Cukurova Medical Journal
ÇUKUROVA ÜNİVERSİTESİ TIP FAKÜLTESİ

Cukurova Med J 2018;43(2):343-349
DOI: 10.17826/cumj.341797

ARAŞTIRMA / RESEARCH

Influence of total knee arthroplasty approaches on component positioning

Total diz artroplastisi yaklaşımlarının komponent yerleşimine etkisi

Elcil Kaya Biçer[1], Murat Celal Sözbilen[2], Semih Aydoğdu[1], Hakkı Sur[1]

[1]Ege Üniversitesi Tıp Fakültesi, Ortopedi ve Travmatoloji Anabilim Dalı, İzmir, Turkey
[2]Dr. Behçet Uz Çocuk Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, İzmir, Turkey

Cukurova Medical Journal 2018;43(2):343-349

Abstract

Purpose: The aim of this study was to evaluate the influence of subvastus and medial parapatellar total knee arthroplasty approaches on component positioning and to explore the possible negative effects of potentially more restrictive approaches especially in highly deformed knees.
Materials and Methods: 88 knees of 84 patients (46 knees operated with medial parapatellar approach (group 1), and 46 knees operated with subvastus approach (group 2)) who had undergone total knee arthroplasty. The patients were also regrouped according to their preoperative mechanical axis deviations. Postoperative femoral and tibial component positioning on frontal and sagittal planes were evaluated.
Results: Frontal femoral (α) and tibial (β) component angles as well as sagittal femoral and tibial component angles were not significantly different between two groups (mean values of α of groups 1&2: 96.79±2.86° and 96.81±3.22°, respectively, of β 89.07°± 3.45° and 89.97°± 3.00° respectively, of sagittal femoral angle 4.85° ± 3.84° and 3.31° ± 3.58°, respectively, of sagittal tibial angle 5.10° ± 3.88° and 4.08 °± 3.18°, respectively). Postoperatively, posterior tibial slope was significantly decreased in both groups.
Conclusion: None of the total knee arthroplasty approaches tested in this study found to exert a significant effect on component positioning even in highly deformed knees. The components can be placed properly utilizing both approaches.

Key words: Knee arthroplasty,osteoarthritis; subvastus approach; medial parapatellar approach

Öz

Amaç: Bu çalışmanın amacı total diz protezi uygulanmış olgularda subvastus ve medial parapatellar yaklaşımın komponentlerin yerleşimine etkisini araştırmak; özellikle yüksek deformiteli dizlerde potansiyel olarak daha kısıtlayıcı yaklaşımların varsa olası olumsuz etkilerini ortaya koymaktır.
Gereç ve Yöntem: Total diz protezi uygulanmış 84 hastanın 88 dizi çalışmaya alındı. Hastalardan 46'sına medial parapatellar (grup 1), 42'sine subvastus yaklaşımla total diz protezi (grup 2) yapılmıştır. Preoperatif radyografilerinde mekanik eksen ve posterior tibial eğim açıları; postoperatif radyografilerinde femoral ve tibial komponentlerin frontal ve sagittal planlarda anatomik eksenlere göre konumlanışı ölçüldü.
Bulgular: Postoperatif femoral komponentin frontal planda konumlanışını gösteren alfa açısının ortalama değeri grup 1'de 96.79°±2.86°, grup 2'de ise 96.81°±3.22° olarak bulundu. Tibial komponentin frontal planda konumlanışını gösteren beta açısının ortalama değeri ise grup 1'de 89.07°±3.45°, grup 2'de 89.97°± 3.00° idi. Sagittal planda konumlanış açısından ortalama sagittal femoral açı grup 1 ve 2'de sırasıyla 4.85°±3.84° ve 3.31°±3.58°, sagittal tibial açı ise yine sırasıyla 5.10°±3.88° ve 4.08°±3.18° olarak bulundu. Hastaların posterior tibial eğimi ve postoperatif sagittal tibial komponent eğimi karşılaştırıldığında, her iki grupta azalmış bulundu.
Sonuç: Total diz protezinde cerrahi yaklaşımın yüksek dereceli deforme dizlerde bile protezin konumlanışı üzerine etkisi gösterilememiştir. Her iki yaklaşımla da komponentler uygun şekilde yerleştirilebilmektedir ve tibianın proksimal posterior eğiminde azalmaya neden olmaktadır.

Anahtar kelimeler: Diz artroplastisi; osteoartrit; subvastus yaklaşım; medial parapatellar yaklaşım

Yazışma Adresi/Address for Correspondence: Dr. Murat Celal Sözbilen, Dr. Behçet Uz Çocuk Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, İzmir, Turkey E-mail: muratcelal@hotmail.com
Geliş tarihi/Received: 20.04.2017 Kabul tarihi/Accepted: 24.05.2017

INTRODUCTION

Correct alignment of components is a crucial step in achieving successful outcomes following total knee arthroplasty (TKA) operations. The components should be positioned optimally with respect to the femoral and tibial anatomical axes both in the frontal and sagittal planes which influence the survival rates of the implants[1,2]. Evaluation of standard postoperative radiographs revealed that the alignment of the lower extremity and positioning of the components were correlated with the clinical outcomes[1,3].

Today, TKA is most commonly performed via standard medial parapatellar approach. However, to a lesser extent, subvastus approach is also utilized to spare the extensor mechanism of the knee. In the subvastus approach, the quadriceps tendon is kept intact and the knee joint is accessed beneath the vastus medialis muscle. The advantage of this approach over standard approach is that the extensor mechanism is not severed which, in turn, facilitates the gain of straight leg raising and quadriceps strength in the early postoperative period[4-6].

In a metaanalysis of randomized control trials comparing TKA approaches, there were a few studies which reported that minisubvastus approach, which primarily preferred in conjunction with minimally invasive TKAs, was no different than standard approach by means of radiographic component positioning[6]. The primary aim of this study was to evaluate the influence of medial parapatellar and subvastus TKA approaches on the alignment of components. When the patients were regrouped according to their mechanical axis deviations being either low or high degree deformities, the influence of approach on component positioning was also aimed to be evaluated.

MATERIALS AND METHODS

This retrospective comparison study was conducted in the Orthopaedics and Traumatology Clinics of Ege University Medical School upon approval from the local ethical board (14-4.2/12). Eighty eight knees of 84 patients who had undergone TKA between June 2001 and February 2014 and had eligible radiographs were included in this study.

The patients were grouped into two with respect to the approach utilized accessing to the knee joints. Standard medial parapatellar approach was followed in 46 knees (group 1) and subvastus approach in 42 knees (group 2). The operations were performed either by the two senior authors (HS, SA) or under their supervision. The demographic characteristics of these patients were given in table 1.

Table 1. The demographic characteristics of the patients

		Group 1 (n=46)		Group 2 (n=42)	
Age (mean ± SD)		69.20±8.37		72.00±6.79	
Sex		6♂ (%13)	40♀ (%87)	2♂ (%4.8)	40♀ (%95.2)
Side (Right/Left)		22 (%47.8)	24 (%52.2)	18 (%42.9)	24 (%57.3)
Postoperative duration (month)		41.65±41.33		52.79±41.63	
Etiology	Osteoarthritis	40(%87)		39 (%92.9)	
	Inflammatory arthritis	4 (%8.7)		3 (%7.1)	
	Osteonecrosis	1 (%2.2)		-	
	Hemophilic arthropathy	1 (%2.2)		-	

Radiographic evaluation

Radiographic assessments of these knees were made utilizing x-rays obtained both preoperatively and postoperatively. In the preoperative period, standing weight bearing long leg x-rays as well as anteroposterior and lateral weight bearing short knee x-rays were obtained. Postoperatively, TKAs were assessed with anteroposterior and lateral short knee x-rays. Mechanical axis deviations were measured on the standing long leg x-rays and posterior tibial slope angles on the preoperative lateral x-rays. Posterior tibial slopes were assessed by measuring the angle between the line passing parallel to the tibial plateau and proximal mid-diaphyseal anatomical line in the sagittal plane. Positioning of the femoral and tibial components was assessed with respect to the criteria of American Knee Society Radiographic Evaluation System. Based on these criteria, positioning of the components relative to the anatomic axes both in frontal and sagittal planes were evaluated and compared between the two groups[1](Figure 1).

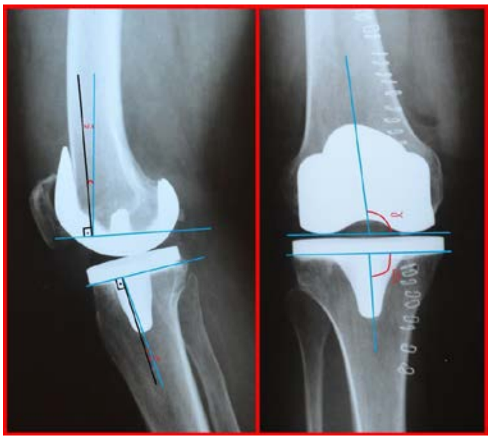

Figure 1. Positioning of the components relative to the anatomic axes both in frontal and sagittal planes

The neutral alignment of the femoral component is mostly commonly accepted as 2°- 8° valgus in the frontal plane (α angle: 92°- 98°) and equal to or less than 3° of flexion in the sagittal plane. Regarding to the tibial component, β angle which corresponds to the angle between the baseplate and the proximal anatomical mid-diaphyseal line of the tibia in the frontal plane should be 90°. The neutral alignment of the tibial component in the sagittal plane which can be interpreted as the posterior slope of the prosthesis should be between 0°- 7°[7, 8]. The outliers of these four parameters were determined and their rates were compared between the two groups.

In addition to the type of approach, the patients were regrouped into two with regards to the preoperative mechanical axis deviations as low degree (less than 15°) and high degree (equal to or greater than 15°) varus deformities. The positioning of the components was compared between the four groups. The changes in the posterior tibial slope in both groups were also evaluated.

Statistical analysis

Statistical analyses were performed utilizing SPSS v18 program. The normality of the distribution was tested with one sample Kolmogorov Smirnov test and homogeneity of the variances with the Levene test. Independent and paired samples t-tests were utilized to compare means. Multivariate analysis was performed using Kruskal-Wallis test. Chi square and Fisher's exact tests were performed to compare rates. The significance level was set at 0.05.

RESULTS

The subvastus and medial parapatellar approach groups were found to be comparable by means of their preoperative mechanical axes deviations and posterior tibial slope angles (Table 2).

The comparison of the four angles related to the component positioning did not constitute a statistically significant difference between the approach groups.

α angle: The mean value of the α angle which corresponded to the positioning of the femoral component in the frontal plane was 96.79°±2.86° in group 1 (parapatellar approach group) and 96.81°±3.22° in group 2 (subvastus approach group); there was not a statistically significant difference between the two approach groups in terms of α angle ($p=0.969$). When the neutral alignment of the femoral component was accepted to be between 2° and 8° of valgus, in other words when the normal value of α angle was between 92° and 98°, in group 1 there were 12 (26.1%) outliers and in group 2 15 (35.7%). All of these outliers but two in the subvastus group were found to be in the valgus position greater than 8°. The two groups were not different by means of outlier ratios (χ^2 value: 2.581 $p=0.275$).

β angle: The mean value of the β angle which corresponded to the positioning of the tibial component in the frontal plane was 89.07°±3.45° in group 1 (parapatellar approach group) and 89.97°± 3.00° in group 2 (subvastus approach group). The comparison of β angle between the two groups did not lead to a statistically significant difference ($p=0.196$). Since the neutral alignment of the tibial component in the frontal plane was 90° relative to the proximal tibial anatomic axis, in group 1 only one and in group 2 four tibial components were inserted neutrally in the frontal plane. The evaluation of the outliers revealed that in group 1, 25 (55.6%) and group 2, 16 (42.1%) of these tibial components were in varus position. The varus alignment was less than 3° in 16 knees (64% of the varus outliers) in group1 and 12 knees (75% of the varus outliers) in group 2. The two groups were not different by means of outlier ratios ($p=0.188$).

Table 2. Preoperative mechanical axis deviation (MA), posterior tibial slope angles, α, β, SFA and STA angles (mean ± standard deviation)

	Parapatellar approach	Subvastus approach	P value
MA (preoperative)	15.74°± 6.46°	17.31°±8.45°	0.32
Posterior tibial slope (Preoperative)	7.31°± 3.16°	8.29°± 3.44°	0.16
Frontal femoral component angle (α angle)	96.79° ± 2.86°	96.81° ± 3.22°	0.96
Frontal tibial component angle (β angle)	89.07°± 3.45°	89.97°± 3.00°	0.19
Sagittal femoral component angle (SFA)	4.85° ± 3.84°	3.31° ± 3.58°	0.057
Sagittal tibial component angle (STA)	5.10° ± 3.88°	4.08 °± 3.18°	0.18

Sagittal tibial angle (STA): The mean values of STA were found to be 5.10°±3.88° and 4.308°±3.518° in groups 1 and 2, respectively; there was not a statistically significant difference between the two approach groups in terms of STA (p=0.184). The neutral alignment of the tibial component in the sagittal plane which corresponded to the posterior slope was accepted to be between 0° and 7° of flexion. In group 1, there were nine (19.6%), and in group 2, eight (19%) knees were beyond this range. All of these outliers but one in the subvastus group was found to have their posterior slopes increased.

When the patients were further grouped according to their preoperative deformities, the comparison of α, β, SFA and STA angles between these four groups did not reveal a statistically significant difference (p values: α: 0.929, β: 0.215, SFA: 0.199, STA: 0.506) (Table 3). The posterior tibial angles were found to be decreased in both groups postoperatively (group 1 p=0.004, group 2 p<0.0001) (Table 4).

Sagittal femoral angle (SFA): The mean values of SFA were found to be 4.85°±3.84° and 3.31°±3.58° in groups 1 and 2, respectively; there was not a statistically significant difference between the two approach groups in terms of SFA (p=0.057). Since the neutral alignment of the femoral component was accepted to be equal to or less than 3° of flexion, 23 knees (50%) in group 1 and 17 knees (42.5%) in group 2 were outliers. The two groups were not different by means of outlier ratios (p=0.399). All of the femoral components but two in the subvastus group were inserted in extension in the sagittal plane.

Table 3. Component positioning in subgroups with respect to the mechanical axis deviations

(mean ± standard deviation)	Parapatellar approach		Subvastus approach		P value
	MA<15 (n=20)	MA≥15°(n =26)	MA<15° (n=17)	MA≥15° (n=25)	
MA (preoperative)	9.65°± 3.51°	20.42°± 3.67°	9.41°± 2.90°	22.68°± 6.51°	
Posterior tibial slope (Preoperative)	6.94°± 2. 81°	7.60°± 3.44°	7.89°± 3.76°	8.56°± 3.26°	0.331
α angle	96.78° ± 3.43°	96.79° ± 2.43°	96.68° ± 2.81°	96.90°± 3.26°	0.929
β angle	87.86°± 3.47°	90.00°± 3.20°	89.68°± 2.60°	90.18°± 3.29°	0.215
SFA	4.57° ± 3.50°	5.06°± 4.32°	2.94°± 2.55°	3.56°± 4.17°	0.199
STA	5.66° ± 3.94°	4.66°± 3.87°	4.31 °± 2.85°	3.92°± 3.44°	0.506

SFA: Sagittal femoral angle STA:Sagittal tibial component angle

Table 4. Comparison of preoperative posterior tibial slopes and sagittal tibial component angles (mean ± standard deviation)

	Posterior tibial slope (Preoperative)	Sagittal tibial component angle	P value
Parapatellar approach	7.31°± 3.16°	5.10° ± 3.88°	0.004
Subvastus approach	8.29°± 3.44°	4.08 °± 3.18°	<0.0001

DISCUSSION

The most important finding of this study was that femoral and tibial components could be positioned appropriately with both medial parapatellar and subvastus approaches as long as corresponding technique was properly performed. Our findings showed that the type of approach for TKA did not influence femoral or tibial component positioning in either frontal or sagittal plane.

The alignment of the components as well as the lower extremity should be restored appropriately with a TKA since the alignment influences both clinical outcomes and prosthetic survival. The influence of different prosthetic designs, instrumentations, navigation, and the preoperative deformity of the lower extremity on the component positioning has been studied before by many investigators[9-16].

Medial parapatellar approach has been widely appreciated as the 'standard' way of exposing the knee joint in TKA. This is related to the fact that medial parapatellar approach facilitates achieving a wide exposure and therefore expedites the surgery. On the other, the subvastus approach which might be regarded as technically more challenging, is also be preferred to protect the extensor mechanism while exposing the knee joint. With the subvastus approach, both quadriceps muscle and patellar tendon is protected and access to the knee joint is achieved underneath the vastus medialis muscle which is first elevated from the intermuscular septum. In case of a stiff knee, patella infera or limited patellofemoral mobility exposing the knee joint with the subvastus approach could be more challenging. Also presence of large patellar osteophytes makes this approach more difficult. In a meta-analysis of randomized controlled trials comparing different TKA approaches, the subvastus approach was favored when compared to the standard approach in terms of visual analog scale scores (VAS) in the sixth month as well as range of motion and straight leg raising both in the first week and 12th month postoperatively. Moreover, it was reported that the necessity to perform lateral retinacular release was less frequent with the subvastus approach[6]. With their unique pros and cons both approaches are conveniently used.

Compared to the sagittal plane, positioning of the components in the frontal plane and their influence on the survival of prosthesis has been more extensively studied. Nevertheless as a result of these studies optimal component alignments were suggested in both planes. In the frontal plane, the optimal positioning of the femoral component was determined as 2° to 8° of valgus, and the tibial component should be inserted strictly vertical to the proximal anatomical axis of the tibia. In the sagittal plane, to position the femoral component between 0° and 3° of flexion and the tibial component with posterior slope of 0° to 7° was favored[7,8].

The findings of this study regarding to the component positioning is comparable with the findings of other studies assessing TKAs radiographically[1,2,16]. Our findings supported that the approach chosen did not influence component positioning and were convenient with the previous reports which mentioned that it was possible to insert the prosthesis appropriately. In a study of Bach et al which evaluated 65 TKAs radiographically according to the criteria of American Knee Society Radiographic Evaluation System α, β, SFA and STA angles were found to be 96.4°, 86.1°,4.5° (flexion) and 3° (flexion), respectively. Also it was reported that correlation coefficient between observers were calculated to be high[1]. In another similar study which evaluated radiographic component positioning in a TKA series devoid of aseptic loosening, Mont et al reported that α angle was found to be between 94° and 105° with an assumption of 91° and 100° as normal; β angle was between 84° and 94°. The accepted normal range for this angle was between 84° and 90°. For the femoral components which were inserted in flexion in the sagittal plane, the mean value of SFA was 3.1°, for the components in extension it was 2.0°. The tibial components inserted in flexion had a mean STA of 3.0° and in extension 2.9°[2].

Among the factors affecting the survival of TKAs, the errors regarding to the alignment of components are of the most important ones. Compared to the femoral component malpositioning, the errors related to the alignment of the tibial component in the frontal plane influence the survival of prosthesis more. Ritter et al evaluated 6070 TKAs which were followed up for a mean duration of 7.6 years and reported that varus alignment of the tibial component was the most significant factor which affected the implant survival[13]. Similar to these findings, insertion of femoral component with a valgus of less than 2° or more than 8° as well as varus alignment of tibial components were shown to be associated with increased failure rates[8]. In another study, 1.3% of 3152 TKAs which were followed up with a mean duration five years were revised because of aseptic tibial component issues and among these failures the most common cause was collapse of medial tibial plateau which was followed by frontal plane alignment of the tibial component greater than 3°, varus alignment of the lower extremity, high body mass index[12]. The findings of our study revealed that the rates of varus malalignment of tibial components did not differ with respect to the approach technique.

The sub-grouping of the patients according to the preoperative mechanical axis deviations did not lead to any difference between groups in terms of component positioning. In both approach groups, in case of severe varus deformities the prosthetic components were implanted achieving optimum positioning. In a study it was shown that it was possible to obtain accurate component alignment in highly deformed knees even though a mini invasive technique (mini midvastus) was utilized[17]. Also, exposing the knee with standard approach in knees with greater than 20º of varus was associated with accurate component alignments in the frontal plane[18].

When the changes in the posterior tibial slope were considered, the slope of tibial tray was significantly decreased postoperatively in both approach groups. The slope changes were considered to be related with the instrumentation and implants. It can be compensated by insert design. In a study perfomed by Bek et al the influence of two different extramedullary tibial cutting guides on the posterior tibial slope was compared revealing that convenient with our results the slope angle was decreased in both groups with respect to the preoperative values[19].

This study has certain limitations such as its retrospective design and the paucity of number of patients involved. The influence of the studied radiographic parameters on the clinical outcome has not been evaluated which was also another weakness. However, assessment of the influence of approach technique on patient satisfaction, clinical outcome or implant survival was beyond the scope of this study.

In conclusion, the findings of this study supported that as long as an appropriate surgical technique was performed it was possible to position femoral and tibial components appropriately in frontal and sagittal planes utilizing both medial parapatellar and subvastus approaches. In order to evaluate the influence of component alignment on the survival of TKAs in patients who had different TKA approaches should be evaluated in other long term clinical studies.

Acknowledgments

This study has been presented orally at the 34th Annual Congress of the Orthopaedics and Traumatology Association of Macedonia and Thrace, Thessaloniki – Greece in 2015 and was presented as a poster at the 24th National Turkish Orthopaedics and Traumatology Congress in 2014.

REFERENCES

1. Bach CM, Steingruber IE, Peer S, Nogler M, Wimmer C, Ogon M. Radiographic assessment in total knee arthroplasty. Clin Orthop Rel Res. 2001;385:144-50.
2. Mont MA, Fairbank AC, Yammamoto V, Krackow KA, Hungerford DS. Radiographic characterization of aseptically loosened cementless total knee replacement. Clin Orthop Rel Res. 1995;321:73-8.
3. Bach CM, Mayr E, Liebensteiner M, Gstöttner M, Nogler M, Thaler M. Correlation between radiographic assessment and quality of life after total knee arthroplasty. Knee. 2009;16:207-10.
4. Cila E, Güzel V, Özalay M, Tan J, Şimşek AS, Kanatlı U, Öztürk A. Subvastus versus medial parapatellar approach in total knee arthroplasty. Arch Orthop Trauma Surg. 2002;122:65-8.
5. Weinhardt C, Barisic M, Bergmann EG, Heller KD. Early results of subvastus versus medial parapatellar

approach in primary total knee arthroplasty. Arch Orthop Trauma Surg. 2004;124:401-3.
6. Peng X, Zhang X, Cheng T, Cheng M, Wang J. Comparison of the quadriceps-sparing and subvastus approaches versus the standard parapatellar approach in total knee arthroplasty: a meta-analysis of randomized controlled trials. BMC Musculoskelet Disord. 2015;16:327.
7. Gromov K, Korchi M, Thomsen MG, Husted H, Troelsen A. What is the optimal alignment of the tibial and femoral components in knee arthroplasty? Acta Orthop. 2014;85:480-7.
8. Kim YH, Park JW, Kim JS, Park SD. The relationship between the survival of total knee arthroplasty and postoperative coronal, sagittal and rotational alignment of knee prosthesis. Int Orthop. 2014;38:379-85.
9. Fang DM, Ritter MA, Davis KE. Coronal alignment in total knee arthroplasty: just how important is it? J Arthroplasty. 2009;24:39-43.
10. Vandekerckhove PJ, Lanting B, Bellemans J, Victor J, MacDonald S. The current role of coronal plane alignment in Total Knee Arthroplasty in a preoperative varus aligned population: an evidence based review. Acta Orthop Belg. 2016;82:129-42.
11. Fang D, Ritter MA. Malalignment: forewarned is forearmed. Orthopedics. 2009;32(9). doi: 10.3928/01477447-20090728-29.
12. Berend ME, Ritter MA, Meding JB, Faris PM, Keating EM, Redelman R et al. Tibial component failure mechanisms in total knee arthroplasty. Clin Orthop Relat Res. 2004;428:26-34.
13. Ritter MA, Davis KE, Meding JB, Pierson JL, Berend ME, Malinzak RA. The effect of alignment and BMI on failure of total knee replacement. J Bone Joint Surg Am. 2011;93:1588-96.
14. Liu HX, Shang P, Ying XZ, Zhang Y. Shorter survival rate in varus-aligned knees after total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2016;24:2663-71.
15. Antony J, Tetsworth K, Hohmann E. Influence of sagittal plane component alignment on kinematics after total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2017;25:1686-91.
16. Hassaballa M, Budnar V, Gbejuade H, Learmonth I. Does improved instrumentation result in better component alignment in total knee arthroplasty? Orthop Rev (Pavia). 2011;3:e3.
17. Liu HC, Kuo FC, Huang CC, Wang JW. Mini-midvastus total knee arthroplasty in patients with severe varus deformity. Orthopedics. 2015;38:e112-7.
18. Mullaji AB, Padmanabhan V, Jindal G. Total knee arthroplasty for profound varus deformity: technique and radiological results in 173 knees with varus of more than 20 degrees. J Arthroplasty. 2005;20:550-61.
19. Bek D, Ege T, Yıldız C, Tunay S, Başbozkurt M. The accuracy of two different extra medullary tibial cutting guides for posterior tibial slope in total knee arthroplasty. Eklem Hastalik Cerrahisi. 2014;25:75-9.