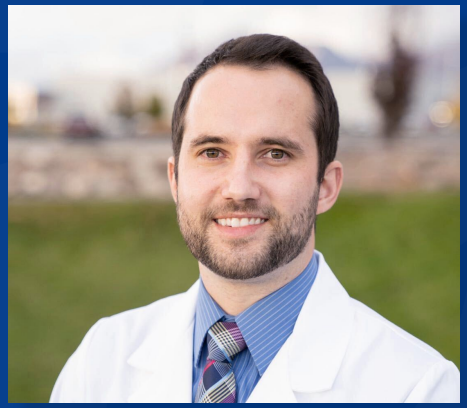
Foundations of Strength Testing: *Knee Techniques*

April 23, 2024

activforce

Introductions:



Daniel Stewart PT, DPT

Kevin Robinson PT, DSc, OCS

activforce

Partnership Announcement:

PHYSIO•U ® × activforce

Revolutionizing Physical Therapy Education Together

We're thrilled to announce an exciting partnership between PhysioU, a digital leader in Physical Therapy education, and ActivForce, a revolutionary force in rehab technology. PhysioU redefines healthcare education by bridging classroom learning to clinical excellence through evidence-based web app solutions. ActivForce's integrated digital systems empower physical therapists with data-driven decision making, offering immediate insights into individual patient capabilities through key strength metrics and force data visualization. *Together, we're combining education with rehab technology to enhance the practice of physical therapy.*

This collaboration aims to offer an affordable, data-driven learning experience enriched with top-notch video content, paving the way for evidence-based practice and quality patient care. Join us in embracing this innovative journey towards a brighter future in Physical Therapy education and practice!

activforce

Study Review: Why Test Quad Strength?

When preparing for a return to sport (RTS) after anterior cruciate ligament reconstruction (ACLR), several criteria are considered to assess readiness and minimize the risk of re-injury. These criteria typically involve a combination of physical readiness, functional testing, and psychological readiness.

activforce

Study Review: Why Test Quad Strength?

Physical and Functional Readiness:

1. **Muscle Strength:**

A common criterion is the assessment of quadriceps and hamstring muscle strength. This is often measured as a percentage of the strength of the uninjured leg, with a common threshold being at least 90% of the strength of the contralateral limb.

2. **Hop Tests:**

Functional tests such as single-leg hop, triple hop, and crossover triple hop are used to assess limb symmetry and function. The goal is typically for the injured limb to perform within 10% of the uninjured limb on these tests.

3. **Running Tests:**

Agility and performance can also be assessed through running tests, which help evaluate the dynamic function and biomechanics of the knee under sport-specific conditions.

activforce

Study Review:

> Knee Surg Sports Traumatol Arthrosc. 2019 Aug;27(8):2494-2501.
doi: 10.1007/s00167-018-5245-3. Epub 2018 Oct 30.

Hand-held dynamometer identifies asymmetries in torque of the quadriceps muscle after anterior cruciate ligament reconstruction

Gabriel Peixoto Leão Almeida [1 2], Thamyla Rocha Albano [3], Antônio Kayro Pereira Melo [3]

Affiliations + expand

PMID: 30377716 DOI: 10.1007/s00167-018-5245-3

Abstract

Purpose: To verify the validity and diagnostic accuracy of the hand-held dynamometer (HHD) with the isokinetic dynamometer for evaluating the quadriceps strength of subjects who have undergone ACL reconstruction (ACLR).

Methods: This validity and diagnostic accuracy study was conducted prospectively by examining 70 consecutive participants who had undergone ACLR at least 6 months previously. All participants performed strength evaluation of the quadriceps muscle using the HHD and isokinetic dynamometer.

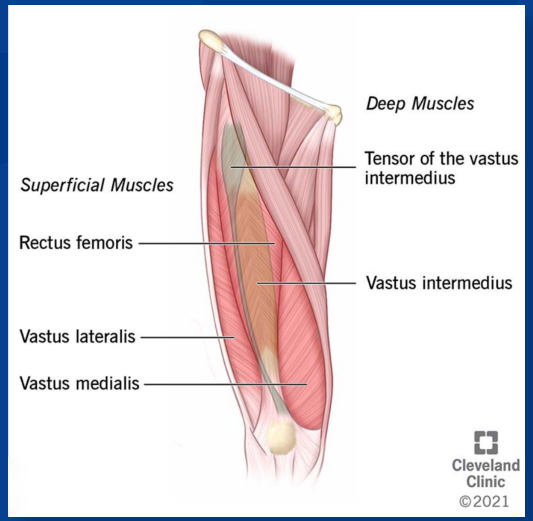
Results: The HHD presented high test-retest reliability [intraclass correlation coefficient (ICC) = 0.98], moderate to good validity with the isokinetic dynamometer when compared for the quadriceps strength (r = 0.62), 100% perfect specificity [LR + infinity, 95% confidence interval (CI) 81.4%-100%] to identify those with LSI > 10%, and a sensitivity of 63.4% (48.9%-76.3%).

Conclusion: The HHD is an instrument valid and reliable of low cost and easy handling compared to the isokinetic dynamometer to evaluate the quadriceps torque and the limb symmetry index after the ACLR with high diagnostic accuracy.

- RTS decisions post ACL reconstruction require a less that 10% difference in strength
- MMT is not accurate enough
- Isokinetic dynamometers are too expensive to be available

activforce

Anatomy Review: Knee Extension



activforce

Ways to Measure Knee Strength:

Extension

Without Strap

With Strap

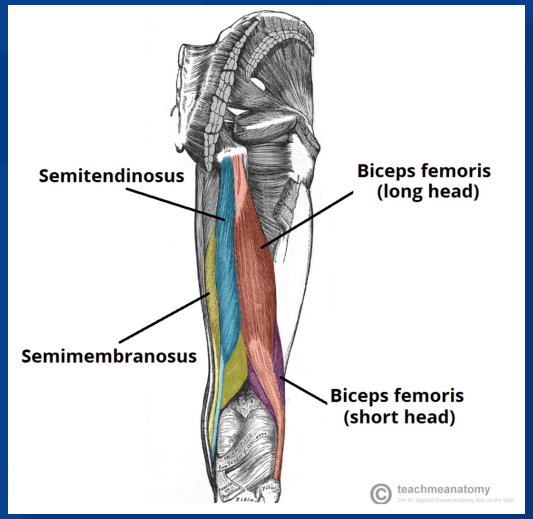
Considerations

- Strength of the muscle
- Patient Positioning
- Provider Positioning
- Allowing the Patient to anchor

https://app.clinicalpattern.com/rom_mmt/2590/2825/2825-2/

activforce

Anatomy Review: Knee Flexion



activforce

Ways to Measure Knee Strength:

Flexion

Without Strap

With Strap

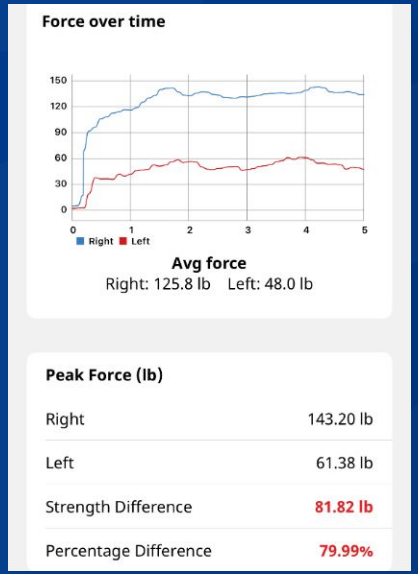
Considerations

- Strength of the muscle
- Direction of muscle
- Patient Positioning
- Provider Positioning
- Allowing the Patient to anchor

What is “Time to Peak Force” and How to test it?

activforce

Great example of how MMT can fool you



The “weaker” side still produced 61.38 lbs of force. Many clinicians would have graded that high on a 0-5 scale

activforce

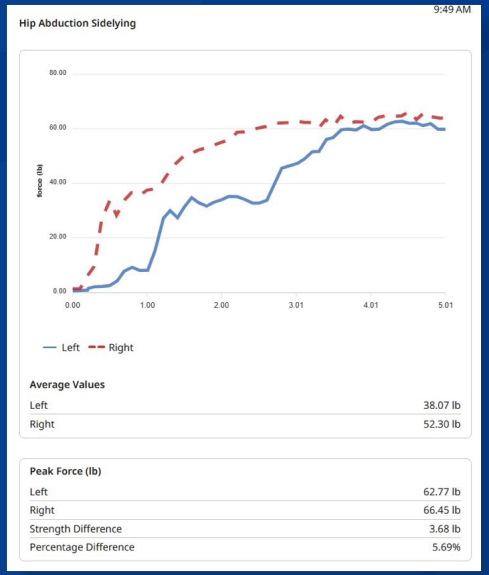
Don’t be fooled by just looking at the numbers

Peak Force (lb)	
Left	62.77 lb
Right	66.45 lb
Strength Difference	3.68 lb
Percentage Difference	5.69%

Force to Weight Ratio	
Weight	200 lb
Left	31.39%
Right	33.22%
F/W Difference	1.84%

activforce

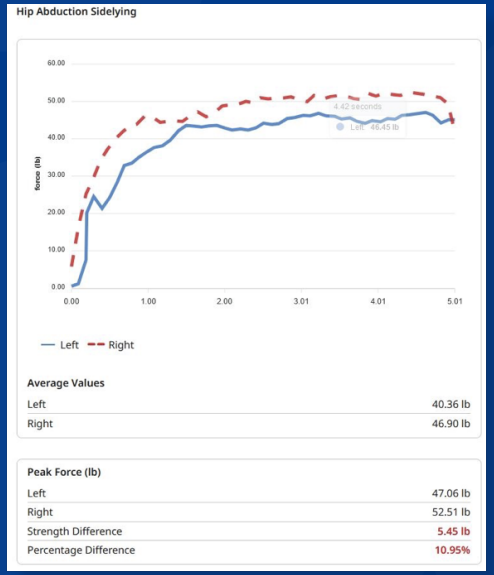
The “Picture” tells so much more



Poor recruitment of Gluteus Medius with delayed RFP on left side (blue)

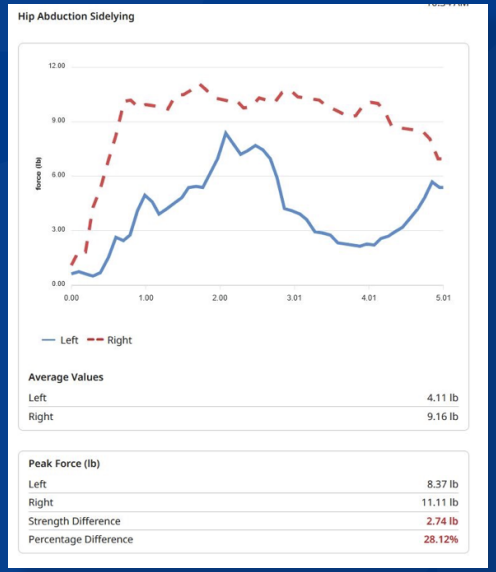
activforce

Typical curves for weakness



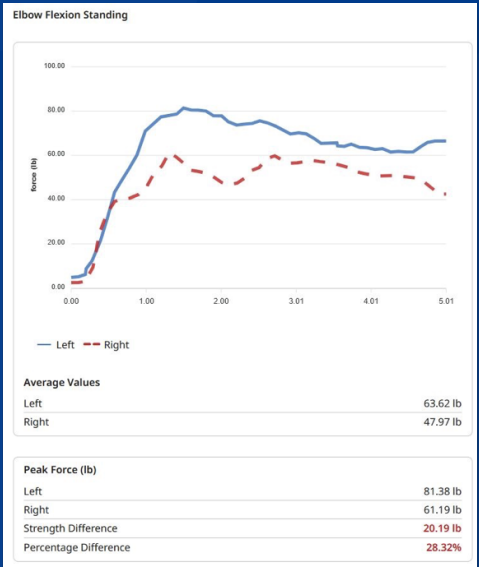
With similar RFP slope

Example of poor muscle recruitment



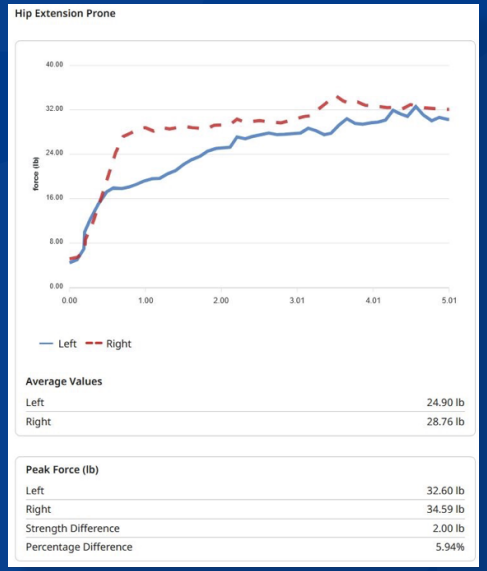
With delayed RFP and unable to maintain force. Gluteus Medius tear on Left side (blue)

C5 Disc Herniation on Right side



The involved side (right) was still able to produce 61.19 lbs of peak force. This weakness was not appreciated by his neurologist during the office exam.

Poor recruitment of Gluteus Maximus



On Left side