Knee biomechanics of single leg hop landings after primary anterior cruciate ligament repair and InternalBrace™ augmentation

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Introduction: Good clinical outcomes and patient reported data after anterior cruciate ligament (ACL) repair with ligament augmentation have been reported.[1, 2] However, the functional outcome of primary ACL repair with ligament augmentation is unknown. The aim of this study was to compare kinematics and kinetics during landing from a single leg hop (SLH) between the affected and contralateral knee in patients after primary ACL repair with InternalBrace™ (Arthrex GmbH, USA) and with the non-dominant knee in healthy controls.

Methods: Ten patients 2 years after surgery (5f/5m; age: 32.2±8.7 years; BMI: 22.8±2.9 kg/m^2; Tegner-Activity-Score: 4.6±1.1; IKDC: 89±9) and 10 age and sex matched controls (5f/5m; age: 31.8±9.0 years; BMI: 24.4±5.0 kg/m2; Tegner-Activity-Score: 4.4±2.0; IKDC: 98±3) performed SLHs for distance. Participants were instructed to achieve maximal jumping distance and maintain balance for 2 seconds after landing. Knee kinematics and kinetics (sagittal plane) were recorded for five trials with a motion capture system (VICON, UK) using the plug-in-gait model and two force plates (Kistler AG, Switzerland). Data for the trial with the greatest distance was used for further analysis. Joint angles, power and ground reaction force parameters were compared within patients and between the affected leg of patients and the non-dominant leg of healthy controls.

Results: We found no significant differences in the knee parameters between the affected and contralateral leg in patients (P>0.183). Kinematic and kinetic parameters of the affected knee in patients did not differ significantly from those of the non-dominant knee in healthy controls (patients vs. controls; jump distance: 1.21±0.32 m vs. 1.21±0.34 m, P=0.778; flexion angle at initial contact: 12.8±6.4° vs. 13.4±6.0°, P=0.830; peak flexion angle: 54.9±15.6° vs. 56.4±6.6°, P=0.788; range of motion: 42.2±10.3° vs. 43.0±7.8°, P=0.836; peak knee power: 6.6±4.9 W vs. 8.6±5.3 W, P=0.391; peak vertical ground reaction force: 377±96% body weight vs. 380±110% body weight, P=0.948).

Conclusion: In this analysis, we found no relevant deficits in knee biomechanics of the patients' affected leg during landing from an SLH compared to their contralateral leg (P>0.183). Moreover, the movement strategy and functional condition of the knee during landing appeared to be comparable to healthy knees, which is in contrast to previous results for patients after ACL reconstruction.[3, 4] The biomechanical analysis further reflects the balanced result of the jump distance between patients and controls. This result is promising and supports the choice of surgical treatment of ACL rupture with primary repair and InternalBrace™. Further studies will be conducted to strengthen these results, to further explore the variability within the groups and to understand the role of proprioception, muscle strength and muscle coordination in the landing biomechanics from jumps after ACL repair.

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References: [1] Bodendorfer et al. J Orth Rhe Sp Med 2017; [2] van Eck et al. Am J Sports Med 2018; [3] Kotsifak et al. Br J Sports Med 2019; [4] Markström et al. Am J Sports Med 2020