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Influence of Placement on the Validity of RunScribe™

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Influence of Placement on the Validity of RunScribe™

EXERCISE SCIENCE
SACRED HEART UNIVERSITY

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ABSTRACT

Due to the high incidence of running-related injury, biomechanical flaws of the running stride must be investigated.[1] RunScribe™ footpods are light-weight devices that clip onto the shoe and record kinematic variables with each step.[2] **PURPOSE**: This study will investigate the influence of footpod placement on the validity of RunScribe™ output compared to hi-speed video analysis. **METHOD:** Ten collegiate distance runners (6 female, 4 male, 20.9yo ± 0.7yo; 170.2cm ± 6.9cm; 61.4kg ± 7.9 kg) volunteered to participate and granted informed consent. Participants were fit with left-sided body-markers along the line of the achilles tendon and superior-inferior axis of the shoe's heel-counter, a RunScribe™ on both the left laces and heel, and ran for two, 5-min sessions on a treadmill (Woodway, Desmo). High-speed cameras (Casio EX-10, 210 Hz) recorded in the sagittal and frontal planes. The last 21 strides were analyzed using Kinovea computer software and compared to data downloaded from RunScribe™ for Stride Length, Stride Rate, Ground Contact Time (GCT), Pronation Excursion, and Max Pronation Velocity. Validity and reliability of measurements between RunScribe™ and video were assessed with SPSS and intraclass correlation coefficients, respectively. **RESULTS:** There was a strong correlation between data from both footpod locations and Kinovea for all sagittal plane variables tested, specifically GCT and Stride Rate. There is a much stronger relationship between the heel and Kinovea (r=0.905) than the laces and Kinovea (r=0.204) for Max Pronation Velocity. **CONCLUSION**: RunScribe™ is an accurate tool in assessing GCT, Stride Rate, and Stride Length for Rearfoot Striker. Heel-placement will likely output more accurate frontal plane data than the laces.

RESEARCH IMPLICATIONS

1. What are the implications of collecting all this data?
2. Most importantly, *can we trust this data?*

Figure 1: Image showing Heel-placement of RunScribe™, as well as some of its data collecting capabilities.[2]

RESEARCH PURPOSE

1. Test RunScribe's™ validity as a method of 2D Kinematic Gait Assessment
2. Test effect of placement location on accuracy of data

PARTICIPANTS

Table 1: Participant Demographics

Total	10 (6 female, 4 male)
Age	20.9 years ± 0.7
Height	170.2cm ± 6.9
Weight	61.4kg ± 7.9
Self-Selected Pace	3.2m/s ± 0.2

Table 2: Inclusion/Exclusion Criteria for Participation

Inclusion	Exclusion
Between 18-25 years of age	Non-RFS pattern (Midfoot or Forefoot)
Active Member of SHU Varsity Cross Country Team	
Rearfoot Striker (RFS)	Contraindicative health status (obtained from *Medical History Survey*)

METHODS

- Subjects were tested at the MAL (Sacred Heart University, Oakview Drive Building)
- Fit with RunScribe™ on laces and heels of left shoe
- Two, 5min sessions of running at self-selected pace on treadmill (Woodway, Desmo)
  - Recording (Casio Ex-10, 210 Hz) occurred in frontal (posterior) and sagittal (left) planes during last 45seconds of second session
- Body markers along superior-inferior axis of left shoe's heel counter and along line of left Achilles Tendon
- Last 21 Stride Cycles were used to sync data between video and RunScribe™ footpods
- Sagittal: Ground Contact Time, Step Rate, Step Length
- Frontal: Max Pronation Excursion, Max Pronation Velocity

Technical Difficulties for Participant 4 Frontal Plane Video and Participant 8 Sagittal Plane Video prevented data collection and comparison.

Figure 2: Flowchart of Study Procedure

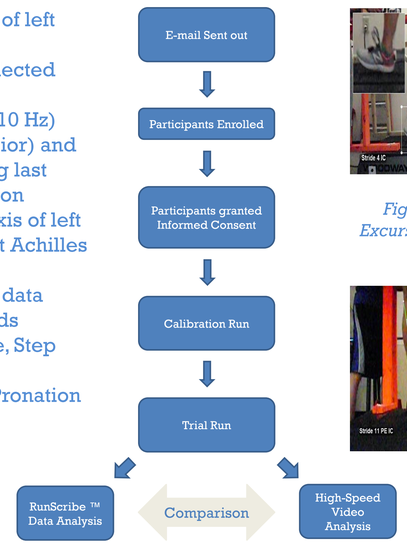


Figure 3.1: Calculating Ground Contact Time using Kinovea

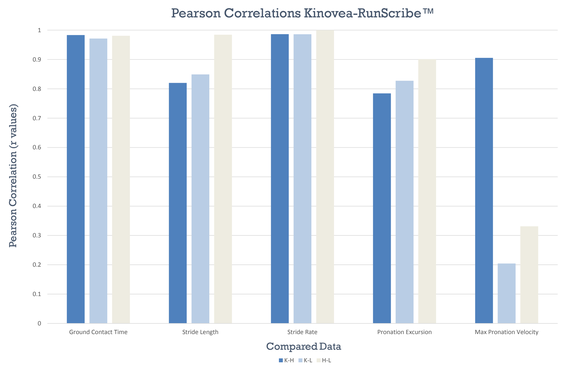
Figure 3.2: Calculating Pronation Excursion and Pronation Velocity using Kinovea

RESULTS

Pearson Correlations	K-H	K-L	H-L
Ground Contact Time	0.983207	0.971338	0.981018
Stride Length	0.820142	0.849194	0.984482
Stride Rate	0.986331	0.985969	0.999786
Pronation Excursion	0.784602	0.827616	0.901207
Max Pronation Velocity	0.905437	0.20447	0.331174

Table 3 (above) shows the r values for each of the data comparisons. r values closer to 1.0 suggest a strong relationship between the two variables. (K-H: Kinovea-Heel; K-L: Kinovea-Laces; H-L: Heel-Laces)

Figure 4 (right) is a bar graph of the r values determined from Pearson Correlations. The x-axis shows the three pairs of data comparison for each kinematic variable tested (labeled), and the y-axis shows the corresponding r value. (K-H: Kinovea-Heel; K-L: Kinovea-Laces; H-L: Heel-Laces)



DISCUSSION

Kinovea-Heel

- Pearson Correlations suggested a strong relationship for Ground Contact Time (r=0.982), Stride Rate (r=0.988), and Max Pronation Velocity (r=0.905) for Rearfoot Strikers. Stride Length (r=0.821) and Max Pronation Displacement (r=0.784) had relatively strong relationships as well.

Kinovea-Laces

- Pearson Correlations suggested a strong relationship for Ground Contact Time (r=0.971) and Stride Rate (r=0.987) for Rearfoot Strikers. A relatively strong relationship was suggested for Max Pronation Displacement (r=0.823) and Stride Length (r=0.849). A very weak relationship was suggested for Max Pronation Velocity (r=0.204)

Heel-Laces

- Pearson Correlations suggested a strong relationship for Ground Contact Time (r=0.981), Stride Length (r=0.986), Stride Rate (r=1.00), and Max Pronation Displacement (r=0.901) for Rearfoot Strikers. A weak relationship was suggested for Max Pronation Velocity (r=0.331).

TAKE HOME MESSAGE

RunScribe™ appears to be an accurate form of 2D Kinematic Gait assessment for Rearfoot Strikers. It produces valid measurements for all Sagittal Plane variables tested (Ground Contact Time, Stride Rate, and Stride Length) from both Heel-Placement and Laces-Placement. RunScribe™ also appears to have high reliability between Heel-Placement and Laces-Placement for all Sagittal Plane kinematic variables tested.

RunScribe™ appears to produce more overall valid measurements for frontal plane kinematic variables from the Heel than the laces for Rearfoot Strikers.

Runners who wish to get the most accurate data from their two RunScribes™ should wear one footpod on the heel of each shoe. This will give valid data for both legs/feet, allowing for the identification of discrepancies or biomechanical flaws on one or both sides of the body.

Future studies can be conducted to test validity of RunScribe™ among Non-Rearfoot Strikers, as well as the validity of it's outputted kinetic data.

REFERENCES

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2. ScribeLabs. Metrics : RunScribe – The Most Advanced Running Wearable http://runscribe.com/metrics/. Accessed October 7, 2016.