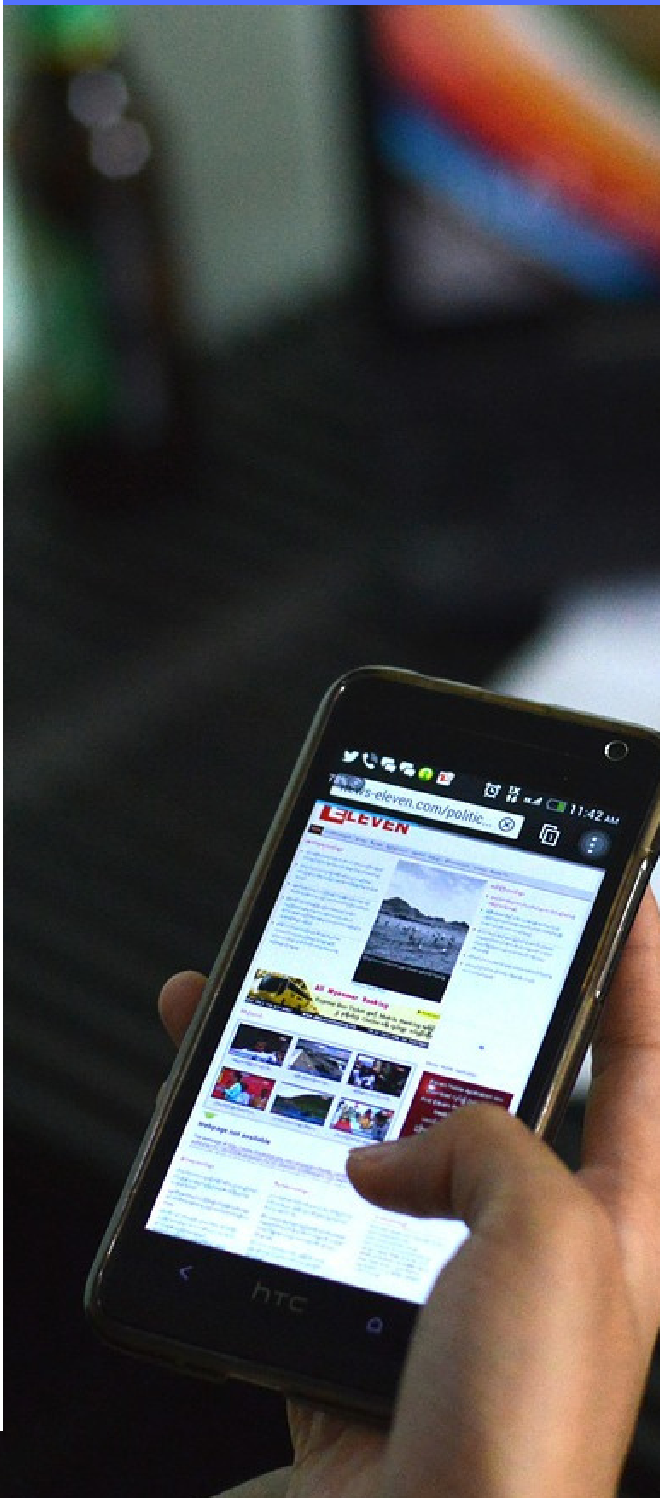
RAPID RESEARCH

@physicaltherapyresearch

July 2021

Inside This Week:

Sports Biomechanics

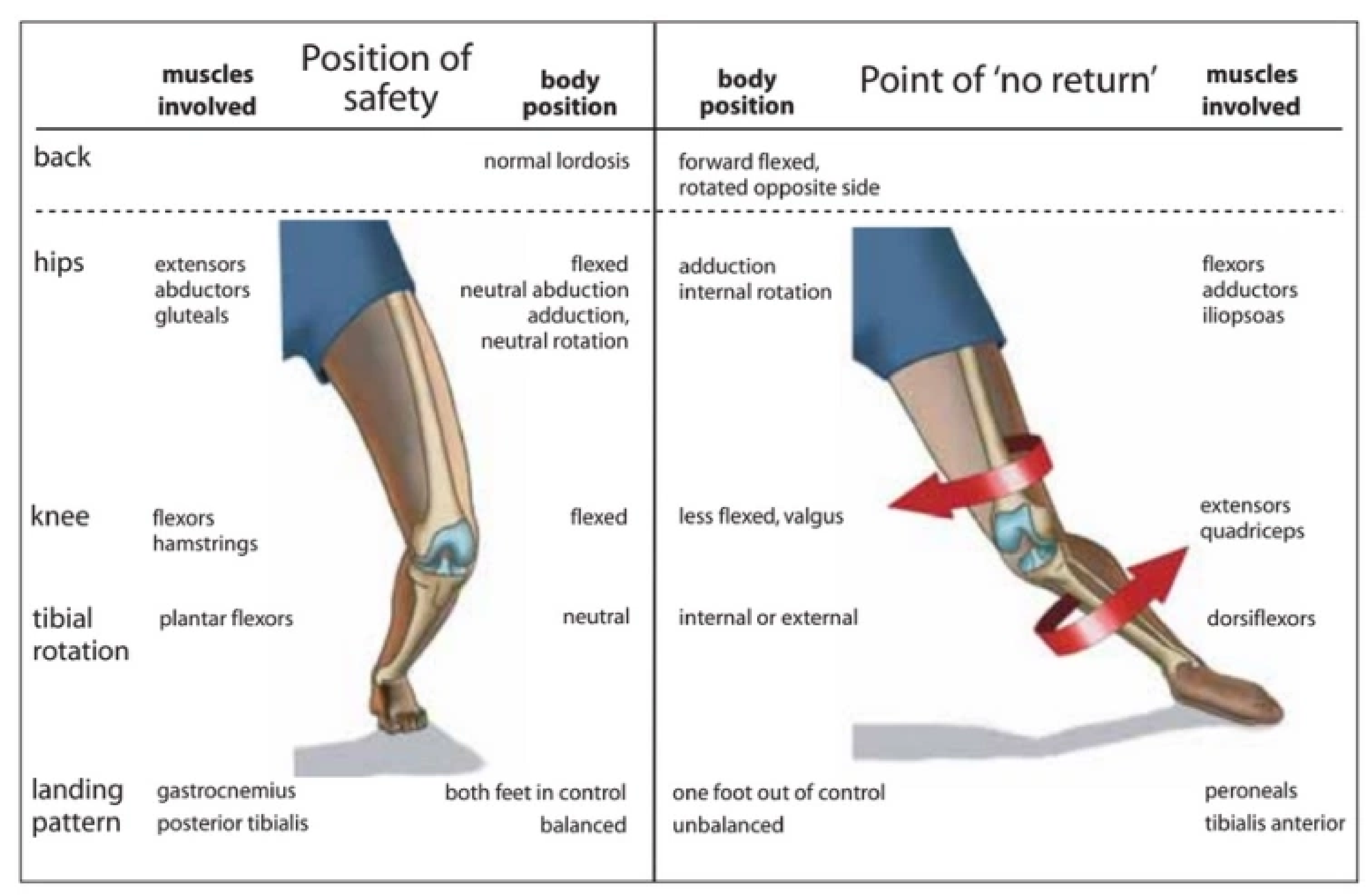


- ✓ Loading Mechanisms of the ACL
- ✓ Lower Leg Strength & Chronic Ankle Instability
- ✓ Leg Muscle Differences Between Sprinters and Distance Runners.

JULY 2021

LOADING MECHANISMS OF THE ACL

This review identifies the knee loads in all 3 planes that have the highest risk of injuring the anterior cruciate ligament (ACL) in athletes.



	Position of safety		Point of 'no return'	
	muscles involved	**body position**	**body position**	**muscles involved**
back		normal lordosis	forward flexed, rotated opposite side	
hips	extensors abductors gluteals	flexed neutral abduction adduction, neutral rotation	adduction internal rotation	flexors adductors iliopsoas
knee	flexors hamstrings	flexed	less flexed, valgus	extensors quadriceps
tibial rotation	plantar flexors	neutral	internal or external	dorsiflexors
landing pattern	gastrocnemius posterior tibialis	both feet in control balanced	one foot out of control unbalanced	peroneals tibialis anterior

KEY FINDINGS

Max ACL load happens with the combination of muscular resistance to:
Large knee flexion moment.
External knee compression.
Internal tibial torque.
& **a knee abduction moment,**
during a single-leg athletic maneuver.

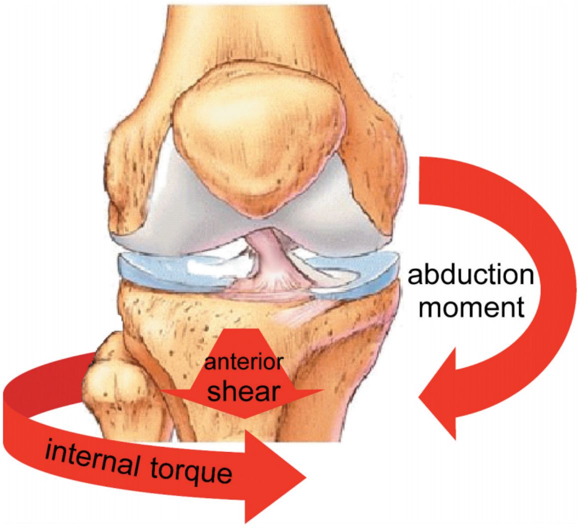


Figure 2. The combination of an anterior tibial shear force, an internal tibial torque, and a knee abduction moment induces the greatest load on the ACL.

Anterior tibial shear force is the **primary ACL loading mechanism.**

But controversy exists regarding the secondary order of importance of transverse-plane and frontal-plane loading in ACL injury scenarios.

Large knee compression forces & a **posteriorly and inferiorly sloped tibial plateau**, especially the lateral plateau—an important ACL injury risk factor—causes **anterior tibial translation and internal tibial rotation, increasing ACL loading**

MAIN TAKEAWAYS

The greatest loads in the ACL happen during a combination of Knee Joint:
Compression, Flexion, Anterior tibial shear, Internal tibial torque & abduction.

Especially during single-leg athletic maneuvers, such as:
Jump landings.
Abrupt turns.
Sudden deceleration

The ACL **can fail under repetitive sub-maximal loading due to micro-damage accumulating.**

This challenges the widely accepted view that an ACL injury only occurs during a single loading event and has implications for better ACL injury prevention in the future.

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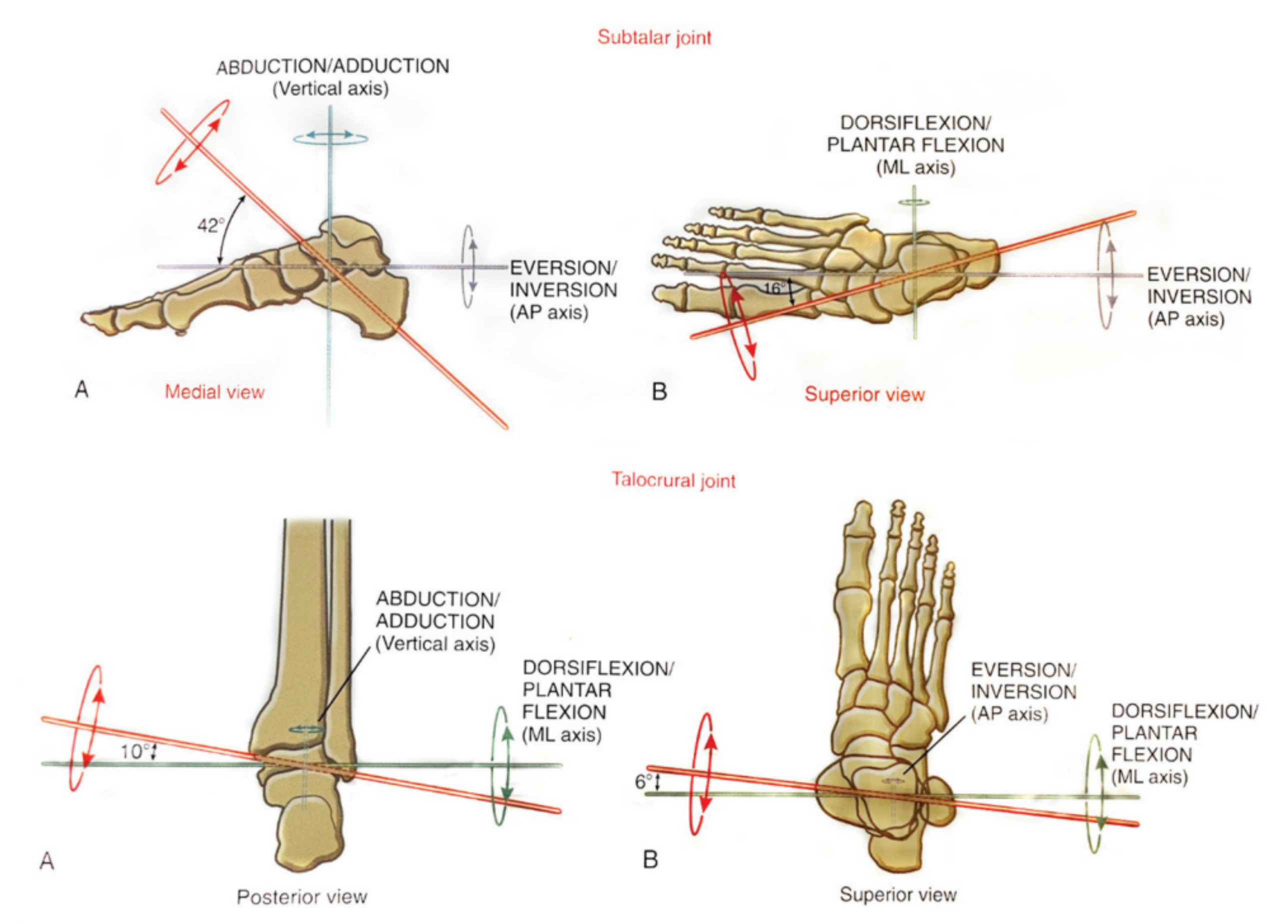
LOWER LEG STRENGTH & CHRONIC ANKLE INSTABILITY

This review offered a contemporary, evidence-based overview of the role of ankle strength measurements as they relate to acute ankle sprain rehabilitation and those who have developed Chronic Ankle Instability.



KEY FINDINGS

Individuals with CAI have **limited range-of-motion (ROM) and altered kinematics of the ankle joints** due to bony and ligamentous restraints.

Stabilization of the ankle comes from co-contraction of agonist and antagonist muscle pairings surrounding the joint.

Majority of ankle sprains occur before the Fibularis muscles have time to activate.

No single factor contributed exclusively to CAI, but instead a combination of **stability variables including:**
Inversion/eversion ankle strength.
Dorsiflexion ROM.
Knee flexion/extension strength.

MAIN TAKEAWAYS

It is important to **assess strength and strategies for improvement** in patients with chronic ankle instability.

Recommended measurements should include:
Positioning & Stabilisation.
Test Velocities
Reliability issues
Normalization Considerations (Lean Body Mass)
Bilateral Muscle Group Comparisons (agonist vs. antagonist)
Spectrum of Muscle Actions (isometric, concentric, eccentric)

These are a great starting point and will allow for **more accurate, consistent results both in the research and clinical environments.**

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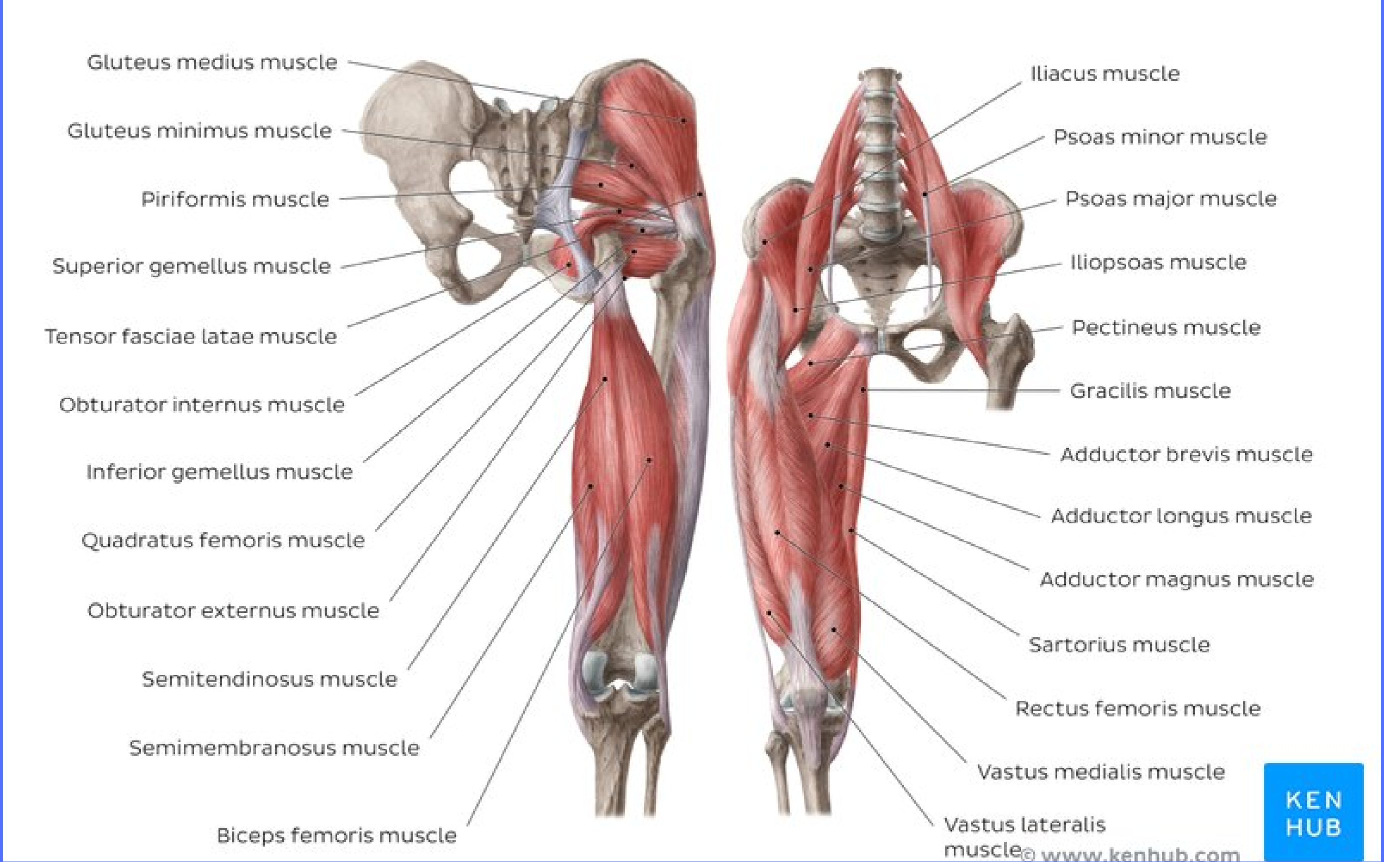
LEG MUSCLE DIFFERENCES BETWEEN SPRINTERS & DISTANCE RUNNERS.

This research compared 65 sprinters, middle distance and long-distance runners for muscle activity at initial contact and toe-off, involving the gluteus medius (GMED), gluteus maximus (GMAX), biceps femoris (BF), rectus femoris (RF), tiabilis anterior (TA) and medial gastrocnemius (MGAS).



KEY FINDINGS

Sprinters showed **high percentages of muscle activity at initial contact**, in particular, the TA activity was the highest.

The **RF activity was significantly the lowest activity registered**.

At **toe-off, sprinters showed the highest activity in all muscles analyzed.**

Middle-distance runners had the **highest activity of GMAX, BF and MGAS during the initial contact.**

In long-distance runners, the **GMED and RF activity during the initial contact is highlighted, showing the highest activity of this phase.**

MAIN TAKEAWAYS

Different patterns of lower limb muscle activity and spatiotemporal parameters **exist depending on the modality of the runner.**

Sprinters at initial contact and toe-off required a **high distal control of ankle joint plantar flexors and dorsiflexors.**

Middle-distance runners at initial contact required a **greater control of leg extensors and plantar flexors muscles.**

Long-distance runners exhibited a greater activity of hip abductors and knee extensors to control the impact at heel strike.

The **toe-off phase in all groups would be more influenced by inertia than by muscle activity**.

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We would greatly appreciate any feedback you have, as it helps us continually improve!

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