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EFFECT OF PATELLOFEMORAL OSTEOARTHRITIS ON FIXED BEARING MEDIAL UNICOMPARTMENTAL KNEE ARTHROPLASTY

UNİKONDİLER DİZ ARTROPLASTİSİ GEÇİREN KİŞİLERDE PREOPERATİF PATELLOFEMORAL ARTROZ DURUMUNUN KLİNİK VE FONKSİYONEL SONUÇLARA ETKİSİ

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Abstract

Objective: To compare short-term clinical and functional outcomes of medial unicompartmental knee arthroplasty (UKA) with and without radiographic evidence of patellofemoral osteoarthritis.

Methods: Patients who were between 40 and 80 years of age, who had medial compartmental arthritis, between 2011 and 2013, and had undergone medial UKA were included in the study. Patient status for preoperative patellofemoral arthritis was classified as early stage (group 1) and advanced stage (group 2).

Patient range of motion measurements, anterior knee pain, Knee Society Knee Arthroplasty Assessment Form Scores, Western Ontario and McMaster University Osteoarthritis Index Scores, and Oxford knee scores were applied during the preoperative period and at the final postoperative follow-up. The duration of the Standing on One Foot Test, passive and active joint position sense, and isokinetic muscle strength test in concentric/concentric mode at an angular velocity of 120°/s were measured at the final postoperative follow-up.

Results: As follow-up, the data of 45 of 109 patients could not be obtained; hence, the study was concluded with 64 patients. There were no statistically significant differences between the groups in terms of the demographical data and duration of postoperative follow-up (Group 1: 25.1 months, Group 2: 24.1 months) ($P > 0.05$). During the postoperative follow-ups of the patients who underwent UKA, the surgery was determined to provide successful outcomes. No effect of whether the patients had early or advanced-stage patellofemoral arthritis was determined.

Conclusion: The radiological stage of patellofemoral arthritis did not influence the short-term functional data of UKA.

Keywords: Unicompartmental knee arthroplasty, patellofemoral osteoarthritis, knee score, balance, joint position sense, isokinetic

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Öz
Amaç: Bu çalışmanın amacı, radyografik olarak patellofemoral osteoartrit kanıtı olan ve olmayan medial tek kompartmanlı diz artroplastisinin kısa dönem klinik ve fonksiyonel sonuçlarını karşılaştırmaktı.
Yöntemler: 2011-2013 yılları arasında medial kompartman artrit olan ve medial unikompartmanal diz artroplastisi uygulanan 40-80 yaş arasındaki hastalar çalışmaya dahil edildi. Pre-operatif artroz durumuna göre, hastalar erken evre (grup 1) ve ileri evre (grup 2) olarak sınıflandırıldı. Hastalara, hareket açıklığı ölçümü, ön diz ağrısı değerlendirmesi için "Diz Cemiyeti" Diz Artroplastisi Değerlendirme Formu (KSS) Skoru, Western Ontario ve McMaster Üniversitesi Osteoartrit Indeks (WOMAC) Skoru ve Oxford diz skoru ameliyat öncesi dönemde ve ameliyat sonrası son kontrolde uygulandı. "Tek Ayakta Durma Testi" süresi, pasif ve aktif eklem pozisyon hissi ölçümü ve 120 ° açısal hızda konsantrik / konsantrik modda izokinetik kas gücü testi son postoperatif kontrolde yapıldı.
Bulgular: 109 hastadan 45'inin takip verileri alınamadığı için çalışma 64 hasta ile sonuçlandı. Gruplar arasında demografik veriler ve postoperatif takip süresi açısından istatistiksel olarak anlamlı fark yoktu (Grup 1: 25,1 ay, Grup 2: 24,1 ay), ($p>0.05$). UKA yapılan hastaların postoperatif takiplerinde ameliyatın başarılı sonuçlar sağladığı belirlendi. Hastalarda erken veya ileri evre patellofemoral artrit olup olmadığının bir etkisi saptanmadı.
Sonuç: Patellofemoral artritin radyolojik evresi, UKA'nın kısa dönem fonksiyonel verilerini etkilememektedir.

Anahtar Kelimeler: Unikondiler diz artroplastisi, patellofemoral osteoartrit, diz skorlaması,denge, eklem pozisyon hissi, izokinetik

Introduction

Increased utilization of medial unicompartmental knee arthroplasty (UKA) for the treatment of medial compartment osteoarthritis over recent decades. The contraindications of UKA remain controversial. Kozinn and Scott reported strict indications and contraindications for UKA in 1989 [1]. If these criteria were maintained, the number patients with knee osteoarthritis who would be suitable for UKA was reported as 6% [2].

Compared to total knee arthroplasty (TKA), UKA has a similar long-term curative effect [3]. UKA also has many advantages over TKA. UKA provides less invasive soft tissue dissection, bone stock preservation, less blood loss, a greater level of activity, better range of motion, high patient satisfaction and high rate of return to sport activity [4-9]. In light of these advantages, indications of UKA were investigated to report more extended indications.

Patellofemoral osteoarthritis (PFOA) is a relatively common condition in patients who have symptomatic medial or lateral compartment osteoarthritis. PFOA is one of the classical contraindications for UKA. The presence of radiographic and clinical findings of PFOA are often considered as a contraindication[10]. The belief that PFOA is likely a contraindication to UKA is common. Presently, arthritis of the patellofemoral compartment, especially arthritis of the lateral facet of the patella, is still a controversial issue for the recommendation of UKA[9].

In the recent literature, there has been a tendency towards ignoring the status of patellofemoral joint when considering UKA [11]. Patellofemoral joint state may be ignored when deciding to perform UKA [12]. Recent studies have had supportive findings of UKA as a successful treatment for PFOA [13,14]. Most studies have evaluated the effect of PFOA on UKA outcomes in mobile bearing prosthesis [10].

There is limited evidence regarding the effect of PFOA on outcomes of UKA. Further studies are needed for the effect of PFOA on the clinical outcomes of UKA.

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The purpose of this study was to compare the short-term clinical and functional results of medial UKA with and without radiographic evidence of PFOA.

Material and Methods

This study was approved by the local ethics committee under decision No. 156 and dated 28.09.2016. This study was conducted in accordance with the principles of the Helsinki declaration. Included in this study were 109 patients who underwent medial UKA.

UKA indications, inactive persons older than 60 age, focal osteonecrosis, under 82 kg (181 lb), min 90° flexion arc, flexion contracture less than 5°, passively up to 10° correctable varus deformity, intact anterior cruciate ligament (ACL), intact contralateral tibio-femoral compartment, intact PF joint, and unicompartmental osteoarthritis (for medial anteromedial osteoarthritis) [15]. After some researchers questioned the age, activation level, weight, ACL lesion, and patellofemoral joint osteoarthritis, broadening the indications to a wider patient group, UKA was implemented [15]. While making the decision for surgery, the presence of pain that influences daily life, presence of varus deformities below 15° during various stress tests, presence of a knee flexion of at least 90°, lack of a loss of more than 10° during knee extension, and functionality of the ACLs were considered. During patient selection for surgery, the presence of PFOA and parameters such as age and body weight were not used.

Fixed-bearing medial UKA was performed in all of the patients using the medial parapatellar mini arthrotomy approach (Zimmer Inc., Warsaw, USA). At the end of prosthesis practice, patellar denervation was performed in all of the patients. All surgical practices were performed with the standard technique by a single knee surgeon (M.U.).

The patients underwent the described surgical procedure, range of motion exercises, isometric muscle strength exercises, and walking training was provided, as much as could be tolerated, in the early postoperative period. After that, a strengthening program was implemented with isotonic muscle strength exercises. Patients who performed their exercises within the first 6 weeks, under medical supervision, then complied with a home exercise program for 6 months. Clinical follow-up visits of the patients were conducted at 6 weeks, 3 month and 6 months, and 1 and 2 years postoperatively.

Patients between 40 and 80 years of age who underwent UKA, did or did not have patellofemoral arthritis, complied with postoperative rehabilitation, whose informed consents were obtained, and who did not meet the exclusion criteria were included in the study. Those who required revision on the surgical site, developed technical insufficiency on the operated knee, had patellofemoral joint arthritis, and did not comply with the functional tests performed were not included in the study.

Patient status of having preoperative patellofemoral arthritis was classified according to the Iwano patellofemoral arthritis classification [16]. Patients with early-stage patellofemoral arthritis (Iwano stage 1 and stage 2) were placed into group 1 and those with advanced stage (Iwano stage 3 and stage 4) were placed into group 2.

Patient range of motion measurement [17], anterior knee pain visual analog scale (VAS) pain score [17], Knee Society Knee Arthroplasty Assessment Form (KSS) score [18], Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score [19], and Oxford knee score (OKS) [16] questionnaires were applied during the preoperative period and at the final postoperative follow-up. At the

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final postoperative follow-up, the Standing on One Foot Test was performed with both eyes closed and then opened for a maximum of 30 s in order to determine functional balance [20]. To evaluate the joint position sense, passive proprioception was measured at 30° and 75°, and active proprioception at an angular velocity of 1°/s on isokinetic dynamometers (HUMAC® NORM™ Testing & Rehabilitation System, USA). To evaluate muscle strength, however, isokinetic muscle strength in concentric mode at an angular velocity of 120°/s was used, all of which were measured by physicians who did not have knowledge about patient status of patellofemoral arthritis [21].

Statistical Analysis:

All data were analyzed using IBM SPSS Statistics for Windows 20.0 (IBM Corp., Armonk, NY, USA). For description of the data, descriptive statistics were given, while the independent samples t test was used for determination of the differences among independent groups, and the dependent samples t test was used for the pretest-posttest evaluation. $P < 0.05$ was accepted as statistically significant. Results were given as the mean ± standard deviation.

Table 1. Range of motion values (°).

	Group 1 (n: 35)	Group 2 (n: 29)	P-value*
Pre op flex ROM	129.3 ± 10.6	126.7 ± 13.2	0.4
Post op flex ROM	128.1 ± 10.3	128.3 ± 11.8	0.9
P-value**	0.7	0.4	
Pre op ext ROM	5.6 ± 3.8	5.2 ± 4.3	0.7
Post op ext ROM	0.3 ± 1.7	0 ± 0	0.3
P-value**	0.001**	0.001**	

Pre op: preoperative, post op: postoperative, flex: flexion, ext: extension, ROM: range of motion. *: independent samples test, **: paired samples test: significant difference.

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Table 2. Anterior knee pain and functional knee score.

	Group 1 (n: 35)	Group 2 (n: 29)	P-value*
Pre op VAS	7.5 ± 1.2	7.3 ± 1.6	0.7
Post op VAS	0.2±0.4	0.4 ± 0.5	0.05
P-value**	0.001**	0.001**	
Pre op KSS/KSS function	48.1 ± 7.6/56.1 ± 10.3	48.5 ± 6.1/55.5 ± 8.9	0.8/0.8
Post op KSS/KSS function	98.2 ± 3.2/98.8 ± 3.3	97.1 ± 2.7/99 ± 3.1	0.2/0.8
*p value***	0.001**/0.001**	0.001**/0.001**	
Pre op WOMAC	48.9 ± 2.2	49 ± 3.5	0.9
Post op WOMAC	98.3 ± 2.3	97.6 ± 2.6	0.2
*p value***	0.001**	0.002**	
Pre op OKS	12.9 ± 3.6	13.2 ± 2.9	0.6
Post op OKS	48.6 ± 9.3	46.4 ± 1.3	0.2
P-value**	0.001**	0.001**	

VAS: Visual Analog Scale, KSS: Knee Society scores, WOMAC: Western Ontario and McMaster Universities osteoarthritis index, OKS: Oxford knee scores. *: independent samples test, **: paired samples test: significant difference.

Results

Of the 35 patients in Group 1, 19 were operated from the right knee, while 16 were operated from the left knee, and the duration of postoperative follow-up was 25.1 months. Of the 29 patients in Group 2, 18 were operated from the right knee, while 11 were operated from the left knee, and the duration of postoperative follow-up was 24.1 months. There was no significant difference with regards to the demographic data and duration of postoperative follow-up between the groups (P > 0.05).

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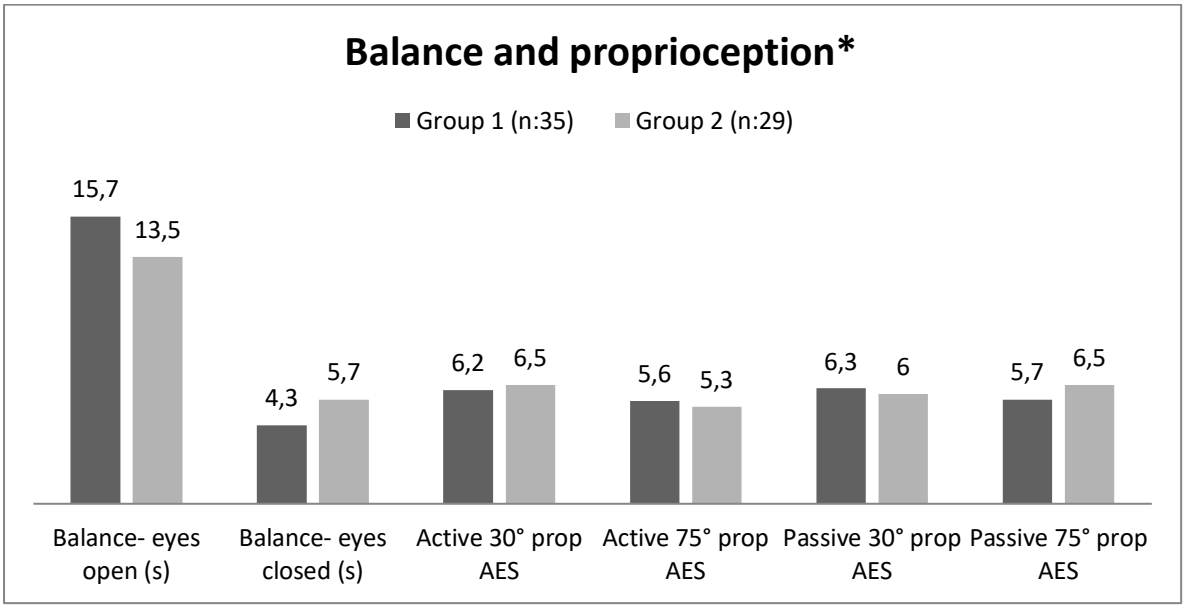
In an evaluation performed between the independent groups, no statistically significant difference was determined in the preoperative-postoperative range of motion, anterior knee pain, and functional knee questionnaires (P > 0.05). In the pretest-posttest evaluation of the groups, a statistically significant difference (P < 0.05) was determined between the groups for all of the parameters, except for range of motion on flexion (P > 0.05) (Tables 1 and 2).

No significant difference was found between the groups with regards to the postoperative functional balance, joint position sense, and isokinetic muscle strength values (P > 0.05) (Figures 1 and 2).

Discussion

It is known that number of women who undergo UKA is higher, as is the incidence rate of osteoarthritis. On this issue, the male/female ratio provided by Mofidi et al. was 1/6.5–7 [22]. In this study, the female/male ratio of the patients was consistent with that in the literature. During the postoperative follow-up of the patients who underwent UKA and had similar preoperative functional findings, the surgery was determined to provide successful outcomes. In addition to this, whether patients had early- or advanced-stage patellofemoral arthritis did not influence the clinical outcomes negatively or positively.

Figure 1. Functional balance (s) and joint position sense (°) values.



Prop: proprioception, AES: absolute error score, s: second. *: independent samples test.

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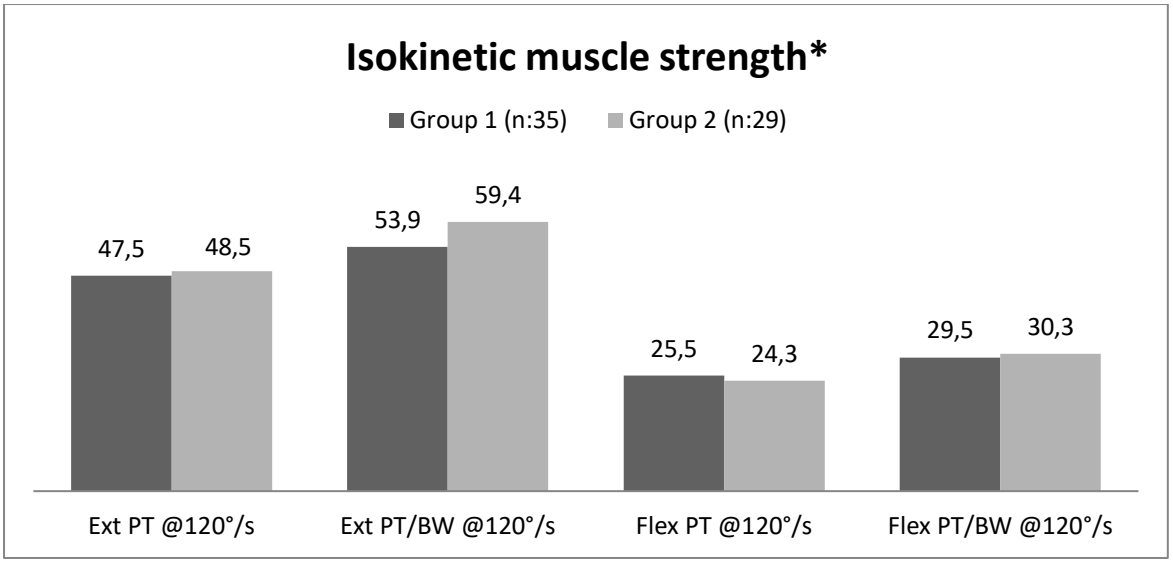
Figure 2. Isokinetic muscle strength values (Nm).



Ext: extension, Flex: flexion, PT: peak torque, BW: body weight, s: second. *: independent samples test.

Until recently, some surgeons have avoided performing UKA on patients with patellofemoral joint arthritis. Some of surgeons performed surgery for patients with asymptomatic patellofemoral joint arthritis, and some have considered whether symptomatic patients had medial facet involvement or minimal lateral facet involvement, and they primarily preferred TKA for patients with lateral facet involvement[9]. It is possible to encounter different studies investigating the effect of patient preference on clinical outcomes in the literature.

Berend et al. reported that that they followed-up their patients for 1–7 years and found that, according to the modified Altman classification, 3.5% of the patients who were stage 0 1.2% who were stage 1, 1.5% who were stage 2, and 0% who were stage 3 required a revision surgery, and the presence of preoperative radiological evidence of patellofemoral disease did not negatively influence the surgical outcomes or survey[11]. In another study by the same researchers, however, it was reported that the presence of preoperative anterior knee pain and radiological status were not associated with postoperative OKS and KSS scores, and neither knee pain nor stage of arthritis would pose any contraindication for UKA[2]. Similar results were observed by different researchers in a cases series with a mean follow-up duration of 50 months [24].

According to some researchers, a low preoperative OKS score, the presence of moderate-degree arthritis, or subluxation of the lateral facet of the patellofemoral joint may negatively influence the outcomes of UKA and progress to a revision surgery [25]. However, no negative association of the presence of a full-thickness cartilage loss in any part of the patella or the presence of preoperative anterior knee pain with success of the surgery was determined[25]. The OKS score, which was a mean of 24 (±7) points preoperatively, increased to up to 40 (±8) points at 1 year after surgery[25]. Similar results were also obtained in the current study.

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On the other hand, there are studies that have reported that the presence of a Outerbridge stage 3–4 cartilage lesion on the lateral facet of patients who underwent UKA did not negatively influence pain or functional outcomes, but the knee scores of these patients were lower[9]. According to the data provided by these studies, it was determined that, of the patients with early stage patellofemoral arthritis, the preoperative KSS score was 34.9 (±2.3) points, anterior knee pain VAS score was 2.1 (±1.9) points, range of motion of knee on flexion was 121 (±7.1)°, and on extension was 4.9 (±4.2)°, whereas they were 96.7 (±4.5) points, 0.11 (± 0.56) points, and 128.9 (± 5.7)°, respectively, during the postoperative follow-up. When the same evaluations were performed for patients with advanced-stage patellofemoral arthritis, it was determined that while they were 33.8 (± 3.3) points, 3.2 (± 2) points, and 112.3 ± 12.3° and 7.4 ± 5.8°, respectively, during the preoperative period, they were 94.4 (±4.5) points, 0.1 (±0.5) points, and 117.6 (±14)°, respectively, during the postoperative follow-up[9]. However, in this case series, it should not be overlooked that the patients with advanced-stage patellofemoral arthritis had more statistically significantly unfavorable clinical presentation during the preoperative period, and this condition might have been reflected on the postoperative outcomes. Data provided in the current study did not comprise a statistically significant difference during preoperative period, making it superior to their study.

Song et al. found that patients with advanced-stage patellofemoral arthritis, according to Kellgren-Lawrence staging system, felt more severe anterior knee pain during the preoperative period, but patients with early- and advanced-stage patellofemoral arthritis did not exhibit any difference with regards to anterior knee pain, Hospital for Special Surgery (HSS) score, radiological parameters, or progression of osteoarthritis during the postoperative 5.4 years. Furthermore, it was also expressed that there was no correlation of the preoperative functional status and pattern of chondral lesion with the postoperative data [10].

While Beard et al. determined OKS scores during the mean postoperative 2nd year to be 41.5 (±7) for patients with full-thickness chondral damage, they determined this score to be 39.4 (±8.7) for those without a chondral lesion. While the OKS score of patients with advanced-stage chondral damage on both the medial and lateral facets was statistically significantly higher, the KSS score was determined to be lower for patients with/without early-stage chondral lesion[12]. Although these results seem to provide paradoxical evidence, the determination of asymptomatic chondral damage with increasing age in cadaver studies may explain this condition [12]. In a different study, it was determined that partial or full-thickness cartilage loss did not cause any difference in the improvement observed in OKS and KSS scores, but the rate of revision surgery of patients in the group with partial-thickness cartilage loss was higher after 5 years[26].

In a study investigating the effects of patellar congruence angle on the outcomes of UKA, it was found that the preoperative degree of congruence angle or patellofemoral degeneration and degree of the WOMAC knee score did not cause any difference between groups by the end of a 2-year follow-up. This situation was considered to result from the improvement of the congruence angle, from 14.2 (±11.2)° preoperatively to 10.05 (±10.2)° postoperatively[27].

In the literature, the number of studies investigating knee proprioceptions and the balance of patients who underwent UKA is limited. In another study on this field, follow-up data of patients who underwent total knee prosthesis and UKA were compared and it was reported that there was an increase in the proprioceptive

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senses of both groups postoperatively. While the joint position sense of the patients was 5.65° before total knee prosthesis and 6.68° before UKA, this sense was postoperatively determined to be 4.68° for patients who underwent total knee prosthesis and 5.27° for those underwent UKA, and the change observed in the patients who underwent UKA was statistically significantly higher [28]. Similar changes and improvement were also obtained in the postural sway parameter, in which the balance is evaluated[28]. No studies investigating the effect of status of patients with preoperative patellofemoral arthritis who underwent UKA on muscle strength, joint position sense, and balance were encountered in the available literature. Evaluation of these parameters in the current study resolves this deficiency in the literature.

Rather than other contraindications of UKA, the majority of the studies on patellofemoral arthritis have suggested that patellar arthritis does not hinder surgery. Possible reasons can be prioritized as the altered contact mechanics of particularly patellofemoral joint after UKA, disappearance of the damaging effect of medial patellar osteophytes on the femur, and acquisition of resemblance by the factors influencing surgical outcomes with increasing age[10,12].

The conduction of various tests for the functional evaluation of UKA surgery and of this study by the same surgeon in one center were the strengths of the study. However, this study also had some limitations. One of these was that the duration of follow-up of the patients was short (2 years); hence, the effect of UKA on long-term functional outcomes and the rate of progression to revision surgery could not be determined. The second was that radiological evaluation was used only for preoperative arthritis classification, and data regarding the tibiofemoral angle, tibial alignment, femoral alignment, and posterior slope angle changes and progression were not provided. The third was that the chondral lesion classification and site of lesion were not described preoperatively.

Conclusion

Data obtained from this study suggested that the radiological stage of patellofemoral arthritis does not influence the short-term functional data of UKA. It may be considered that patellofemoral arthritis does not pose any contraindication for UKA.

Conflict of Interest

The authors declare that they have no conflict of interest

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