

Relationship Between Isokinetic Quadriceps and Hamstring Strength to Lower Extremity Functional Tests

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Comparison of isokinetic strength testing and closed kinetic chain functional testing of the lower extremity is important in the clinical setting. Our purpose was to compare open kinetic chain isokinetic strength to closed chain functional exercise that included the step-up-and-over test (SUO), the forward lunge (FL). Isokinetic peak torque strength evaluation included bilateral reciprocal quadriceps and hamstring concentric and eccentric contractions at 60 and 120 °/sec on the Biodex System 3 (Biodex Inc. Shirley, NY). Functional testing was performed on the NeuroCom Long Force Plate (Neurocom Inc. Clackamas, OR). The independent variables for the isokinetic testing were speed, muscle group, and contraction; and the functional tests included: the step-up-and-over test and the forward lunge. Subjects were asked to step up and over a 12 inch high wooden box, and perform a standing forward lunge. A Pearson product moment correlation was used for comparison and a probability level of $\leq .05$ was considered significant. Testing was performed in the University of Kentucky Biodynamics Laboratory. Thirty recreationally active subjects (age=22.5 +/- 4.1 yr, mass= 71.2 +/- 13.0kg, ht=105.29cm +/- 5.1cm) with no history of knee or lower extremity injury or surgery in the past 6 months participated. Dependent variables for the: step-up-and-over test included the mean lift-up index (average force exerted by the step-up leg was expressed as a percent body weight, % bw), and impact index (maximum force of the lagging leg as it lands on the surface, % bw); and the forward lunge included the mean impact index (maximum force transmitted through the lunge leg as it lands on the surface; % bw), and the mean force impulse (the average work of the landing leg; % bw/sec). Isokinetic strength was measured as peak torque (ft/lb). There was a moderate significant relationship between the SUO lift-up index and right and left concentric quadriceps strength at 60°/sec and 120°/sec, $r = .40 - .50$, $r = .38 - .52$, respectively. There was a strong significant relationship between SUO impact index and right and left quadriceps eccentric strength at 60°/sec and 120°/sec, $r = .69 - .80$ and $r = .69 - .82$, respectively. There was a relationship between forward lunge force impulse and right and left concentric quadriceps strength at 60 and 120°/sec, $r = .30 - .47$ and $r = .36 - .49$, respectively. There was a relationship between right and left eccentric quadriceps strength at 60°/sec and 120°/sec, $r = .31 - .53$, $r = .29 - .43$, respectively. Performance on the step-up-and-over test was most closely related to isokinetic quadriceps strength at 60 and 120°/sec. The results of this study suggest that performance on the step-up-and-over test may be useful for assessing dynamic and functional control of the quadriceps muscle. As eccentric and concentric quadriceps strength increased the vertical force (% bw) on the force plate was decreased. Future research is needed determine if assessment of the step-up-and-over test can be used to estimate muscular strength.