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ORIGINAL ARTICLE

Return to sports after medial unicompartmental knee arthroplasty in patients with concomitant patella-femoral osteoarthritis: multicenter retrospective cohort study with minimum 5-year follow-up

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Abstract

Purpose The purpose of our study was to evaluate clinical outcomes and return to sports after medial unicompartmental knee arthroplasty (UKA) in middle-aged active patients with concomitant patella-femoral joint (PFJ) osteoarthritis at time of surgery.

Methods One-hundred and fifty-one patients who underwent medial fixed-bearing cemented UKA, between 2012 and 2015, for medial unicompartmental osteoarthritis of the knee, were retrospectively reviewed with a minimum 5-year follow-up. The mean age at surgery was 54.3 years (range 47 to 60 years). Radiological evaluation of patella-femoral joint (PFJ) osteoarthritis was performed according to Sperner classification to select a control-group (< grade III) and case-group (≥ grade III). The visual analog scale (VAS) for pain and Knee Society score (KSS) was used to evaluate preoperative and final outcomes. Physical activity level before and after the surgery was assessed by the use of UCLA score.

Results One-hundred and thirty-seven patients (89 males and 48 females) were available at last follow-up. The mean follow-up was 6.2 years (range 5.2 to 7.5 years). At last follow-up improvements of VAS and KSS scores revealed not significant correlation with PFJ osteoarthritis. The majority of patients (87.7%) returned to their sports activity after UKA surgery.

Conclusions Improved quality of life and sports activity level resulted in middle-aged, active patients after UKAs. PFJ osteoarthritis showed no significant correlation with poorer outcomes at 5-year follow-up.

Level of Evidence III, multicenter retrospective cohort study.

Keywords Unicompartmental knee arthroplasty · Patellofemoral osteoarthritis · Sports activity

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Introduction

Unicompartmental knee arthroplasty (UKA) continues to be confirmed as an effective surgical option for medial or lateral knee osteoarthritis, even in active individuals highly committed to resume physical activities [1–3]. The fundamental arguments which recommend such procedure in active individuals rely on the fact that UKA does not change the original natural alignment or ligament balance of the knee, patients recover quicker with similar success rate as the alternative osteotomy [4, 5]. In addition, there is a significant advantage that failed UKA is easier to convert to total knee arthroplasty (TKA) than after high tibial osteotomy (HTO) [6].

Systemic inflammatory diseases, anterior and posterior knee instability, severe varus deformity and flexion contracture are generally categorized as primary contraindications for UKA [7, 8]. Differing from what was previously accepted, the status of patellofemoral joint (PFJ) is no longer considered as an absolute contraindication and more recent studies [9–11] demonstrated that neither anterior knee pain nor PFJ degeneration significantly affect clinical outcome and survivorship of UKA.

Other studies [12–15] have been conducted to evaluate the sports activities of younger patients after UKA surgery, and they reported high "return-to-sport" rate and absence of correlation between PFJ osteoarthritis with poorer outcomes although the effect of physical activities in the osteoarthritis progression and anterior knee pain was not completely cleared. Furthermore, it is still unknown whether PFJ osteoarthritis may affect the functional outcomes and level of physical activities in younger high-demanding patients following UKA.

The purpose of this study was to assess medium-term outcomes of middle-aged active patients suffering for medial osteoarthritis of the knee and concomitant PFJ osteoarthritis who underwent UKA. Our hypothesis was that PFJ osteoarthritis does not affect physical activity level and return to sports in middle-aged active individuals.

Methods

This study received approval from our ethics committee. The data of 151 patients who underwent cemented fixed-bearing Oxford unicompartmental knee prostheses (Biomet UK Ltd., Bridgend, UK) in eight different hospitals, for medial unicompartmental osteoarthritis of the knee, were retrospectively reviewed between 2012 and 2015.

Patients who met the following criteria were included: (1) age ≤ 60 years at the time of surgery; (2) symptomatic medial osteoarthritis of the knee grade 3, or 4 according to Kellgren-Lawrence classification [16]; (3) involvement in recreational sports activities; (4) minimum of 5-year follow-up. The exclusion criteria were as follows: (1) diagnosed inflammatory arthritis; (2) deficiency of the anterior cruciate ligament (ACL) and peripheral ligaments of the knee; (3) frontal deformity > 15°, flexion contracture > 15°; (4) osteoarthritis involving the lateral compartment; (5) radiographic evidence of PFJ lateral grooving and bone loss.

Radiological evaluation of preoperative PFJ osteoarthritis was performed according to Sperner classification [17] and patients were divided into two categories < grade III "control-group" and ≥ grade III with PFJ osteoarthritis "case-group".

All patients received a standardized rehabilitation regimen with physiotherapy commencing on the first postoperative day, which included the use of a continuous passive motion (CPM) machine for three hours per day (0° to 90°), regular cryotherapy and gait training. The return to sport activity was allowed no earlier than five months after surgery.

Outcome measures

The clinical follow-up consisted of a routine physical examination of the knee with range of movement (ROM) and stability testing and a standard series of radiographs: AP, lateral and axial patellar views. All measurements were carried out by two independent observers (CE, AM).

For clinical evaluation, visual analog scale (VAS) for pain and the Knee Society score (KSS) were used [18]. The KSS is characterized by "Knee Score" section (7 items) and a "Functional Score" section (3 items). Both sections are scored from 0 to 100 with lower scores being indicative of worse knee conditions and higher scores being indicative of better knee conditions.

Physical activity level before and after the surgery was assessed by the use of UCLA score [19]. Patient satisfaction was assessed by the use of the Self-Administered Patient Satisfaction Scale (SAPS) with response categories consisting of very satisfied (100-points), somewhat satisfied (75-points), somewhat dissatisfied (50-points) and very dissatisfied (25-points) [20]. The rate of return to sports and any changes in sports activities were also questioned.

Statistical analysis

Statistical Package for the Social Sciences ver. 20.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. The statistical analysis of the data was performed using the unpaired *t*-test according to the normality of data. The level of statistical significance was set at $P < 0.05$.

Table 1 Demographics at baseline and sports activity level at 5-year follow-up

Preoperative	137
Sex	
Male/Female	89/48
Age (mean. range)	
Year ≤ 60	54.3(47–60)
Body weight (mean. SD)	
Kg	78.5(12.4)
Body height (mean. SD)	
Centimeters	177(10)
Body mass index (mean. SD)	
kg/m^2	27.8(2.5)
PFJ Osteoarthritis according to Sperner's classification	
< grade III (*n*,%)	74(54%)
≥ grade III (*n*,%)	63(46%)
Sports activity level (preoperative)	
High impact (*n*, %)	19(14%)
Intermediate impact (*n*, %)	55(40%)
Low impact (*n*, %)	63(46%)
Sports activity level at 5-year FU	
High impact (*n*, %)	17 (12.5%)
Intermediate impact (*n*, %)	65 (47.3%)
Low impact (*n*, %)	39 (28.5%)
No return to sports	16 (11.7%)

Results

Patient characteristics and baseline data

A total of 137 patients were available for final review. None of them had bilateral UKAs. Demographic data such as age, sex, body mass index (BMI) and sports activity level were recorded (Table 1). The mean follow-up time was 6.2 years (range 5.2 to 7.5 years) (Fig. 1).

Physical examination

At time of final follow-up, in our series, the average knee-flexion ability was 125° and not statistically difference between control-group (125° ± 8) and case-group (127° ± 5) was found ($P = 0.08$). Three patients (2.8%) had a limited flexion under 110°. Four patients (3.7%) showed a mild extension deficit of 5°; two patients (1.8%) had an extension deficit of 10°.

VAS and KSS score

At the last follow-up, 80 patients (58%) were very satisfied, 48 (35%) somewhat satisfied, five (4%) somewhat dissatisfied and four (3%) very dissatisfied.

A significant improvement of the preoperative status in terms of pain was observed on VAS score that decreased from 5.3 ± 2.0 to 1.7 ± 1.9 ($P < 0.001$) and from 5.1 ± 2.5 to 2.0 ± 1.5 ($P < 0.001$), respectively, in control-group and

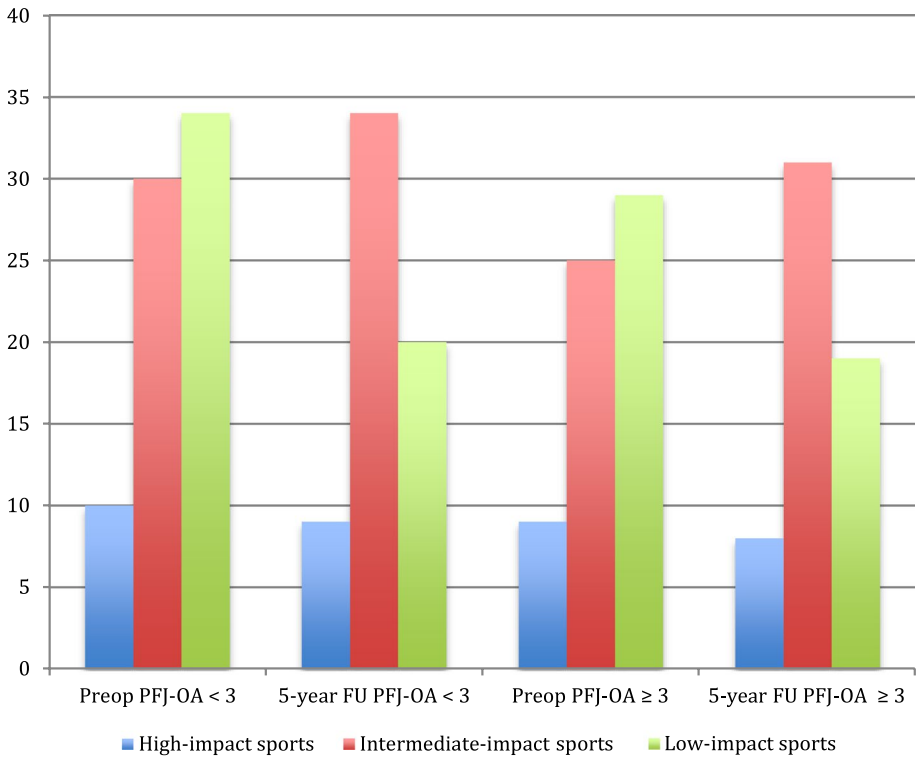

Fig. 1 Distribution of sports activities before and after medial unicompartmental knee arthroplasty (UKA) implantation

Table 2 Changes of VAS, Knee Society scores (KSS) and UCLA scores and PFJ osteoarthritis preoperatively and at 5-year follow-up

Number	PFJ-OA < grade III (control-group)		*P* value	PFJ-OA ≥ grade III (case-group)		*P* value
	74			63		
	Preoperative (Baseline)	Last FU (Follow-up)		Preoperative (Baseline)	Last FU (Follow-up)	
VAS score	5.3 ± 2.0	1.7 ± 1.9	< 0.001	5.1 ± 2.5	2.0 ± 1.5	< 0.001
Mean KSS knee score	61 ± 9.5	80 ± 13.5	< 0.001	58 ± 12.5	78 ± 11.7	< 0.001
Mean KSS function score	51 ± 17.1	85 ± 7.5	< 0.001	49 ± 15.5	77 ± 10.5	< 0.001
UCLA Activity Rating scale	4.5 ± 1	7.0 ± 1.5	< 0.001	4.4 ± 1.6	7.7 ± 1.0	< 0.001

Values are presented as mean (standard deviation)

case-group at final follow-up (Table 2). Not statistically significant difference between control-group and case-group was reported (Table 3).

The mean KSS improved from 61 ± 9.5 to 80 ± 13.5 (P < 0.001) and from 58 ± 12.5 to 78 ± 11.7 ($P < 0.001$), respectively, in control-group and case-group at the last follow-up (Table 2); not statistically significant difference between control-group and case-group was found ($P = 0.360$) at last follow-up (Table 3).

The mean KSS function score increased from 51 ± 17.1 to 85 ± 7.5 ($P < 0.001$) and from 49 ± 15.5 to 77 ± 10.5 ($P < 0.001$), respectively, in control-group and case-group ($P < 0.001$) at the last follow-up and not statistically significant difference between control-group and case-group (Table 3) was reported ($P = 0.197$).

Radiological findings

At 5-year follow-up radiological evaluation of standard radiographs revealed progression of OA in the contralateral compartment although not statistically difference in loss of height on lateral compartment between control-group (1.1 ± 0.9) and case-group (1.3 ± 0.5) was found ($P = 0.119$).

Physical activity and return to sports

Sports activities were preoperatively categorized according to their impact on weight-bearing joints in high, intermediate and low-impact sports. High-impact sports included jogging 5(3.6%), soccer 2(1.5%), volleyball 4(3%), basketball 5 (3.6%) and martial arts 3 (2.2%); intermediate-impact sports included doubles tennis 15 (11%), cross-country skiing 18 (13%), downhill skiing 5 (3.6%) and riding 17 (12%); low-impact sports included Nordic walking 15 (11%), cycling 10 (7.8%), swimming 18 (13%), gymnastics 13 (9.5%) and dancing 7 (5.1%). Patients returned to sport activity at mean time of 6 months (range: from 5 to 7 months) after surgery.

Among the 137 patients available at final follow-up, the majority (87.7%) returned to their preoperative sports activities and 16 patients stopped their sports. Ten of these gave reasons other than UKA surgery to stay away from regular sports participation.

The UCLA activity score five years after UKA procedure averaged 7 ± 1.5 in control-group and 7.2 ± 1.0 in case group (Table 3) and not statistically difference was found ($P = .369$).

In 71 patients (52%), the score increased to a higher level than 7 which defines return to intense sports activity; a similar improvement was observed in control-group and case-group (Table 4).

At last follow-up, sports activities included jogging 5(3.6%), soccer 2 (1.5%), volleyball 4 (3%), basketball 5 (3.6%) and martial arts 2 (1.5%); intermediate-impact sports included doubles tennis 21 (15.3%), cross-country skiing 19 (13.8%), downhill skiing 9 (6.5%) and riding 15 (11%); low-impact sports included Nordic walking 7 (5.1%), cycling

Table 3 Changes of VAS, KSS and UCLA outcomes in baseline and follow-up examination according to control-group and case-group

	Baseline (Preoperative)			Last Follow-up		
	PFJ-OA < grade III (control-group)	PFJ-OA ≥ grade III (case-group)	*P* value	PFJ-OA < grade III (control-group)	PFJ-OA ≥ grade III (case-group)	*P* value
VAS score	5.3 ± 2.0	5.1 ± 2.5	0,604	1.7 ± 1.9	2.0 ± 1.5	0.313
Mean KSS knee score	61 ± 9.5	58 ± 12.5	0.113	80 ± 13.5	78 ± 11.7	0.360
Mean KSS function score	51 ± 17.1	49 ± 15.5	0.478	85 ± 7.5	83 ± 10.5	0.197
UCLA Activity Rating scale	4.5 ± 1	4.4 ± 1.6	0.657	7.0 ± 1.5	7.2 ± 1.0	0.369

Values are presented as mean (standard deviation)

Table 4 Percentage of patients with a UCLA activity score ≥ at final follow-up

UCLA activity score ≥ (% of patients)	PFJ-OA < grade III ($n = 37$)		PFJ-OA ≥ grade III ($n = 34$)	
	Preoperative	21%	Preoperative	20%
	Postoperative	27%	Postoperative	25%

10 (7.4%), swimming 10 (7.4%), gymnastics 5 (3.6%) and dancing 7 (5.1%). A shift (10%) toward intermediate-impact sports was found.

Complications

Six patients (4.3%) underwent revision surgery: in four patients UKA has been revised in TKA due to aseptic loosening of tibial component; in two other patients revision surgery consisted of lavage and exchange of the polyethylene insert for suspected infection with persistent pain.

Discussion

During the past two decades, UKA has been growing in popularity because a number of clinical studies [2, 3, 21] have demonstrated that partial joint replacement is less invasive, improves pain relief, provides faster recovery and earlier return to work and sports activities in comparison to TKA [22, 23] and HTO [6, 24, 25]. In addition, the strict use of selection criteria and the modern advances in surgical techniques and implant design have generated excellent ten-year survivorship rate [1–5].

It has been indicated that the best candidates for UKA are older than 60 years of age and low activity level [8]. However, original indications proposed by Kozinn and Scott [7] in 1989 have gradually been extended and nowadays, patella-femoral osteoarthritis, younger age and sports activities are no longer considered as absolute contraindications for UKA [10].

Beard et al. [26] investigated the influence of the patella-femoral joint status on medial UKA outcomes and reported no statistical correlation between PFJ osteoarthritis and worse outcomes. Similar studies [9, 11] have demonstrated that preoperative PFJ osteoarthritis was poorly correlated with UKA outcomes and suggested that preoperative PFJ osteoarthritis could be safely ignored without compromising implant survivorship.

Nowadays, the treatment of unicompartmental osteoarthritis of the knee in middle-aged individuals still represents a challenging therapeutic dilemma because younger and active patients demand return to higher function and their sports activities represent one of the major concerns [12–14].

In a meta-analysis study, Waldstein et al. [15] reported that return-to-sports rate after UKA ranged from 87 to 98% with more participation in low-impact than in high-impact sports activities and the recent study of Jacquet et al. [31] confirmed higher rate of patients able to practice impact activities after HTO than UKA. In other studies [27, 28], the majority of patients returned to their sports after UKA at a higher level (78%) than before the surgery and their functional scores were better in comparison to HTO and TKA whereas.

Dahm et al. [19] reported that 91% of patients were satisfied with the sports activities they were able to perform after UKA. Similarly, in a 2010 study, Felts et al. [13] showed, in a series of 62 patients younger than sixty, that 94% of these were satisfied with their sports activity level after UKA.

On the contrary, few clinical studies [9–11] are available for the evaluation of functional outcomes and return-to-sports rate after UKA of active patients < 60 years of age with concomitant PFJ osteoarthritis at the time of surgery and consequently, it is still unclear if PFJ osteoarthritis may affect the functional outcomes and level of physical activities in younger high-demanding patients following UKA.

The main significant finding of our medium-term study was that UKA has yielded satisfactory outcomes, in younger patients involved in recreational sports activities with the result of high rate of return-to-sports (87.7%) without significant correlation between preoperative PFJ osteoarthritis and poor outcomes.

Furthermore, our hypothesis that PFJ osteoarthritis does not affect physical activity level and return to sports in middle-aged active individuals has been confirmed.

Similarly, to previous published studies [14, 15], the majority of our patients were involved in low-impact and intermediate-impact sports and their physical activity level increased after surgery with a shift (10%) toward intermediate-impact sports.

Some patients have started lower-impact activities after their operation but may eventually sustain higher-impact activities.

In our opinion, this observed flux might be due to a number of reasons. Firstly, the majority our patients (93%) were satisfied with their functional results after surgery and such important achievement might have contributed to promote participation in higher-impact sports. Secondly, the effect of general deterioration in health status of aging patients which may lead to a shift toward low-impact sports activities was not detectable in our series of younger individuals that are characterized by good health even at last follow-up. Thirdly, patient's wish to preserve operated knee, according to instructions from the surgeons and another health care professional, including physiotherapists and sports trainers.

In other words, some patients had capacity to persist with their higher-impact activity for a period after their operation before settling for a lower-impact activity.

Similarly, to other studies [9, 10, 13], the mean postoperative UCLA score of 7.6 of our series can explain our cohort's overall maintenance of high-impact activities (12.5%) without any relationship with preoperative status of PFJ.

The present study was not a long-term analysis on UKA survivorship, therefore a relationship between different sports activities and higher failure rate could not be assessed; however, our medium-term results in active younger patients practicing sports were reassuring and our failure rate (4.3%) is comparable to other published reports [28–30]. Furthermore, long-term studies will be necessary to ascertain UKA failure rate and investigate relationship between failure modality and sport-specific gesture.

Limitations of this study include the retrospective design and lack of comparison with mobile-bearing UKA in < 60-year-old active patients. Second, recommendations of surgeons to stop contact sports might have indirectly influenced the choices of sports. Lastly, the average follow-up duration (5 years) is too short to determine progression of OA in the lateral compartment of the knee and evaluate its effects on the durability of clinical improvement and sports activity levels.

Conclusions

In middle-aged, active individuals with medial compartment osteoarthritis UKA is an effective surgical option to improve their quality of life and return to the same or higher level of sports. In patients with concomitant patella-femoral osteoarthritis, a correlation between poorer outcomes or restricted sports activities was not found.

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Declaration

Conflict of interest All the authors declare that have no relevant financial or non-financial interests to disclose. All the authors declare that have no conflicts of interest to declare that are relevant to the content of this article.

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