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Harold L. Merriman
University of Dayton

Kurt Jackson
University of Dayton

Jamie Wynk
University of Dayton

Megan Gordon
University of Dayton

Kathryn Quinn
University of Dayton

See next page for additional authors

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Authors

Harold L. Merriman, Kurt Jackson, Jamie Wynk, Megan Gordon, Kathryn Quinn, and Sarah Welsh

Predicting Falls in Community-Dwelling Older Adults Using the Repetitive Step Test

Harold Merriman PhD, PT, CLT, Kurt Jackson PhD, PT, GCS, Jaime Wynk, PT, DPT, Megan Gordon, SPT, Kate Quinn, SPT, Sarah Welsh, SPT

University of Dayton

Department of Physical Therapy

Introduction

One third of older adults > 65 years old fall each year resulting in injuries that are the leading cause of death and are associated with the greatest number of trauma hospital admissions. Common clinical tests that predict fall risk can be time consuming, require a large amount of space and/or have a ceiling effect. The Repetitive Step Test (RST) is a balance test which consists of stepping in various directions at 50% and 75% of leg length. Previous research in community-dwelling older adults has shown that the RST has the ability to retrospectively differentiate multiple fallers from non-fallers and has excellent intra-rater, inter-rater and test-retest reliability.

Purpose/Hypothesis

To determine the predictive capabilities of the RST in identifying fallers in community-dwelling older adults. We hypothesize that individuals who complete fewer steps on the RST are more likely to fall within 12 months, and that the RST will predict falls at least as well as other established balance tests.

Subjects

63 community-dwelling adults with and without a fall history (27 males, 36 females), ages > 65 yo, mean age 75.7 years.

Materials

Masking tape, goniometer, tape measure, gait belt, four canes, chair, cone, stop watch, BP cuff and stethoscope. RST configuration shown in Fig. 1.
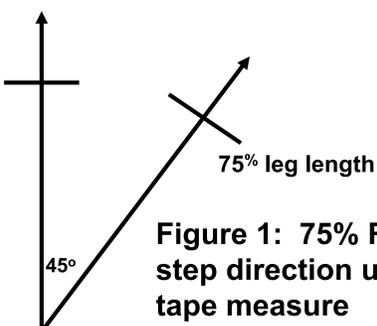

Figure 1: 75% RST grid design for right anterolateral step direction using masking tape, goniometer and tape measure
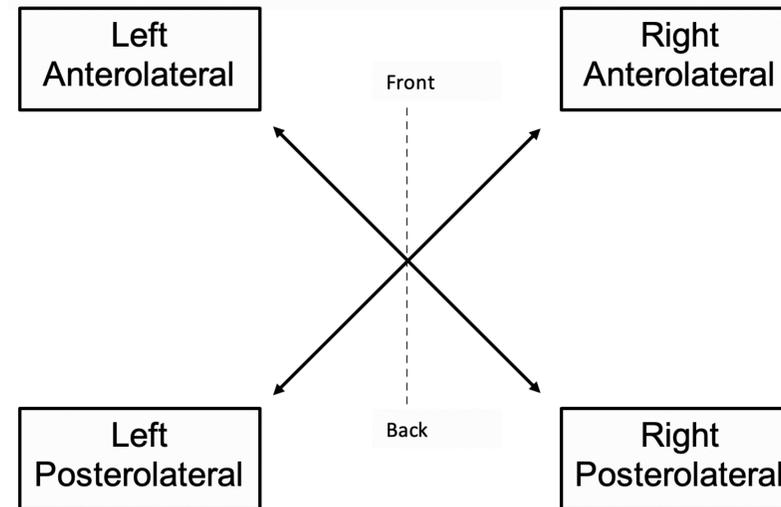
75% leg length

45°

Left Anterolateral		Right Anterolateral
Front	
Back	
Left Posterolateral		Right Posterolateral

Figure 2: Four RST step directions

Table: Area Under the ROC Curve (AUC) - multiple fallers vs non-fallers

Balance and Mobility Assessment	RST at 50% Leg Length	RST at 75% Leg Length	FSST	TUG	ABC Scale	10MWT
AUC (95% CI)	0.40 (0.22 - 0.58)	0.41 (0.24-0.57)	0.45 (0.28-0.62)	0.49 (0.32-0.66)	0.61 (0.44-0.78)	0.67 (0.51-0.83)

Abbreviations

ABC: Activities-specific Balance Confidence; a subjective measure determining subject confidence in performing daily dynamic balance activities.
FSST: Four Square Step Test; dynamic balance assessment in which subjects step over four canes placed on the ground in the form of a cross.
TUG: Timed Up and Go; functional mobility assessment in which subjects stand up from a chair, walk 10 feet, turn around, walk back to the chair and sit down.
10MWT: 10 Meter Walk Test; assessment of gait speed in which subjects walk 10 meters at a comfortable pace.

Methods

Subjects performed the FSST, TUG, 10MWT and RST assessments randomly. For the RST test, leg length was determined by measuring the distance from the ASIS to ipsilateral medial malleolus. Subjects stepped to a mark that was 50% of their leg length. A repetition was only counted if the subject completed the motion and returned to the start position with their feet side by side. After 15 seconds, the number of repetitions was recorded. Subjects stepped in the following directions: anterolateral and posterolateral with right and left legs (see Fig. 2). Once all directions were completed at 50% leg length, 10 minutes of rest was allowed and subjects repeated the RST protocol at 75% of their leg length.

Results

Based on 12 months of data, receiver operating characteristic (ROC) analysis was used (see Table) to calculate the area under the ROC curve (AUC) comparing subjects who fell multiple times (> 2 times, n=17) to subjects who did not fall (n=29).

Conclusion

At 12 months, the RST and other balance and mobility measures either failed to or poorly predicted the number of falls. Research is needed to determine how to best predict falls in this population, and whether any single balance test or combination of tests can effectively identify individuals who are most likely to fall.

Clinical Relevance

Currently, there is no single and simple measure of balance and mobility that can accurately predict falls in community-dwelling older adults. The newly developed RST was also ineffective in predicting falls at 12 months. Given the unique characteristics of the RST, it may still be a useful tool for assessing and monitoring bilateral lower extremity performance and stepping ability, especially in individuals who present with asymmetrical impairments.