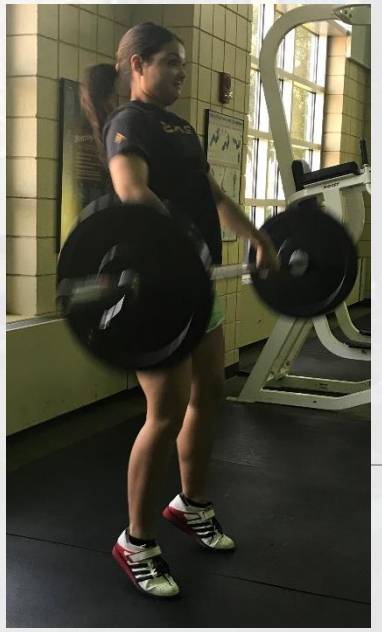
# Assessing Upper-, Lower- and Total-body Power: A Practical Approach



MIKE WALLER PHD, CSCS, NSCA-CPT, FNSCA

SCCC WRITTEN EXAMINATION COMMITTEE MEMBER

# Thank you

Chuck & Becky

CSCCa Conference Committee

My Mentors

Colleagues

Friends

Family

# Disclaimer

- If you have a large budget and access to the $$$ equipment

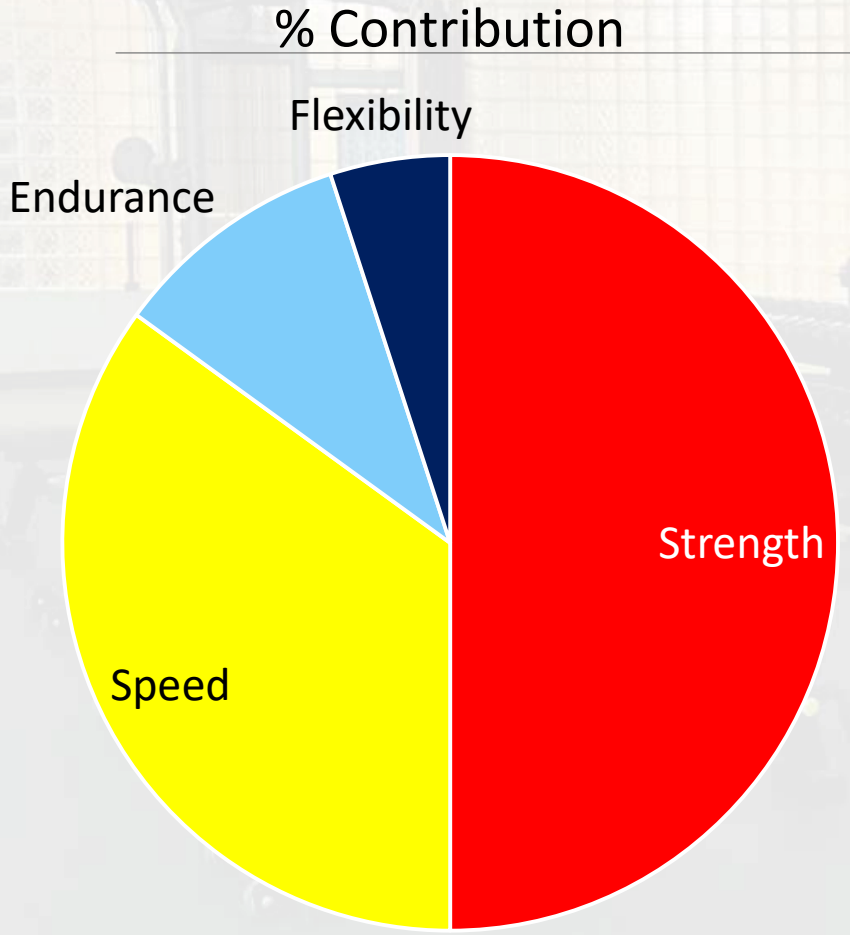
- Support/trained staff to analyze & report


YOU KNOW WHAT REALLY GRINDS MY GEARS?
GRINDS
MY
GEARS

# Testing Logistics

- Trained staff + Number
- Equipment accessibility
- Testing efficiency
- Time to process + analysis
- Time to develop report
- Testing provides direction if data is meaningful and applicable


# Power


% Contribution
Flexibility
Endurance
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Speed
Strength
Speed
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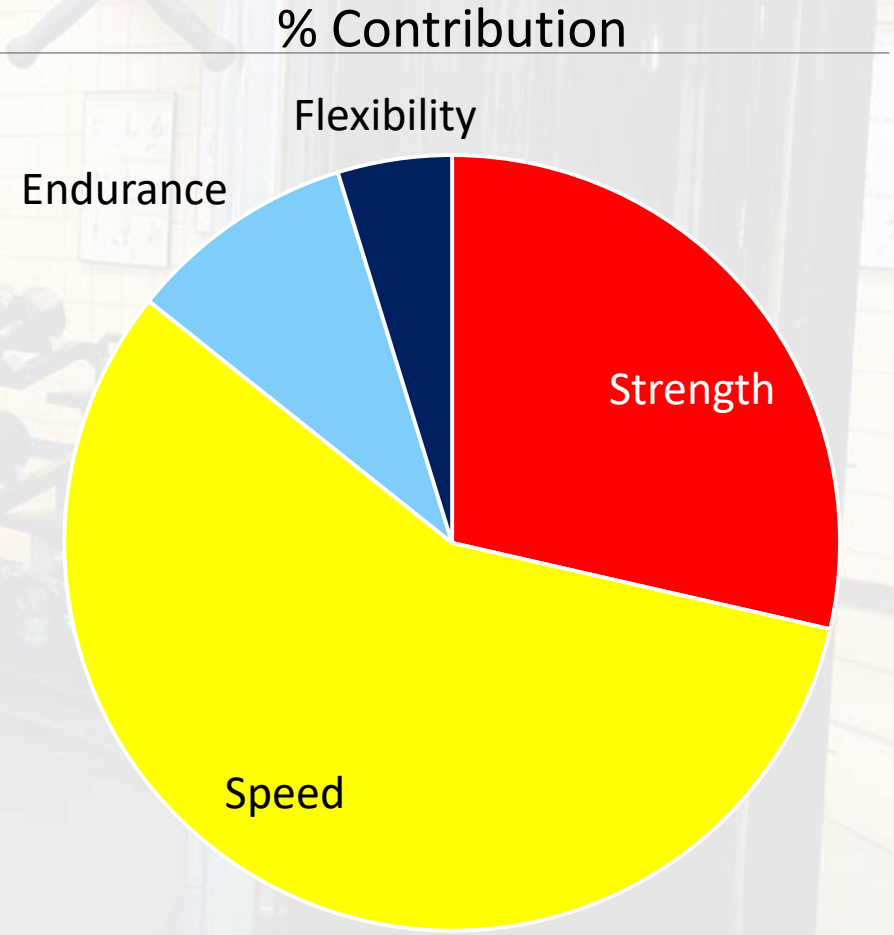
% Contribution
Flexibility
Endurance
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Strength
Speed
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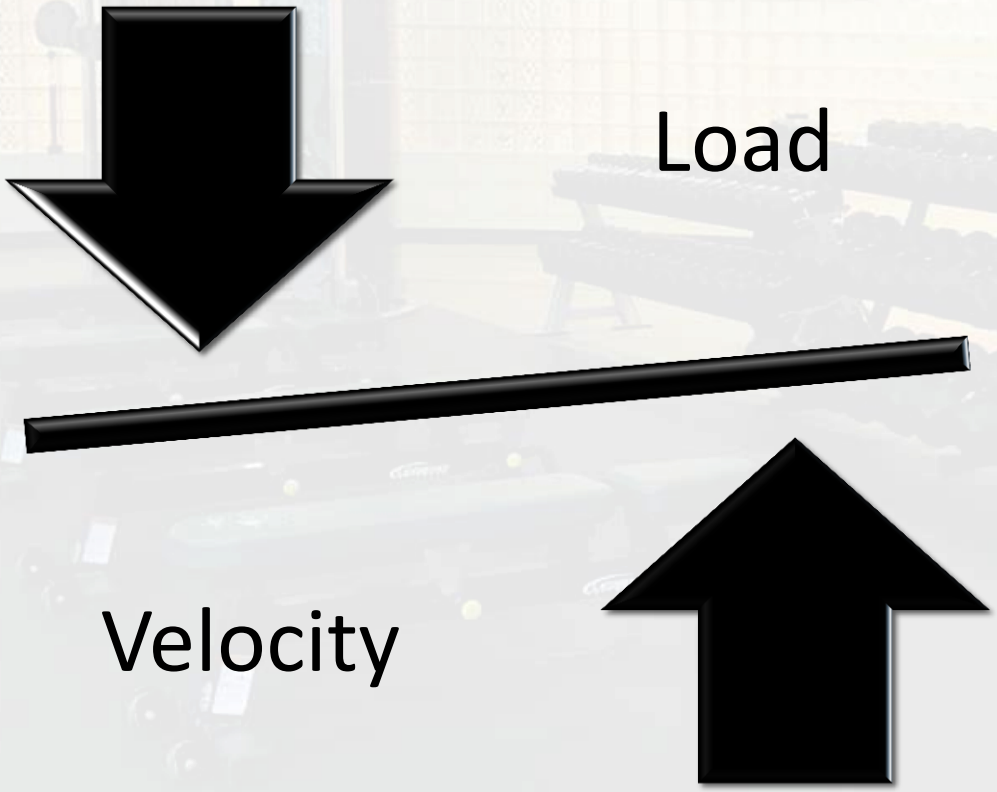
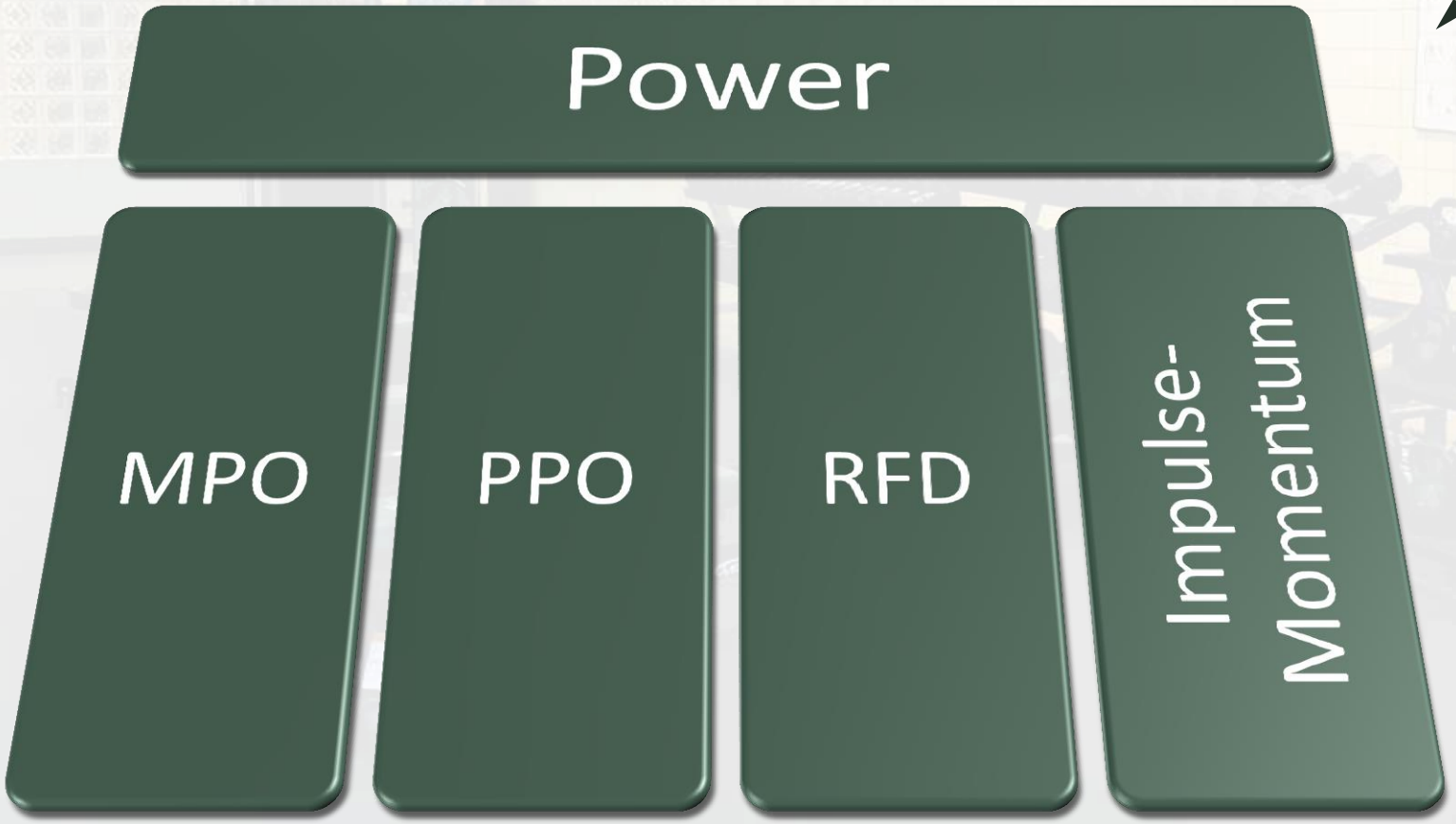
Flexibility

# Power



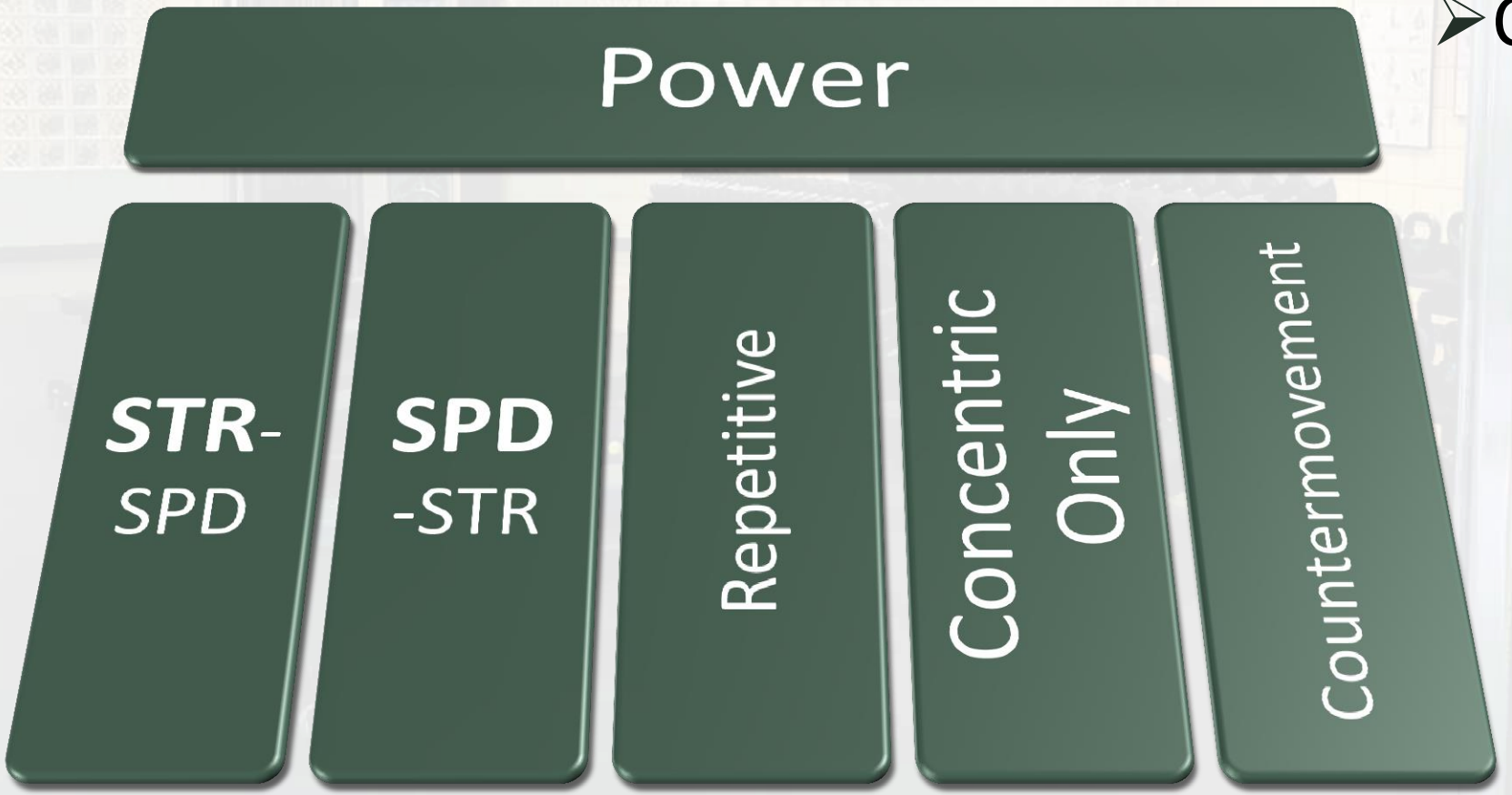

| | |
|---|---|
| Strength | Speed |
| Speed | Strength |

# Power




- Biomechanist's perspective

# Power




- Coaching perspective

# Power

Tendo™ units, Gymaware™

Logistically Challenging

- ❑Force plates*
- ❑Motion analysis
- ❑Cycling power tests
- ❑Isokinetic machines

Practical

- ❑Jump variations
- ❑Weightlifting movements
- ❑Throws

# Upper-body Power
## Bench Barbell Throw

- Gymaware™ or Tendo™
- Timing switches
- Relatively cost effective
  - Timers can be built in
- (Load x Distance)/Time

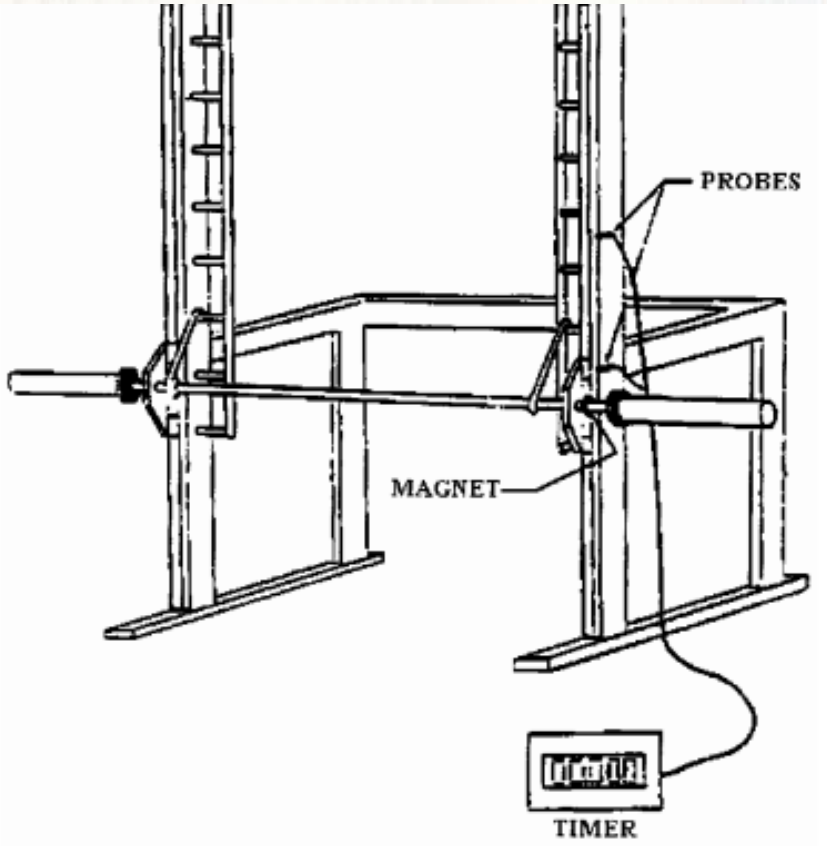



**Figure 1.** Smith machine with timer circuit.


Shim, AL, Bailey, ML, and Westings, SH. Development of a field test for upper-body power. *J Strength Cond Res*. 15(2):192–197. 2001.

# Upper-body Power

- ❑Chest Throws
- ❑Overhead Throws
- ❑MB Puts – seated
- ❑Minimize or Restrict LB
- ❑Seated absent back support
- ❑Seated on floor & wall
- ❑45° inclined bench

Cronin, J.B., and G.J. Owen. Upper-body strength and power assessment in women using a chest pass. J Strength Cond Res. 18(3):401–404.

# Upper-body Power




- Stopwatch
- Scale

- Sport? = Wrestling

$$\text{Power (W)} = \frac{\text{body mass (kg)} \times 9.81 \times \text{rope distance (m)}}{\text{ET (s)}}$$

5-m rope-climbing test demonstrated reliability and strongly correlated with other tests

Dhahbi et al., (2015) Five-Meter Rope-Climbing: A Commando-Specific Power Test of the Upper Limbs. *International Journal of Sports Physiology and Performance* 10: 509 -515.

# Upper-body Power

## "Explosive" Push-up

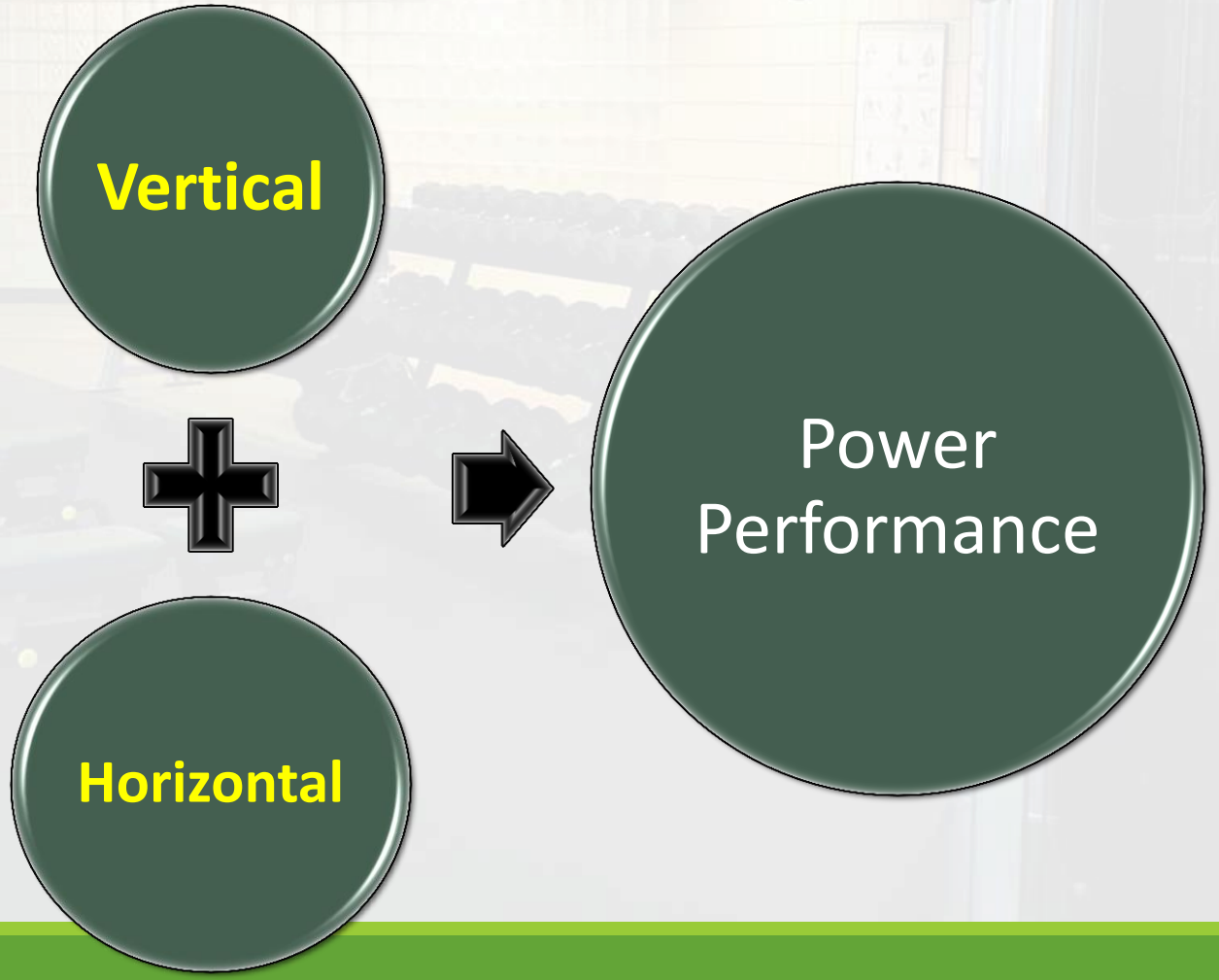
- ❑Just Jump Mat
- ❑Measure displacement
- ❑Static start
- ❑Countermovement
- ❑Drop (from knees)


Hinshaw, TJ, Stephenson, ML, Sha, Z, and Dai, B. (2018) Effect of external loading on force and power production during plyometric push-ups. *J Strength Cond Res* 32(4): 1099–1108.

Moore, LA, Tankovich, MJ, Riemann, BL, and Davies, GJ. (2012) Kinematic Analysis of Four Plyometric Push-Up Variations. *International J Exer Sci* 5(4) : 334-343

Vossen, J.F., J.F. Kramer, D.G. Burke, and D.P. Vossen. (*2000)* Comparison of dynamic push-up training and plyometric push-up training on upper-body power and strength. *J Strength Cond Res. 14(3): 248–253.*

# Lower-Body Power



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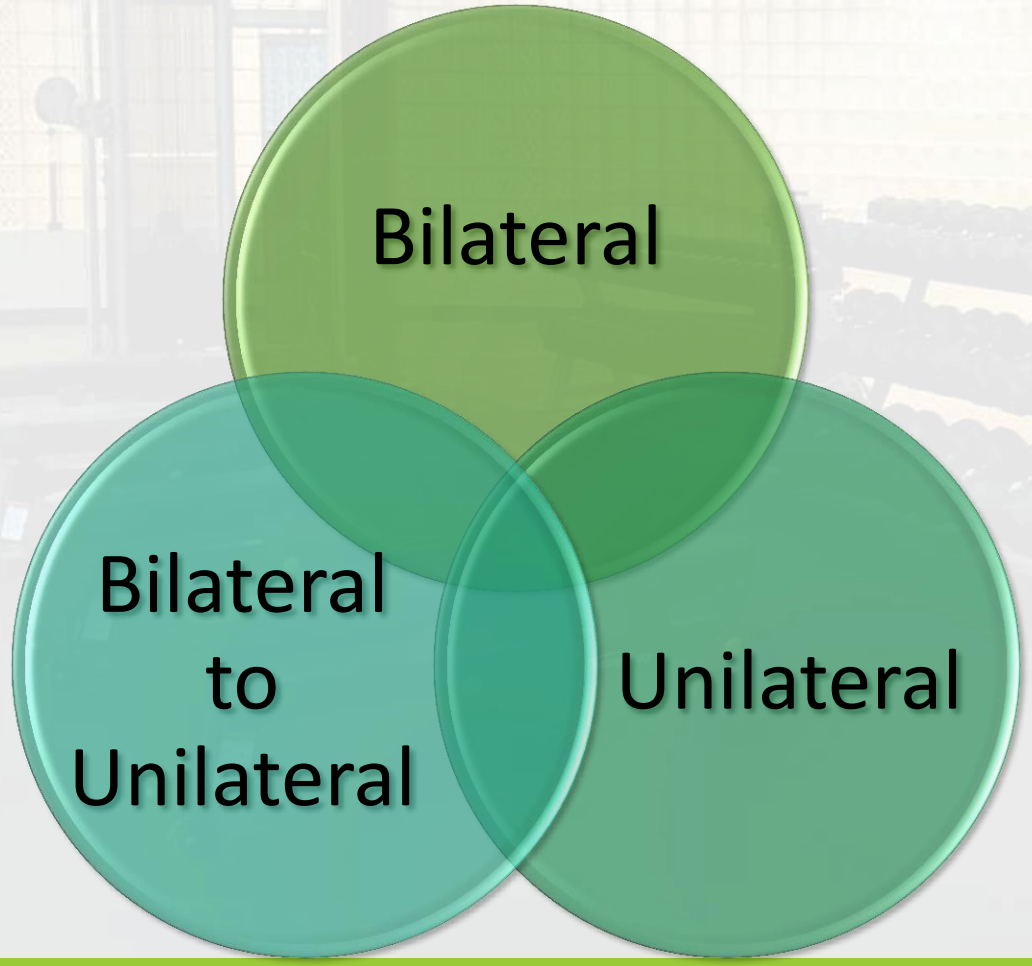
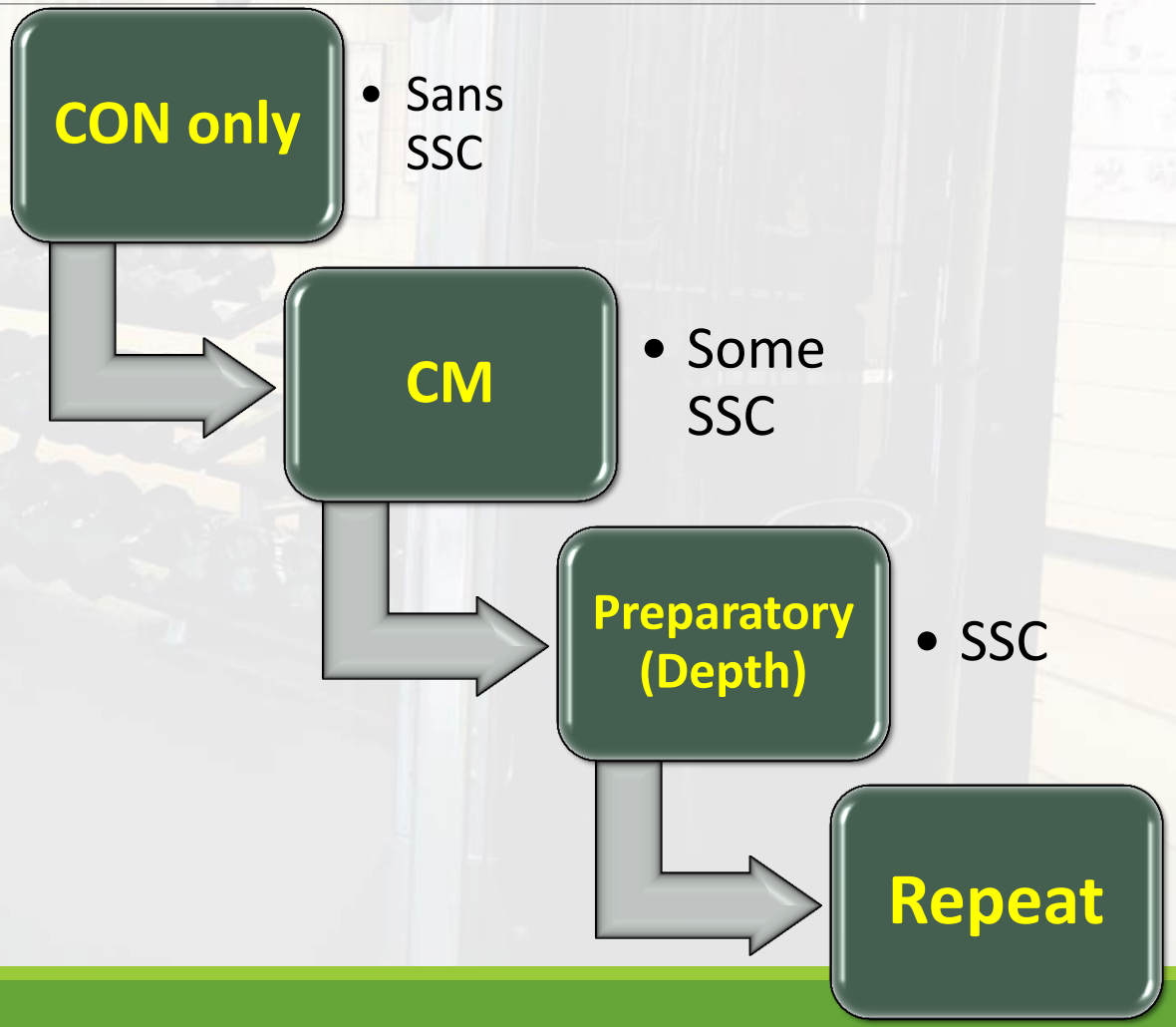
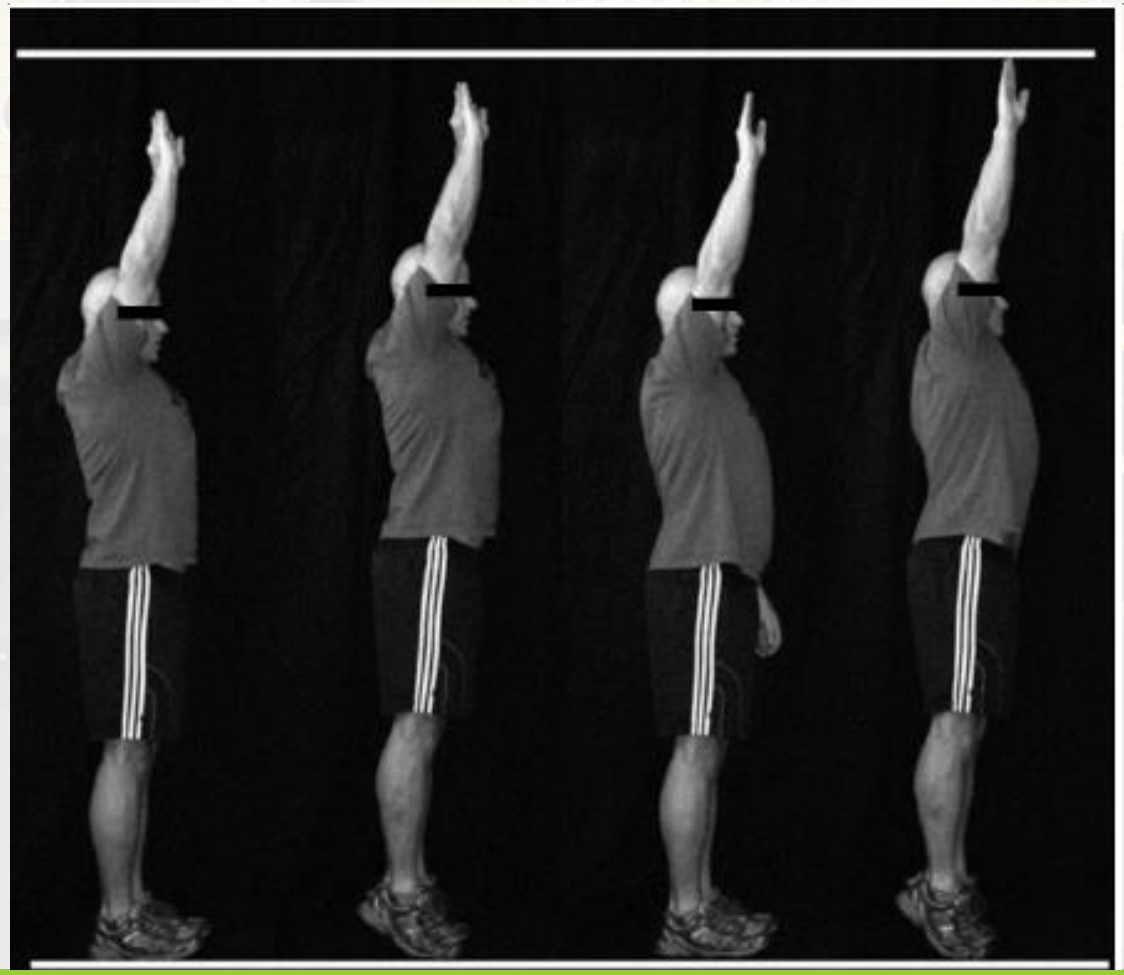


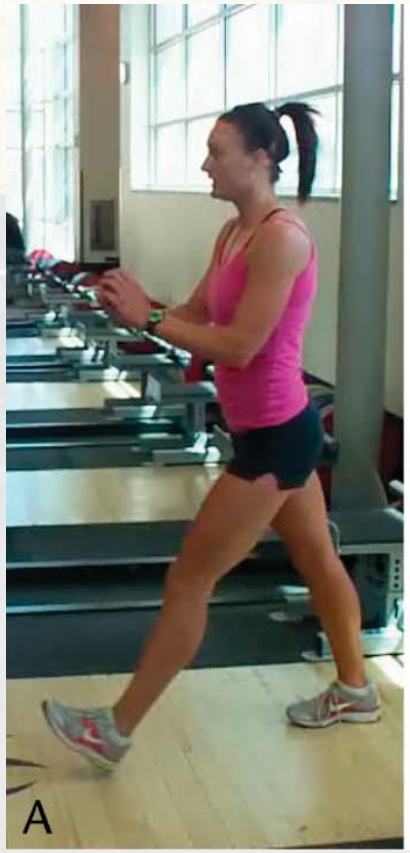



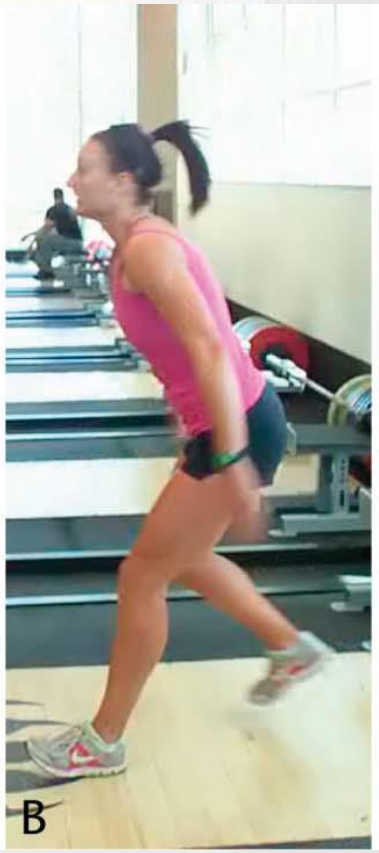
# Lower-Body Power



Ferreira, LC, Schilling, BK, Weiss, LW, Fry, AC, and Chiu, LZF. (2010) Reach height and jump displacement: implications for standardization of reach determination. *J Strength Cond Res* 24(6): 1596–1601

# Lower-Body Power





Waller, Gersick, and Holman (2013) Various Jump Training Styles for Improvement of Vertical Jump Performance. Strength Cond J 35(1): 82-89

# Lower-Body Power

$CMJ_{vert}$ and Horiz.SJ relate with T-test, 20 yds accel, & 40 yds sprint (r = .70 to 0.9) and strong relationship to 30 m sprints

Sayers equation IF you want to calculate power

Just Jump Mat™, Vertec™, or simply chalk mark on wall

Horizontal tape measure toes to heel landing (sand pit best)

Starting position/action = Static, CM, Approach, Repeat (3x)

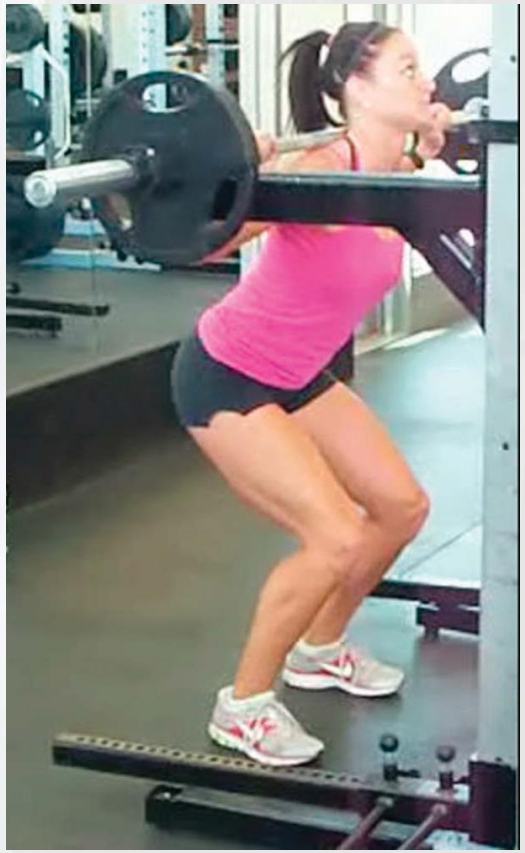

Darmiento, A, Galpin, AJ, and Brown, LE. (2012) Vertical jump and power. *Strength Cond J*. 34(6): 34-43 .

Peterson, M.D., B.A. Alvar, and M.R. Rhea. (2006) The contribution of maximal force production to explosive movement among young collegiate athletes. *J. Strength Cond. Res*. 20(4): 867–873.

Dobbs, CW, Gill, ND, Smart, DJ, and McGuigan, MR. (2015) Relationship between vertical and horizontal jump variables and muscular performance in athletes. *J Strength Cond Res* 29(3): 661–671.

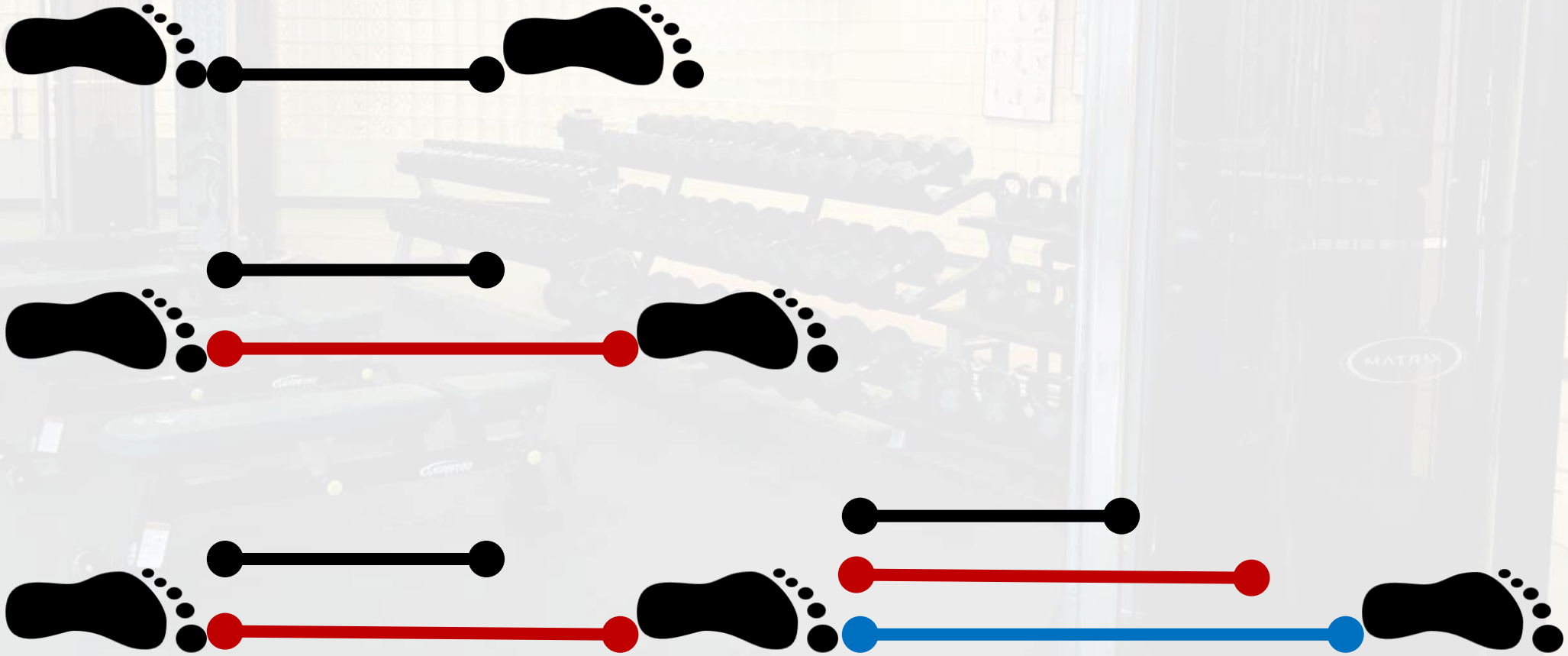
# Lower-Body Power

- ❑Assessing lower-body power loaded
- ❑Depth of squat (Self or Set)
- ❑Load 10-40% 1RM of HFLV



Stone, M.H., H.S. O'Bryant, L. McCoy, R. Coglianese, M. Lehmkuhl, and B. Schilling. *(2003)* Power and maximum strength relationships during performance of dynamic and static weighted jumps. *J Strength Cond Res. 17(1):140–147.*

# Lower-Body Power

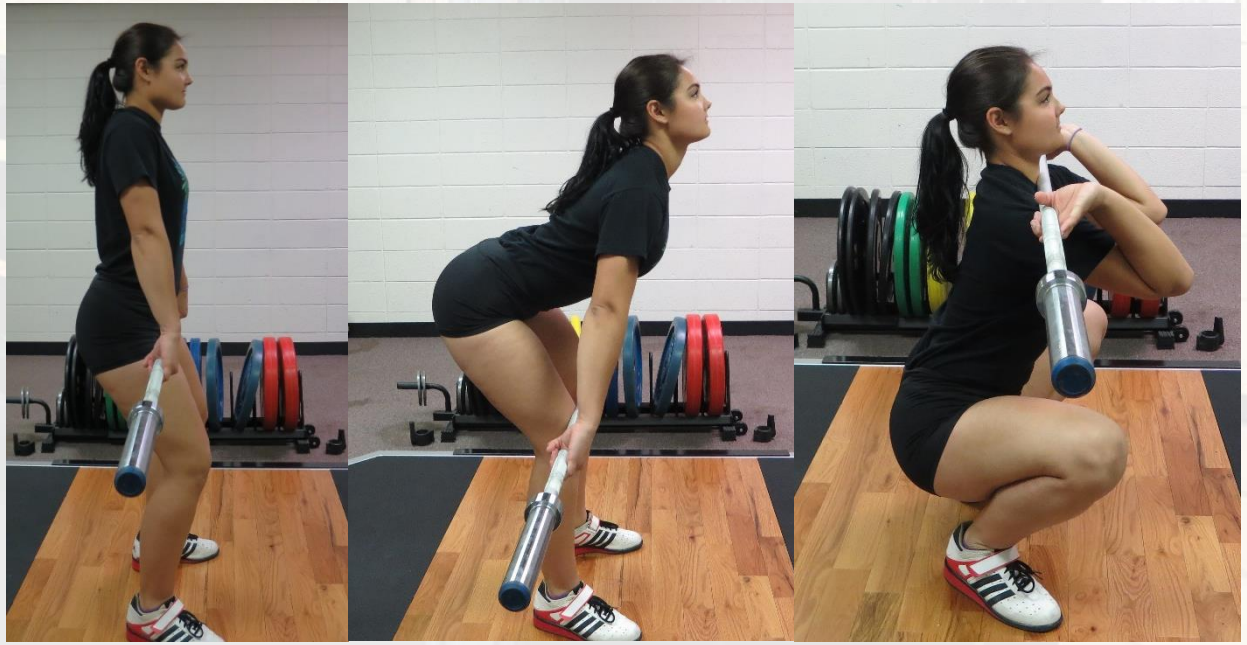


# Total-body Power


# Total-body Power

Clean or Snatch Variations

- Hang above-knee
- Hang mid-thigh
- Power
- Full



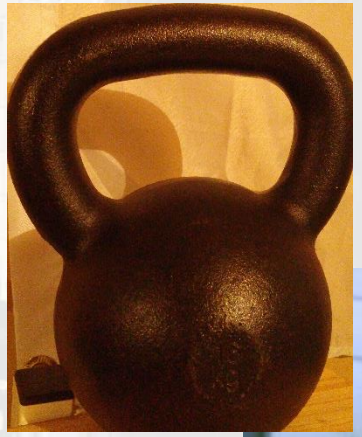
# Now for something completely different. If you see technique like this…

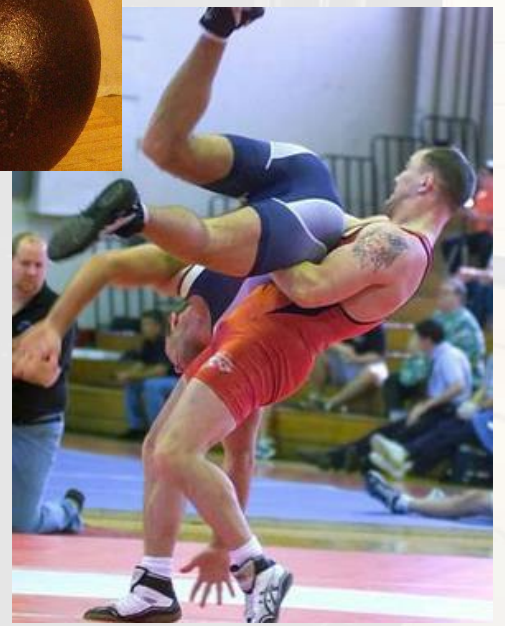
STOP and COACH!

# Total-body Power

What about the KB Swing?

- Use a reasonable load (e.g. 16 kg)
- KB must reach shoulder level
- Time frame 10 – 15 s
- Number of reps completed
- Same rep with > load?






Brown, JC. (2004) Kettlebell Training for Sport. http://www.kettlebelltrainingforsport.com

Campbell, BI, and Otto III, WH. (2013) Should Kettlebells Be Used in Strength and Conditioning? *Strength Cond J*. 35(5): 27-29.

Lake, JP and Lauder, MA. (2012) Kettlebell swing training improves maximal and explosive strength. *J Strength Cond Res* 26(8): 2228–2233.

# Total-body Power

Push Press

Squat Jerk

Split Jerk

**Peak Power**

Push Press = 3640.1 ±573.8 W

Jump Squat = 3885.2 ±302.3 W

**Mean Power**

Push Press = 2313.6 ±332.5 W

Jump Squat = 2096.0 ±201.8 W

**Peak Impulse**

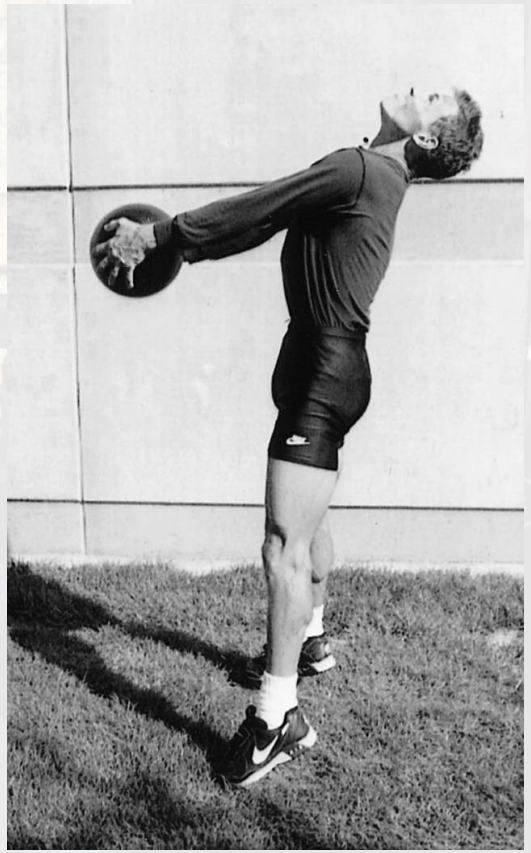
Push Press = 247.8 ±34.6 N·s

Jump Squat = 278.7 ±22.8 N·s

Lake, JP, Mundy, PD, and Comfort, P. Power and impulse applied during push press exercise. J Strength Cond Res 28(9): 2552–2559, 2014

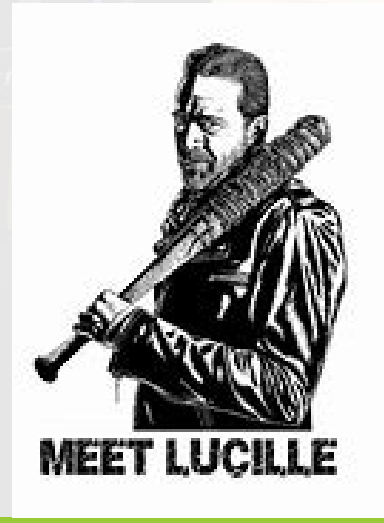
# Total-body Power

- Backward MB throw
- Over-shoulder MB throw
- Over-head MB throw
- Approach over-head MB throw
- Rotational MB throw – Static start
- Rotational MB throw – CM



Stockbrugger, B.A., and R.G. Haennel. (2003) Contributing factors to performance of a medicine ball explosive power test: A comparison between jump and nonjump athletes. *J. Strength Cond. Res. 17(4):768–774.*
Stockbrugger, B.A., and R.G. Haennel. (2001) Validity and reliability of a medicine ball explosive power test. *J Strength Cond Res. 15(4):431–438.*

# Total-body Power


Talukdar, K, Cronin, J, Zois, J, and Sharp, AP. (2015) The role of rotational mobility and power on throwing velocity. J Strength Cond Res 29(4): 905–911

# Application

Hang or Block Start Position
SN and CL

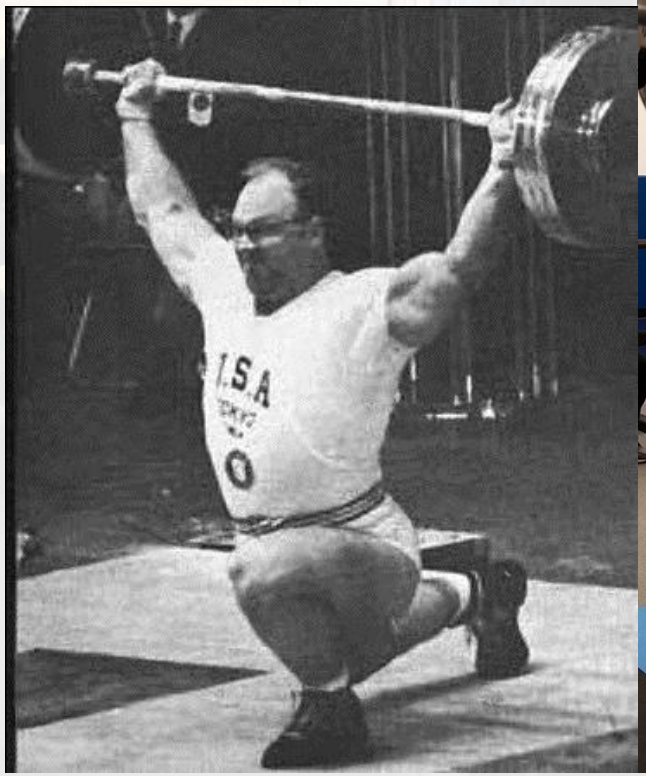
- Minimal Time to Develop Force from a Static Start Standing
- Peak Power with Minimal Joint Angle Displacement

- American FB: WR & DB
- Football (Soccer)
- Basketball
- Volleyball
- High Jumper
- T&F Throwers

# Application

## Split Jerk or Split Snatch

- ❑Hurdler
- ❑Triple Jumper
- ❑Javelin Thrower
- ❑Hockey
- ❑Football (Soccer)




# Application

# Application

**Jumps-Horizontal**

- American FB – WR, DB, RB, Kick Return
- Football (Soccer)
- Lacrosse
- Field Hockey

**Unilateral Repeat Hops**

- American FB – LB, RB
- Ice Hockey
- Tennis
- Fencing

# Application

Squat Jumps$_{vert}$

- American FB – Line
- Football (Soccer) – Goalie
- Softball & Baseball

BMBT or OSMBT

- Wrestling
- Hammer
- Diving

# Application

# Concluding Thoughts


- ❑Testing for adaptations vs monitoring
- ❑Test only what is needed
- ❑Determine when testing will occur
- ❑Static, Countermovement, Approach
- ❑Determine the logistics and implement
- ❑USE the information

# Thank you for your time & attention

**Send questions, complaints, or hate mail to:**

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