Acute Changes to Foot Strike Pattern Effects on the Biomechanics and Ground Reaction Forces in Collegiate Recreational Runners

Thesis Project by Patrick Brown
Key Terms

- The foot strike pattern continuum
- Habitual/Non-habitual foot strike pattern
Key Terms

Ground Reaction Forces

Rear Foot Strike

Fore Foot Strike

Mid Foot Strike
Key Terms

- **Peak Acceleration**
  \[ \text{Acceleration}_{\text{peak}} = \frac{\text{Force}_{\text{peak}} - \text{Mass} \times \text{Gravity}}{\text{Mass}} \]

- **Average Acceleration**
  - Touch Down to Peak
Purpose

Habitual Foot Strike

Vs.

Non-habitual Foot Strike

Fore Foot Striker

Vs.

Rear Foot Striker

Fore Foot Striker

Rear Foot Striker
Previous Studies

- **Cadence**
  - (Karamanidis, et al., 2004), (Wellenkotter, et. al., 2014), (Altman & Davis, 2012) (Lenhart, et. al., 2014)

- **Stride Length**
  - (Bonacci, 2014), (Thompson, et al., 2014), (Altman & Davis, 2012)

- **Ground Reaction Force Curves**
  - (Schmitz, et al., 2013), (Cole, et. al., 1995), (Thompson, et al., 2014), (Wellenkotter, et al., 2014), (Karamanidis, et. al., 2004), (Kernozek, et al., 2014)
Unanswered Questions

Are there differences in:

The Peak Acceleration in a
1. rear foot striking condition?
2. forefoot-striking condition?

The Average Acceleration in a
3. rear foot striking condition?
4. forefoot striking condition?
Participants

- College aged men and women: Between 18 and 24
  - n= 25, RFS:16, FFS:9, MFS:0
- Training status: Can run/jog 5km or 3 miles without stopping
  - Runs at a recreational level
- Injury status: Free of lower extremity injuries and are in good apparent health.
Instruments

- Bertec 3 Dimensional Force Plate utilizing the Motis 32 software system
- iPhone 6 Plus camera utilizing the Hudl application for slow motion video analysis
Measures

- Ground Reaction Forces in Newtons over time for a foot strike at 480Hz.
- Slow motion video capture 720p in 240 frames per second.

https://runnersrationale.files.wordpress.com/2012/10/altman_davis_fi g2.jpg
Equipment

- **Medical Scale**
  - For body mass to be used to normalize data and to measure height with the length function.

- **Treadmill**
  - Used to warm up and to acclimate runners to non-habitual foot strike patterns.
Procedures

- Informed consent and adapted PAR-Q
- Measures of body mass and height were taken
- Habitual foot strike
  - Treadmill use
  - Force plate runway use
- 1st Random Non-Habitual Foot Strike Pattern
  - Treadmill use
  - Force plate runway use
- 2nd Random Non-Habitual Foot Strike Pattern
  - Treadmill use
  - Force plate runway use
Analysis

- Independent Samples T-Test: n=25
  - The peak acceleration
  - The average acceleration
1. There were **no significant differences** in Peak Acceleration in a rear foot striking condition, $t(23) = -0.373$, $p = .712$.

3. There was a **significant difference** in Peak Acceleration in a fore foot striking condition, $t(23) = 2.059$, $p < .05$.

   The fore foot strikers had a higher peak acceleration ($m = 26.86 \pm 1.66$) than the rear foot strikers running in a fore foot striking condition ($m = 24.79 \pm 2.72$).
Results: Average Acceleration (Touch Down to Maximum Peak)

2. There were no significant differences in average acceleration (touch down to peak) in a rear foot striking condition, $t(23) = .921, p = .366$.

4. There were no significant differences in average acceleration (touch down to peak) in a fore foot striking condition, $t(23) = -.245, p = .808$. 
Discussion

- Peak Acceleration
  - Why the significant differences?
  - No time involved

- Average Acceleration
  - Touch Down to Peak = Time Involved

- What does this mean for runners?
  - It's how the body copes is amazing
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Thank you for your time!

Questions?