

Evidence Based Postoperative Upper Extremity Testing for Informing RTS



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Presenter Objectives

No Conflict

- The views expressed in these slides and the today's discussion are mine
- My views may not be the same as the views of my company's clients or my colleagues
- Participants must use discretion when using the information contained in this presentation

Objectives

- Summarize the current literature surrounding upper extremity return to sport testing in athletes across a variety of populations.
- Develop return to sport testing battery for the upper extremity guided by patient population and equipment accessibility.
- Explain the interpretation of data obtained with return to sport testing and apply it to ongoing care plans and clinical progressions for athletes with upper extremity injuries.

Literature Review

Considerations for Shoulder Injury

- Arm position during sport
 - Above shoulder height
 - Below shoulder height
 - Reverse chain
- With or without throwing
- Contact/collision or no collision

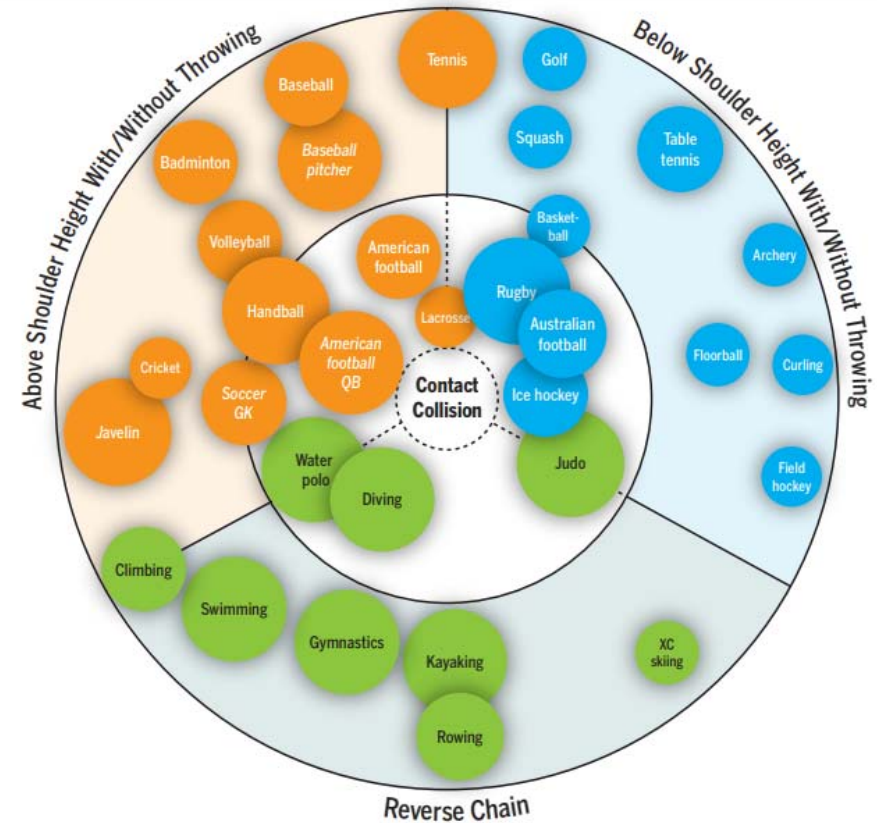


Image from: Consensus Statement Created by The Swiss Sports Physio Organization

Risk Factors

- Non-modifiable

- Previous injury
- Position
- Level of play

- Modifiable

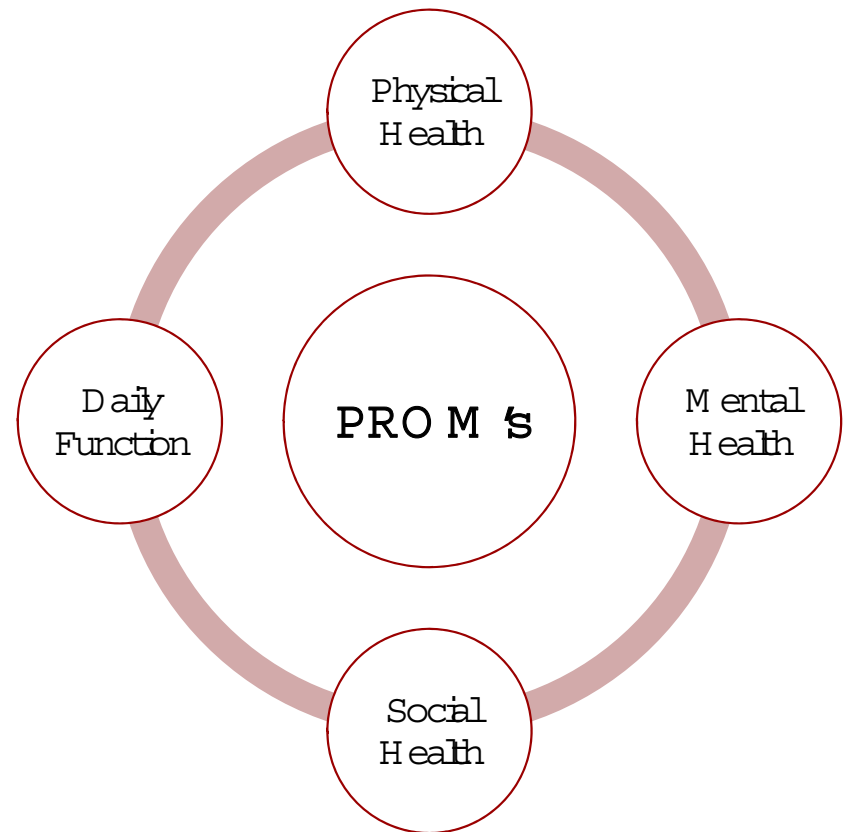
- Spikes in workload
- Muscle imbalances
- Decreased range of motion
- Psychosocial factors



PRO s	Passive range of motion	Strength	Function	Plyometrics	Core/Lower Extrem ity

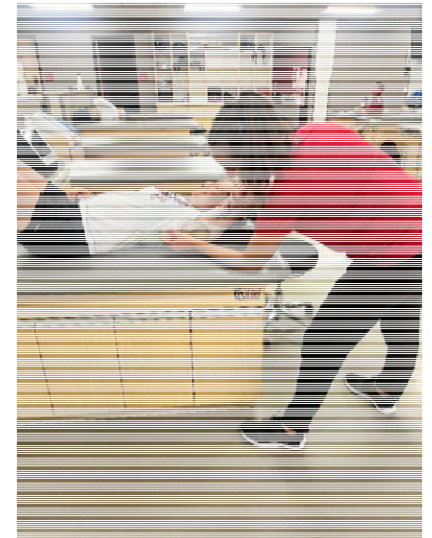
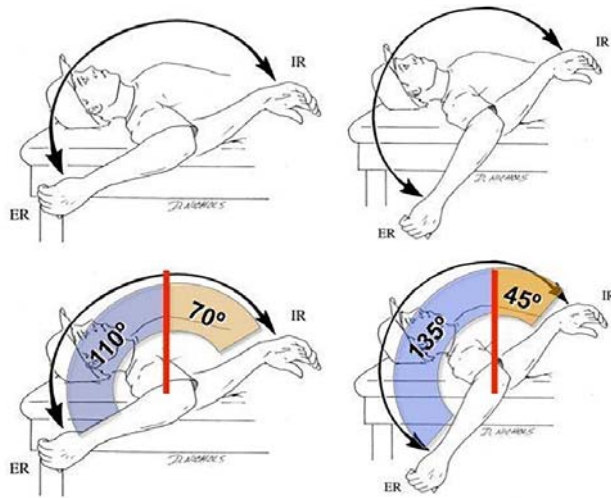
Patient Reported Outcome Measures

- **SRSI:**
 - Targets shoulder instability kinesiophobia, sports
 - 12 ?s
- **TSK-11:**
 - Targets more generalized kinesiophobia
 - 11 ?s
- **Western Ontario Shoulder Instability Index**
 - Targets collision athletes
 - 21 ?s
- **Keran-Jobe Orthopaedic Clinical Shoulder and Elbow Score**
 - Targets shoulder and elbow, general
 - 19 ?s
- **QuickDASH :**
 - Targets full upper limb
 - 11 ?s



PRO s	Passive range of m otion	Strength	Function	Plyom etrics	C ore/Lower Extrem ity
Shoulder Instability Return to Sport Questionnaire					
TSK-11					
Western Ontario Shoulder Instability Index					
Kerlan-Jobe Orthopedic Clinical Shoulder and Elbow Score					
Quick DASH					

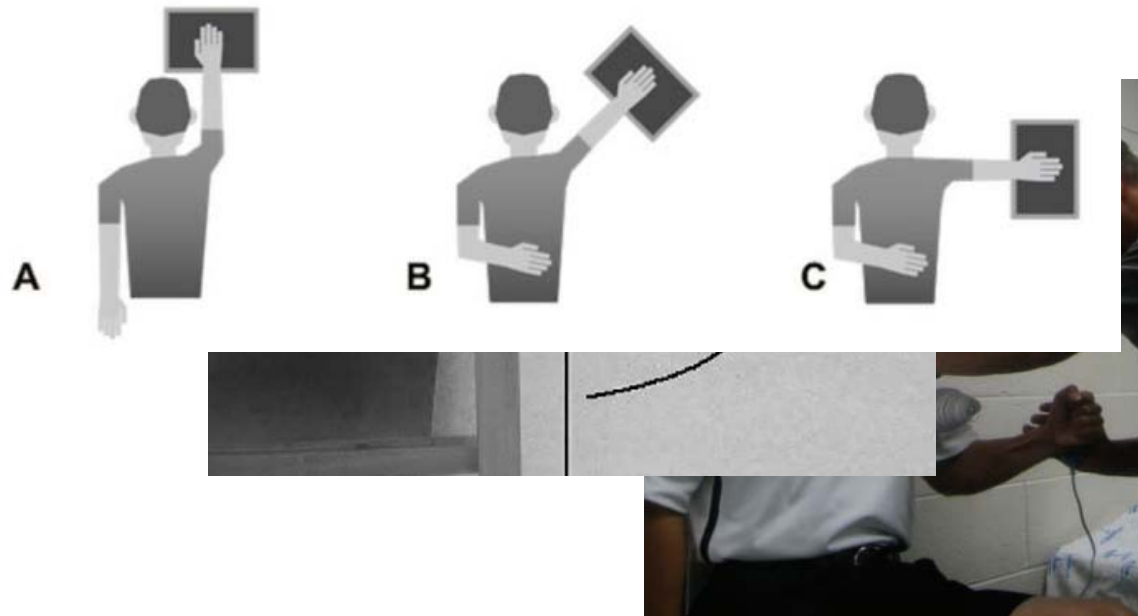
Range of Motion



PRO s	Passive range of motion	Strength	Function	Plyometrics	Core/Lower Extremity
Shoulder Instability Return to Sport Questionnaire	Flexion PROM LSI				
TSK-11	IR/ER TROM LSI				
Western Ontario Shoulder Instability Index	ER at 0				
Kerlan-Jobe Orthopedic Clinical Shoulder and Elbow Score	Horizontal adduction at 0				
Quick DASH					

Strength

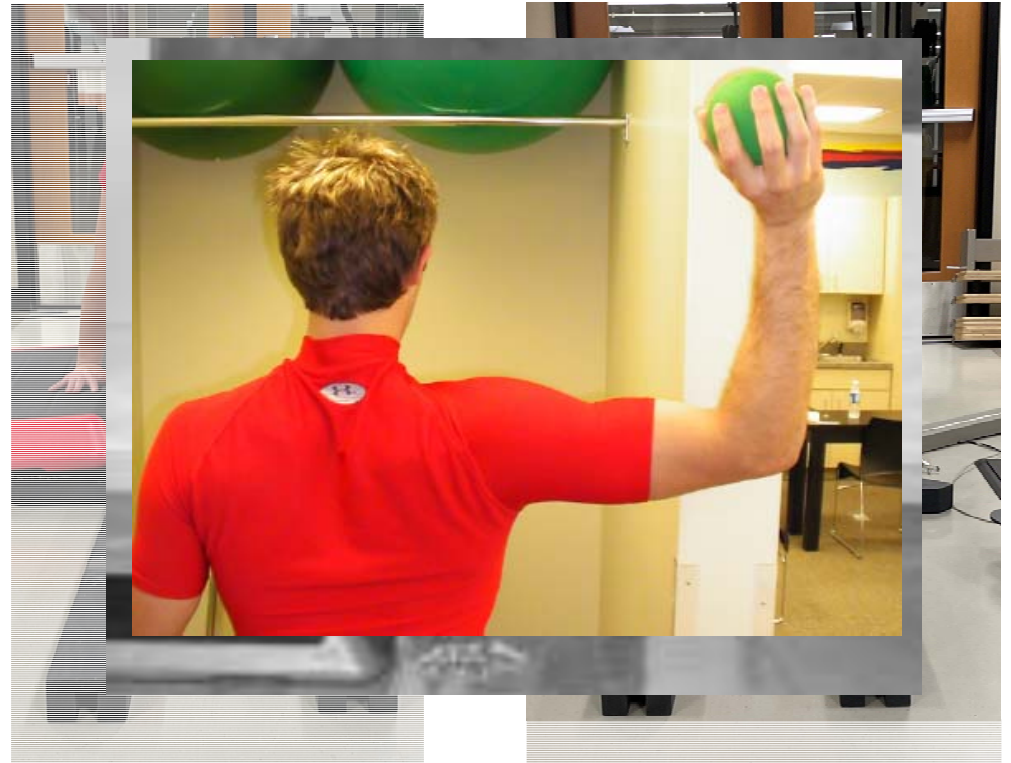
- Peak torque testing
 - Isometric HHD
 - Isokinetic
- Endurance work
 - Posterior chain endurance test
 - 2% of BW
 - External rotation at 0/90deg
 - 5% BW
 - Cable push/pull test
 - 30% of BW
- Closed chain testing
 - ASH
 - UE CKC ST
 - UE Y-Balance
 - Push up on force plate



PRO s	Passive range of motion	Strength	Function	Plyometrics	Core/Lower Extremity
Shoulder Instability Return to Sport Questionnaire	Flexion PROM LSI	Isometric HHD testing	Various medicine ball throws		
TSK-11	IR/ER TROM LSI	Isokinetic testing	Cable machine press/pull		
Western Ontario Shoulder Instability Index	ER at 0	Posterior chain or cuff endurance	Force plate push up		
Kerlan-Jobe Orthopedic Clinical Shoulder and Elbow Score	Horizontal adduction at 0	Upper extremity Y-balance testing	Flexed arm hang/modified pull up variations		
Quick DASH		UE closed kinetic chain stability test			
		Athletic shoulder testing			

Plyometrics

- Force plate plyometric push up
- One arm hop test
 - Norms in wrestlers and linemen
- Wall throws at 90/90



PRO s	Passive range of motion	Strength	Function	Plyometrics	Core/Lower Extremity
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TSK-11	IR/ER TROM LSI	Isokinetic testing	Cable machine press/pull	One arm hop test	
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		Athletic shoulder testing			

Core/lower extremity testing?



- BUN KIE
- FM S bwerscreening options
- Forward step down testing
- D L counter over ent jump

Are we adequately capturing "Function"?

- Patient reported outcome measures
- ROM
- Strength
- "Sports Function"
- In pact/plyometric

Performance Test	ROM/Strength Test	Kinetic Chain	Sport-Specific Test Example
CKCUEST ²⁵ VIDEO 11^a	90°/90° concentric/eccentric rotator cuff testing	Push-up test: assessing for ability, quality of movement, control, and endurance	Number of pain-free throws/serves at or above previous speed
PSET ^{32,33,63} VIDEO 12^a	Isometric rotation strength ER/IR at 90°/0°	Side plank endurance	Throwing at full speed
Shoulder Endurance Test (SET) (endurance test for ER in ABD/ER, 90°/90°) ²⁶	Total rotational ROM within 10% of the contralateral side	Plyometric push-up	Visual assessment of the "smoothness" of the throwing technique
The Athletic Shoulder Test (ASH-Test) ⁶	ER force measured with HHD in prone at 90°/90° and 90°/0° VIDEO 13^a	Single-leg squat test	Wrestling drills
Y Balance Test for the upper and lower extremities ⁴⁰ VIDEO 14^a	ER/IR ratio: sport-specific numbers apply	Thoracic spine rotation	Tackle replication (eg, for American football or rugby) VIDEO 15^a
Seated medicine-ball throw ²⁵ VIDEO 16^a	IR/ER ratio at 90°/90° in sitting (break test, HHD) VIDEO 17^a	Bench press	Tackle replication with leg grab VIDEO 18^a
Ball abduction-ER test VIDEO 19^a	IR/ER ratio in sitting at 90° of abduction and neutral rotation VIDEO 20^a	Upper-limb rotation test ²⁵	...
Ball taps on wall test VIDEO 21^a
Prone ball-drop test VIDEO 22^a

Abbreviations: CKCUEST, closed kinetic chain upper extremity stability test; ER, external rotation; PSET, posterior shoulder endurance test; ROM, range of motion.
^aVideos can be found at www.jospt.org/doi/10.2519/jospt.2022.10952

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**2022 Bern Consensus Statement
on Shoulder Injury Prevention,
Rehabilitation, and Return to Sport for
Athletes at All Participation Levels**

Designing A Protocol

Considerations for sport, injury type, and resources

Literature Available

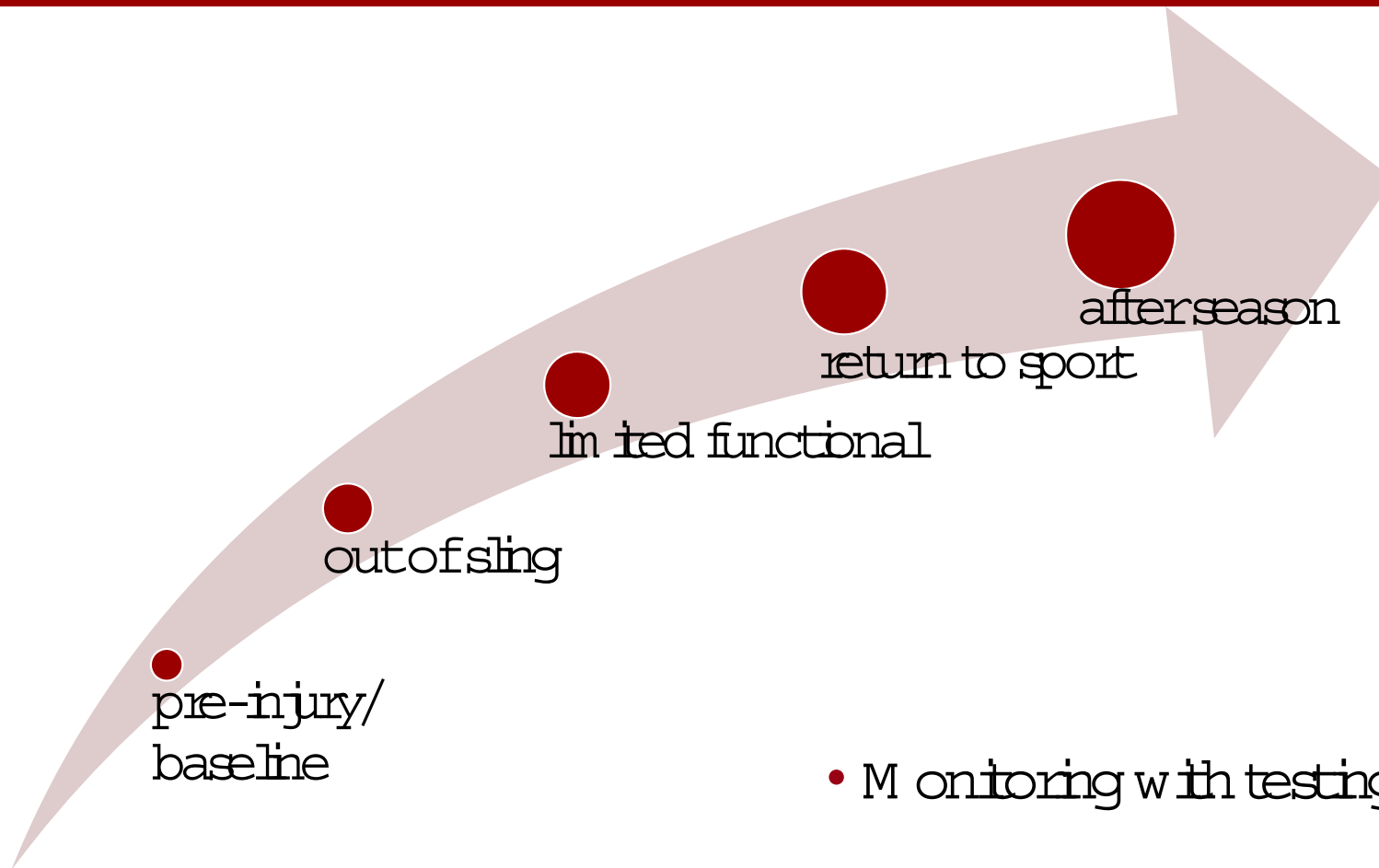
PRO s	Passive range of motion	Strength	Function	Plyometrics	Core/Lower Extremity
Shoulder Instability Return to Sport Questionnaire	Flexion PROM LSI	Isometric HHD testing	Various medicine ball throws	Force plate plyometric push up testing	Bunkie
TSK-11	IR/ER TROM	Isokinetic testing	Cable machine press/pull	One arm hop test	SL step down
Western Ontario Shoulder Instability Index	ER at 0	Posterior chain or cuff endurance	Force plate push up	Wall throws at 90/90	FM SLE screening options
Kerlan-Jobe Orthopaedic Clinical Shoulder and Elbow Score	Horizontal adduction at 0	Upper extremity Y-balance testing	Flexed arm hang/modified pull up variations		DL counter movement jump
QuickDASH		UE closed kinetic chain stability test			

Differences Across Populations

- Athletics / General Population
- Sport
 - Variety
 - Task
- Sprint / Endurance
- Position
- Age



Return to play/competition/peak



- Monitoring with testing over time

UW Health Surgical Protocol

UW HEALTH SPORTS REHABILITATION

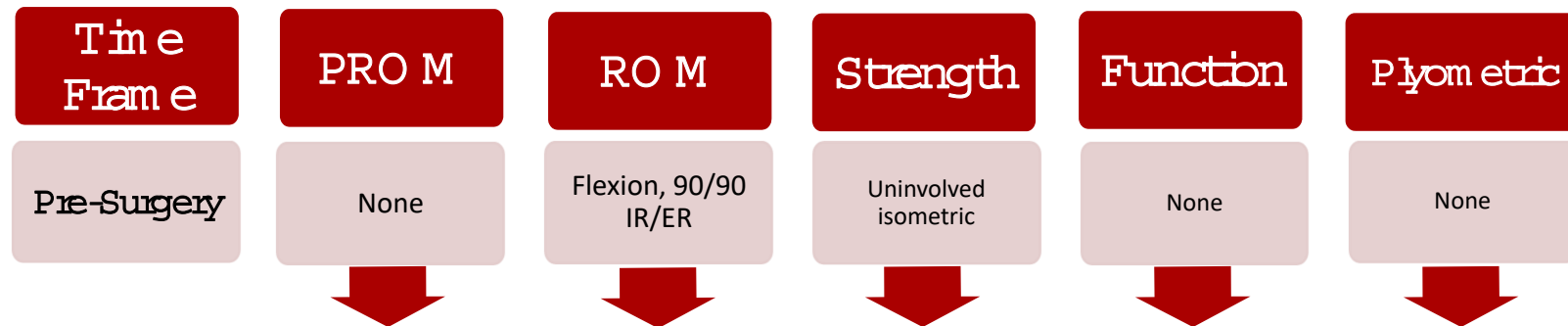
Rehabilitation Guidelines for Anterior Shoulder Reconstruction with Arthroscopic Bankart Repair

PHASE II (begin after meeting Phase I criteria, usually 6 weeks after surgery)

Appointments	<ul style="list-style-type: none">• Rehabilitation appointments are once every 1-2 weeks
Rehabilitation Goals	<ul style="list-style-type: none">• Full shoulder active ROM in all cardinal planes• Progress shoulder ER ROM gradually to prevent overstressing the repaired anterior tissues of the shoulder• Strengthen shoulder and scapular stabilizers in protected position (0- 45° abduction)• Begin proprioceptive and dynamic neuromuscular control retraining
Precautions	<ul style="list-style-type: none">• Avoid passive and forceful movements into shoulder ER, extension and horizontal abduction
Progression Criteria	<ul style="list-style-type: none">• Full shoulder active ROM• Negative apprehension and impingement signs• 5/5 shoulder IR and ER strength at 45° abduction

- Outgoals = surgical goals
- Testing time frame based off protocol

UW Timeline for Testing



Modifying w /Resource Availability

Testing Goal	High Tech	Low Tech
Strength	<ul style="list-style-type: none">Isokinetic testingIsometric fatigue testing	<ul style="list-style-type: none">Isometric testing w /H H DPosterior shoulder endurance test

Reproducibility and Consistency

Conclusions

The purpose of this study was to establish absolute and relative reliability for several procedures measuring the rotational shoulder ROM and strength into IR and ER.




The study results show good to excellent reliability values for all procedures performed. Clinicians should

consider their choice based on the available equipment and the ability of the patient to achieve the body or shoulder position. In general, measurements in the supine position are recommended because of practical applicability and body stabilization, and clinicians are recommended to use more than 1 procedure to allow functional measurements based on the patient's abilities at the moment of evaluation.

- 
- 1) Standardize testing
 - 2) Be consistent

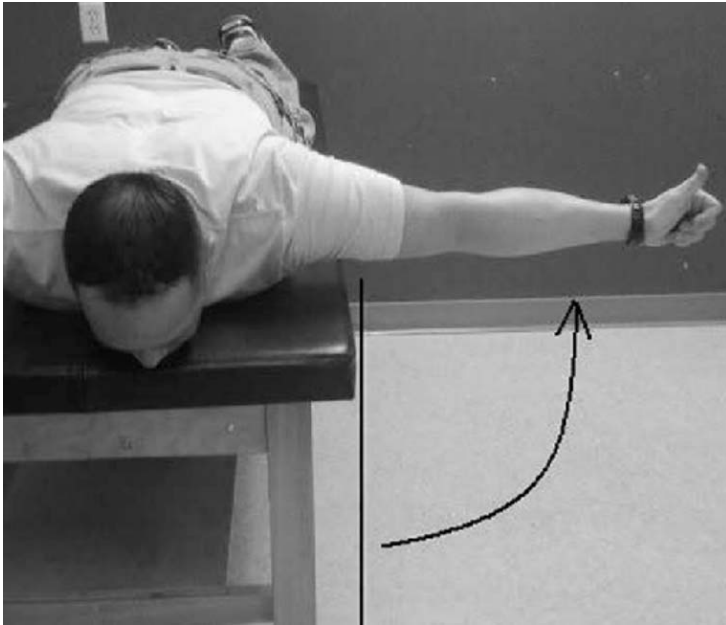
Ceiling Effect

- Crossover between sports for baseline norms
- Team means

Sport	IR-ER ROM	Flexion ROM
		
		
		

Modifications to the testing series

- Posterior shoulder endurance testing
- Quantifying shoulder “fatigue”

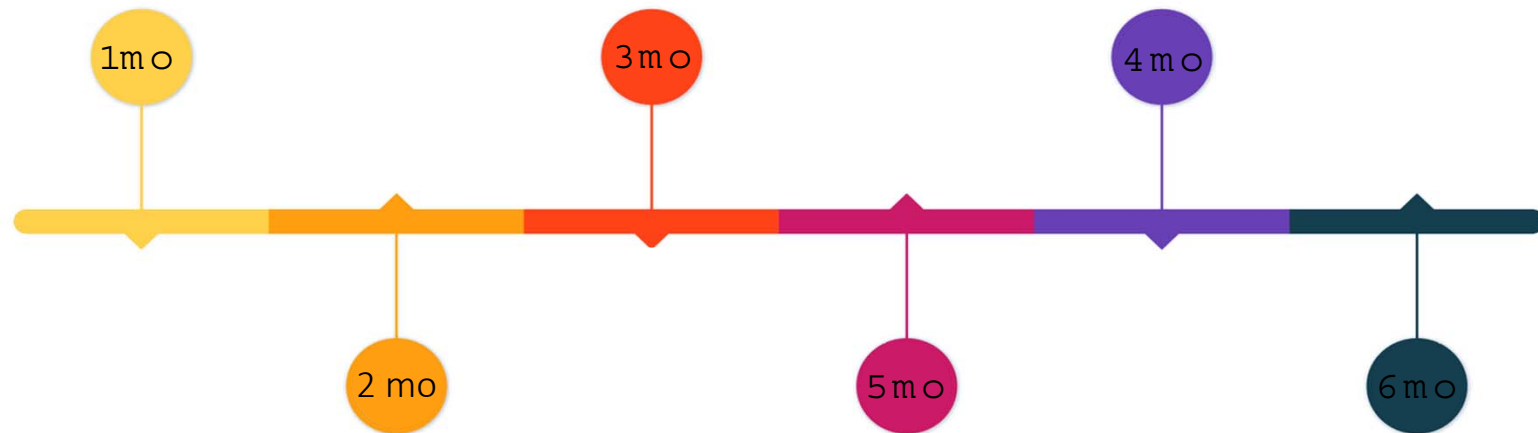
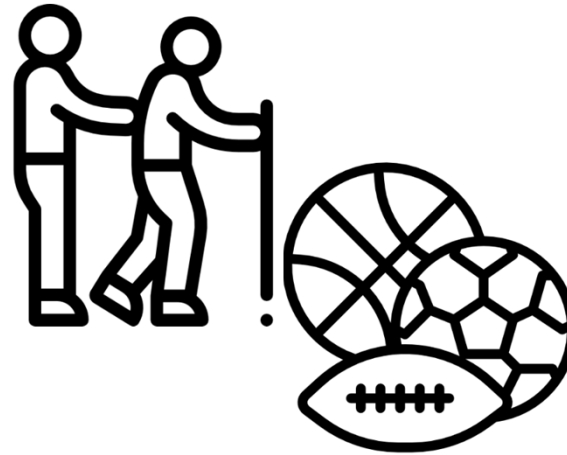


Interpreting The Data

A quick case

What To Consider When Interpreting Results

- Time frame
 - Having realistic expectations
- Surgical history
- Goal function level
 - What is actually required for what they will return to
- Testing procedures



Case Example 1

BUCKY BADGER

Surgery Date: 6/27/2022

Injured Limb: R

Test Date: 6/28/2022

8w 16w 24w 1y



Notes

Case Example 2

BUCKY BADGER

Surgery Date: 5/23/2022

Injured Limb: L

Test Date: 11/14/2022

■ ■ ■ 16w ■ 24w



Notes



INTERPRETATIONS



Strength and Power	<p>Push & Pull Strength: Patient's pushing power symmetry has reached 100% compared to the opposite side, while pulling power symmetry is nearing 85%. Pull to push ratio is currently 1.25. Focus on posterior chain strengthening may be warranted to improve pull symmetry.</p> <p>Er & IR Strength: Patient's external rotation PT/BW is currently 13%, and internal rotation PT/BW is currently 18%. Limb symmetry for internal rotation has reached 87% while external rotation limb symmetry lags behind at 82%. Progressive external rotation strengthening may be warranted to reach symmetry and PT/BW normative values.</p> <p>General: Patient presents with resolving internal and external rotation strength deficits, but continues to score slightly below normative values for both IR and ER when normalized for body weight. Patient has resolved power deficits with concentric phase of push up testing, but offloads when landing, indicating further impact work may be beneficial. Patient also has a lower SIRSI score than average at this time point and that may warrant further follow up.</p>	Meets Expectations
		Area of Continued Emphasis
	<p>Push_Up</p> <p>Patient offloads injured arm by 15% during force absorption phase of the push up. Peak power during the concentric phase shows 95% symmetry.</p>	Area of continued emphasis
	<p>RDM</p> <p>Patient uninvolved shoulder range of motion is 9 deg greater than the involved shoulder. This meets goal values for symmetry at this time.</p>	Meets expectations
<p>Other</p>	<p>Patient SIRSI score is 45%. This is slightly below goal values at this time point.</p>	Area of continued emphasis

Plan of Care Modifications

SIRSI Questionnaire

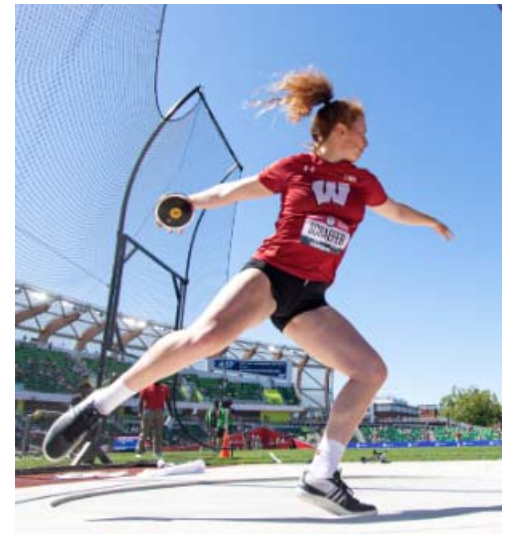
- Work on any underlying deficits to promote confidence
- Consider a referral to sports psychology if kinesiophobia persists

Establishing Normative Values

Healthy and injured cohorts

Normative For What?

- What is success?
 - ADLs
 - Return to sport
 - Re-injury risk reduction
- Goals for specific time points through recovery
- Goals for specific sport/function
- What's 'normal' for your population?



Our Goals

- What is success?
 - Return to sport
- Goals for specific time points through recovery
 - 8, 16, 24 weeks post op
- Goals for specific sport/function
 - Team dependent
- What's “normal” for your population?
 - D1 collegiate athletes



Goal Values



Range of Motion

- Symmetry:
- Flexion: 5°
- IR: 15°
- ER: 10°
- Total ER-IR range: 10°
- Raw Values:
- Crossbody add >40 deg on D

ER = External Rotation; IR = Internal Rotation; D= Dominant; ND = Non-Dominant

Case Example 2

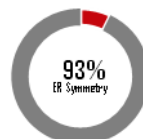
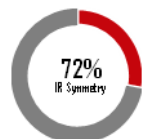
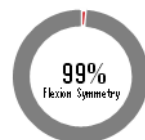
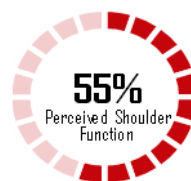
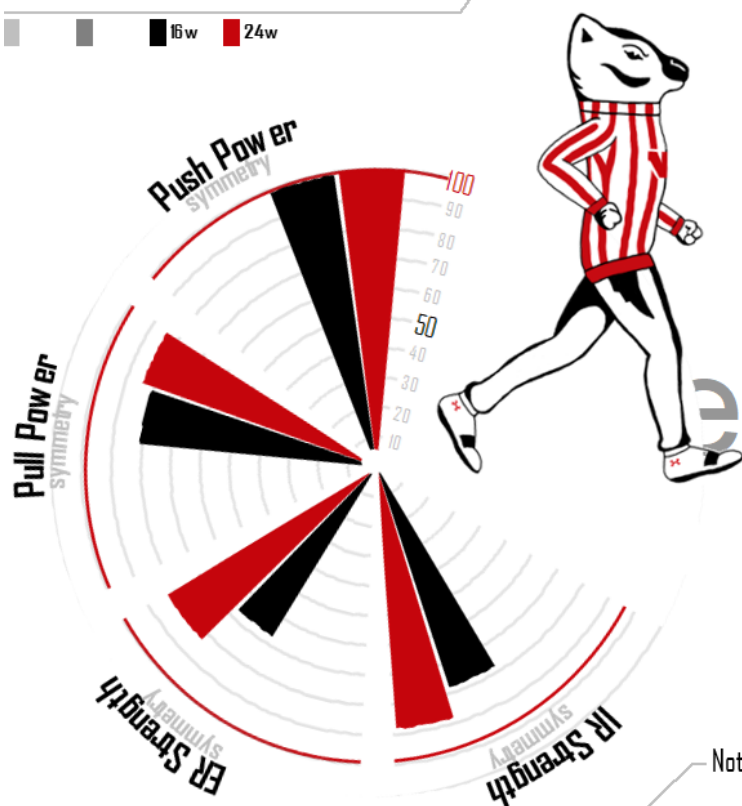
BUCKY BADGER

Surgery Date: 5/23/2022

Injured Limb: L

Test Date: 11/14/2022

■ 16w ■ 24w



Push-Up Power Symmetry

N/A
N/A
N/A
N/A

Notes

Considerations:

- 1) How does this change your rehab moving forward?
- 2) Is this athlete ready to be completely cleared for full activity?
- 3) Is this athlete ready to begin throwing?

Return To Throw Considerations

PAIN

0/10 shoulder or elbow
pain

*Performed with no pain and appropriate mechanics

Take Home Points

- Objective shoulder testing should encompass elements of patient reported outcome measures, ROM, strength, plyometrics, and lower extremity function
- Testing results should be compared utilizing limb symmetry, strength/BW, and comparison to healthy normative values when available
- Testing should be performed with consistent methodology and at consistent time points to ensure best accuracy of interpretations

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Thank you!

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