A 2-DIMENSIONAL VIDEO BASED MODEL FOR USE IN ERGOMETER ROWING KINEMATICS

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INTRODUCTION: Motion capture of the rowing stroke using accurate 3D opto-reflective systems has been limited by the constraints of the surrounding hydrodynamic environment. As a consequence 2D lower-extremity kinematic models have been used in an attempt to counter these logistical issues (Lamb, 1989). Despite this, there is limited research supporting the accuracy of a 2D video based model (2DVBM) for motion capture of the rowing stroke. The purpose of this study was to assess the accuracy of a 2DVBM against the conventional gait model using a 3D opto-reflective system.

METHODS: Ten (two females, eight males) novice rowers were analysed with both kinematic models simultaneously on a stationary ergometer. The 2DVBM marker set comprised five markers placed on the second metatarsal head of the left foot, lateral malleolus of left foot lateral femoral epicondyle for left leg, greater trochanter of left leg and a pelvic orientation marker. A 12 camera Vicon system collected marker coordinate data of the Plug-in-Gait model at 100 Hz and a single stationary DV camera captured the 2DVBM at 50 Hz. Kinematic data for three complete stroke cycles were processed in Vicon Nexus (version 1.6.1, Vicon, Oxford, UK) and Peak Motus using scaling calibration (v9.0, Peak Performance Technologies, Inc.) for the 3D and 2D models respectively. Root Mean Square Error, percentage variation and Coefficient of Multiple Correlations (CMC) were then calculated.

RESULTS AND DISCUSSION: All mean RMSE values were ±5˚ which was within the limits considered acceptable in clinical research (Rash, et al., 1999). Similarly, mean CMCs demonstrated strong associations between models for all joints (Table 1). The ankle and hip joints, however demonstrated a percentage variation greater than that considered acceptable in clinical research (Mayagoita et al. 2007). It is possible that differences between these models may have been due to soft-tissue and clothing movement artifacts acting differently between models. Potential out-of-sagittal-plane movement due to the novice subject group may have also contributed to kinematic differences. Reliability testing is needed to assess whether the 2DVBM is sensitive to measuring intra-athlete differences.

Table 1: Mean (and SD) of RMSE, Percentage Variation and CMC for all sagittal joint displacements.

	Ankle	Knee	Hip
RMSE	4.59° ±2.34°	4.93° ±1.94°	4.94° ±1.67°
Percentage variation	10.91% ±5.57%	4.59% ±1.81%	10.08% ±3.41%
CMC	0.96 ±0.03	0.99 ±0.01	0.98 ±0.02

CONCLUSION AND PRACTICAL IMPLICATION: A 2DVBM was found to be within the limits of conventional standards of clinical acceptability. Therefore the 2DVBM was considered acceptable for monitoring of the rowing stroke. Despite this, reliability testing is necessary to evaluate whether a 2DVBM is suitable for assessing intra-athlete changes.

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