Reliability and Concurrent Validity of the Four Square Step Test in Osteoarthritic Knee Patients

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Abstract

Research has demonstrated reduced dynamic standing balance in people with knee osteoarthritis, but reliable studies appropriate for clinical use have not been assessed. This study looked to assess the validity and reliability of the Four Square Step Test in patients with knee osteoarthritis. A randomised observational, repeated measures study design for inter-rater and intra-rater reliability was completed in men and women with knee osteoarthritis (N=62). In this cohort study, patients completed a baseline assessment including the Four Square Step Test, Berg Balance Scale and Figure of 8 Walk Test, and returned within a four-week period to be reassessed to determine the inter and intra-rater reliability of the Four Square Step Test. The Four Square Step Test, F8W, and Berg Balance Scale were shown to have significant concurrent validity ($p < .001$, $r = 0.803$, 0.838, and -0.777 respectively). Over a four-week period intra-rater reliability the Four Square Step Test was significantly reliable (ICC=0.89, lower 95% CI = 0.809). The Four Square Step Test displayed optimal inter-rater reliability between two assessors during assessment two (ICC = 0.983, lower 95% CI = 0.976). The FSST has been shown to be an appropriate measure of dynamic standing balance in knee osteoarthritis patients and is recommended for clinical use.

1) Introduction & Background

Dynamic standing balance (DSB) is important for individuals to complete many activities of daily life (e.g. stepping on curbs or sidewalks). Though DSB is reduced in people with knee osteoarthritis (OA) (Marsh et al, 2003), it has garnered minimal research interest in this population (Hatfield et al, 2016). Most studies have assessed DSB using complex equipment. The difficulty lies in generalising these research findings for clinical use where such equipment is not readily available. Inexpensive, valid and reliable clinical tests of balance need to be developed to reliably test balance in these groups (Hinman et al, 2002; Wegener et al, 1997). The FSST is a dynamic standing balance test to assess mobility in older adults, with advantages including minimal space and equipment requirements (Dite and Temple, 2002). Therefore, the purpose of this study is to determine the reliability and concurrent validity of the FSST in knee OA patients.

2) Methodology

Subjects: Patients aged 55 years and above, with diagnosis of moderate to severe OA due to undergo replacement surgery.

Design: A randomised repeated-measures design investigating validity and reliability of FSST as an indicator of DSB.

Procedures: Two visits to Nuffield Orthopaedic Centre, including baseline assessment and follow-up within a three-week period.

Primary Measures: FSST, Figure-8 Walk Test (F8W), and Berg Balance Scale (BBS)

Secondary Measures: Oxford Knee Score, Activities Specific Balance Confidence (ABC) Scale and feasibility questionnaires.

3) Analysis

Intra-rater and Inter-rater Reliability will be analysed using Intraclass Correlation Coefficients (ICC) with 95% Confidence Intervals

Concurrent Validity of the FSST relative to the already established BBS and F8W will be determined using the Pearson Product-Moment Correlation with Effect Sizes and Scatter Graphs

The Measurement error associated with the FSST will be estimated using the Standard Error of Measurement and Minimal Detectable Change

4) Results

Intra-rater reliability

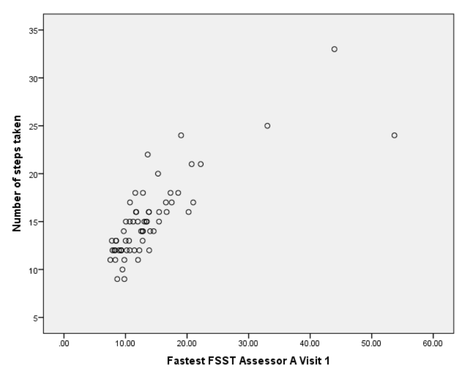
The FSST indicated a high level of reliability for intra-rater reliability during the study period (ICC = 0.89, lower 95% CI = 0.809).

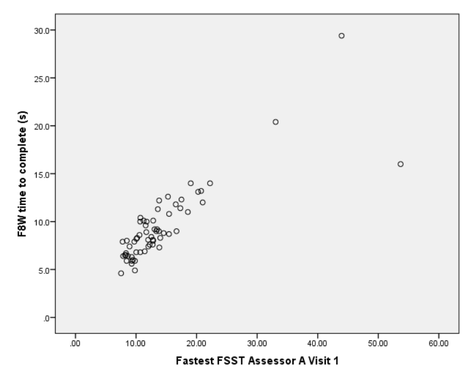
Inter-rater reliability

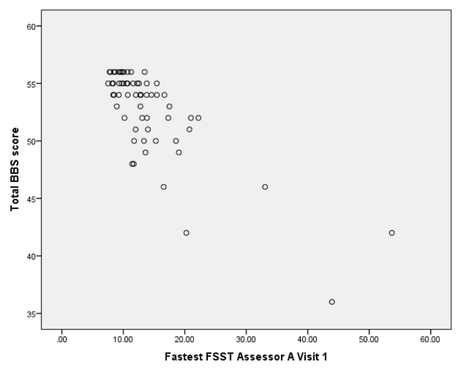
A high level of reliability was indicated between assessor A and a secondary assessor for the FSST (ICC = 0.983, with 95% CI = 0.976.

Concurrent Reliability

FSST (time in s) and F8W (steps taken and time in s) scores reveal a statistically significant positive linear relationship ($p < .001$, $r = 0.803$ and 0.838, respectively). As FSST time reduces, F8W scores reduce. A negative statistically significant correlation between BBS score and FSST time were found; higher BBS score is associated with reduced FSST time ($p<0.01$, $r = -0.777$).







Descriptive Characteristics of OA Patients at baseline (N=62)

Characteristic	Mean (SD)
Sex (F:M)	24:38
Age (years)	71.2 (7.1)
Height (cm)	167.4 (23.2)
Mass (kg)	86.8 (18.4)
BMI (kg/m²)	31.0
OA side (L:R)	33:29

5) Conclusions

In this study we aimed to determine the reliability and validity of the FSST as a measure of DSB in knee OA patients. The FSST was found to be sufficiently reliable between raters and within one rater across time, and was also shown to have concurrent validity as a measure of DSB with the BBS and F8W test.

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