

Comparative Study of Isokinetic Dynamometry and the Standing Heel-Raise Test for Assessing Ankle Plantar Flexion Strength

When compared to more sensitive measures of strength, such as isokinetic dynamometry, manual muscle testing has been shown to be insensitive in detecting mild weakness of the plantar flexors. This study collected normative isokinetic dynamometry data for plantar flexor strength and looked for correlations among the Standing Heel-Raise Test (SHRT), isokinetic dynamometry strength tests, and torque production on a force plate during the heel-raise test.

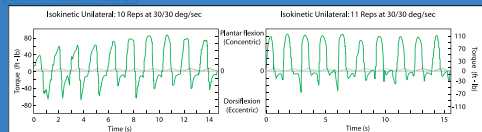
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Introduction:

The purpose of this study was to improve physical therapy evaluation techniques for addressing ankle strength. The study compared three methods of testing ankle plantar flexion strength:

- 1) Biodex System 3 Isokinetic Dynamometer
- 2) Dr. Perry Standing Heel-Raise Test (SHRT)
- 3) Plantar flexion torque production on a force plate during the standing heel-raise test

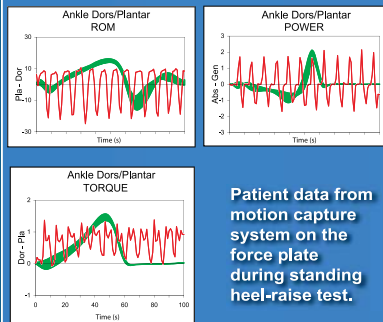
Biodex Test:



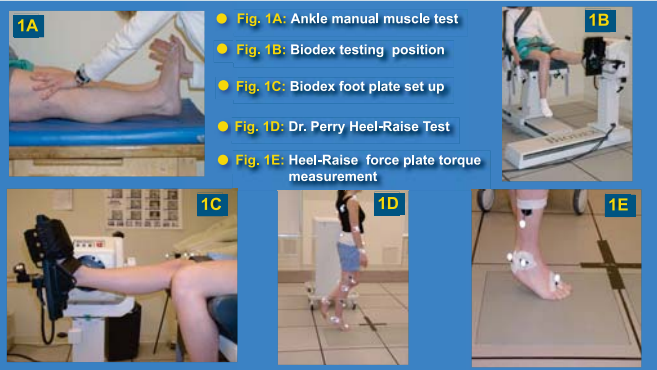
Side: Right		Plantar FLX Concentric
Number of Reps:	10	30 Deg/Sec
PEAK TORQUE	FT-LBS	87.6
PEAK TQ/BW	%	59.6
MAX REP TOT WORK	FT-LBS	23.9
COEFF. OF VAR.	%	20.4
AVG. POWER	WATTS	33.2
ACCELERATION TIME	MSEC	10.0
DECELERATION TIME	MSEC	130.0
ROM	DEG	19.7
MAX AVE PEAK TQ	FT-LBS	70.3
AGON/ANTAG RATIO	%	82.5

Side: Right		Plantar FLX Concentric
Number of Reps:	11	30 Deg/Sec
PEAK TORQUE	FT-LBS	114.4
PEAK TQ/BW	%	77.8
MAX REP TOT WORK	FT-LBS	32.9
COEFF. OF VAR.	%	5.7
AVG. POWER	WATTS	52.6
ACCELERATION TIME	MSEC	10.0
DECELERATION TIME	MSEC	170.0
ROM	DEG	19.6
MAX AVE PEAK TQ	FT-LBS	100.2
AGON/ANTAG RATIO	%	69.8

Force Plate Test:



Patient data from motion capture system on the force plate during standing heel-raise test.



Methods:

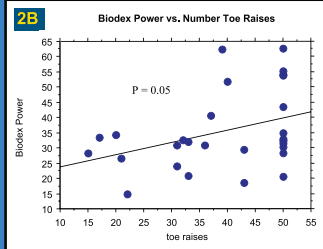
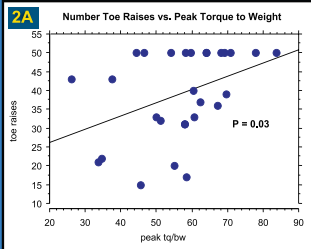
The subject's dominant limb was tested on the Biodex System 3 to gather data on their plantar flexion peak torque per body weight output. The subject then performed the Dr. Perry Standing Heel-Raise Test during motion capture on a force plate. The maximum number of heel-raises the subject could perform and the plantar flexion torque during the heel-raise test were both measured.

Subjects

Study group size	28
Under 35 years of age	14
35 years of age and older	14
Males	11
Females	17

Analysis:

Statistical analysis was performed to compare the results of the Biodex plantar flexion strength test, the Dr. Perry Standing Heel-Raise Test, and the plantar flexion force plate torque values measured during the heel-raise test. T-tests and ANOVA's were performed on multiple variables, such as peak torque to body weight, age, and sex.



Regression analysis showing a positive correlation between both sets of variables.

Fig. 2A: Toe raises and Biodex peak torque to body weight

Fig. 2B: Toe raises and Biodex power values

Conclusion:

- Men demonstrated significantly higher Biodex peak torque values and performed more heel raises than women ($p < .05$).
- Subjects younger than 35 years of age produced higher Biodex peak torque values than subjects older than 35 years ($p < .05$).
- A significant correlation was found between the number of heel raises performed and the Biodex peak torque/body weight ($p = .03$).
- There was a significant correlation between the number of heel raises performed and the Biodex power values ($p = .05$).