BIOMECHANICAL EVALUATION OF THE PERFORMANCE-ORIENTED MOBILITY ASSESSMENT (POMA)

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INTRODUCTION

The Performance-Oriented Mobility Assessment (POMA) is a tool used widely for assessing the mobility and risk of falls in the elderly [1]. Testing takes less than 15 minutes and requires only a chair, stopwatch, and a small area to walk in. The test involves a number of different components including assessment of sitting, rising to stand, standing, and walking. Assessment is made by a trained rater who simply assesses the different activities on a three point scale. It has been demonstrated that the POMA has good inter-rater reliability and that years of experience has no effect on rater agreement [2, 3].

The gait related portion of the POMA focuses on the assessment of asymmetries in the subject's gait. The purpose of this study was to compare the POMA assessment of gait with biomechanical measures of gait asymmetry.

METHODS

A group of eight subjects were recruited for this study (age – 21.4 ± 1.3 years; height - 1.762 ± 0.086 m; mass – 59.55 ± 17.68 kg). All subjects provided informed consent, and all procedures had been approved by the Institutional Review Board. All subjects were able to walk unaided, but some had injuries which precluded symmetrical gait. The subjects were instructed to walk on an instrumented treadmill (Kistler Gaitway) which has two force plates under the belt. After a 10 minute period to habituate to the treadmill the subjects selected their preferred walking speed (1.91 ± 0.32 $m.s^{-1}$) and walked on the treadmill at this speed while force plate and video data (front and rear views) were collected for 10 seconds. Custom written software permitted determination of kinematic and kinetic descriptors of gait from the force plate records. The descriptors were are listed in Table 1, note VGRF refers to (VGRF). The symmetry index (SI) was used to assess left-right asymmetry in each of these descriptors [4].

The video images of the walking trials were shown to eight clinicians who assessed the gait of the subjects using the POMA scale. Pearson Product Moment Correlations were computed to assess which gait variables were most correlated with the POMA scores. Based on this analysis, and scatter plots, linear regression equations were formulated that attempted to predict the POMA score using the SI data. In these equations non-significant coefficients ($p > 0.05$) were removed.

RESULTS

The SI for the gait descriptors ranged from -62% to 49% (positive scores indicate asymmetry to the right side, 0% no asymmetry). There were a range of correlations between POMA scores and the biomechanical measures of asymmetry (Table 1). The regression equation that best predicted the POMA scores was,

$$POMA = c_1 + c_2\,(SI\ 2^{nd}\ Peak\ VGRF) + c_3\,(SI\ Time\ of\ Trough)$$

All regression coefficients were statistically significant ($p < 0.0001$). The adjusted r-squared value of the final model was 96%.

Table 1: The correlation coefficients between the symmetry indices for the gait parameters and POMA scores.

Gait Parameter	*Minimum Correlation*	*Maximum Correlation*
Step Interval	-0.191	0.477
Step Length	-0.599	0.280
Contact Time	-0.325	0.670
1st Peak VGRF	-0.406	0.404
Time 1st Peak	-0.560	0.270
2nd Peak VGRF	-0.013	0.874
Time 2nd Peak	-0.447	0.622
Trough in VGRF	-0.612	0.337
Time Trough	0.371	0.790

DISCUSSION

The elderly are the most rapidly increasing proportion of society [5]. A major problem confronting this cohort is their susceptibility to falls [6], as a consequence the POMA is a popular means of assessing the mobility status of older adults. Sophisticated biomechanical measures have identified a demonstrated a link between postural stability and the ability to avoid falls [7].

The regression equation predicting the POMA score accounted for more than 90% of the variance yet the regression equation contained variables that are not directly observable. The time of the trough in the vertical ground reaction force curve does approximately correspond with mid-stance and it is possible the raters were observing asymmetries in this variable. The high r-squared indicates that the POMA is capturing the asymmetry in two aspects of gait, the functional significance of these variables in elderly gait remains to be established.

REFERENCES

1. Tinetti ME. *J Am Geriatr Soc.* **34**, 119-126, 1986.
2. Cipriany-Dacko LM et al. *Arch Phys Med Rehabil.* **78**, 1160-1164, 1997.
3. Faber MJ et al. *Phys Ther.* **86**, 944-954, 2006.
4. Sadeghi H et al. *Gait Posture.* ***12***, 34-45, 2000.
5. Fuller GF. *Am. Fam. Physician.* **61**, 2159-2168, 2000.
6. Jantti PO, et al. (1995) *Aging (Milano),* 7, 23-27, 1995.
7. Wolfson L. *J. Gerontol,* ***49***, M258-263, 1994.