The Influence of Isometric Strength Specificity on Functional Task Abilities

University of North Carolina at Chapel Hill, Chapel Hill, NC

MUSCLE STRENGTH ASSESSMENTS:
• Single-joint leg extension peak torque (Nm) was measured during an isometric maximum voluntary contraction (MVC) while seated in a isometric dynamometer.
• The limb was extended to 60° below the horizontal plane.
• Multi-joint leg extension peak force (N) was measured during a MVC while seated in an isometric, leg press dynamometer
• The participant sat with the knee at 60° of flexion, hip at 90° while sitting upright, and ankle joint 9° of plantarflexion during the CMJ and SEBT assessments.

PURPOSE: To determine if a multi-joint, isometric leg press muscle strength assessment is more strongly associated with functional task performance (i.e., star excursion balance tests (SEBT), countermovement vertical jump test (CMJ), stair climb (SC) assessment) than traditional single-joint measures of leg extension isometric strength.

METHODS: Forty-one men and women (age = 24 ± 5 years) performed an initial familiarization visit. On visit two, peak force (PF) was measured during 3 maximum voluntary contractions (MVCs) on an isometric leg press dynamometer, followed by a timed and weighted (22.73 kg vest) SC. On visit three, leg extension peak torque (PT) was also determined during 3 MVCs, followed by the CMJ and SEBT assessments.

Pearson's product-moment correlation coefficients evaluated the relationships between each muscle strength value (PF and PT) and each functional measure of performance with alpha level of 0.05. Steiger Z calculations determined the difference between the relationships for each respective functional task, with z > 1.96 being significant.

RESULTS: Isometric PT and PF were associated with higher CMJ average power (r = 0.786, r = 0.817) and faster SC times (r = 0.592, r = 0.599), respectively. No significant correlation existed between the SEBT for both legs and PT or PF.

When comparing correlation values for each measure of strength, no significant difference existed in the relationships between each functional task (P > 0.483).

We found our results that traditional measures of single-joint isometric leg extension strength and multi-joint leg press isometric strength demonstrated similar relationships with CMJ power output, SC time, and normalized distance reached during the SEBT. It is possible that knee joint angle may be more important than the strength testing modality.

ACKNOWLEDGEMENTS: This project was supported by the Tom and Elizabeth Long Excellence Fund for Honors administered by Honors Carolina and Graduate Student Research Award from the National Strength and Conditioning Association Foundation.

REFERENCES: