

# Indications for knee arthroplasty have remained consistent over time

Morten G. Thomsen, Henrik Husted, Kristian S. Otte, Thue Ørsnes & Anders Troelsen

## ABSTRACT

**INTRODUCTION:** Between 2004 and 2009, the incidence of primary total knee arthroplasty (TKA) in Denmark has almost doubled. It has been speculated that this increase may be a result of patients being operated on weaker indications. The purpose of this study was to compare preoperative degrees of osteoarthritis and health-related quality of life (QoL) in patients receiving primary TKA in 2004 and 2009.

**MATERIAL AND METHODS:** We identified 154 and 369 primary TKAs inserted at our institution in 2004 and 2009, respectively. Patients had been invited to complete the Short Form (SF)-36 questionnaire preoperatively. Two groups of patients that were representative with regard to age and gender were randomly sampled and compared ( $n = 44$  in 2004 versus  $n = 106$  in 2009). The Kellgren-Lawrence (K-L) grade of osteoarthritis was assessed on preoperative radiographs in all patients.

**RESULTS:** We found no statistically significant differences in gender distribution or mean age at surgery. We reached K-L grades of 3-4 in 52.4% and 49.6% in 2004 and 2009, respectively ( $p = 0.57$ ). The preoperative mean SF-36 physical component scores were 32.6 and 33.7, respectively ( $p = 0.44$ ). The preoperative mean SF-36 mental component scores were 43.0 in 2004 and 49.3 (i.e. 6.3 points higher) in 2009 ( $p = 0.003$ ).

**CONCLUSION:** Preoperative degrees of osteoarthritis and physical health-related QoL did not change from 2004 to 2009. Thus, it seems that these components of operative indications have not weakened. The increased preoperative SF-36 mental component score of these patients may have had a positive effect on postoperative outcomes.

**FUNDING:** not relevant.

**TRIAL REGISTRATION:** not relevant.

The primary goals of joint arthroplasty in the treatment of arthritic disease are pain relief and restoration of function and health-related quality of life (QoL). The indications for primary total knee arthroplasty (TKA) are pain with impairment of daily function, deteriorating health-related QoL and radiological signs of osteoarthritis. Furthermore, analgesic treatment, physical training and weight loss should be considered before settling on surgical treatment.

Within the past decade, a considerable increase



FIGURE 1

Anteroposterior radiograph showing the left knee of a standing patient one year postoperatively. In this case the Cruciate Retaining AGC prosthesis (Biomet).



has been observed in the amount of primary TKAs performed in Denmark [1]. Between 2004 and 2009, the incidence of primary TKA almost doubled from 85 to 163 patients per 100,000 inhabitants per year. Similar increases in incidences have been seen in the rest of Europe, North America and in the South Pacific [2]; and Kurtz et al. projected that the demand for primary TKA would increase by 673% in the USA from 2005 to 2030 [3]. It has been speculated that this increase may be a result of patients being operated on weaker indications in terms of less osteoarthritis and less affection of physical performance or of health-related QoL.

In this retrospective cohort study, we aimed to compare preoperative degrees of osteoarthritis and health-related QoL in patients receiving primary TKA at our institution in 2004 and 2009. A change in these parameters could indicate that patients were being treated on weaker indications.

## ORIGINAL ARTICLE

Department  
of Orthopaedics,  
Hvidovre Hospital

Dan Med J  
2012;59(8):A4492

## MATERIAL AND METHODS

Through database searches, we identified all patients who had undergone primary TKA at Hvidovre Hospital, Denmark, in 2004 and 2009, respectively. The years of 2004 and 2009 were chosen because the number of patients receiving primary TKA in Denmark approximately doubled in this period [1]. The incidence of primary TKA at our institution mirrored the increase in incidence seen in Denmark, 154 patients received primary TKA in 2004 and 369 patients received primary TKA in 2009. The patients had a mean age of 68.1 and 67.6 in 2004 and 2009, respectively ( $p = 0.57$ ); and the gender distribution was 90 female/64 male in 2004 and 223 female/146 male in 2009, i.e. no statistically significant difference ( $p = 0.67$ ). We assume that the two groups had comparable socio-economic conditions prior to surgery as patients came from the same urban region.

Preoperative radiographs of all knees were evaluated with regard to degree of osteoarthritis. This was conducted using the Kellgren-Lawrence (K-L) grading scale, which has previously been validated and has been proven to be highly reproducible when used in the grading of knee osteoarthritis [4]. Anterior-posterior and lateral radiographs of the knees were used (Figure 1). All radiographs were assessed by one orthopedic surgeon who was not blinded to the year in which patients were operated.

Preoperatively, all patients had been invited to complete the Short Form (SF) 36 questionnaire which is a self-administered instrument consisting of 36 questions reviewing the patients' physical and mental health-related QoL. The Danish version of the SF-36 questionnaire has previously been validated [5].

A total of 50 of the patients operated in 2004 and 252 of the patients operated in 2009 completed the SF-36 questionnaire. Of these, an age and gender-matched

sample group of patients from each year was randomly selected, and the SF-36 scores for physical and mental health-related QoL were calculated. The size of the sample groups was based on an a priori sample size calculation with five points in the SF-36 mental or physical component score considered a clinically relevant difference. The 5-point difference was chosen based on a study performed by Angst et al [6] who found that effects larger than 12% of baseline score could be detected as the minimal clinically important difference. Calculations revealed that 44 patients in 2004 and 106 patients in 2009 would be needed to show a statistical significance (80% power and a significance level of 0.05). The two sample groups were representative of the rest of the patients of each year with regard to age and gender (Table 1). A flow diagram showing patients operated with primary TKA and included in the SF-36 analysis in 2004 and 2009 is presented in Figure 2.

Normally distributed data are presented as mean values and ranges, and comparisons were made using a two-sample t-test. Binomial data are presented as proportions or percentages, and comparisons made by Pearson's  $\chi^2$ -test. The level of significance was set at  $p < 0.05$ . For all statistical analysis, the STATA statistical package, version 10.1 (College Station, Tx, USA) was used.

*Trial registration:* not relevant.

## RESULTS

### The Kellgren-Lawrence grade

The K-L grades of patients receiving primary TKA in 2004 and 2009 are presented in Table 2. When comparing the proportion of patients with K-L grades 3-4 in the two groups, i.e. those with severe radiological signs of osteoarthritis, we found no statistically significant differences, with proportions of 52,4% and 49,6% grade 3-4 patients in 2004 and 2009, respectively ( $p = 0.57$ ).

### Short Form 36

We found no statistically significant differences in the SF-36 physical component score when comparing the sample groups of patients in 2004 and 2009. When comparing the mental component scores of the sample groups, however, we found that patients receiving primary TKA in 2009 had a statistically significantly improved mean score compared with patients receiving primary TKA in 2004 (Table 3).

## DISCUSSION

Between 2004 and 2009, the incidence of primary TKA performed in Denmark almost doubled [1]. Similar trends are seen in other countries [2]. It has been speculated that this increase may be the result of pa-

FIGURE 2

Flow diagram showing patients operated with primary total knee arthroplasty (TKA) and included in the Short Form (SF) 36 analysis in 2004 and 2009.

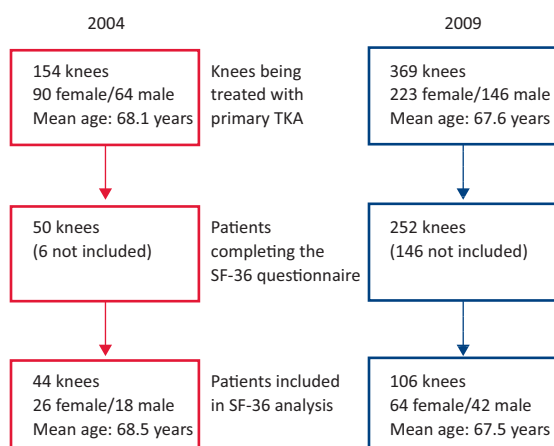




TABLE 1

Demographics of the sample groups versus the rest of the patients for years 2004 and 2009.

	Sample group	Rest	p-value
2004			
Age, mean, years	68.5	67.9	0.76
Female/male, n	26/18	64/46	0.92
2009			
Age, mean, years	67.5	67.6	0.93
Female/male, n	64/42	159/104	0.92



TABLE 2

The Kellgren-Lawrence scores for percentages of patients receiving primary total knee arthroplasty in 2004 and 2009.

K-L score	2004	2009
0	0.0	0.0
1	17.0	14.7
2	30.6	35.7
3	31.3	36.5
4	21.1	13.1

tients being operated on weaker indications. The purpose of this study was to compare preoperative degrees of osteoarthritis and health-related QoL in patients receiving primary TKA in 2004 and 2009 in order to determine if these components of the indications for primary TKA changed in this period.

In our study, we found no statistically significant differences in the age and gender distribution of patients being operated in 2004 and 2009, respectively. The age and gender distribution of our patients are similar to those of other patients undergoing primary TKA in Denmark and in other Scandinavian countries: around 68 years of age with approximately 60% being women [1, 7, 8].

The K-L grades of our patients ranged from 1 to 4 with the majority presenting with K-L grades 2-4. We found no statistically significant difference between the K-L grades of patients operated in 2004 and 2009. Earlier studies have found poor correlation between radiological signs of osteoarthritis and patient symptoms [9, 10], and Meding et al found no association between preoperative radiological signs of osteoarthritis and postoperative outcome [11]. However, it is traditionally perceived that the presence of osteophytes and possible or definite narrowing of the joint space on conventional radiographs (corresponding to K-L grades 2-4) are among the indications for TKA surgery.

The preoperative SF-36 scores of our patients were comparable to the results obtained in similar studies of

health-related QoL before TKA surgery [12-14] and were markedly lower than normative SF-36 scores found in persons aged 65 to 74 in the Danish population (a mean physical component score of 48.4 and a mean mental component score of 58.5) [5]. This is indicative of the negative effects of knee joint osteoarthritis on physical and mental health-related QoL.

Have operative indications for total knee arthroplasty weakened? The indications for primary TKA are pain with impairment of daily function, deteriorating health-related QoL and radiological signs of osteoarthritis. The majority of patients in the present study had radiological signs of osteoarthritis; and results of the SF-36 physical component score revealed significant negative affection of the patients' arthritic disease. Patients with symptoms and radiological signs of osteoarthritis of the knee benefit from treatment with primary TKA in terms of pain relief and increased activity and health-related QoL [15-17]. In this study, we found no signs indicating that the preoperative degrees of osteoarthritis and physical health-related QoL of patients being treated with primary TKA changed between 2004 and 2009. The results do not inarguably support that indications are unaltered; but based on an assessment of radiological signs of osteoarthritis and physical health-related quality of life, it seems that the indications for primary TKA did not deteriorate during the period which was characterized by an increase in the incidence of inserted TKAs.

What is the potential importance of an improved preoperative patient-reported status? Lim et al [18] performed a study comparing preoperative functional status and postoperative outcome in patients undergoing TKA due to osteoarthritis. They found that patients with more severe physical symptoms achieved poorer functional outcomes than patients with mild symptoms. Two other studies performed by Fortin et al and Kennedy et al found similar results with regards to physical function [12, 19]. Becker et al [14] found that patients with higher degrees of physical function and emotional role had a better chance of fulfillment of their preoperative expectations than patients achieving lower scores; and Forsythe et al [20] found that a high degree



TABLE 3

The Short Form 36 scores for the sample groups of patients receiving primary total knee arthroplasty in 2004 and 2009.

	Mean (range)		Difference (95% CI)	p-value
	2004	2009		
Physical component score	32.6 (17.8-45.6)	33.7 (18.7-56.0)	-1.1 (-3.8 to 1.7)	0.44
Mental component score	43.0 (20.5-69.3)	49.3 (28.3-69.7)	-6.3 (-10.5 to -2.1)	0.003

CI = confidence interval.

of pre-operative pain was associated with increased postoperative pain. Based on these studies, it seems that postponing surgery would lead to decreased patient-reported scores in patients with symptoms and radiographic signs of osteoarthritis, which would, in turn, result in a poorer outcome with regard to pain, satisfaction and physical function. In this study, we did not investigate postoperative outcome. But as suggested by literature findings, the increased SF-36 mental component score may yield a better overall outcome.

A weakness of this study is that we were unable to include a knee joint-specific patient-reported outcome measure due to the retrospective setup. Instead, we used the SF-36 questionnaire, which has previously been validated [5] and is considered relevant for evaluating the health-related QoL of patients receiving primary TKA.

In conclusion, we performed a retrospective cohort study in 154 and 369 patients undergoing primary TKA in 2004 and 2009, respectively, investigating preoperative degrees of osteoarthritis and health-related QoL. We found no signs indicating that preoperative degrees of osteoarthritis and physical health-related QoL changed in primary TKA in this period. The increased SF-36 mental component score observed may have yielded better postoperative outcomes. Our results indicate that operative indications related to these parameters have not weakened. Research investigating the reasons for and impact of the dramatic incidence increase in performed TKAs remains forthcoming. Our study investigates only two aspects of operative indications for TKA, and more research is obviously needed. The increased SF-36 mental component score may lead to better postoperative outcomes.

**CORRESPONDENCE:** Morten G. Thomsen, Ortopædkirurgisk Afdeling, Hvidovre Hospital, 2650 Hvidovre, Denmark.  
E-mail: morten@grovethomsen.dk

**ACCEPTED:** 13 June 2012

**CONFLICTS OF INTEREST:** Disclosure forms provided by the authors are available with the full text of this article at [www.danmedj.dk](http://www.danmedj.dk).

#### LITERATURE

1. The Danish Knee Arthroplasty Register and Department of Orthopaedics, Aarhus University Hospital, Denmark.
2. Kurtz SM, Ong KL, Lau E et al. International survey of primary and revision total knee replacement. *Int Orthop* 2011;35:1783-9.
3. Kurtz S, Ong K, Lau E et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *Bone Joint Surg Am* 2007;89:780-5.
4. Günther KP, Scharf HP, Puhl W et al. Reproducibility of radiologic diagnosis in gonarthrosis. *Z Orthop Ihre Grenzgeb* 1997;135:197-202.
5. Bjørner JB, Damsgaard MT, Watt T et al. Danish manual for SF-36. Copenhagen: LIF, 1997.
6. Angst F, Aeschlimann A, Stucki G. Smallest detectable and minimal clinically important differences of rehabilitation intervention with their implications for required sample sizes using WOMAC and SF-36 quality of life measurement instruments in patients with osteoarthritis of the lower extremities. *Arthritis Rheum* 2001;45:384-91.
7. The Norwegian Arthroplasty Register, Department of Orthopaedic Surgery, Haukeland University Hospital, Bergen, Norway.
8. The Swedish Knee Arthroplasty Register, Dept of Orthopedics, Clinical Sciences, Lund. Lund University, Sweden.
9. Hart DJ, Spector TD, Brown P et al. Clinical signs of early osteoarthritis: reproducibility and relation to x ray changes in 541 women in the general population. *Ann Rheum Dis* 1991;50:467-70.
10. Felson DT. The epidemiology of knee osteoarthritis: results from the Framingham Osteoarthritis Study. *Semin Arthritis Rheum* 1990;20:42-50.
11. Meding JB, Ritter MA, Faris PM et al. Does the preoperative radiographic degree of osteoarthritis correlate to results in primary total knee arthroplasty? *J Arthroplasty* 2001;16:13-6.
12. Fortin PR, Clarke AE, Joseph L et al. Outcomes of total hip and knee replacement: preoperative functional status predicts outcomes at six months after surgery. *Arthritis Rheum* 1999;42:1722-8.
13. Shields RK, Enloe LJ, Leo KC. Health related quality of life in patients with total hip or knee replacement. *Arch Phys Med Rehabil* 1999;80:572-9.
14. Becker R, Döring C, Denecke A et al. Expectation, satisfaction and clinical outcome of patients after total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2011;19:1433-41.
15. Callahan CM, Drake BG, Heck DA et al. Patient outcomes following unicompartmental or bicompartmental knee arthroplasty: a meta-analysis. *J Arthroplasty* 1995;10:141-50.
16. Hawker GA, Wright JG, Coyte PC et al. Health related quality of life after knee replacement. *J Bone Joint Surg Am* 1998;80:163-73.
17. Larsen K, Sørensen OG, Hansen TB et al. Accelerated perioperative care and rehabilitation intervention for hip and knee replacement is effective: a randomized clinical trial involving 87 patients with 3 months of follow-up. *Acta Orthop* 2008;79:149-59.
18. Lim JT, Luscombe KL, Jones PW et al. The effect of preoperative symptom severity on functional outcome of total knee replacement—patients with the lowest preoperative scores achieve the lowest marks. *Knee* 2006;13:216-9.
19. Kennedy LG, Newman JH, Ackroyd CE et al. When should we do knee replacements? *Knee* 2003;10:161-6.
20. Forsythe ME, Dunbar MJ, Hennigar AW et al. Prospective relation between catastrophizing and residual pain following knee arthroplasty: two-year follow-up. *Pain Res Manag* 2008;13:335-41.