Patient outcomes in Anteromedial Osteoarthritis Patients over 80 Years Old Undergoing Oxford Unicompartmental Knee Arthroplasty in China

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Abstract

Background: Oxford Unicompartmental Knee Arthroplasty (UKA) has increased rapidly around the world, and the effectiveness and safety of a minimally invasive surgical approach for it demonstrate excellent outcome. Oxford UKA represents an interesting solution for older patients. The aim of our study is to evaluate the perioperative complications and short-term clinical outcome and analyze the safety for older patients who undergo Oxford UKA.

Methods: A retrospective review was performed of all patients who underwent Oxford UKA between June 2015 and January 2018. We divided all patients into three groups (ages 60–69; ages 70-79; age over 80). We used the HSS score and WOMAC score to evaluate the general condition of the patients' knees. We also recorded perioperative complications and long-term complications.

*Result:*60 patients (60 knees) between the ages of 60 and 69 (Group 1), 70 patients (79 knees) between the ages of 70-79 (Group 2) and 65 patients (70 knees) over 80 years old (Group 3) were included in the study. The mean follow-up was 21.34±12.04, 22.08±11.38 and 21.76 ± 10.20 months in Group 1, 2 and 3, respectively. At last follow-up, the patients in Group 3 showed lower function scores as compared to group 1 and 2 (P <0.05), but both the HSS score and the WOMAC score were significantly improved in both groups after surgery. The rate of perioperative complications and other complications in elderly patients is the same as in younger patients.

Conclusion: Oxford UKA is an effective and safe treatment for osteoarthritis, even in old adult patients in China. The knee joint pain symptoms of the elderly patients are relieved and the function is improved, but the function is still poor compared with the younger patients.

Introduction

Unicompartmental knee arthroplasty (UKA) is one of most effective surgical procedures for the treatment of isolated medial compartment osteoarthritis. Compared to total knee arthroplasty (TKA), UKA(including both fixed bearing UKA and mobile bearing UKA) can provide better physiological function, quicker recovery, shorter hospital stay, and fewer perioperative complications, especially for early arthritis[1,2]. Recently, the use of the Oxford UKA has increased rapidly around the world, and the effectiveness and safety of a minimally invasive surgical approach for Oxford UKA has demonstrated good to excellent long-term follow-up[3,4]. Today, with the improvement in medical standards, the phenomenon of aging in the population is becoming more and more obvious all over the world. Many elderly patients cannot undergo surgery because of its high risk. Due to the potential reduction of morbidity and mortality compared to TKA, UKA may represent an interesting solution for older patients when the disease is limited to medial femorotibial disease. Because Asian populations have different lifestyles, such as squatting and sitting on the floor, from those of Western populations. Asian populations need more range of motion (often knees flex more than 120°) to perform daily activities (such as squatting and sitting on the floor) [5,6].Previous study also reported a substantially higher bearing dislocation in Asian populations[7], which may relate to the lifestyle involved high degrees of knee flexion in Asian populations. Thus, it is possible that the clinical outcomes and survival rate of Oxford UKA for Asian patients may be different. No related study has compared the clinical outcomes of UKA in patients over 80 to young patients in Asian populations. On the other hand, the relevance between effectiveness and patients' age has not become clear, and the background of patients who benefit by receiving Oxford UKA is still unknown. A re-evaluation of the effectiveness and safety of Oxford UKA for old adult patients is, thus, needed. We conducted the present study to clarify the effectiveness and safety of Oxford UKA in Asian patients aged over 80 years.

Materials And Methods

Participants

We retrospectively reviewed 195 knee osteoarthritis patients who underwent medial Oxford UKA (Oxford unicompartmental Phase 3; Biomet, Warsaw, IN, USA) between June 2015 and January 2018. The study protocol was reviewed and approved by the hospital institutional review board. All patients provided informed consent for participation in the study. All patients were diagnosed with anteromedial osteoarthritis (AMOA) of the knee, based on history, physical examination, and radiographs. Before surgery, all patients had standard X-ray views taken (anteroposterior [AP] and lateral radiographs; full-length standing, weight-bearing AP and lateral radiographs; and patella tangential view) and underwent magnetic resonance imaging (MRI) to evaluate the ligament, meniscus, and lateral compartment. The indication criteria for UKA were: older than 55 years; a correctable varus deformity (varus less than 15 degree); flexion deformity less than 15degree, relatively intact ligaments, especially the anterior cruciate ligament (ACL) and medial collateral ligament (MCL) functionally normal (We usually observe the stage of deterioration of ACL intraoperatively, if the ACL deficiency less than 2 grade we could perform Oxford UKA)(ACL grade:1.Normal; 2. Loss of synovial covering, usually starting distally; 3. Longitudinal splits in the substance of the exposed ligament; 4. Friable and fragmented with stretching and loss of strength of the collagen bundles; 5. Absent or ruptured.); an intact lateral compartment; proper range of motion(at least 0-100°); and no inflammatory disease. Exclusion criteria: the lateral side of the patellofemoral joint exhibits bone loss with eburnation and longitudinal grooving; absent or severely damaged ACL (or PCL or MCL);

Surgical technique And Perioperative Management

All patients were operated on by the same group of doctors. The patient was placed in the supine position; a tourniquet was applied to the proximal thigh on the operative side. All patients underwent the standard Oxford UKA surgical procedure (minimally invasive Oxford UKA, using the Oxford Microplasty instrumentation). All patients received an analgesic intra-articular cocktail mixture injection containing ropivacaine, parecoxib sodium, oxycodone, epinephrine, and tranexamic acid. Patients received an intravenous infusion of drugs to control pain for three days after surgery. All patients routinely received a drainage tube; the drainage tube was removed on the first day after surgery. All patients received anticoagulant therapy from one day after surgery until two weeks after surgery.

Outcome measure

Clinical and radiographic follow-up was performed within three months and then at six months and one year. We used the Hospital for Special Surgery (HSS) Knee score and Western Ontario and McMaster (WOMAC) Universities Osteoarthritis Index to evaluate the general condition of the patients' knees before surgery and three months, six months, and one year after surgery. After that, the knee function score will be reviewed once a year, based on the score at the last follow-up.

Depending on the age of the patients, we divided all patients into three groups (ages 60–69; ages 70-79; age over 80). Patient records were reviewed and the following data was collected: American Society of Anesthesiologists (ASA) score, body mass index (BMI), type of anesthesia, length of stay, hemoglobin values. (before surgery and three days after surgery), change of hematocrit (before surgery and first and third day after surgery), tourniquet time, and previous basic disease (e.g., hypertension, diabetes, coronary heart disease). We used the Mercurialis method to calculate the volume of blood loss[8]. We use the visual analogue scale (VAS) score to evaluate pain degree eight hours (h), 16 h, and 24 h after surgery. We also recorded preoperative and postoperative range of motion (ROM), HSS, and WOMAC scores, perioperative complications, and short-term complications. The HSS score and WOMAC score were recorded at the final follow-up.

Statistical analysis

The statistical software used for all analyses was SPSS 22.0 (SPSS Inc., Chicago, IL, USA). Continuous variables are reported as means ± standard deviation (with range). Discrete variables are reported as number (with percent of total). Chi-squared tests were used to compare binary variables (demographic data and complication rates). We used analysis of variance (ANOVA) for comparison of clinical score (HSS score, WOMAC score) between the three groups (significance set at $P<0.05$).

Results

195 patients enrolled in our study. Among the patients, 60 (60 knees) were 60 to 69 years old (Group 1), 70 patients (79 knees) were 70 to 79 years old (Group 2), and 65 patients (70 knees) were older than 80 years old (Group 3). The mean follow-up was 21.34±12.04, 22.08±11.38 and 21.76 ± 10.20 months in Group 1, 2 and 3. Table 1 describes the general condition of all patients.

Table 2 describes the patients' characteristics and perioperative variables between different groups. In Group 3, the number of patients with hypertension was statistically higher than that of Group 1 and 2 ($p<0.05$). There were no significant differences in ASA scores, BMI, and other basic diseases between the three groups. There were no significant differences in preoperative ROM.

Table 3 describes postoperative variables and perioperative complications between the different groups. There were no significant differences in hospital stay, tourniquet time, changes of hemoglobin, blood loss volume, or postoperative ROM between the three groups. About perioperative complications, the risk of superficial wound infection and wound swelling in elderly patients is slightly higher than that in patients under 80 years old (p <0.05). 13 patients suffered superficial infection after surgery in Group 1, 2 and Group 3. They received vacuum sealing drainage (VSD) and recovered. There were no significant differences in other perioperative complications.

Table 4 describe the preoperative and postoperative knee score in both Group 1 ,2and 3. There were also no significant differences in preoperative and postoperative HSS or WOMAC score. Although there is no statistical difference between the three groups, the knee scores of older patients are still lower than those of relatively young patients. However significant improvements in HSS and WOMAC scores among the three groups. Compared to Group1 and 2, Group 3(p <0.05) showed lower HSS function and WOMAC function scores, but the function score still has been improved compare to preoperative condition in group 3. There were no significant differences in postoperative VAS score between the three groups.

Table 5 describes the surgery-related complications after Oxford UKA. 1 patient in Group 1 developed loosening of the tibial component two years after surgery, but he did not have any complaint of discomfort, we are also continuing clinical follow-up of this patient. 5 patients in Group 1, 5 patients in Group 2 and 9 patients in Group 3 developed radiolucency two years after surgery. 1 patient in Group 1 suffered bearing dislocation four months after surgery and received total knee arthroplasty after that. 1 patient in Group 3 fell accidentally two months after surgery and was diagnosed with periprosthetic fracture. This patient later underwent open reduction of the tibial fracture with internal fixation (LCP Medial Proximal Tibial Plate).

Discussion

In our study, there was no major systemic complication following 209 consecutive Oxford UKAs (179 patients). This study revealed no significant difference in the perioperative complication rate in patients between the different group All patients obtained satisfactory clinical outcome, but compared to the patients over 80 years old, the patients between the ages of 60 and 79 had higher function scores in both HSS and WOMAC scores.

Clinical outcome of UKA

Iacono F et al. evaluated the results obtained in patients older than 75 years treated with UKA. Sixty-seven knees in patients with a minimum age of 75 years were evaluated at mean nine years' follow-up. All clinical scores improved significantly at this follow-up, and the outcome was considered good or excellent in 92.6% of the patients[9], but the prosthesis they used was different from ours.

Concerning the clinical outcomes in very old patients who underwent OXFORD UKA, a recent study from the Oxford center analyzed 1000 OXFORD UKAs and found that at 10-year follow-up, patients younger than 60 at the time of the operation had significantly better American Knee Society Score Function (AKSS-F) score, Oxford Knee Score (OKS), and Tegner Activity Score than patients older than 60, but no difference in categorical functional outcomes was seen between the groups[10]. A meta-analysis reported that the functional outcome of UKA in the elderly is good, with low rates of perioperative morbidity and mortality[11]. Inale P A et al. reviewed the short-term results of mobile bearing medial UKA in elderly patients and compared the results with younger patients. The differences between the knee scores from the elderly patients and from the younger patients were not statistically significant. Revision rate and survival of the implant were not different among the different groups[12].

In our study, there was a clear improvement in HSS and WOMAC scores in both groups after surgery. WOMAC scores evaluate efficacy through three aspects: function, pain and stiffness. HSS score evaluate efficacy through two aspects: function and pain. There was no statistical difference between the three groups in the whole HSS score and WOMAC score. But the Group 3 had lower score in the function aspect in HSS and WOMAC score, and there was no statistical difference in the pain aspect in HSS and WOMAC score. This is considered small and still within the minimum clinically important difference (MCID) of the function outcome measurement. Thus, even though the difference is statistically significant, it might not be clinically important. The lack of exercise and the decline of activity by patients older than 80 might also have led to this finding. In Asian populations, body size, BMI, lifestyle, and knee morphology of Asian populations differ from those in western countries. And a proportion of patients, whose knees flex more than 120°, is required to perform daily activities that include squatting and sitting on the floor. And that may lead to different clinical outcome from western populations. But in our study the clinical outcome of Chinese patients is similar to western patients' clinical outcome, and the ROM also changes significantly in both groups before and after surgery. Lim et al. reported that MIS-UKA can yield satisfactory clinical and functional results and has a ten-year survival rate of 94% in Korean patients[7]. Yoshida et al. reported similar good medium-term results with a ten-year survival rate of 95% in Japanese patients[13].

Surgery-related Complications

One systematic review assessed over 8,000 OXFORD UKA patients and found the 10-year survival to be 93% and 15-year survival to be 89%, and a medical complication incidence of 0.8%. Very good outcomes were achieved by both designer and non-designer surgeons[14]. The literature shows that the main reasons that led to failures of OXFORD UKA were bearing dislocation, aseptic loosening, lateral compartment arthritis progression, and persistent unexplained pain[15-17,14,18]. Of the 209 OXFORD UKAs in our study, 19 (9.1%) patients were found to have radiolucent lines (RLL) under the tibial component on radiographs one year after surgery. That is different from the result reported by other studies. Previous literature showed that the incidence of RLL ranged from 62% to 96%, which was not clinically related to inferior functional outcomes[19-22]. The etiology of radiolucency remains unknown.

The incidence of RLL in the current study was lower than in the previous literature; several reasons may lead to this phenomenon, such as the small sample size and short follow-up time and cannot get standard X-rays. About the X-ray, that it is our limitation, because we usually cannot get standard X-ray when outpatient follow-up. But we usually perform an X-ray examination immediately after the operation. (Our screened radiographs were made with the beam of the radiographs parallel to the flat underside of the tibial component on the AP view and parallel to the flat posterior surface of the femoral component on the lateral view). As Goodfellow et al. described, pathological RLL is >2 mm, poorly defined, and often related to aseptic loosening. On the contrary, physiological RLL is 1–2 mm and well-defined[23]. The presence of these radiolucent lines in patients was not related to symptoms or indicative or predictive of loosening, and according to the X-rays, we confirmed it was physiological RLL (Figure 1). We still need to assess clinical outcomes through mid- and long-term follow-up. One patient developed a bearing dislocation four months after surgery. (Figure 2 shows the data of imaging before and after surgery.) The possible reason for this may be that the abnormal morphology of the patient's femur leads to a deviation in the intramedullary positioning, and the femoral prosthesis is placed close to the inside. Poor prosthesis position caused the rotation of the bearing during the knee flexion, resulting in dislocation of the bearing. Bearing dislocation is a major complication of OXFORD UKA, as previous literature has reported, and the rate of bearing dislocation was higher in the Asian population than that in the Western population[5,24,25]. It can occur in the presence of an unbalanced flexion–extension gap, impingement of the bearing with adjacent bone or tibial/femoral component, instability of the medial compartment due to medial collateral ligament (MCL) injury, or secondary to femoral/tibial component loosening[5].

One patient developed periprosthetic fracture two months after surgery due to a fall (81 years old), and we performed an open reduction of the tibial fracture with internal fixation. (Figure 3 shows the X-ray before and after surgery.) The literature shows that the rates of fractures of knee arthroplasties were reported to be from 0.2% to 2.5% in clinical studies and 0.02% to 0.17% in worldwide arthroplasty registers[26]. Risk factors associated with unicompartmental component fracture included malalignment with increased local stresses due to malpositioning, progressive osteoarthritis, and cruciate ligament deficiency. Patients with a BMI greater than 30 were also at greater risk[27].

Perioperative Complications

The major perioperative complications in our study were CMVT and superficial infection. There were no deaths during the perioperative period nor pulmonary embolisms or symptomatic DVTs in this study.

Chan et al. compared one-stage and two-stage bilateral unicompartmental knee replacement during the first 30 days postoperatively and found that the rates of proximal DVT, pulmonary embolus, and death secondary to pulmonary embolus to be 0.9%, 1.9%, and 0.3%, respectively[28]. If the patient was diagnosed with DVT or CMVT, the patient should receive low molecular weight heparin (nadroparin 0.4 mL, twice per day) for two weeks. After two weeks after surgery, patients were treated with Rivaroxaban for anticoagulant therapy. Check the deep vein ultrasound of the lower extremity and stop the drug if the thrombus disappears or dissolves. Other patients received low molecular weight heparin (nadroparin 0.4 mL once per day) after surgery. In total, 13 patients developed superficial infection after surgery (11 patients older than 80). Patient-related risk factors included previous revision arthroplasty or previous infection associated with a prosthetic joint at the same site, tobacco use, obesity, rheumatoid arthritis, a neoplasm, immunosuppression, and diabetes mellitus[29]. Postoperative risk factors included incision healing complications (e.g., superficial infection, hematoma, delayed healing, incision necrosis, and dehiscence), atrial fibrillation, myocardial infarction, urinary tract infection, and prolonged hospital stay[29,30].

We conclude that OXFORD UKA is a safe procedure with a low rate of perioperative complications, similar to previous studies[31]. Previous studies also showed that increasing patient age and history of cardiovascular disease were identified as risk factors for perioperative death in TKA[32]. However, in our study, patients older than 80 who underwent OXFORD UKA also showed good clinical outcomes with a low rate of perioperative complications and other complications (e.g., bearing dislocation, aseptic loosening, lateral compartment arthritis progression, and persistent unexplained pain).

There are several limitations in our study. The study sample was relatively small, and the follow-up was relatively short. Further research, large samples, and long-term follow-up are required to evaluate function. The mean follow-up time of the study group in the present study was 21.76 months, which is comparatively long-term if the entry age of 80 years is considered.

Conclusion

Oxford UKA is an effective and safe treatment for osteoarthritis, even in old adult patients in China. The knee joint pain symptoms of the elderly patients are relieved and the function is improved, but the function is still poor compared with the younger patients. The rate of perioperative complications and other complications in the elderly patients was alomost the same as in younger patients (the risk of superficial wound infection and wound swelling in elderly patients is slightly higher than that in patients under 80 years old). Our study shows a safe use of OXFORD UKA in octogenarians in China.

Declarations

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Authors’ contributions

JBC, MLF and SBL conceived and designed the experiments. MLF, ZL and GLC performed the surgeries. SA and JBC analyzed the data. JBC prepared the figures. JBC wrote the main manuscript text. All authors reviewed the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All experimental protocols were approved by Xuanwu hospital, Capital Medical University Committee, written informed consent was obtaining from every patient.

Consent for publication

We obtained permission from the participants to publish their data.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

OXFORD UKA: oxford unicompartmental knee arthroplasty; UKA: unicompartmental knee arthroplasty; TKA: total knee arthroplasty; AMOA: anteromedial osteoarthritis; MRI: magnetic resonance imaging; HSS: Hospital for Special Surgery knee score; WOMAC: Western Ontario and McMaster (WOMAC) Universities Osteoarthritis Index; ASA score: American Society of Anesthesiologists score; BMI: body mass index; VAS: visual analogue scale score; ROM: range of motion; DVT: deep vein thrombosis; CMVT: calf muscular vein thrombosis; CDFI: color Doppler flow imaging; VSD: vacuum sealing drainage; AKSS-F: American Knee Society Score Function score; OKS: Oxford Knee Score; MCID: minimum clinically important difference; RLL: radiolucent lines; MCL: medial collateral ligament.

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Tables

Table 1 Patient Demographic Characteristics

Variable	Group 1	Group 2	Group 3
Knees	60	79	70
Age (y)	64.93±3.28	75.17±4.12	82.41±2.40
Sex (male: female)	26:34	30:49	34:36
Follow-up (m)	21.34±12.04	22.08±11.38	21.76±10.20

Table 2 Comparison of Patient Characteristics, and Preoperative Variables Between different groups

Variable	Group 1	Group 2	Group 3	*P* Value
ASA score	1.5±0.5	1.5±0.5	1.5±0.5	0.723
1-2	51 (85.0%)	64 (81.0%)	51 (72.9%)	
3-4	9 (15.0%)	15 (19.0%)	19 (27.1%)	
BMI	27.35±3.64	27.19±3.82	26.84±3.61	0.932
Normal (<25)	21 (35.0%)	28 (35.5%)	26 (37.1%)	
Overweight (25-30)	30 (50.0%)	31 (39.2%)	30 (42.9%)	
Obese (>30)	9 (15.0%)	20 (25.3%)	14 (20.0%)	
Anesthesia				
General	1 (1.7%)	2 (2.5%)	10 (14.3%)	
Spine	59 (98.3%%)	77 (97.5%)	60 (85.7%)	
Hypertension	35 (58.3%)	48 (60.7%)	57 (81.4%)*	**0.036**
Diabetes	18 (30.0%)	24 (30.4%)	19 (27.1%)	0.792
Coronary heart disease	14 (23.3%)	19 (24.1%)	20 (28.5%)	0.697
Digestive diseases	5 (8.3%)	7 (8.8%)	7 (10.0%)	0.711
Nervous system disease	6 (10.0%)	9 (11.4%)	12 (17.1%)	0.323
Immune system disease	1 (1.7%)	2 (2.5%)	0	0.283
Respiratory diseases	2 (3.3%)	3 (3.8%)	7 (10.0%)	0.113
Peripheral vascular disease	1 (1.7%)	2 (2.5%)	6 (8.5%)	0.204
Coagulation abnormalities	8 (13.3%)	12 (15.2%)	11 (15.7%)	0.841
Preoperative ROM	111.91±11.57	108.83±10.84	103.86±10.68	0.539

“*” Represent compared with the Group 1and 2, the difference in Group 3 is statistically different.

Table 3 Comparison of postoperative variables and Perioperative complications between different groups

Variable	Group 1	Group 2	Group 3	*P* Value
Hospital stay (d)	10.54±3.37	11.23±2.82	12.64±2.68	0.387
Tourniquet time (min)	72.50±6.57	75.16±9.53	76.23±11.18	0.204
Changes of hemoglobin (g/L)	14.11±7.48	15.29±9.39	13.05±8.69	0.458
Blood loss volume (ml)	178.17±74.73	179.80±84.22	175.50±80.39	0.783
Postoperative ROM	120.23±7.99	115.38±8.27	112.95±7.01	0.413
Perioperative complications				
Myocardial infarction	0	0	0	
Congestive heart failure	1 (1.6%)	0	0	0.567
Cerebrovascular accident	0	0	0	
Lung infection	1 (1.6%)	1 (1.2%)	2 (2.9%)	0.542
Pulmonary embolism	0	0	0	
Urinary system infection	0	0	0	
Abnormal renal and liver function	2 (3.3%)	4 (5.1%)	0	0.195
Deep vein thrombosis	3 (5.0%)	5 (6.3%)	5 (7.1%)	0.838
Calf muscular vein thrombosis	9 (15.0%)	14 (17.7%)	13 (18.5%)	0.643
Hypoproteinemia	8 (13.3%)	9 (11.4%)	11 (15.7%)	0.455
Superficial infection	1 (1.6%)	1 (1.2%)	11 (15.7%)*	**0.015**
Deep infection	0	0	0	
Swelling of the wound	4 (6.6%)	5 (6.3%)	12 (17.1%)*	**0.023**

"*" Represent compared with the Group 1and 2, the difference in Group 3 is statistically different.

Table 4 Comparison of preoperative and Postoperative Knee score between different groups

	Group 1	Group 2	Group 3	*P* Value
VAS score (8h after surgery)	1.08±0.83	1.29±0.56	1.25±0.57	0.608
VAS score (16h after surgery)	1.65±0.76	1.83±0.79	1.80±0.72	0.590
VAS score (24h after surgery)	1.43±0.48	1.73±0.42	1.54±0.56	0.667
Preoperative HSS	61.74±6.96	58.13±7.59	55.68±7.53	0.147
Function score	13.96±3.08	12.59±2.36	11.09±2.60	0.160
Pain score	13.20±6.27	13.00±5.28	12.27±4.30	0.513
Preoperative WOMAC	44.30±11.26	46.85±14.90	48.91±13.10	0.208
Function score	32.28±10.27	33.28±12.27	36.68±11.58	0.140
Pain score	11.60±3.86	10.50±4.06	10.88±4.63	0.684
Stiffness	3.01±1.98	2.98.50±3.06	3.21±2.11	0.798
Postoperative HSS	86.61±6.38	85.23±6.98	83.09±6.04	0.129
Function score	19.34±2.56	18.34±2.59	16.64±1.56*	**<0.001**
Pain score	5.96±2.08	5.39±3.14	5.76±3.08	0.785
Postoperative WOMAC	24.16±10.53	25.56±10.53	28.00±9.50	0.086
Function score	14.28±5.53	13.89±4.69	18.23±5.81*	**<0.001**
Pain score	5.29±3.19	5.46±4.42	5.76±3.08	0.781
Stiffness	2.26±1.36	1.98±1.43	2.24±1.14	0.620
Change of HSS	24.87±6.67	27.10±6.83	27.40±6.02	0.108
Change of HSS function score	5.68±3.21	6.21±3.02	5.85±4.15	0.698
Change of WOMAC	20.93±4.82	21.90±5.39	20.91±4.68	0.728
Change of WOMAC function score	19.18±8.01	20.08±6.99	18.00±7.10	0.657

“*” Represent compared with the Group 1and 2, the difference in Group 3 is statistically different.

Table 5 The surgery-related complications after Oxford UKA

Complication	Group 1	Group 2	Group 3
Implant loosening	1	0	0
Radiolucency	5 (8.3%)	5 (6.3%)	9 (12.9%)
Dislocation	1 (0.7%)	0	0
Periprosthetic fracture	0	0	1 (2.5%)
Periprosthetic joint infection	0	0	0
Progression of arthritis	0	0	0
Persistent unexplained pain	4 (6.7%)	2 (2.5%)	3 (4.2%)

Figures

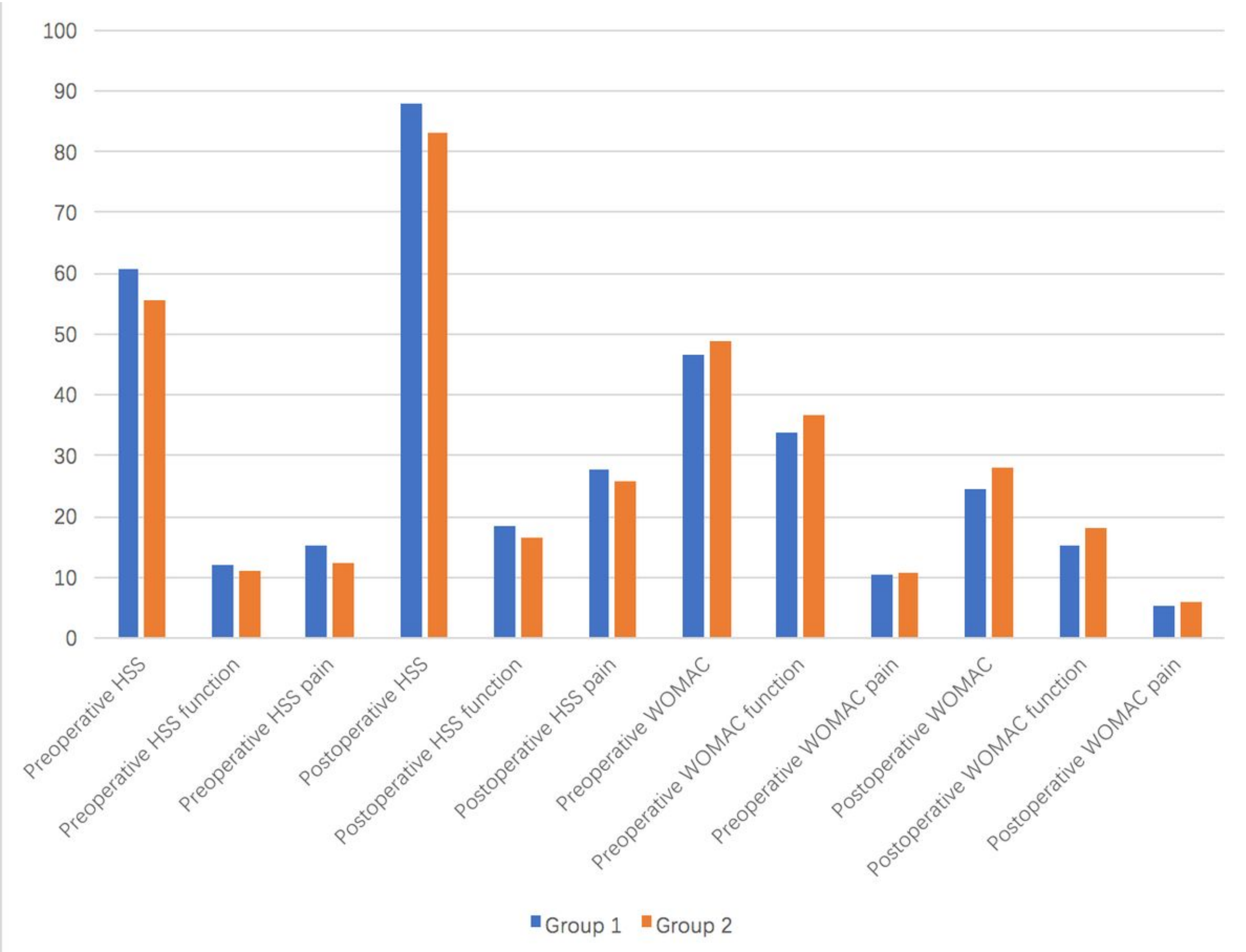

Figure 1

Group 1, Group 2

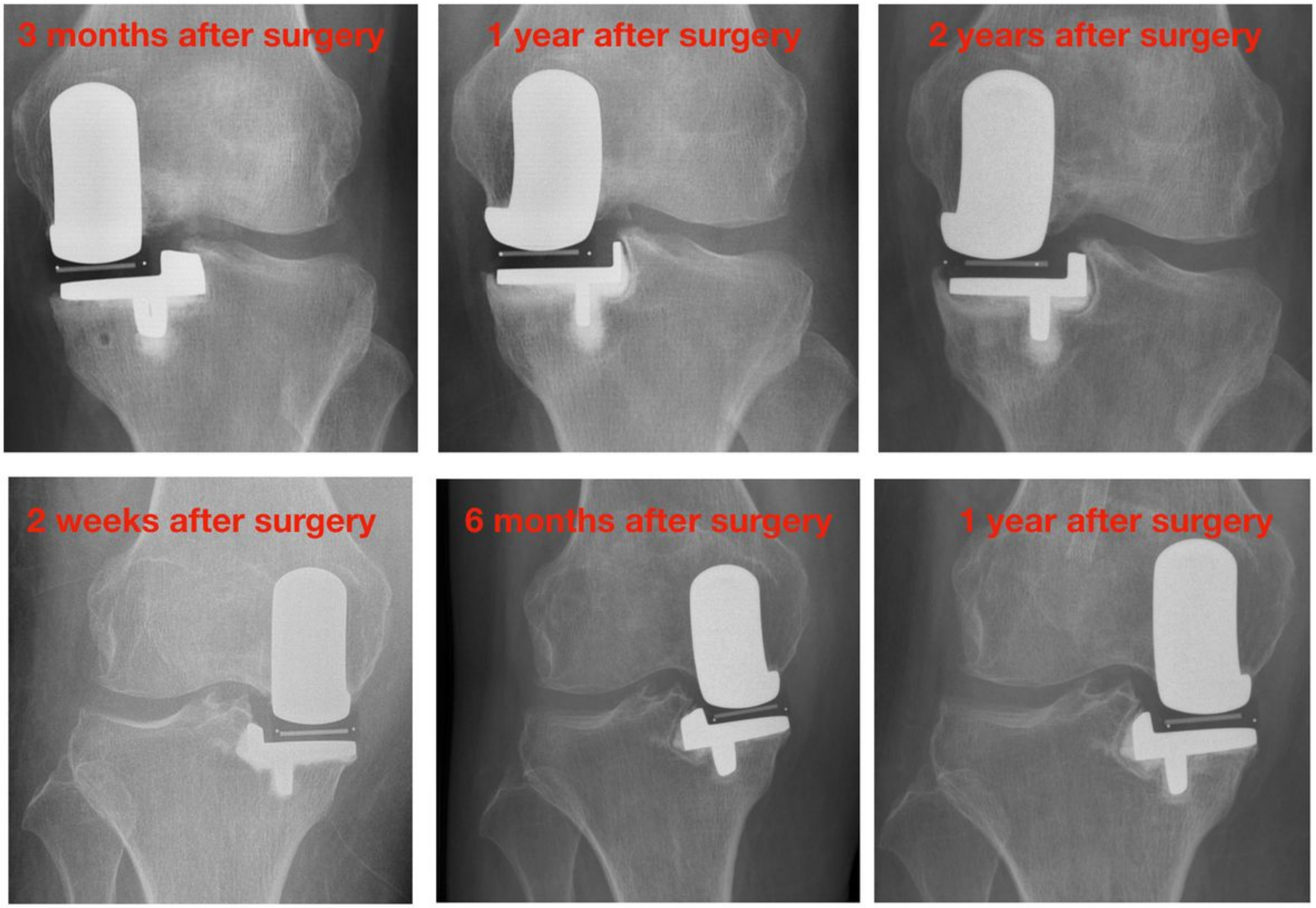

Figure 2

physiological RLL

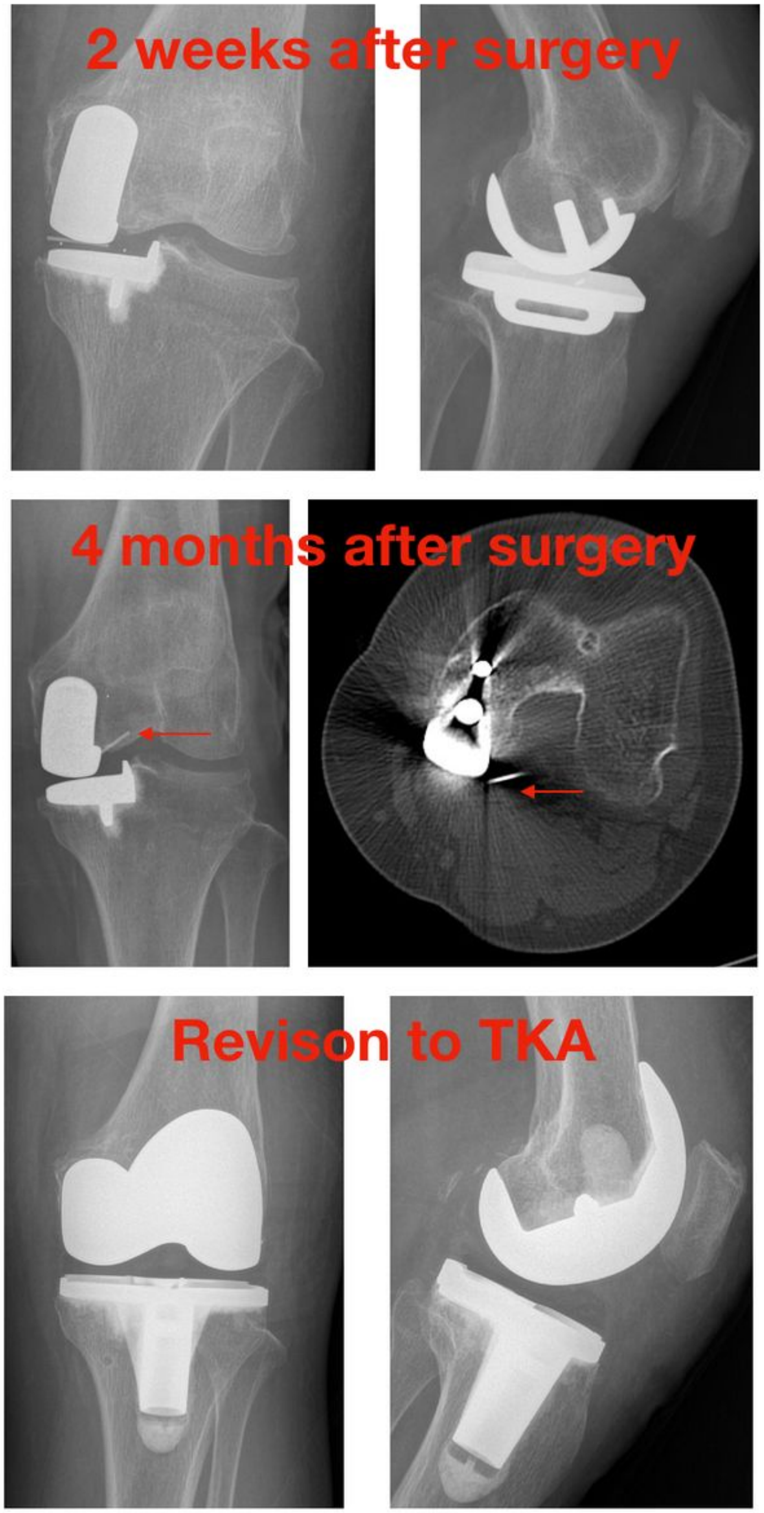

Figure 3

3 shows the data of imaging before and after surgery

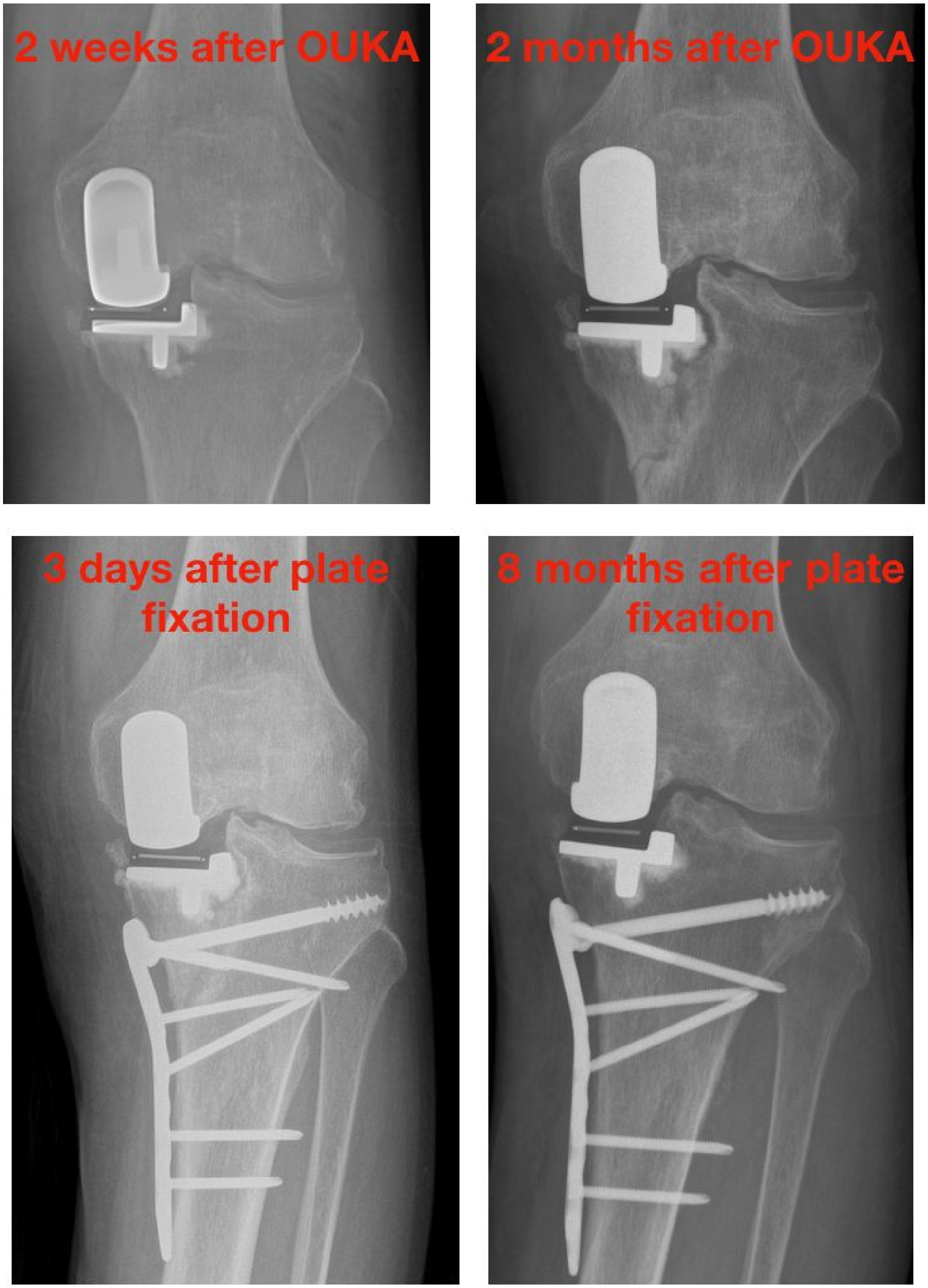

Figure 4

shows the X-ray before and after surgery