

# Body position and technique effects on displacement in the dyno maneuver in rock climbing

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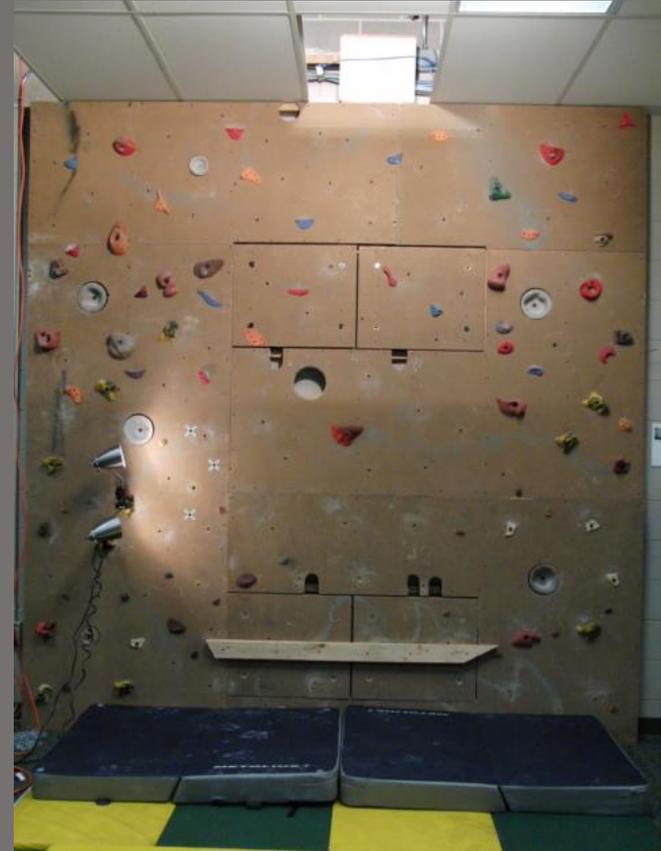
# Introduction

- Dyno = Dynamic Movement
- Popular Performance Recommendations:
  - Obtain the goal hold at the apex of upward movement, known to climbers as the “dead point”
  - Body position... [1,2,3]
  - Jump technique... [1,2,3,4]
- Starting position - highest vertical displacement of the hand (VDH) ?
- Jump technique - highest VDH at each starting position?



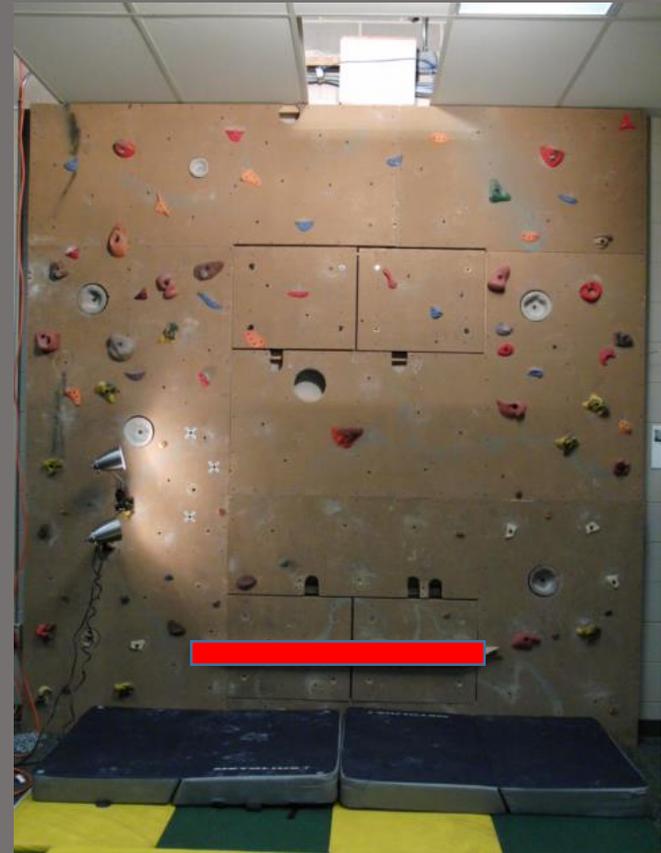
# Methods

- Thirteen recreational rock climbers: Mean  $\pm$  SD =  $22 \pm 5.2$  y;  $65.5 \pm 8.2$  kg;  $172.5 \pm 5.2$  cm
- Mean climbing ability: 5.11 YDS/VII+ UIAA/6c French/22 Ewbank



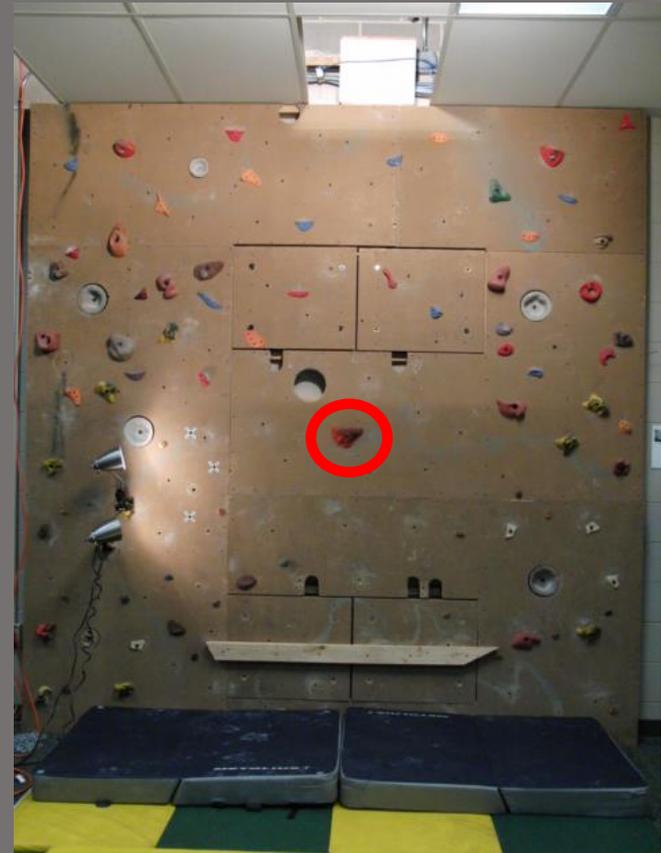
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- Foot hold: block of wood protruding 3.8 cm from the wall



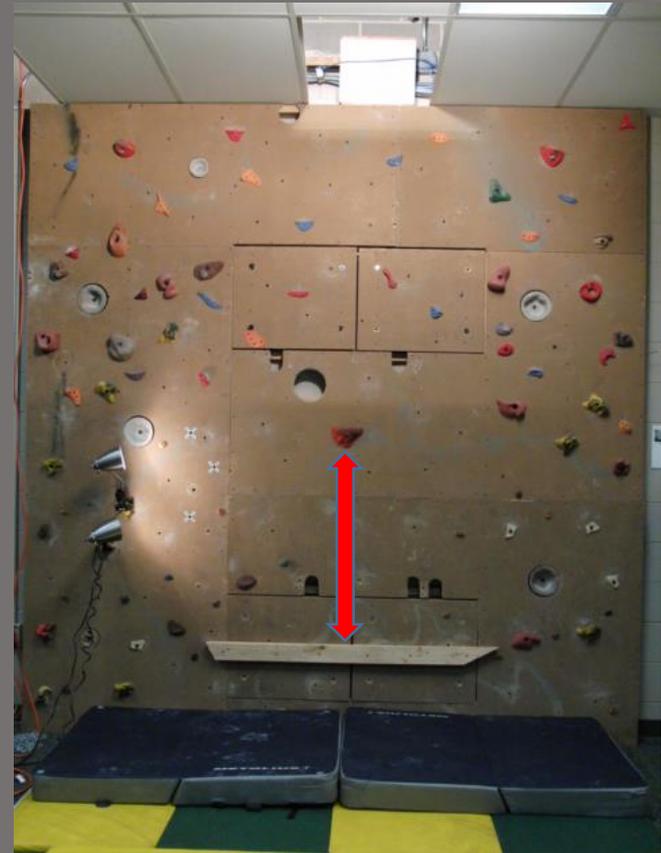
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- Foot hold: block of wood protruding 3.8 cm from the wall
- Hand hold: 1 large feature (Jug)



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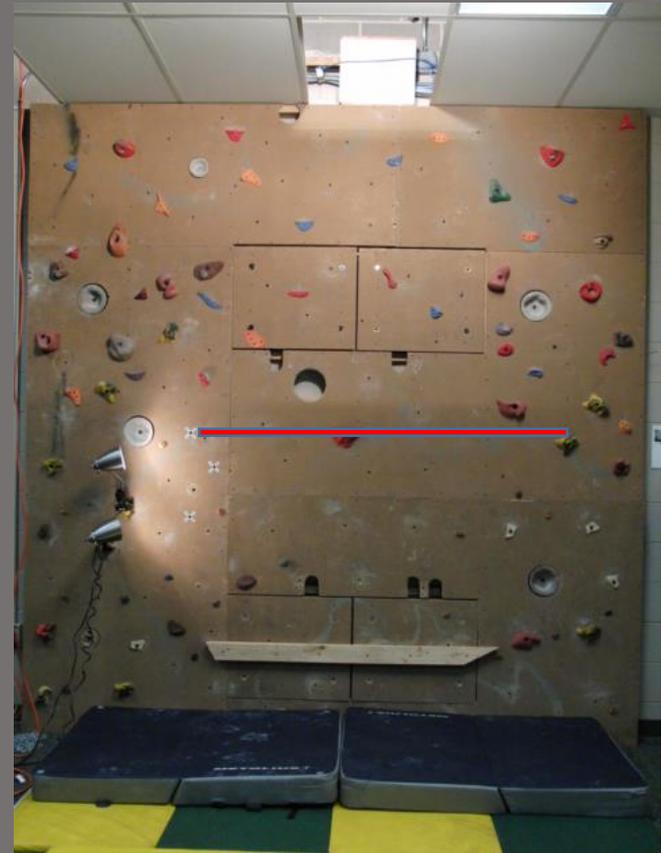
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# Methods

- Distance between the hand and foot holds:

High – 104.14 cm

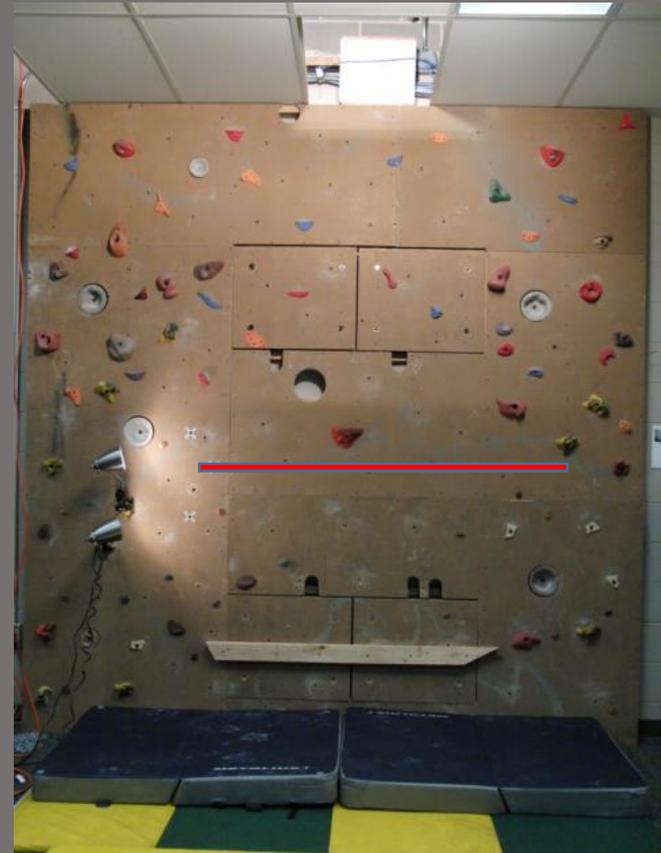


# Methods

- Distance between the hand and foot holds:

High – 104.14 cm

Middle – 86.36 cm



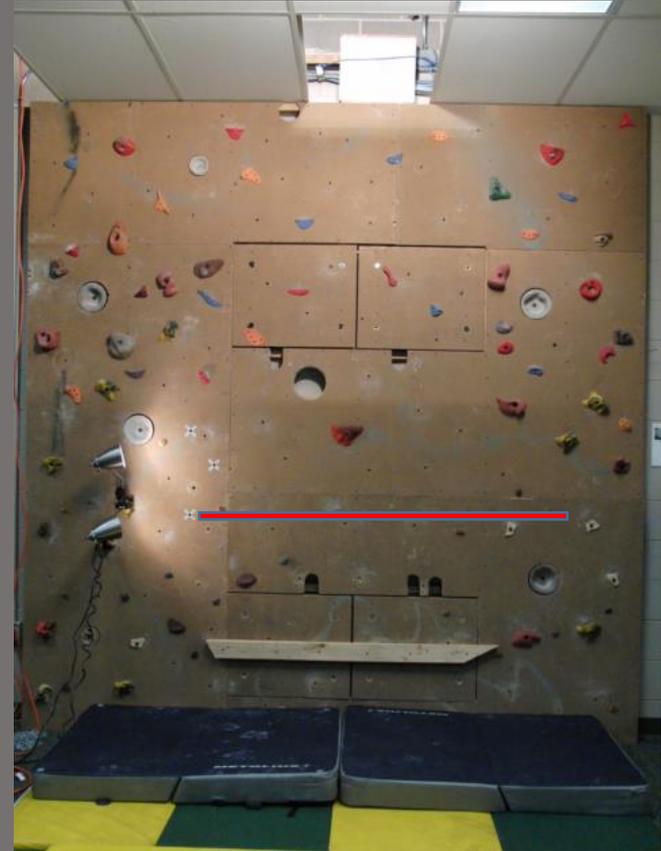
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- Distance between the hand and foot holds:

High – 104.14 cm

Middle – 86.36 cm

Low - 60.96 cm



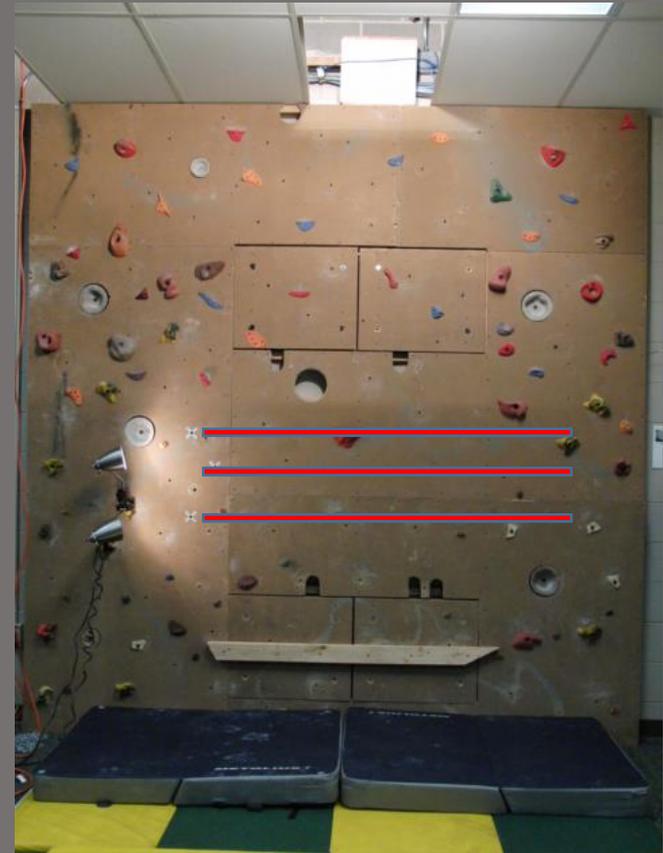
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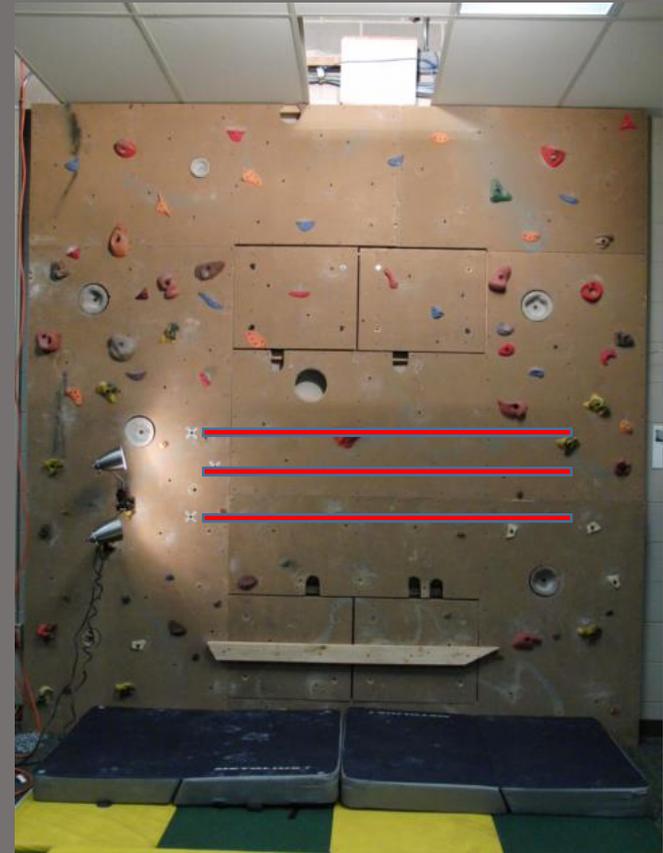
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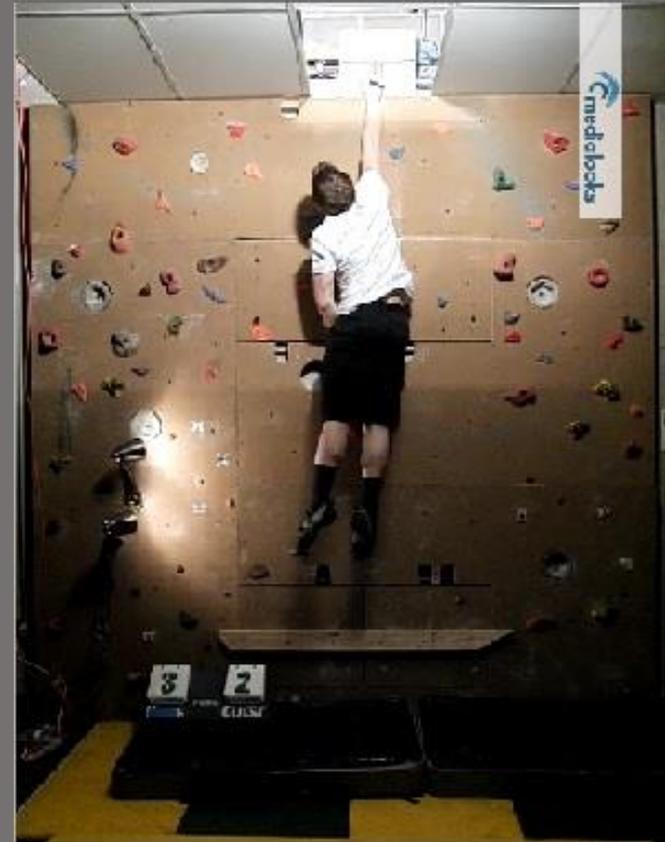
Low - 60.96 cm

- Foot position – shoulder width
- Rock climbing shoes worn by all participants



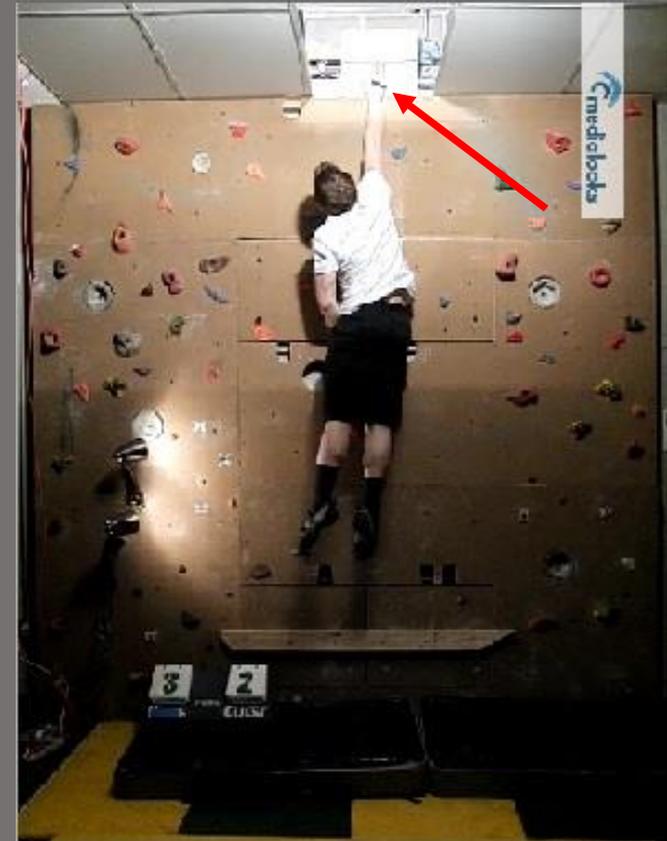
# Methods

- 15 minute warm up / 5 minutes rest
- Two dynos per technique at each starting position, randomized order
- Video analysis



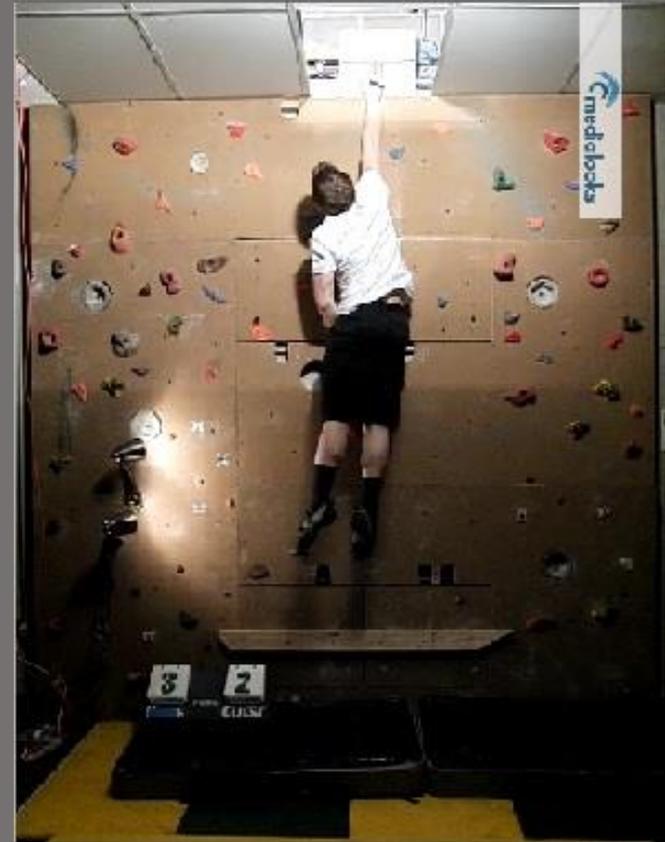
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- Marker on participant's hand was digitized



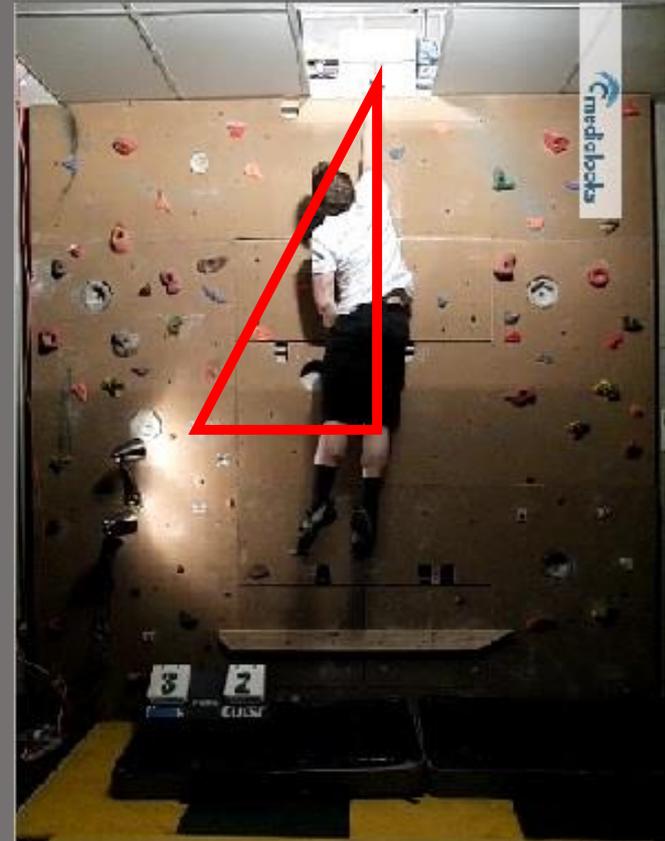
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- Highest VDH in each trial was used for statistical analysis



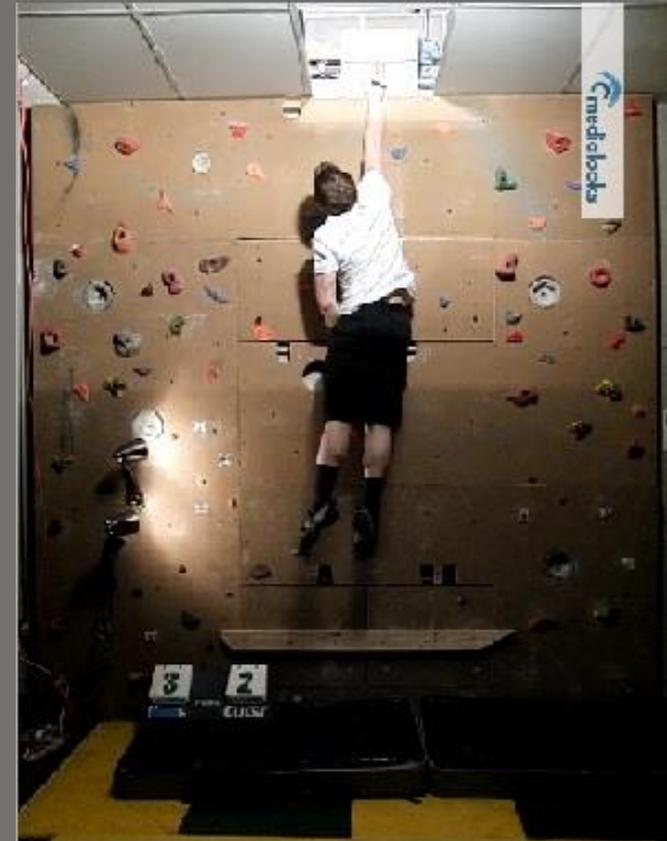
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- A Pythagorean theorem was used to calculate VDH

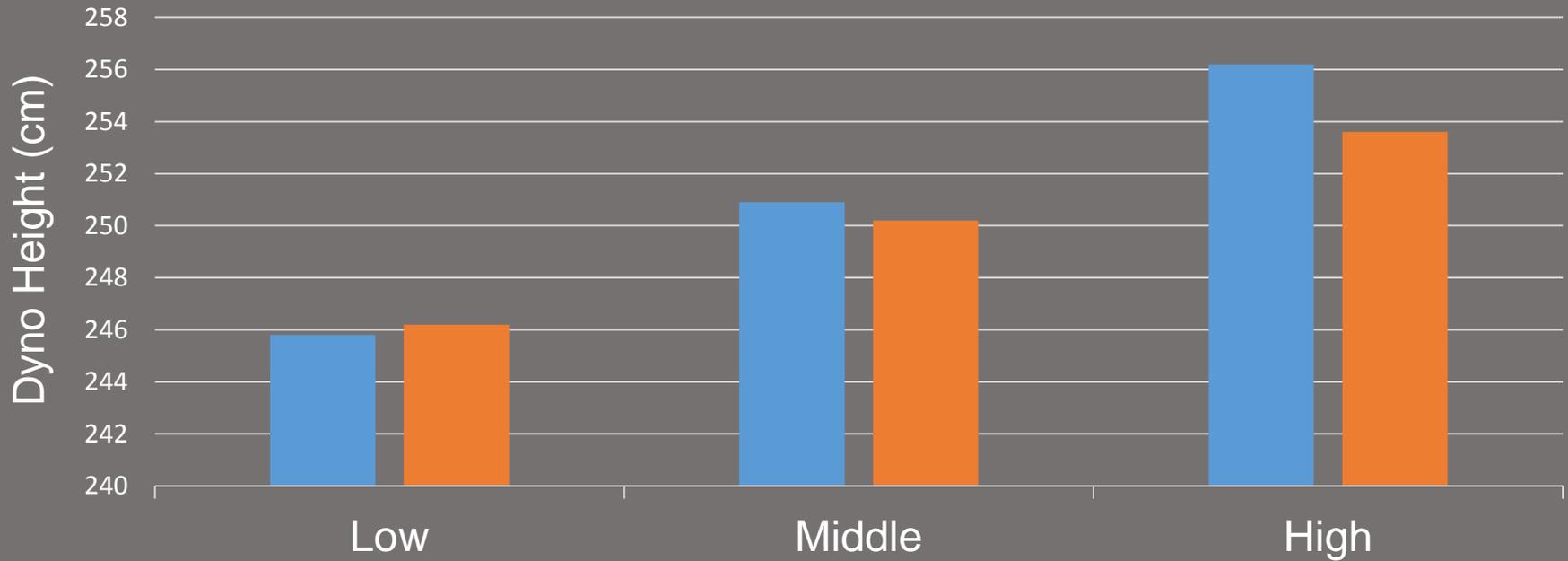


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- A Pythagorean theorem was used to calculate VDH
- 2X3 Repeated Measures ANOVA (jump technique X starting position)



# Results



	Low <sup>a</sup>	Middle <sup>b</sup>	High
<b>Squat Jump</b>	<b>245.8 ± 12.8</b>	<b>250.9 ± 13.7</b>	<b>256.2 ± 15.2</b>
<b>Counter-movement</b>	<b>246.2 ± 15.2</b>	<b>250.2 ± 14.3</b>	<b>253.6 ± 14.6</b>

<sup>a</sup> Significantly different from Middle and High conditions

<sup>b</sup> Significantly different from Low and High conditions

# Discussion – Body Position

- Optimal starting position of close hands and feet?  
As the hands and feet became closer, VDH significantly decreased
- Range of motion(ROM)?  
Standing jump: full ROM is available for the arms and legs  
Dyno: ROM is determined by the distance between the hand and foot holds  
ROM is further affected by climbing surface near the knees
- Decrease in VDH from the high to medium to low starting position is likely caused by the subsequent decreases in ROM

# Discussion – Jump Technique

- No significant differences between VDH achieved between jump techniques
- Biomechanical complexity?
  - CM technique allows an increase in number of degrees of freedom theoretically allowing it to be executed in a variety of ways <sup>[5]</sup>
- Non-elite rock climbers?
  - Actual performance involves the reliance on optimal control and recruitment of motor units <sup>[6]</sup>
  - Elite rock climbers may be better able to utilize the benefits of a CM technique

# Conclusion

- How to maximize VDH at three different starting positions on a vertical wall while considering jump technique
  - Relatively large distance between hand and foot holds
  - Jump technique should be based on personal preference or experience
- Suggested future studies:
  - Inclination of the wall
  - Size and shape of the hand and foot holds
  - Surface roughness of the holds
  - Body position and technique when performed by elite rock climbers

# References

- [1] Green, S. M., & Spencer-Green, I. (2010). *Rock Climbing: From the Gym to the Rocks*. Globe Pequot.
- [2] Burbach, M. (2005). *Gym Climbing: Maximizing Your Indoor Experience*. The Mountaineers Books.
- [3] Bensman, B. (1999). *Bouldering with Bobbi Bensman*. Stackpole Books.
- [4] Horst, E. J. (2008). *Training for Climbing: The Definitive Guide to Improving Your Performance* (2nd ed.). Globe Pequot.
- [5] Bobbert, M. F., & van Ingen Schenau, G. J. (1988). Coordination in vertical jumping. *Journal of Biomechanics*, 21(3), 249–262.
- [6] Bobbert, M. F., & Van Soest, A. J. (1994). Effects of muscle strengthening on vertical jump height: a simulation study. *Medicine and Science in Sports and Exercise*, 26(8), 1012–1020.