreased use of arm at home has not changed symptoms

3 Week Progress

Outcomes	Eval	3 weeks
QuickDASH	30%	25%
Rest Pain	1	1
Max Pain	5	6
Primary Complaint	Reaching Back	Reaching Back Overhead

- **Fear Avoidance Beliefs Questionnaire:** Patient's fear-avoidance beliefs about physical activity that may affect and contribute to his/her pain and resulting disability.
  - High: >62.5%
  - Low: ??
- **Pain Catastrophizing Scale:** Seeks patients impression of how pain affects them in 3 main areas (rumination, magnification, & helplessness)
  - High: >44%
  - Low: <17%
  - High/Low 24%

George, 2006
Grotle, 2012
Archer, 2013

Neuroscience Pain Education

- Neurophysiology of pain
- Nociception and nociceptive pathways
- Neurons
- Action potentials
- No reference to anatomic or pathoanatomic models
- No discussion of emotional or behavioral aspects of pain
- Spinal inhibition and facilitation
- Peripheral and/or central sensitization
- Plasticity of the nervous system
- Role of environment on pain

- ~1 hour pain neuroscience educational session
  - Q & A
- Preplanned powerpoint presentation related to the patient
- Relayed in stories and metaphors to allow understanding
- Added treadmill walking to ther ex

Louw, 2011 & 2013

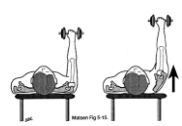
4 Week Outcomes

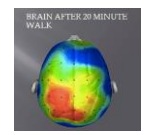
Outcomes	Eval	3 weeks	4 weeks	1 Week Change	4 Week Change
QuickDASH	30%	25%	10%	15%	20%
Rest Pain	1	1	0	1	1
Max Pain	5	6	3	3	2
Primary Complaint	Reaching Back	Reaching Back Overhead	Reaching Back	-	-
FABQ-PA	-	75%	41%	34%	-
PCS	-	44%	17%	21%	-

** Self-discharged at 4 weeks**

Discussion

- The pain neuroscience education in addition to the traditional exercise regime had a strong and positive effect on the functional and pain related outcomes used for this patient





Critical Education

- Neurophysiology of pain/Role of environment on pain: Contextualization of physical and emotional environment on pain

Introduction > Case Description > Discussion

Reflection on Treatment Approach

History

- 60 year old, female,
- Retired teacher, fixed income
- 5 month history shoulder pain following a FOOSH mechanism,
- Increasing pain over the past month with decreased/modified physical activities
- MRI: Posterior/superior SLAP

PMH
- MI- 3 years prior
- Hypertension
- OA
- DM type II
- Crohn's disease
  Recent flair up

Meds
- Amlodipine
- Aspirin
- Losartan
- Humalog
- Metformin
- Lantus

PLUS
- Anxiety about being seen in PT clinic
- Caring for her sick mom
- Increase in pain with holidays
- PCS score
- FABQ-PA score

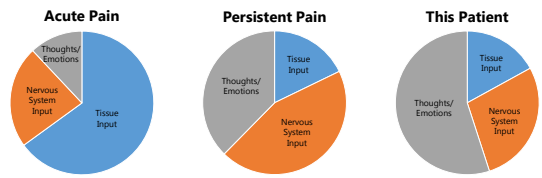
Introduction > Case Description > Discussion

Persistent Shoulder Pain

- Predictors associated with persistent shoulder pain
  - Manual labor, heavy loading
  - Overhead occupational exposure
  - Monotonous work
  - Initial pain intensity
  - Length of time in pain prior to treatment ✔
  - Pain catastrophizing ✔
  - Psychological complaints (stress, anxiety, etc.) ✔

Introduction > Case Description > Discussion

Theoretical Contributions to Pain



Introduction > Case Description > Discussion

Limitations

- The exact cause for the change in the patients symptoms is unknown
- Likely both pain neuroscience education and exercise treatments helped in the patients recovery
- Future studies should assess the role of psychologically informed treatment approaches on outcomes in (shoulder) patients with chronic and acute pain

Introduction > Case Description > Discussion

Conclusion

- This case study details the immediate and positive changes in pain, disability and function when pain neuroscience education is added to traditional shoulder rehab in a patient with persistent shoulder pain
- The outcomes suggest that pain neuroscience education may be of benefit to certain patients with persistent (shoulder) pain
- Earlier consideration of utilizing psychologically informed treatments may have helped this patient sooner

Introduction > Case Description > Discussion > Conclusions

Thanks Yawl!

References

- Kuijpers T, van der Windt DA, van der Heijden GJ, Bouter LM. Systematic review of prognostic cohort studies on shoulder disorders. Pain. 2004;**109**(3):420-31.
- Kuijpers T, van der Windt DA, van der Heijden GJ, Twisk JW, Vergouwe Y, Bouter LM. A prediction rule for shoulder pain related sick leave: a prospective cohort study. BMC musculoskeletal disorders. 2006;**7**(1):97.
- George SZ, Wallace MR, Wright TW, et al. Evidence for a biopsychosocial influence on shoulder pain: pain catastrophizing and catechol-O-methyltransferase (COMT) diplotype predict clinical pain ratings. Pain. 2008;**136**(1):53-61.
- Fletcher D, Stamer UM, Pogatzki-Zahn E, et al. Chronic postsurgical pain in Europe: An observational study. European Journal of Anaesthesiology (EJA). 2015;**32**(10):725-34.
- Harkness E, Macfarlane G, Nahit E, Silman A, McBeth J. Mechanical and psychosocial factors predict new onset shoulder pain: a prospective cohort study of newly employed workers. Occupational and Environmental Medicine. 2003;**60**(11):850-7.
- Mayer J, Kraus T, Ochsmann E. Longitudinal evidence for the association between work-related physical exposures and neck and/or shoulder complaints: a systematic review. International archives of occupational and environmental health. 2012;**85**(6):587-603.

References

- Nicholas MK, George SZ. Psychologically informed interventions for low back pain: an update for physical therapists. Physical therapy. 2011;**91**(5):765-76.
- Michener LA, McClure PW, Karduna AR. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. Clin Biomech (Bristol, Avon). 2003 Jun;**18**(5):369-79.
- McClure PW, Michener LA. Staged Approach for Rehabilitation Classification: Shoulder Disorders (STAR–Shoulder). Physical therapy. 2015;**95**(5):791-800.
- Louw A, Butler DS, Diener I, Puentedura EJ. Development of a preoperative neuroscience educational program for patients with lumbar radiculopathy. American Journal of Physical Medicine & Rehabilitation. 2013;**92**(5):446-52.
- Moseley L. Combined physiotherapy and education is efficacious for chronic low back pain. Australian Journal of Physiotherapy. 2002;**48**(4):297-302.
- Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. Archives of physical medicine and rehabilitation. 2011;**92**(12):2041-56.
- Gifford L. Pain, the tissues and the nervous system: a conceptual model. Physiotherapy. 1998;**84**(1):27-36.

References

- George, Steven Z, Fritz, Julie M, & McNeil, Daniel W. (2006). Fear-avoidance beliefs as measured by the fear-avoidance beliefs questionnaire: change in fear-avoidance beliefs questionnaire is predictive of change in self-report of disability and pain intensity for patients with acute low back pain. The Clinical journal of pain, 22(2), 197-203.
- Grotle, Margreth, Garratt, Andrew M, Jenssen, Hanne Krogstad, & Stuge, Britt. (2012). Reliability and construct validity of self-report questionnaires for patients with pelvic girdle pain. Physical therapy, 92(1), 111-123.
- Archer KR, Motzny N, Abraham CM, et al. Cognitive-Behavioral–Based Physical Therapy to Improve Surgical Spine Outcomes: A Case Series. Physical therapy. 2013;**93**(8):1130-9.
- Gereau RW, Sluka KA, Maixner W, et al. A pain research agenda for the 21st century. The Journal of Pain. 2014;**15**(12):1203-14.

FABQ

Name: _____ Date: _____

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your ~~back~~ shoulder pain.

	COMPLETELY DISAGREE			UNSURE			COMPLETELY AGREE
1. My pain was caused by physical activity	0	1	2	3	4	5	6
2. Physical activity makes my pain worse	0	1	2	3	4	5	6
3. Physical activity might harm my ~~back~~ shoulder	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse	0	1	2	3	4	5	6

Pain Catastrophizing Scale

PCS

Client No.: _____ Age: _____ Sex: M(__) F(__) Date: _____

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain:

0 – not at all 1 – to a slight degree 2 – to a moderate degree 3 – to a great degree 4 – all the time

When ***I'm in pain*** **…**

- I worry all the time about whether the pain will end.
- I feel I can't go on.
- It's terrible and I think it's never going to get any better.
- It's awful and I feel that it overwhelms me.
- I feel I can't stand it anymore.
- I become afraid that the pain will get worse.
- I keep thinking of other painful events.
- I anxiously want the pain to go away.
- I can't seem to keep it out of my mind.
- I keep thinking about how much it hurts.
- I keep thinking about how badly I want the pain to stop.
- There's nothing I can do to reduce the intensity of the pain.
- I wonder whether something serious may happen.

Treatment of Upper Extremity Phantom Limb Pain

Todd Hooks PT,ATC,OCS,SCS,CMTPT,CSCS, N-REMT1,FAAOMPT

Thanks

- ASSET
- Kellie Bliven
- Tim Uhl
- Steve Thomas

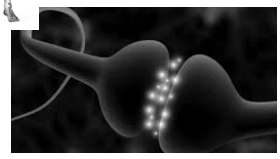
Patient c/o and Presentation & Goals of Treatment

- Decrease Flexibility
- Decrease Strength
- Decrease Function
- PAIN

Patient Assessment/Evaluation

- Strength
- ROM
- Palpation
- Joint Assessment
- Special Tests
- R/I and R/O spine
- What about assessment of muscular tissue

Assessment and Treatment



Manual Therapy 14 (2009) 531–538

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original Article

The mechanisms of manual therapy in the treatment of musculoskeletal pain: A comprehensive model

Joel E. Bialosky [a,*], Mark D. Bishop [a], Don D. Price [b], Michael E. Robinson [c], Steven Z. George [a]

- Manual therapy likely works through biomechanical and neurophysiological mechanisms. A limitation of the current literature is the failure to acknowledge the potential for a combined effect of these mechanisms.

Myofascial Trigger Points

-
  -
    and chronic pain
  - Constitute one of the most common musculoskeletal pain conditions
  - Acute pain following exercise or sports participation may be due to painful MTrPs
  - Muscles feature nociceptors
    -

Hidalgo-Lozano et al: Exp Brain Res
Mense: J Musculoskelet Pain 2010, J Appl Physio 2003
Hendler & Kozikowski: Psychosomatics 1993

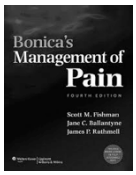
Muscle Pain in History

- French physician Guilluame de Baillou (1538-1616) published "Liber de Rheumatismo" "muscular rheumatism"
- Thomas Sydenham (1624-1689), the "Father of English Medicine" published "Observations Medicae" in 1676: "Rheumatism"

- British physician Balfour (1816): "patients as having a large number of nodular tumours and thickenings which were painful to the touch, and from which pains shot to neighbouring parts"

Characteristics of Muscle Pain

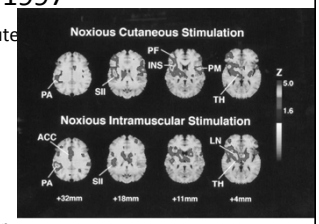
- Aching, cramping pain, difficult to localize and referred to deep somatic tissue
- Muscle pain activates unique cortical structures



- Dommerholt, Shah. "Myofascial Pain Syndrome". In: Ballantyne JC, Rathmell JP, Fishman SM. Eds. Bonica's Pain Management, 4th ed. 2010.

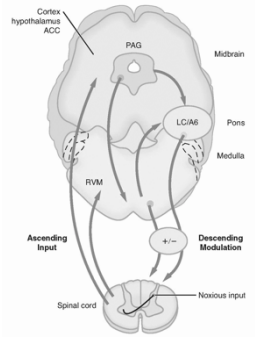
Svensson: J Neurophysiol. 78:450-60, 1997

- Cerebral processing of acute skin and muscle pain in humans
- Myofascial Pain:
  - cortex/periaquaductal gray (PAG)
  - Associated w/ affective-emotional pain component and w/ heightened attention to painful stimulus
- Cutaneous Pain:
  - No involvement of the anterior cingular cortex



Central Sensitization

- Disinhibition is a major mechanism for triggering and maintaining central sensitization



Criteria to diagnosis MTrPs

- Taut band palpable
- Exquisite spot tenderness in a taut band (may or not be nodular)
- Reproduction of familiar pain
- Gerwin: Interrater reliability in myofascial trigger point examination. Pain 1997;69:65-73.

Reliability of Assessing for MTrPs

- Al-Shenqiti, Oldham. Clin Rehabil. 2005;19:482-7
- 58 pts dx with RC tendonitis
- Test-retest reliability
- Taut band, spot tenderness, jump sign, and pain recognition – kappa values 1
- Referred pain – Kappa ranged 0.79 and 0.88
- LTR – 0.75 and 1

Twitch Response

Lucas et al: Clin J Pain. 2009;25:80-89.

A Systematic Review of the Literature

Nicholas Lucas, BSc, MHSc, MPainMed† Petra Macaskill, BA, MAppStat, PhD,† Les Irwig, MBBCH, PhD,† Robert Moran, BSc, MHSc,‡ and Nikolai Bogduk, MBBS, PhD, MD, DSc§*

- Data on the reliability of physical examination for trigger points are conflicting and physical examination cannot currently be recommended as a reliable test for the diagnosis of trigger points
- Examiners are not representative of those who would normally use the test in practice
- Evidence for the diagnostic reliability of TrPs is available from only a limited number of studies
- Because there is no accepted reference standard for TPs, physical examination findings cannot yet be validated, even though they may be shown to be reliable

Manual Therapy 16 (2011) 136–140

Contents lists available at ScienceDirect

Manual Therapy

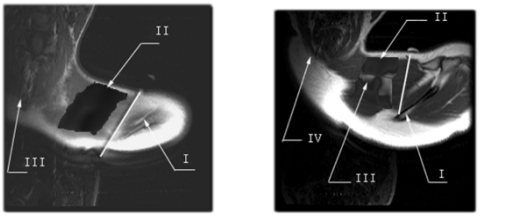
journal homepage: www.elsevier.com/math

Original article

Standardized manual palpation of myofascial trigger points in relation to neck/shoulder pain; the influence of clinical experience on inter-examiner reproducibility

Corrie Myburgh [a,*], Henrik Hein Lauridsen [a,b], Anders H. Larsen [c], Jan Hartvigsen [a]

- Identification of clinically relevant TrP(s) in the region of the upper trapezius musculature is a reproducible procedure.
- When performed by two experienced clinicians, agreement is substantial.
- A pairing of one experienced and one inexperienced observer, both of who have undergone a standardization protocol, can yield moderate agreement.



23 y.o. - Non MPS 28 y.o. - MPS

- Chen Q, Bensamoun SF, Basford JR, Thompson JM, An KN. Identification and Quantification of Myofascial Taut Bands with Magnetic Resonance Elastography. *Arch Phys Med Rehab* **2007**, 88:1658-61.
- Chen Q, Basford JR, An KN. Identification of Myofascial Taut Band Using Magnetic Resonance Elastography. *Clin Biomech* **2008**, 23 : 623-9.

Visible nodule

Sikdar S, et al. Novel Applications of Ultrasound Technology to Visualize and Characterize Myofascial Trigger Points and Surrounding Soft Tissue *Arch Phys Med Rehabil.* 2009;90:1829-38

Characteristics of MTrPs

- Active
  –
- Latent
  –
- Cause allodynia at the TrP
  –
- Hyperalgesia
  – Exaggerated reaction to painful stimulus
- MTrPs can be a constant source of nociceptive input

Giamberadino: J Pain 2007

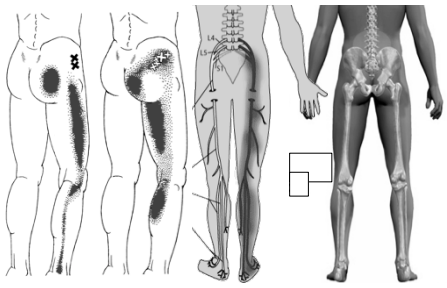
MRI findings

- Weiner and Patel: JOSPT 2008
  – Prospectively evaluated the MRIs of 50 patients undergoing lumbar microdiscectomy
  – Sensitivity 72%, Specificity 68%, 70% accurate in detecting containment of lumbar herniated disc
  – 28% false positives
  – 33% false negatives

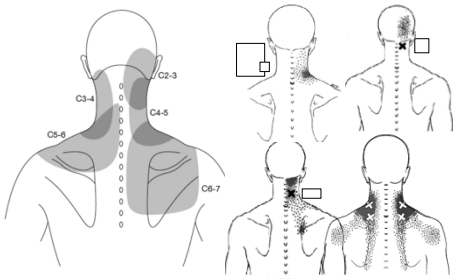
Brinjikji et al: Am J Neuroradiol 2014

- Prevalence of disk degeneration in asymptomatic individuals increased from 37% of 20 y/o to 96% of 80 y/o
- Disk protrusion prevalence increased from 29% of those 20 years of age to 43% of those 80 years of age

Radiculopathy? MTrP referred pain? Both?



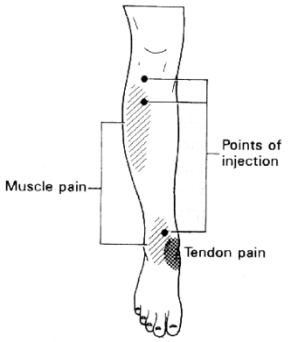
Facet joint? Trigger point? Both?

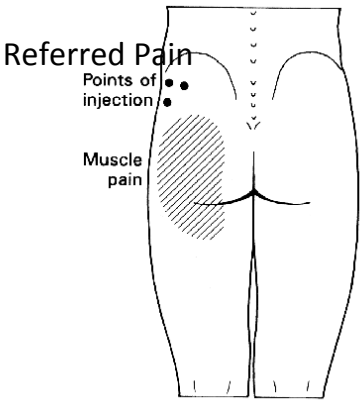


Bogduk, N. and Simons, D.G., Neck pain: joint pain or trigger points, in Progress in fibromyalgia and myofascial pain, H. Vaeroy and H. Merskey, Editors., Elsevier: Amsterdam. 1993; 267-273.

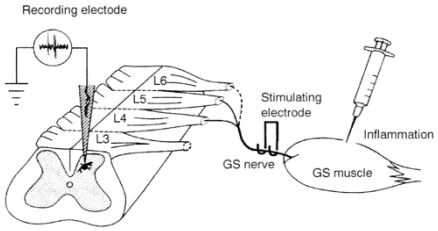
Referred Pain

J.H. Kellgren, Clinical Science, vol.3.pp 175-190© 1938

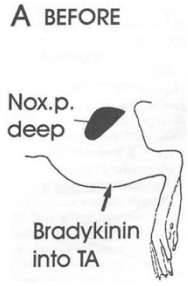




Modified Convergence Projection Theory
Siegfried Mense, MD, PhD



Expansion of Receptive Field

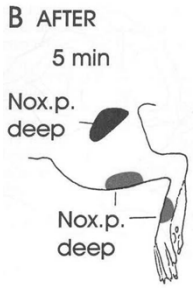


Selected neuron responds only to deep pressure in biceps femoris muscle

Hoheisel U, Mense S, Simons DG. Appearance of new receptive fields in rat dorsal horn neurons following noxious stimulation of skeletal muscle: a model for referral of muscle pain?

Neurosci lett 153:9-12, 1993

Expansion of Receptive Field

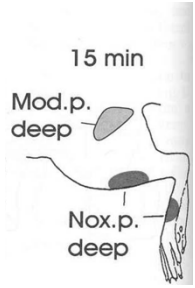


5 min after BK injection in tibialis anterior, the neuron can now be excited by additional RF's located in deep muscle that normally have high threshold

Hoheisel U, Mense S, Simons DG. Appearance of new receptive fields in rat dorsal horn neurons following noxious stimulation of skeletal muscle: a model for referral of muscle pain?

Neurosci lett 153:9-12, 1993

Expansion of Receptive Field

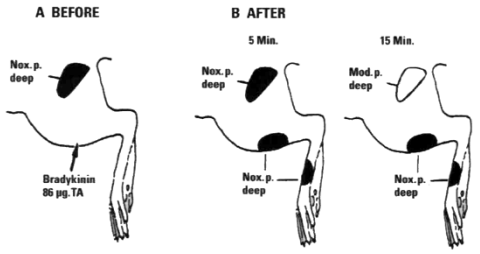


15 min after BK injection the neuron responds to moderate (*innocuous*) pressure in its original receptive field - biceps femoris

Hoheisel U, Mense S, Simons DG. Appearance of new receptive fields in rat dorsal horn neurons following noxious stimulation of skeletal muscle: a model for referral of muscle pain?

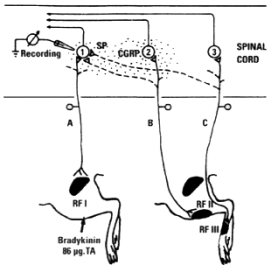
Neurosci lett 153:9-12, 1993

Referred Pain



Mense, S. in: APS Journal, 3(1), 1994, 1-9

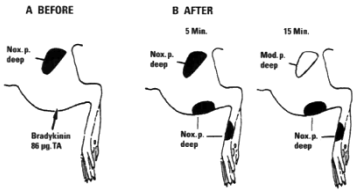
Referred Pain



Mense, S. in: APS Journal, 3(1), 1994, 1-9

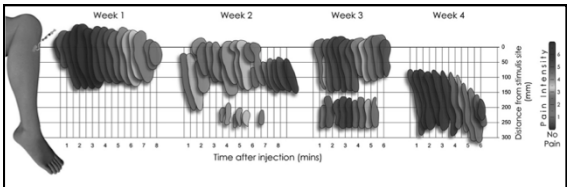
Clinical Relevance

- Expansion of the Receptive Field
- Sensitization



Neuroplasticity: Referred Pain

- Nociceptive impulses entering the spinal cord spread upward and downward over 7-10 spinal segments,
- Activation of dormant synapses
- Morphologic changes that are re-enforced with persistent stimulation



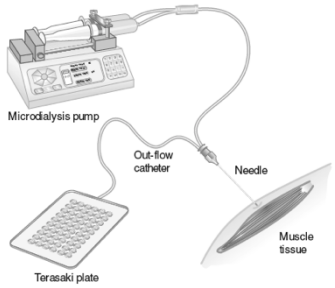
Repeated noxious stimuli over time decreases in local but increases in referred pain, suggesting central changes in processing noxious inputs.

Changes in the Spatiotemporal Expression of Local and Referred Pain Following Repeated Intramuscular Injections of Hypertonic Saline: A Longitudinal Study
Troy K. Rubin, Luke A. Henderson,and Vaughan G. Macefield

The Journal of Pain 11(8):737-745, 2010

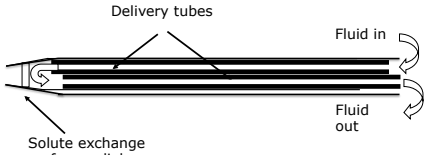
Pathophysiology of MTrPs

Microdialysis System



Shah, J.P., et al., An in-vivo microanalytical technique for measuring the local biochemical milieu of human skeletal muscle. J Appl Physiol, 2005. 99: p. 1980-1987

Microdialysis of TrPs with 0.3 mm needle



Shah, J.P., et al., An in-vivo microanalytical technique for measuring the local biochemical milieu of human skeletal muscle. J Appl Physiol. 2005. 99: p. 1980-1987

Elevated levels:

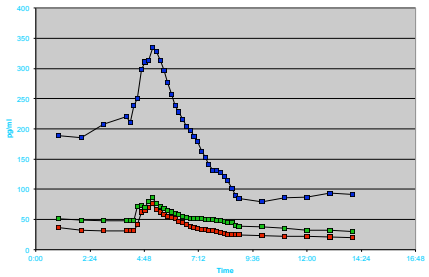
- CGRP
- Norepinephrine
- TNF – α
- Interleukin 1, 6 and 8
- Serotonin

Reduced levels:

- Interleukin 12

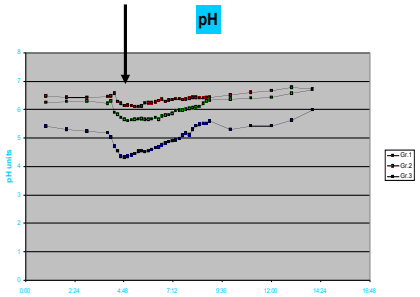
- *Appl Physiol, 2005. 99: p. 1980-1987*
- Phys Med Rehabil. **89**(1): 16-23, 2008

Substance P



Shah, J.P., et al., An in-vivo microanalytical technique for measuring the local biochemical milieu of human skeletal muscle. J Appl Physiol, 2005. 99: p. 1980-1987
Shah JP, Danoff JV, Desai MJ, Parikh S, Nakamura LY, Phillips TM, and Gerber LH, Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. Arch Phys Med Rehabil. **89**(1): 16-23, 2008

pH

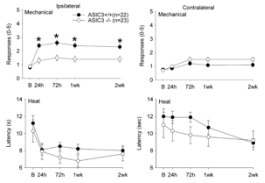


Shah, J.P., et al., An in-vivo microanalytical technique for measuring the local biochemical milieu of human skeletal muscle. J Appl Physiol, 2005. 99: p. 1980-1987
Shah JP, Danoff JV, Desai MJ, Parikh S, Nakamura LY, Phillips TM, and Gerber LH, Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. Arch Phys Med Rehabil. **89**(1): 16-23, 2008

ASIC3 in muscle mediates mechanical, but not heat, hyperalgesia associated with muscle inflammation

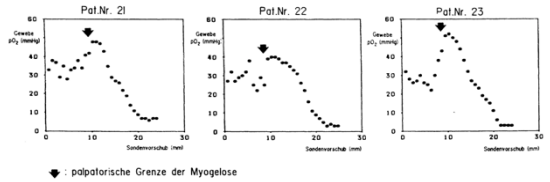
Kathleen A. Sluka [a,b,c,*], Rajan Radhakrishnan [a,b,c,1], Christopher J. Benson [b,c,d], Jayasheel O. Eshcol [d], Margaret P. Price [d], Kazimierz Babinski [e], Katherine M. Audette [b,c], David C. Yeomans [f], Steven P. Wilson [g]

- on the initiation and perpetuation of muscle pain
- A more acidic milieu may activate ASIC1 or ASIC3 muscle nociceptors, which in turn could produce mechanical hyperalgesia

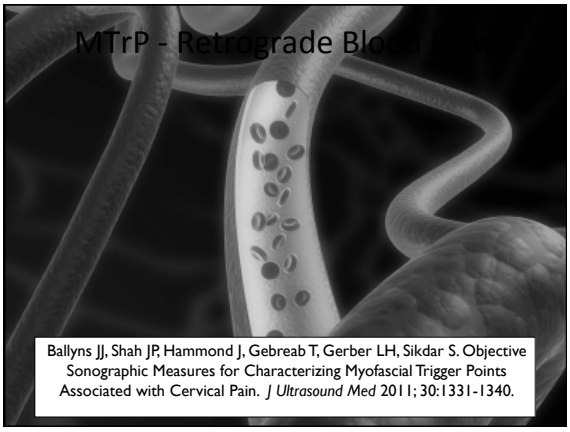


Pain 129 (2007) 102–112

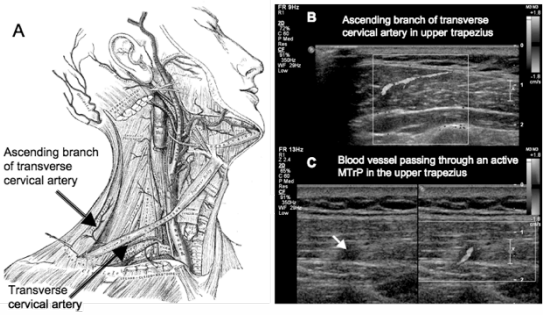
O_{2-} tissue saturation in TrPs



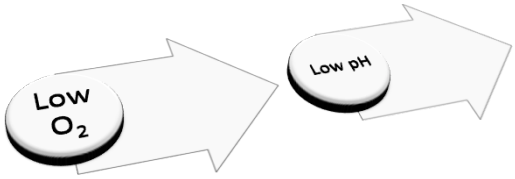
Brückle, W., et al., Gewebe-pO2-Messung in der verspannten Rückenmuskulatur (m. erector spinae). Z. Rheumatol., 1990. 49: p. 208-216.

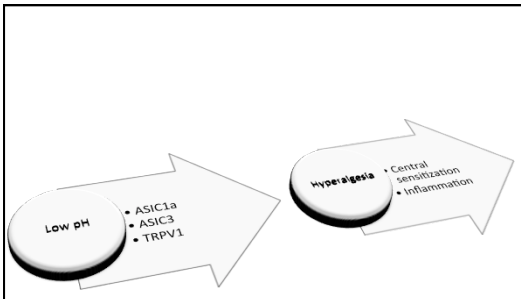


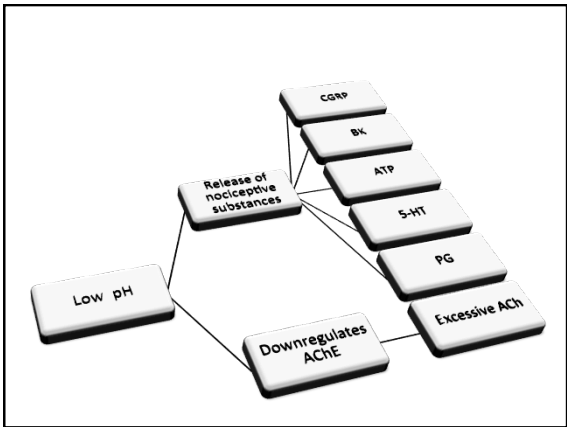
Ballyns JJ, Shah JP, Hammond J, Gebreab T, Gerber LH, Sikdar S. Objective Sonographic Measures for Characterizing Myofascial Trigger Points Associated with Cervical Pain. *J Ultrasound Med* 2011; 30:1331-1340.



Sikdar S, et al. Novel Applications of Ultrasound Technology to Visualize and Characterize Myofascial Trigger Points and Surrounding Soft Tissue *Phys Med Rehabil.* 2009;90:1829-38

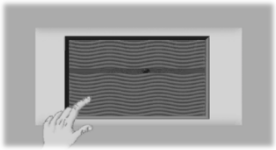


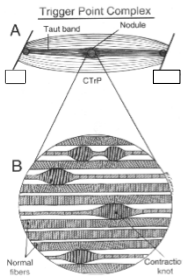




Trigger Point

- taut band





a hyperirritable spot in the skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band (Simons, 1999).

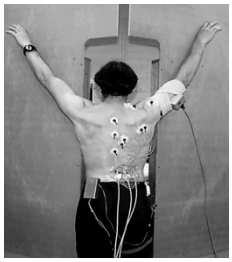
Contributions to Development of Trigger Points

- Persistent low level muscle contractions
- Direct Trauma
- Unaccustomed eccentric contractions
- Maximal/strenous concentric contractions
- Afferent Input from Joints
- Afferent Input from Internal Organs
- Stress/Tension

Effects of MTrPs on the Muscular System

Latent TrPs influence muscle activation patterns (MAPs)

- Results:
  - stable sequential MAP
  - LTrP group had a variable MAP that was statistically significant



Lucas et al. Latent myofascial trigger points: their effects on muscle activation and movement efficiency. Journal of Bodywork and Movement Therapies (2004) 8, 160-166.

Accelerated Muscle Fatigability of Latent Myofascial Trigger Points in Humans

Hong-You Ge, MD, PhD, Lars Arendt-Nielsen, Dr. Med. Sci., PhD, and Pascal Madeleine, Dr. Med. Sci., PhD

A latent MTP is associated with an accelerated development of muscle fatigue and simultaneously overloading active motor units close to a MTP.

The relationship between latent trigger point and muscle strength in healthy subjects: A double-blind study

Derya Celik[a,*] and İpek Yeldan[b]

- Group 1: 2+ TrPs on dominant side
- Group 2: no TrPs

- Isometric shoulder flexion and scaption w/hand held dynamometer

- **RESULTS:** those with latent TrPs were significantly weaker than those in control group

Dry Needling

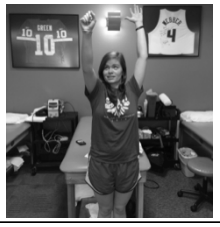
- Connective Tissue Winding
  - cytoplasmic extensions
  - Langevin: J Cell Physiol 2005

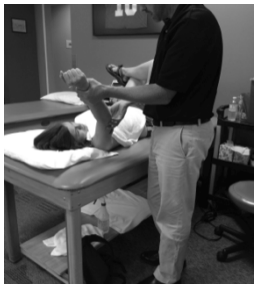
Decreased Range of Motion

[CASE REPORT]

DEREK CLEWLEY, PT, DPT, OCS, FAAOMPT • TIMOTHY W. FLYNN, PT, PhD, OCS, FAAOMPT • SHANE KOPPENHAVER, PT, PhD, OCS, FAAOMPT

Trigger Point Dry Needling as an Adjunct Treatment for a Patient With Adhesive Capsulitis of the Shoulder

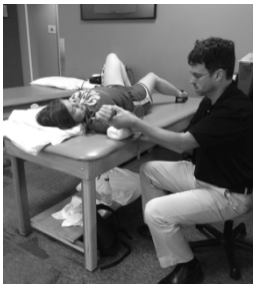
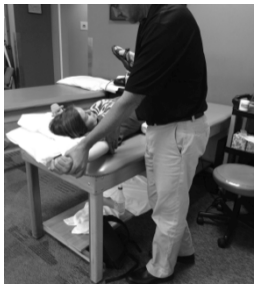




Joint Assessment

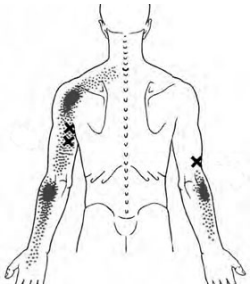
Dry Needling Treatment

- 1st treatment
- PROM
- Stretches
- Dry needling

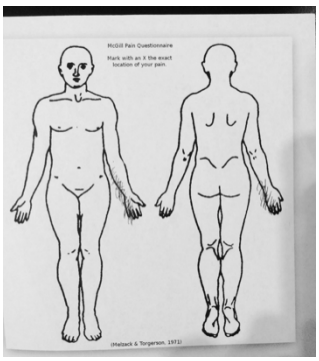



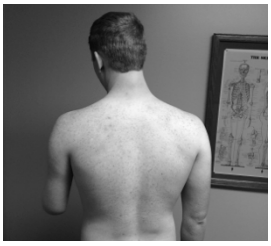
Local Twitch Response

- Decrease in Neurotransmitters (CGRP, substance P, cytokines, interleukins)

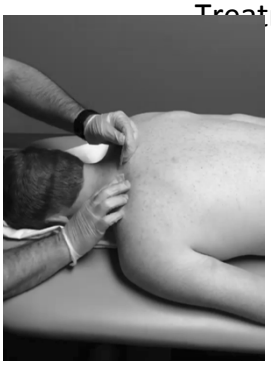



Muscle Inhibition






Treatment



Conclusions

- Consider all tissues in the evaluation of each patient
- MTrPs warrant consideration
  - Especially in case of prolonged pain
  - Tissue language

THANK YOU

SC & AC Joint Mobilization Can Dramatically Increase Shoulder Girdle Elevation

Bryce Gaunt, P.T., S.C.S.
Director of Physical Therapy
HPRC @St. Francis Rehabilitation Center
Columbus, Georgia

St. Francis Rehabilitation Center
St. Francis Orthopaedic Institute
HPRC HUMAN PERFORMANCE AND REHABILITATION CENTERS, INC

Objectives

- Overview anatomy / biomechanics/ theory
- Overview SC joint mobilization technique
- Overview AC joint mobilization technique
- How you can screen for AC/SC dysfunction
- Case examples

Art and Science

Where is This Stuff Coming From?

PRIMARY INFLUENCES

- International Academy of Orthopedic Medicine - US
  - www.iaom-us.com
- Tom Boers, PT, MT
  - Arthropraxis
- My own clinical experience
  - Trial and Error

The Basic Idea

- The elevation chain
  - Glenohumeral joint
  - Scapulothoracic joint
  - **SC joint**
  - **AC joint**
  - Cervical spine
  - Thoracic spine
  - Lumbar spine
- Full elevation requires normal movement all components
- Links in chain interconnected

AC/SC Basic Idea

- Essential movement occurs at AC/SC joints
- Limited AC/SC movement may = limited scapula motion during end range elevation = altered position of glenoid (↓ upward rotation, post tilt, ER) = limited GH joint terminal elevation
- If limited AC/SC motion, mobilization can significantly ↑ arm elevation (10º-25º) immediately

How Can AC/SC Mobilization Help?

- Can restore AC/SC motion limited due to
  - 1) adaptive shortening of the capsule / ligaments
  - 2) the arthrokinematic reflex (+AKR)
- +AKR = overloading the mechanorecptors in jt capsule activates positional spasm of stabilizing muscles, that are innervated by the same nerve supplies capsule (Hilton's law) (Wyke 67)
- +AKR = protective response to avoid tissue injury (Wyke 67)

The Proof is in the Pudding

Pre 1st Rx

The Proof is in the Pudding

Post **only AC/SC mobs**

1st Rx: **6 min** later

The Proof is in the Pudding

- Pre 1st Rx
- Post 1st Rx: 6 min later

SC / AC Screening for Dysfunction

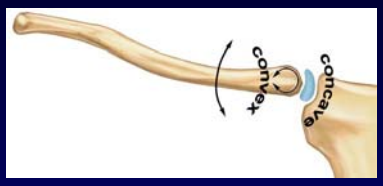
- S/S suggestive of dysfunction:
  - Clavicle or SC pain at rest
  - AC/ SC / clavicle tender to palpation
  - AC/ SC / clavicle pain w/ A/PROM
  - Clavicle less vertical than contralateral side w/ elevation

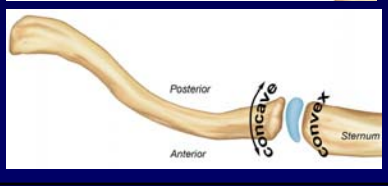
SC / AC Screening for Dysfunction

- S/S suggestive of dysfunction:
  - Clavicle or SC pain at rest
  - AC/ SC / clavicle tender to palpation
  - AC/ SC / clavicle pain w/ A/PROM
  - Clavicle less vertical than contralateral side w/ elevation
  - Isolated terminal FE limitation w/ normal GH joint play
  - Longstanding limitation of overhead elevation
- If any + = Specific joint accessory motion assessment indicated

SC Joint Anatomy

- Coronal
  - Concave sternum
  - Convex clavicle (Rockwood)
  - Interarticular disk
- Transverse
  - Convex sternum
  - Concave clavicle





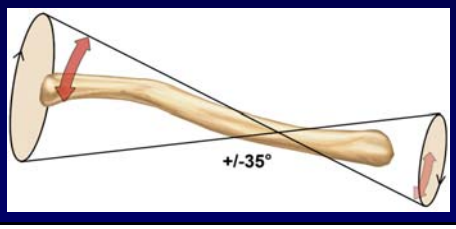
SC Joint Biomechanics w/ Elevation

- Clavicle's motion at SC
  - Elevation 35°
  - Retraction 35 °
  - Post rotate 45-50°

Inman 44
Teece 08
Van der Bijl 75
Martetschläger 14

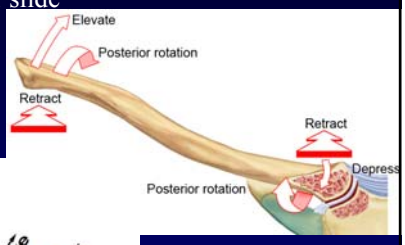
SC Joint Biomechanics w/ Elevation

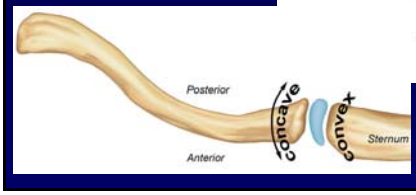
- Center of rotation – prox 1/3 clavicle
  - Small proximal motion = big distal motion
  - Small proximal restriction = bigger limitation of distal movement



SC Joint Biomechanics w/ Elevation At Articular Surface

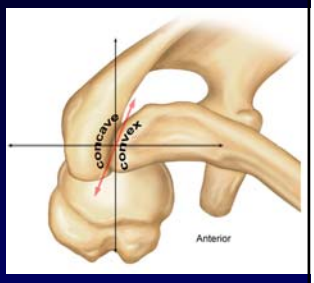
Superior roll w/ inferior slide
Posterior roll and slide
Posterior rotation





AC Joint Anatomy

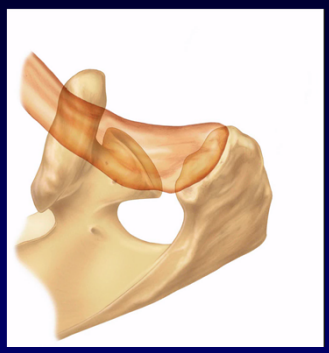
- Diarthrodial planar joint
- May include disk
- Small synovial cavity ant ½
- Clavicle – slight convex
- Acromion – slight concave
- Variances in frontal plane
- Superior / inf AC ligs



AC Joint Biomechanics w/ Elevation

- AC motion = scapular movement w/ respect clavicle
- During Elevation AC joint motion:
  - **IR** (Teece 08, Van der Bijl 75)
  - **Upward rotate** (Teece 08, Van der Bijl 75)
  - Post tilt (Teece 08) vs
  - Ant tilt (Van der Bijl 75)
  - Roll / glide same direction

AC Joint Biomechanics w/ Elevation



AC Joint Biomechanics w/ Elevation

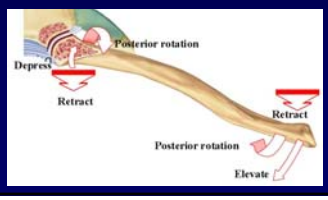
- Don't Forget:
  Clavicle is elevating, retracting, & rotating post while AC joint motion occurs
- Is why AC joint motion is scapula IR not ER

SC Joint Assessment / Mobilization to ↑ Elevation

- Must establish / follow sternal angle 1st
- Pre-position in max PFE that is comfortable w/support

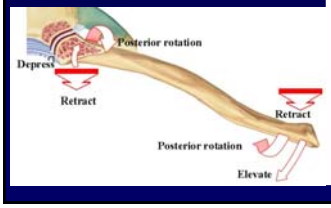
SC Assessment / Mobilization to ↑ Elevation

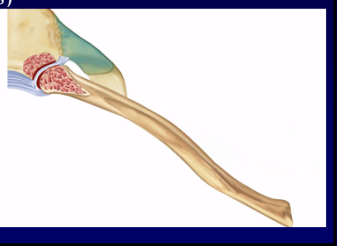
- Assess/ mobilize for normal triplanar arthrokinematics while take joint to end range (Boers)
  - Superior roll (distal hand) inferior slide (prox thumb)
  - Caudal roll and slide (distal hand, prox 2-3rd finger)
  - Posterior rotation (both hands)
  - Compression (distal hand)



SC Assessment / Mobilization to ↑ Elevation

- Assess/ mobilize for normal triplanar arthrokinematics while take joint to end range (Boers)
  - Superior roll (distal hand) inferior slide (prox thumb)
  - Caudal roll and slide (distal hand, prox 2-3rd finger)
  - Posterior rotation (both hands)
  - Compression (distal hand)





SC Assessment / Mobilization to ↑ Elevation

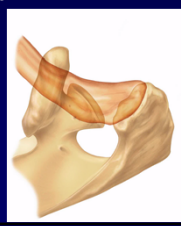
- Triplanar mobilization w/ movement to end range with compression

SC Joint Mobilization to ↑ Elevation

- Superior roll (distal hand) Inferior slide (prox thumb)
- Caudal roll & slide (distal hand scapula, prox 2-3rd finger)
- Posterior rotation (both hands)
- Compression

AC Assessment / Mobilization to ↑ Elevation

- Preposition in max PFE that is comfortable w/ support
- Assess/ mobilize for normal triplanar arthrokinematics while take joint to end range w/ compression
  - Move acromion distal hand through scapula
  - Move distal clavicle w/ proximal hand
  - Roll / glide same direction



AC Joint Mobilization to ↑ Elevation

- Mobilize acromion in arc around convex distal clavicle
- Acromion
  - IR
  - Up rotation
  - Post tilt
- Clavicle
  - ER (retraction)
  - Posterior rotate
  - Elevate
- Compression

Precautions / Contraindications

- Contraindications same as w/ all mobilizations
- Precautions
  - Osteoporosis
  - Osteopenia
  - Elderly
  - RA
  - SAD / EDC
  - Healed AC ligament repair/ reconstruction

Case Study

- 44 y/o male
- 14 mo s/p ARCR, SLAP repair, Bankart repair
- Completed post-op rehab SFRC at POD 2 – POM 5
  - PFE = 155º AFE = 145º PER = 55º
  - PER @ 90º = 65º PIR @ 90º = 45º
  - Capsular end feel
- Primary c/o on return eval 1/3/08
  - Intermittant pain @ rest
  - ↑ pain w/ overhead ROM / activities
  - ↑ pain w/ more vigorous activities

Initial Evaluation 1/3/08

- ROM
  - PFE = 155º AFE = 140º (p>120) PER = 65º
  - PER @ 90º = 95º PIR @ 90º = 50º IR = T1
- GH joint assessment
  - Normal accessory motions
- + Neer Impingement
- C-spine = +AKR C0-C3 flex
- Penn = 76

Initial Evaluation 1/3/08

- AC/SC screening factors that were +
  - Clavicle less vertical than contralateral side w/ PFE/AFE
  - Isolated terminal FE limitation w/ normal GH joint play
  - Longstanding limitation of overhead elevation
  - SC tender w/ joint assessment
- SC joint specific assessment
  - +AKR
  - ↓ Inferior slide
  - ↓ Posterior roll and slide
  - ↓ Posterior rotation

Assessment

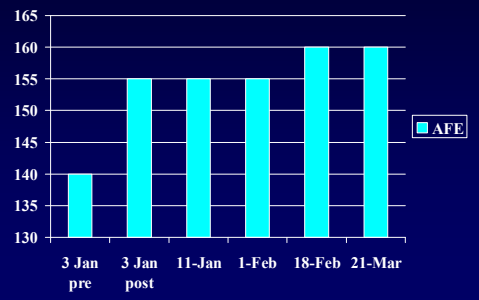
- ↓GH Elevation & secondary impingement due
  - Primarily to SC joint dysfunction
  - Secondarily to
    - Posterior shoulder tightness
    - Cervical facet dysfunction (+AKR)

Treatment

- 6 rx over 11 weeks
- SC & AC joint mobilization: 4 rx
- C-spine mobilization: 2 rx
- HEP
  - Basic cuff strengthening including AFE
  - Sleeper stretch
  - Cervical ROM
  - Bursal catching w/ AFE @ 135º limited progression

Outcomes: ROM

- IR @90º: 1/3/08 = 50º 3/21/08 = 75º



Outcomes ROM

Outcomes

- Penn Scores
  - 1/3/08 76
  - 1/11/08 76
  - 3/21/08 85

  - Penn Change = 9
  - MDC = 12.1
  - MCID = 11.4
- Cont significant bursal catching w/ AFE @ 135º
  - Bursectomy offered

Other Examples

- JW 22y/o M
- Conservative Rx – Ant shoulder instability
  - 1 month little progress.
- MOI - MVA, rear-ended, holding handle passenger door
- Pain rest, and w/ activity, difficulty lifting arm overhead
- +AKR SC joint, SC joint tender during joint assessment
- 1 Rx – SC mobs (inferior emphasis) & AC mobs

Pre Rx

Rx

Immediately After 1st Rx

Other Examples

- VB 57y/o F
- 2.5 mo s/p ARCR
- MOI - 3 days prior, caught falling vase = ↑ pain since then. Especially collar bone. ↓ ROM
- Mod pt tender SC joint and shaft of clavicle
- +AKR SC joint
- AFE decreased from 110° to 95 °
- 1 Rx – SC mobs (post emphasis) & AC mobs
- Immediate ↑ in ROM to 110° and abolished SC / clavicle pain

Other Examples

- JG 39y/o F
- 3 mo s/p ARCR, ant/post Bankart & capsulorraphy
- No subjective c/o indicative of SC/AC limitation
- End range AFE looked "labored" (AFE = 145°)
- +AKR SC joint and c-spine
- 1 Rx – SC mobs (post & inf emphasis) & AC mobs
- Immediate and dramatic ↑ease of AFE
  - No change in ROM = 145°

Other Examples

- AJ 18 y/o F
- High school student trainer
- 3 mo s/p L AC joint sprain (gr 1), rotator cuff strain
- Previous PT including FDN – improved but not resolved
- 1° c/o - anterior sh pain, pain shooting to neck, occasional headaches – intermittent rest, vigorous activity (wt training), still takes pain meds
- A/PROM – mild limitation FE & Abd w/ AC jt pain
- Mod pt tender L AC joint, + AKR = SC, AC joint, C-spine flex
- MMT flex, er = 4+/5 w/ mild pain
- 2 Rx = AC/SC joint mobilization (1), cuff /scap strength
- F/u 1 wk = s/s resolved basic ADL's, restricted vigorous
- Penn: Eval = 62, 1 wk f/u = 96, 1 mo f/u = 99

Other AC/ SC Tidbits

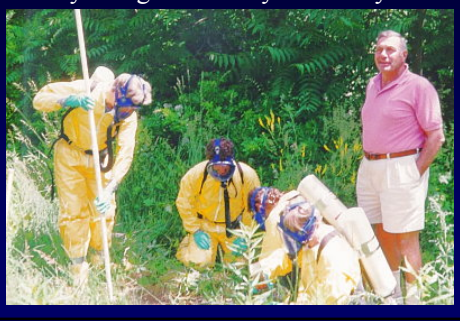
- If Rx needed, always treat both (SC 1st)
- How often used?
- How steep learning curve?
- Potential down sides?
- How much motion gain?

Conclusion

- Part of the problem/ solution for limited shoulder girdle motion
- Interconnectedness throughout
- ↓ AC/SC/ Cervical facet joint motion (including +AKR) can limit terminal shoulder passive / active elevation.
- Direct mobilization can efficiently / effectively result in marked, immediate ↑ in elevation.
- ↑ terminal elevation +/- significant ↑ in Penn score.
- Multidisciplinary PT approach

Conclusion

- In medicine you only see what your looking for and only recognize what you already know.



Bryce Gaunt PT, SCS

HPRC

706 256-0825 ph

bgaunt@hprc.net

St.Francis Rehabilitation Center

American Society of Shoulder and Elbow Therapists

St.Francis Orthopaedic Institute

A SYSTEMATIC APPROACH TO SHOULDER REHABILITATION

SC & AC Joint Mobilization Can Dramatically Increase Shoulder Girdle Elevation
References:
Bryce W. Gaunt, PT, SCS

Bearn JG: Direct observation on the function of the capsule of the sternoclavicular joint in clavicular support. J Anat 101:159, 1967.

Hollinshead WH: Anatomy for surgeons, Vol 3, 3rd ed. Philadelphia: Harper & Row, 1982.

Inman VT, Saunders JR, Abbott LC: Observations on the function of the shoulder joint. J Bone Joint Surg. 26:1, 1944.

Kapandji: The physiology of joints, Vol 1. Baltimore: Williams & Wilkins, 1970.

Ludewig PM, Behrens SA, Meyer SM, Spooden SM, Wilson LA. Three-dimensional Clavicular motion during arm elevation: reliability and descriptive data. J Orthop Sports Phys Ther; 34(3):140-149, 2004.

Martetschläger F, Warth RJ, Millett PJ. Instability and Degenerative Arthritis of the Sternoclavicular Joint: A Current Concepts Review. The American Journal of Sports Medicine.42:999-1007,2014.

Matsuki K, Matsuki KO, Yamaguchi S, Ochiai N, et al. Dynamic in vivo glenohumeral kinematics during scapular plane abduction in healthy shoulders. J Orthop Sports Phys Ther.42:96-104,2012.

Novotny J, Beynnon B, Nichols C. Modeling the stability of the human glenohumeral joint during external rotation. Journal Of Biomechanics. 33:345-354;2000.

Rockwood CA, Matsen III FA eds: The shoulder, Vol 1, 2nd ed. Philadelphia: W.B. Saunders, 1990.

Teece RM, Lunden JB, Lloyd AS, Kaiser AP, Cieminski CJ, Ludewig PM: Three-dimensional acromioclavicular joint motions during elevation of the arm. J Orthop Sports Phys Ther; 38(4):181-190, 2008.

Van der Bijl Jr, G: Active and passive motion in the joints of the extremities. Lochem, The Netherlands: De Tijdstroom, 1975.

Wyke B: The neurology of joints. Ann R Coll Surg Engl; 41(1): 25–50, 1967.

Winkel D: Diagnosis and treatment of the upper extremities, nonoperative orthopaedic medicine and manual therapy. Gaithersburg, Maryland: Aspen Publishers, 1997.

ASSET Annual Meeting
2015

Techniques that Assist with Evaluation and Restoration of Shoulder Range of Motion by Restoring Pure Glenohumeral Mobility in Patients with Shoulder Stiffness

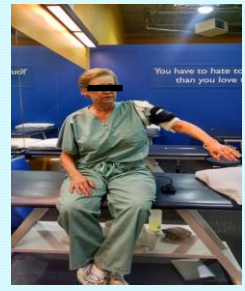
Wendi Sanny, PT, ATC
Athletes' Training Center
Omaha, NE

Objectives

- Discuss ways to evaluate "pure" glenohumeral (GH) range of motion.
- Discuss stretching techniques that isolate GH movements from scapulo-thoracic motions as an adjunct to current techniques used to restore shoulder ROM.

Prevalence of shoulder stiffness

- Shoulder stiffness can be a painful, sometimes debilitating condition.
- Subtle deficits can be left un-noticed and untreated in the athletic population.
- In some cases, patients go on to have a 2nd surgery to resolve the deficits.

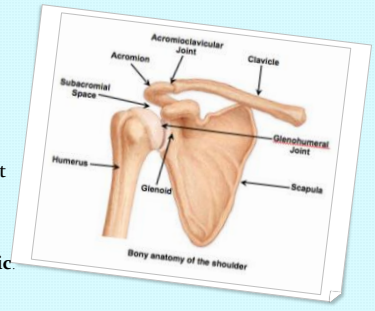


The "Shrug"

- Elevation is dominated by upper trapezius activity
  - Capsular and ligamentous restrictions
  - Poor rotator cuff strength resulting in superior humeral head migration

Assessment of "pure" GH motion

There is limited discussion about isolating the **glenohumeral** ROM from the **scapulothoracic**.



Limited discussion on this topic…

- I was first exposed to the concept of "pure" glenohumeral ROM and how to evaluate and treat using the concept by Dr. John Conway.
- Wilk, et al (2009) in *Sports Health* looked at different scapular stabilization techniques for best assessing IR.
- Tauro, JC discussed concept of GH TROM (*Arthroscopy*, 2006)
  - ER,IR, flex, abd

Indications for using these techniques

- Sub-acute stages of post-op rehabilitation.
- Late stages of rehabilitation in which full ROM has not been gained.
- ROM deficits in overhead athletes where it is important to detect even subtle deficits.

Evaluation of "pure" GH motions

- Utilize a separate person to take the measurements.
- Stabilize the scapula and measure ROM for abduction, horizontal adduction and ER/IR.
- Goniometers, digital inclinometers or inclinometer apps on smartphones may be used for measurements.

Glenohumeral abduction

"Pure" glenohumeral abduction

- A study by Freedman and Munro in 1966 in JBJS looked at the amount of glenohumeral abduction, separate from scapular motion.
- 61 male subjects.
- Used x-ray to measure abduction in the scaption plane.
- Found a mean value of 167 degrees of abduction.
  - ~65 degrees scapular movement
  - ~103 degrees of humeral movement in the glenoid.

There is a lack of consensus on how much the GHJ contributes

Freedman and Munro(1966)

- Found 3:2 ratio for glenohumeral to scapulothoracic movement w/ abduction in a scaption plane.

Poppen and Walker (1976)

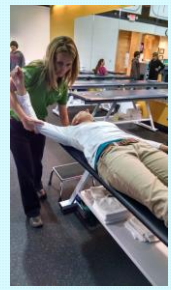
- Found a 5:4 ratio of GH to ST movement.
- Also measured abduction in the scaption plane.

Assessment and treatment techniques

- Begin with patient supine .
- Stabilize the scapula with one hand and provide a subtle depression
  - avoid depression of the brachial plexus.
- Using the other hand, the therapist cradles the patient's arm with the elbow flexed to 90 deg. Gently abduct the arm until a firm endfeel is detected.
- Give cues as appropriate to avoid guarding and resulting proximal translation of the humerus.
- Measurements may be taken at this time.

Begin treatment in Supine vs Sitting

- Initially begin with supine position.
- Patient relaxation is better.
- As the patients learns to relax over a period of visits, I transition to seated.



Assessment of pure GH abduction

- Be sure to assess in supine AND sitting.
- Usually a deficit is more notable in sitting.
- Take your time and allow the patient to relax so you can detect the tissue tension.
- Sitting position may be more useful in subacute or later stages.

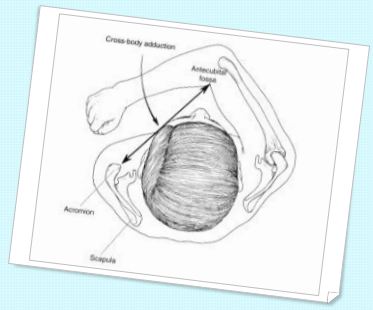
Treatment pearls

- Patient must learn to relax
- Be sure to avoid subacromial impingement.
- Additions to the technique:
  - Apply an inferior glide.
  - Neuro-reeducation: Have the patient hold the position *without* upper trapezius compensation.

Horizontal Adduction

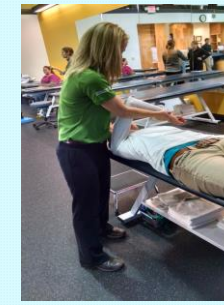
Measurement of horizontal adduction

Distance from the olecranon to the opposite acromian.



Restoring Horizontal adduction with scapular stabilization

- Left hand stabilizes scapula at the coracoid and posterior scapula.
  - OR-stabilize the lateral border of the scapula
- Gently pull the arm across the body until the tissue tension increases.
- Perform measurement OR stretching at this angle.
  - *Assess bilaterally.



Internal Rotation

Wilk, et al (Sports Health, 2009)

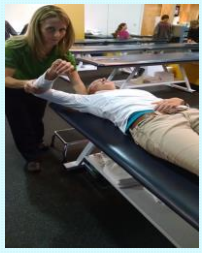
- Studied 3 different scapular stabilization techniques for assessment of internal rotation.
  - Stabilization of humeral head
  - Stabilization of the scapula
  - No stabilization.

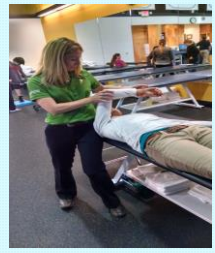
  Recommended stabilizing the scapula to assess IR

  - I would take it one step further…fully abduct the arm to it's full potential. Then measure IR.

IR with scapular stabilization

IR being restored and/or assessed at varying angles from ***abduction*** to a more ***horizontally adducted*** position.

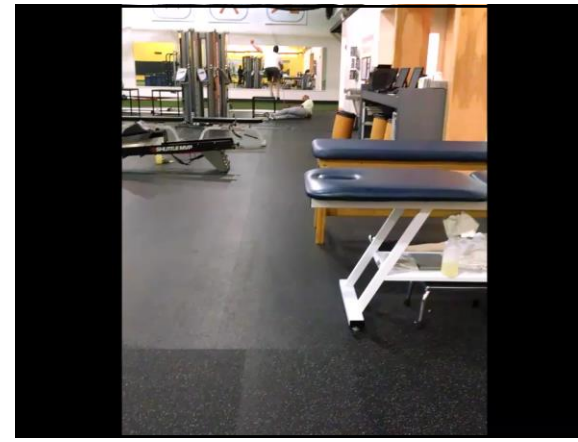




External Rotation

External rotation ROM

ER at 90 deg **ER with horizontal adduction**



In summary…

- Physical therapists routinely assess and treat shoulder stiffness but *deliberate* assessment and restoration of mobility in the GHJ may be a useful adjunct to current techniques.

"Effects of a Single Bout of Shoulder Horizontal Adduction Contract Relax Stretching"

Amber Buckles, Jennifer Cox, Daniel Laochinda, Jacob Snodgrass
Robert Manske, DPT, PT, MEd, Smith BS, PT, PhD

Shoulder IR ROM Loss -GIRD

- Descriptive research profiles IR loss in dominant arm of OH athletes
- GH IR lost linked to both shoulder and elbow injuries:
  - Wilk, 2011
  - Shanley, 2011
  - Dines, 2009

Table 1. *Normative Range of Motion Measures for Overhead Athletes*

Dominant Arm	Non-Dominant Arm	"N"	Population / Age	Source
ER: 132+11 IR: 52+12 TR: 184	127+11 63+12 190	369	Professional BB Pitchers Mean age: 25.6 years	Wilk et al,[23]
ER: 125.6+11 IR: 53.4+11 TR: 179	117.8+11 61.4+9 179	143	High School BB Mean age: 15 years	Shanley et al,[25]
ER: 123.8+13 IR: 60.2+13 TR: 184	121.1+14 66.8+12 187	103	High School Softball Mean age: 15 years	Shanely et al,[25]
ER: 143+13 IR: 35.9+9 TR: 178	136+12 41.8+8 178	294	Little League Baseball Age Range 8-16 years	Meister et al,[16]
ER: 130 IR: 60 TR: 190	120 75 195	210	High School BB Pitchers Mean age: 16.1 years	Hurd et al,[10]
ER:103.9+9 IR: 39.4+9 TR: 142	99.1+9 52.2+9 151	150	Male Elite Junior Tennis	Ellenbecker et al,[13]
ER: 105.6+7· IR: 41.5+8 TR: 147154	101.3+7 52.1+7	149	Female Elite Junior Tennis	Ellenbecker et al,[13]

Muscular Contributions to GH Motion Loss

- 67 professional baseball players
- IR measurements taken before, immediately after and 24 hours after throwing
- Loss of 9 degrees of IR following throwing.

Changes in Shoulder and Elbow Passive Range of Motion After Pitching in Professional Baseball Players

Reinold M, et al. Changes in shoulder and elbow passive range of motion after pitching in professional baseball players. *Am J Sports Med*. 2008;36(3):523-527.

Muscular Contributions to GH Motion Loss

- Tennis players
- 2.5 hour match
- Measures at 90 and 180
- Significant decreases in IR and TROM during extended tennis match

ROM	To	T90	T180
IR	51±15	36±16*	30±21*
ER	82±15	80±11	75±14
TROM	133±14	116±22	105±28*

Martin et al, 2015. Unpublished data. Submitted to *BJSM*

Comparison of Shoulder Stretching

- 44 Recreational Athletes
- 2 groups
  - <10 bilateral difference in IR ROM
  - (Controls)

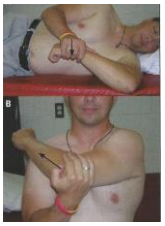
RESEARCH REPORT

A Randomized Controlled Comparison of Stretching Procedures for Posterior Shoulder Tightness

McClure et al, A randomized controlled comparison of stretching procedures for posterior shoulder tightness. *JOSPT*. 2007;37(3):108-114.

Comparison of Shoulder Stretching

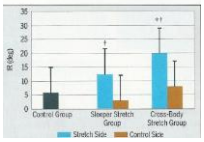
- 2 groups
  - 10 or > loss of IR ROM (Treatment)
    - Sleeper
    - X-arm (scapula not stabilized)
  - Control
  - 4 week intervention program
    - Unilateral stretching 5 reps x 30 sec hold



McClure et al, A randomized controlled comparison of stretching procedures for posterior shoulder tightness. *JOSPT*. 2007;37(3):108-114.

Comparison of Shoulder Stretching

- **Results**
  - IR ROM increases
  - Sleeper >Control
  - X-arm > Sleeper & Control
  - X-arm stretch (19.9°); Sleeper (9.8°); Control (8.2°)
- **Clinical application**
  - X-arm more effective than sleeper or control
  - Use of scapular stabilization?



McClure et al, A randomized controlled comparison of stretching procedures for posterior shoulder tightness. *JOSPT*. 2007;37(3):108-114.

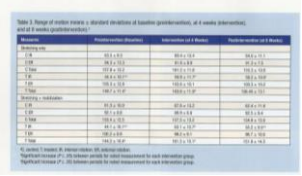
Comparison of Shoulder Stretching

- 39 healthy college age subjects
- X-arm vs. X-arm + joint mobs
- 20 Stretching only
- 19 Stretching + posterior capsule joint mobs
- No control group
- RCT
- 8 weeks
- 4 weeks intervention; 4 weeks wash out

Manske RC, et al. A randomized, controlled, single-blind comparison of stretching versus stretching and joint mobilization for posterior shoulder tightness. *Sports Health*. 2010; 2(2):94-100.

Comparison of Shoulder Stretching

- **Results**
  - Both groups increased internal rotation motion
  - Trends toward more motion improved with the addition of posterior capsule joint mobilization
- **Clinical Application**
  - Both x-arm and x-arm with joint mobs increased IR ROM



Manske RC, et al. A randomized, controlled, single-blind comparison of stretching versus stretching and joint mobilization for posterior shoulder tightness. *Sports Health*. 2010; 2(2):94-100.

Comparison of Shoulder Stretching

- 61 D-I baseball players
- Single application of MET for X-arm (25%) contract relax stretch
- Single application of MET for Shoulder IR (25%) contract relax stretch

Moore, et al. The immediate effects of muscle energy technique on posterior shoulder tightness; a randomized controlled trial. *JOSPT*. 2011;41(6):400-407.

Comparison of Shoulder Stretching

- Single session = 3 reps
- Control group
- Measurement of X-arm and IR pre and post

Moore, et al. The immediate effects of muscle energy technique on posterior shoulder tightness; a randomized controlled trial. *JOSPT*. 2011;41(6):400-407.

Comparison of Shoulder Stretching

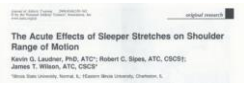

TABLE 2 — Descriptive Statistics for Glenohumeral Joint Horizontal Adduction Range of Motion*

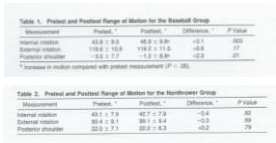
- **Results**
  - Significantly greater Add (**Habd=6.8; ER=5.0; C=-1.1**) and IR ROM (**Habd=4.2; ER=0.2; C=-0.2**) improvement following contract relax to X-arm stretch.
- **Clinical Application**
  - Habd more effective than ER MET

Moore, et al. The immediate effects of muscle energy technique on posterior shoulder tightness; a randomized controlled trial. *JOSPT*. 2011;41(6):400-407.

Comparison of Shoulder Stretching

- Acute effects of sleeper stretch
- ROM before and after 3x30 sec sleeper
- Increase of 3.1°


The Acute Effects of Sleeper Stretches on Shoulder Range of Motion



Laudner K, Sipes RC, Wilson JT. The acute effects of sleeper stretches on shoulder range of motion. *J Athl Train*. 2008;43(4):359-363.

Acute Effect of CR HA cross body stretch on shoulder IR using t Band Stretch Strap

- Determine the acute effects of self directed HA cross body CR stretch on shoulder IR using Tband Stretch Strap

Physiotherapy Associates

Ellenbecker TS, Manske RC. Acute effects of contract relax cross body stretch on shoulder internal rotation using Tband stretch strap. Unpublished data, 2013.

Acute Effect of CR HA cross body stretch on shoulder IR using t Band Stretch Strap

- Standard goniometer
- Tband Stretch Strap
- 5 min sub max warm up
- Randomized (dominant/non dominant extremity)
- Pre-test
- Intervention
- Post-test

Ellenbecker TS, Manske RC. Acute effects of contract relax cross body stretch on shoulder internal rotation using Tband stretch strap. Unpublished data, 2013.

Acute Effect of CR HA cross body stretch on shoulder IR using t Band Stretch Strap

- 3 Cycles
  - Contraction
    - HA – 5 sec (25% effort)
  - Relaxation/Stretch
  - 30 sec to end ROM - HA
- SPSS
  - Pre-Post differences in IR ROM
  - 0.25 Level
  - Bonferroni Adj (2)

Ellenbecker TS, Manske RC. Acute effects of contract relax cross body stretch on shoulder internal rotation using Tband stretch strap. Unpublished data, 2013.

Acute Effect of CR HA cross body stretch on shoulder IR using t Band Stretch Strap

- Sig increases ($p<0.001$) IR ROM following stretch
  - 8.26+/- 5.26
- Non sig increases in non stretched shoulder
  - 0.446 degree change

Ellenbecker TS, Manske RC. Acute effects of contract relax cross body stretch on shoulder internal rotation using Tband stretch strap. Unpublished data, 2013.

Current Research

- Current research has found PNF/MET/CR stretching to improve:
  - Flexibility, increase ROM
- There is minimal research examining the effects of CRS in the shoulder and none looking at the duration of those effects.

What is Contract Relax?

- CRS is a technique where a muscle contraction is held in the target muscle group followed by a passive stretch of the same muscle group.
- Indications for CRS:
  - Limitations in range of motion and flexibility

Purpose

- Determine how long the effects of a single session of horizontal adduction (HA) contract relax stretching (CRS) of the posterior shoulder will last.

Introduction

Null Hypothesis

- There will be no significant difference in ROM between the control shoulder and experimental (stretched) shoulder at different measurement intervals including immediately following, one hour, six hours, and 24 hours after the initial stretch.

Sample

- Asymptomatic adult participants were recruited from Wichita State University Physical Therapy Department (Classes of 2015-2017)
- 32 participants
  - 24 Female
  - 8 Male

Inclusion/Exclusion Criteria

- Participants had to be between 18-35 years of age
- No shoulder surgery within the past 6 months
- No shoulder pain within the past 6 months
- No current shoulder pathology

Methods

- Materials Used:
  - Goniometer: 12 inch Baseline® Evaluation Instrument
  - Plinth: Standard Armedica™ plinth
  - Towel Roll

Methods, con't.

- Participants were randomly assigned via coin flip as to which shoulder would be the treatment (stretched) shoulder.
- Measurers were blinded to which shoulder was the experimental vs control.

Measurements Taken

- ROM measurements were taken on both shoulders at different time intervals throughout the study
  - Internal rotation, external rotation, and horizontal adduction
    - The order of the three measurements were randomized
    - Horizontal adduction required the use of two measurers to determine end range

Stretching

- After the initial measurements were taken, participants were sent to another location (out of sight/hearing range of measurers) to stretch the experimental shoulder.
- Participants were instructed to perform the CRS.

Stretching Instructions

- Used their control arm to grab under the elbow of their treatment arm.
- Instructed to isometrically contract their treatment arm for 10 seconds (25%)

Stretching, con't

- After contracting for 10 seconds the participants were instructed to relax.
- The participants were then instructed to passively stretch their treatment shoulder for 10 seconds.
- The cycle is repeated 4 times
  - Participants were instructed to perform 4 repetitions of CRS which was equal to a single bout.

Immediately Post

- Participants were then sent to the measurement plinth to have their ROM measured.
- This is the "immediately post" measurement.

Interval Measurements

- The participants were re-measured at the following intervals:
  - Immediately post
  - 1 hour
  - 6 hours
  - 24 hours

Results

Range of Motion In The Shoulder Following Contract-Relax Stretch						
		Pre	Post	Post 1 hr	Post 6 hr	Post 24 hr
IR	Unstretched	46.8	48.6	47.8	48.7	47.3
IR	Stretched	48.0[a]	52.0[a,b,c]	49.1[b,d]	49.7	45.8[c,d]
ER	Unstretched	64.8	66.3	65.8	63.0	62.8
ER	Stretched	66.8	68.2	66.1	64.2	65.0
HA	Unstretched	7.5	9.7	8.5	6.0	6.4
HA	Stretched	6.8	9.6[a,b]	8.7	6.3[a]	7.0[b]

*a, b, c, d: indicates significant difference p<0.05 with Bonferroni correction

Results

Range of Motion In The Shoulder Following Contract-Relax Stretch						
		Pre	Post	Post 1 hr	Post 6 hr	Post 24 hr
IR	Unstretched	46.8	48.6	47.8	48.7	47.3
IR	Stretched	48.0[a]	52.0[a,b,c]	49.1[b,d]	49.7	45.8[c,d]
ER	Unstretched	64.8	66.3	65.8	63.0	62.8
ER	Stretched	66.8	68.2	66.1	64.2	65.0
HA	Unstretched	7.5	9.7	8.5	6.0	6.4
HA	Stretched	6.8	9.6[a,b]	8.7	6.3[a]	7.0[b]

*a, b, c, d: indicates significant difference p<0.05 with Bonferroni correction

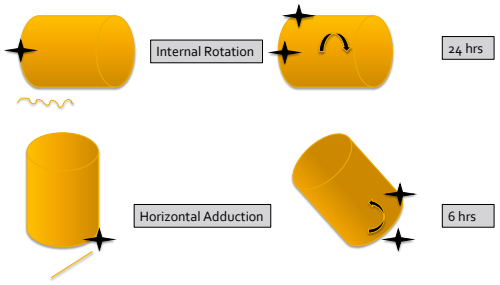
Discussion

- Increase in IR and HA

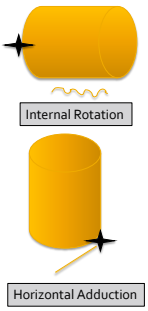
- IR increase lasted up to 24 hours.

- HA increase lasted up to 6 hours.

Discussion



Discussion

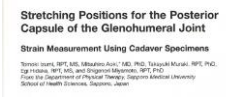


Both positions are in 90 elevation. Classic cadaver studies have shown this position stressed posterior-inferior aspect of GH joint capsule

Gagey OJ, Boisrenoult P. Shoulder capsule shrinkage and consequences on shoulder movement. *Clin Orthop Relat Res*. 2004;218-222.

Gerber C, Werner CM, Macy JC, Jacob HA, Nyffeler RWW. Effect of selective capsulorrhaphy on the passive range of motion of the glenohumeral joint. *J Bone Joint Surg* Am. 2003;85:48-55.

Discussion


Stretching Positions for the Posterior Capsule of the Glenohumeral Joint

Strain Measurement Using Cadaver Specimens


Quantifying Strain on Posterior Shoulder Tissues During 5 Simulated Clinical Tests: A Cadaver Study

Best stretch for middle and lower posterior capsule was 0° and 30° of elevation in scapular plane with shoulder internal rotation

Most strain when humerus placed in 40 or 60 degrees of flexion and internal rotation

Izumi T, et al. Stretching positions for the posterior capsule of the glenohumeral joint. Strain measurements using cadaver specimens. *Am J Sports Med*. 2008;36(10):2014-2022.

Borstadt JD, Dashottar A. Quantifying strain on posterior shoulder tissues during 5 simulated clinical tests: A cadaver study. *J Orthop Sports Phys Ther*. 2011;41(2):90-99.

Discussion

- PNF Stretching
  - Confirms CRS increases ROM
- This research parallels the findings of McClure et al, Manske et al, Moore et al, and Ellenbecker et al.
- Cross body stretch
  - Immediate increase in IR
  - No significant change in ER

Limitations

- Number of participants
  - n = 32
- HA ROM variability
  - Measurement protocols
- Force applied by participants
  - All the stretches were applied by the participant themselves with verbal guidance from a supervising examiner

Limitations

- Lack of scapular stabilization
- Scapular stabilization may be critical to optimize posterior shoulder stretching

Limitations

- 60 asymptomatic VB players
- X-arm with and without scapular stabilization
- 3x30s holds

Salamh PA, Kobler MJ, Hanney WJ. Effect of scapular stabilization during horizontal adduction stretching on passive internal rotation and posterior shoulder tightness in young women volleyball athletes: a randomized controlled trial. *Arch Phys Med Rehab*. 2015;96:349-356.

Limitations

- Posterior shoulder tightness with Tyler test
- IR with standard scapular stabilized IR

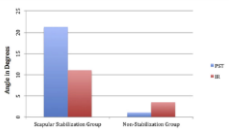
Salamh PA, Kobler MJ, Hanney WJ. Effect of scapular stabilization during horizontal adduction stretching on passive internal rotation and posterior shoulder tightness in young women volleyball athletes: a randomized controlled trial. *Arch Phys Med Rehab*. 2015;96:349-356.

Limitations

Salamh PA, Kobler MJ, Hanney WJ. Effect of scapular stabilization during horizontal adduction stretching on passive internal rotation and posterior shoulder tightness in young women volleyball athletes: a randomized controlled trial. *Arch Phys Med Rehab*. 2015;96:349-356.

Limitations

- Significantly greater increases in x-arm Add and IR ROM with stabilization
- Stretching x-arm adduction best with stabilization



Salamh PA, Kobler MJ, Hanney WJ. Effect of scapular stabilization during horizontal adduction stretching on passive internal rotation and posterior shoulder tightness in young women volleyball athletes: a randomized controlled trial. *Arch Phys Med Rehab*. 2015;96:349-356.

Additional Research Ideas

- Expand patient population to include those that have limited ROM and shoulder pathologies
- Increase frequency of retest measurements to allow for a higher resolution for when the stretch will dissipate
- Effectiveness of multiple bouts of PNF stretch to determine if a summative effect is present

Conclusion

- CRS of the posterior shoulder
  - Can increase both IR and HA ROM of the treated shoulder:
    - IR up to 24 hours
    - HA up to 6 hours
- Optimal ROM increases:
  - Perform CRS for the posterior shoulder
  - No less than a 24 hour period

Acknowledgements

- Acknowledgements
  - WSU Classes of 2015, 2016, and 2017 for their contributions as our research participants

Questions?

FRESNO STATE
Kinesiology

UK
UNIVERSITY OF KENTUCKY
College of Health Sciences

Changes in Mobility Following Instrument-Assisted Soft Tissue Mobilization of the Posterior Shoulder Musculature

Stephanie Moore-Reed, PhD, ATC
Caitlyn Kerins, MS, ATC
Tim Uhl, PhD, PT, ATC

Clinical Commentary

- Clinically, patients respond well to non-surgical interventions *(Burkhart, 2003)*
  - Why? What tissues are being affected—muscle, capsule, or both?
- IR deficit is also noted as a clinical problem in symptomatic or post-operative shoulder patients.
  - “stretching makes them worse”

Purpose

- To determine the effectiveness of IASTM (Graston Technique®) on shoulder mobility in asymptomatic overhead athletes with IR ROM deficits

Study Design: Prospective RCT

Independent variables

- Group
  - Experimental
  - Sham
- Time
  - Visit 1 pre-treatment
  - Visit 1 post-treatment
  - Visit 4 pre-treatment
  - Visit 4 post-treatment

Dependent variables

- Internal Rotation ROM (degrees)

Subjects

Inclusion Criteria

- IR ROM deficit ≥ 15° and TROM deficit ≥ 10° compared bilaterally
- Penn Shoulder Score
  - Minimal pain
  - Minimal functional deficit

Exclusion Criteria

- Shoulder surgery in the past year
- Steroid injection in the past month
- UE numbness / tingling
- Cervical radiculopathy
- Adhesive capsulitis
- Glenohumeral arthritis
- Rotator cuff pathology

Subjects

- *A priori* Sample size estimation = 20/group
- Screened 65 athletes over 6 month period
- Enrollment: 17 subjects

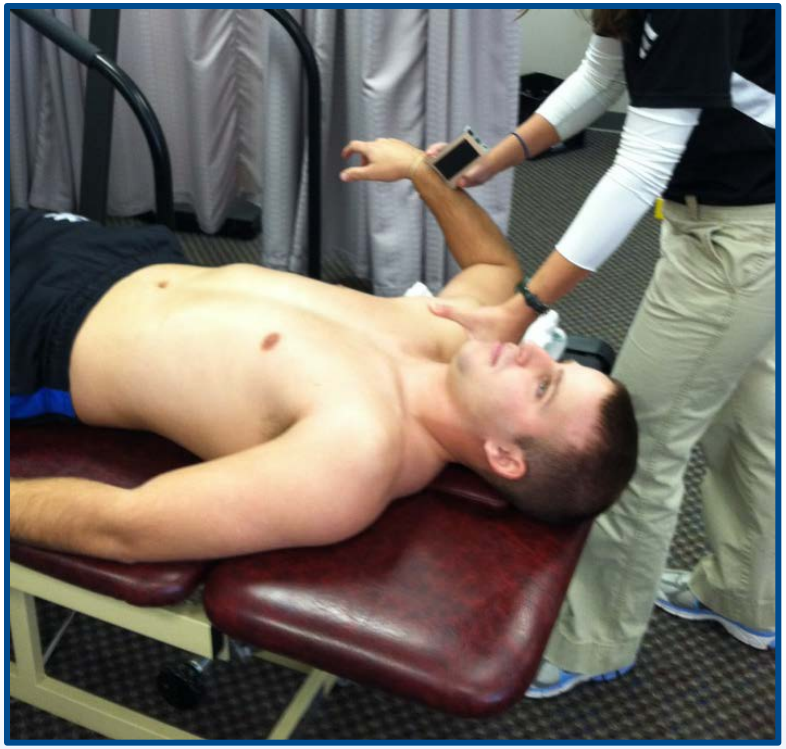
Age	22±5 years
Height	174±2 cm
Weight	80±2 kg
Sex	8 males

Procedures

- Patients randomly assigned to 2 groups based on randomization table established *a priori*
- Investigator taking measurements (C.K.) was blinded to group membership
- Measurements and treatments conducted at site convenient to participant

Range of Motion

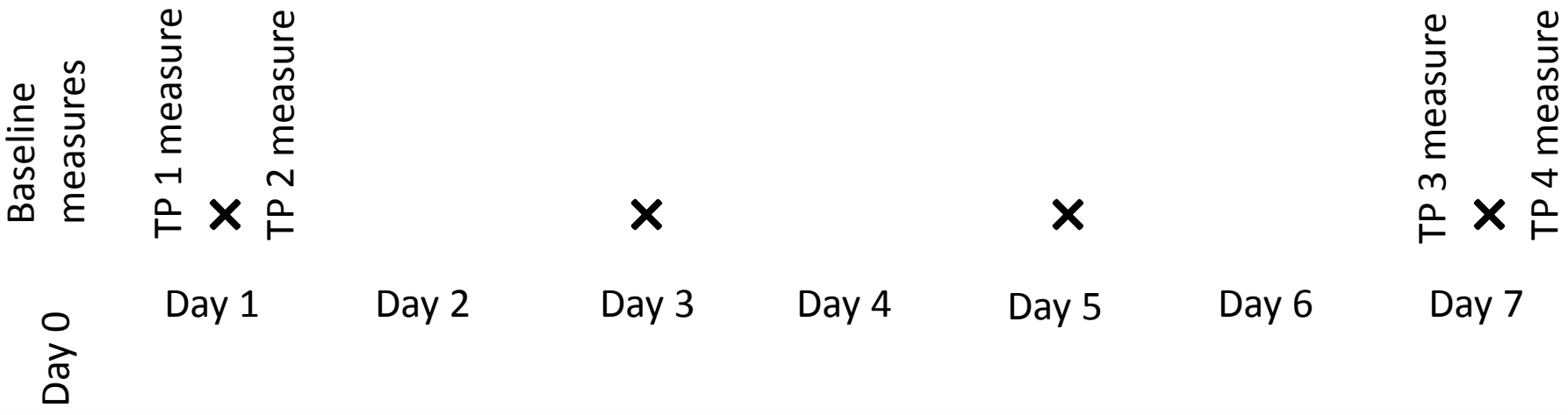
- Digital inclinometer
  (J Tech Dualer IQ)
- Subject position
  - Supine
  - 90° shoulder abduction
  - Humerus supported
  - Scapula stabilized at coracoid process



Treatment Intervention

- 2 minute treatment
  - 20 sec parallel and 20 sec perpendicular to each area
  - Experimental group
    - Posterior deltoid
    - Infraspinatus
    - Teres musculature
  - Sham group
    - Distal biceps brachii
    - Medial forearm
    - Lateral forearm

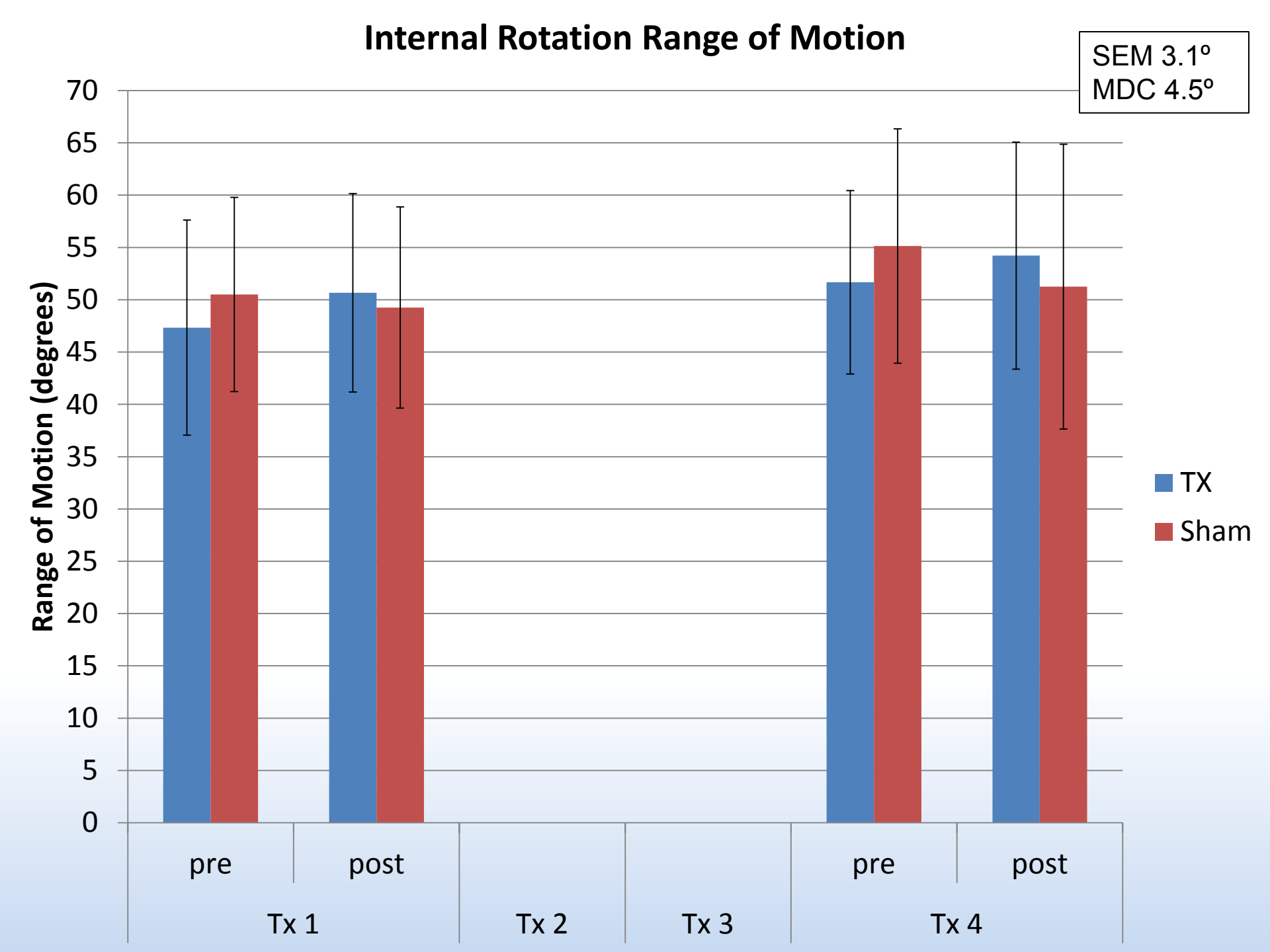
Testing and Treatment Schedule



× denotes treatment

Statistical Analysis

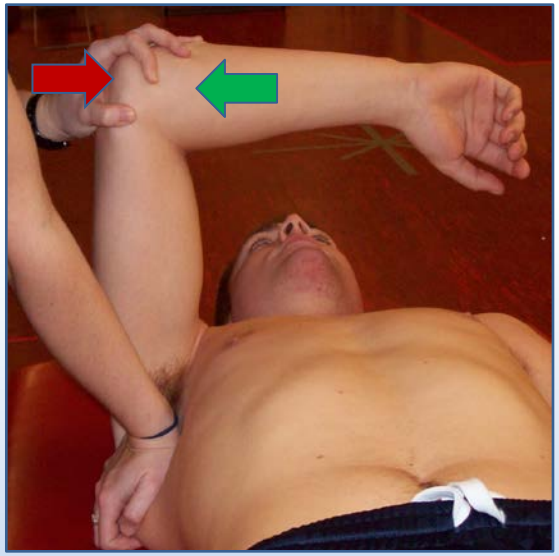
- 2(Group) x 4(Time) Repeated Measures ANOVA performed for IR ROM
- $\alpha \leq 0.05$


Internal Rotation Range of Motion
SEM 3.1º
MDC 4.5º
Range of Motion (degrees)
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
pre
post
pre
post
Tx 1
Tx 2
Tx 3
Tx 4
TX
Sham

Discussion

- Acute effects of 2 minute treatments
  - Clinician applied sleeper stretch 3x30 sec: +3° IR *(Laudner, JAT 2008)*

  - Contract relax and static stretch 3x30 sec for horizontal abductors: +4 ° IR *(Moore, JOSPT 2011)*



Clinical Application

- Muscular component of posterior shoulder tightness can be addressed specifically
- Preparatory treatment
- Can improve flexibility without stretching muscle
  - Post-operative immobilization

Limitations

- No control over what subjects did during the week of testing
- Heterogeneous sample
- Small sample size

Future Directions

- Well powered study
- Symptomatic or post-operative patients
- Longer duration of care (4 weeks?)

FRESNO STATE
Kinesiology

Thank You!
Questions?

UK
UNIVERSITY OF KENTUCKY
College of Health Sciences

sdmreed@csufresno.edu