

Suprascapular Neuropathy in Overhead Athletes



Introductions



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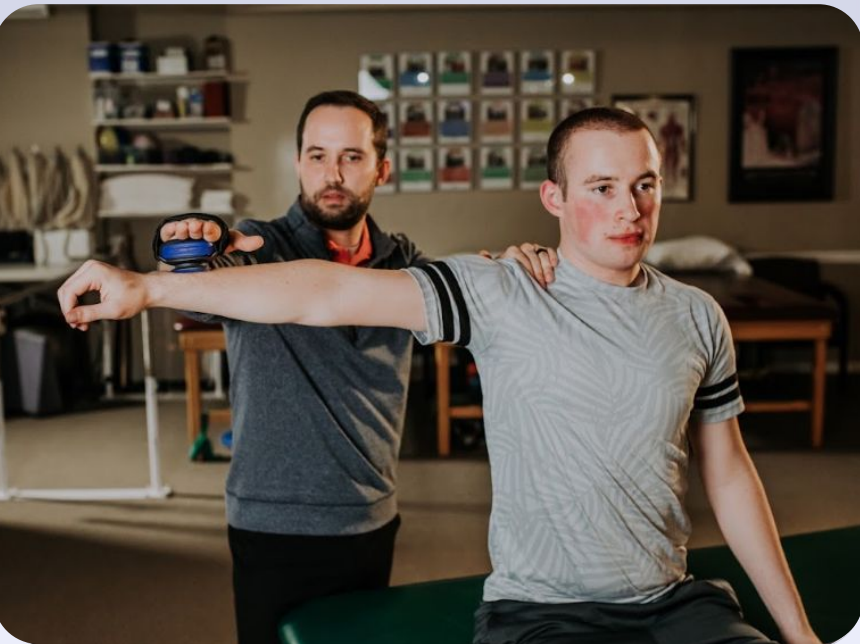


Learning Outcomes



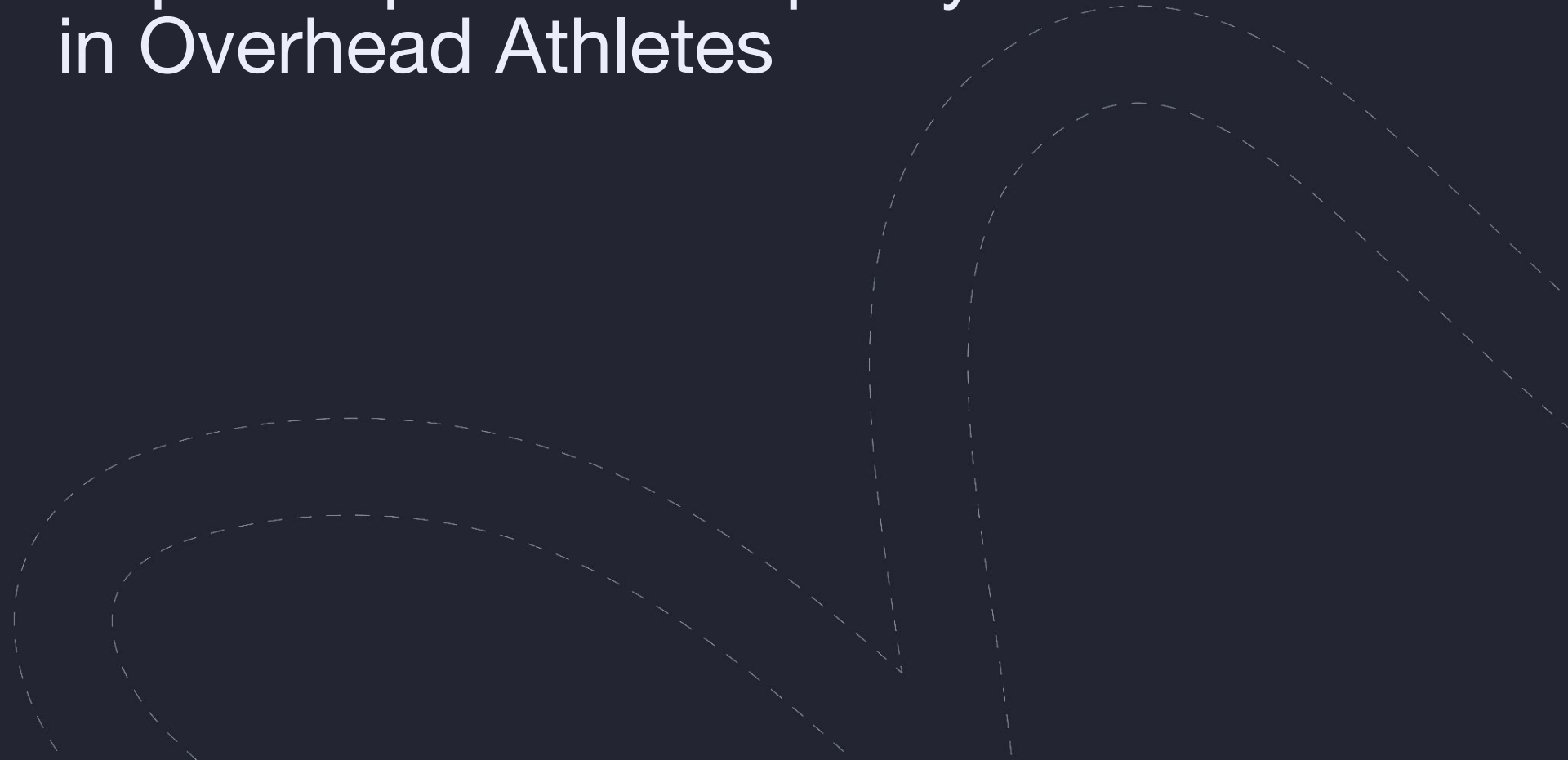
- Understand the pathophysiology, entrapment mechanisms, risk factors & clinical presentations of suprascapular neuropathy in overhead athletes — at the suprascapular and spinoglenoid notches.
- Execute an integrated assessment protocol using targeted ROM evaluations and ActivForce2 dynamometry for shoulder ER, abduction, and scapular stabilization to objectively quantify nerve involvement.
- Analyze ActivForce2 dashboard data — ER:IR ratios, ER:ABD comparisons, and bilateral asymmetries — to build a criterion-based rehab protocol from isolated cuff activation to sport-specific overhead loading.

Agenda



- Introduction: Investigating Injuries: Suprascapular Neuropathy in Overhead Athletes
- Clinical Presentations of Suprascapular Neuropathy in Athletes
- Anatomical Structures Affected
 - Primary and Secondary / Contributing Structures
- Mechanisms of Injury: Traction, Compression, and Repetitive Overhead Microtrauma
- Common Causes and Risk Factors
- Clinical Assessment
 - ROM: Shoulder External Rotation, Shoulder Internal Rotation, Shoulder Flexion, Shoulder Horizontal Adduction, Scapular Mobility and Upward Rotation
 - Muscle Testing: Shoulder External Rotators, Shoulder Abductors, Scapular Stabilizers, Shoulder Internal Rotators
- Case Study: Data Review and Analysis
- Treatment and Rehabilitation Strategies
- Q&A

Suprascapular Neuropathy in Overhead Athletes





Why Suprascapular Neuropathy Matters in Overhead Sports

What is Suprascapular Neuropathy?

- Peripheral nerve entrapment or traction neuropathy of the suprascapular nerve
- Causes posterior shoulder pain, weakness, and progressive muscle atrophy
- Affects supraspinatus and/or infraspinatus depending on the entrapment site
- Frequently misdiagnosed as rotator cuff tear or posterior impingement



~Up to 33%

of elite volleyball players show SSN
on imaging

12-24 months

mean delay to accurate diagnosis from
symptom onset

C5-C6

nerve root origin — upper trunk
of brachial plexus

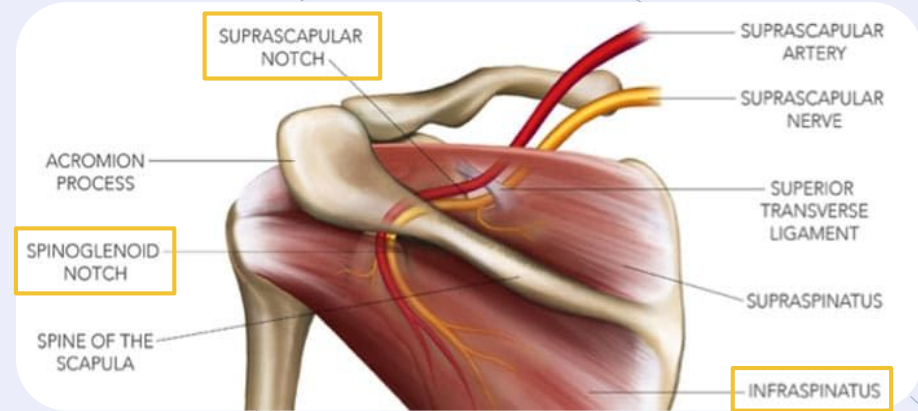


Why Suprascapular Neuropathy Matters in Overhead Sports

Key Clinical Distinction — Entrapment Site

- Suprascapular notch entrapment:
 - affects both supraspinatus and infraspinatus (proximal)
- Spinoglenoid notch entrapment:
 - affects infraspinatus only (distal branch)
- Isolated infraspinatus atrophy:
 - hallmark of distal (spinoglenoid) SSN

Site of entrapment determines muscle involvement, atrophy pattern, and assessment strategy





How Suprascapular Neuropathy Presents in Athletes

Pain Behavior

Deep, dull posterior shoulder ache — often poorly localized. Worsens with overhead loading and throwing volume. May persist at rest and disrupt sleep in chronic presentations.

Location & Muscle Findings

Posterior shoulder near the infraspinous fossa. Visible infraspinatus atrophy is pathognomonic in chronic SSN. Supraspinatus wasting indicates proximal (suprascapular notch) involvement.

Aggravating Factors

Overhead reaching, serve or spike follow-through, cross-body movements. Symptoms often peak during or after sport — not always acute in onset.

Functional & Special Signs

ER weakness (infraspinatus); ABD weakness if proximal entrapment. Positive Neer/Hawkins-Kennedy may be present. Cross-body adduction may reproduce posterior pain. Visible infraspinatus hollowing on inspection.



Primary Structures Involved

The suprascapular nerve pathway — from origin to terminal motor innervation

Suprascapular Nerve

Arises from upper trunk of the brachial plexus (C5–C6). The sole nerve crossing the scapular notch. Provides sensory supply to the glenohumeral and AC joints, and motor innervation to supraspinatus and infraspinatus.

Suprascapular Notch (TSL)

Primary entrapment site. The transverse scapular ligament (TSL) bridges the notch — the nerve passes beneath it while the suprascapular artery passes above. TSL ossification or thickening narrows the canal, compressing the nerve.

Spinoglenoid Notch

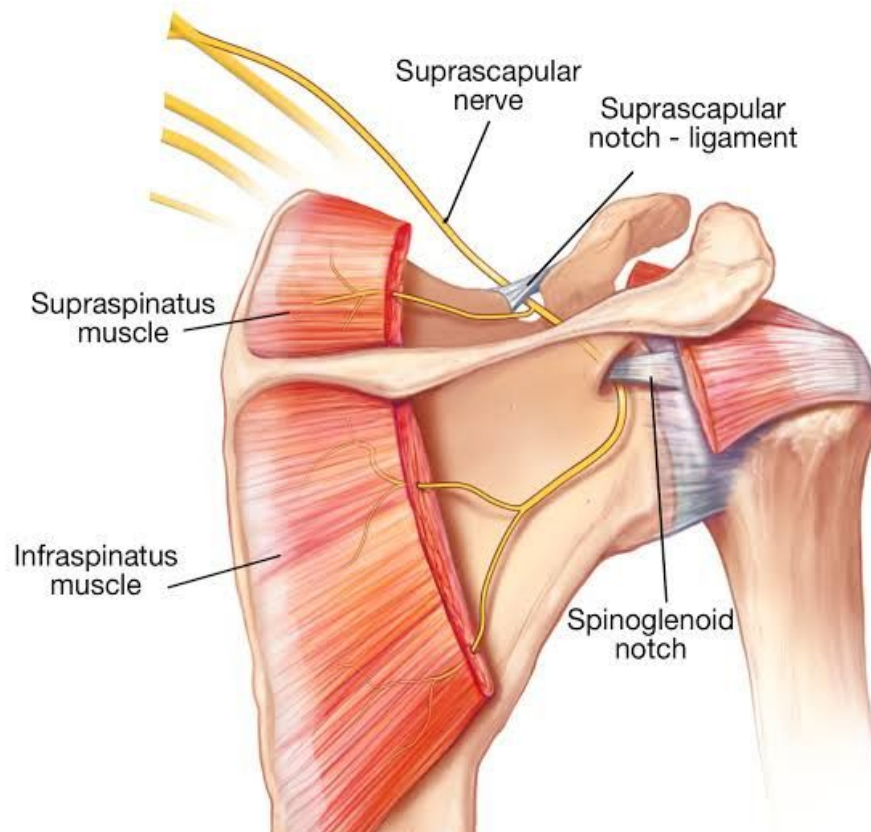
Second entrapment site. The distal infraspinatus branch curves here. Compression from paralabral cysts or posterior capsule tethering causes isolated infraspinatus weakness.

Supraspinatus

Innervated by the proximal suprascapular nerve branch (before the spinoglenoid notch). Weakness or atrophy indicates suprascapular notch-level entrapment.

Infraspinatus

Innervated by the distal branch at the spinoglenoid notch. Most commonly affected. Isolated infraspinatus weakness/atrophy is the hallmark of distal SSN.





Secondary & Contributing Structures

Structures that perpetuate, amplify, or complicate suprascapular nerve involvement

Suprascapular Artery & Vein

Travel with the nerve through the suprascapular canal — the artery above the TSL, the vein accompanying the nerve below. Vascular crowding within a narrow notch can contribute to dynamic compression, particularly in hypertrophied overhead athletes.

Glenohumeral Joint Capsule (Posterior)

Posterior capsule tightness or hypertrophy (common with GIRD in throwing athletes) tethers the distal nerve branch during arm elevation and follow-through. A well-documented mechanism in pitchers and volleyball players.

Paralabral Cysts (Spinoglenoid Notch)

Ganglia arising from posterior labral tears expand into the spinoglenoid notch, directly compressing the infraspinatus branch. Cyst size correlates with ER weakness severity on EMG. MRI is diagnostic — arthroscopic cyst excision plus labral repair is the definitive intervention.

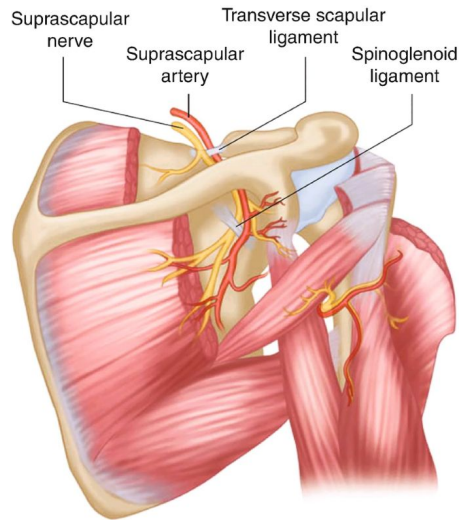
Clinical note: paralabral cysts and posterior capsule tethering are the dominant contributing structures in throwing athletes. Imaging is essential when these are suspected.



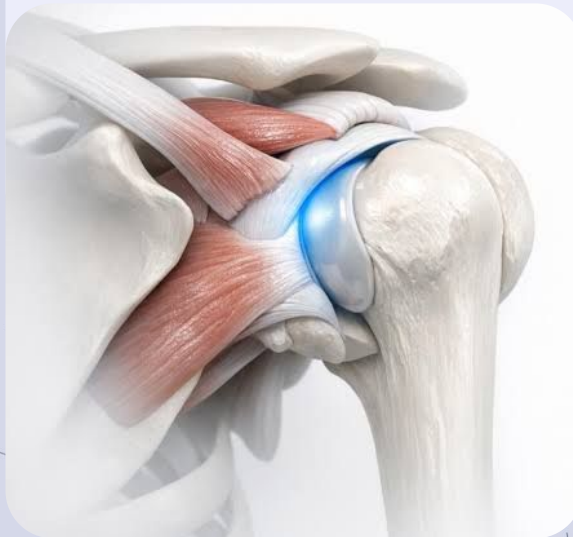
Secondary & Contributing Structures

Structures that perpetuate, amplify, or complicate suprascapular nerve involvement

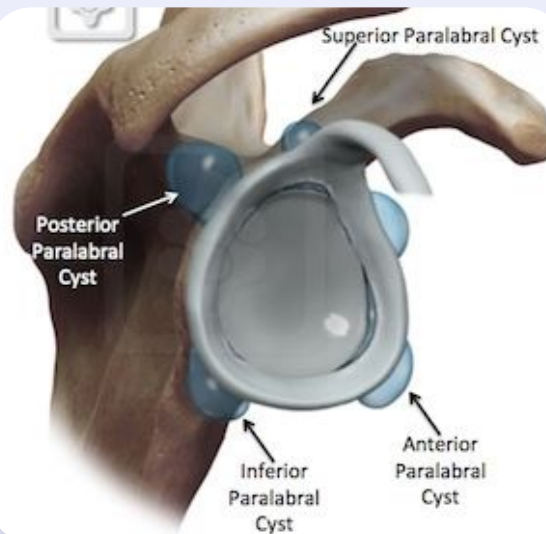
Suprascapular Artery & Vein



Glenohumeral Joint Capsule (Posterior)



Paralabral Cysts (Spinoglenoid Notch)



Clinical note: paralabral cysts and posterior capsule tethering are the dominant contributing structures in throwing athletes. Imaging is essential when these are suspected.



Three intersecting pathways - typically coexisting in the overhead athlete

Traction

Scapular 'sling' mechanism

- Rapid scapular protraction during follow-through stretches the nerve over the TSL
- Nerve is tethered between TSL above and spinoglenoid notch below — two-point tension
- Repeated at high volume (300–500+ spikes/session in volleyball) = progressive ischemia
- Cumulative traction → demyelination → denervation without acute traumatic event

Compression

Structural Entrapment

- TSL ossification or hypertrophy reduces suprascapular canal cross-sectional area
- Paralabral cysts occupy the spinoglenoid notch, compressing the infraspinatus branch
- Posterior capsule tethering increases nerve tension against bony notch margins
- Static compression causes progressive axonal injury regardless of activity level

Repetitive Microtrauma

Cumulative Loading

- High-volume overhead sport repeats the same nerve stress cycle thousands of times per season
- Subcritical loads accumulate when recovery is insufficient between training sessions
- Intraneural inflammation compounds mechanical nerve injury over time
- Training load spikes and technique errors (e.g., excessive scapular protraction) amplify risk



Primary Structural Drivers of SSN

Suprascapular Notch (TSL)

TSL compresses the nerve beneath it. Ossification, hypertrophy, or narrow V-shaped notch morphology reduces available canal space — increasing static and dynamic compressive load on the nerve trunk, affecting both supraspinatus and infraspinatus.

Spinoglenoid Notch

Paralabral cysts from posterior labral tears or posterior capsule tethering compress the distal infraspinatus branch. Isolated infraspinatus weakness is the clinical fingerprint. MRI and EMG confirm site and severity of compression.

Scapular “sling” Traction

During the follow-through phase, rapid scapular protraction stretches the nerve between its two fixed points (TSL and spinoglenoid notch). Repetitive tensile loading in high-volume overhead sport = progressive nerve ischemia and demyelination.

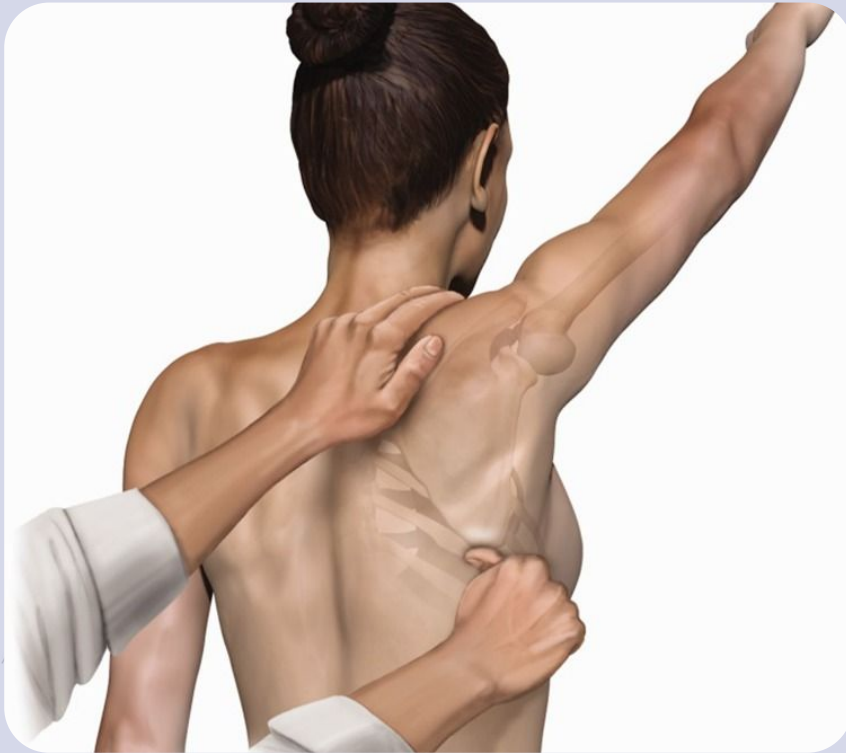
****These drivers compound each other — scapular dyskinesis worsens traction, posterior capsule tightness amplifies compression, and high training volume accelerates microtrauma accumulation.*



Sports & Extrinsic Factors

- Volleyball, baseball/softball, swimming, tennis, water polo — highest documented SSN prevalence
- High-volume repetitive overhead loading; preseason training spikes without adequate preparation
- Faulty overhead mechanics — excessive or abrupt scapular protraction during follow-through
- Insufficient recovery between high-volume overhead training sessions
- Congenitally narrow or V-shaped suprascapular notch morphology (structural predisposition)



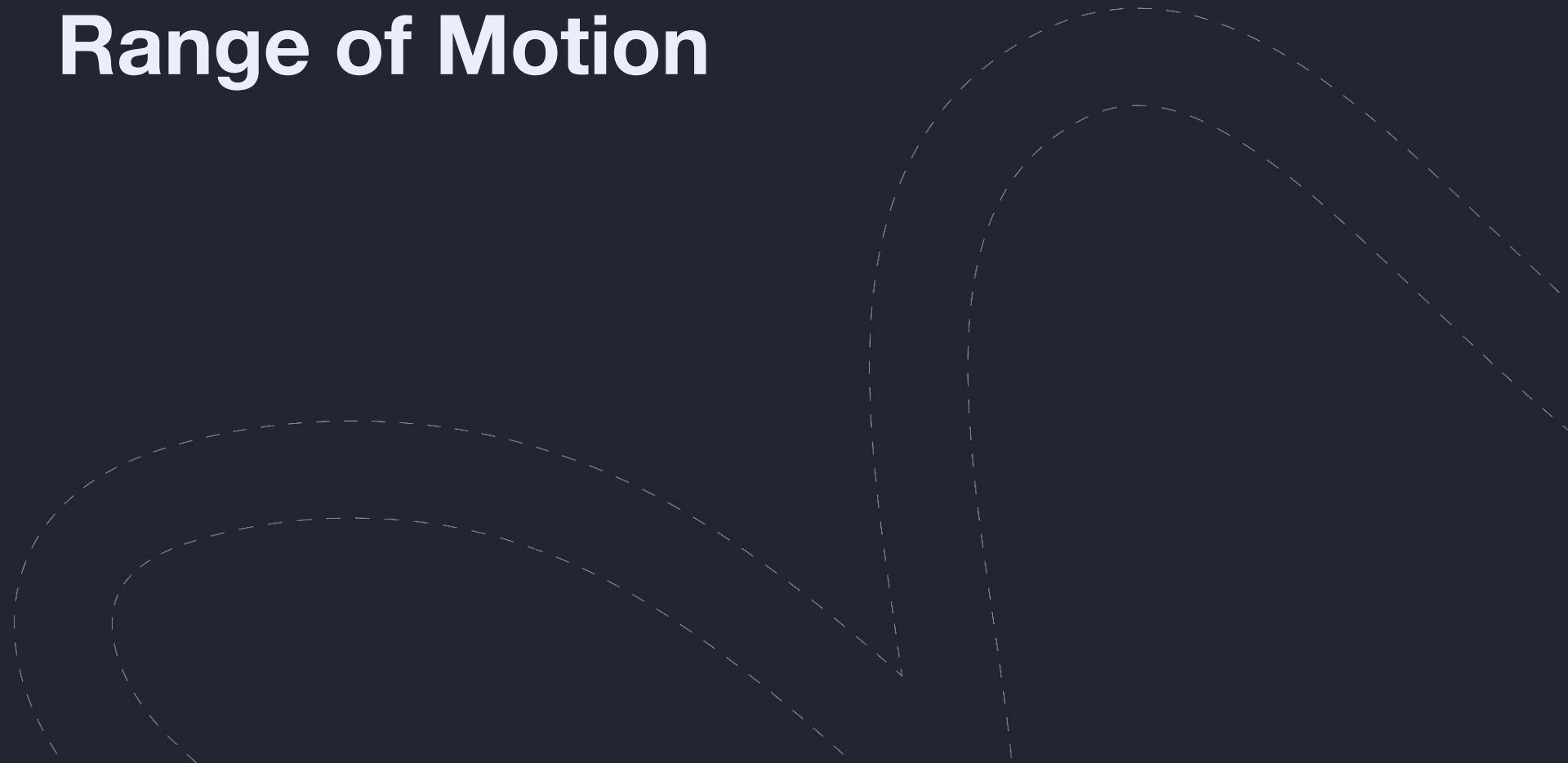


Biomechanical & Intrinsic Factors

- Scapular dyskinesis — reduced upward rotation amplifies nerve traction during overhead loading
- GIRD (glenohumeral IR deficit) — posterior capsule tightness tethers the distal nerve branch
- Reduced shoulder ER ROM or horizontal adduction ROM — indicators of posterior capsule restriction
- Prior posterior labral tear — source of paralabral cysts at the spinoglenoid notch
- RC weakness or force imbalance — increased compensatory loading and scapular instability



Assessment: **Range of Motion**





Shoulder External Rotation

- Infrapinatus weakness marker — ER deficit is the primary SSN finding; bilateral comparison essential.
- Best tested with the device strapped on the patient's arm or wrist.
- Can be done in supine, sidelying, seated, or standing



Shoulder Internal Rotation

- GIRD screen — $\geq 18-25^\circ$ loss vs. contralateral indicates posterior capsule tightness.
- Best tested with the device strapped on the patient's arm or wrist.
- Can be done in supine, sidelying, seated, or standing



Shoulder Flexion

- Overhead capacity; supraspinatus weakness may reduce active elevation range.
- Best tested with the device strapped on the patient's arm or wrist.
- Can be done in supine, sidelying, seated, or standing



Horizontal Adduction

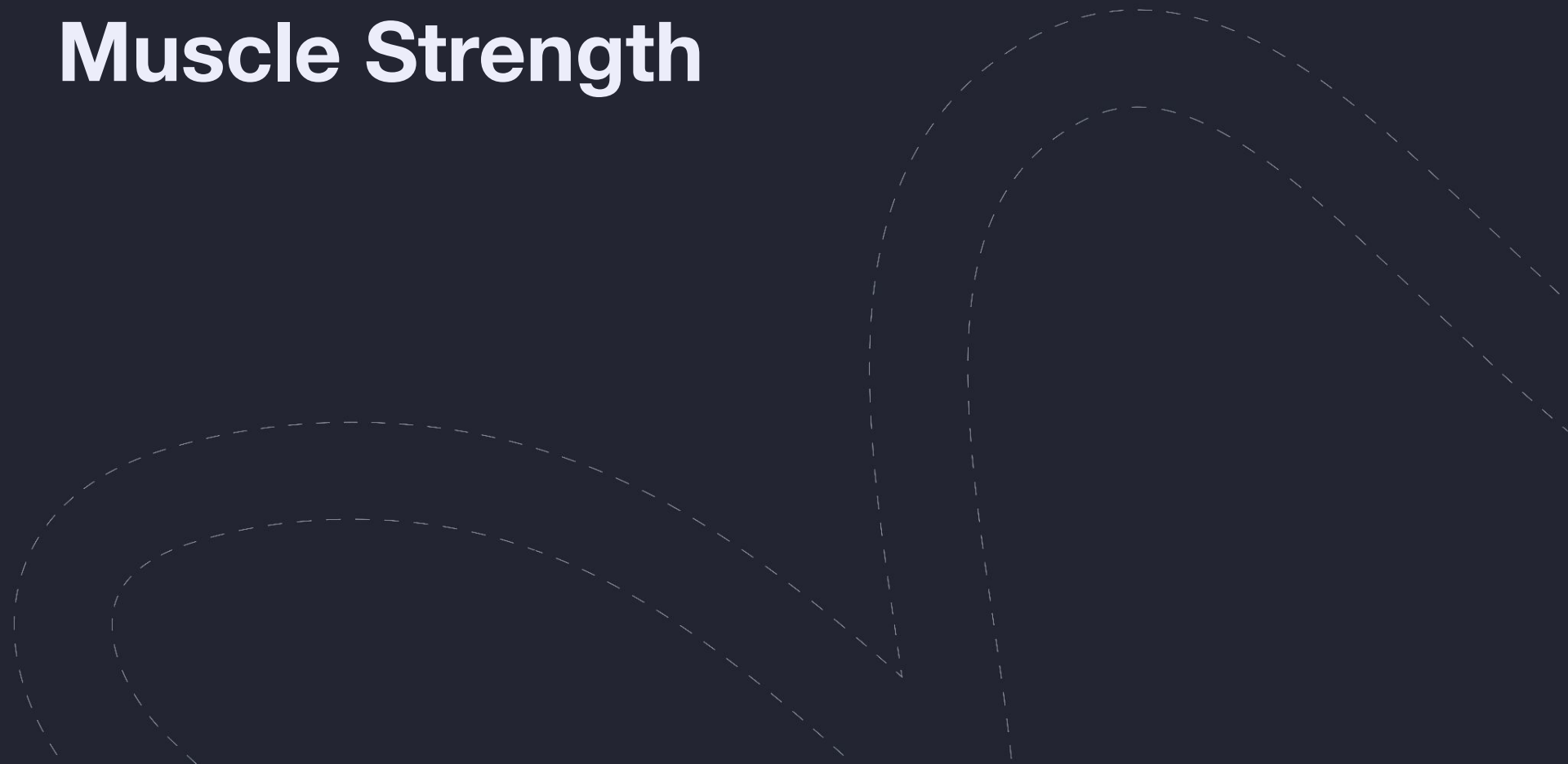
- Posterior capsule tightness screen; may reproduce posterior shoulder pain in SSN.
- Best tested with the device strapped on the patient's arm or wrist.
- Can be done in supine, sidelying, seated, or standing



Scapular Mobility & Upward Rotation

Dyskinesia screen — reduced upward rotation amplifies suprascapular nerve traction load.

Assessment: **Muscle Strength**





Shoulder External Rotators

- Infraspinatus & Teres Minor
- DISTAL suprascapular nerve branch. Primary SSN indicator.
- Can be done in supine, sidelying, seated, or standing

Shoulder Abductors

- Supraspinatus
- PROXIMAL suprascapular nerve branch. Compare bilaterally. ER:ABD ratio localizes entrapment site.
- Can be done in supine, sidelying, seated, or standing



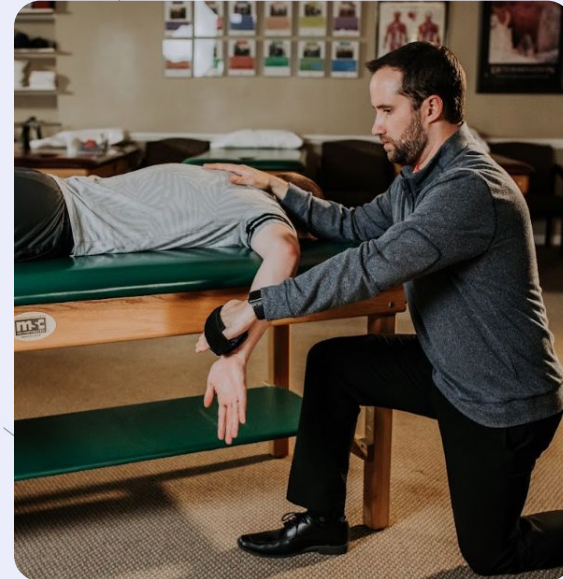


Scapular Stabilizers

- Mid/Lower Trapezius, Serratus Anterior
- Used for ER:IR ratio and differential with cervical radiculopathy.
- Can be done in supine, sidelying, seated, or standing

Shoulder Internal Rotators

- Subscapularis
- Used for ER:IR ratio and differential with cervical radiculopathy.
- Can be done in supine, sidelying, seated, or standing



Case Study:

Suprascapular Neuropathy In an Elite Canoe Slalom Athlete

The background of the slide is a dark blue-grey color. It features several abstract, dashed white lines that sweep across the lower half of the image, creating a sense of motion or flow. These lines are thin and vary in curvature, some starting from the left and curving towards the right, while others are more vertical and curved.

Ice Breaker



oto /
tration



Athlete Profile

- 21 year old international
- C1 athlete - “Righty”
- 8-10 water sessions/week
- 3 x S&C sessions per week

History of L sided distal clavicle osteolysis

U23's but has been on Senior Squad (2025)

Demands as U23 - Selection, World Championships, European Championship
(Deputise in World Cups if slot becomes available)

Limited baseline/screening data for this athlete

Demand Summary:

- Repetitive high-force overhead paddling
- Dynamic scapular control requirements
- Significant shoulder rotational loading
- High training volumes



“Not everything that can
be measured *matters*
and not everything matters
can be *measured*”



Biomechanics

On side (i.e Right)

Phase	Right Side (Top Hand/T-Grip)	Left Side (Bottom Hand/Shaft)
Catch	Shoulder: Flexion, Adduction, and Mild Internal Rotation Elbow: Flexion to position the hand over the blade.	Shoulder: Flexion and protraction Elbow: Terminal/Sub-terminal extension
Power	Shoulder: Abduction and internal rotation Elbow: Extension towards end of stroke	Shoulder: Extension and retraction Elbow: Terminal extension
Exit/Recovery	Shoulder: Partial extension and external rotation as the hand drops Elbow: Slight flexion to transition back over the deck.	Shoulder: Abduction and external rotation to return to start of stroke Elbow: Flexion

Off side (i.e Left, without “switching”) *Tx Rotation

Phase	Right Side (Top Hand/T-Grip)	Left Side (Bottom Hand/Shaft)
Catch	Shoulder: Horizontal abduction, flexion, and mild internal rotation Elbow: Flexion	Shoulder: Horizontal adduction and flexion Elbow: Extended



Presenting Complaint

History & Symptoms

- Insidious onset posterior shoulder pain
- Progressive weakness during paddling
- Reduced power generation through left arm
- Symptoms present for 3 months

Aggravating Factors

- Repetitive Paddling
- Overhead gym activities
- High-volume training blocks
- Functional limitation
- Reduced sprint performance
- Difficulty maintaining stroke power
- Early fatigue

Initial concerns

- Rotator cuff pathology? Which one?
- Labral injury?
- Neurological involvement?

*Usually reaches finals. Did not reach semifinals of World Championships.

Wasting?

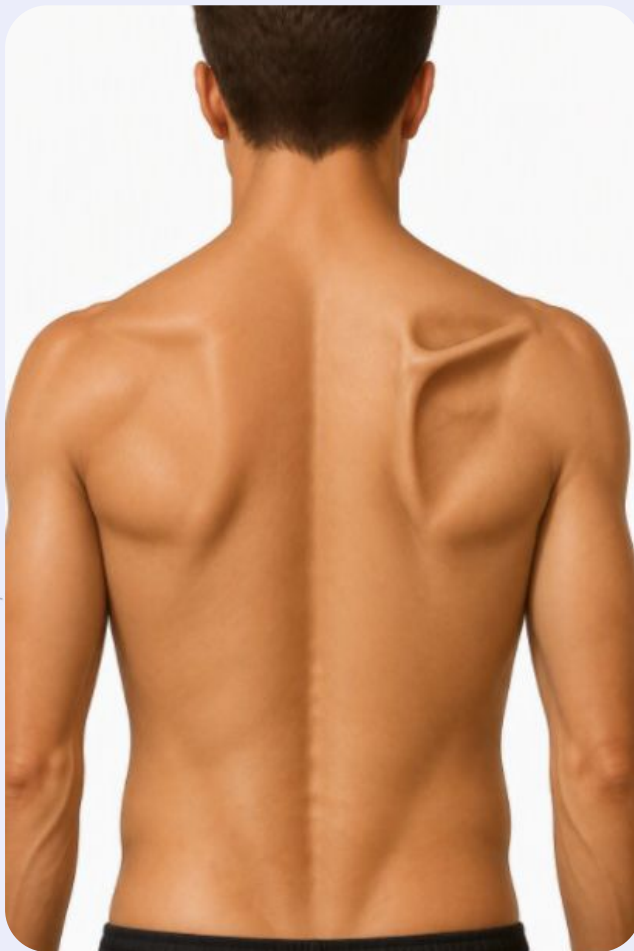


photo /
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Initial Assessment

Subjective Findings

- Early onset fatigue and a feeling of heaviness/weakness
- Symptoms exacerbated post paddling sessions

Observations

- Visible infraspinatus wasting
- Mild scapular dyskinesis
- Reduced posterior shoulder bulk

Clinical significance

Muscle atrophy suggested a potential neural component rather than isolated tendinopathy. Nil traumatic mechanism

Discussion Question

“Which differential diagnoses would you prioritise?”



Relevant Anatomy (Reviewed in earlier slides)

Primary

- Suprascapular nerve
- Suprascapular notch
- Spinoglenoid notch
- Supraspinatus infraspinatus

Secondary

- Glenoid labrum
- Suprascapular vessels
- Posterior capsule
- Paralabral cysts

Clinical relevance

Site of compression determines pattern of weakness and atrophy

Photo /
Illustration



ROM Findings

Cx and Neuro (sensory)

NAD

Shoulder

Movement	Left side	Right side
ER	98°	105°
IR	45°	58°
Flexion	Full	Full
Horizontal Adduction	Mild Restriction	Normal

Scapular Findings

- Reduced upward rotation
- Delayed posterior tilt

Interpretation

Posterior shoulder tightness and scapular control deficits may contribute to nerve traction. ER on both sides better than expected for this cohort of athletes. Why?



Scapular Nerve Test?

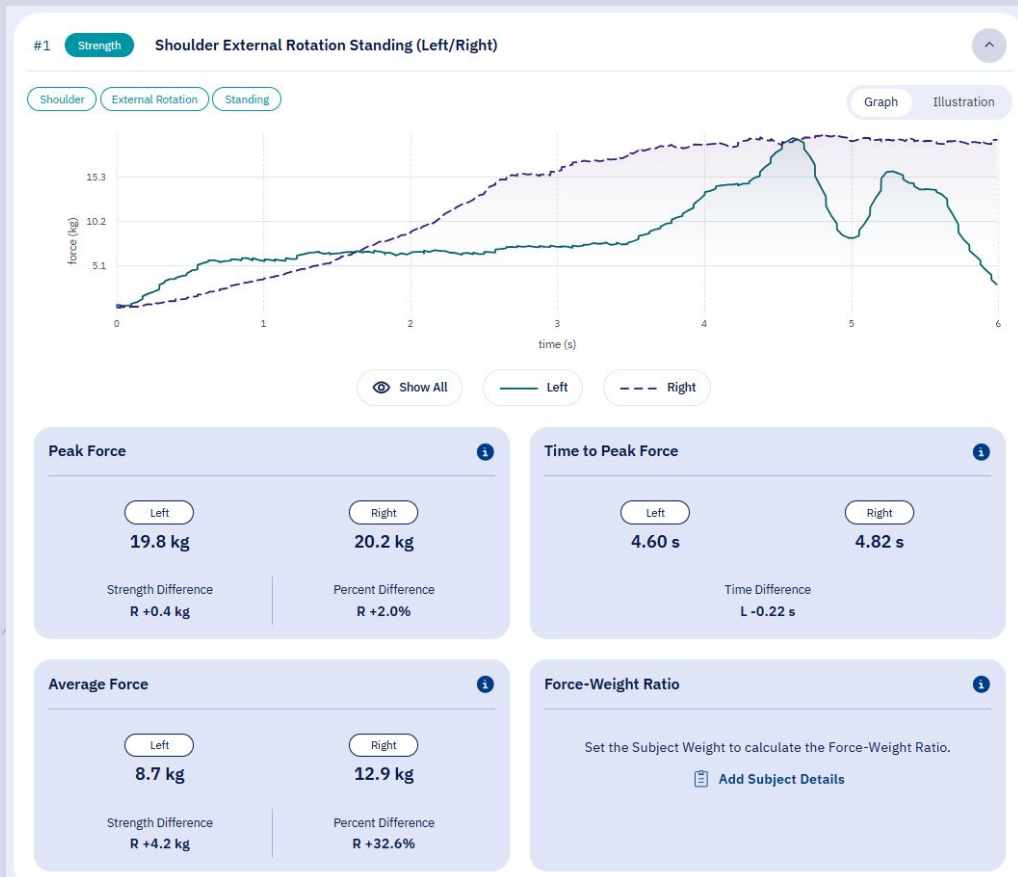
This test consists of laterally rotating the patient's head away from the painful shoulder and retracting the neck and shoulder on the affected side. A test is "positive" when the maneuver provokes pain at the posterior shoulder. (Lafosse et al 2011)

Would anyone consider O'Briens?

Photo /
Illustration



ActivForce2 Testing - Standing ER - First Attempt



Thoughts?







ActivForce2 Testing - Standing ER - Second Attempt (Left)

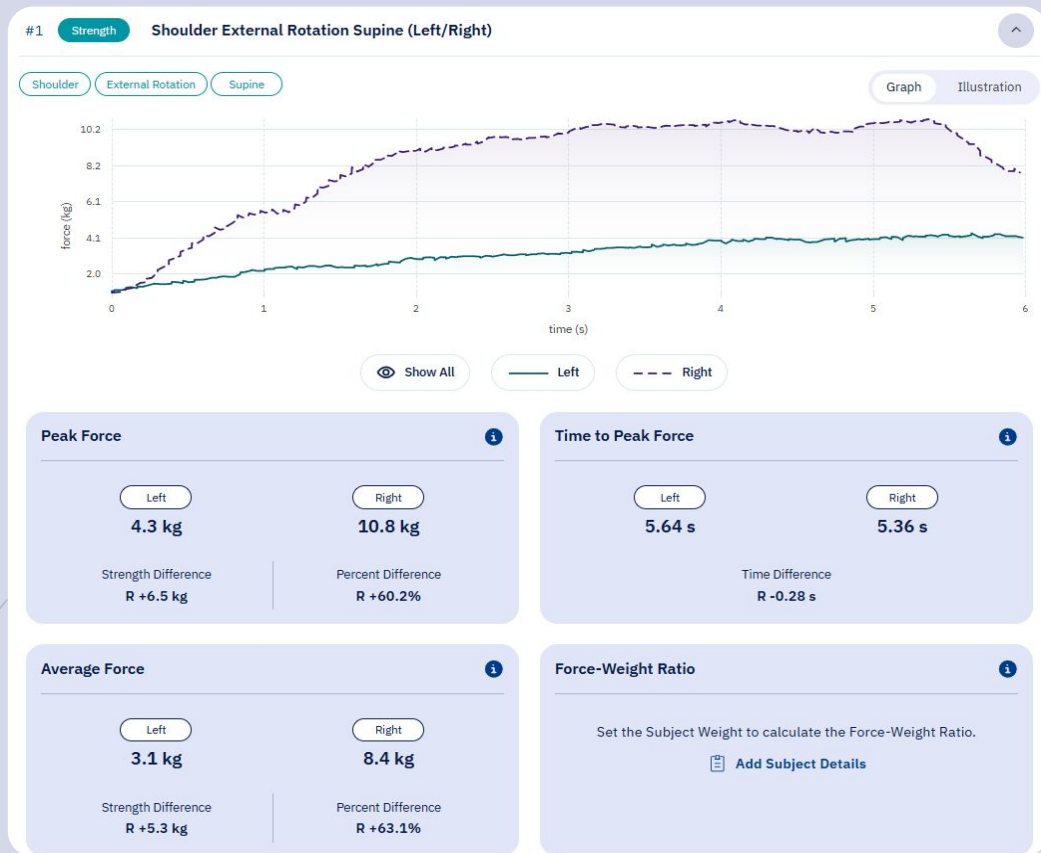


L side attempt 2.
57% deficit L
compared to R.

Photo /
Illustration



ActivForce2 Testing - ER Supine 90 Abduction

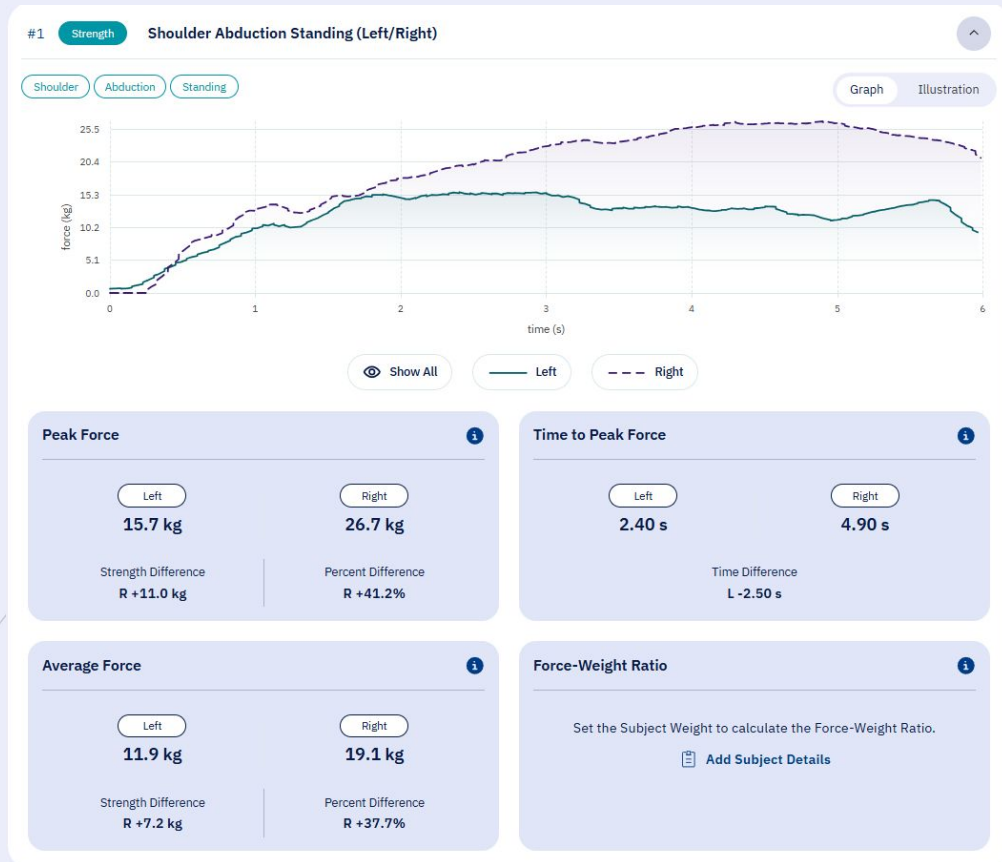


Reasons for testing position?

Supine
“Vulnerable positions”



ActivForce2 Testing - Abduction



ER/Abd ratio:

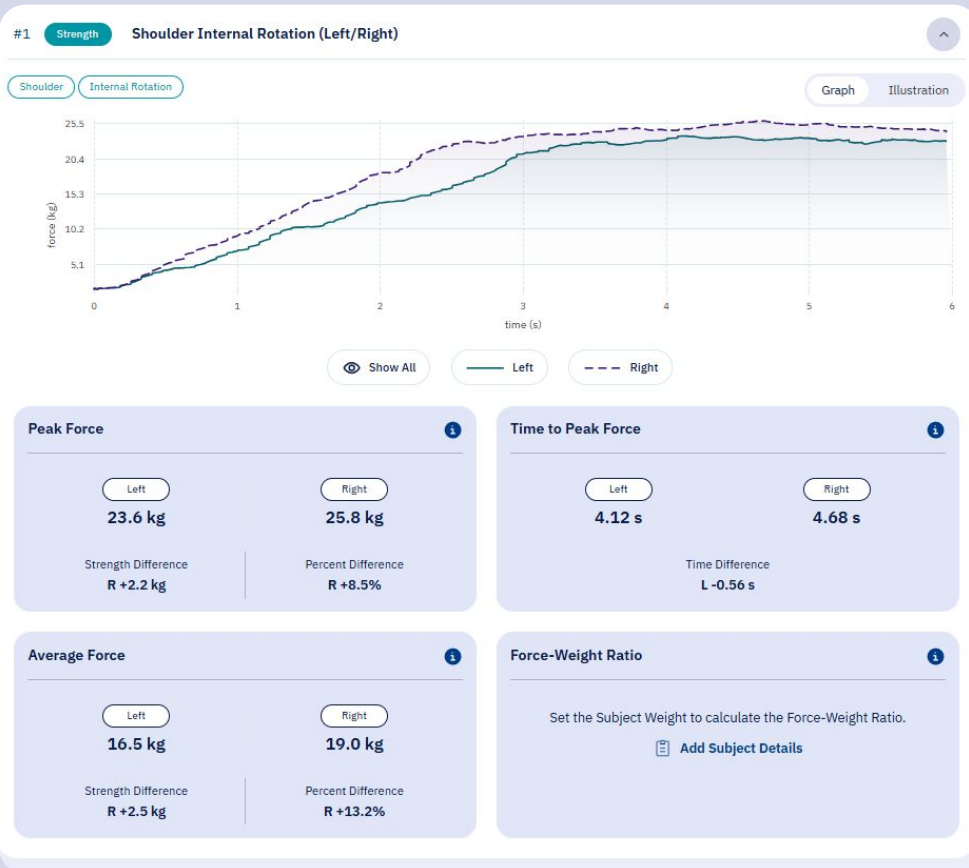
L: 0.73 / 1

R: 0.75 / 1

What does this mean?



ActivForce2 Testing



ER/IR ratio:

L: 0.49 / 1

R: 0.78 / 1

Is the Normal Shoulder Rotation Strength Ratio Altered in Elite Swimmers?

Craig Boettcher¹, Mark Halaki², Kylie Holt³, Karen A Ginn⁴

Affiliations [+ expand](#)

PMID: 32032235 DOI: [10.1249/MSS.0000000000002177](https://doi.org/10.1249/MSS.0000000000002177)



Nerve Conduction Velocity Study – Gold Standard for Diagnosis

Sensitivity = 74%, Specificity = 91%

Reduced compound muscle action potential amplitude of suprascapular nerve on affected side; latency mildly prolonged.

Consistent with chronic compression neuropathy

*Exact report not accessible

Onset Latency	Mean $\pm$ SD	Normal Limit
Supraspinatus recording	2.7 $\pm$ 0.5 ms	$\leq$ 3.7 ms
Infraspinatus recording	3.3 $\pm$ 0.5 ms	$\leq$ 4.2 ms

Liveson & Ma (1992)



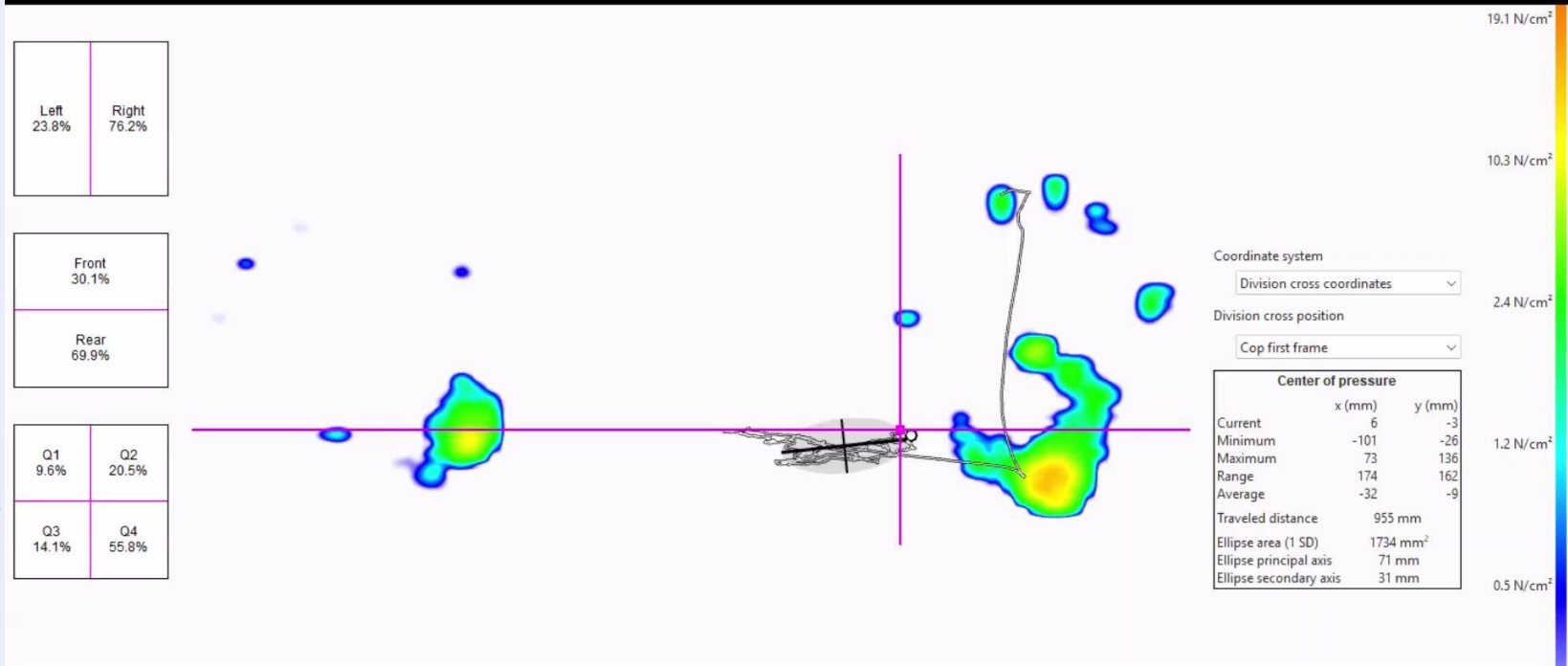
Surface EMG Findings

Reduced supraspinatus activation amplitude and delayed recruitment during resisted abduction compared with contralateral side

*Exact report not accessible

"Unlike nerve conduction studies, standardized normative surface EMG amplitude values for the supraspinatus have not been established. Electromyographic activity is typically normalized to maximal voluntary isometric contraction (%MVIC) to permit comparison between subjects." (Alenabi et al 2018)

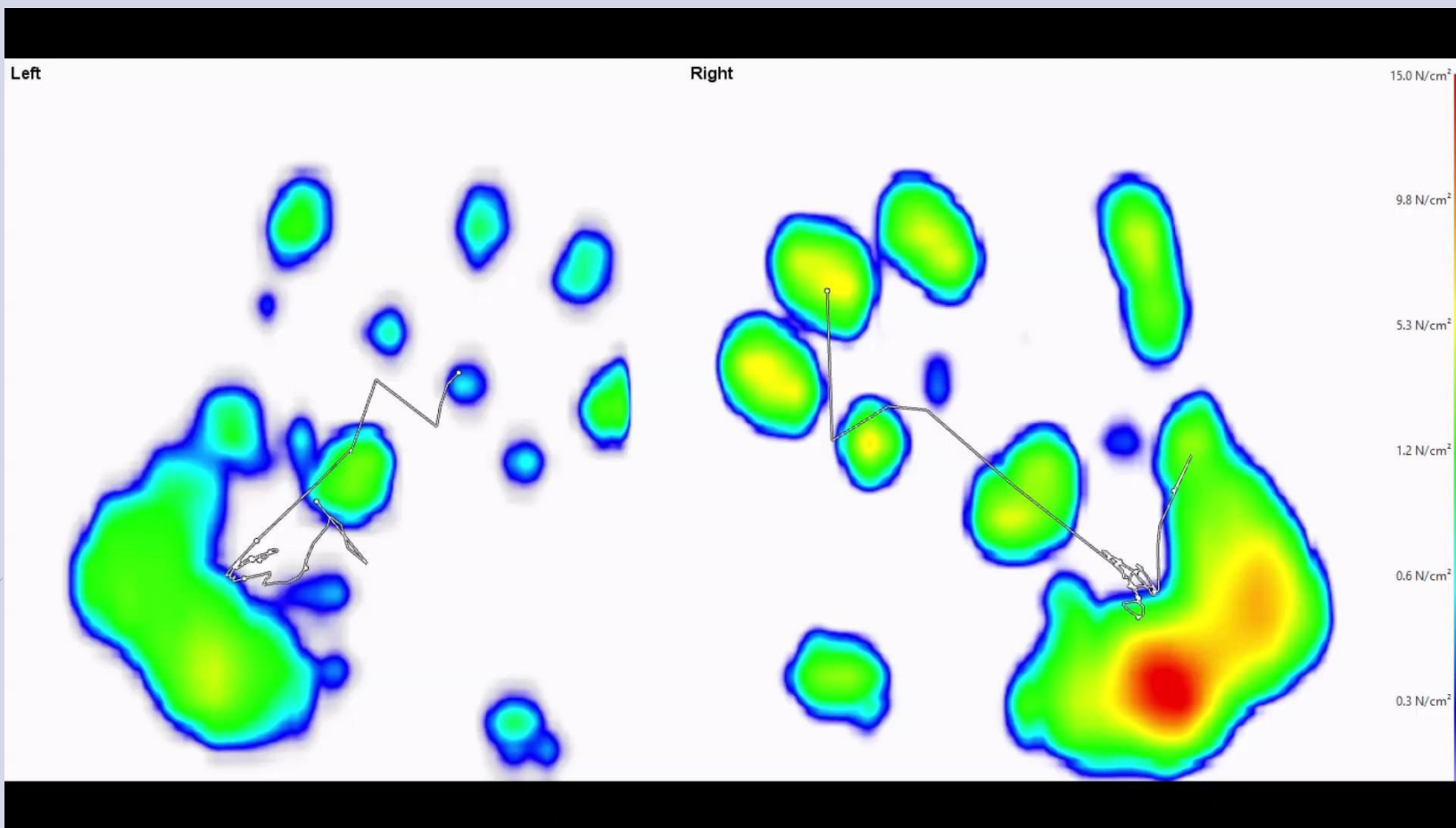
CASE STUDY





Left

Right

15.0 N/cm²9.8 N/cm²5.3 N/cm²1.2 N/cm²0.6 N/cm²0.3 N/cm²



MRI & Diagnosis

Differential Diagnosis

Conditions

- Brachial plexus injury / Parsonage Turner syndrome
- Rotator cuff tendinopathy
- Partial cuff tear
- Posterior labral pathology
- Cervical radiculopathy
- Suprascapular neuropathy

MRI Findings

- Small paralabral cyst at spinoglenoid notch
- Infraspinatus atrophy
- Mild denervation changes

Diagnosis

Spinoglenoid notch suprascapular nerve compression

*Shoulder adduction and internal rotation increase tension at the inferior portion of the spinoglenoid ligament, directly superior to the suprascapular nerve (Lieder et al 2021)

Photo /
Illustration

Treatment Strategies





Management Options?

Physiotherapy

- Most evidence is case study based.
- Usually indicated if nil space-occupying lesion or entrapment.
- Course of NSAIDs
- Lower traps, cuff, rhomboids, serratus anterior load/patterning
- ESWT?
- Other adjunctive therapies?
- NMES/Variants

Minimally Invasive - Usually if conservative failed. Can be utilised in the presence/absence of a space-occupying lesion.

- Nerve block
- Aspiration
- Cryoneurolysis
- Pulsed radiofrequency

Surgical

- Decompression
- +/- labral repair, cuff repair etc



Upper body muscle activity during C1 canoe slalom strokes

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¹ Department of Biomedical Physiology and Kinesiology, Simon Fraser University, Burnaby, British Columbia, Canada

Please cite as: Conquergood, NA, Wood, H, & Wakeling, J. (2025). Upper body muscle activity during C1 canoe slalom strokes. *SportRxiv*.

A kinematic comparison of on-ergometer and on-water kayaking

Kent K. Klitgaard ✉, Christian Hauge, Anderson Souza Oliveira, Frederik Heinen

First published: 09 November 2020 | <https://doi.org/10.1080/17461391.2020.1831617> |

Arthroscopic suprascapular nerve release: indications and technique

Laurent Lafosse¹, Kalman Piper, Ulrich Lanz

Affiliations + expand

PMID: 21281924 DOI: [10.1016/j.jse.2010.12.003](https://doi.org/10.1016/j.jse.2010.12.003)

Ultrasound-Guided Aspiration of a Paralabral Cyst at the Spinoglenoid Notch with Suprascapular Nerve Compressive Neuropathy

[Tze-Chao Wee](#)¹, [Chueh-Hung Wu](#)^{2,*}

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PMCID: PMC6159318 PMID: [30283206](#)

Greater Strength Increase with Cyst Decompression and SLAP Repair than SLAP Repair Alone

[Gita Pillai](#)¹, [Jason R Baynes](#)², [James Gladstone](#)¹, [Evan L Flatow](#)^{1,✉}

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PMCID: PMC3048282 PMID: [21104358](#)

Treatment of suprascapular nerve entrapment syndrome

[Joseph D Leider](#)¹, [Olivia C Derise](#)², [Kyle A Bourdreaux](#)², [Gregor J Dierks](#)², [Christopher Lee](#)^{3,✉}, [Giustino Varrassi](#)⁴, [William F Sherman](#)⁵, [Alan D Kaye](#)⁶

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PMCID: PMC8567757 PMID: [34745481](#)

Management of Suprascapular Nerve Compression via Nonoperative Methods

[Nirbhay S Jain](#)^{*,✉}, [Kevin Y Chen](#)^{*}, [Lacey R Pflibsen](#)^{*,§}, [Lauren E Wessel](#)^{*}

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PMCID: PMC12487946 PMID: [41040894](#)



Phase 1

Protection & Re-activation

- Training load modification
- Isometric ER loading
- Neuromuscular activation
- Scapular control training

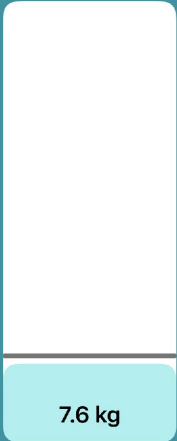
Early Criteria

- Subjective symptom change $<2/10$ (pain, fatigue, heaviness, perception of weakness)
- Improved activation (Time to peak force or RFD, sEMG)
- Stable strength trends

Isometric Advice



< Test 1



< 9.6 kg

7.6 kg

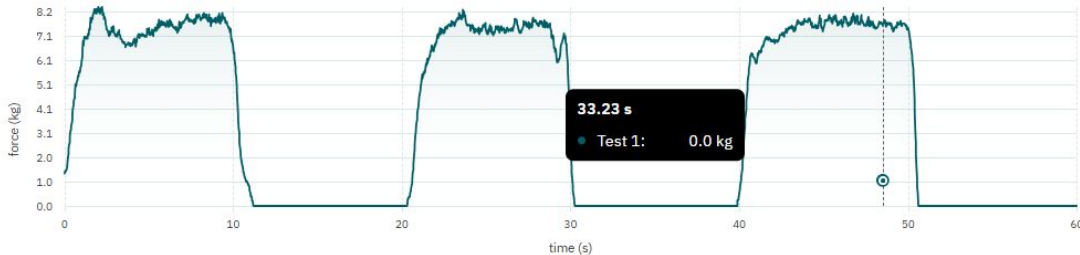
51 sec



① Keep the device steady and maintain your position.
Apply force according to the instructions.
Do not release until the test finishes.

#1 **Strength** Test 1 ^

Graph Illustration



force (kg)

time (s)

33.23 s

Test 1: 0.0 kg

Peak Force ⓘ
8.3 kg

Time to Peak Force ⓘ
2.00 s

Average Force ⓘ
3.6 kg

Force-Weight Ratio ⓘ
Set the Subject Weight to calculate the Force-Weight Ratio.
 **Add Subject Details**



Phase 2

Strength Development

- Side-lying ER + Cable ER > From neutral to "vulnerable"
- Serratus anterior loading – weight bearing initially to non weight-bearing
- Lower trapezius strengthening – options for this?

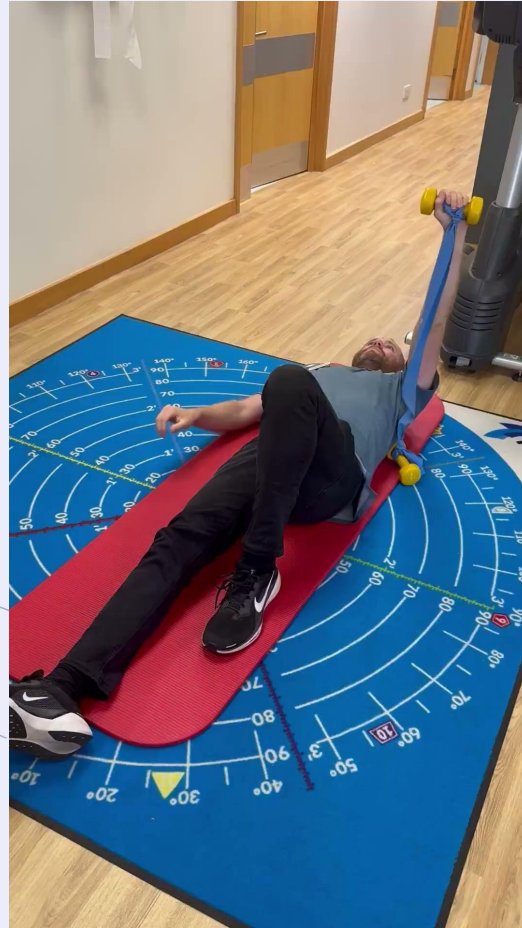
Phase 3

Integrated Function

- High-speed rotational work – Active de-rotations from cross bow position
- Paddle-specific ergometer loading (Klitgaard et al 2021) – Increased loads
- Fatigue response (as monitored below)

Monitoring

- Sessional ActivForce2 re-testing
- <15% deficit post session





Return to Sport

Criteria / Objective Benchmarks

- ER deficit <10%
- ER:ABD or ER:IR ratio normalized
- Symmetrical scapular control (unloaded and loaded)
- Full paddling tolerance flat (speed) and white water
- COD performance on white water restored

Return-to-Paddle Progression

- Technical sessions and repeats
- Volume progression
- Race intensity intervals
- Competition simulation



ActivForce2 Testing - Post Rx





Final Reflections

- Challenges with a lack of baseline data.
- Value of objective data and diagnostics > special tests
- A number of reasons that this athlete did not opt for surgery initially. *Initial good outcome and return to competition. Nil change to wasting. Symptom recurrence with increased volumes. Did opt for surgical intervention

Questions?



@activforce



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activbody-inc.



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