DOES HIP ABDUCTOR FATIGUE AFFECT RUNNING MECHANICS?

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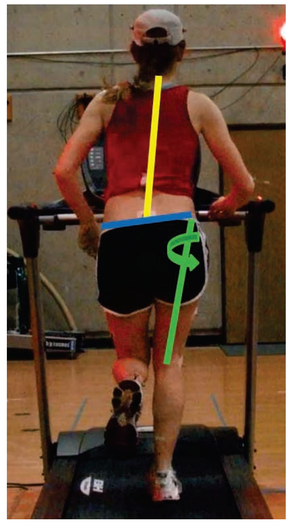
INTRODUCTION

Background

- The most common knee injury in runners is patellofemoral pain syndrome (PFPS), defined as anterior knee pain without significant structural or pathological changes in the underlying structures [1]
- Females with PFPS have been shown to display weaker hip abductor muscles [1-2] and greater hip adduction and hip internal rotation during running compared to healthy female controls [3]
- Hip muscle strengthening is the standard of care during physical therapy and has been shown to decrease pain in patients with PFPS [4]



- However, hip strengthening programs do not appear to change hip or knee kinematics during running, making the mechanism for pain reduction unclear [4]
- Question: What is the relationship between hip abduction strength and running kinematics?

Purpose

1. Evaluate changes in running kinematics after an immediate reduction in hip abduction strength
2. Are these changes in kinematics sex-specific?

METHODS

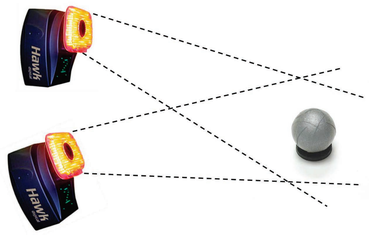
Subjects

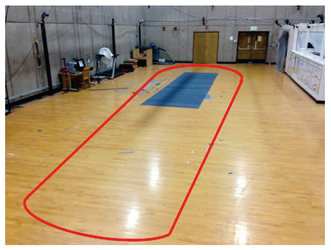
- Inclusion criteria:
  1. Ages 18-45 years old
  2. Running greater than 20 miles per week
  3. No major injuries over the past 6 months
- 16 runners (8 males and 8 females) met these criteria

METHODS

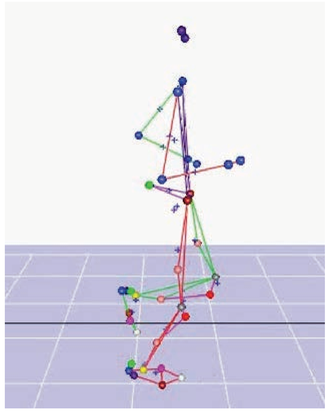
Running

- Subjects were outfitted with 39 reflective markers



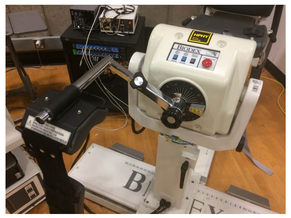


- Subjects ran continuous laps in the laboratory at their easy run pace before and after hip abductor fatigue
- Running kinematics (peak angles) were collected using a 3D motion capture system (Motion Analysis Corp.)



Hip Muscle Strength

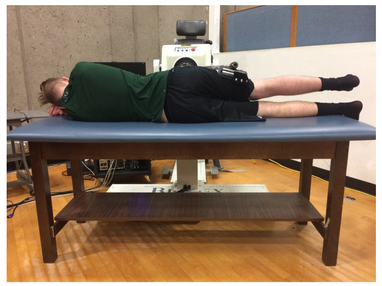
- Isometric hip abduction strength was measured using a Biodex System 3 Dynamometer
- Isometric hip strength was measured at 4 time points:

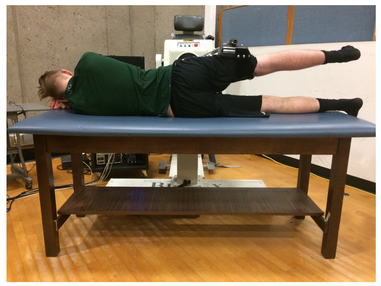


1. Before Run #1
2. After Run #1
3. After the fatigue protocol
4. After Run #2

Hip Muscle Fatigue

- The hip abductor muscles were fatigued via a 2 minute protocol on the Biodex machine
- Subjects continually pushed up while the dynamometer rotated up and down at 30º / sec





RESULTS

Fatigue

- Significant reduction in hip abduction strength after the fatigue protocol, which remained after the second bout of running (Fig 1)

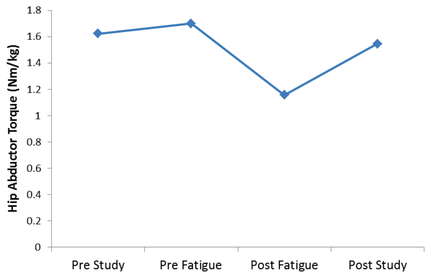


Figure 1. Hip abductor strength throughout the study

Running

- Subjects ran with significantly greater peak ipsilateral trunk lean after the fatigue protocol (p = .007) (Fig 2)

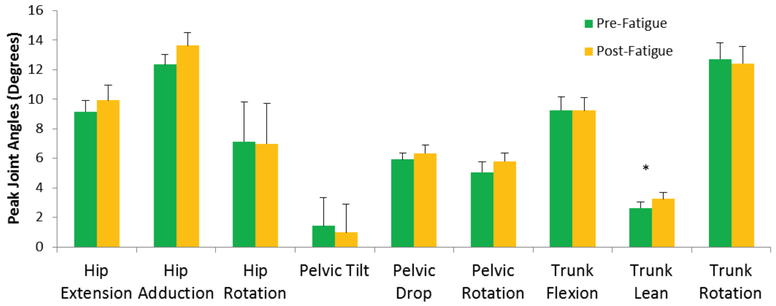


Figure 2. Differences in peak joint angles between conditions

SUMMARY AND CONCLUSIONS

- After fatiguing the hip abductors, runners increased their peak ipsilateral trunk lean while lower extremity kinematics remained unchanged
- Increased lateral trunk lean may increase the knee abduction moment, increasing knee joint stress
- This may help explain why hip strengthening reduces knee pain despite no change in hip & knee kinematics

REFERENCES

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3. Noehren B, et al. *Clin Biomech*. **27**: 366-371, 2012.
4. Willy RW & Davis IS. *J Orthop Sport Phys*. **41**: 625-632, 2011.

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