32nd Annual Magic City Sports Medicine Conference

FORCE CAPACITY TESTING IN ACL REHABILITATION & RETURN TO PLAY

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RETURN TO PLAY IS A PROCESS! NOT AN EVENT!

- Reframe thinking
- Your rehabilitation IS the return to play process
- And, serial testing keeps us honest

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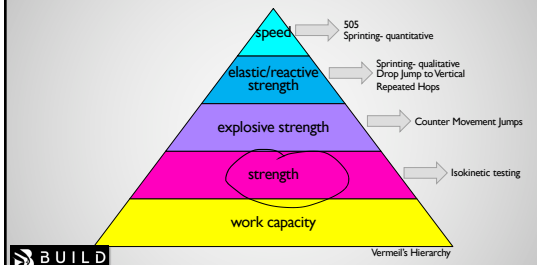
Vermeil's Hierarchy



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"FUNCTIONAL TESTS"

- Horizontal Hop Test- single hop for distance, triple hop, cross over hop
- Y Balance Testing
- Side to Side Hop Test
- Vertical Hop Test
- Drop Jump
- LESS

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LIMB SYMMETRY INDEX

INVOLVED MEASURE / UNINVOLVED MEASURE X 100

GOAL TYPICALLY >90%

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LIMB SYMMETRY

- INCORRECT ASSUMPTION THAT THE CONTRALATERAL LIMB IS "NORMAL"
- CONTRALATERAL LIMB CAN GET DETRAINED THROUGH REHAB
- BOTH LIMBS MAY HAVE BEEN SUBOPTIMAL AT TIME OF INJURY

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MUSCLE CAPACITY (OR "STRENGTH")

- Max muscle strength
- Rate of force development
- Power
- Reactive Strength
- Stiffness
- Eccentric deceleration
- Muscle morphology- cross sectional area

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QUAD INDEX

involved torque / uninvolved torque X 100

GOAL TYPICALLY >90%

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FUNCTIONAL TESTING DOES NOT MEASURE MUSCLE CAPACITY!

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HOP TESTING

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HORIZONTAL HOP TESTING- CROSS OVER HOP

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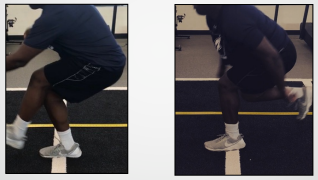
DIFFERENT LANDING STRATEGIES- WHY?



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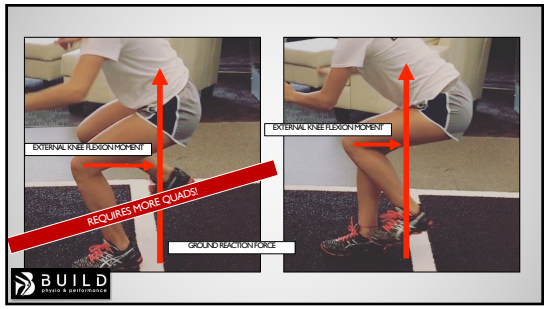

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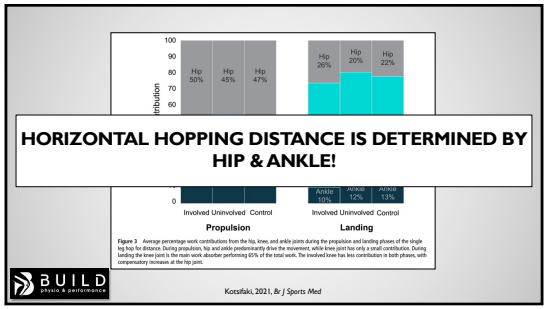

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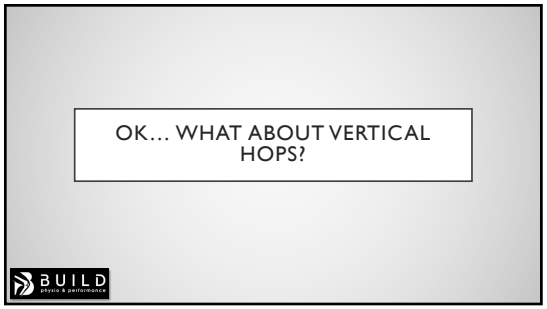

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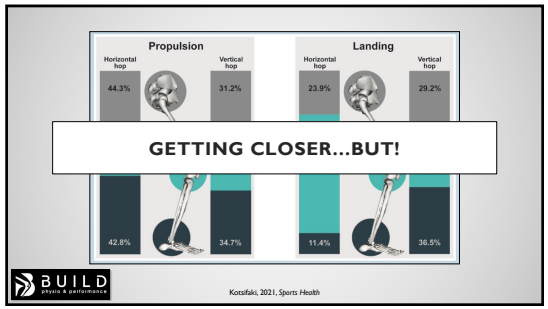

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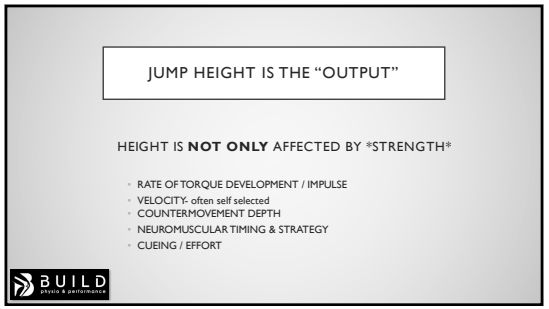

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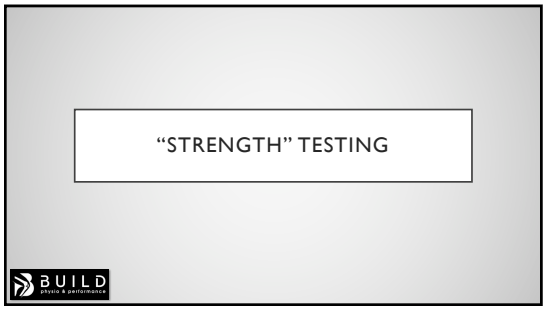

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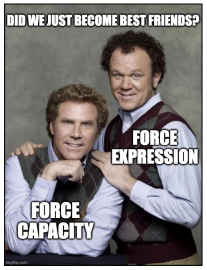
WHAT IS "STRENGTH"

Ability to produce **FORCE**
- Force has magnitude & direction
- Units may include N or lb F (or kg F)

Force is Independent of **EXPRESSION**



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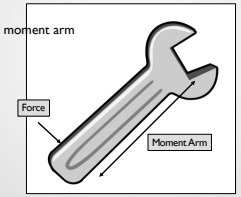
TORQUE

Torque = force x moment arm



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ISOKINETIC TESTING

- Accommodating resistance applied through a set range of motion at a set speed
- Measures TORQUE
- Can measure concentric, eccentric, and isometric

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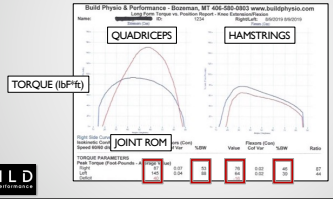
ISOKINETIC TESTING



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TORQUE TO BODY WEIGHT

- Eliminates LSI which overestimates function
- Limited studies compare torque to body weight
- 3 Nm/kg (Isom @90°)- higher patient satisfaction

Kuenze, 2015; Pietrosimone, 2016

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NORMATIVE VALUES

- Isometric (90°) quads-100% body weight (3 Nm/kg)
- Isometric (90°) hamstrings- 60% body weight (1.8 Nm/kg)
- Isometric hip abduction- 2.5 Nm/kg
- Isometric hip adduction- 2.5 Nm/kg

Kuenze, 2015; Pietrosimone, 2016; Risberg, 2018; Plourz-Snyder, 2002; Aargaard, 1998, Thorborg, 2014

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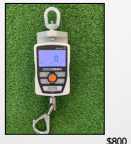
LOW TECH OPTIONS

$1170



$800

$220

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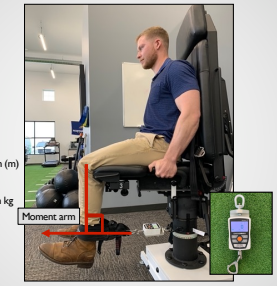
Quad Torque Testing

Line of pull is perpendicular to moment arm

Torque = force (N) * moment arm (m)

Torque to Body Weight = divide torque (Nm) by patient's weight in kg



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METHODOLOGY

- Test set up
  - Fixation- strap 'em down!
- Cueing
- Number or trials- taking average or best trial
- Testing frequency

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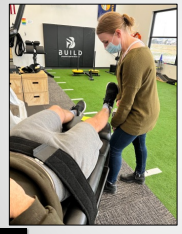

Photo credit: Larson et al, 2022

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HOW ARE WE DOING?

- 30-35% of pe -9 months achieve both) torque to body weight

Chaput, 2021; Gokeler 2017

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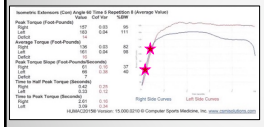
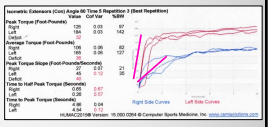
RATE





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SERIAL TESTING

- Testing every month ensures progress is made
- Isometric testing only tests one point in the ROM
- Isometric testing will be "normal" prior to isokinetic testing- may be the point to refer out for complete testing

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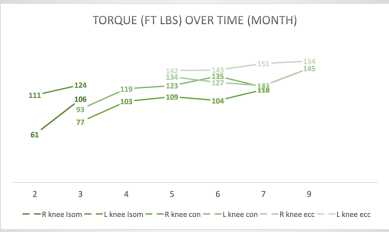

Pre test UI 4 days post injury in season— 120 lbF*ft, 92% BW

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DON'T WAIT TO TEST

- Only 2/3 of people have quad symmetry at 2 years post ACL reconstruction!
- Half of those people had returned to sport at 1 year

Lynch, 2015

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WHEN CAN (SHOULD) I RUN?

1.72 Nm/kg & 67% LSI- minimum capacity needed to run symmetrically

Rambaud, 2018

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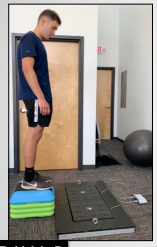
WHEN CAN (SHOULD) I JUMP?



2.07 Nm/kg- cutoff depicts when a person's knee joint power is similar to controls in a DVJ

Graham, 2023

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505 TEST

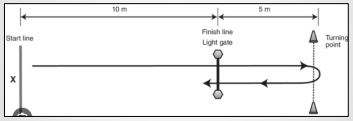

Photo credit: Gabbett, 2008

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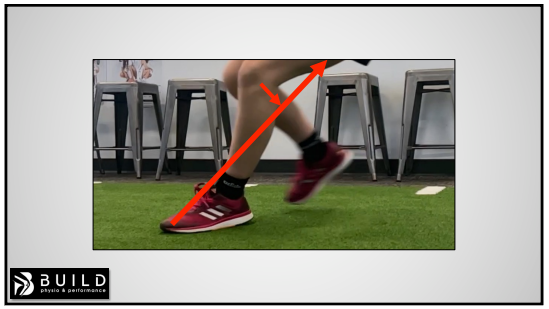

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CAN'T TRAIN SOMEONE OUT OF POOR QUAD FUNCTION

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THANK YOU!

@lauraopstedal

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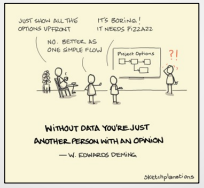

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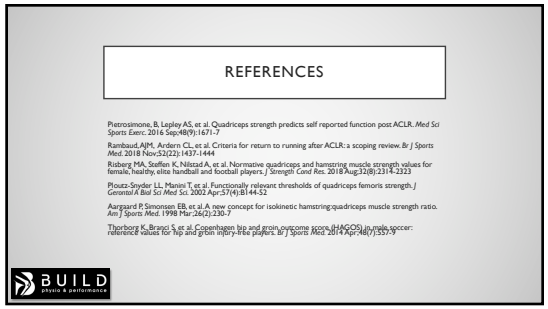
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