

TEST-RETEST RELIABILITY OF REARFOOT MOVEMENT MEASURES USING A LASER JIGG

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INTRODUCTION

Rearfoot valgus is considered a risk factor for certain running injuries. However, in a review Wen concluded this may simply be based on intuition, conjecture and expert opinion [1]. Still, rearfoot angle measures are frequently used in clinical settings to classify movement of the ankle joint and influence intervention strategies.

Several gait analysis protocols have been developed to assess foot kinematics during ambulation assisted by different motion capture systems [2]. However, a consistent definition of joint angles and projections is difficult to apply to describe the rearfoot complex due to various methodological problems, such as skin movement artifacts, anatomical differences between individuals or the protocol used. If a simple, reliable setup can be developed, it may be possible to establish a relationship between overuse injuries in runners and rearfoot varus/valgus.

Thus, a major concern in any type of kinematic analysis is whether the method demonstrates adequate within- and between-day reliability as well as intra- and intertester reliability.

The purpose of this study was to investigate the test-retest reliability of a two-dimensional, four-marker-based automated motion analysis system for obtaining data which is used to calculate rearfoot valgus during walking. Marker placement was assisted by a custom designed laser jig.

METHODS

Fifteen subjects (7 men, 8 women, age 30.1 ± 7.1 ; BMI 25.0 ± 2.9) were included in the study. A test-retest study design was conducted with two weeks between tests. A Multi Video Sequence Analysis (MVSA) was used to measure maximal rearfoot valgus in the frontal plane during walking on a treadmill [3]. A custom made jig was used to place four reflective markers (qualisys 12 mm) on the rear aspects of the calcaneus and leg, 2, 6, 13 and 17 cm above surface level.

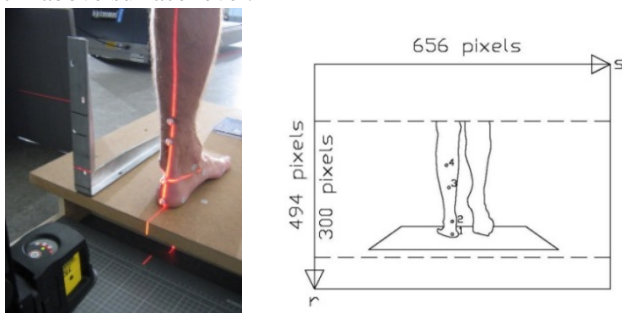


Figure 1 - Illustration of the marker placements. Dynamic coordinates were calculated based on an automatic recognition of the markers over 20 steps.

The jig consisted of an elevated panel and a laser system projecting a cross at the calcaneus and lower leg. The reflective markers were placed at the crosses (Fig. 1) by

two novice testers (A and B). Reliability was expressed by the coefficient of repeatability ($CoR = 1.96 * SD$); where SD is the standard deviation of the differences between two measurements [4]. Intraclass correlation coefficients were calculated using a parallel model (2.1, two-way random effect, total agreement).

RESULTS AND DISCUSSION

The mean ICC values ranged from 0.16 to 0.72. Table 1 shows that there is a substantial variation across subjects. The coefficient of repeatability varied from 4.02 to 4.90° for intratester and 6.50 to 10.9 for intertester comparisons.

Intratester ICC values				
	Within-day		Between-day	
	ICC	CoR	ICC	CoR
A	0.70 (0.25-0.90)	4.02	0.72 (0.31-0.91)	4.60
B	0.61 (0.07-0.87)	4.05	0.57 (0.03-0.86)	4.90
Intertester ICC values				
A-B	0.52 (-0.09-0.83)	6.50	0.16 (-0.42-0.64)	10.9

Table 1 – ICC values within- and between-day, intra- and intertester reliability. CoR is Coefficient of repeatability in degrees.

ICC values for intratester agreement are higher than the intertester agreement. Intertester values for repeatability are lower for between-day comparisons than within-day variability.

Overall, all analyses presented here reveal low reliability for this method. This is in opposition to the hypothesis that an alignment device will help to improve reliability of rearfoot measures. However, it is possible that the ICC and CoR might improve for experienced clinicians. It would therefore remain questionable if this or similar methods are suitable in the contexts of prospective studies on running injuries, especially if data would be collected from several testers in large scale investigations.

CONCLUSIONS

Marker placement on calcaneus and tibia assisted by a custom made laser jig is not a reliable method for obtaining data which is used to calculate maximal rearfoot valgus during gait on a treadmill. Alternative techniques have to be developed.

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