

Stabilization Times of the Lower Extremity Following ACL Reconstruction Using Two Sub-Maximal Single-Leg Hop Protocols

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Objective: Lower extremity function is often assessed using a single-leg hop for distance test. Stabilization times have been reported for ACL reconstructed patients when required to hop a distance equal to their respective leg lengths. While this is a consistent distance, it is not clinically challenging. Our purpose was to determine the effect of two sub-maximal single-leg hop protocols on stabilization times of the lower extremity when comparing an ACL reconstruction (ACLr) and control group.

Design and Setting: A repeated measures post-test only control group design was used. The independent variables and respective levels were Group (ACL reconstructed, control), Extremity (involved, uninvolved), and Protocol (leg length, 80% of maximum hop distance). The first protocol, leg length, was defined as the distance from the greater trochanter to the lateral malleolus. The second protocol, an 80% of maximum hop distance was determined by calculating 80% of the maximum distance performed after completing three maximal jumps. Both legs were tested three times from each distance. Repeated measures ANOVAs were used to assess differences in stabilization times of the two, single-leg hop tests for ground reaction forces and center of pressure. Tukey post-hoc analyses were used to determine statistical significance and a probability level of $<.05$ was considered significant. Testing was performed in the University of Kentucky Biodynamics Laboratory.

Subjects: The control group consisted of 18 recreationally active subjects (age= 22.5 +/- 4.1 yr, mass= 71.2 +/- 13.0kg, ht= 105.29 +/- 5.1cm) with no history of knee or lower extremity pathologies. The ACLr group consisted of 18 subjects (age=22.8 +/- 5.8yr, mass=77.7 +/- 21.5kg, ht= 104.7 +/- 6.7cm) at least six months post-operative with no history of hip, knee, or ankle injuries within the last 6 months.

Measurements: A Kistler (Amherst, NY) force plate was used to measure ground reaction forces (vertical, medial-lateral, and anterior-posterior) and center of pressure (medial-lateral, and anterior-posterior). Order of testing was counterbalanced. The average of 3-trials was used for analysis. Stabilization time (ms) was defined as the point in time where the sequential average remained within one-quarter standard deviation of the overall series mean.

Results: There was a significant extremity by group interaction for maximal hop distance. There was a significant difference between the involved (167.8cm) and uninvolved (181.2cm) leg of the ACLr, and between the involved legs of the ACLr group and the control group (182.6cm). There was a significant group by protocol interaction for stabilization time in the anterior-posterior direction. It took an average of 506ms and 300ms longer to stabilize when the ACLr group was compared to the control group for the leg length and 80% of maximum protocols, respectively. There was a significant difference in the stabilization time for vertical force when the ACLr involved extremity was compared to the uninvolved extremity for the leg length protocol. Stabilization time was an average of 95ms longer for the uninvolved than the involved extremity.

Conclusions: Following ACL reconstruction (x=58±19 weeks) single-leg hop for distance scores were not within normal limits when compared to the contralateral limb. In addition, the ability of the ACLr group to stabilize in the anterior-posterior direction following either submaximal hop protocols was decreased when compared to a control group.