RELATIONSHIPS BETWEEN HANDGRIP STRENGTH MEASUREMENTS AND POSTURAL BALANCE PERFORMANCE IN OLDER WOMEN

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ABSTRACT

The link between handgrip strength and postural balance in older adults is not well understood. **PURPOSE:** This study aimed to examine the correlations between postural balance performance and handgrip peak force and rate of force development (RFD) measurements in older women. **METHODS:** Twenty older women (67 ± 5 years) completed two postural balance assessments followed by three handgrip maximal voluntary contractions (MVCs) with the dominant hand. Postural balance assessments were performed using a commercially designed balance testing system. The system assessed postural balance performance by measuring sway index. A lower index value indicates less postural sway and therefore, better balance. Handgrip MVCs were performed using a novel strength testing device. This device consisted of a microcomputer and a load cell that was equipped with two semi-cylindrical handles for gripping. For each MVC, participants sat in an upright position and were instructed to squeeze the handles of the load cell "as hard and fast as possible" for 3-4 seconds. Handgrip peak force, peak RFD, and RFD at 0-100 (RFD100) and 0-200 (RFD200) milliseconds from contraction onset were calculated and displayed by the device at the conclusion of each assessment. Pearson correlation coefficients (*r*) were calculated to examine the relationships between sway index and handgrip peak force and RFD variables. Multiple regression analysis (stepwise model) was used to determine which variables were the best predictors of sway index. **RESULTS:** There were significant negative correlations between sway index and handgrip peak force (r = -0.497, P = 0.026), peak RFD (r = -0.552, P = 0.012), RFD100 (r = -0.539, P = 0.014), and RFD200 (r = -0.499, P = 0.025). For the multiple regression analysis, handgrip peak force, peak RFD, RFD100, and RFD200 were entered as predictor variables into the stepwise model. The model revealed that handgrip peak RFD was the single best predictor of sway index (R^2 = 0.305), with the other variables explaining no further unique variance. **CONCLUSIONS:** The results of this study showed significant negative correlations between sway index and handgrip peak force and RFD variables. These findings suggest that greater handgrip strength is associated with better postural balance. The output from our multiple regression analysis indicated that handgrip peak RFD was the single best predictor of sway index. The other variables, including peak force, did not add any unique variance to the stepwise prediction model. Taken together, these findings highlight the importance of rapid strength and suggest that handgrip peak RFD may be a better parameter than peak force at explaining the variance associated with postural balance in older women. **PRACTICAL APPLICATIONS:** Given the potential importance of rapid strength to balance-related tasks, clinicians and other practitioners may want to consider using handgrip measurements of RFD in their current test battery. These measurements may provide practitioners with an additional evaluation tool to help in identifying individuals with poor postural balance. Because loss of balance is known to be a major cause of falls during physical activity, handgrip RFD measurements may also have important and promising implications for the assessment and prediction of falls risk in older adults.

PURPOSE

The link between handgrip strength and postural balance in older adults is not well understood. This study aimed to examine the correlations between postural balance performance and handgrip peak force and rate of force development (RFD) measurements in older women.

METHODS

Twenty older women (67 ± 5 years) completed two postural balance assessments followed by three handgrip maximal voluntary contractions (MVCs) with the dominant hand. Postural balance assessments were performed using a commercially designed balance testing system. The system assessed postural balance performance by measuring sway index. A lower index value indicates less postural sway and therefore, better balance. Handgrip MVCs were performed using a novel strength testing device (Figure 1). This device consisted of a microcomputer and a load cell that was equipped with two semi-cylindrical handles for gripping. For each MVC, participants sat in an upright position and were instructed to squeeze the handles of the load cell "as hard and fast as possible" for 3-4 seconds. Handgrip peak force, peak RFD, and RFD at 0-100 (RFD100) and 0-200 (RFD200) milliseconds from contraction onset were calculated and displayed by the device at the conclusion of each assessment. Pearson correlation coefficients (*r*) were calculated to examine the relationships between sway index and handgrip peak force and RFD variables. Multiple regression analysis (stepwise model) was used to determine which variables were the best predictors of sway index.

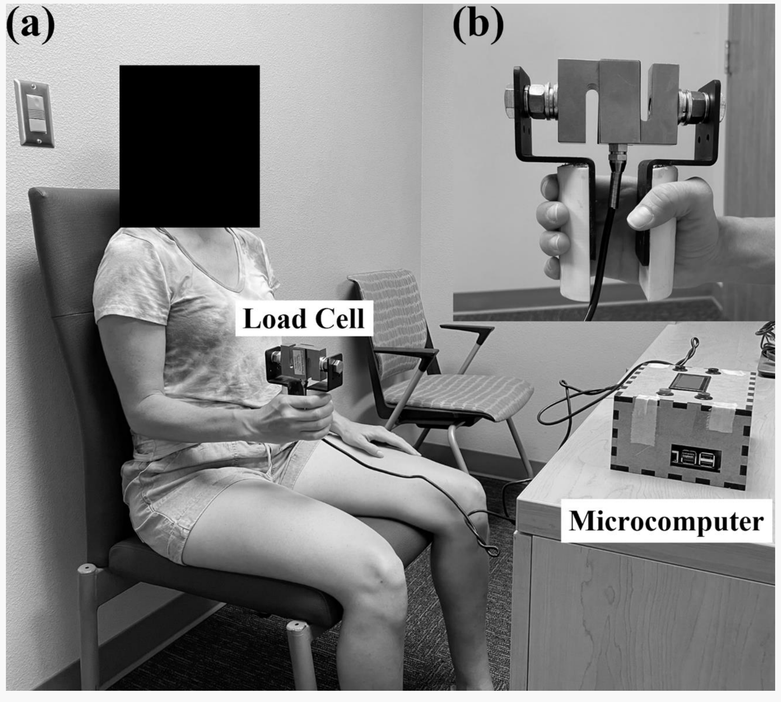

Figure 1. (a) A participant performing a handgrip maximal voluntary contraction (MVC) using a novel strength testing device. This device consisted of a load cell and a microcomputer. The load cell was equipped with two semi-cylindrical handles for gripping. For each MVC, participants sat in an upright position and were instructed to squeeze the handles of the load cell "as hard and fast as possible" for 3-4 seconds. (b) An enlarged picture of the handles attached to the load cell is provided.

RESULTS

There were significant negative correlations between sway index and handgrip peak force (r = -0.497, P = 0.026), peak RFD (r = -0.552, P = 0.012), RFD100 (r = -0.539, P = 0.014), and RFD200 (r = -0.499, P = 0.025) (Figure 2). For the multiple regression analysis, handgrip peak force, peak RFD, RFD100, and RFD200 were entered as predictor variables into the stepwise model. The model revealed that handgrip peak RFD was the single best predictor of sway index (R^2 = 0.305), with the other variables explaining no further unique variance.

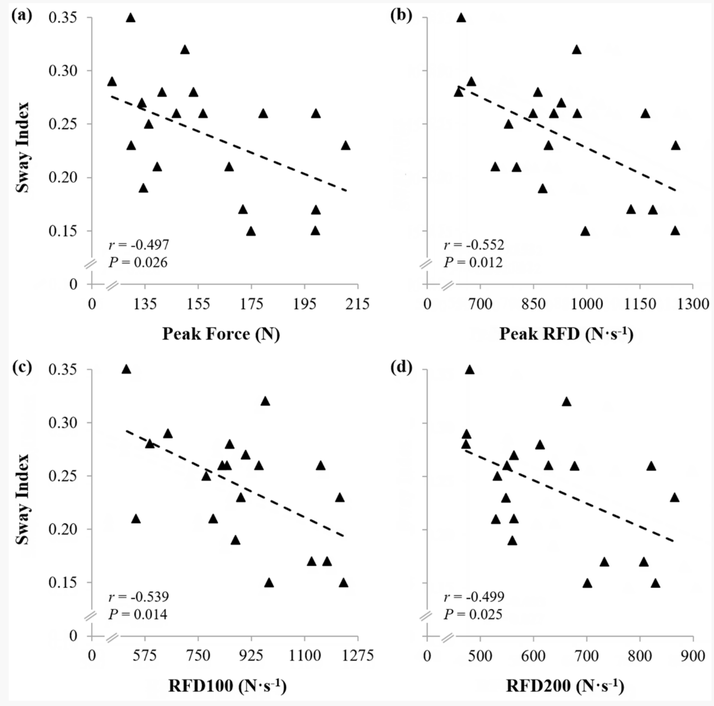

Figure 2. Relationships between sway index and handgrip (a) peak force, (b) peak RFD, (c) RFD100, and (d) RFD200. RFD = rate of force development.

CONCLUSIONS

The results of this study showed significant negative correlations between sway index and handgrip peak force and RFD variables. These findings suggest that greater handgrip strength is associated with better postural balance. The output from our multiple regression analysis indicated that handgrip peak RFD was the single best predictor of sway index. The other variables, including peak force, did not add any unique variance to the stepwise prediction model. Taken together, these findings highlight the importance of rapid strength and suggest that handgrip peak RFD may be a better parameter than peak force at explaining the variance associated with postural balance in older women.

PRACTICAL APPLICATIONS

Given the potential importance of rapid strength to balance-related tasks, clinicians and other practitioners may want to consider using handgrip measurements of RFD in their current test battery. These measurements may provide practitioners with an additional evaluation tool to help in identifying individuals with poor postural balance. Because loss of balance is known to be a major cause of falls during physical activity, handgrip RFD measurements may also have important and promising implications for the assessment and prediction of falls risk in older adults.