

Highlighting the difference between:

Gastrocnemius vs Soleus tears



Introductions



Dr. Daniel G. Stewart
PT, DPT

 [dr.danielstewartdpt](https://www.instagram.com/dr.danielstewartdpt)



Steve Miller

Physiotherapy BSc/MSc/MACP

- ❖ Newcastle Red Bulls (Rugby Union)
- ❖ UK Sports Institute (British Judo/Team GB)
- ❖ Founder & Mentor: Grow Physio Academy
- ❖ Lecturer in Higher Education (UCB & UoB)



Learning Objectives



- Understand the anatomical, biomechanical, and clinical distinctions between gastrocnemius and soleus tears, including mechanisms, risk factors, and differential presentation.
- Execute a differentiated assessment using knee and ankle ROM and ActivForce2 dynamometry in knee-extended and knee-flexed positions to objectively identify the structure involved.
- Interpret ActivForce2 bilateral force comparisons and limb symmetry indices to build a criterion-based rehab progression from protected loading to return-to-sport benchmarks.

Agenda



- Introduction: Investigating Injuries: Highlighting the Difference between Gastrocnemius vs Soleus Tears
- Clinical Presentations: Gastrocnemius vs Soleus Tears — Key Differentiators
- Anatomical Structures Affected
 - Primary and Secondary Structures
- Mechanisms of Injury: Eccentric Overload and Musculotendinous Junction Failure
- Common Causes and Risk Factors
- Clinical Assessment
 - ROM: Ankle Dorsiflexion (gastrocnemius and soleus length), Ankle Plantar Flexion, Knee Flexion and Extension, Subtalar Inversion and Eversion, Hip Extension
 - Muscle Testing: Ankle Plantarflexors — Gastrocnemius (tested knee extended), Ankle Plantarflexors — Soleus (tested knee flexed), Knee Flexors — Hamstrings (for differential diagnosis), Single-leg Heel Rise Assessment (functional endurance screen)
- Case Study: Data Review and Analysis
- Treatment and Rehabilitation Strategies
- Q&A

Highlighting the Difference between Gastrocnemius vs Soleus tears





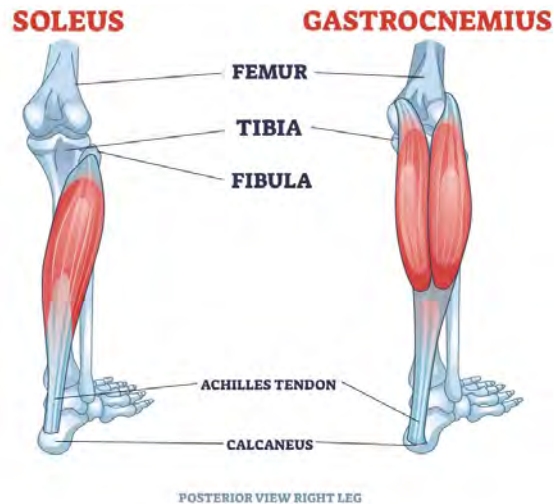
Why Differentiation Matters

GASTROCNEMIUS

- Biarticular — crosses knee and ankle
- Superficial; visible/palpable belly
- Dominant in high-speed, loaded push-off
- Medial head: most common tear site (tennis leg)

SOLEUS

- Monoarticular — crosses ankle only
- Deep; lies beneath gastrocnemius
- Dominant in sustained, repetitive loading (distance running)
- More insidious onset; often misdiagnosed as DVT or cramp



~30% Of calf injuries involves the gastrocnemius MTJ

Ages 35-55 Peak incidence - recreational and masters athletes

~75% Medial head involvement in gastrocnemius tears



Key Clinical Differentiators

	Gastrocnemius	Soleus
Onset	Sudden; explosive mechanism (sprint, jump, serve)	Gradual; repetitive loading or sudden acceleration
Pain	Sharp, localized to medial calf; 'snap' or 'hit' sensation	Deep, diffuse ache; often mistaken for cramp or DVT
Location	Posteromedial calf, proximal to mid-belly (MTJ)	Mid to distal calf; deeper and more diffuse
Swelling	Visible bruising and swelling within 24–48 hrs	Minimal early swelling; bruising less common
Aggravated by	Knee extended + ankle dorsiflexion; push-off	Knee-flexed loading; prolonged walking/running
Special Tests	Palpable defect at MTJ; Thompson test negative (intact Achilles)	Deep palpation tenderness; Thompson negative

Anatomical Structures Involved



Primary Structures

Medial Gastrocnemius MTJ

Most common tear site; highest tensile load at push-off. Biarticular stretch creates peak stress here.

Lateral Gastrocnemius

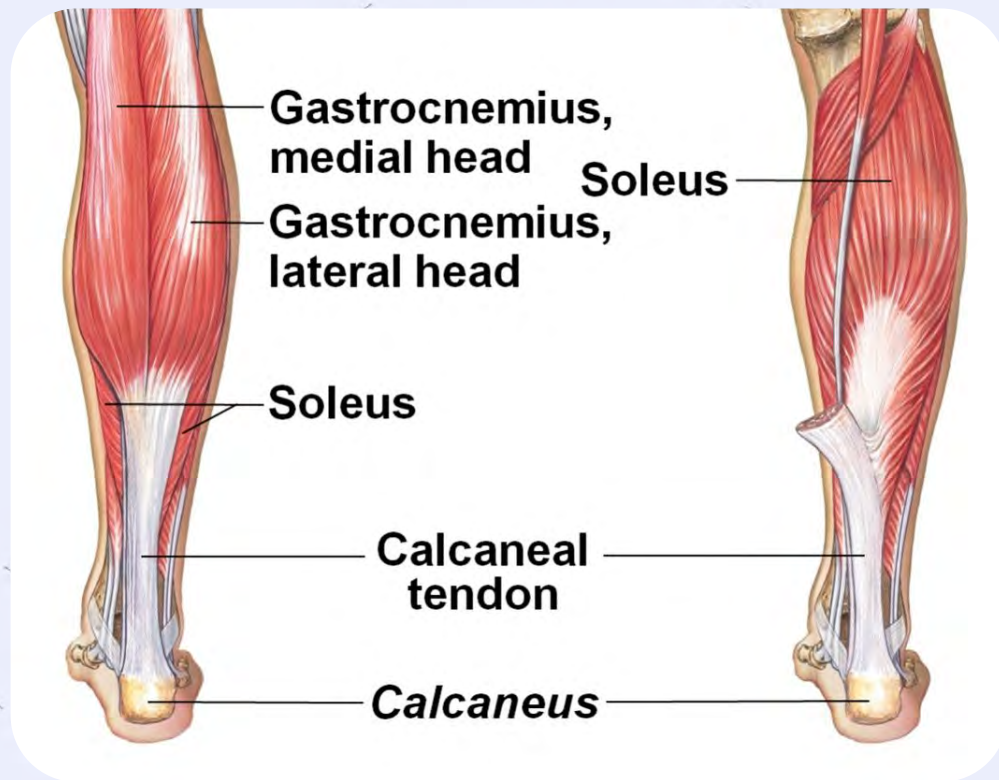
Less commonly involved; same MTJ vulnerability. Tears here are often lateral calf pain with similar mechanism.

Soleus Muscle Belly

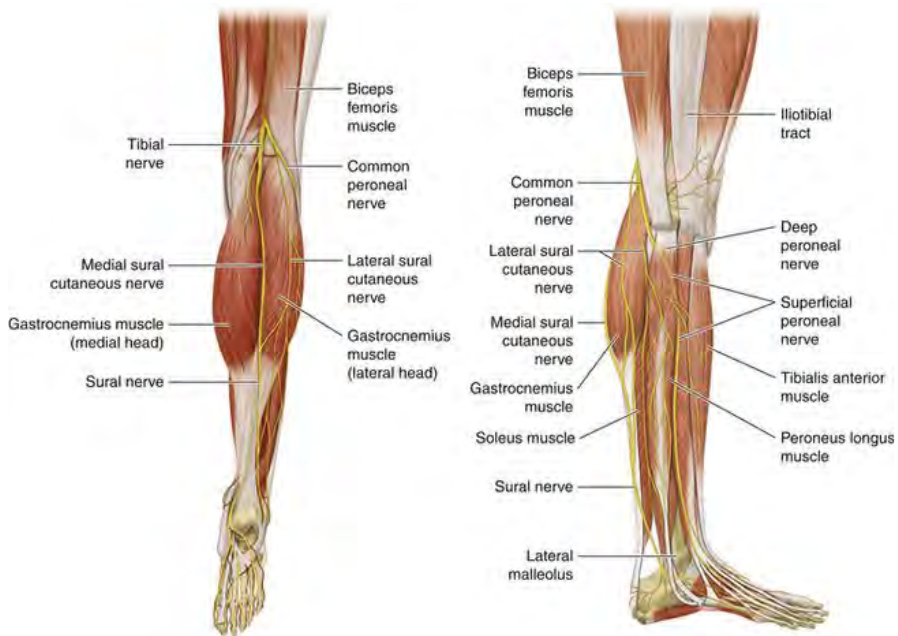
Injured in knee-flexed loading; deep location makes palpation difficult. Key: soleus is monoarticular.

Soleus Musculotendinous Junction

Distal MTJ where soleus meets the Achilles complex. Site of isolated soleus MTJ tears in runners.



Anatomical Structures Involved



Secondary / Contributing Structures

Plantaris Tendon

Co-injured in ~25% of gastrocnemius MTJ tears. Long, thin tendon lying between gastrocnemius and soleus.

Achilles Tendon Complex

Distal confluence of gastrocnemius and soleus tendons. Chronic gastrocnemius tightness increases Achilles load.

Deep Posterior Compartment Fascia

Fascial compartment surrounding tibialis posterior, FHL, FDL. Bleeding from a tear can increase compartment pressure.

Sural Nerve

Runs between gastrocnemius heads; may be irritated by hematoma or scarring. Can cause posterior calf dysesthesia.



Eccentric Overload & MTJ Failure

Distinct loading patterns drive injury to each muscle

Rapid Eccentric Demand

Sudden high-force lengthening contraction during push-off, deceleration, or change of direction.

Two-Joint Loading (Gastrocnemius)

Knee extended + ankle dorsiflexed simultaneously — maximum stretch on biarticular gastrocnemius.

MTJ Stress Concentration

Peak tensile load at the musculotendinous junction — the weakest point in the muscle-tendon unit.

Fiber Failure

Partial or complete disruption of muscle fibers at or near the MTJ; degree determines grade (I–III).

Primary Drivers:

Medial Gastrocnemius MTJ
(highest load at push-off)

Soleus belly
(knee-flexed repetitive load)

Plantaris
(co-injury in gastroc tears)





Common Causes & Risk Factors

Sport & Extrinsic Factors

- Sports requiring explosive push-off: tennis, basketball, cricket, sprinting, football
- Rapid increases in training volume or intensity (running mileage spike)
- Insufficient warm-up before high-intensity activity
- Playing on hard or uneven surfaces
- Cold ambient temperature — reduced muscle extensibility
- Inappropriate or worn footwear; excessive heel drop change





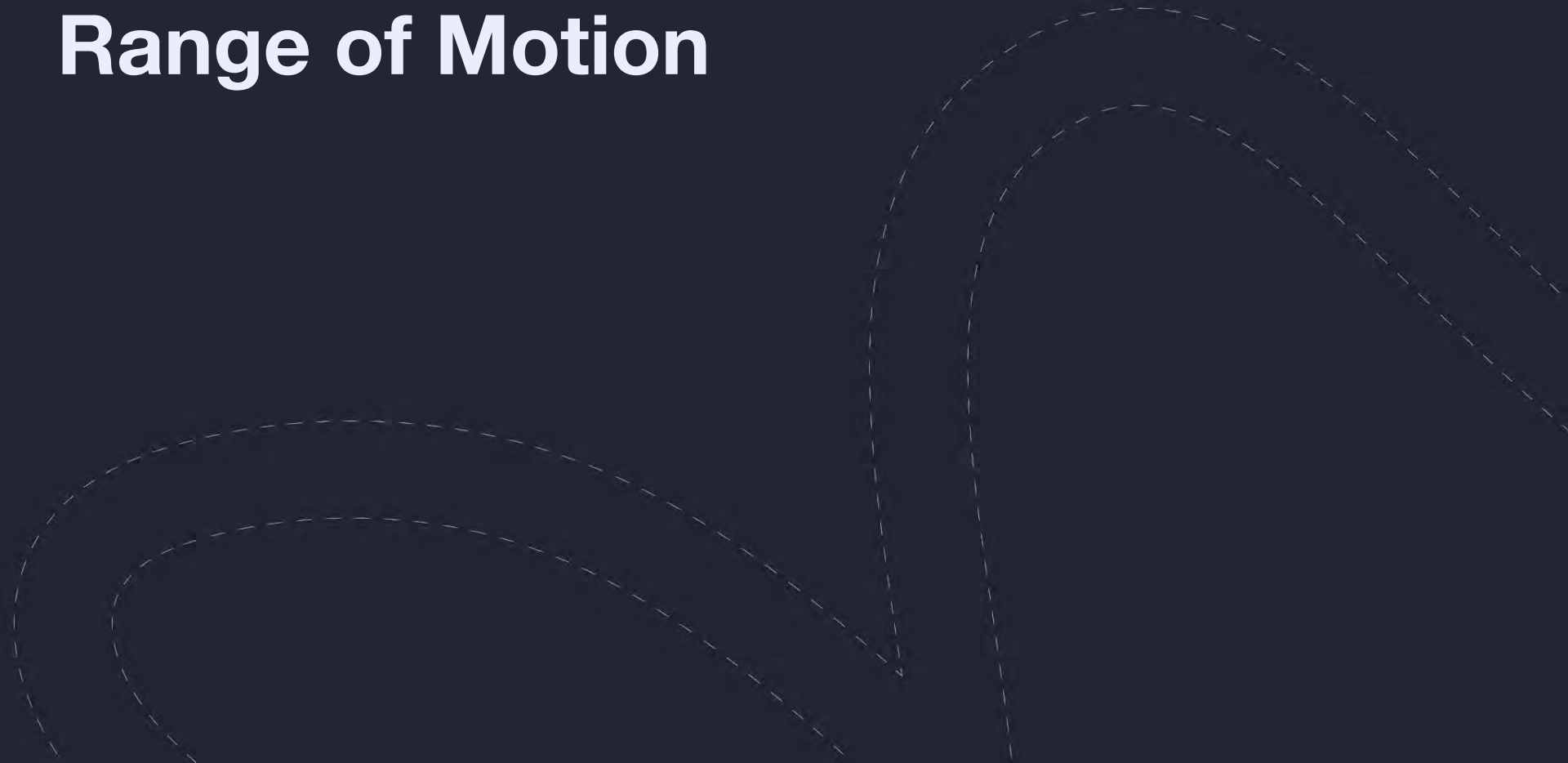
Common Causes & Risk Factors



Biomechanical & Intrinsic Factors

- Age 35–55 — decreased muscle elasticity, tendon stiffness, and repair capacity
- Reduced ankle dorsiflexion ROM (gastroc) — increased MTJ tensile load during push-off
- Reduced soleus flexibility (knee-flexed dorsiflexion) — elevated soleus tear risk
- Plantarflexor strength deficit or bilateral asymmetry
- Prior calf injury, incomplete rehabilitation, or premature return-to-sport
- Fatigue, dehydration, and poor sleep — impaired neuromuscular control

Assessment: **Range of Motion**





Ankle Dorsiflexion



Gastrocnemius focused - Knee Extended

Gastrocnemius length; restricted ROM = gastroc tightness / elevated MTJ tensile load.

Norm: $\geq 10^\circ$



Soleus focused - Knee Flexed

Soleus length in isolation; deficit with knee flexed but not extended = isolated soleus restriction.

Norm: $\geq 20^\circ$



Ankle Plantar Flexion

Baseline plantarflexion capacity; gross deficit may indicate significant structural tear or pain inhibition.

Assess both Gastrocnemius and Soleus.

Norm: 0–50°



Knee Flexion



Differentiates biarticular vs. monoarticular loading; identifies contributing hamstring tightness. Assess both Gastrocnemius and Soleus.

Knee Extension





Subtalar Inversion

Norm: 0-30°



Subtalar Eversion

Norm: 0-20°



Rules out concurrent ankle or peroneal pathology; assesses foot complex mechanics.



Hip Extension

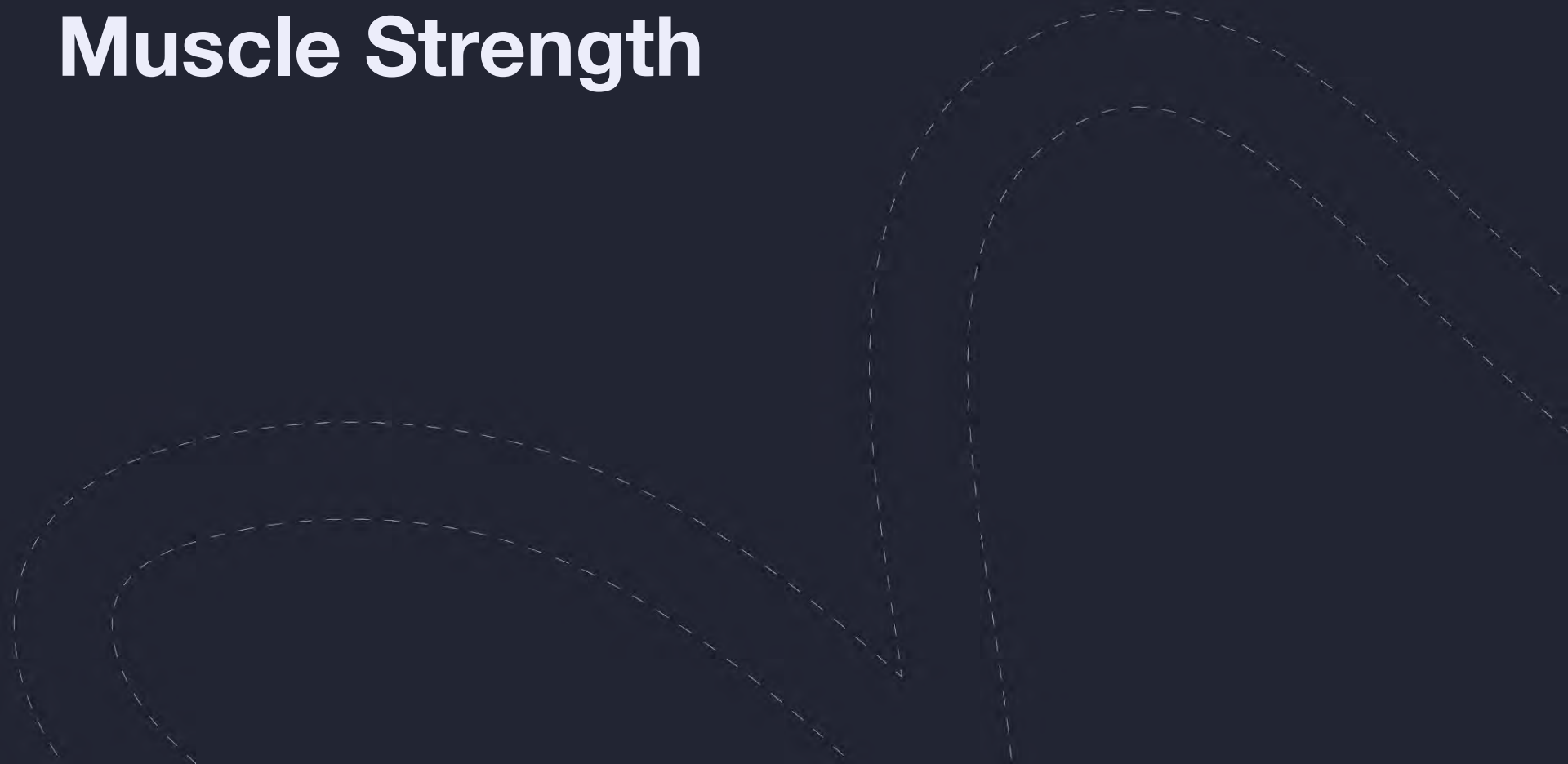
Hip Extension

Hip flexor tightness increases lumbopelvic-hip compensation during running gait — indirect calf loading factor.

Norm: 0–20°



Assessment: **Muscle Strength**



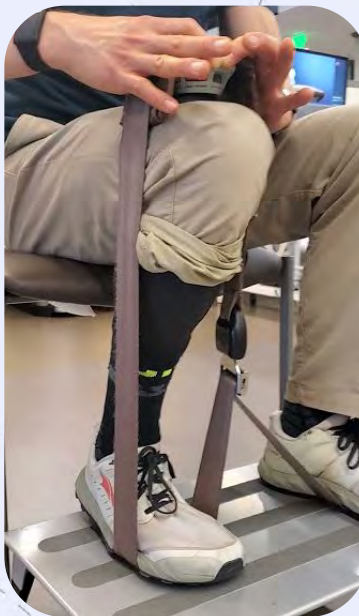


Ankle Plantarflexion



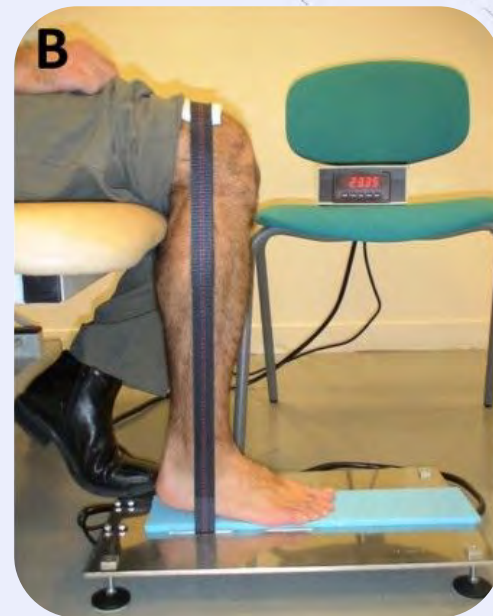
Soleus focused - Knee Flexed 90°

Setup: Seated; knee at 90° flexion; same distal foot placement. Gastroc is slackened — isolates soleus.



Gastrocnemius focused - Knee Extended

Setup: Supine or seated; knee fully extended; dynamometer at plantar forefoot. Isometric push.





Knee Flexors - Hamstrings

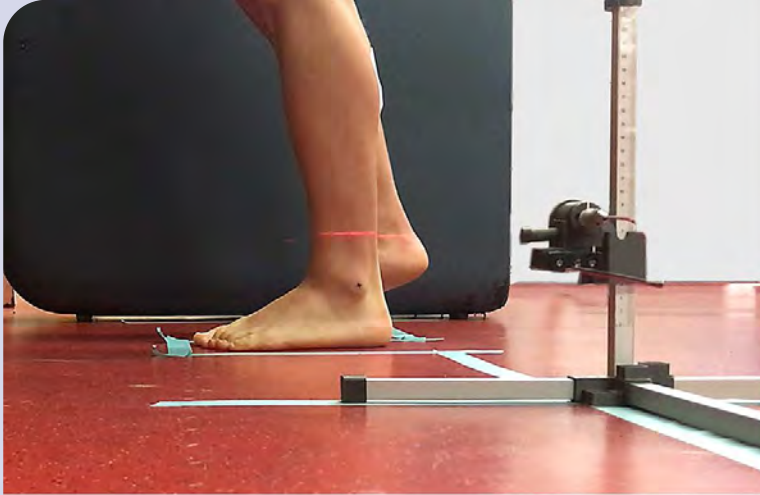
Prone, 60° knee flexion

Setup: Dynamometer at posterior distal tibia. Rules out proximal posterior chain deficit contributing to calf mechanics.





Single-Leg Heel Raise (Functional)



A. Starting position.



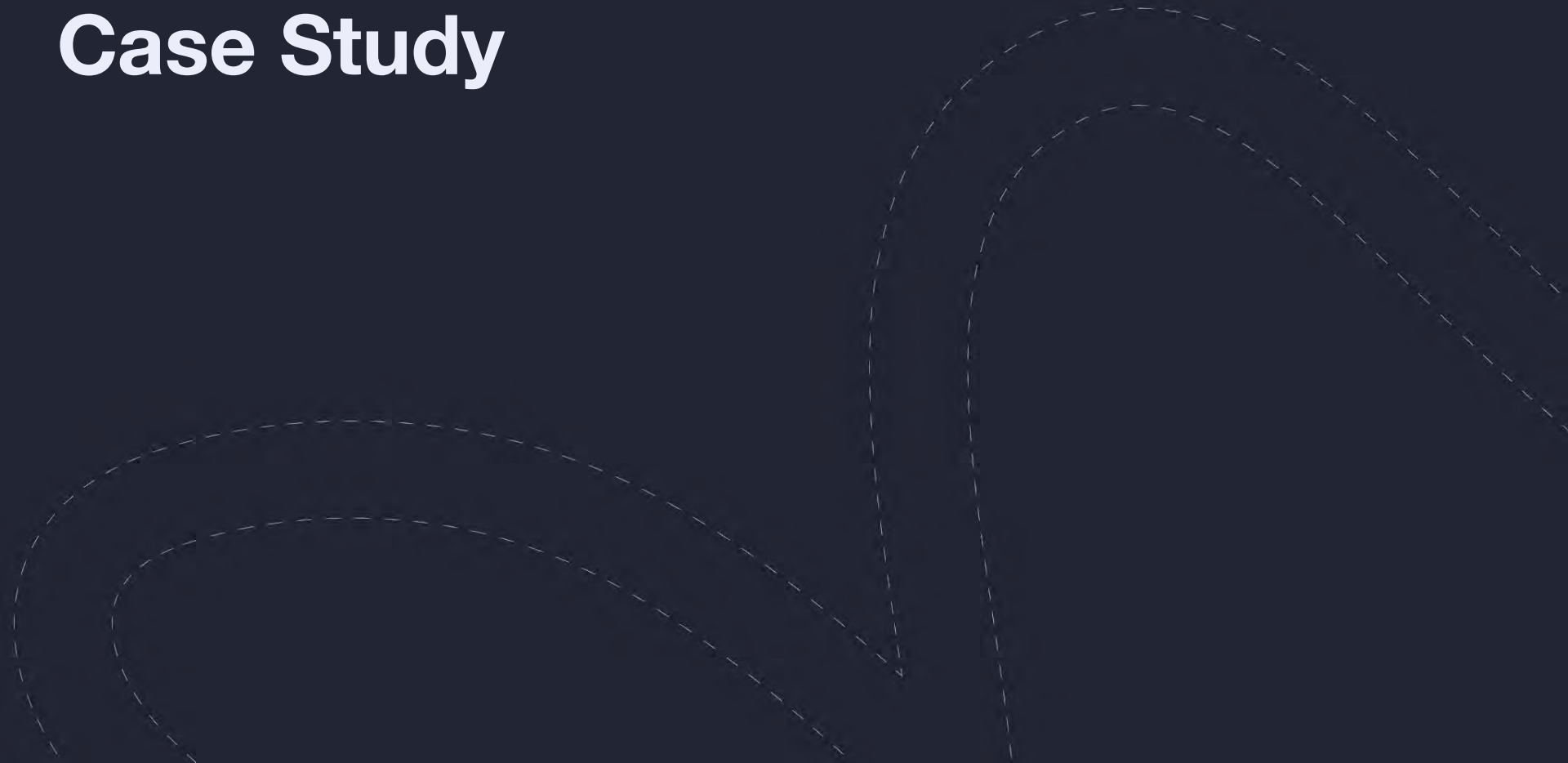
B. Heel rise. The beam of the laser pointer was set at the height of the heel rise.

Standing — both positions

Setup: Standardized 25-rep max or timed test. Compare symptomatic vs. asymptomatic side.
ActivForce2 captures force if belt-fixation setup used.

Assessment - Treatment - Rehab:

Case Study



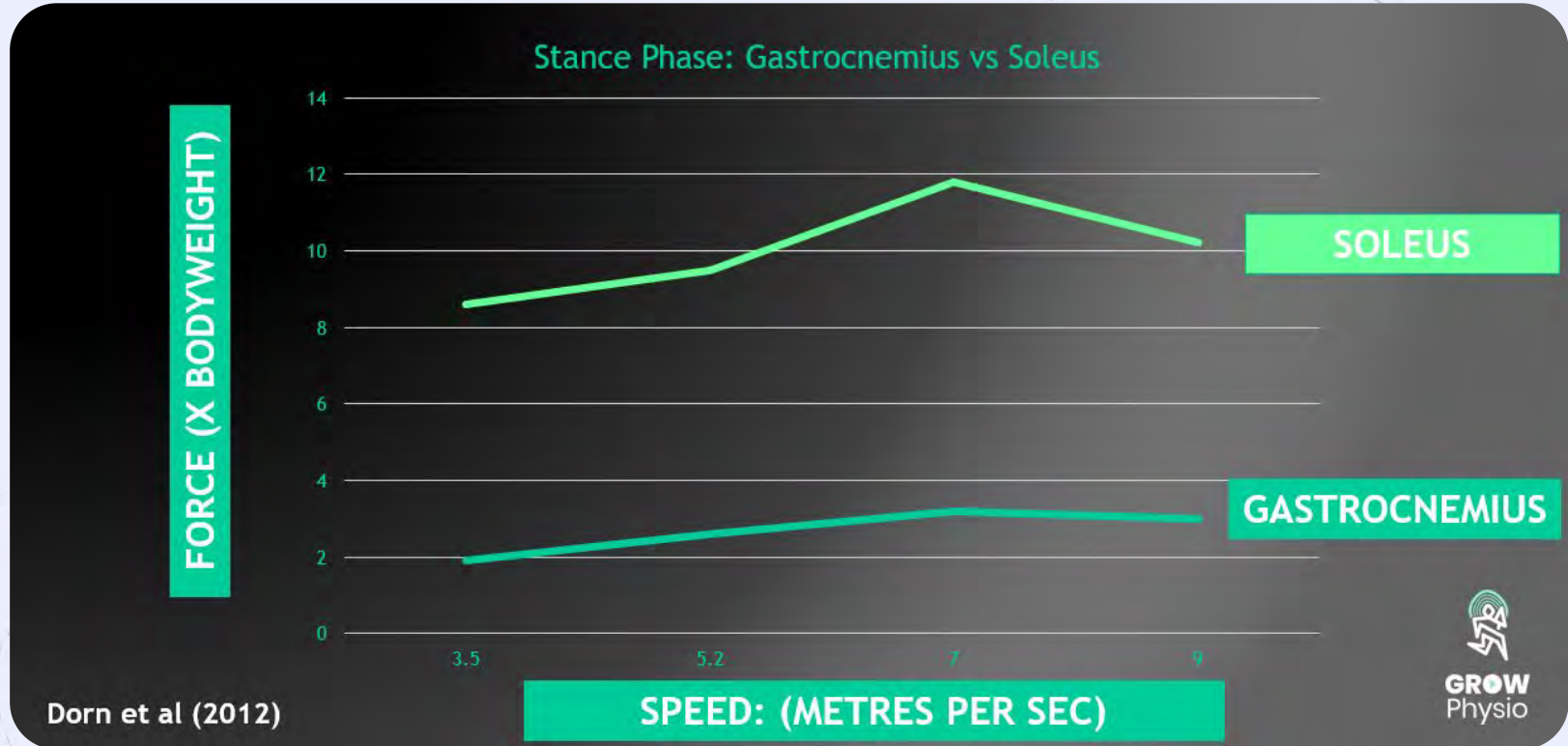


Common Injury Locations

- ✕ Gastrocnemius: Medial Head
- ✕ Myotendinous Junction (MTJ)
- ✕ Soleus: Medial > Lateral
- ✕ Plantaris
- ✕ Achilles Tendinopathy



Running Speed: Force Output & Ground Contact Time



Objective Markers: Knee to Wall



Photo /
Illustration

Neural Mobility: Straight Leg Raise (SLR) & Slump



Active vs Passive

- Tone: Influence on RoM
- Differentiation: Proximal or Distal

Proximal/Hip Based Wind-Up

- Neutral ankle and hip, knee extended
- Heavy, resistance/reluctance
- Increased calf tone vs neural 'block'



Altered Wind-Up (Knee-based)

- Hip 90 degrees, knee 90 degrees
- Active knee extension → passive



Additional Testing Options



Soleus 'Strength'



Force Plate: Soleus



**Force Plates:
Gastrocnemius**

Symptom Summary



Grading	DL Calf Raise Knee Extended	DL Calf Raise Knee Flexed >60	SL Calf Raise Knee Extended	SL Calf Raise Knee Flexed >60	Knee to Wall Distance	Hopping	Palpation
'Tightness'							
Grade I							
Grade II							
Grade III							

Early Enough? Reduced Capacity Options



Wall/Ball Presses

Athlete Led

Plantargrade -> Through Range

5 x 5-45 secs



Adapted Rehab

Reduced BW Loading

Flat Foot & DL -> Split Stance / SL

BloodFlow Restriction/Occlusion



Seated Calf Raise

Various Protocols
Hypertrophy with low loads



Alternatives

Deloaded Calf Raises
Cycle/WattBike

Soleus Bias Loading: Sufficient Load?



Seated Hamstring Machine

Isometrics -> Slow Dynamic

Floor: Limits Terminal Dorsiflexion



Dynamic Soleus Progressions

Through RoM, DL -> SL

Rep Duration: 5-30 secs

Isometrics: Forward/Backward Propulsion



Prowler Walks

Stiffness, GCT & Forward Drive
Increase Cadence & Drive



Prowler/Sled Pulls

Posterior Chain
Hamstrings and Calves

Sprinter Variations



Rolling/Rocked Calf Raises

Reduced -> Increased Concentric Demand
Asymmetries: Foot, Ankle, Pelvis...

Quicker Exchanges

Stiffness & Stick
1, 2, 3's & 1, 2, 3, 4, 5's



Summary

- Subjective: ‘Detective’
- Examination & Specificity
- Objective Markers, Grading & Classifications
- Timescales, Planning & Communication
- Documentation & Reflection



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References:

Alfredson, H., Pietilä, T., Jonsson, P., & Lorentzon, R. (1998). Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. *The American Journal of Sports Medicine*, 26(3), 360–366. <https://doi.org/10.1177/03635465980260030301>

Bianchi, S., Martinoli, C., Abdelwahab, I. F., Derchi, L. E., & Damiani, S. (1998). Sonographic evaluation of tears of the gastrocnemius medial head ('tennis leg'). *Journal of Ultrasound in Medicine*, 17(3), 157–162. <https://doi.org/10.7863/jum.1998.17.3.157>

Bright, J. M., Fields, K. B., & Draper, R. (2017). Ultrasound diagnosis of calf injuries. *Sports Health*, 9(4), 352–355. <https://doi.org/10.1177/1941738117696019>

Delgado, G. J., Chung, C. B., Lektrakul, N., Azocar, P., Botte, M. J., Coria, D., Bosch, E., & Resnick, D. (2002). Tennis leg: Clinical US study of 141 patients and anatomic investigation of 4 cadavers with MR imaging and US. *Radiology*, 224(1), 112–119. <https://doi.org/10.1148/radiol.2241011067>

Green, B., McClelland, J. A., Semciw, A. I., Schache, A. G., McCall, A., & Pizzari, T. (2022). The assessment, management and rehabilitation of gastrocnemius muscle tears in the elite athlete: A case series. *BMJ Case Reports*, 15(1), e246553. <https://doi.org/10.1136/bcr-2021-246553>

Hebert-Losier, K., Newsham-West, R. J., Schneiders, A. G., & Sullivan, S. J. (2009). Raising the standards of the calf-raise test: A systematic review. *Physical Therapy in Sport*, 10(4), 125–140. <https://doi.org/10.1016/j.ptsp.2009.07.001>

Karagiannopoulos, C., Griech, S., & Leggin, B. (2022). Reliability and validity of the ActivForce digital dynamometer in assessing shoulder muscle force across different user experience levels. *International Journal of Sports Physical Therapy*, 17(4), 669–676. <https://doi.org/10.26603/001c.35577>

Pedret, C., Balias, R., Blasi, M., Masci, L., Peirau, X., & Doménech, J. (2021). Soleus muscle injuries. *Muscles, Ligaments and Tendons Journal*, 11(4), 636–644. <https://doi.org/10.32098/mltj.04.2021.12>

Orchard, J., & Best, T. M. (2002). The management of muscle strain injuries: An early return versus the risk of recurrence. *Clinical Journal of Sport Medicine*, 12(1), 3–5. <https://doi.org/10.1097/00042752-200201000-00003>

Silfverskiöld, N. (1924). Reduction of the uncrossed two-joints muscles of the leg to one-joint muscles in spastic conditions. *Acta Chirurgica Scandinavica*, 56, 315–328.

Strauss, E. J., Campbell, K., & Bosco, J. A. (2007). Analysis of the cross-sectional area of the Achilles tendon and the effect of age. *Journal of Orthopaedic Surgery and Research*, 2, 14. <https://doi.org/10.1186/1749-799X-2-14>

Physiopedia. (2024). Gastrocnemius muscle. <https://www.physio-pedia.com/Gastrocnemius>

Physiopedia. (2024). Soleus muscle. <https://www.physio-pedia.com/Soleus>