

Investigating Injuries

Quadriceps Tear



Introductions



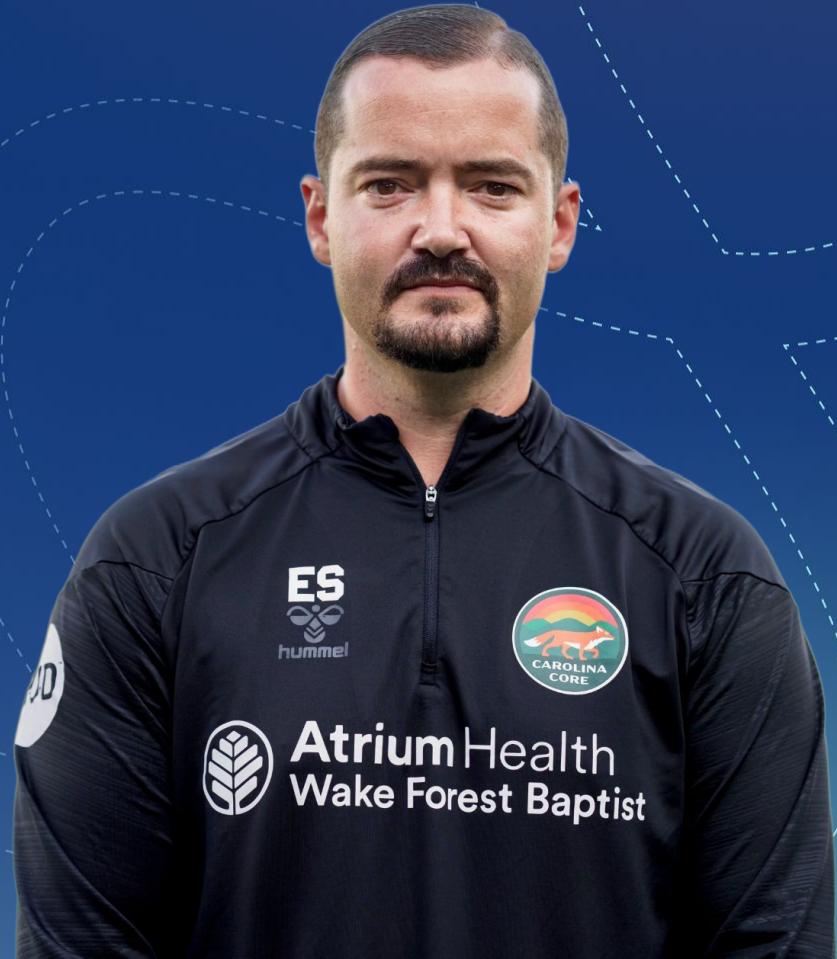
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PT, DPT



Introductions



Ethan Solger
Head Athletic Trainer





Agenda

- Introduction: “Understanding Quadriceps Tear”
- Clinical Presentations and Mechanism of Injury
- Common Causes and Risk Factors
- Anatomical Overview: Quads Focus
 - Rectus Femoris
 - Vastus Lateralis
 - Vastus Medialis
 - Vastus Intermedius
- Clinical Assessment
 - ROM: Knee flexion, Hip extension
 - MMT: Quadriceps, Hamstrings, Abductors, Adductors, Hip Flexors, Hip Extensors
- Case Study
 - Data Review and Analysis
- Treatment and Rehabilitation Strategies
- Q&A

Quadriceps Injury



Understanding Quadriceps Tear

- Injury involving partial or complete disruption of one or more quadriceps muscles
- Common in athletes performing explosive movements (e.g., sprinting, jumping, kicking)
- Severity ranges from mild strain to full rupture of the muscle or tendon
- Leads to pain, weakness, and impaired knee function
- Early diagnosis and rehabilitation are crucial for optimal recovery and prevention of re-injury

Clinical Presentations

- It typically presents with sudden anterior thigh pain following an explosive movement such as jumping, sprinting, or kicking.

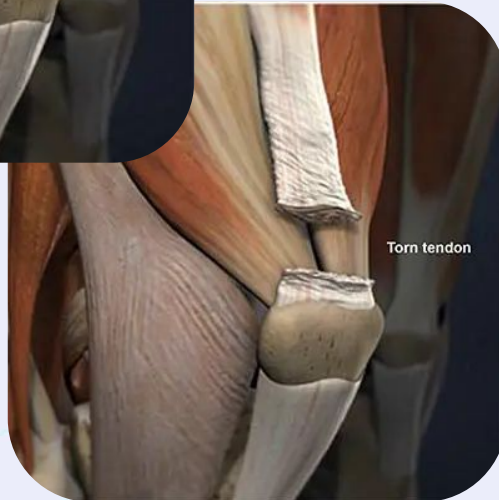
Other signs may include:

- Swelling and bruising over the anterior thigh
- Palpable defect or gap in the muscle (if severe)
- Difficulty straightening the knee or performing a straight-leg raise
- Tenderness along the quadriceps muscle belly or tendon





Mechanism of Injury



- Forceful eccentric contraction of the quadriceps during knee flexion (e.g., landing from a jump)
- Sudden overload while the muscle is lengthened or contracting under tension
- Often occurs during sprinting, kicking, or abrupt deceleration movements
- In older adults, may result from degenerative changes or weakened tendon tissue



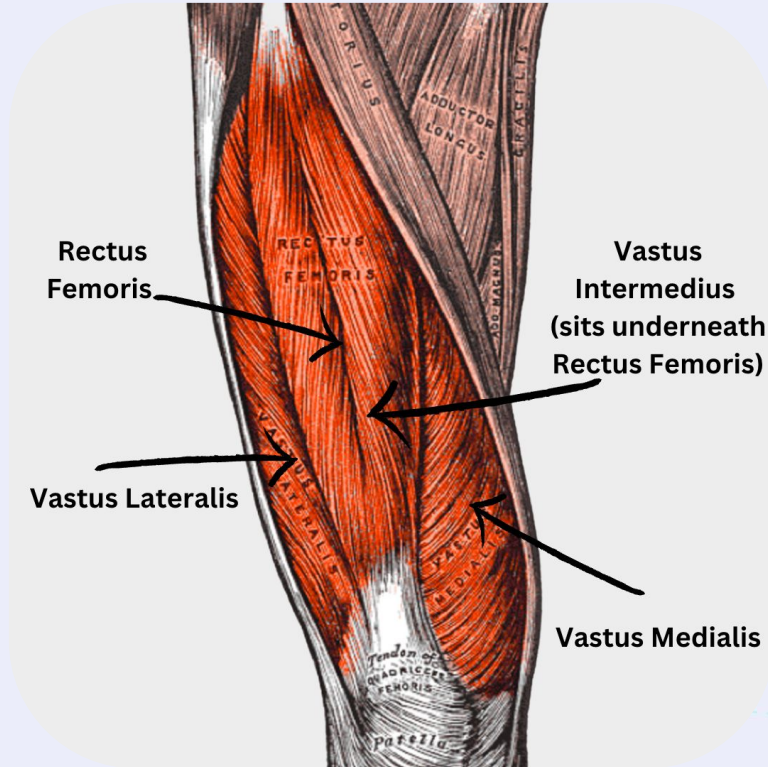
Common Causes and Risk Factors

Quadriceps tears may develop from a combination of intrinsic and extrinsic factors:

- Overuse or Repetitive Strain
- Sudden Overload
- Age and Degeneration
- Previous Injury or Scar Tissue
- Muscle Imbalance
- Inadequate Warm-Up or Conditioning



Anatomical Overview



- Rectus Femoris
 - Most commonly injured due to its biarticular nature
- Vastus Lateralis
 - Less frequently torn. Plays crucial role in patellar tracking.
- Vastus Medialis
 - Vastus Medialis Oblique (VMO) - are distal fibers of VM that are vital for patellar alignment
- Vastus Intermedius
 - Deeply located and often involved in central quadriceps strains.

Figure 4. (a) T2-weighted sagittal MRI demonstrating complete QTR of the rectus femoris. (b) T2-weighted sagittal MRI demonstrating partial QTR of the rectus femoris subtendon.



(a)



(b)

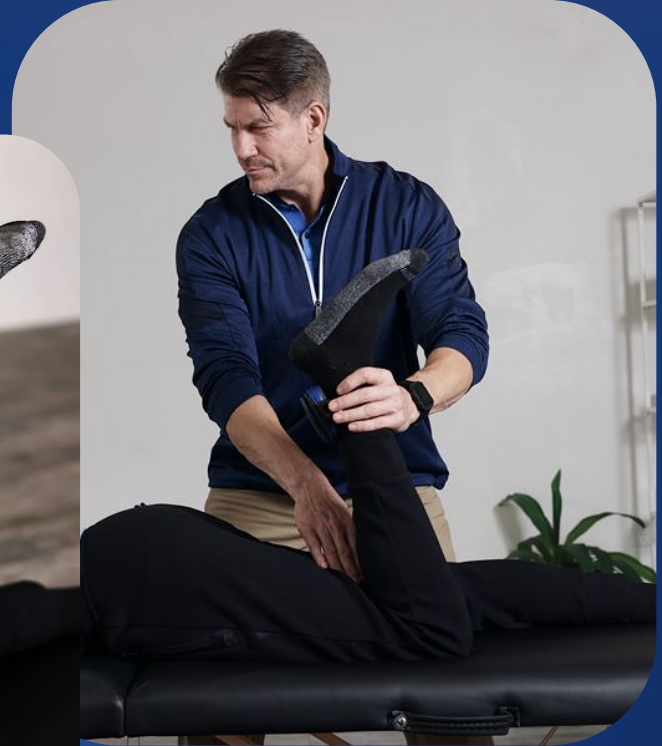
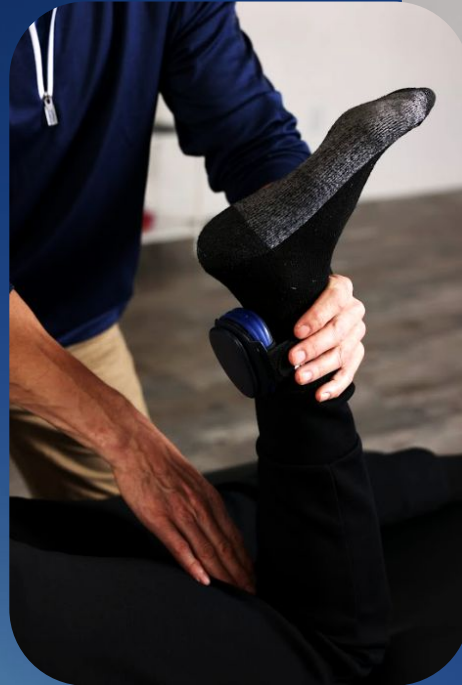
Clinical Assessment





Range of Motion: Knee Flexion

Can be tested in both prone and supine positions.





Range of Motion: Hip Extension

Best tested in prone with device strapped around ankle.





Muscle Testing: Quadriceps

Best tested in sitting position
with or without a strap
attachment.





Muscle Testing: Hamstrings

Best tested in prone with or without a strap attachment.





Muscle Testing: Abductors

Can be tested in side lying position with or without a strap attachment.





Muscle Testing: Adductors

Can be tested in side lying position with or without a strap attachment.





Muscle Testing: Hip Flexors

Can be tested in sitting position with or without a strap attachment.





Muscle Testing: Hip Extensors

Can be tested in prone position with or without a strap attachment.



Case Study

The background is a solid dark blue. A thick, light blue wavy line starts from the bottom right corner, curves upwards and to the left, then curves downwards and to the left, and finally curves upwards and to the left again, ending near the top right corner.



Right contract quad injury sustained in match. Imaging was obtained on MD+1 due to injury history and clinical exam, which consisted of diagnostic ultrasound & subsequent MRI due to abnormal ultrasound imaging.

Athlete sustained a right quad tear injury during a shooting action during the previous season that only had MSK US performed so there was no MRI to compare to. Athlete had palpable and observable defect during pre participation medical exam.

Initial Imaging

IMAGING

MRI REPORT

Ultrasound

MRI (BAMIC Grading)

- Confirmed tear of quad muscle and confirmed prior injury.
- Grade 3B tear of quad muscle with significant retraction (65.7mm)

• **grade 0**

- grade 0a: focal neuromuscular injury with normal MRI
- grade 0b: generalized muscle soreness with normal MRI or MRI findings typical of delayed onset muscle soreness (DOMS)

- **grade 1** (mild): high STIR signal that is <10% cross-section or longitudinal length <5 cm with <1 cm fiber disruption

- **grade 2** (moderate): high STIR signal that is 10-50% cross-section; longitudinal length 5-15 cm with <5 cm fiber disruption

- **grade 3** (extensive): high STIR signal that is >50% cross-section or longitudinal length >15 cm with >5 cm fiber disruption

- **grade 4:** complete tear

Grades 1-3 are subclassified depending on site:

- **a:** myofascial (peripheral)
- **b:** myotendinous junction / muscular
- **c:** tendinous

For grade 4 (complete tears), the distinction is only made between tears involving muscle versus those solely involving the tendon, as follows:

- **grade 4:** myofascial, muscular, or myotendinous
- **grade 4c:** tendinous

Plan of Management

- Estimated Recovery Time = 8 - 12 weeks
- Due to location of tear (Musculotendon Junction) = NO SURGERY

Time before return to play for the most common injuries in professional football: a 16-year follow-up of the UEFA Elite Club Injury Study ⁸

⁸ Jan Ekstrand ^{1, 2}, Werner Krutsch ³, Armin Spreco ⁴, Wart van Zoest ⁵, Craig Roberts ⁶, Tim Meyer ⁷, ⁸ Håkan Bengtsson ¹

Quadriceps muscle injury (structural)	914 (4.6)	19.5 (18.1 to 20.9)	13.0 (12.0 to 14.0)	7.0; 23.0	4.0; 41.0	15.6
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Quadriceps muscle injury (structural)	143 (4.7)	23.7 (20.2 to 27.2)	16.0 (13.0 to 21.0)	9.0; 33.0	4.0; 56.0	
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Time to return to full training and recurrence of rectus femoris injuries in elite track and field athletes 2010–2019; a 9-year study using the British Athletics Muscle Injury Classification

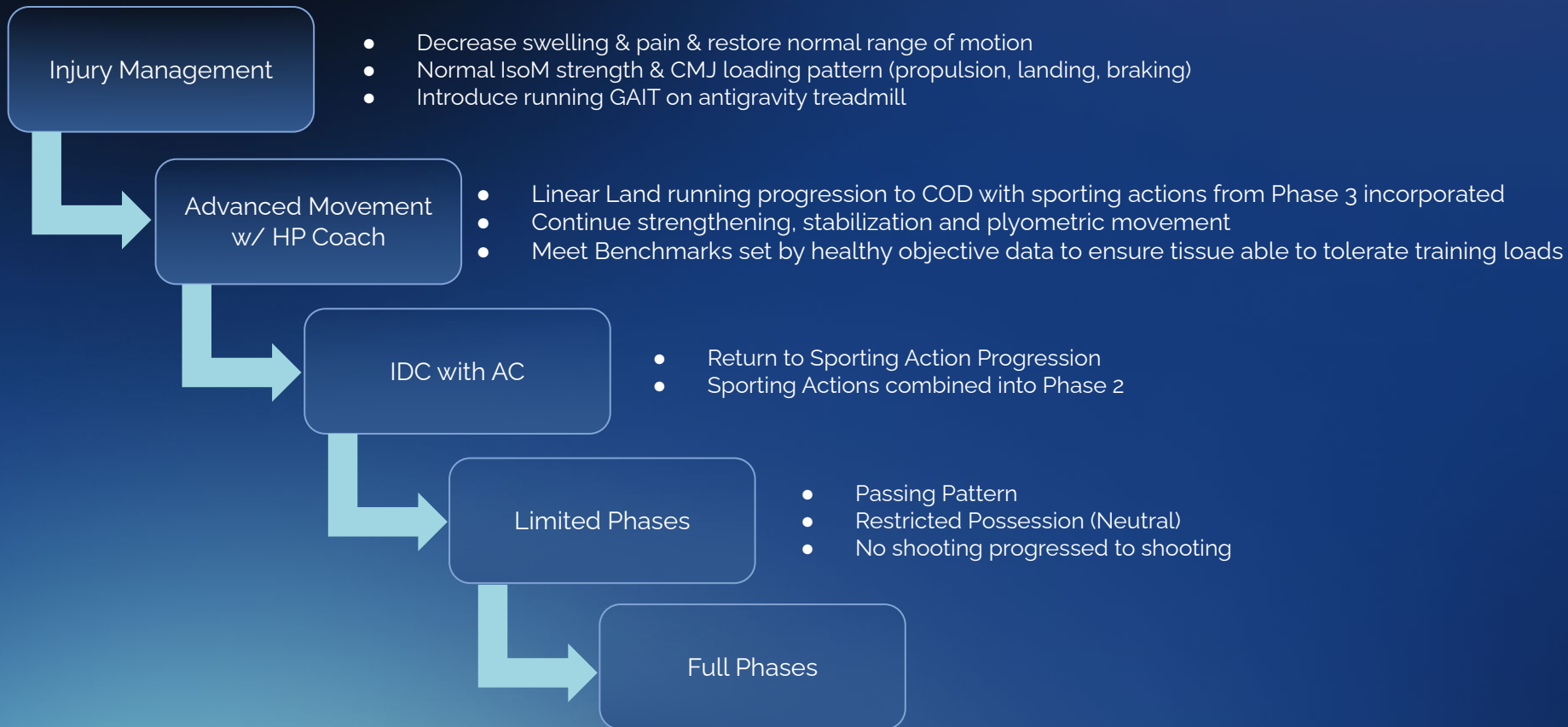
Stephen McAleer [✉], Ben Macdonald, Justin Lee, Wilbur Zhu, Michael Giakoumis, Tanya Maric, Shane Kelly, James Brown, Noel Pollock

TABLE 4 Analysis of British Athletics classification and TRFT

Grade	Number	Average TRFT	Recurrence
0	6	9.3 ± 1.0	0
1a	10	13.1 ± 5.8	0
1b	1	12	0
2a	2	25.9 ± 9.9	0
2b	3 ^a	23.5 ± 6.4	0
2c	4 ^b	41.7 ± 18.7	1
3a	2	26.0 ± 7.1	0
3b	2 ^c	34	2
3c	4	34.8 ± 20.6	2
4c	4	129.8 ± 16.8	0

^a1 case was complicated by another different injury in rehabilitation and

Return to Play





(All)

9/24/2025

Strength Testing

	Peak Force	
	Left	Right
Knee Extension	102.8	117.8
Knee Flexion	84.4	86.8
Hip Abduction	48.6	54.6
Hip Adduction	44.6	46.3

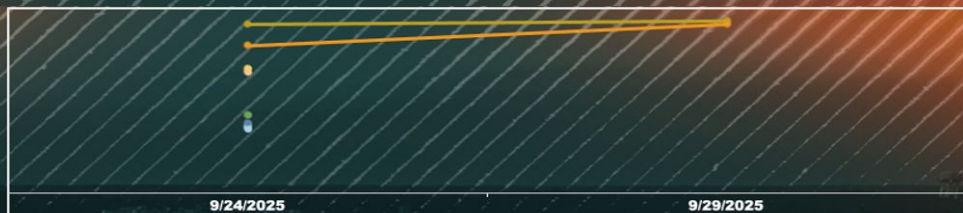
L ADD:ABD	0.9	L H:Q Ratio	0.8
R ADD:ABD	0.8	R H:Q Ratio	0.7

INV LIMB

Right

Strength Testing LSI

Hamstring	103%
Quad	115%
Groin	104%
Glute	112%



Force Plate Testing

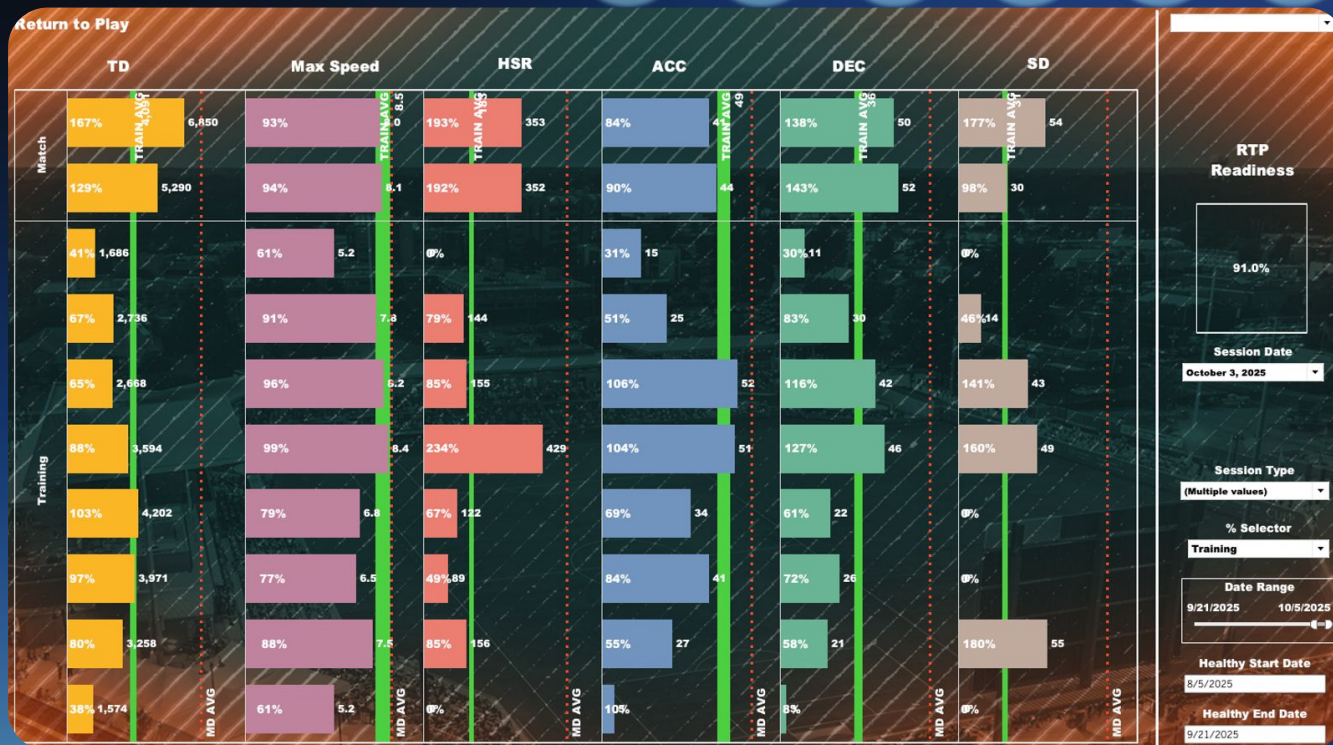
8/5/2025	13.08	2,025.0	2.72	6,113.5	2,016.00
8/13/2025	13.30	1,959.5	2.69	6,214.5	1,939.50
8/18/2025	12.77	1,971.0	2.63	6,325.5	1,969.50
8/26/2025	13.23	1,838.5	2.68	7,230.5	1,839.50
9/8/2025	13.35	1,824.5	2.70	6,304.0	1,802.50
9/16/2025	12.71	1,965.5	2.64	6,097.5	1,961.50
9/24/2025	12.00	1,840.5	2.59	5,590.0	1,825.50
9/29/2025	11.78	2,099.0	2.55	5,392.0	2,069.00
9/30/2025	13.47	2,197.5	2.72	5,184.5	2,160.50

	Jp Ht	PK Propulsive Force	PK Velocity	PK Landing Force	PK Braking Force
8/5/2025	2.57	2.92	10.63	-8.40	-1.23
8/13/2025	1.71	2.44	0.85	-2.49	0.74
8/26/2025	2.26	1.57	-4.65	-13.50	-0.98
9/8/2025	2.40	3.44	-1.95	-15.82	-2.25
9/16/2025	2.40	1.81	0.49	-0.12	-0.17
9/24/2025	1.69	1.79	4.13	-1.79	1.69
9/29/2025	1.69	1.79	4.13	-1.79	1.69
9/30/2025	1.69	1.79	4.13	-1.79	1.69

RTP Summary

- Normal Isometric Limb Symmetry (Involved leg stronger than uninvolved). Groin/Glute ratio Normal. Quad/HS ratio normal.
- Force Plate Testing - PRed in Jump Height, Propulsive Force, Landing Force & Braking Force post injury. Peak Velocity @ pre-injury max. R v L mechanics with propulsion, landing, and braking within his normal ranges.

GPS Session RTP Report



- Max Speed, Change of Direction (ACCEL + DECEL), High Speed Running and Sprint Distance above normal training load numbers or within normal range.

RTP

- 45 minutes off bench in second half
- No issues, felt confident, had some good actions, and felt like his normal self





Questions?

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