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Hip Strength Influences Ground Reaction Force Attenuation on a Side Leap in Collegiate Dancers

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PURPOSE: The vast majority of dance-related hip injuries are due to overuse, muscular compensation secondary to strength imbalances, and lower extremity misalignment. Altered landing mechanics may decrease force attenuation capacity at ground contact so evaluation of jump landing strategies exhibited by dancers and differences elicited post fatigue on a side leap maneuver might elucidate injury risk. The purpose of this study was to examine pre to post fatigue ground reaction force attenuation differences potentially influenced by strength and alignment factors. METHODS: 16 healthy female dancers from a university dance team, each with at least 6 years of competitive experience, participated. A cross-sectional design was used. Independent variables were strength and agonist-antagonist strength ratios (eccentric strength levels for hip extensors, flexors, abductors, adductors, lateral and medial rotators, and knee extensors), q-angle, foot type and time (pre v post fatigue). Dependent variables were peak vertical force, rate of loading, and anterolateral shear force composite. RESULTS: Independent t-test showed dancers with higher composite hip strength scores had significantly lower peak normalized vertical force ($p = .01$, $t = 2.16$) and vertical rate of loading ($p = .004$, $t = 2.16$) pre-fatigue on a side leap landing, compared to a weaker group. No other group differences in strength, static Q-angle, foot mobility or fatigue were statistically significant. CONCLUSIONS: Dancers in a hip strong group were better able to attenuate vertical force at ground contact pre-fatigue. Possibly, those with greater hip strength pre-fatigue might be better equipped to maintain effective ground force attenuation strategies when landing from a higher leap post fatigue. However, leap height differences between pre- and post-fatigue conditions were not directly measured. Traditional analyses concerning dance-related impact landings have focused on vertical components and associated predictive alignment flaws. However, the lateral nature of landing a side leap maneuver might redirect some of the landing force attenuation load from sagittal and vertical components to lateral shear force. Future research models should consider multi-directional forces imposed at ground contact during complex landing maneuvers.