increasing walking speed, remains a topic for future analyses. As the unit of analysis is a curve, the p-value is also a curve, which can show local, significant effects. This also challenges the idea of what points of a curve are good representatives of them as a whole.

O029

How repeatable is adult human walking?

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Summary: This novel study examined the intrinsic inter-session variation in kinematic gait data from five healthy adult participants over multiple intervals from two hours to one week.

Conclusions: Healthy young people vary their walking by 1–2 degrees over intervals of 2 hours to 1 week. In reliability studies, errors of this magnitude may simply reflect natural or 'intrinsic' human variation rather than measurement error. These data represent lower limit or 'target' values for reliability studies.

Introduction: Kinematic data from repeated gait analysis of individuals shows variation between sessions. Marker placement inconsistency is frequently regarded as a major source of error when conventional gait models are used [1]. Recent studies have suggested that intrinsic differences in gait patterns may also contribute to inter-session variation when these sessions are on different days [2,3]. Little is known about how much variation is attributable to participants naturally varying their walking over typical time intervals used in reliability studies.

Patients/Materials and Methods: 3D gait data was captured from five healthy adults (3F, 2M, aged 21–33, mean BMI 23.5) on 4 days over a 9 day period; Day 1, Day 2, Day 8 and Day 9. On each day, 4 sessions of data were collected at 2 hourly intervals using a 6-camera system and Plug-in-Gait model. At the end of Day 1, marker locations were marked with permanent marker. On subsequent days markers were replaced on these exact locations to minimise variance due to inconsistent marker placement. A multi-level random effects linear regression model was used to estimate inter-trial and inter-session variance for session intervals of 2 hours, within-day, across-a-day and across-a-week.

Results: Inter-trial variation was relatively constant within all sessions and ranged from an SD of 0.7 degrees (pelvic tilt and obliquity) to 2.5 degrees (knee flexion). Inter-session variation (see Figure 1) differed across gait variables and time intervals. For most variables, variation increased slightly with each longer time interval.

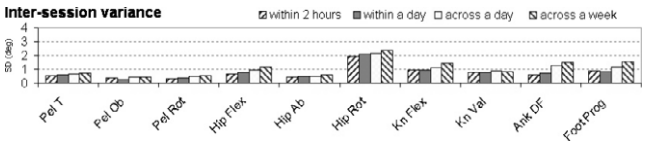

Figure 1.

Discussion: This study provides reference data about the variation in walking by healthy young people over intervals of up to a week. The findings suggest that inter-session variation of around 1–2 degrees may be largely due to natural variation in walking and not necessarily reflect measurement error. These results may guide selection of time intervals for future reliability studies and assist in interpretation of the results. In typical studies with marker replacement between sessions, variation above these threshold values can be considered to reflect procedural error. Studies of reliability should consider adding a 'no marker replacement' session in order to establish similar threshold values of intrinsic variation related to the participant group and biomechanical model.

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O030

Use of kinematic fitting and functional calibration exercises to reduce variability in kinematic measurement

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Summary: A new gait model is proposed based on kinematic fitting and functional calibration. Within and between assessor variability was assessed in 10 children without pathology assessed by experienced staff.

Conclusions: The new approach shows levels of variability at least as good as the performance of expert assessors using the conventional gait model.

Introduction: Both kinematic fitting [1–3] and functional calibration have been used by several groups but none have brought the two together in a package suitable for widespread use. This study aims to establish the potential of such an approach to determine pelvis, hip and knee kinematics.

Patients/Materials and Methods: The approach is based on a 5 segment model (pelvis, 2 × femur, 2 × tibiae) with 3 dof hip joints and 3 dof knee joints (2 dof during calibration). A new 18 marker set (see Figure 1) was devised using skin mounted markers placed on locations considered to be least susceptible to soft tissue artefact. Calibration exercises comprised a five star movement through about 30º at the hip and three repeated non-weight-bearing knee flexions from about 10º to 90º. One assessor performed three fully independent gait analyses; another assessor performed one independent gait analysis. Both had more than 10 years experience in the field. Additional markers were also applied to allow concurrent comparison with the conventional gait model (Plugin Gait, VICON). Multi-level random effects linear regression was used to estimate variance components including those within and between assessors.

Results: Figures 2a and b illustrate within and between assessor variance components (standard deviation, SD, indicated by height of coloured area) and total variability (SD indicated by height of