Table 1 – Performance of the subject specific models with the Root mean squared error (RMSE) expressed in body weight (BW). For the posterior/anterior forces, a distinction is made between breaking and pushing force.

	Peak vertical forces			Peak posterior/anterior forces			
Subject	RMSE (BW)	Mean absolute peak error (BW (% of peak))	Pearson's r	RMSE (BW)	Mean absolute breaking force error (BW (% of peak))	Mean absolute push-off force error (BW (% peak))	Pearson's r
1	0.088	0.051 (1.88)	0.995	0.040	0.030 (7.8)	0.027 (7.78)	0.984
2	0.096	0.048 (2.11)	0.991	0.051	0.033 (9.71)	0.028 (9.11)	0.966
3	0.064	0.042 (1.75)	0.997	0.035	0.026 (7.59)	0.021 (7.19)	0.983
4	0.074	0.060 (2.33)	0.996	0.037	0.028 (8.19)	0.025 (8.8)	0.982
5	0.088	0.052 (2.15)	0.994	0.046	0.034 (10.95)	0.031 (9.76)	0.973
6	0.090	0.047 (1.90)	0.994	0.034	0.022 (6.45)	0.022 (8.25)	0.984

1884

Accuracy Of A Portable Motion Capture System For Kinematic Analysis Of Movement Skills In Children

Nicholas L. Lerma, Heather Gulgin. *Grand Valley State University, Allendale, MI.*

PURPOSE: With recent advances in motion capture technology, there remains to be an accessible field-based measurement system for kinematic analysis in physical education. The purpose of this research is to assess the accuracy of a portable, cost-effective motion capture system to assess movement skills in children.
METHODS: Eighteen healthy children ages 5-17 years performed the vertical jump and land (JL) and leap while being recorded by the Microsoft Kinect V2 with AssessLink software and Vicon MX13 with Nexus 2.0. Data was analyzed using Pearson correlation coefficient and a Bland-Altman plot to determine accuracy of the Kinect V2 to collect kinematic data for nine body segments during five phases of the JL and eight body segments during three phases of a leap.
RESULTS: Overall, the correlation and mean bias between the two devices varied by body segment, movement type, and movement phase. For JL, the Pearson r for knees and shoulder ranged from -.239 (p=.109) to .521 (p < .001) and -.743 (p < .001) to .410 (p < .05), respectively. For JL, bias and level of agreement showed better agreement in the spine, hips, and knees. Sagittal assessment of leap often produced results for the appendicular skeleton that did not appear valid. Pearson r for axial segments including the sagittal spine ranged from .345 (p=.032) to .553 (p < .001) across the three movement phases.
CONCLUSIONS: With limited measurements that are considered acceptable, our results indicate the Kinect V2 with AssessLink should not be used as a replacement for laboratory-based kinematic assessment. If used, the intrinsic limitations of the Kinect V2 promote a necessity to be selective of body segments, movement skills, and phases to be quantitatively assessed.

1885

The Battle Of Distal & Proximal Peak Tibial Acceleration: Inclusion Of All Acceleration Components

Jasper Reenalda[1], Robbert Van Middelaar[1], Junhao Zhang[1], Allison Gruber, FACSM[2], Peter Veltink[1]. [1]*University of Twente, Enschede, Netherlands.* [2]*Indiana University, Bloomington, IN.* (Sponsor: Allison Gruber, FACSM)

Peak tibial acceleration (PTA) is considered a surrogate measure for impact forces during running and therefore associated with lower extremity injuries. Commonly, only accelerometers are used distally or proximally on the tibia for measuring PTA. Centripetal acceleration is therefore often ignored in PTA estimation distally due to an assumed low contribution or is not included at all proximally resulting in an underestimation of PTA.
PURPOSE: To look into the contribution of each PTA component (longitudinal, centripetal, gravitational) for both a distal and proximal sensor during running. Furthermore, the possibility towards estimating PTA at the tibia with rigid body kinematics (RBK), independent of sensor location, is explored.
METHODS: 8 recreational runners (3F/5M, running >10 km p/w >1 year; heel strikers) ran 90 s on a treadmill at 12 kph. Two IMUs (240 Hz) were placed distal-medial (±10 cm above ankle joint) and proximally on the medial surface of the tibia, respectively, where each acceleration component (norm) of the dominant leg was calculated according to Lafortune (1991). Furthermore, with RBK, acceleration on any location on the assumed rigid tibia segment can be estimated based on one sensor to evaluate both sensor location measurements.
RESULTS: Both sensors showed similar total impact acceleration including all PTA components (table 1). RBK showed greater longitudinal acceleration distally (p=0.02) but still a similar impact acceleration (87.82 m/s^2 distally vs. 80.12 m/s^2 proximally, p=0.22).
CONCLUSION: Inclusion of all components is needed to accurately estimate PTA. Here, there is a similar impact PTA for both sensor locations, therefore it seems that the position does not matter if all components are included. Further research is needed to clarify and validate RBK acceleration estimations based on influence of external factors on reliability of both sensor locations and its potential towards estimating PTA at any location of the tibia.

Table 1: Comparison between distal and proximal measurement solely based on the sensor measurement ('Directly via sensor') and comparison based on RBK. With RBK, 'distal' is estimated from the proximal sensor and vice versa. Impact = Longitudinal + Centripetal – Gravitational. T-test performed between 'distal' and 'proximal' for both methods.

	Directly via sensor			Via Rigid body kinematics		
	Distal	*Proximal*	*p*	*Distal*	*Proximal*	*p*
Longitudinal acceleration [m/s²]	83.50 ± 16.31	79.11 ± 13.48	*0.51*	92.95 ± 11.55	76.28 ± 19.09	***0.02***
Centripetal acceleration [m/s²]	5.36 ± 0.81	9.34 ± 4.26	***<0.01***	3.90 ± 1.04	14.05 ± 2.41	***<0.01***
Gravitational acceleration [m/s²]	9.81 ± 0.00	9.81 ± 0.00		9.81 ± 0.00	9.81 ± 0.00	
Impact acceleration [m/s²]	79.61 ± 16.35	80.79 ± 12.31	*0.86*	87.82 ± 10.75	80.12 ± 17.87	*0.22*

1886

A Comparison Of Treadmill And Overground Running With The Use Of IMUs

Jean L. McCrory, FACSM, Griffin R. Moon, Brian K. Leary, Anh-Dung Nguyen. *West Virginia University, Morgantown, WV.*

Treadmill running has historically been utilized in the laboratory to mimic outdoor running. Recent developments in portable technology, such as Inertial Measurement Units (IMUs), allow researchers to assess runners in their natural environment.
PURPOSE: To compare peak tibial acceleration, stance time, stride frequency, and rearfoot eversion velocity between treadmill and overground running (asphalt, track, and grass).
METHODS: Twenty subjects (age: 22.1±2.0 yrs, mass: 70.8±11.9 kg, hgt: 174.5 ± 10.0 cm, 8F/12M) participated. Following consent, subjects ran three 30m trials on each overground surface (grass, track, and asphalt) at their self-selected speed. A timing system was used to control for speed across surfaces. Subjects then ran on a treadmill at this same self-selected pace. For all running conditions, IMUs were placed on the right distal medial tibia and the posterior heel cap of the right shoe to record 3D linear accelerations and angular velocities. During these trials, stride frequency, peak tibial acceleration, max rearfoot eversion velocity, and stance time were extracted. Thirty steps from each condition across 3 trials were used for analysis. In our statistical analysis, a repeated measures ANOVA or Friedman test was conducted on each variable to examine any significance between running surface. Post-hoc tests were performed when appropriate (α=0.05).
RESULTS: Stride frequency, peak tibial acceleration, and max rearfoot eversion velocity were significantly different (p<0.001) between surfaces. Stride frequency was statistically faster during treadmill running (1.39±0.09 stride/s) compared to all the overground surfaces (avg. 1.36 stride/s). Peak tibial acceleration was only different between the treadmill (7.9±1.6 G) and outdoor running conditions (11.0±2.7 G asphalt, 10.7±3.4 G grass, and 10.6±2.3 G track). Max rearfoot eversion velocity was statistically the lowest on grass (394.9±256.5 deg/s) and greatest on track (623.5±299.3 deg/s) and asphalt (620.7±289.1 deg/sec). There was no difference in stance time between surfaces (p=0.231).
CONCLUSION: With the use of IMUs, treadmill running has been shown to be different than overground, therefore, laboratory-based studies on running biomechanics may not truly reflect the "natural" gait used on outdoor running surfaces.

1887

The Dance Effectiveness In Single-leg Support In Older Adults, Using Inertial System Units; Pilot Study

Tyrone Loría-Calderón[1], José Pino-Ortega[2], Keven Santamaría-Guzmán[1], Mynor Rodríguez-Hernández[1]. *[1]University of Costa Rica, San Ramón, Costa Rica. [2]University of Murcia, Murcia, Spain.*

PURPOSE To analyze the effectiveness of dancing over postural control in older people, using inertial system units.
METHODS: 10 subjects participated (age 64.1 ± 5.53, BMI= 29 ± 3.7 Kg / m2) in a pilot study, performed a 45-min. single dance class, and, three Single-limb Stance balance tests: pre-test, right after the dance class, and, after sitting one hour. Data from acceleration variable magnitude, or resulting vector, were collected through wireless inertial measurement units (WIMU PRO) (RealTrack Systems, Almería, España) placed in six postural control points, 1. Between T2-T4 (T), 2. L1-L3 (L), 3&4. Right (RK) and left (LK) at vastus lateralis muscle insertion, and, 5&6. Right (RA) and left (LA) peroneal malleolus.
RESULTS: Balance improved significantly in right leg, between pre-test and one hour after the class, in L (F = 5.78, p = 0.008, η^2 = .300) and T (F = 4.54, p = 0.020, η^2 = .252); also, for left leg balance improved significantly in LA (F = 12.0, p = 0.001, η^2 = .471) and in T (F = 4.08, p = 0.028, η^2 = .232) between pre-test and one hour after class.
CONCLUSION: from an acute stimulus, we determined that dancing is a feasible exercise for older people to improve postural control, an important outcome to prevent accidents related to lack of balance.