

# FACTORS AFFECTING THE FUNCTIONAL OUTCOME OF OXFORD PHASE 3 UNICOMPARTMENTAL KNEE ARTHROPLASTY

## FATORES QUE AFETAM O RESULTADO FUNCIONAL DA ARTROPLASTIA UNICOMPARTIMENTAL DO JOELHO OXFORD PHASE 3

AYŞE ESİN POLAT<sup>1</sup> , BARIŞ POLAT<sup>2</sup> , TAHSİN GÜRPINAR<sup>3</sup> , BARIŞ PEKER<sup>4</sup> , TOLGA TÜZÜNER<sup>5</sup> 

1. Dr. Akçiçek State Hospital, Orthopaedics and Traumatology Department, Kyrenia, Turkish Republic of Northern Cyprus.

2. University of Kyrenia, Orthopaedics and Traumatology Department, Kyrenia, Turkish Republic of Northern Cyprus.

3. Istanbul Training and Research Hospital, Orthopaedics and Traumatology Department, Istanbul, Turkey.

4. Dr. Burhan Nalbantoğlu State Hospital, Orthopaedics and Traumatology Department, Nicosia, Turkish Republic of Northern Cyprus.

5. Acıbadem Bakırköy Hospital, Orthopaedics and Traumatology Department, Istanbul, Turkey.

### ABSTRACT

**Objective:** To determine the factors that affect the functional outcome of Oxford Phase 3 unicompartmental knee arthroplasty (UKA). **Methods:** We assessed a total of 52 UKA knees of 49 patients with a minimum follow-up of 2 years (24-72 months). We recorded the results for Range of motion (ROM) and body mass index (BMI) and the presence of patello-femoral arthrosis (PFA). In the radiological evaluation, we measured the posterior tibial slope (PTS), the tibial plateau angle (TPA) and the femorotibial angle, in addition to an assessment using the Oxford radiological criteria. Patients were grouped by age, follow-up time, BMI, radiological criteria, PFA presence, occurrence of complications and revision surgery. The clinical and functional results of these groups were compared statistically. **Results:** A total of 40 women and 9 men participated in the study, with an average age of 60 years, and a mean BMI of 34.6. No significant differences were found among the age and PFA groups. Postop VAS scores were high and knee evaluation scores were significantly lower in the morbidly obese group and in the groups with postop TPA <85° and >90°. The revision ratio was 11.5%. **Conclusion:** Postop TPA, PTS and morbid obesity are the most significant factors that can lead to revision surgery. **Level of Evidence IV, Case series.**

**Keywords:** Osteoarthritis. Arthroplasty. Replacement. Knee. Pain.

### RESUMO

**Objetivo:** Determinar os fatores que afetam o resultado funcional da artroplastia unicompartmental do joelho Oxford Phase 3 (AUJ). **Métodos:** Foram incluídos 52 joelhos AUJ de 49 pacientes com um período mínimo de 2 anos (24-72 meses) de acompanhamento. Foram registrados: amplitude de movimento (ADM), índice de massa corporal (IMC) e presença de artrose femoropatelar (AFP). Na avaliação radiológica, medimos o declive tibial posterior (DTP), o ângulo do planalto tibial (APT) e o ângulo femorotibial, além de usarmos os critérios radiológicos de Oxford. Os pacientes foram agrupados de por idade, tempo de acompanhamento, IMC, critérios radiológicos, presença de AFP e ocorrência de complicações e cirurgias de revisão. Os resultados clínicos e funcionais desses grupos foram comparados estatisticamente. **Resultados:** Participaram do estudo 40 pacientes do gênero feminino e 9 do gênero masculino, com idade média de 60 anos, IMC de 34,6. Não foram encontradas diferenças significativas entre os grupos formados por idade e presença de AFP. As marcações da EVA pós-operatória foram altas e as marcações do joelho foram significativamente baixas no grupo com obesidade mórbida e nos grupos com APT pós-operatória <85° e >90°. A taxa de revisão foi de 11,5%. **Conclusão:** APT e DTP pós-operatório e obesidade mórbida são os fatores mais significativos que podem levar à cirurgia de revisão. **Nível de Evidência IV, Série de casos.**

**Descritores:** Osteoartrite. Artroplastia do Joelho. Dor.

**Citation:** Polat AE, Polat B, Gürpınar T, Peker B, Tüzüner T. Factors affecting the functional outcome of Oxford phase 3 unicompartmental knee arthroplasty. *Acta Ortop Bras.* [online]. 2020;28(2):78-83. Available from URL: <http://www.scielo.br/aob>.

All authors declare no potential conflict of interest related to this article.

The study was conducted at Istanbul Training and Research Hospital, Orthopaedics and Traumatology Department.  
Correspondence: Barış Polat, Şehit Yahya Bakır Street, 10, Kyrenia, Cyprus. [drbpolat@hotmail.com](mailto:drbpolat@hotmail.com)



## INTRODUCTION

Osteoarthritis is the most common joint disease in the world and the most frequent cause of chronic musculoskeletal pain.<sup>1</sup> In 80-90% of the cases, osteoarthritis begins in the medial compartment and tends to remain unicompartmental.<sup>2</sup> There are different types of surgical treatment for single compartment osteoarthritis, including Total Knee Arthroplasty (TKA), High Tibial Osteotomy or Unicompartmental Knee Arthroplasty (UKA), when conservative treatments are not responsive. Oxford Phase 3 UKA, was introduced in 1998 by Murray and Goodfellow et al.<sup>3</sup> Many advantages of the UKA are mentioned in the literature, including: minimally invasive incision, preservation of the anterior and posterior cruciate ligaments, fewer bone cuts, less postoperative blood loss and pain, better functional outcomes, reduced hospitalization time, lower costs and faster and earlier rehabilitation.<sup>4,5</sup> Its disadvantages include surgical technical difficulties and experience requirements.<sup>4-7</sup> Additionally, higher revision rates have been reported for UKA compared to total knee arthroplasty (TKA).<sup>8</sup> Improper patient selection and implant malpositioning may be responsible for this high rate.<sup>5,7,9</sup>

With the development of implants, component materials, surgical fixation techniques, and the definition of correct indications and correct patient selection criteria, positive results have been recorded for UKA in the last 20 years.<sup>6,10,11</sup>

All surgeons must analyse the pitfalls and underlying clinical and radiological reasons for early failure of UKA before performing this procedure. However, as the surgeons' experience increases, their surgical technique improves, ensuring a more accurate implant positioning. We aimed to evaluate radiological and clinical results and determine the factors that affect the functional outcome of Oxford Phase 3 unicompartmental knee arthroplasty cases. This study also intends to be a helpful tool for surgeons, identifying the causes of early failure of UKA.

## MATERIAL AND METHODS

### Participants

In this retrospective study, we analysed 52 knees of 49 patients who underwent Oxford Phase 3 unicompartmental knee arthroplasties (Oxford Partial Knee, Biomet Orthopaedics, Bridgend, UK) for anteromedial osteoarthritis. These surgeries were performed by the last author (TT) or under his control, in the Orthopaedics and Traumatology Clinic of the Istanbul Training and Research Hospital, between 2011 and 2016. The inclusion criteria were: presenting non-inflammatory arthritis with an intact anterior cruciate ligament, passively correctable angular deformity under 10° varus and 5° valgus, flexion deformity under 15° and no lateral compartment involvement. Patients with a minimum follow-up of 2 years were included. This study was approved by the Research Ethics Committee (ID:47 date:07/06/2016). All patients who took part in this study signed forms of informed consent, agreeing to its publishing.

### Clinical and radiological evaluation

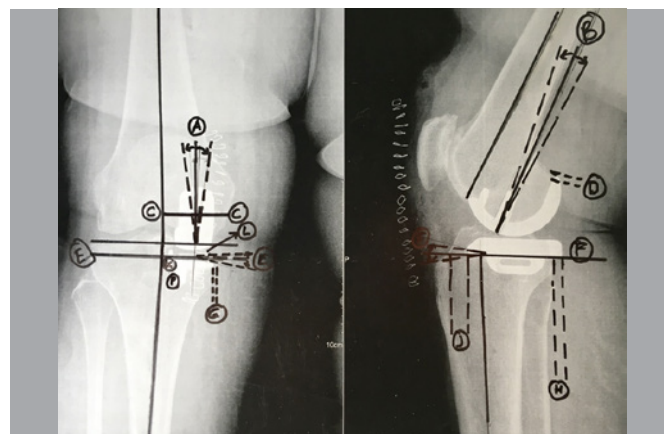
As part of the preoperative radiological evaluation, we assessed weight-bearing anteroposterior and flexed lateral knee X-rays, patella tangential X-rays, varus-valgus stress X-rays and orthoroentgenograms. Preoperatively, all 52 knees underwent MRI examinations. The groups divided according to the presence of patellofemoral arthrosis (PFA) were based on its grading shown in the Magnetic resonance imaging (MRI). Postoperatively, we performed orthoroentgenograms, weight-bearing anteroposterior and flexed lateral knee X-ray imaging.

For the evaluation of the patients, pre and postoperatively, we used the Knee Society Score (KSS) and functional Knee Society Score (fKSS), the Oxford Knee Score (OKS) and the visual analogue scale (VAS). The range of motion (ROM) was also recorded for each patient pre and postoperatively. Additionally, the body mass index (BMI) and the presence of patellofemoral arthrosis (PFA) were documented. In the radiological evaluation, we assessed the posterior tibial slope (PTS), the tibial plateau angle (TPA) and the femorotibial angle (FTA), besides using the Oxford radiological criteria (Table 1) (Figure 1). Preop and postop FTA are measured by the angle between the two lines drawn from the centers of the femur and tibia, which start 10 cm above and below the joint line. Preop and postop PTS are defined by the angle between the tibial anatomical axis and the line drawn tangentially to the medial tibial plateau on the lateral radiographs. The preop TPA is the angle between the tibial plateau and the tibial anatomic axis, whereas the postop TPA is measured between the tibia anatomic axis and the tangential line of the medial plateau implant cuts. Two authors (AEP and TG) assessed all images and measured all angles independently. The images were blinded, and their order was randomized. When there was a disagreement between the examiners, re-evaluations were made until a consensus was reached. Patients were grouped according to their ages, follow-up time, BMI, varus-valgus and flexion-extension positions of the femoral component, FTA, PTS, TPA, PFA presence in MRI, occurrence of complications and revision surgeries. The clinical and postoperative ROM results of these groups were statistically compared.

**Table 1.** Oxford radiological criteria.

	Description	Criterion
<b>Femoral component</b>		
A/A	Varus/valgus angle	< 10° varus to < 10° valgus
B/B	Flexion/extension angle	< 5° flexion to < 5° extension
C/C	Medial/lateral placement	Central
D	Posterior fit	Flush/ < 2 mm overhang
<b>Tibial component</b>		
E/E	Varus/valgus angle	< 10° varus to < 5° valgus
F/F	Posteroinferior tilt	7° ± 5°
G	Medial fit	Flush or < 2 mm overhang
H	Posterior fit	Flush or < 2 mm overhang
J	Anterior fit	Flush or < 3 mm overhang
K	Lateral fit	Flush, no gap

Source: Oxford Phase 3 unicompartmental knee prosthesis user's manual.



**Figure 1.** Postoperative correct positioning of unicompartmental knee arthroplasty according to Oxford radiological criteria.

## Statistical analysis

For the statistical analysis, we used the SPSS 15.0 software for Windows. The ratio of categorical variables in the groups was tested by Chi-square analysis. The Monte Carlo simulation was applied when the conditions were not met. Because the numerical variables presented no normal distribution, two independent group comparisons were made using the Mann-Whitney U test and the Kruskal Wallis test in all groups. Subgroup analysis was done using Mann-Whitney U test and interpreted by Bonferroni correction. The relationships between numerical variables were examined by Spearman correlation analysis, since the parametric test conditions were not provided. The Cox Regression Analysis Forward Method was used in the model, based on the factors that could affect the revision rates. Statistical significance level alpha was accepted as  $p < 0.05$ .

## RESULTS

In total, 40 patients (81.6%) were women and 9 (18.4%) were men. Their mean age was 60 years (in a range of 49-80), and their mean BMI was 34.6 (in a range of 22-56.9). Two (3.8%) of the patients had normal weight (BMI below 25 kg/m<sup>2</sup>), 11 (21.2%) were overweight (BMI, 25-29.9 kg/m<sup>2</sup>), 31 (59.6%) were obese (BMI, 30-34.9 kg/m<sup>2</sup>) and 8 (15.4%) were morbidly obese (BMI  $\geq$  35 kg/m<sup>2</sup>). The left knees of 21 patients, the right knees of 28 patients and both knees of 3 patients underwent UKA. The mean follow-up period of the patients was 48 months (ranging between 24 and 72 months). The average OKS, KSS and fKSS scores improved significantly, from 12.7, 43.3 and 34.8 in preoperative measurements to 37.8, 85.7 and 82 in postoperative measurements, respectively, and the mean VAS scores decreased from 9 to 2.6. Additionally, ROM improved from 111° to 123° (Table 2). According to the Oxford radiological criteria, component replacement error was found in 19 (36.5%) patients. The most common error was a defective central placement of the femoral component. However, the most frequent problems in the revised knees were errors in the lateral placement of the tibial component – more than 10° varus or valgus of the tibial component, or more than 10° varus or valgus of the femoral component – and posterior tibial slope defects. All three patients with PTS misplacement underwent revision surgery (Table 3).

**Table 2.** Pre and postoperative scores.

		Preoperative	Postoperative	p
ROM		111.2 ± 12.6 (90-130)	123.6 ± 14.6 (75-135)	< 0.001
KSS		43.3 ± 9.7 (17-69)	85.7 ± 19.9 (31-100)	< 0.001
n (%)	Excellent	—	40 (76.9)	
	Good	—	5 (9.6)	
	Fair	2 (3.8)	2 (3.8)	
	Poor	50 (96.2)	5 (9.6)	
fKSS		34.8 ± 19.0 (0-90)	82.0 ± 24.4 (0-100)	< 0.001
n (%)	Excellent	1 (1.9)	38 (73.1)	
	Good	1 (1.9)	7 (13.5)	
	Fair	2 (3.8)	2 (3.8)	
	Poor	48 (92.3)	5 (9.6)	
OKS		12.7 ± 7.8 (0-32)	37.8 ± 10.4 (7-48)	< 0.001
n (%)	Severe	43 (82.7)	6 (11.5)	
	Moderate	6 (11.5)	2 (3.8)	
	Mild	3 (5.8)	6 (11.5)	
	Normal	—	38 (73.1)	
VAS		9.0 ± 1.1 (6-10)	2.6 ± 2.9 (0-10)	< 0.001

OKS: Oxford Knee Score; KSS: Knee Society Score; fKSS: functional Knee Society Score; ROM: range of motion; VAS: visual analogue scale.  
Values are shown as mean ± SD (range) unless otherwise indicated.

**Table 3.** Defects and revision percentages according to Oxford radiological criteria.

Criterion	Defects	Revisions
A. Femoral component > 10° varus-valgus positioning defect	3 (5.7)	2 (66.6)
B. Femoral component > 5° of flexion-extension positioning defect	4 (7.69)	—
C. Femoral component central positioning defect at coronal plane	12 (23)	2 (16.6)
D. Femoral component posterior fit defect	—	—
E. Tibial component > 10° varus-valgus positioning defect	2 (3.8)	2 (100)
F. Posterior tibial tilt defect	3 (5.7)	3 (100)
G. Tibial component more than 2 mm medial flush	1 (1.9)	1 (100)
H. Tibial component posterior fit defect	—	—
J. Tibial component anterior fit defect	1 (1.9)	—
K. Tibial component lateral fit defect	4 (7.69)	3 (75)
L. Insert positioning	—	—

Values are shown as n (%).

Patients were grouped according to the following postoperative measured angles: PTS (87° – 79° is normal), FTA (over 175° is varus, 170° – 175° is normal, under 170° is valgus) and TPA (over 90° is valgus, 90° normal, 89° – 85° is minor varus, under 85° is varus). KSS, fKSS, OKS, VAS and ROM were compared postoperatively in these groups (Tables 4 and 5).

**Table 4.** Preoperative and postoperative mean values.

		Preoperative	Postoperative	p
PTS		82.9 ± 1.9 (78-87)	84.0 ± 4.0 (76-102)	0.074
n (%)	> 87	—	5 (9.6)	
	87-79	51 (98.1)	41 (78.8)	
	< 79	1 (1.9)	6 (11.5)	
FTA		179.4 ± 3.0 (174-190)	174.9 ± 4.6 (162-185)	< 0.001
n (%)	> 175	47 (90.4)	20 (38.5)	
	175-170	5 (9.6)	28 (53.8)	
	< 170	—	4 (7.7)	
TPA		84.8 ± 2.7 (80-90)	88.7 ± 3.7 (72-98)	< 0.001
n (%)	> 90	—	2 (3.8)	
	90 (normal)	4 (7.7)	34 (65.4)	
	85-89	25 (48.1)	11 (21.2)	
	< 85	23 (44.2)	5 (9.6)	

PTS: posterior tibial slope; FTA: femorotibial angle; TPA: tibial plateau angle.  
Values are shown as mean ± SD (range) unless otherwise indicated.

**Table 5.** Comparison of postoperative clinical scores in the postoperative tibial plateau angle groups

	Tibial plateau angle								
	> 90*		90 (normal)		85-89		< 85		P
	Ort.	SD	Ort.	SD	Ort.	SD	Ort.	SD	
ROM postop	112.5	31.8	124.9	14.1	127.7	8.2	110	17.7	0.933
KSS postop	54.0	32.5	88.5	17.0	94.7	6.6	59.4	25.2	0.010
fKSS postop	45.0	63.6	84.4	19.3	92.3	11.7	58.0	37.7	0.048
OKS postop	21.0	12.7	38.8	9.6	42.9	3.3	26.4	12.4	0.014
VAS postop	6.00	4.24	2.24	2.74	1.45	1.92	6.00	2.92	0.020

ROM: range of motion; KSS: Knee Society Score; fKSS: functional score; OKS: Oxford Knee Score; VAS: visual analogue scale.

The patients, whose mean age was 60 years, were divided into three age groups: those younger than 55 years, those between

55 and 65 years, and those older than 65 years. There were no statistically significant differences among these groups. Furthermore, there were no statistically significant differences among the patients grouped according to the presence of PFA, identified by MRI. In the morbidly obese group, the postop clinical scores were significantly lower and the VAS scores, significantly higher, while clinical scores were excellent in the other BMI groups.

Complications developed in five patients (9.6%). Three of the complications were intra-operative eminence fractures and two of them were insert dislocations. The eminence fractures occurred in the first UKA surgery experiences, while the surgeon was making a horizontal tibial cut, and were fixed intra-operatively with two headless cannulated screws (Figure 2). In the subsequent surgeries, a sagittal saw was used to avoid this complication. Two of these patients underwent revision surgeries, 7 months and 45 months after the UKA operation. The eminence fracture healed completely with the revision. Both these patients also had implant misplacement. The other patient with an eminence fracture did not have any implant placement defects and their postoperative functional outcomes were good. Two patients were referred to the authors' clinic because of ROM limitations, and insert dislocations were diagnosed at 3 and 10 months after the operation. Both patients had a history of knee distortion. Radiologic evaluations of the patients with insert dislocation did not reveal any misplacement at implantation, except for the central placement of the femoral component (placed 4 mm or 3 mm laterally). Furthermore, two of the five patients who developed complications were morbidly obese and three of them were obese.



**Figure 2.** Eminence fracture fixed intra-operatively with two headless cannulated screws.

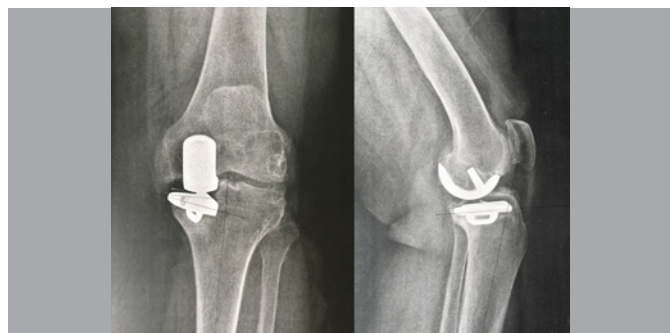
Six (11.5%) of the patients required revision (Table 6). The UKA revision rate in the authors' clinic was 11.5%, while the TKA revision rate for the same period was 8%; UKAs performed between 2011-2016 accounted for 4.6% of the knee replacement surgeries conducted during that period.

Using the Cox Regression Analysis, Forward Method, we assessed the age, sex, BMI, presence of PFA, postop TPA, postop FTA, postop PTS, varus and valgus alignment of femoral component and follow-up times, composing a model of the factors that could lead to the need of revision. In this analysis, the postop tibial plateau angle (Figure 3), the postop posterior tibial slope (Figure 4) and morbid obesity were determined as the most significant factors that could lead to revision.

**Table 6.** Summary of findings on revision patients.

	PTS\F	FTA	TPA\E	Fem component VARUS\VALGUS\	C	G	J	K	BMI	Complication	Revision Cause	Revision time	Age	Revision implant
1	102	183	78 VAR	N	N	N	4 mm Posterior	1 mm	38.7	None	T. loosening + collapse	52nd m.	53	Constrain
2	90	N	84 VAR	N	N	N	N	N	33	Eminence fracture	T.+F. loosening	45th m.	65	Primer
3	N	183	N	12 VAR	2 mm Med	N	N	1 mm	41.6	Eminence fracture	T. loosening + collapse	7th m.	58	Primer
4	N	N	N	N	N	N	N	N	47	None	T.+F. loosening	7th m.	51	Primer
5	N	183	98 VAL	N	3 mm Med	3 mm Med	N	2 mm	50	None	T. loosening + collapse	12nd m.	53	Constrain
6	76	185	72 VAR	12 VAR	3 mm Med	N	N	N	49	None	T.+F. loosening	12nd m.	56	Primer

BMI: body mass index; C: femoral component central positioning; FTA: femorotibial angle; G: tibial component more than 2 mm medial flush; J: tibial component anterior fit defect; K: tibial component lateral fit defect; m: month; N: normal; PTS\F: posterior tibial slope or F:posterior tibial tilt; T: tibial; F: femoral; TPA\E: tibial plateau angle or E: tibial component varus-valgus; VAR: varus. VAL: valgus; Med: medial; mm: millimeter.



**Figure 3.** 4th year postoperatively, anteroposterior/lateral X-ray view of unicompartmental knee arthroplasty with tibial plateau angle 8° valgus.



**Figure 4.** 3rd year postoperatively, anteroposterior/lateral X-ray view of unicompartmental knee arthroplasty with PTS 78°.

## DISCUSSION

Although the patient selection process has been shown to be one of the most important factors for obtaining successful outcomes in UKA surgery, there are still some controversial indication criteria.<sup>9,12,13</sup> Kozin et al. were the first to identify the traditional criteria for such indications. They were limited to the patients with medial osteoarthritis over 60 years old, with a body weight under 82 kg, no anterior knee pain and no arthrosis, except for minimal erosive changes in the patellofemoral region.<sup>12</sup> The indications were then expanded by Berend and Lambordi.<sup>13</sup> According to these authors, to be eligible for UKA it is sufficient to have posteriorly preserved anterior full-thickness medial cartilage loss, fully correctable varus deformity, full-thickness preserved on the lateral cartilage and a solid anterior cruciate ligament.<sup>13</sup> The indication criteria of the Oxford Group include knees with medial arthrosis (except inflammatory diseases), a solid anterior cruciate ligament (ACL), flexion contractures under 15 degrees, full-thickness on the lateral cartilage and fully correctable intra-articular varus deformities.<sup>9</sup> In the present study, the parameters of the Oxford Group were preferred when determining the indications.

The presence of PFA is controversial in the indication criteria. It was a contraindication in previous studies,<sup>14</sup> but in recent publications this is no longer accepted.<sup>9</sup> In accordance with the current literature, this study shows that PFA does not affect early and mid-term functional outcome of UKA.

Price et al. reported that the 10-year cumulative survival rate in 52 Oxford UKA patients under 60 years of age was not significantly different from that of patients older than 60 years.<sup>9</sup> In this study, no statistically significant differences were found among age groups. We believe that the UKA is a suitable method for patients of all ages, provided that the indications are met.

In 2013, Murray et al. demonstrated, with multicenter trials, that there is no reduction in survival rates in patients with high BMI values (such as 45-50).<sup>15</sup> In this study, while the functional outcomes of patients who were obese, overweight and had normal weight were excellent, those of morbidly obese patients were significantly lower. We believe that it is not appropriate to perform UKA on morbidly obese patients, although it is possible to achieve excellent results in obese and overweight patients with effective planning and correct surgical techniques.

Most authors believe that valgus overcorrection of the varus deformity is the main cause for lateral arthrosis<sup>16</sup> and some surgeons recommend that the implants should be placed in the minimal varus position, in order to avoid lateral arthrosis.<sup>17</sup> Perkins et al. reported that FTA angles greater than 3° varus and 7° valgus decreased the functional results and increased the revision rate.<sup>18</sup> Consonantly with the literature, in this study the implant placement detected postoperative was 1.5° minor varus. The results were worse in patients whose tibial component position had an angle smaller

than 85° (varus) or bigger than 90° (valgus), while the 85° – 90° TPA groups (normal and minor varus) had excellent results. Furthermore, four out of six patients requiring revision presented TPA disturbances. Bruni et al. found an increase in the PTS in the revised knees of 84 UKA patients, due to spontaneous osteonecrosis, so they recommend the avoidance of PTS overcorrection.<sup>19</sup> All three patients who were diagnosed with PTS misplacement had been submitted to revision. Shakespeare et al. reported that femoral component malalignment did not lead to disorientation in the lower extremity,<sup>20</sup> but many publications state that this angular deformity could lead to polyethylene wear.<sup>16</sup> In this study, the group with the femoral component placed more than 10° varus had lower *f*KSS, with a statistically significant difference, and their VAS was significantly higher.

In the Swedish Knee Arthroplasty Register of 2004, which reported a wider number of cases, the most common cause of failure was aseptic loosening of components.<sup>4</sup> In this study, six (11.5%) patients required revision. For three of them, the reason was the loosening collapse of the tibial and femoral components, while in the other three, it was the tibial loosening and collapse. In five of these cases, what caused the need for revision was incorrect implant positioning, in the case of the other patient, it was caused by morbid obesity (Table 5). Moreover, it was seen that BMI, postoperative TPA and postoperative PTS were the most significant factors that could motivate revision.

We found no statistically significant difference between the clinical and radiological outcomes of UKA surgeries performed in the first two years and those of the two subsequent years. However, 60% of the complications and all the revisions occurred during the first two years of UKA surgical experience. This shows the importance of surgical experience.

We understand that the retrospective nature of this study is a limitation. It could be a guide for new surgeons starting to perform UKA surgeries, demonstrating the complications caused by intra-operative eminence fractures, which are not mentioned in the literature. Another factor that attests the value of this study is the insufficient information in the literature about the effect of the PTS angle on implant survival. Multicenter studies should be conducted so that more meaningful results can be obtained, investigating more case series.

## CONCLUSION

As the results indicate, implant positioning is a critical factor in the functional outcome and survival rates of UKA. Tibial plateau angle and posterior tibial slope are the radiological parameters that should be particularly considered. In terms of patient selection, UKA is not a suitable option for morbidly obese patients. It may be possible to reduce significantly the revision rates through appropriate patient selection, correct surgical technique and increased surgical experience. If these conditions are met, UKA is a method that can provide excellent results for anteromedial arthrosis in patients of middle and advanced ages.

**AUTHORS' CONTRIBUTIONS:** Each author contributed individually and significantly to the development of the manuscript. AEP: data collection and analysis and writing of the study; B.PO: surgeries, conceptualization of the study and of the manuscript; TG: surgeries and writing of the study; B.PE: surgeries and revision of the study; TT: surgeries, conceptualization of the study and development of the research project.

## REFERENCES

1. Peat G, McCarney R, Croft P. Knee pain and osteoarthritis in older adults: a review of community burden and current use of primary health care. *Ann Rheum Dis.* 2001;60(2):91-7.
2. White SH, Ludkowski PF, Goodfellow JW. Anteromedial osteoarthritis of the knee. *J Bone Joint Surg Br.* 1991;73(4):582-6.
3. Murray DW, Goodfellow JW, O'Connor JJ. The Oxford medial unicompartmental arthroplasty, a ten year survival study. *J Bone Joint Surg Br.* 1998;80(6):983-9.
4. Swedish Knee Arthroplasty Register. Annual Report 2004. Lund; 2004.
5. Chou DT, Swamy GN, Lewis JR, Badhe NP. Revision of failed unicompartmental knee replacement to total knee replacement. *Knee.* 2012;19(4):356-9.
6. O'Connor JJ, Goodfellow JW, Dodd JA, Murray DW. Development and clinical application of meniscal unicompartmental arthroplasty. *Proc Inst Mech Eng H.* 2007;221(1):47-59.
7. Robertsson O, Knutson K, Lewold S, Lidgren L. The routine of surgical management reduces failure after unicompartmental knee arthroplasty. *J Bone Joint Surg Br.* 2001;83(1):45-9.

8. Lyons MC, MacDonald SJ, Somerville LE, Naudie DD, McCalden RW. Unicompartmental versus total knee arthroplasty database analysis: is there a winner? *Clin Orthop Relat Res.* 2012;470(1):84-90.
9. Price AJ, Dodd CA, Svard UG, Murray DW. Oxford medial unicompartmental knee arthroplasty in patients younger and older than 60 years of age. *J Bone Joint Surg Br.* 2005;87(11):1488-92.
10. **Tadros BJ, Dabis J, Twymar R. Short-term outcome of unicompartmental knee arthroplasty in the octogenerian population. *Knee Surg Sports Traumatol Arthrosc.* 2018;26(5):1571-6.**
11. Pandit HG, Jenkins C, Barker K, Dodd CA, Murray DW. The Oxford medial unicompartmental knee replacement using a minimally-invasive approach. *J Bone Joint Surg Br.* 2006;88(1):54-60.
12. Kozinn SC, Scott R. Unicompartmental knee arthroplasty. *J Bone Joint Surg Am.* 1989;71(1):145-50.
13. Berend KR, Lombardi AV Jr. Liberal indications for minimally invasive oxford unicompartmental knee arthroplasty provide rapid functional recovery and pain relief. *Surg Technol Int.* 2007;16:193-7.
14. Goodfellow JW, O'Connor J. Clinical results of the Oxford knee. Surface arthroplasty of the tibiofemoral joint with a meniscal bearing prosthesis. *Clin Orthop Relat Res.* 1986;205:21-42.
15. Murray DW, Pandit H, Weston-Simons JS, Jenkins C, Gill HS, Lombardi AV, et al. Does body mass index affect the outcome of unicompartmental knee replacement? *Knee.* 2013;20(6):461-5.
16. Hernigou P, Deschamps G. Alignment influences wear in the knee after medial unicompartmental arthroplasty. *Clin Orthop Relat Res.* 2004;(423):161-5.
17. **Vasso M, Del Regno C, D'Amelio A, Viggiano D, Corona K, Schiavone Panni A. Minor varus alignment provides better results than neutral alignment in medial UKA. *Knee.* 2015;22(2):117-21.**
18. Perkins TR, Gunckle W. Unicompartmental knee arthroplasty: 3- to 10-year results in a community hospital setting. *J Arthroplasty.* 2002;17(3):293-7.
19. Bruni D, Iacono F. Is unicompartmental arthroplasty an acceptable option for spontaneous osteonecrosis of the knee? *Clin Orthop Relat Res.* 2012;470(5):1442-51.
20. Shakespeare D, Ledger M, Kinzel V. Accuracy of implantation of components in the Oxford knee using the minimally invasive approach. *Knee.* 2005;12(6):405-9.