Are two-dimensional measured sagittal plane kinematics related to three-dimensional joint loading during the drop vertical jump test?

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Background Acute and overuse knee injuries are common in sports involving jump-landing movements, especially in female athletes. More erect sagittal plane movement patterns are believed to increase injury risk. Whilst three-dimensional (3D) measurements are considered to be the gold standard, they are complex and two-dimensional (2D) video analysis may be a valuable alternative to screen athletes in clinical practice.

Objective The purpose of the present study was to investigate the relationship between 2D sagittal plane kinematics and 3D joint loading during the drop vertical jump (DVJ) test.

Design Cross-sectional.

Setting Controlled laboratory study.

Participants Fifty injury-free elite female athletes were tested.

Risk factor assessment Two-dimensional sagittal plane video analysis and 3D motion analysis were used during the DVJ test

Main outcome measurements Hip flexion, knee flexion and ankle dorsi flexion angles were measured at the deepest landingposition (2D analysis). External hip flexion moments (HFM), knee flexion moments (KFM) and knee abduction moments (KAM) were measured across the entire support phase (3D analysis). One-dimensional statistical parametric mapping was used to examine the temporal relationship between 2D angles at the deepest landing position and 3D moments across the entire support phase. Significance was set at $P<.0055$.

Results The amount of hip flexion was significantly related to HFM, KFM and KAM during the time frames corresponding with highest 3D moments, while the amount of knee flexion was only significantly related to HFM during these time frames. No significant results were found for ankle dorsiflexion.

Conclusions These results indicate that 2D measured sagittal plane hip and knee flexion angles at the deepest landing position are associated with sagittal plane peak joint loading during a DVJ. Furthermore, the significant association of hip flexion with frontal plane knee loading provides evidence that assessment of knee joint injury risk could benefit from measuring maximal hip flexion.