Hawkin

TRUSTRENGTH DYNAMOMETER

THE QUADRICEP TESTING SOLUTION

THE IMPORTANCE OF

QUADRICEP ASSESSMENT AND MONITORING

Knee extensor strength is essential for lower-limb performance, influencing everyday tasks like walking and standing, as well as athletic actions such as sprinting, jumping, and rapid change of direction [1] . Strength deficits and asymmetries are common following knee injury and can affect movement quality and readiness to return to sport.

The TruStrength dynamometer is validated against isokinetic dynamometry, the gold standard measure of knee extensor kinetics [2] and has demonstrated low variability in quantifying knee extensor peak force in applied environments [3].

With increased portability, accurate assessments of knee extension are possible in any environment.

The Hawkin team advises several reliable quadricep testing protocols, giving coaches and clinicians confidence in their knee extensor strength assessments.

Although the TruStrength device can be used to assess quadricep force capabilities using a variety of protocols, our team recommends the following tests, which are described in this guide:

- ***Seated Knee Extension 90° Test***
- ***Seated Knee Extension 60° Test***
- ***Seated Knee Extension 30° Test***

SEATED KNEE EXTENSION 90°

Equipment checklist

- ✓ TruStrength
- ✓ Adjustable Strap
- ✓ Multiplanar Clamp Mount or Pivot
- ✓ Eyebolt x1
- ✓ Carabiner x2
- ✓ Ankle Strap

The 90° deeper knee angle allows high quadriceps activation and typically produces greater peak force compared to the knee extension at shorter muscle lengths (30° degrees). Additionally, this 90° position may simulate and relate to deeper-flexion demands such as deceleration, and high force directional changes such as 180 degrees [4,5].

TEST SETUP INSTRUCTIONS

This protocol has been reported as a reliable method compared to limb and torso fixed positions 3.

- The athlete is seated, hips flexed at 90° facing away from the fixation point on a plyo box/plinth. The involved knee flexed 60° with both feet off the floor.
- The TruStrength, fixed using the clamp mount to allow a direct line of force application with the ankle strap placed at 2cm superior to the lateral malleolus.
- Minimal pretension is applied to the strap and following a 3,2,1 countdown, athletes are cued to push as hard and as fast as they can for 3-5s.

SEATED KNEE EXTENSION 60°

Equipment checklist

- ✓ TruStrength
- ✓ Adjustable Strap
- ✓ Multiplanar Clamp Mount or Pivot
- ✓ Eyebolt x1
- ✓ Carabiner x2
- ✓ Ankle Strap

The seated 60° knee extension test is recommended when wanting to replicate the optimal joint angle for determining the peak torque of the quadriceps [6]. A key consideration is that the athlete has to account the moment arm due to gravity acting on the lower leg, which the 90° knee extension protocol does not [7].

TEST SETUP INSTRUCTIONS

- The athlete is seated, hips flexed at 90° facing away from the fixation point on a plyo box/plinth. The involved knee flexed 60° with both feet off the floor.
- The TruStrength, fixed using the clamp mount to allow a direct line of force application with the ankle strap placed at 2cm superior to the lateral malleolus.
- Minimal pretension is applied to the strap and following a 3,2,1 countdown, athletes are cued to push as hard and as fast as they can for 3-5s.

SEATED KNEE EXTENSION 30°

Equipment checklist

- ✓ TruStrength
- ✓ Adjustable Strap
- ✓ Multiplanar Clamp Mount or Pivot
- ✓ Eyebolt x1
- ✓ Carabiner x2
- ✓ Ankle Strap

This seated 30° position reduces joint compression and emphasises terminal-extension strength, producing slightly lower peak force than 90° and 60°. It is useful for late-stage rehabilitation, sprinting, and kicking mechanics 8,9.

Additionally, assessing the knee in this extended position mimics the angles where knee injuries such as ACL injuries typically occur (0-30°), therefore it is important to test clients and athletes in these more vulnerable, but still safe positions 8,9

TEST SETUP INSTRUCTIONS

- The athlete is seated, facing away from the fixation point on a plyo box/plinth to allow for a 30 degree flexion at the knee with feet off the floor.
- The TruStrength, fixed using the clamp mount to allow a direct line of force application to the ankle strap placed at 2cm superior to the lateral malleolus.
- Minimal pretension is applied to the strap and following a 3,2,1 countdown, athletes are cued to push as hard and as fast as they can for 3-5s.

DATA & METRICS

Every TruStrength test is processed the same way, every time. Removing human error and inconsistency ensure results reflect real changes, not differences in how the data was handled.

PEAK NET FORCE

Peak Net Force provides insight into an athlete’s maximal strength. This metric is great to track during mid-stage rehabilitation and/or pre-season, and early in-season.

NET IMPULSE / AVERAGE FORCE

The average force or impulse can give you insight into an athlete’s ability to sustain force over the entire contraction duration.

RAPID FORCE / RFD

Net force at 50-200 ms and rate of force development (RFD) during the repetition can give you insight into the athlete’s explosive strength capability.

The TruStrength system makes strength testing quick, reliable and repeatable, empowering practitioners with real-time data that supports decision making and elevates client outcomes.

TAG SELECTION

This example represents a tag workflow for the Seated 60° Knee Extension test. Accurate tags are essential for insightful data analysis, so you know HOW you tested when it comes to analysis.

TEST NAME: **KNEE EXTENSION 60**
TEST LIMB: **RIGHT**

Protocol Considerations

LONGER DURATIONS
10+ seconds
Recommended if muscle endurance is of interest

MODERATE DURATIONS
3-5 seconds
Recommended if maximal strength is of interest

SHORT DURATIONS
1 second
Recommended if rapid force expression is of interest

VERBAL CUES
“fast” and “hard"
Recommended for any test duration (assuming uninjured athlete)

Whether you are profiling, screening or monitoring your athletes, TruStrength brings precision and confidence to strength testing.

Join leading professionals who are using Hawkin data to drive smarter decisions.

ENDNOTES

[1] Hori, M., et al. Relationship of the knee extensor strength but not the quadriceps femoris muscularity with sprint performance in sprinters: A reexamination and extension. BMC Sports Science, Medicine and Rehabilitation. 2021;13(1): 67.

[2] Oranchuk, D., et al. The validity of a portable strain-gauge apparatus versus a commercial isokinetic dynamometer for evaluating knee extension kinetics. International Journal of Sports Physical Therapy. 2024;19(3). 258.

[3]Juneau, C.M., et al. Intersession variability of knee extension kinetics using a strain gauge device with differing clinically practical physical constraints. Journal of Sport Rehabilitation. 2022;32(1): 96-101.

[4] Garnier, Y. et al. Effect of the knee and hip angles on knee extensor torque: neural, architectural, and mechanical considerations. Frontiers in Physiology. 2022; 12, 789867.

[5] Garcia, S. C., et al. Optimal joint positions for manual isometric muscle testing. Journal of Sport Rehabilitation. 2022; 25(4).

[6] Welsch, M. A., et al. Quantification of full-range-of-motion unilateral and bilateral knee flexion and extension torque ratios. Archives of physical medicine and rehabilitation 79.8 (1998): 971-978.

ENDNOTES

[7] Norris, R., et al. Inline dynamometry provides reliable measurements of quadriceps strength in healthy and ACL-reconstructed individuals and is a valid substitute for isometric electromechanical dynamometry following ACL reconstruction."The Knee 46 (2024): 136-147.

[8] Quatman, C. E., & Hewett, T. E. The anterior cruciate ligament injury controversy: is “valgus collapse” a sex-specific mechanism?. British Journal of Sports Medicine. 2009;43(5): 328-335.

[9] Shimokochi, Y., & Shultz, S. J. Mechanisms of noncontact anterior cruciate ligament injury. Journal of Athletic Training. 2008;43(4): 396-408.