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Joint Level Analysis Of Mechanical Power During Drop Vertical Jumps In Youth Post ACL Reconstruction

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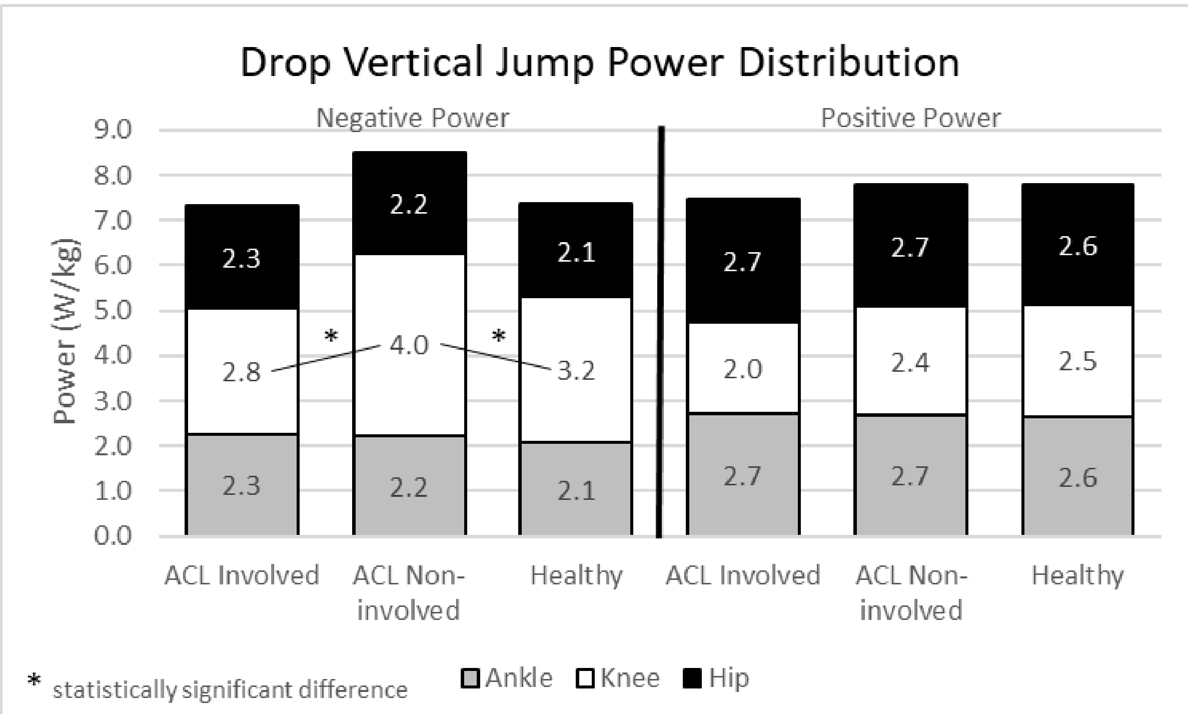
Drop vertical jumps are common in return to sport testing post ACL reconstruction (ACLR) but are generally utilized for kinematic analysis of landing mechanics. It is less clear how kinetic variables during a drop vertical jump, such as mechanical power, could be used to guide rehabilitation post ACLR.

PURPOSE: To identify differences in power distribution (negative power/energy absorption, positive power/energy generation) between hip, knee, ankle, and limb during a drop vertical jump in youth athletes post ACLR and their healthy peers.

METHODS: Thirty-two athletes (19 F, 13 M, 16±2 years, 7±1 months post-op) who underwent ACLR and twenty-five (9 F, 16 M, 15±2 years) healthy controls completed three drop vertical jumps on two Bertec force plates while 3D data was collected using a Vicon motion capture system. Work done at each joint was summed in all planes for each capture frame and areas under the curve were divided by ground contact time to produce positive and negative power. Hip, knee, and ankle were combined for total limb power. Healthy data was compiled into a single limb. Joint power data were grouped by ACL involved, ACL non-involved, or healthy then analyzed using a one-way ANOVA.

RESULTS: Knee joint negative power was significantly different between groups ($p<0.001$). Post hoc analysis showed the ACL non-involved knee (-4.0 W/kg) had greater negative power than both the ACL involved (-2.8 W/kg, $p<0.001$) and healthy knee (-3.2 W/kg, $p=0.006$). Despite notable effect sizes for total limb negative power ($\eta^2=0.048$, $p=0.066$) and knee positive power ($\eta^2=0.045$, $p=0.077$), no other comparisons were significant.

CONCLUSIONS: The ACL non-involved limb absorbed more energy at the knee than the ACL involved limb or healthy limb, demonstrating a greater reliance on the ACL non-involved knee during the eccentric phase of the drop vertical jump. Increased dependence on the ACL non-involved limb during landing may contribute to increased risk for contralateral ACL tear.



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The Effects Of Weighted Loads On Pitching Mechanics In Division 1 Pitchers

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An effective pitcher is both consistent and powerful; appropriate training optimizes these characteristics. In baseball, the overload principle is commonly employed with the use of cable devices and weighted balls. While this may elicit increases in velocity, the alteration of throwing mechanics is not well understood.

PURPOSE: To evaluate acute performance and biomechanical responses to applied resistance in pitching.

METHODS: 10 Division 1 collegiate baseball pitchers were tested using Proteus technology (Proteus Motion, USA). After a standardized warm-up, they completed 5 sets of 5 pitches against varying electromagnetic loads. Each successive set increased in resistance by 1 lb, ranging from 1 to 5 lbs. Repeated measures ANOVA examined the effect of load on throwing power (w), acceleration (m/s^2), explosiveness (w/s), velocity (m/s^2), deceleration (m/s^2), endurance (score of power maintenance in serial repetitions), range of motion in three-dimensional space, and consistency (score of how well throw mechanics were replicated across all repetitions in a set). Power, acceleration, explosiveness, velocity, and deceleration were considered acute performance metrics. Endurance, range of motion, and consistency were considered biomechanical responses to increased load. Significance was set at $p < 0.05$.

RESULTS: Pitchers were 73.0 ± 2.8 inches tall, were mostly right-handed (88%), and had a fastball velocity of 84.6 ± 3.9 mph. Repeated measures ANOVA detected differences in power ($F = 306.443$; $p < 0.001$), acceleration ($F = 103.327$; $p < 0.001$), explosiveness ($F = 92.782$; $p <0.001$), velocity ($F = 8.186$; $p < 0.001$), and deceleration ($F = 129.861$; $p < 0.001$) in response to incremental load changes. However, increasing load did not affect consistency ($F = 1.023$; $p = 0.415$), endurance ($F = 1.914$, $p = 0.111$), or range of motion ($F = 2.840$, $p = 0.100$).

CONCLUSIONS: Adjustments in load produced acute performance changes in pitching power, acceleration, explosiveness, velocity, and deceleration without influencing consistency, endurance, or range of motion. These findings provide preliminary evidence that pitch training against three-dimensional isotonic resistance may enhance throw velocity without significant compromise to kinematic parameters.