Hip Movement Strategies during Virtual Obstacle Crossing between Adults with Obesity and Normal Body Mass Index

Raghu Nema

Motor Development Lab, Undergraduate Research Program

Boston University College of Health & Rehabilitation Sciences: Sargent College

Research Question

What are the differences in amount of hip abduction and adduction during virtual obstacle crossing between adults living with obesity and adults without obesity?

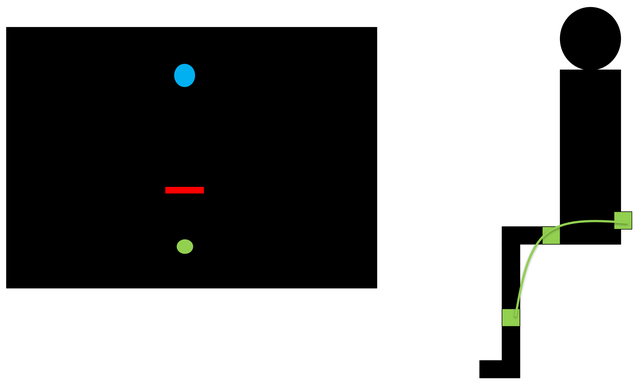
Obesity and Alternative Movement Strategies

- Individuals with obesity use different strategies to cross obstacles; moving their hips in a wide arc either outwards (Abduction) away or inwards (Adduction) from the center of their bodies
- These strategies are reasonable to use when crossing obstacles. However, people with obesity have challenges with balance, which increases the risk of falling, particularly when using strategies that may tip them off balance
- These differences in movement may also limit opportunities for those living with obesity to engage in physical activity

Participants

- 12 adults with obesity (BMI > 30, Age: 18-64 years)
- 14 adults with normal weight (18.4 < BMI < 25, Age: 18-64 years)

Virtual Avoidance Task



Participants sat in front of the monitor at eye-level. They used their right leg to move the green dot on the screen to the red dot, while avoiding any obstacle that was presented in between the two dots.

Experimental Procedure

Body-worn sensors (IMUs) were attached to participants' waists, thighs, and shins to measure angular velocity data

Participants had one practice block before they completed five blocks with 20 Trials each consisting of 5 different Trial Conditions

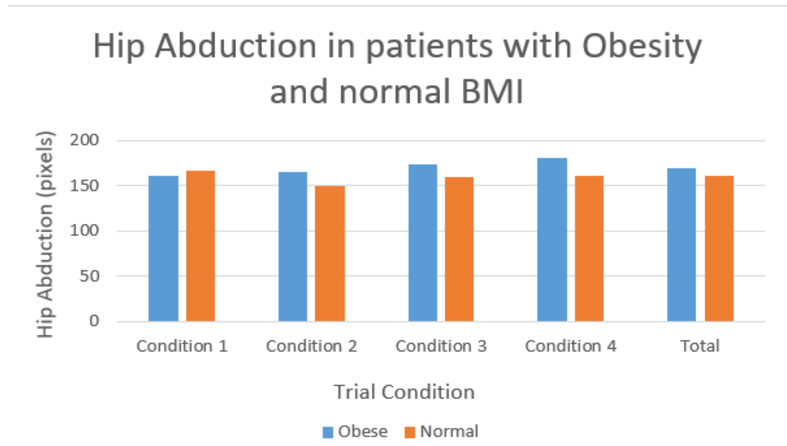
Conditions:

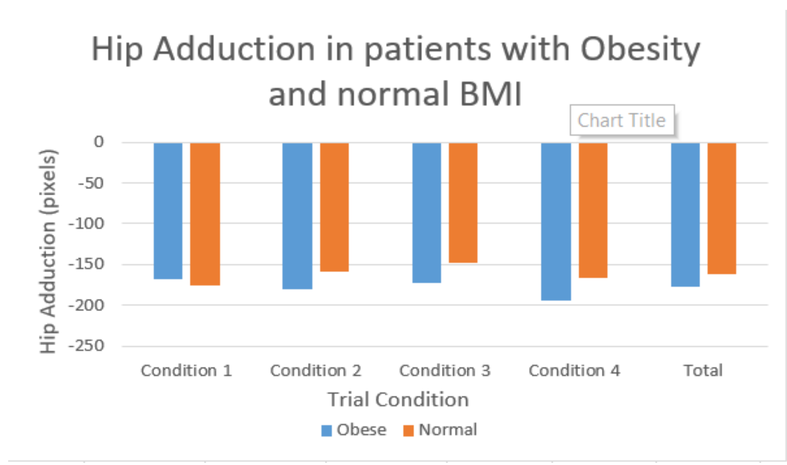
- Condition 0: No obstacle
- Condition 1: Obstacle appears prior to cue
- Condition 2: Obstacle appears with cue
- Condition 3: Obstacle appears with movement onset
- Condition 4: Obstacle appears at 20% of movement amplitude

Results

- Results were calculated as the amount of pixels participants moved from the center (0,0). Positive movement, to the right, was hip abduction. Negative movement, to the left, was hip adduction.
- People with obesity used a hip adduction strategy more often (55.6%) when avoiding obstacles, compared to controls who tended to use a hip abduction strategy (53.5%), $p < .001$.
- The group with obesity also showed greater degrees of hip adduction ($p < .05$) and abduction ($p < .05$) than the control group.
- For both movement strategies, people with obesity had higher average movement than people without obesity.
  - Condition 4: people with Obesity had a mean hip adduction of -194.41, the control group had a mean of -166.45.
  - No significant interaction between hip movement and condition was found
- We found interactions between hip adduction and group ($p = 0.036$) and hip abduction and group ($p = 0.043$).
  - No interaction between Trial Condition and Group were found

Results





Conclusions

- These alternative strategies might be attributed to decreased dynamic sitting balance and movement control.
- These results highlight the utility of seated virtual tasks in revealing underlying impairments in motor control in individuals with obesity.

References

- Peggy P.K. Lai, Aaron K.L. Leung, Agnes N.M. Li, M. Zhang, Three-dimensional gait analysis of obese adults, 2008
- Gill, S. V., & Hung, Y. C. (2014). Effects of overweight and obese body mass on motor planning and motor skills during obstacle crossing in children.

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