"Higher forgotten joint score for fixed-bearing than for mobile-bearing total knee arthroplasty"

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Abstract

PURPOSE: To compare the postoperative subjective outcome for fixed- and mobile-bearing total knee arthroplasty (TKA) by using the forgotten joint score (FJS-12), a new patient-reported outcome score of 12 questions evaluating the potential of a patient to forget about his operated joint. The hypothesis of this study was that a mobile-bearing TKA would have a higher level of forgotten joint than a fixed-bearing model of the same design. METHODS: A retrospective cohort study was conducted in 100 patients who underwent TKA at least 1 year [mean (SD) 18 (5) months] before with either a fixed-bearing (N = 50) or a mobile-bearing (N = 50) TKA from the same implant family. Clinical outcome was evaluated with the knee society score and patient-reported outcome with the forgotten joint score. RESULTS: No difference was observed for demographics in between both study groups. The mean (SD) postoperative FJS-12 for the fixed-bearing TKA was 71 (28) compared to a mean (SD) of 56.5 (30) for the mo...

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Higher forgotten joint score for fixed-bearing than for mobile-bearing total knee arthroplasty

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Abstract
Purpose To compare the postoperative subjective outcome for fixed- and mobile-bearing total knee arthroplasty (TKA) by using the forgotten joint score (FJS-12), a new patient-reported outcome score of 12 questions evaluating the potential of a patient to forget about his operated joint. The hypothesis of this study was that a mobile-bearing TKA would have a higher level of forgotten joint than a fixed-bearing model of the same design.
Methods A retrospective cohort study was conducted in 100 patients who underwent TKA at least 1 year [mean (SD) 18 (5) months] before with either a fixed-bearing ($N = 50$) or a mobile-bearing ($N = 50$) TKA from the same implant family. Clinical outcome was evaluated with the knee society score and patient-reported outcome with the forgotten joint score.
Results No difference was observed for demographics in between both study groups. The mean (SD) postoperative FJS-12 for the fixed-bearing TKA was 71 (28) compared to a mean (SD) of 56.5 (30) for the mobile-bearing TKA.
Discussion The clinical relevance of the present retrospective study is that it shows for the first time a significant difference between fixed- and mobile-bearing TKA by using a new patient-reported outcome score. The hypothesis that mobile-bearing TKA would have a higher degree of forgotten joint than a fixed-bearing TKA could not be confirmed. A level I prospective study should be set up to objectivise these findings.
Level of evidence IV.

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Keywords Total knee arthroplasty · Forgotten joint score · Mobile bearing · Fixed bearing

Introduction

Approximately 30 % of patients believe that their expectations about joint replacement surgery were not fully achieved [7, 26]. One of the key expectations, and therefore possible goals of the surgery, is the ability of patients to forget about their joint replacement in everyday life. When this ultimate result is obtained, this can lead to the greatest possible patient satisfaction [3, 6, 23, 28].

Mobile-bearing total knee arthroplasty (TKA) has been cited to be more prone to obtain a "forgotten joint" as a postoperative result [4]. However, to the best of our knowledge, since there was not a "forgotten joint" score before, this statement has not been evaluated objectively previously [3, 12]. Most of the previous studies performed to compare fixed- and mobile-bearing TKA could not demonstrate any difference utilizing conventional outcome scores [1, 16, 19, 30].

There are a variety of tools for assessing functional outcome after arthroplasty [2, 28]. Surgeons' ratings and patient-reported outcome (PRO) tools should be combined to reduce surgeon bias in the outcome evaluation [9, 10, 14, 24]. However, many PRO scores have a limited ability to differentiate between patients with good and excellent outcomes [3, 26] or to capture subtle differences in patient satisfaction between different designs or implantation techniques [17].

The "Forgotten Joint" Score (FJS-12) (Table 1) is a recently published PRO scale that assesses joint awareness in hips and knees during various activities of daily living (ADL) following joint replacement [3, 28]. The FJS-12 has

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Table 1 Forgotten joint score (FJS-12)

Questions	Never	Almost never	Seldom	Sometimes	Mostly
Are you aware of your artificial joint …					
1. …in bed at night?	0 points	1 point	2 points	3 points	4 points
2. …when you are sitting on a chair for more than 1 h?					
3. …when you are walking more than 15 min?					
4. … when you are taking a bath/shower?					
5. …when you are travelling in a car?					
6. … when you are climbing stairs?					
7. … when you are walking on uneven ground?					
8. … when you are standing up from a low-sitting position?					
9. …when you are standing for long periods of time?					
10. … when you are doing housework or gardening?					
11. … when you are taking a walk/hiking?					
12. … when you are doing your favorite sport?					

All responses are summed and then divided by the number of completed items. This mean value is multiplied by 25 and then subtracted from 100 to evaluate how high the score is with 100 being the maximal and 0 the minimal score

been used to evaluate total hip arthroplasty (THA), total knee arthroplasty (TKA), unicompartmental arthroplasty, and patellofemoral arthroplasty, separately and in comparison with each other [28]. In the index study, introducing the FJS-12, Behrend et al. [3] observed a lower postoperative score for TKA than for THA [3, 6].

The clinical relevance of this study was that with the availability of the FJS-12 score, it would be possible for the first time to evaluate whether subtle subjective differences exist in favour of a mobile-bearing design and whether it would lead to a higher level of forgetting the operated knee than in a fixed-bearing knee design.

The hypothesis of this study was that a mobile-bearing TKA would have a higher forgotten joint score (FJS-12) than the same design of TKA but with a fixed-bearing liner.

Materials and methods

One hundred patients with primary knee osteoarthritis (OA) who underwent at least one year (mean (SD) follow-up; 18 (5) months) before the study either a fixed-bearing (FB) TKA ($N = 50$) (Vanguard PS, Biomet, Warsaw, US) or a mobile-bearing (MB) TKA ($N = 50$) (ROtative Concave Convex (ROCC) Vanguard, Biomet, Warsaw, US) were included in this retrospective cohort study. Exclusion criteria were any prior open surgery to the knee except meniscectomy, history of infection or atypical chronic pain syndromes, fibromyalgia, diabetic neuropathy, and the inability to understand the French language. One surgeon (ET) performed all fixed-bearing surgeries and another surgeon (DZ) all mobile-bearing surgeries each in their own hospital.

Questionnaires were presented either at the outpatient clinic when patients came back for their follow-up, with a research nurse explaining to the patients how to complete these and making herself available for any questions thereafter or were send to patients by mail with an explanation letter and a contact phone number in case of questions. Patients received a reminder phone call if no reply was received within 1 month. The knee society score (KSS) was used as a reference for the quality of the surgical treatment. The surgeon's part from the KSS was retrieved from the surgical notes at latest follow-up, and the PRO part was included as a separate questionnaire for the patients. Patients with a KSS under 90 were excluded from the study. The research nurse, who was blinded for the type of implant and calculated the different scores, collected all results. The number of respondents with the lowest possible score ("floor") or the highest possible score ("ceiling") was determined. Unacceptable ceiling or floor effects are considered to be present if more than 15 % of the respondents achieve the highest or lowest score [27].

Sociodemographic data such as gender, age, BMI, and laterality of arthritis were collected.

Outcome measures

KSS

The KSS is a widely used clinician-reported outcome score. The clinical part (knee score) covers pain, range of movement, alignment, and stability. The functional part (function score) covers the patient's mobility (walking distance and stairs) and the use of walking aids. The KSS ranges from 0 to 100 points with higher scores indicating less severe impairment [13].

FJS-12

The FJS-12 [3] was recently developed and assesses patients' awareness of their knee joint during various ADL. The instrument was developed with the consideration that joint awareness is a very important and a highly discriminative outcome parameter, especially in patients with good-to-excellent joint function [11]. The FJS-12 uses a 5-point Likert response format, consisting of 12 equally weighted questions with the raw score transformed to range from 0 to 100 points. High scores indicate good outcome (i.e. a high degree of being able to forget about the affected joint in daily life). In its validation study, the FJS-12 showed a low ceiling effect and high internal consistency (Cronbach $\alpha = 0.95$) [3]. For the current study, the cross-validated French version of the FJS-12 was used [28].

All patients provided informed consent to participate in this study, and ethical approval was obtained for a retrospective analysis of the collected data from the Ethics Committee of the Saint Luc University Hospital, Brussels, Belgium (CEBHF 2013/04MAR/072).

Statistical analysis

Sample characteristics are presented as numbers, percentages, means, standard deviations (SD), and ranges. Ceiling or floor effects of the scales are described as percentages of patients showing the best or worst possible score on a scale. The covariates BMI and age were categorized as ≤25, 25–30, and >30 kg/m^2; and ≤60, 60–70, and >70 years, respectively.

To determine significant differences between baseline variables, the Pearson Chi-square test was used for categorical variables and the Student's *t* test for continuous variables. The Shapiro–Wilks test was used for continuous data to test for violations of the normality assumption. To assess robustness of our findings, association between the postoperative FJS-12 and implant design (FB vs. MB), sex, age, and BMI were assessed with a multiple linear model. Main terms of the aforementioned covariates were left in the model with the aim to control for potential confounding.

Statistical analysis was conducted with SPSS 18 Statistical Software (SPSS Inc, Chicago, IL, USA), and significance was set at $p < 0.05$. Based on previous publications about the FJS-12 [3, 28], two study groups of 50 patients were considered significant.

Results

No significant differences were found for demographic parameters in between both study groups (Table 2). No difference was observed for KS scores. The mean (SD) FJS-12 score for the fixed bearing was 71 (28) compared to 56.5 (30) for the mobile bearing (Table 3).

Table 2 Demographic data for both study groups

	Fixed bearing	Mobile bearing	*p*
Mean (SD) age (years)	69 (10)	68.5 (8)	n.s.
Sex (M/F)	13/37	16/34	n.s.
Mean (SD) BMI (kg/m^2)	29.5 (6)	30 (5.5)	n.s.
Laterality (R/L)	30/20	25/25	n.s.

Table 3 Results of knee society score (KSS) and forgotten joint score (FJS-12)

	Fixed	Mobile	*p*
Mean (SD) KSS	90 (5)	90 (5)	n.s.
Mean (SD) FJS-12	71 (28)	56.5 (30)	<0.05

On average, the answer "mostly" was provided by the fixed-bearing patients, a mean (SD) of 3 (3) times and a mean (SD) of 4 (3) times for mobile-bearing TKA (p = n.s.). The answer "never" was provided a mean (SD) of 6 (4) times by the fixed-bearing patients and a mean (SD) of 4.5 (3) times for mobile-bearing TKAs, ($p = 0.036$).

The postoperative floor effect was found in 2 % in fixed- and 6 % in mobile-bearing TKA, and the postoperative ceiling effect was 14 % for fixed- and 14 % for mobile-bearing TKA.

The results for the covariates are summarized in Table 4. No statistically significant differences were observed for any of the covariates. Adjusted for age, gender, and BMI, the difference in postoperative FJS-12 score was 16 points, in favour of the FB design.

Discussion

The most important finding from the current study is that at a mean (SD) of 18 (5) months the postoperative FJS-12 score was higher for fixed- than for mobile-bearing knees, thereby not confirming the study hypothesis.

Several authors attempted to compare fixed- and mobile-bearing TKA with conventional scores such as the WOMAC, Oxford, KSS, and VA Scores (VAS) and found no difference in clinical outcomes [1, 16, 20, 30]. A joint-specific score that is more responsive such as the FJS-12 is a more discerning measure of patient outcome observing for the first time a difference between these two treatment options [11].

Behrend et al. [3] found in their initial study of the FJS-12 a mean value of 50 as a postoperative value for the FJS-12 after LCS TKA (Depuy, Johnson & Johnson), which is

Table 4 Covariate analysis

	Coefficient	95 % CI	*p* value
Fixed bearing	71.1	63.0–81	
Mobile bearing	56.5	46.5–66	<0.001
Age			
≤60 years	(Reference group)		
60–70 years	12.5	−4.9–29.8	n.s.
>70 years	1.7	−15.3–18.7	n.s.
BMI			
≤25 kg^{-2}	(Reference group)		
25–30 kg/m^2	11	−5.5–27.2	n.s.
>30 kg/m^2	2.3	−13.9–18.5	n.s.
Sex			
Female	(Reference group)		
Male	−5.4	−18.5–8.2	n.s.

CI confidence interval

also a mobile-bearing design. In the current study, a mean value of 56.5 was calculated for the Vanguard mobile-bearing TKA. The advantage of joint-specific scores is that they show the highest responsiveness in terms of effect size [12]. Both values of the mobile-bearing designs were inferior to the results found in this study for the fixed-bearing Vanguard, similar to earlier published FJS-12 scores on this implant [28].

This observed difference in the results between fixed and mobile bearing could potentially be explained by a more anterior contact point that was observed in mobile-bearing TKA [30]. Van Stralen et al. [30] could, however, not observe differences in clinical outcomes when the KSS and VAS were used to evaluate the outcome. In this study, no differences were observed with the KSS either, but significant differences were observed for the FJS-12.

There were no significant differences observed for sex, age, or BMI with the FJS-12. This indicates that the FJS-12 is optimally adapted to compensate for age, sex, and obesity covariates. Lizaur-Utrilla et al. [18] found an advantage for mobile-bearing TKA in older patients because they obtained earlier postoperative flexion. With regard to age, as patients' activity levels naturally decrease with age, the awareness of the joint during the remaining activities of everyday life may also alter. Furthermore, in an older population, health problems unrelated to the artificial joint often overshadow minor joint-related impairments [3, 15, 25, 28].

The PRO with the FJS-12 found, respectively, in the fixed-bearing group a 2 % floor and 14 % ceiling effect and for the mobile bearing a 6 % floor effect and a 14 % ceiling effect. It was also observed that 60 % of the patients did not answer the question about whether they participate in sporting activities and 56 % did not answer the hiking question in both groups. Therefore, we cannot conclude that mobile-bearing TKA would allow people to engage more often in sporting activities [21].

This study has several limitations. First of all, it is a retrospective study with questionnaires sent to patients and KS Scores established on the basis of surgeon's notes. However, the KSS was only used to exclude patients with an insufficient functional result and should be considered as a screening score to identify the study population. All patients filled in the FJS-12 scores, without the presence of the surgeon and at a satisfactory distance [18 (5) months] of their surgery. A second limitation is that the FJS-12 score is a recent score that has a limited scientific basis compared to older more acquainted scores. This study wanted to contribute to a broader basis of available studies on the FJS-12 and observed an interesting finding that question 11 and 12 might be less adequate in an elderly arthroplasty population.

The main limitation of this study is that each type of bearing was implanted by one of both surgeons and that this was not a single-surgeon study. Obviously, even minor differences in anaesthetic or surgical technique could make a difference as well as patient selection and social class of the study population (2 different geographic areas of the country). However, the advantage of this study protocol was that the surgeon who had most experience with their type of design performed each type of implant. Standardization was introduced by using the same surgical approach, the same mechanical alignment philosophy, the same gap balancing and ligament release technique, and finally the same type of cemented implant (Vanguard, Biomet). Additional research is required on this subject and a single surgeon, with experience in both designs, should set up a prospective randomized controlled trial. The data found in this study can be used to calculate power to have two representative groups for the RCT.

The clinical importance of the current study is that the mobile bearing shows inferior results compared to a fixed-bearing design of the same TKA family as measured with a unique new patient-reported outcome score. Since the price of a mobile-bearing implant is superior to a fixed bearing and it presents intrinsic complications such as bearing dislocation, it should show its superiority either by better clinical outcomes or by better long-term survival [8, 22, 29, 31]. These results will be available 20 years after introduction of the most current mobile-bearing knee designs [5, 19].

The inclusion of the FJS-12 as an instrument to evaluate outcomes after knee replacement is strongly proposed. In general, one is not aware of a healthy joint during the usual ADL and it can therefore be regarded as "forgotten"; the approximation of this ultimate result and this new score can now evaluate the effect size of a treatment if this score will be utilized preoperatively too.

Conclusion

In this retrospective bi-centre study where fixed-bearing TKA was compared with mobile-bearing TKA from the same implant family, a superior clinical outcome was observed for the fixed-bearing design when measured with the FJS-12 score.

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