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Original Article

The validity and reliability of the modified forgotten joint score

Patrick G. Robinson[a], Conor S. Rankin[b,*], Jonathan Lavery[c], Iain Anthony[c], Mark Blyth[c], Bryn Jones[c]

[a] Trauma and Orthopaedics Department Royal Infirmary Edinburgh, UK
[b] University of Edinburgh, 3/2f2 Warrender Park Terrace, Edinburgh, EH9 1JA, UK
[c] Glasgow Royal Infirmary Orthopaedic Research Department, Glasgow, UK

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ABSTRACT

We aim to validate the "Modified Forgotten Joint Score" (MFJS) as a new patient-reported outcome measure (PROM) in hip and knee arthroplasty, against the UK's gold standard Oxford Hip and Knee Scores (OHS/OKS).

The original Forgotten Joint Score (FJS) (12 items) was created to assess post-arthroplasty joint awareness. We modified the FJS to 10-items to improve its reliability.

Postal questionnaires were sent out to 400 total hip or knee replacement (THR/TKR) patients who were 1–2 years' post-op, along with the OHS/OKS. Data, collected from the 212 returned questionnaires (53% response rate), was analysed in relation to construct and content validity. A sub-cohort of 77 patients took part in a test-retest repeatability study, to assess reliability of the MFJS.

The MFJS proved to have an increased discriminatory power in high-performing patients in comparison to the OHS and OKS. 30.8% of TKR patients (n = 131) scored highly (87.5% or more) in the OKS compared to just 7.69% in the MFJS TKR patients. The MFJS proved to have increased test-retest repeatability, based upon its intra-class correlation coefficient of 0.968 compared to the Oxford's 0.845, $p < 0.001$.

The MFJS is a more relevant tool, compared to the FJS, with greater discrimination in the assessment of well performing hip and knee arthroplasties in comparison to the OHS/OKS.

1. Introduction

Hip and Knee Joint replacement surgery has proven to be highly successful in improving patient's pain and function.[1] Surgical techniques and advancements in technology have led to joint arthroplasty evolving to the benefit of the patients. However, it is vital to evaluate patient's outcome post-operatively to assess the levels of improvement in joint function after joint replacement in order to demonstrate efficacy and monitor patient progress. As well as measuring simple surgical parameters, assessment of function has been recognised as an essential evaluation tool which has led to the development of patient-reported outcome measures (PROMS). Technological advancements in surgical techniques or implant design need to be evaluated against current standards, but often gains in performance are small and these may not be able to be picked up by current scoring systems/PROMS which may be restricted by a ceiling effect.[2,3]

The Forgotten Joint Score (FJS) was developed by Behrend et al in 2007. This new PROM measures a very appealing concept; the ability for a patient to forget about their artificial joint in everyday life.[4] Behrend et al believed the optimal outcome after a total knee or total hip replacement (TKR/THR) was for a patient to be "unaware" that they had a prosthetic joint.

In the UK, the gold-standard PROM for knee and hip arthroplasties are the Oxford Knee and Hip Scores (OKS/OHS). The Oxford 12-item Knee and Hip Questionnaires were developed in 1998 by Dawson et al as a self-administered, disease and site specific questionnaire, specifically for hip and knee arthroplasty patients.[5] Since then, the OKS/OHS have been used extensively throughout the UK and have been translated into several languages for use globally.[2,3,5–10]

The objective of our study was to assess the usefulness in everyday orthopaedic practice of our modification of the Forgotten Joint Score – the Modified Forgotten Joint Score (MFJS) by validating it against the OHS and OKS. In our evaluation we assessed the construct and content validity of both questionnaires along with the reliability by comparing the test-retest repeatability of the two scores.[11]

* Corresponding author.
E-mail addresses: probins2@ed.ac.uk (P.G. Robinson), conorrankin@doctors.org.uk (C.S. Rankin), jonathan.lavery@nhs.net (J. Lavery), iain.anthony@ggc.scot.nhs.uk (I. Anthony), mark.blyth@ggc.scot.nhs.uk (M. Blyth), bryn.jones@ggc.scot.nhs.uk (B. Jones).

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2. Background

2.1. The Oxford hip and knee questionnaires

The Oxford Knee and Hip Questionnaires contain 12 items, which assesses a patient's pain and function by asking them to answer a range of questions. Each question is scored on five point scale from 0 to 4. The score for each question is added together to give an overall score out of 48.

In the Oxford Score, high scores indicate good outcomes. A high score indicates higher level of function and less pain. For ease of interpretation we use the term "ceiling-effect" to refer to the best possible score (48) and "floor-effect" to refer to the worst possible score (0).

2.2. The original forgotten joint score

The original FJS is a 12-item questionnaire which asked patients to answer questions based upon their "awareness" of their artificial joint during everyday activities. The questionnaire differs from that of the OKS and OHS as it is not site specific, covering both hip and knee arthoplasty patients in the one questionnaire. The FJS scales answers from 1 to 5. These scores add up to give a score out of 60, which is then converted into a percentage.

Behrend et al stated that in an initial validation study of the FSJ-12, it outperformed the Western Ontario and McMaster Universities (WOMAC) osteoarthritis index in several areas, including discriminatory power and combating the ceiling effect.[4]

2.3. Reliability and validity

The reliability of a questionnaire is defined as the ability of a test to "yield the same results on repeated trials under the same conditions".[4,5]

Validity in our case refers to the ability of a questionnaire to measure the construct it is intended to measure. It can be determined by measuring the correlation between two study groups as well as determining the frequency distribution of scores, along with the ceiling and floor effects.[12] A ceiling effect occurs when a patient achieves a very high score in a questionnaire and would be unable to show improvement in subsequent questionnaires despite improving clinically.[13]

2.4. The pilot study

We performed an initial pilot study in 2013 comparing the FJS to the OKS/OHS. The FJS proved to have increased sensitivity, especially in the well performing patients in comparison to the OHS and OKS. However, some areas of missing data in the FJS responses were observed (Table 1).

We used a further pilot group of TKR and THR patients (n = 25) to gain feedback with regards to their understanding of the original questions, along with suggestions on proposed alternative questions.

We put into place a number of modifications which are summarised below:

- **Removal of Q.11. . . awareness taking a walk/hiking?**

In 5.71%(THR) and 3.91%(TKR) of respondents the answer to this question was missing, while also showing a strong correlation with Q.3 – implying patients often left this question out or answered it the same as Q.3. Both factors lead to the belief that the question was redundant and therefore should be removed.

- **Removal of Q.12. . . awareness when playing your favourite sport?**

This question posed a significant problem based on the large percentage of missing data associated with it; 39.13% (THR) and 47.82%(TKR) patients failed to answer this question. This, along with the fact that playing sport is not a popular activity within the arthroplasty population, meant it was decided to omit this question from the modified questionnaire.

Table 1
FJS – Overall Missing Data.

FJS-12	Missing Data THR	Missing Data TKR
Overall Missing Data	6.82%	6.69%
1. Awareness in bed at night?	0.29%	0.69%
2. Awareness sitting on a chair for more than 1 h?	0.28%	0.92%
3. Awareness when you are walking for more than 15 min?	1.63%	0.69%
4. Awareness taking a bath/shower?	0.82%	1.61%
5. Awareness travelling in a car?	1.91%	1.84%
6. Awareness climbing stairs?	0.82%	1.84%
7. Awareness walking on uneven ground?	1.91%	2.07%
8. Awareness squatting?	23.10%	25.75%
9. Awareness standing for longer?	1.09%	1.61%
10. Awareness doing housework or gardening?	5.16%	2.99%
11. Awareness taking a walk/hiking?	5.71%	3.91%
12. Awareness when playing your favourite sport?	39.13%	47.82%

- **Rewording of Q.8. . . awareness when squatting?**

This question again was completed poorly with 23.10% (THR) and 25.75% (TKR) of patients failing to answer it. In discussions with our patient group (n = 25), feedback showed that many patients did not fully understand the intended activity being asked and therefore failed to answer the question. With this in mind we decided to amend the question to;

- ○ ***.. . awareness when squatting/crouching?***

- **Rewording of Q.10. . . awareness when doing housework/gardening?**

This question had a percentage of missing data of 5.16% (THR) and 2.99% (TKR), with almost twice as many males failing to answer it as females. Therefore, it was decided to modify this question to;

- ○ ***Awareness when doing housework or gardening or the most strenuous activity you do around the home?***

2.5. Scoring system change

The original FJS scored each answer on a range from 1 to 5. This was added up and converted to a percentage to give an overall score (20–100%). The higher the percentage the better the outcome. The new, Modified FJS (MFJS) is now scored on a range from 0 to 4. This means it gives a more easily understood percentage range of 0–100%.

These changes created a Modified Forgotten Joint Score (MFJS) with an aim to maintain the FJS's increased discriminatory power while ameliorating the large amount of missing data seen in the pilot study.

3. Methods

The study population, to assess the reliability and validity of the MFJS, consisted of 400 consecutive patients who had received either a THR or TKR in a university teaching hospital. 200 patients underwent THR and 200 underwent a TKR. Patients were between 1–2 years post-arthroplasty. These patients were sent out the following postal