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KNEE ARTHROPLASTY

Posterolateral overhang affects patient quality of life after total knee arthroplasty

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Abstract

Purpose To investigate the appropriate mediolateral placement of symmetrical tibial components and the amount of overhang expected from the posterolateral of tibial components implanted to give ideal coverage and the subsequent incidence of residual knee pain and reduction in functional capacity.

Method A retrospective evaluation was made of 146 consecutive total knee arthroplasties. The posterolateral overhang, rotational alignment and coverage of the tibial component were measured on a post-operative CT scan and the effect of posterolateral overhang on clinical outcomes was analysed 3 years after surgery.

Results Complaints of local pain in the posterolateral corner were determined in 76 (52.1%) patients. At the Posterolateral corner, overhang was determined in 111 (76%) patients, in the cortical border in 11 (7.6%) patients and underhang in 24 (16.4%) patients. In 71 (48.6%) patients, pain was determined together with oversize and in the evaluation of the overhang of the tibial component in the posterolateral region and the rotation status, there was determined to be overhang in 75 (96.2%) patients where the tibial component was placed in ideal rotation, in 25 (100%) where placement was in external rotation and in 11 (25.6%) where placement was in internal rotation. The mean KSS, KSS-F and WOMAC-P scores were 83.9 ± 6.3, 83.3 ± 7.8 and 4.6 ± 2.9, respectively, in those with posterolateral overhang of the tibial component .The mean KSS, KSS-F and WOMAC-P scores were 86.6 ± 8.4, 89.5 ± 7.8 and 2.8 ± 2.1, respectively, in those with no overhang and the difference was determined to be statistically significant. The amount of overhang was determined as mean 3.6 ± 2.0 mm in those with posterolateral pain and 0.02 ± 3.4 mm in those without pain and the difference was statistically significant.

Conclusions This study demonstrated that overhang in the posterolateral region is surprisingly high and negatively affects the clinical results following TKA, thereby presenting a danger to the success of TKA. The risk of posterolateral oversizing can increase with placement of the tibial component in external rotation.

Keywords Knee arthroplasty · Posterolateral overhang · Tibial baseplate · Knee pain

Introduction

In parallel with increased mean life expectancy, patients have increased daily activity and functional expectations and this has led to an increase in total knee prosthesis applications. With the use of modern designs of prosthesis, complications such as infection, early loosening, metallosis, implant fatigue and insert wear have reduced, and excellent long-term clinical results have increased the number of applications worldwide [1]. The most important factor affecting the survival of total knee arthroplasty and patient satisfaction is that the surgeon achieves 3-dimensional alignment of the components together and that soft tissue balance around the knee is compatible with the placed implants to be able to

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provide movement. Optimal size of components is extremely important for postoperative patient satisfaction [2].

Residual pain following total knee arthroplasty (TKA) is still frequently encountered and is a significant source of dissatisfaction for patients. Impingement caused by overhang of the implants from the edges of the bone to the soft tissue around the knee may cause persistent postoperative pain and a reduced range of flexion [3, 4]. As the tibial plateau is an asymmetrical structure, while attempting to provide a suitable rotational alignment, there may be overhang from the posterior of the lateral plateau, which is smaller and the posterior edges are less visible, and associated with this there may be impingement of the popliteus tendon which is a dynamic structure with a course making contact with the edge of the bone [5, 6]. Knee arthroplasty baseplates have been developed to be morphometrically compatible with the asymmetric tibial plateau and although they have aimed to overcome impingements caused by this type of overhang and errors in rotational alignment, there may be overhang from the bone edges which may be overlooked [7, 8].

To the best of our knowledge, there has been no previous study which has examined tibial component overhang from the posterior edge and evaluated in detail the related effect on quality of life and functional status. The aim of this study was to investigate the appropriate mediolateral placement of symmetrical tibial components and the amount of overhang expected from the posterolateral of tibial components implanted to give ideal coverage and the subsequent incidence of residual knee pain and reduction in functional capacity.

Material and method

Approval for the study was granted by the Local Institutional Review Board. All patients provided informed consent. A retrospective analysis was made of the data of 146 knees of 146 patients who underwent TKA between January 2010 and July 2012. The indications for inclusion in this study were that patients had undergone primary elective unilateral TKA with LPS-flex Fixed Bearing Total Knee System (NexGen Complete Knee Solution Legacy Knee Posterior Stabilized, ZIMMER®, Warsaw, Indiana, USA), with at least 3 years of follow-up, safe mobilization with or without support, were able to meet their own personal needs, had no wound site problems and no major complications or inflammatory disease. Patients included in the study all had varus knee and medial compartmental arthrosis. Patients were excluded from the study if there were missing records of preoperative and postoperative KSS, KSS-F and WOMAC-P scores or if there was no voluntary informed consent form.

Our routine clinical study content includes preoperative examination and follow-up examinations at 1, 3, 6, and 12 months postoperatively and every year thereafter. All measurements were made by the same physiotherapist group, and data were recorded in the patient registry. Patients who agreed to participate in the study and who had completed at least 3 years postoperative follow-up were called for examination. The KSS, KSS-F, WOMAC-P scores and ROM measurements were calculated again after the examinations and the patients were questioned and evaluated with scores in respect of pain in the posterolateral of the knee, flexion and extension range of movement (ROM), mediolateral and anteroposterior stability, flexion or extension contracture, walking distances, use of assistive devices and walking up and down stairs.

All patients were asked about pain in the posterolateral area and sensitivity was evaluated with palpation under medium finger pressure on the popliteus tendon and posterolateral corner of the knee. The examination was repeated twice by three observers. The pain status in the posterolateral region of the joint line was assessed from the patient anamnesis and the physical examination. The threshold value for pain was determined as the patient suffering pain after palpation. For an objective evaluation of the effect on pain of overhang of the tibial component from the bone edge in the posterolateral region, the changes in KSS, KSS-F and WOMAC-P were statistically evaluated [9, 10].

All patients were operated on by the same surgical team. In all knees, the femoral components and the tibial components were fixed with cement. The same surgical technique was applied to all the patients. The first bone cut was made from the tibia. The posterior reference system was used in the femur cuts and the femoral component rotation was adjusted appropriate to the epicondylar axis. Patelloplasty and patellar denervation were applied to all patients; no patient required a patellar implant. Ligament-balancing techniques, which included any necessary soft tissue release and removal of peripheral osteophytes, were used and confirmed with spacer blocks to ensure a balanced knee with equal flexion and extension gaps. The proximal tibial bone cut was performed first. The tibial cut should be perpendicular to the tibial mechanical axis. In the rotation of the tibial component, the Akagi line, tibial crest and midpoint of the ankle were used as reference and placement of the tibial component was achieved with as much cortical fit as possible in the anteroposterior and mediolateral planes. In addition, for tibial sizing and setting, the tibial template was always placed against the osteotomized tibial plane to visually determine the maximum coverage with the osteotomized tibial plateau. The popliteus tendon was not sacrificed in any patient. The trial prosthesis was inserted to check malrotation and tracking between the patellar, femoral, and tibial components with knee flexion and extension several times before inserting the final prosthesis. Priority was always given to correction of the tibial rotational positioning and maximum tibial coverage.

A preliminary study was performed by the observers before the measurements. Then, from the computed tomography (CT) images taken at the final follow-up examination, digital measurements were taken and recorded in mm to evaluate the amount of posterolateral corner overhang or underhang of the tibial component.

Radiological evaluation

In the radiological evaluation of the patients at the final follow-up examination, CT images were taken at 0.6 mm slice thickness with metal artefact eliminating software (256 slices multidetector scanner; Siemens®, Erlangen, Germany). Each CT image of the patients was examined by radiologists experienced in musculoskeletal system radiology with Leonardo Dr/Dsa Va30a software (Siemens®, Erlangen, Germany). To reduce interobserver and intraobserver errors, the images of the patients were evaluated double-blind by three different orthopedic surgeons (MES, SG, MA). The maximum errors of the measurements were determined as 0.7 mm and 1.2° using the current measurement techniques. Measurements were made to a sensitivity of 1/10 mm in the axial plane, of the tibial component rotational alignment and of the downsize and oversize status of the tibial component from the posterolateral (Fig. 1).

The highest tolerance between all the measurements was determined as 0.7 mm. Oversize was evaluated as > 1 mm overhang and downsize as > 1 mm recess. By calculating the tibial component rotation according to the Berger method, standardisation was obtained for males and females. In the Berger rotational measurement of tibial component placement, ideal rotation is accepted as 0° ± 2.6° according to the medial third of the tibial tubercle. Components placed in internal rotation > 2.6° to the medial third of the tibial tubercle were accepted as in internal rotation and components placed in external rotation > 2.6° to the medial of the tuberositas tibia were accepted as in external rotation [11, 12] (Fig. 2).

Statistical analysis

Conformity of the variables in the study to normal distribution was evaluated with the Shapiro–Wilks test. Descriptive statistics were used and variables showing normal distribution were stated as mean ± standard deviation (SD) and those not showing normal distribution were stated as median (minimum–maximum). As additional information, mean ± SD were stated. Categorical variables such as gender, overhang status and pain were shown as number (*n*) and percentage (%).

The independent sample *t* test was used to examine the difference in age, BMI and postoperative month values

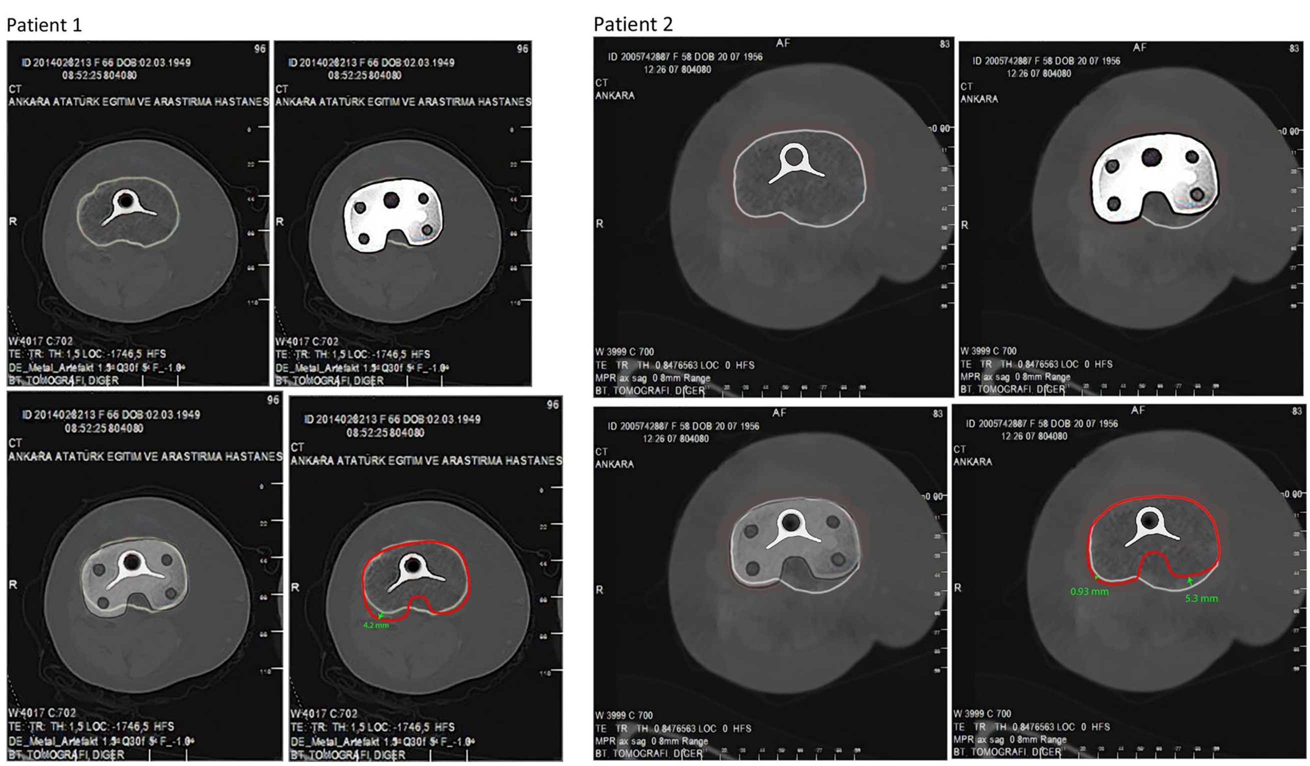

Fig. 1 Measurement techniques of the posterolateral overhang of tibial component

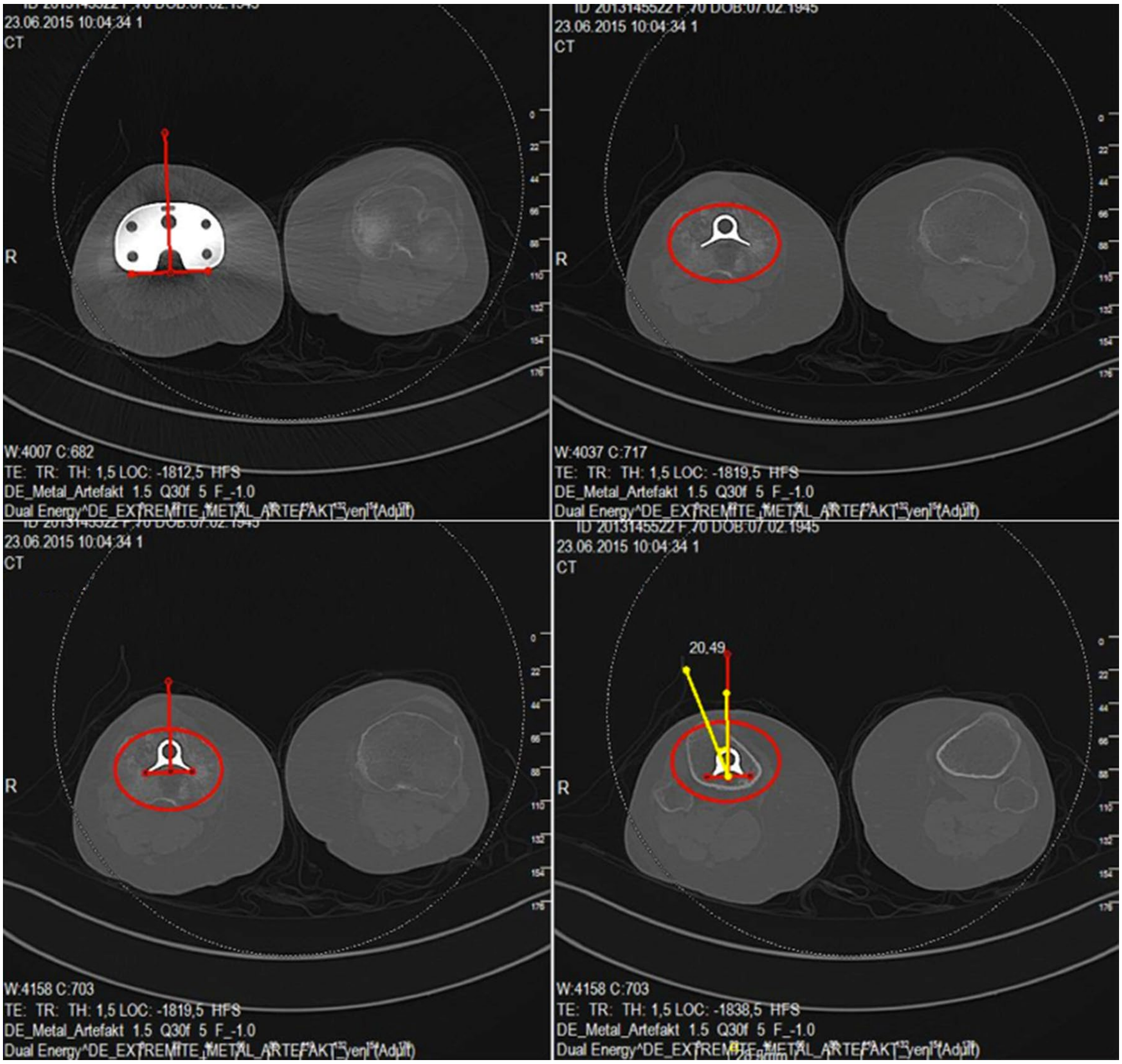

Fig. 2 Measurement of rotation of the tibial component with computed tomography

according to gender. In the comparison of the pre and post-operative values of KSS, KSS-F, WOMAC and ROM, the Wilcoxon Signed Rank test was used. The Pearson Chi-square test was applied to show any differences between the groups in respect of categorical variables.

When the number of subjects was insufficient, number and percentage were stated. To examine the differences in the groups in respect of overhang, pain and rotation and the KSS, KSS-F and WOMAC-P values, a method was used compatible with the Mann–Whitney *U* test and the Kruskal–Wallis non-parametric variance analysis. For variable values with a significant difference determined as a result of Kruskal–Wallis analysis, the analysis results were given after Bonferroni correction in the paired comparison of the groups.

Results

The study included 25 males (17.0%) and 121 females (82.9%). Body mass index (BMI) and postoperative month were similar in both genders ($p = 0.075$ and $p = 0.151$, respectively) (Table 1). The mean age was 69.8 ± 7.2 years in males and 66.0 ± 4.9 years in females. According to the preoperative Kellgren–Lawrence grading of gonarthrosis of males and females, 7 (4.8%) patients were grade 2, 43 (29.4%) were grade 3 and 96 (65.8%) were grade 4. The surgery was applied to the right knee in 56.8% and the left knee in 43.2% of the patients (Table 1).

The postoperative month was mean 45.2 ± 9.5. A statistically significant difference was determined between

Table 1 Age, BMI and postoperative month values of the patients

Variables	Gender				
	Male		Female		p value
	Min; max	Mean ± SD	Min; max	Mean ± SD	
Age	60.0; 77.0	69.8 ± 7.2	58.0; 80.0	66.0 ± 4.9	0.017
BMI	23.0; 34.0	27.8 ± 3.4	23.0; 36.7	29.1 ± 3.2	0.075
Post-op month	36.0; 63.0	45.2 ± 9.5	36.0; 62.0	47.8 ± 8.0	0.151

the preoperative and postoperative values of KSS, KSS-F, WOMAC-P and ROM ($p < 0.001$). The KSS, KSS-F and ROM values showed an increase after surgery and the WOMAC-P values decreased (Table 2).

The status of whether or not there was pain in the posterolateral region in the joint line was assessed from the patient anamnesis and the physical examination. Complaints of local pain in the posterolateral corner were determined in 76 (52.1%) of 146 patients (Table 5). Posterolateral overhang was determined in 111 (76%) in the posterolateral, in the cortical border were in 11 (7.6%) and underhang were in 24 (16.4%) patients of 146 patients (Table 3).

The relationship between overhang in the posterolateral region and pain was evaluated. In 71 (64%) patients, pain was determined together with oversize and in 40 (36%) patients with oversize, no pain was determined. In patients with component placement at the cortical border, no pain was determined in 10 (90.9%) and in those with underhang, no pain was determined in 20 (83.3%). The differences were determined to be statistically significant ($p < 0.001$) (Table 3).

For an objective evaluation of the effect on pain of overhang of the tibial component from the bone edge in the posterolateral region, the changes in KSS, KSS-F and WOMAC-P were statistically evaluated. The mean KSS score was determined to be 83.9 ± 6.3 in those with posterolateral overhang of the tibial component and 86.6 ± 8.4 in those with no overhang, The mean KSS-F was 83.3 ± 7.8 in those with posterolateral overhang of the tibial component and 89.5 ± 7.8 in those with no overhang and the difference was determined to be statistically significant ($p = 0.019$ and $p = 0.001$). The mean WOMAC-P score was 4.6 ± 2.9 in those with posterolateral overhang of the tibial component and 2.8 ± 2.1 in those with no overhang and the difference was determined to be statistically significant ($p = 0.001$) (Table 4).

The amount of overhang of the tibial component was determined to be greater in patients with pain compared to those without pain. The amount of overhang was determined as mean 3.6 ± 2.0 mm in those with posterolateral pain and 0.02 ± 3.4 mm in those without pain and the difference was statistically significant ($p < 0.001$) (Table 5).

In the evaluation of the overhang of the tibial component in the posterolateral region and the rotation status, there was determined to be overhang in 75 (96.2%) patients where the tibial component was placed in ideal rotation, in 25 (100%)

Table 2 Comparison of the preoperative and postoperative KSS, KSS-F, Womac-P and ROM values

Variables	Measurement time				
	Preop		Postop		p value
	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	
KSS	23.0 0.0; 59.0	22.9 ± 17.5	87.0 56.0; 98.0	86.0 ± 8.0	**< 0.001**
KSS-F	32.5 0.0; 65.0	33.1 ± 15.7	90.0 65.0; 100.0	88.0 ± 8.2	**< 0.001**
WOMAC-P	18.0 14.0; 20.0	17.8 ± 1.8	3.0 0.0; 9.0	3.2 ± 2.4	**< 0.001**
ROM	90.0 65.0; 110.0	89.7 ± 11.4	115.5 90.0; 134.0	114.8 ± 10.6	**<0.001**

Table 3 The relationship between pain and overhang from the posterolateral region

Pain +/−	Placement of the tibial component on posterolateral region with computed tomography			p value
	Underhang n (%)	Cortical border n (%)	Overhang n (%)	
Tibia postero-lateral				
Pain +	4 (16.7)	1 (9.1)	71 (64.0)	**< 0.001**
Pain −	20 (83.3)	10 (90.9)	40 (36.0)	

where placement was in external rotation and in 11 (25.6%) where placement was in internal rotation. When the tibial component rotation was changed from internal to external, the increase in the rate of overhang from the posterolateral corner was found to be statistically significant ($p<0.001$) (Table 6).

Statistical evaluation was made of the effect of the rotational placement of the tibial component on the clinical evaluation parameters of KSS, KSS-F, WOMAC-P and ROM. The mean KSS score, KSS-F score, WOMAC score and ROM degree were determined as 88.1 ± 6.8, 91 ± 7.5, 2.5 ± 2.3 and 116.0 ± 10.3 with component placement in ideal rotation; 82.0 ± 10.1, 86.6 ± 7.7, 3.8 ± 1.8 and 114.0 ± 10.0 with component placement in external position and 84.6 ± 6.7, 83.5 ± 7.4, 4.2 ± 2.7 and 113.0 ± 11.0 with component placement in internal position ($p=0.003$, $p<0.001$, $p<0.001$ and $p=0.565$, respectively) (Table 7).

No statistically significant difference was determined in the rates of coverage of the component in all three rotational positions. A mean of > 90% coverage was determined to have been achieved in all three rotational positions ($p=0.161$) (Table 8).

Discussion

The most important findings of the present study were that posterolateral overhang encountered with symmetrical tibial implants was particularly frequent and particularly posterolateral overhang particular appears to lead to an increase in the rate of residual pain, poorer knee flexion, and a decreased overall functional result [13, 14].

During implantation of the tibial component in the tibia, depending on the level of the tibia cut, the rotational compatibility of the tibial component and incorrect sizing will result in overhang of the tibial component from the bone border occurs, which although not seen as catastrophic by the surgeon may lead to the occurrence of unexplained pain of unknown causes after a well-performed, uncomplicated total knee arthroplasty [13–16].

Table 4 The relationship between outcome scores and posterolateral overhang

146 patient	Tibial component posterolateral overhang (+ or −)				
Outcome scores	Overhang (+)		Overhang (−)		p value
	Min; max	Mean ± SD	Min; max	Mean ± SD	
KSS	85.0 70.0; 97.0	83.9 ± 6.3	88.0 56.0; 98.0	86.6 ± 8.4	**0.019**
KSS-F	85.0 65.0; 100.0	83.3 ± 7.8	90.0 65.0; 100.0	89.5 ± 7.8	**< 0.001**
WOMAC-P	5.0 0.0; 9.0	4.6 ± 2.9	3.0 0.0; 8.0	2.8 ± 2.1	**0.001**

Table 5 The relationship between the amount of overhang and pain in the posterolateral region

	Pain present		Pain absent		p value
	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	
Component position of Postero-Lateral region (mm) Overhang (+) value Underhang (−) value	4.0 − 3.0; 7.0	3.6 ± 2.0	4.0 − 9.0; 4.0	0.02 ± 3.4	**< 0.001**

Table 6 The relationship between overhang and rotational placement of the tibial component

146 patients	Tibial component's axial rotation			
	Internal rotation (n = 43) (%)	Ideal rotation (n = 78) (%)	External rotation (n = 25) (%)	p value
Tibia postero-lateral				
Underhang	**23 (53.5)**	1 (1.3)	0 (0.0)	**< 0.001**
In the cortical border	9 (20.9)	2 (2.6)	0 (0.0)	
Overhang	**11 (25.6)**	**75 (96.2)**	**25 (100.0)**	

Table 7 The relationship between the rotational status of the tibial component and the clinical evaluation scores Variables

Variables	Rotational status of the tibial component						
	Internal rotation ($n=43$)		Ideal rotation ($n=78$)		External rotation ($n=25$)		p value
	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	
KSS	86.0 70.0–98.0	84.6 ± 6.7	88.0 56.0–98.0	88.1 ± 6.8	84.0 57–98	82.0 ± 10.1	0.003
KSS-F	85 65.0–95.0	83.5 ± 7.4	90 70.0–100.0	91 ± 7.5	86 65.0–100.0	86.6 ± 7.7	**< 0.001**
WOMAC-P	4 0.0–9.0	4.2 ± 2.7	2 0.0–8.0	2.5 ± 2.3	3 0.0–8.0	3.8 ± 1.8	**< 0.001**
ROM	116.0 90.0–130.0	113.0 ± 11.0	117.0 95.0–134.0	116.0 ± 10.3	115.0 96.0–132	114.0 ± 10.8	0.565

Table 8 Percentage of tibial surface coverage according to the rotational position

	Internal rotation ($n=43$)		Ideal rotation ($n=78$)		External rotation ($n=25$)		p
	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	Median Min; max	Mean ± SD	
Percentage of tibial coverage	94% 81%; 100%	93.4 ± 3.99	93.5% 82%; 100%	95.2 ± 3.80	91% 79%; 98%	89.2 ± 3.53	0.161

It is attempted to precisely match implants with the bony contours of the knee is sought during TKA. Although the consequences of poor fit in the anteroposterior and mediolateral dimensions have previously been analyzed, literature seems to be extremely weak in respect of the effect on clinical outcome scores of overhang of the tibial component from the tibial bone border and related impingement syndromes.

There were some limiting factors to this study:

1. As the study only included patients with gonarthrosis based on a varus knee, the effect of overhang in patients with a short and stretched popliteus tendon as in valgus knees was not evaluated.
2. The radiological methods to be used in the determinaton of inflammatory changes (tenosynovitis) in the popliteus tendon caused by impingement of the popliteus tendon by the tibial component are at the developmental stage.
3. No clear differentiation was made of the factors causing low outcome scores in cases other than those with ideal rotation (those with implants in internal rotation or external rotation) as to whether they were from rotational errors or from overhang.
4. There were insufficient data on the subject of whether reverse asymmetrical tibial plateau morphometry or symmetrical tibial plateau morphometry caused rotational errors as preoperative CT images had not been taken.
5. Genetic and morphometric differences were not shown in the tibial tubercle, tibial crest, PCL tibial attachment site, tibial-ankle rotation and epicondylar axis, which are used in the planning of rotational alignment.
6. There was no objective method other than palpation for the measurement of posterolateral pain.
7. The study was largely retrospective in nature, even though the data were obtained from a prospectively followed series and The population was small.
8. There was no examination of femoral component impingement on popliteus tendon in our study.
9. No subgroup analyses were made, such as between-gender differences in age and BMI.

Traditionally, the placement of the tibial component in TKA has focused on maximizing coverage of the tibial surface. However, the degree to which maximal coverage affects correct rotational placement of symmetric and asymmetric tibial components has not been well defined and might represent an implant design issue worthy of further inquiry. In the current series, it was aimed to provide maximum coverage and ideal rotation on tibia plateau with symmetric tibial component. Implant undersizing could theoretically be harmful by leaving an uncovered cancellous bone surface, where friction of the soft tissues on the bone ridges can cause pain [14, 15]. In the current study, maximum coverage and ideal rotation on tibia plateau with symmetric tibial component [17–21]. in our study, Percentage of tibial surface coverage was more than 90% in all three rotational positions .

Bonnin et al. noted that correct positioning of the tibial component requires that two criteria be fulfilled simultaneously; first, implant rotation ensuring optimal knee kinematics and second, optimized prosthetic coverage ensuring uniform load transfer [14]. The concern that too little coverage causes an increase in stress of the tibia–implant interface has not been shown to decrease the success of implants, unless coverage was less than 75% [3, 11, 16–18].

In a study by Martin et al., four commercially available tibial designs (two symmetrical, two asymmetrical) were placed on the resected tibial surface. The resulting component rotation was examined. In all four designs, 70% of all the tibial components placed in an orientation to maximize fit to the resection surface were internally malrotated (average 9°). The asymmetrical designs had fewer cases of malrotation (28 and 52% for the two asymmetrical designs, 100 and 96% for the two symmetrical designs) and less malrotation on average (2° and 5° for the asymmetrical designs, 14° for both symmetrical designs) [22–25]. In this respect, as a result of aiming for ideal rotation and maximum coverage with symmetrical tibial components, the tibial coverage determined in this study was very high and there were a large number of posterolateral overhang cases.

Foruria et al. reported that anatomic tibial baseplates require less offset to be able to provide ideal rotation and coverage. In a narrative review of literature, Peersman et al. stated that identification of and where appropriate, adjustment for any pre-existing maltorsion deformities is thought to significantly reduce the proportion of patients with residual complaints following TKA. Well-designed and well-conducted clinical studies are required to support their hypotheses [25].

Ideally, to be able to achieve rotational alignment without overhang of the tibial component to the tibial plateau, the use of asymmetrical or anatomic tibial components is recommended, but as approximately 17% of tibial plateaux is symmetrical or reverse symmetrical, this becomes more difficult in those cases [22–26].

Even if a tibial component is normosized in the mediolateral dimension, it may be oversized in the anteroposterior dimension because of the limited design of tibial components. For optimal sizing, tibial components should be available in many sizes in both AP and ML dimensions. This point warrants further investigation, but may have possible implications for the design of these knee implants [11, 27–29].

The popliteus tendon takes a course in a superior and lateral direction from the tibial posterior surface towards the lateral and anterior section of the femoral lateral condyle adjacent to the tibia posterolateral edge. Its main function is to aid in tibia internal rotation during flexion of the knee and therefore it has a dynamic function [30, 31]. When there is overhang from the posterolateral of the tibial component, popliteus tendon synovitis may develop with an inflammatory reaction in the popliteus tendon because of impingement on the tendon, which is a dynamic structure. Just as in all cases of tenosynovitis, popliteal tendon tenosynovitis results in diminished quality of life with pain and reduced functional capacity [32–34].

In the current study, when the effect on clinical scores of overhang from the tibia cortical border were examined, it was concluded that posteromedial and posterolateral overhang significantly decreased KSS, posterolateral overhang significantly decreased KSS-F and when there was posterolateral overhang, the WOMAC-P score increased. When the relationship was evaluated between pain and the amount of overhang from the tibia cortical border, the mean amount of overhang was 3.6 ± 2.0 mm in cases with pain in the posterolateral edge and 0.02 ± 3.4 mm in cases with no pain. In a study by Michel P. Bonnin et al., the effects of mediolateral overhang of the tibial and femoral components were evaluated on clinical function and pain. The amount of overhang was determined in 114 knees by measuring component placement in the mediolateral plane of the femur and tibia with CT. Better results were seen to be obtained in the KOOS scores and ROM values of the knees with mediolateral overhang in the tibia and femur compared to cases with no overhang. In contrast, no difference was reported between cases with oversize in the posterolateral region and cases with undersize in respect of KOOS score, pain score and knee flexion [19]. Chau et al. applied unicondylar knee arthroplasty and reported that when overhang of the tibial component was > 3 mm, there were negative changes in the Oxford Knee Score and in the pain score [20]. In another study by M. Bonnin et al., the mechanisms and extent of popliteus impingements before and after TKA were determined and the influence of implant sizing was evaluated. The results showed that at the tibia, TKA caused the popliteus to translate posteriorly, mostly in full extension: 4.1 ± 2 mm for normosized implants, and 15.8 ± 3 mm with oversized implants, but no translations were observed when using undersized implants. It was also reported that a well-sized tibial component modified popliteal tracking, while an undersized tibial component maintained more physiological patterns. These findings suggest that as in the current study, popliteus impingements could play a role in residual pain and stiffness after TKA [31].

By creating pressure on the popliteus tendon for both the tibial component and the femoral component, posterolateral overhang may cause injury to the tendon and pain [16, 27, 32–35].

To avoid popliteus impingements after TKA, slightly undersizing the tibial component could be an option, in order to preserve a peripheral bony margin at its posterolateral corner. The use of anatomic base plates, which replicate the tibial asymmetry, may help the surgeon to both undersize laterally and preserve a good medial coverage. Dai et al. [27] recently demonstrated that asymmetric tibial base plates provide better conformity to resected surfaces.

Hirakawa et al. [34] in a series of 40 TKAs in a Japanese population reported a overhang of the posterolateral condyle greater than 3 mm in 25 patients and suggested to reduce the dimensions of the posterolateral condyle in TKA In an Indian population, Shah et al. also reported overhang of the posterolateral condyle when implanting a standard TKA [36]. Mahoney et al. intra-operatively measured overhang with the Scorpio prosthesis in several zones of the femur but did not detail the incidence of posterior condyle overhang [28].

Conclusions

The results of the current study confirmed that overhang in the posterolateral region in the tibial component negatively affects the clinical results following TKA and thus presents a danger to the success of TKA. Despite the use of currently available symmetrical, asymmetrical and anatomic tibial components, because of morphometric differences in the tibial plateau, if good intraoperative dissection is ignored while providing ideal coverage together with ideal rotation, it must be taken into consideration that there could be overhang from the posterolateral edge. To be able to prevent overhang from the bone border, it can be recommended that implant selection is made after preoperative evaluation of the tibiamorphometry.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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