BILATERAL SYMMETRY IN SINGLE LEG LANDINGS

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INTRODUCTION

Landing on one foot from a jump is a complex task that is required during many sporting activities. An athlete uses muscular energy in an attempt to dissipate these forces with the contractile and articular structures about the knee playing a significant role as a shock absorber [1,2]. It is argued that the high mechanical demand on the knee joint on initial impact and during the landing phase makes it vulnerable to injury [2,3]. Therefore, variations in landing technique and knee movement patterns could contribute to the risk of injury by both increasing the amount of force as well as altering the direction of the load transmitted to the passive structures of the knee [4]. Significant asymmetries have been identified in bipedal landings [5] but there is no information comparing landing strategies of lower limbs in single leg landings. The aim of this project was identify differences in kinematics of the knee joint of the dominant and non-dominant legs during a single leg landing task.

METHODS

Five male and five female healthy university students performed 10 single leg landings on each leg from a fixed height of 37.5 cm. A 12 camera (Eagle™, EGL-500RT) motion analysis system (EVaRT™, Motion Analysis Corporation™, USA) was used to collect 3D kinematic data. Data were captured for three seconds at a sampling rate of 200 Hz and synchronised with the force plate (BP2436, Advanced Medical Technologies Inc™, USA) sampling at 1000 Hz. Calibration markers placed over the medial and lateral malleoli and knee joint lines, and the ASIS and PSIS on each lower extremity established the thigh and shank body fixed coordinate systems and allowed the local coordinates of segment markers to be determined relative to their respective local axes. Seventeen markers per limb allowed a least squared reconstruction of segment trajectory paths for the thigh and shank [6]. These trajectory data were then used to determine the kinematic variables of motion acting at the knee joint prior to foot contact to maximum knee flexion. These data were then filtered with a 6 Hz low pass Butterworth filter and exported into an Excel™ database for further analysis. A one way ANOVA was also used to consider the effect of gender on these kinematic parameters.

RESULTS AND DISCUSSION

While comparisons between the dominant and non-dominant legs demonstrated minimal differences in the sagittal plane knee kinematics, the movement patterns and sampled variables revealed considerable variability both between and within-subjects. However, the presence and formation of these movement pattern asymmetries appeared to occur independently of both limb dominance and gender. In contrast, and consistent with previous research, male to female differences were observed for the discrete variables of both flexion and valgus initial contact and maximum displacement. Importantly when the data were pooled and the leg dominance groups compared, these individual differences were concealed, highlighting the potential error of drawing conclusions regarding individual performance on the basis of group characteristics.

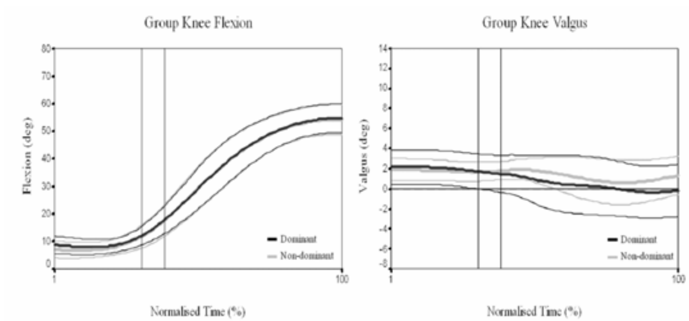

Figure 1: Sagittal and frontal plane knee kinematic patterns of the group means and confidence intervals for the dominant and non-dominant legs. Vertical lines represent the 95% confidence interval for initial contact.

CONCLUSIONS

These findings not only add to our understanding of the kinematics of landing performance and possible risk factors for non-contact ACL injuries, but should also guide methodology and interpretation of results in future research on single leg landings in sports tasks The results question the reliability of pooling data to make conclusions about individual subjects. Further investigations including other biomechanical and neuromuscular parameters are needed to allow a more comprehensive comparison of the dominant and non-dominant legs during landings, which will then provide a clearer illustration of the clinical implications for non-contact ACL injuries.

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