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# ORIGINAL RESEARCH

## INTERSESSION RELIABILITY OF UPPER EXTREMITY ISOKINETIC PUSH-PULL TESTING

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### ABSTRACT

**Background:** Based on the frequency pushing and pulling patterns are used in functional activities, there is a need to establish an objective method of quantifying the muscle performance characteristics associated with these motions, particularly during the later stages of rehabilitation as criteria for discharge. While isokinetic assessment offers an approach to quantifying muscle performance, little is known about closed kinetic chain (CKC) isokinetic testing of the upper extremity (UE).

**Purpose:** To determine the intersession reliability of isokinetic upper extremity measurement of pushing and pulling peak force and average power at slow (0.24 m/s), medium (0.43 m/s) and fast (0.61 m/s) velocities in healthy young adults. The secondary purpose was to compare pushing and pulling peak force (PF) and average power (AP) between the upper extremity limbs (dominant, non-dominant) across the three velocities.

**Methods:** Twenty-four physically active men and women completed a test-retest (>96 hours) protocol in order to establish isokinetic UE CKC reliability of PF and AP during five maximal push and pull repetitions at three velocities. Both limb and speed orders were randomized between subjects.

**Results:** High test-retest relative reliability using intraclass correlation coefficients ( $ICC_{2,1}$ ) were revealed for PF (.91-.97) and AP (.85-.95) across velocities, limbs and directions. PF typical error (% coefficient of variation) ranged from 6.1% to 11.3% while AP ranged from 9.9% to 26.7%. PF decreased significantly ( $p < .05$ ) as velocity increased whereas AP increased as velocity increased. PF and AP during pushing were significantly greater than pulling at all velocities, however the push-pull differences in PF became less as velocity increased. There were no significant differences identified between the dominant and nondominant limbs.

**Conclusion:** Isokinetically derived UE CKC push-pull PF and AP are reliable measures. The lack of limb differences in healthy normal participants suggests that clinicians can consider bilateral comparisons when interpreting test performance. The increase in pushing PF and AP compared to pulling can be attributed to the muscles involved and the frequency that pushing patterns are used during functional activities.

**Level of Evidence:** 3

**Keywords:** Closed kinetic chain, power testing, strength testing, upper extremity

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#### Acknowledgements

We acknowledge Biodex Medical Systems (Shirley, NY) for their support of this project.

#### Conflict of Interest

The principal investigator for this study is an Adjunct Clinical Instructor for Biodex Medical Systems (Shirley, NY).

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