INTRODUCTION

- Force platforms provide a valid and reliable method for measuring initial contact (foot strike) during running. The use of force platforms however, is not practicable for outdoor situations as they are fixed in the ground and are therefore non-portable.
- Recent developments in wireless inertial sensors may enable the determination of key events in running gait outside of a laboratory environment. Accelerometers are useful for field based testing as they are portable, lightweight, and can be used for an extended periods (Kavanagh et al., 2006).
- STUDY AIM:
  - The main aim of this study was to develop a method for identifying peak impact accelerations using the Delsys Trigno System during running and comparing the timing of this event with the initial contact on the force plates.

METHODS

PARTICIPANTS: n = 7, age: 22.3 ±2.2 years, mass: 60 ±8.93 kg, height: 1.69 ±0.87c m

PROCEDURES: University ethical approval granted. A standard warm up was completed followed by a series of familiarisation trials prior to the testing. Participants then completed 10 runs at up to 50% of maximum effort across a force platform over a distance of 10 metres.

MEASURES: For the testing protocol a Delsys Trigno Wireless EMG System Natick MA, USA and an AMTI force plate (OR6-5, Advanced Mechanical Technology, Inc., Watertown, MA, USA) were used to obtain ground reaction force and accelerometer data.

STATISTICAL ANALYSIS: The force plate data were analysed to determine the instant of foot contact. The Z axis accelerometer data was filtered using a low pass Butterworth filter with a frequency cut off (fc) of 10 Hz and the time the peak acceleration occurred was recorded and compared to the force plate data. The timings of the Z axis peak impact acceleration was compared to the force plate data.

RESULTS AND DISCUSSION

Table 1. Average minimum, maximum, Upper LoA, Lower LoA, Intraclass Correlation Coefficient and Pearson R comparisons of force plate and accelerometer data

<table>
<thead>
<tr>
<th></th>
<th>Average Minimum Differences (s)</th>
<th>Average Maximum Differences (s)</th>
<th>Upper Limits of Agreement</th>
<th>Lower Limits of Agreement</th>
<th>Intraclass Correlation Coefficient Interval</th>
<th>Pearson R</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>0.015</td>
<td>-0.017</td>
<td>0.038</td>
<td>-0.0123</td>
<td>&gt;0.99</td>
<td>0.999</td>
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Figure 1: Exemplar graph illustrating anterior-posterior (Positive = anterior movement), accelerometer data filtered at 10 Hz compared to initial contact on the force plates for subject 5 trial 7.

- The purpose of this study was to develop a method for determining foot-strike or a close as possible to foot strike on the force plates during running using an accelerometer device (Delsys Trigno Wireless).
- The results show that the use of accelerometers provides a means to determine approximate of peak tibial impact accelerations of a laboratory setting. The data demonstrate that Peak tibial impact acceleration is a very good approximation to foot impact with average maximum and minimum differences of -0.017 to +0.015 s.
- In analysis of running gait, peak tibial impact acceleration may be used to normalise the gait cycle data. It should be borne in mind that while this event is different from foot-strike it generally provides a useful approximation event.
- Therefore in practical situations, running gait cycles could be effectively normalised using consecutive peak tibial impact acceleration events rather than consecutive foot strikes.

CONCLUSIONS

This study found that a single accelerometer positioned on the tibialis anterior is a suitable technique to approximate foot strike to within ±0.017. The findings from this study provide a means of data collection and analysis outside the laboratory.

REFERENCES