Ankle dorsiflexion range of motion impacts sagittal-plane, but not frontal-plane landing mechanics

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Introduction

Poor landing mechanics has been highlighted as injury risk factor for the development of both acute and chronic injuries (Shimokochi *et al*., 2009). Deficits in ankle dorsiflexion range of motion (DF ROM) have been shown to lead to altered landing mechanics in the lower extremities. However, at present there is limited evidence for restrictions in ankle DF ROM influencing hip or trunk kinematics during landing tasks.

Aims

The aims of study investigated the relationship between ankle DF ROM and the aberrant strategies in lower extremity and trunk kinematics during a single leg drop vertical jump (SLDVJ).

Methods

Thirty-one participants volunteered for this investigation (12 women and 19 men, mean ± *SD;* age 21 ± 1.7 years, height 173.1 ± 8.2 cm, mass 72.3 ± 13.7). Ankle DF ROM was measured for the right limb using the weight bearing lunge test (WBLT). With institutional ethical approval, a single-leg drop vertical jump was performed off a 10 cm box on the right limb for three repetitions. Using 2d motion analysis, sagittal-plane initial contact and peak flexion angles were calculated for the hip, knee and ankle joints. Frontal-plane projection angles (FPPA) for the knee and the lateral trunk angle were also calculated at the moment of peak knee flexion. Pearson correlation tests were used to identify if a relationship existed between ankle DF ROM and the landing mechanics in both planes.

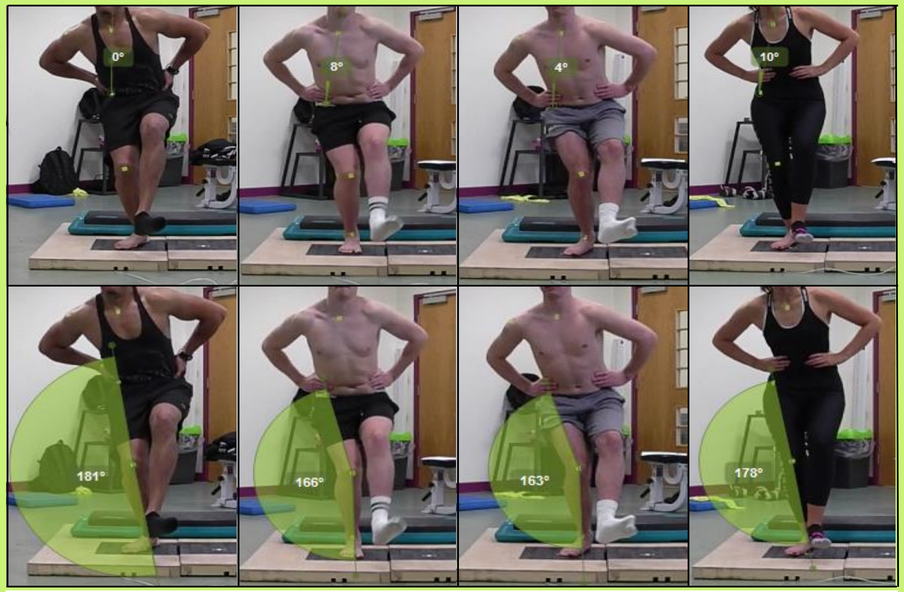

Figure 1: Peak flexion frontal-plane projection angles during SLDVJ.

Figure 2: Peak flexion in sagittal-plane during SLDVJ

Figure 3: Initial contact angle in sagittal-plane during SLDVJ

Results

A significant negative relationship was found between ankle DF ROM and peak flexion at the knee (R = -0.53, P<0.002) and ankle (R = -0.49, P<0.006) joints. No relationship was found between ankle DF ROM and other measures of landing performance at the initial contact or the moment of peak flexion.

Variables	P value	R value
Lateral trunk lean	0.277	0.201
Knee valgus	0.665	-0.081
ICA – hip	0.117	-0.288
ICA – knee	0.055	-0.348
ICA – ankle	0.055	-0.349
Peak hip flexion	0.0.82	-0.317
Peak knee flexion	0.002*	-0.526*
Peak ankle flexion	0.006*	-0.486*

Table 1: Correlation between the WBLT and landing mechanics in the frontal and sagittal-plane

Summary and conclusions

These results show that reduced ankle ROM may result in reduced knee flexion and ankle dorsiflexion during single leg landings. However, in single leg landings restrictions in ankle DF ROM do not increase FPPAs.

Key Points:

- Restrictions in ankle DF ROM results in decreased knee flexion and ankle DF, thus increasing injury risk factor.
- Restricted ankle DF ROM does not effect FPPA or lateral trunk angle
- Further research into what sufficient levels of ankle DF ROM are required to perform jump landing tasks without compensation.

References: Dowling, B., Mcpherson, A.L. and Paci, J.M. (2018) 'Weightbearing ankle dorsiflexion range of motion and sagittal plane kinematics during single leg drop jump landing in healthy male athletes.', *The Journal of sports medicine and physical fitness,* 58(6), pp. 867-874 . Shimokochi, Y., Yong Lee, S., Shultz, S.J. and Schmitz, R.J. (2009) 'The relationships among sagittal-plane lower extremity moments: implications for landing strategy in anterior cruciate ligament injury prevention', Journal of Athletic Training, 44(1), pp. 33-38.

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