



## Construct Validity and Test Re-Test Reliability of the Forgotten Joint Score



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### ABSTRACT

Consecutive patients undergoing knee arthroplasty completed questionnaires: FJS, Knee Injury and Osteoarthritis Outcome Score (KOOS) and WOMAC Score (mean 39 months after surgery), and were mailed a repeat questionnaire after 4 to 6 weeks. The test–retest reliability was almost perfect for the FJS (ICC = 0.97), and the FJS subdomains (ICC > 0.8). Convergent construct validity of the FJS was correlated with the KOOS Subscores of Quality of Life (0.63,  $P = 0.001$ ), Symptom (0.33,  $P = 0.001$ ), Pain (0.68,  $P = 0.001$ ) and ADL (0.66,  $P = 0.001$ ) and the Total WOMAC (0.70,  $P = 0.001$ ). The FJS demonstrates high test–retest reliability and construct validity compared to the Normalised WOMAC and KOOS Subscales. The FJS does not demonstrate the ceiling effect of the WOMAC or KOOS pain scores so may have greater discriminatory ability following TKR.

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Total knee arthroplasty is an ever increasingly utilised surgical treatment of osteoarthritis [1]. Whilst the overall success of TKA as a treatment modality for osteoarthritis is not in question, there remain a significant number of patients who remain dissatisfied with their arthroplasty [2,3]. Outcomes following total knee arthroplasty are typically assessed using clinical scoring tools. Many different scoring tools are available including both patient and clinician based tools, disease specific (WOMAC) and global health questionnaires (SF-12). These scores should be validated, reproducible and responsive to changes in the patient's condition [4]. Despite many of these tools having been validated and tested extensively there is no commonly accepted 'gold standard' measurement tool to assess TKA outcomes [5].

As patient outcomes have continued to improve and patient expectations have increased over recent years, traditionally used scoring tools have begun to demonstrate a ceiling effect, potentially losing the ability to determine differences in outcome in a high functional range [6,7]. Additionally, from a patient's perspective the true success of the procedure may not equate to the sum of a set outcome variables. It has recently been suggested that the ultimate goal of arthroplasty surgery is for the patient to be able to forget their prosthetic joint during regular day to

day activities. A new scoring system, The Forgotten Joint Score (FJS) has been developed. The FJS focuses on the patients' awareness of their joint arthroplasty during a range of day to day and recreational activities [8]. The FJS has been validated in German and French language form, but not in English [9]. This score consists of 12 questions where subjects are asked to rate their awareness of their joint arthroplasty during various activities.

The aim of this study was to investigate the test retest reliability and the construct validity of the FJS-12 in English, specifically for patients who have undergone total knee arthroplasty.

### Materials and Methods

#### Patients

Ethical approval for this study was sought and granted from an independent ethical review board. All patients provided signed informed consent to participate. From a prospective surgical knee registry, 240 patients who had undergone primary total knee arthroplasty under the care of a single surgeon between 2006 and 2010 were invited via mail to participate in the study. Patients with a significant cognitive impairment, an intellectual disability or mental illness were excluded.

Patients were asked to complete a questionnaire consisting of the Forgotten Joint Score (FJS-12) and the Knee Injury and Osteoarthritis Outcome Score (KOOS). A normal knee (normal range of motion, no pain or instability on a day to day basis) should be the benchmark test for a forgotten joint arthroplasty. The FJS-12 evaluates the knee according to the patients' ability to forget their joint arthroplasty in comparison to a normal knee in everyday life, by assessing variables such as functional ability, expectations, activity level, psychosocial factors, stiffness and pain. The Western Ontario and McMaster Universities

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**Table 1**  
Statistics for the FJS, WOMAC and KOOS Scales.

		Mean	SD	Range
FJS-12	Initial	62	29	0–100
	Follow up	60	29	0–100
Normalised WOMAC	Pain	90	13	50–100
	Stiffness	84	17	38–100
	Function	90	11	53–100
	Total	90	11	52–100
KOOS	Quality of Life	76	18	12–100
	Symptom	65	14	4–100
	Pain	90	12	56–100
	ADL	89	13	35–100

**Table 2**  
Test Retest Reliability Analysis of the FJS-12.

	Intra Class Correlation	95% Confidence Interval	Landis & Koch Classification
Overall Score	0.97	0.95–0.98	Almost Perfect
Individual Questions			
Night Symptoms	0.88	0.84–0.92	Almost Perfect
Sitting	0.84	0.77–0.88	Almost Perfect
Walking	0.92	0.89–0.94	Almost Perfect
Bathing	0.88	0.84–0.92	Almost Perfect
Travelling	0.86	0.81–0.90	Almost Perfect
Stairs	0.94	0.92–0.96	Almost Perfect
Walking uneven ground	0.91	0.88–0.94	Almost Perfect
Rising	0.90	0.86–0.93	Almost Perfect
Standing	0.91	0.88–0.94	Almost Perfect
Housework/Gardening	0.91	0.87–0.93	Almost Perfect
Walking/Hiking	0.92	0.89–0.94	Almost Perfect
Favourite Sport	0.94	0.91–0.96	Almost Perfect

**Table 3**  
Correlation of the FJS-12 with the Normalised WOMAC and KOOS Scales.

		Forgotten Joint Score	
		Spearman's	Significance
Normalised WOMAC	Pain	0.67	0.001
	Stiffness	0.52	0.001
	Function	0.66	0.001
	Total	0.70	0.001
KOOS	Quality of Life	0.63	0.001
	Symptom	0.33	0.007
	Pain	0.68	0.001
	ADL	0.66	0.001

(WOMAC) osteoarthritis index scores were calculated from the KOOS score, and normalised in to a scale where high scores indicate a good outcome. WOMAC scores were normalised by summing the total score

of each subscale and dividing by the maximum total score for the scale. Those who completed and returned their initial questionnaire were mailed a repeat questionnaire at 4 weeks.

### Statistical Analysis

Mean and standard deviations were calculated for each of the measurement variables. Test retest reliability was calculated using the interclass correlation coefficient (ICC). This was calculated for the overall score and for the individual components and was classified according to Landis and Koch's guidelines of almost perfect (>0.8), substantial (0.6–0.8), moderate (0.4–0.6), fair (0.2–0.4), slight (0.0–0.2) and poor (<0.0). Convergent construct validity was assessed with a Spearman's correlation between the first FJS score and the normalised WOMAC scales and the KOOS scales. Statistical significance was set at 0.05. Statistical analysis was performed with SPSS Version 11.

### Results

A total of 147 of the 240 (61%) completed and returned both questionnaires and were included in the analysis.

There were 68 females and 79 males with a mean age of 67 years (range 32–89). The right knee was involved in 75 cases. A Triathlon (Stryker) prosthesis was used in 120 knees and a Genesis II (Smith & Nephew) prosthesis was used in 27 knees. The mean time from surgery to completion of the first questionnaire was 39 months (range 18–72).

The FJS-12 returned a mean score of 62 and 60 (range 0–100) and the normalised WOMAC overall mean score of 90 (range 52–100). Results are summarised in Table 1.

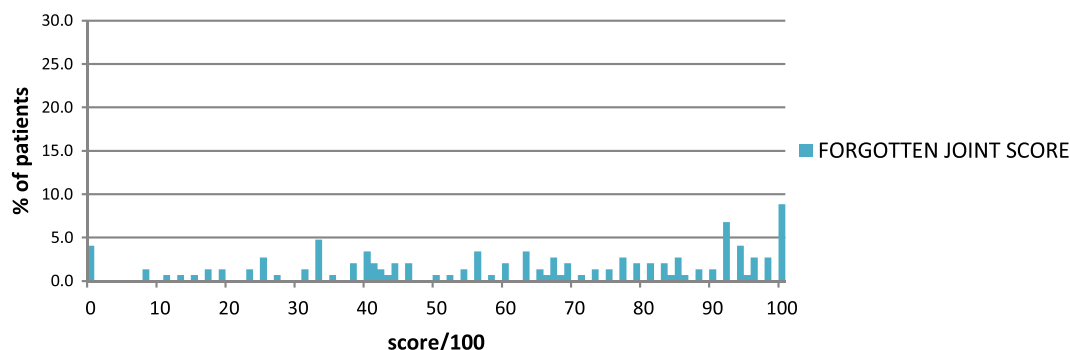
### Test–Retest Reliability of the FJS-12

The test–retest reliability for the Forgotten Joint Score is shown in Table 2. The mean time between completion of questionnaires was 6 weeks (range 3–15).

### Convergent Construct Validity of FJS

Convergent construct validity of the FJS-12 was compared to both the KOOS and WOMAC subscales using correlation (Spearman's correlation coefficient). The results are shown in Table 3.

The distribution of the FJS to the Normalised WOMAC and KOOS Subscales is shown in the Figs. 1–5. It can be seen in Figs. 1–5 that the Forgotten Joint Score demonstrates a much greater distribution of responses than the WOMAC or KOOS pain scores, which are clustered at the ceiling. The percentage of subjects who reported the maximum score is a measure of the ceiling effect. The FJS-12 showed a ceiling effect of 6.8% (10/147) and a floor of 3.4% (5/147). The ceiling effect was 2% for KOOS symptom, 13% for KOOS Quality of Life, 33% for KOOS Pain score and 9% for the normalised WOMAC score.

**Fig. 1.** Distribution of the Forgotten Joint Score.

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