

# Does the overhang of tibial component in fixed bearing medial unicondylar knee arthroplasty affect 1-year results?

Sabit tip medial unikonidler diz artroplastisinde tibial komponentin kemik yüzeyden taşması 1 yıllık sonuçları etkiler mi?

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## Abstract

**Aim:** Unicondylar knee arthroplasty (UKA) is an effective treatment for single-compartment knee arthrosis. The compatibility of the size of the components with the bone is one of the factors determining patient satisfaction. With this study we aimed to investigate the effect of size concordance of the tibial component and bone in fixed bearing UKA on functional scores and pain.

**Methods:** Demographic data, preoperative and postoperative 1-year visual analog pain scale (VAS) and Oxford Knee Scores (OKS) were collected from 43 patients operated by a single surgeon with a fixed bearing UKA implant (Zimmer UKA, Warsaw USA) for this prospective cohort study. Patients were then grouped according to radiological compliance of the tibial component to the bone as perfect match or overhang, and the groups were compared in terms of pain and functional scores.

**Results:** Among 43 patients included in the study, 9 (20.9%) were males and 34 (79.1%) were females. The mean age of the patients was 62.1 (8.1) years. The median VAS and OKS scores of the patients before surgery were 6 (3-8) and 26 (21-30), respectively. Postoperatively, VAS score decreased to 1 (0-2), while OKS increased to 44 (37-48) ( $P<0.001$  for both). There were only 3 patients with underhang. Twenty-two (52.1%) patients had perfect match and 18 (41.9%) had an overhang from the bone surface. There was no patient with an overhang greater than 3mm. The VAS and OKS scores at post-operative 1-year of 18 patients with overhang and 22 patients without bone overhang were similar ( $P=0.674$  and  $P=0.873$ , respectively).

**Conclusion:** The overhang of the tibial component in fixed bearing unicondylar knee arthroplasty is common, however, this does not affect functional results in 1-year follow-up. Nevertheless, the sizing of the component should be checked by adequate means.

**Keywords:** Unicondylar, Knee, Arthroplasty, Function, Implant size

## Öz

**Amaç:** Unikonidler diz artroplastisi (UDA) tek kompartman artrozunda etkinliği kanıtlanmış bir tedavidir. Kemik ile implant bileşenlerinin uyumu hasta memnuniyetini etkileyen faktörlerden biridir. Bu çalışma ile kemik ve tibial bileşen uyumunun ağrı ve fonksiyon skorları üzerindeki etkisini incelemeyi amaçladık.

**Yöntemler:** Bu prospektif kohort çalışmasında tek cerrah tarafından opere edilmiş 43 sabit tip UDA (Zimmer UKA, Warsaw, ABD) hastasının demografik verileri, cerrahi öncesi ve cerrahi sonrası birinci yıldaki vizüel analog ağrı skalası (VAS) ve Oxford Knee Score (OKS) sonuçları incelenmiştir. Hastalar radyolojik olarak kemik yüzey ile implantın uyumuna göre mükemmel uyum ve taşma olarak gruplanmıştır. Ardından grupların ağrı ve fonksiyon skorları karşılaştırılmıştır.

**Bulgular:** İncelenen 43 hastanın 9'u (%20,9) erkek ve 34'ü (%79,1) kadındır. Ortalama yaş 62,1 (8,1) yıldır. Cerrahi öncesi VAS ve OKS ortanca değerleri sırasıyla 6 (3-8) ve 26 (21-30) idi. Cerrahi sonrasında VAS 1'e (0-2) düşerken OKS 44'e (37-48) yükselmiştir (her ikisi için  $P<0,001$ ). Sadece 3 hastada implant kemikten daha küçüktü. 22 (%52,1) hastada kemik ile protez arasında tam uyum mevcuttu. 18 (%41,9) hastada ise kemik yüzeyden taşma izlenmiştir, ancak bu hastalardan hiçbirinde fark 3 mm'den fazla değildi. Mükemmel uyum ve taşma grubunun cerrahiden sonraki birinci yıl VAS ve OKS sonuçları karşılaştırıldığında anlamlı bir fark olmadığı görülmüştür (sırasıyla  $P=0,674$  ve  $P=0,873$ ).

**Sonuç:** Sabit tip unikonidler diz artroplastisinde taşma sık görülürken bunun cerrahi sonrası birinci yıl ağrı ve fonksiyonel sonuçlar üzerinde bir etkisi yoktur. Yine de implant seçimi yapılırken taşmanın önüne geçmek için gerekli önlemler alınmalıdır.

**Anahtar kelimeler:** Unikonidler, Diz, Artroplasti, Fonksiyon, İmplant büyüklüğü

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Ethics Committee Approval: This study was approved by the Ethics Committee of Ankara University, Faculty of Medicine (7/13/2020-16-390-20). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Etik Kurul Onayı: Çalışma Ankara Üniversitesi Tıp Fakültesi Etik Kurulu (13.7.2020-16-390-20) tarafından onaylanmıştır. İnsan katılımcıların katıldığı çalışmalardaki tüm prosedürler, 1964 Helsinki Deklarasyonu ve daha sonra yapılan değişiklikler uyarınca gerçekleştirilmiştir.

Conflict of Interest: No conflict of interest was declared by the authors.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Published: 7/27/2020

Yayın Tarihi: 27.07.2020

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## Introduction

Unicondylar knee arthroplasty (UKA) is an effective and successful treatment method that has been used for a long time in isolated single-compartment knee arthrosis [1,2]. For a successful and long-lasting UKA, the quality of the surgical procedure is as important as the patient selection. The amount of correction of the underlying varus, the arrangement and placement of the components used are very important [3,4]. In particular, the compatibility of the size of the components with the bone is one of the factors that determine patient satisfaction [5].

Joint pain, which does not dissolve after surgery, is often the most prominent complaint regarding prosthesis. Especially incompatibility and overhang of the components with bone surface may lead to permanent pain [6]. Although similar studies in total knee arthroplasty have shown a detrimental effect on patient satisfaction and functional outcomes of implant overhang, there are not enough studies investigating this situation in unicondylar knee arthroplasty [7,8]. In unicondylar knee arthroplasty, where there is more fear of tibial component collapse than total knee arthroplasty, there is a tendency among surgeons to choose a larger sized implant.

With this study, we aimed to investigate the size concordance of the tibial component and bone in fixed bearing unicondylar knee arthroplasties and evaluate the effect of the underhang or overhang if present on functional scores.

## Materials and methods

This study complies with Helsinki Declaration and has the approval of the Ethics Committee of Ankara University Faculty of Medicine (13/7/2020- I6-390-20). All patients who underwent medial fixed bearing unicondylar knee arthroplasty in our department in 2018 and who were followed up for at least one year were included in the study. Surgical indications for unicondylar knee arthroplasty were gonarthrosis in only one compartment of the knee with bone-to-bone contact, an intact anterior cruciate ligament and knee varus less than 15°.

From a total of 47 patients who received UKA, 1 patient was excluded due to lateral compartment UKA, 2 patients were excluded for being lost to follow-up before the 1-year control and 1 patient was excluded because she did not have the appropriate x-rays.

All patients were operated by a single surgeon who had at least 5 years of UKA experience and performed more than 50 unicondylar knee arthroplasties. After exsanguination and application of tourniquet, a 7-10 cm skin incision was made. Arthrotomy was achieved by the midvastus approach. Cemented fixed bearing unicondylar knee implants were used in all patients (Zimmer High Flex Unicompartmental, Warsaw USA). Femoral side was prepared with the help of the intramedullary guide, then a tibia cut was made with the extramedullary guide as recommended by the manufacturer. With the measuring apparatus provided in the surgical set, the size of the tibial components was decided. Also, the insert thickness appropriate for the medial collateral ligament tension was selected by using tension guide with trials. After the trial, the original implants were fixed with cement and the incisions were closed (Figure 1).



Figure 1: X-rays showing the antero-posterior and lateral knee views of a patient with UKA.

Demographic data (age, gender, BMI), size of the implant used, pain visual analog scale (VAS) values before and at the 1-year follow-up were obtained from the patient files. Functional results were evaluated with the Turkish Oxford Knee Score (OKS) of the patients obtained before the surgery and at the first-year follow-up [9]. The radiological evaluation was made by an experienced orthopedic surgeon (MK) other than the one who performed the surgeries. The long leg and knee AP and side radiographs were used. The amount of varus correction in coronal plane and the conformity between the bone and tibial component were explored in both the coronal and sagittal plan. Any underhang or overhang were measured in mm with PACS. Patients were grouped according to radiological compliance of the tibial component to the bone as perfect match, underhang or overhang.

### Statistical analysis

Kruskal–Wallis test was used to compare continuous values and Chi-square statistical test was used to compare categorical data for each of the groups. Statistical significance level was set at  $P$ -value  $<0.05$ .

## Results

Among 43 patients included in the study, 9 (20.9%) were male and 34 (79.1%) were female. The mean age of the patients was 62.1(8.1) years. The mean body mass index was 30.4(4.2) kg.m<sup>-2</sup>. While the average varus alignment in the operated leg before surgery was 9.3°(4.3°), it decreased to 2.8°(1.9°) postoperatively. Preoperatively, the median VAS and OKS scores of the patients were 6 (3-8) and 26 (21-30), respectively. After surgery, VAS score decreased to 1 (0-2), while OKS increased to 44 (37-48). The improvement of both VAS and OKS were statistically significant ( $P<0.001$  for both).

The postoperative x-rays of the patients revealed that only 3 patients had underhang in the sagittal plane. Therefore, the underhang group was not included in the evaluation of functional results and VAS scores. In 22 patients, bone and implant were perfectly matched in both the coronal and sagittal planes. In 18 (41.9%) of the patients, the tibial component was observed to overhang from the bone surface. While 6 patients had mismatch in the sagittal plane (overflowing from the posterior of the tibia), the remaining 12 patients had medial overhang. In both plans, no patient had an overhang greater than 3mm.

The change of VAS and OKS scores of 18 patients with overhang and 22 patients without bone overhang were similar ( $P=0.674$  and  $P=0.873$  respectively) (Table 1).

Table 1: Table showing the age, gender, pain and functional scores of the perfect implant-bone match group and overhang group

		Perfect match	Overhang	P-value
n		22	18	
Age		61.9	62.1	0.999
Gender	Male	5	3	0.898
	Female	17	15	
VAS	Preoperative	6 (3-7)	5 (3-8)	0.674
	Postoperative*	1 (0-2)	1 (0-2)	
OKS	Preoperative	26 (21-29)	27 (22-30)	0.873
	Postoperative*	43 (37-48)	44 (37-48)	

VAS: Visual Analog Scale, OKS: Oxford Knee Score, \* Postoperative 1-year

## Discussion

The results of our fixed bearing unicondylar knee arthroplasty series show that there is no significant relationship between the presence of overhang and functional results. Only 51.2% of patients had perfect fit. However, it should be remembered that none of the patients with incompatibility had an overhang of more than 3 mm.

The current literature shows that the perfect fit of the proximal tibia and the tibial component is lower than predicted [10,11]. Chau et al. [12] reported that the one-to-one fit was only seen in 3% of 149 Oxford unicondylar knee arthroplasties they examined. Similar results can be seen with the total knee cases in the literature [8,13]. Although the exact compliance rate reported in our series is 51.2%, the percentage of overhang is still noteworthy. Almost half of the cases have an implant protruding from the surface of the bone in one of the two plans. Still, this overhang was less than 3 mm in every case.

Anatomical studies indicate that perfect bone-implant match is exceedingly challenging to achieve because the implant sizes increase by 2 mm increments and the antero-posterior and medio-lateral lengths are constant [10]. Also, the rotation of the tibial bone cut can lead to direct size mismatch [6,14]. Although techniques such as robotic surgery or patient specific instrumentation have been introduced by the industry to correct rotational and alignment problems, there is still no definitive solution to such issues [15–17]. Another important factor is the difference in bone morphology and sizes in men and women. It is known that compliance decreases, especially as the tibia becomes smaller [12]. Although gender-specific implants are currently available, their efficacy is also controversial [18]. It should be taken into consideration that we had more female patients than males and they tend to have implants smaller in size.

Manufacturers and various authors suggest that small placement of the tibial component is associated with early aseptic loosening of the implant, particularly in unicondylar knee arthroplasty, so underhang should be avoided [19,20]. In the proximal tibia, the cortex is stronger and the implant subsidence and the risk of periprosthetic fracture are lower when the implant makes direct contact with the cortex [15]. Gudena et al. state that overhanging up to 2mm is acceptable in Oxford knee implants [21].

Unfortunately, we do not know our long-term results, for which studies with longer follow-up periods should be conducted.

The overhang of the tibial component from the bone is an important problem leading to patient dissatisfaction, especially by causing soft tissue irritation. An in vitro cadaver study has shown that overhang over 2 mm creates a significant

amount of tension in MCL [21]. There is only one study in UKA that compares functional results with tibial overhang by Chau et al. [12]. They examined the relationship of the tibia with the component in the Oxford model knee prosthesis in the coronal plane and showed that 70% of patients had less than 3mm overhang, which did not affect the functional results. Only 9% of the patients had more than 3mm of overhang with complaints. Similarly, there are large series in total knee arthroplasty literature showing that the oversized tibial component does not affect functional results [22–24]. Akin to those, our study emphasized that overhang does not affect functional results in patients.

It should not be forgotten that the surgical technique is not the only factor determining functional results and patient satisfaction. Other factors such as alignment and soft tissue balance are as important as the choice of component size [25,26]. For example, in a national database review where revised UKAs were examined, it was stated that technical defects related to alignment, bone cut or cementing constituted more than half of the revision indications but there was only a 9% error regarding the implant size [11].

## Limitations

It is clear that our study has some limitations. First, 4.6% of the patients were lost to follow-up. Although this ratio is small, their inclusion in the study would have increased its power. In addition, standard postoperative radiographs were used as the measurement method. It is known that computed tomography is a more successful method especially in evaluating rotation and measuring small overhangs, however, it is unethical to use CT only for study purposes due to the high ionizing radiation. The most critical point of the study that needs improving is the lack of long-term follow-up.

## Conclusion

The overhang of the tibial component seems a common occurrence in fixed bearing unicondylar knee arthroplasty, but this does not affect functional results in 1-year follow-up. Nevertheless, the sizing of the component should be checked by adequate means like preoperative templating, intraoperative x-rays or use of fluoroscopy.

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