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Can Knees be Forgotten Two Years After Total Knee Arthroplasty?

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Abstract

Background: There have been multiple ways to measure outcomes post total knee arthroplasty. Ultimate goal is to replicate a natural joint to allow patients to perform most activities of daily living and give high satisfaction rates. Patient reported outcome measures (PROM) like Forgotten Joint Score (FJS), Oxford Knee Score (OKS)and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) have been validated and used for evaluation of total knee arthroplasty (TKA) patients. FJS helps to evaluate how natural a prosthesis feels post surgery. Our primary aim was to study how natural a joint felt or was forgotten two years after surgery and how FJS correlates with OKS and WOMAC scores. The secondary objective was to study the factors affecting FJS-12.

Materials and Methods: We evaluated 254 total knee arthroplasty with minimum two years post TKA. All the patients who were at least two years post operative, completed FJS questionnaire where scores are ranged from 0-100; OKS questionnaire where scores are ranged between 0-48; Short – form WOMAC questionnaire where scores are ranged between 0-28. Correlation analysis was performed for FJS with OKS and short - form WOMAC scores.

Results: 254 patients with mean age of 65.01 years of which 83 males and 171 females were evaluated with minimum of 24 months follow up and average follow-up of 30.85 months. Average FJS, OKS and SF WOMAC were 77.24, 38.75 & 79.97 respectively. FJS showed good correlation with OKS and SF WOMAC scores.

Conclusion: FJS is an easy and equally effective outcome measure, which is valid and reliable like the other common well know measures like OKS and WOMAC. Patients experience a marked improvement in the FJS over the first two years. Patients in our series had good outcomes who had more natural feel of knees or a feeling of "forgotten knees" in their day to day activity after two years of surgery.

Background

Patients with end stage arthritis are best treated with total joint arthroplasty which help them achieve pain free, good functioning and satisfactory joints [1-3]. Some studies show that almost 40% patients are not satisfied post arthroplasty because their expectations were not met [4,5]. There are many clinical scoring systems available to assess outcomes post arthroplasty, these can be either patient or clinician based. Clinician based systems may not be able to reflect patient's perspective though they may show good clinical outcomes.

Hence patient reported outcome measures (PROMs) have been used successfully to evaluate pain and function of a joint. Most of the PROMs have been validated and used extensively but there is no 'gold standard' tool to assess outcomes post TKA [6]. These PROMs may be restricted by ceiling effect and may not be able to differentiate between good and excellent outcomes [7,8].

Keywords*: FJS, OKS, WOMAC, Patient reported outcome measure, Total knee arthroplasty*
Level of Evidence*: III*

From patient perspective the ability to forget their replaced joint during their day to day activities would be an ideal outcome. More natural a joint feel more satisfied a patient would be [9]. Forgotten Joint Score (FJS-12) was developed in 2012 which focused on patient's awareness of their joint arthroplasty during their daily and recreational activities [9]. FJS – 12 has been used to evaluate total hip, total knee, unicompartmental and patellofemoral arthroplasty; it has also been used to compare fixed vs mobile-bearing designs [9-11].

The primary objective of the study was to see how natural joint felt after two years of arthroplasty using FJS-12, to compare FJS -12 with other most common PROMs Oxford Knee Score (OKS) and Short – Form Western Ontario and McMaster Universities Osteoarthritis Index (SF WOMAC) and correlation between the scores. The secondary objective was to study if pre-operative factors affect FJS – 12.

Materials and Method

In this cross-sectional questionnaire based study, we selected 254 patients who had under gone unilateral primary total knee arthroplasty at our institution previously. Only patients who were at least 24 months post surgery were included. Patients who underwent revision arthroplasty, previous fractures on the same side or having prosthetic joint infections were excluded from the study. These patients were asked to fill out OKS, SF WOMAC and FJS -12 questionnaires either during follow up in out-patient or over telephonic interview. Patients who did not complete the questionnaire or failed to answer the questions were not part of the final count. Other demographic data like age, gender, side, time since surgery, body mass index (BMI), type of deformity were also collected. Ethical approval was obtained.

Forgotten Joint Score (FJS-12)

The FJS-12 (Table 1) is a PRO scale used in the recent times to assess patient's awareness of their hip/knees during their activities of daily living [9]. Here the patient rates 12 equally weighted questions on scale of 0-4. The total score is divided by the number of questions completed (unanswered questions/ values are not included in the completed items), this mean value is multiplied by 25 to get a total range between 0 and 100. This score is subtracted from 100 to change the direction of the final score where higher score indicates higher degree of "forgetting the joint". If more than four questions were unanswered then this score discarded [9]. It has showed low ceiling effect and high internal consistency in its validation study [9].

Table 1: Questions included in the FJS questionnaire

Are you aware of your artificial knee … (Rate on scale of 0-4, never to all the time)	
1	in bed at night?
2	when sitting on a chair for more than one hour?
3	when you are walking for more than 15 minutes?
4	when taking a bath/shower?
5	when traveling in a car?
6	when climbing stairs?
7	when walking on uneven ground?
8	when standing up from a low-sitting position?
9	when standing for long periods of time?
10	when doing housework or gardening?
11	when taking a walk or hiking?
12	when doing your favorite sport?

Short-Form Western Ontario and McMaster Universities Osteoarthritis Index (SF- WOMAC)

WOMAC is widely used PROM for lower limb OA [12]. It has been extensively tested for validity, reliability and responsiveness in patients undergoing joint arthroplasty [12-15]. The original score uses five-point Likert response categories consists of 24 questions covering three categories: pain (five questions), stiffness (two questions), and function (17 questions). We have used a reduced version of WOMAC, the short-form WOMAC function scale (Table 2) developed by Whitehouse et al which has shown to be valid, responsive, reliable as well as practical [16-17]. Short questionnaires result in better patient compliance and response rates thus improving the quality of response [18-20]. Short form WOMAC uses seven of the 17 function scale (ascending stairs, rising from sitting, walking on the flat, getting in or out of a car, putting on socks, rising from bed, and sitting) scores are given between 0-4, range totalling to 0-28, and then transformed to a 0-100 scale, worst to best [21]. If the patient failed to answer

Table 2: Questions included in the SF-WOMAC questionnaire

Degree of difficulty in performing following activities … (Rate on scale of 0-4, difficult to no difficulty at all)	
1	when ascending stairs?
2	when rising from sitting?
3	when getting in/out of car?
4	when walking on flat surface?
5	when rising from bed?
6	when putting socks?
7	when sitting?

more than equal to three questions the response was invalidated, for up to two missing values, mean of remaining items were substituted for missing values [21].

Oxford Knee Score (OKS)

OKS developed in 1998, is knee specific questionnaire which contains 12 items, five for pain and seven for function [22]. In an updated scoring method (Table 3) each item is scored between 0-4 (worst to best), totalling between 0-48 (higher score represents better function and less pain) [23]. In case of missing response the scores are substituted with mean of the remaining responses, if more than two responses are missing then the total score is discarded [22]. This score has been validated in many studies and widely used in arthroplasty research [24-26].

Table 3: Questions included in the OKS questionnaire

Pain / discomfort /trouble/ duration before being symptomatic / frequency of pain during activities (Rate on scale of 0-4, worst to best)	
1	Pain in knee?
2	Trouble washing of drying yourself?
3	Trouble getting in and out of car/public transport?
4	How long can you walk before pain becomes severe?
5	Pain while getting up from chair?
6	Limp while walking?
7	Difficulty in kneeling down and getting up again?
8	Pain in knee at bed in night?
9	Pain interfering with usual work including house work?
10	Felt if knee might give away?
11	Doing household shopping?
12	Walking down one flight of stairs?

Statistical Analysis

Sample characteristics are given as means, standard deviations.

(SDs), ranges, proportions and frequencies.

Regression analysis was performed first then using analysis of variance (ANOVA) and Pearson's correlation, different variables and correlation between them were studied. Based on patient response two groups were made one who complaint of knee pain and others who did not, similar statistical analysis were performed on patients with knee pain and correlation between these groups were studied again using Welch t-Test.

The confidence level for rejecting null hypotheses was set at 95% ($P < .05$).

Results

In this study total of 254 patients who underwent primary TKA were studied. Of these 171 (67.32%) were females, 83 (32.68%) were males. Patient characteristics are tabulated in (Table 4). Mean age was 65.01 (28-91) years. All patients in the study had minimum follow up of 24 months with average follow up of 30.85 (24-38) months. Of the total knees 55.12% were left sided and 44.88% were right, in our group 10.63% of patients had valgus knees who underwent TKA.

Table 4: Patient Characteristics at baseline (n = 254)

Age in years	Mean (SD)	65.01 (7.74)
	Range	28-91
Sex	Men	83 (32.68%)
	Women	171 (67.32%)
Side	Left	140 (55.12%)
	Right	114 (44.88%)
BMI in kg/m2	Mean (SD)	29.74 (4.83)
	Range	18-52
Duration post surgery in months	Mean (SD)	30.85 (3.05)
	Range	24-38

Patients who failed to return the questionnaire or did not answer minimum number of questions were not part of the total final count.

Average FJS-12 was found to be 77.24 (SD-9.06, range 45-93). Mean OKS was 38.75 (SD-5.44, range 26-48) compared to average SF-WOMAC of 79.97 (SD- 8.43, range 60-96).

Using Pearson's correlation we found positive correlation between FJS-12, SF-WOMAC and OKS. Correlation between FJS-12 and SF-WOMAC; $R=0.68$ ($p<0.0001$) (Figure 1). Between FJS-12 and OKS; $R=0.87$ ($p<0.0001$) (Figure 2). Finally SF-WOMAC and OKS correlate as $R=0.69$ ($p<0.0001$) (Figure 3).

Ceiling effect was defined as when patient reached a score within 15% of maximum achievable score, for FJS-12 and SF- WOMAC (>= 85) and for OKS (>=41). In our study we found ceiling effect of 24.02% for FJS-12 compared to 32.68% and 36.22% for SF-WOMAC and OKS respectively.

Patients were divided into two groups, one who had pain free knees and another who complaint of constant and chronic knee pain. We had 25(9.84%) in the painful knee group. Using Welch t-Test all the scores were significantly lower in painful group ($p<0.0001$). Average FJS-12, SF-WOMAC, OKS scores were 59.80 (SD-6.56, range 45-70), 70.12 (SD-6.31, range 60-85), 30.84 (SD-2.23, range

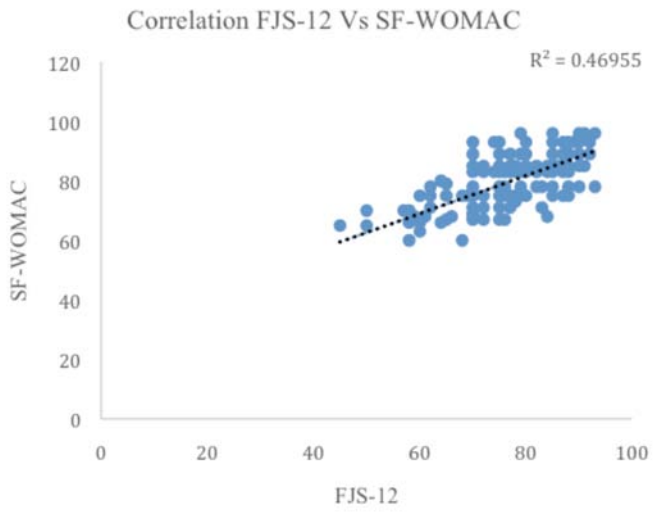

Figure 1: FJS-12 Vs SF-WOMAC

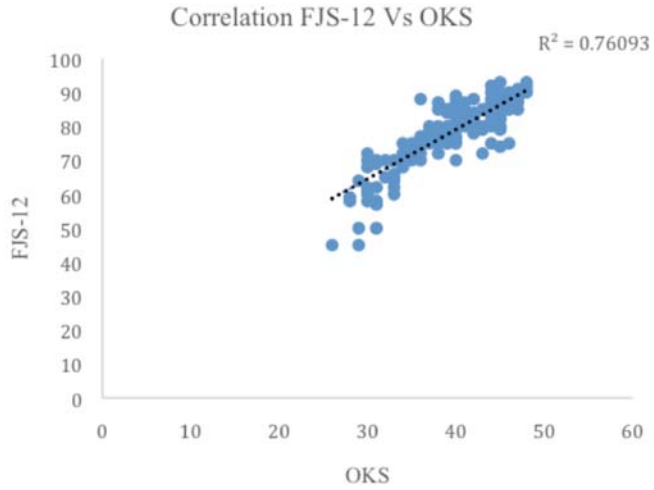

Figure 2: FJS-12 Vs OKS

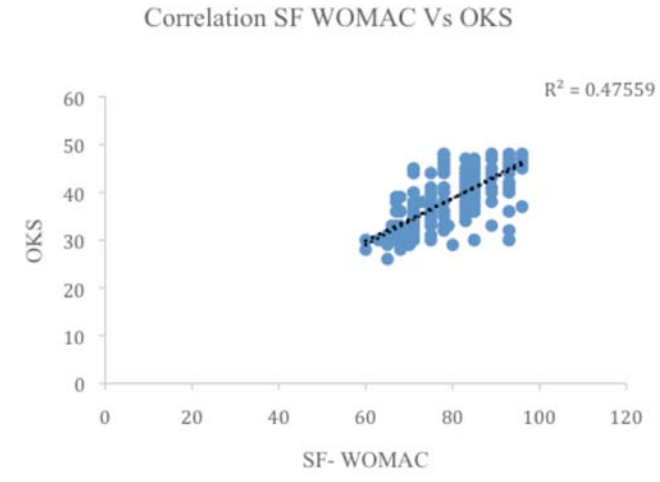

Figure 3: SF-WOMAC Vs OKS

26-26) respectively (Table 5). In these groups it was found that BMI was the only factor which had significant difference, patients with painful knees had mean BMI of 33.97 compared to 29.26 (p <0.001).

Table 5: Scores compared in painful and pain free knees

	Overall Mean (SD)	Mean in pain free knees (SD)	Mean in painful knees (SD)	P Value
FJS-12	77.24 (9.06)	79.14 (7.04)	59.80 (6.56)	<0.0001
SF-WOMAC	79.97 (8.43)	81.04 (7.93)	70.12 (6.31)	<0.0001
OKS	38.75 (5.44)	39.62 (4.98)	30.84 (2.23)	<0.0001

Factors like age, sex, BMI and time since surgery were studied using multiple regression and ANNOVA to see if they have any effect on the scores. There was no effect of age, BMI, sex or time since surgery on either FJS-12, SF-WOMAC or OKS. Same was the case in group with painful knees, except BMI which showed significant result with FJS-12 (p = 0.048) (Table 6). Which meant patients with higher BMI and painful knees are likely to have poor FJS-12 scores.

Table 6: P values for correlation between different factors and scores overall and in painful knees

	FJS-12	SF-WOMAC	OKS
Age	0.24	0.32	0.56
Sex	0.70	0.18	0.75
BMI	0.17	0.75	0.64
Time since surgery	0.79	0.82	0.41
In Painful knees			
Age	0.53	0.56	0.92
Sex	0.72	0.92	0.46
BMI	0.048	0.39	0.84
Time since surgery	0.48	0.65	0.95

Discussion

Currently there is no universally accepted measurement to define ultimate success of total knee arthroplasty. PROM's have become main assessment tools after joint surgery, any PROM should be reliable, valid and responsive [27]. Ideally ultimate goal of surgery would be the ability of the patient to "forget" that they have had a joint arthroplasty.

A "forgotten joint" is hard to achieve. In a study even healthy control group with no history of knee problems failed to achieve the maximum score of 100 and had lower mean values [9]. The scale to be variable and adequate even in these patients. This is the reason why FJS-12 can differentiate very well in high functioning knees of joint arthroplasty patients. FJS-12 has almost perfect test and retest reliability with overall interclass correlation of 0.97 [28]. Literature has shown OKS too has high level of reliability with an interclass correlation of 0.85 [29]. SF-WOMAC which we have used in this study has also been validated multiple times [30].

Our study is helpful because not many studies have measured FJS beyond two years, only one study has been done to asses FJS over five years post surgery [31]. Multiple studies have been done to assess FJS between 1-2 years after surgery [10,32]. Studies showing FJS-12 between 1-2 years of surgery have range between 56.3 - 73.2 [9,10,32]. In the study by Carlson et al. found that patients experienced marked improvement on FJS in first year post knee arthroplasty, minimal improvement in second and third year, after four years there was decline in the score. The scores improved from average of 39.3 at first month to 72.5 at one year, remained at 76.4 and 75.1 at second and third year and declined to 68.6 and 64.4 at the end of four and five years respectively [31]. We had average FJS of 77.24 with average follow up of 30.85 months which is similar to findings by Carlson et al.

FJS have also been used to assess different types of implants or designs. In a study where PCL retaining implants were compared with PCL substituting designs with minimum follow up of two and a half years, FJS in both the groups were similar at 94.3 and 92.5 in PCL retaining and substituting group [33]. These values seem higher and exceeds reported FJS scores in healthy adults with no knee issues [9]. When mobile and fixed bearing TKSs were compared with follow up of three years, scores were found to be 77.2 and 61.9, which are comparable to our findings [34].

Oxford scores were developed keeping in mind pre-operative population to assess symptoms at a particular time point, whereas FJS reflects symptoms and changes in post-operative patients [22]. That is the reason why FJS-12 has high floor effect if assessed pre operatively but OKS does not suffer with the same problem, but FJS has lower ceiling effect when compared to OKS post operatively [35]. Ceiling effect for FJS in our study was found to be 24.02 %, for SF-Womac 32.68% and OKS – 36.22%. In the validation study by Hamilton et al. ceiling effect for FJS at one year was 12.6% and 25.5% for OKS [35]. Giesinger et al. while comparing the responsiveness of outcomes measures for TKA found ceiling effect of 33% for FJS and 39.6% for total WOMAC for follow up between 1-2 years [36]. Ceiling effect seems higher in our study probably because we had a longer average follow up compared to the other studies. Also we defined ceiling effect as scores within 15% of maximum achievable score, Giesinger et al defined it as percentage of patients with highest possible score, Hamilton et al defined scores within 10% of maximum score [35,36].

Hamilton et al. found high correlation between FJS-12 and OKS with r=0.85 compared to our 0.76 [35]. Thompson et al. found positive correlation between FJS-12 and total normalised WOMAC score with r- 0.70 compared to our 0.46, where we used the short version of WOMAC [37].

A study has found BMI, age and gender to be the three preoperative patient related factors that can predict FJS-12, but we did not find any effect of the three on overall scores [38]. On the other hand patients with higher BMI were prone to have painful knees and these patients showed lower FJS-12 scores. This shows the importance of weight reduction pre operatively for better results.

Minimal detectable change (MDC) gives the ability of questionnaire to detect changes over time, Thomsen et al. calculated MDC of 24 in their study which indicated that FJS is less suitable for repeated assessments of a patient during long term follow-up, as only difference of above 24 points can be detected [39]. With high MDC and decline in FJS scores in long term as discussed above implies usefulness of FJS-12 beyond 3 years is questionable and needs further evaluation [31].

Weakness of this study was the cross sectional design where we did not have the pre-operative values or the scores at different time intervals during follow up which would have helped us study the change in the scores and outcome. There are very few studies which have studied pre-operative FJS and compared the change post operatively, to our knowledge there are only two studies in this regard [35,40]. FJS has a problem with recurring incomplete data leading to omission of patients. Questions which created confusion and most commonly not answered were, awareness while playing favourite sport or squatting, awareness while talking walks was similar to awareness after walking for more than 15 minutes. Robinson et al. have proposed a modified FJS which addresses this issue and is more relevant with higher discriminatory power, this could be an ideal substitute [41].

Conclusion

FJS is a simple, effective, valid, reliable PROM with

low ceiling effect and pertinent patient perspective. It shows good correlation to other commonly used PROMs like WOMAC and OKS. Patients in our series had good FJS of 77.24 after two years of arthroplasty with sense of having and near natural knee joint while performing day to day activities. BMI is an important factor determining FJS in painful knees, thus it becomes important to educate patients the need for weight loss and setting their expectations accordingly.

We think the best use of FJS is up to three years beyond which the utility raises doubts. High MDC suggests that it is not for repetitive long term use. On the other hand it is seen that there may be a decline in FJS after three years of arthroplasty. To improve compliance and response rates use of modified FJS could be beneficial. There is limited data with respect to long term follow ups, comparing scores at multiple post op intervals as well as pre op score and utility of modified FJS, in this regard further well designed studies will give a clearer picture.

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AUTHOR DISCLOSURES

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