

# Midvastus Versus Medial Parapatellar Approach in Total Knee Arthroplasty: A Comparison of Early Functional Results

## Total Diz Artroplastisinde Midvastus Yaklaşımına Karşılık Medial Parapatellar Yaklaşım: Erken Fonksiyonel Sonuçların Karşılaştırılması

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**ABSTRACT Objective:** The purpose of this study was to compare the early outcomes of total knee arthroplasty (TKA) using midvastus (MV) versus medial parapatellar (MPP) approaches on both knees. **Material and Methods:** Fifty two consecutive patients (104 knees) who underwent single-stage bilateral TKA performed by two surgeons between August 2004 and December 2007 were evaluated retrospectively at a minimum follow-up duration of two years. Patients were divided into two groups. In the MV group, consisted of 27 patients, a midvastus approach was performed on both knees. Besides, in the MPP group, consisted of 25 patients, a medial parapatellar approach was performed on both knees. **Results:** Mean follow-up duration was 40.2 months (27-66 months) and 42.3 months (25-61 months) for the MV and MPP groups, respectively. The Knee Society Clinical Rating System (knee and function score), the range of motion, patellofemoral pain questionnaire, patient satisfaction questionnaire and radiography were used for the evaluation of both groups. Lateral retinacular release (LRR) was performed on four knees in the MPP group whereas it was not used in the MV group. There was a significant difference between the two groups with regard to the rate of LRR ( $p=0.034$ ). Axial radiographs revealed that six patellas in the MPP group, but only one in the MV group exhibited lateral displacement postoperatively ( $p=0.039$ ). **Conclusion:** The preservation of normal patellar tracking is important for TKA. In this study, the midvastus approach required significantly less LRR as compared to the medial parapatellar approach.

**Key Words:** Arthroplasty, replacement, knee; orthopedic procedures

**ÖZET Amaç:** Bu çalışmanın amacı her iki dize midvastus (MV) ve mediyal parapatellar (MPP) yaklaşımları ile uygulanan total diz artroplastisi (TKA) nın erken sonuçlarını karşılaştırmaktır. **Gereç ve Yöntemler:** Ağustos 2004 ile Aralık 2007 arasında iki cerrah tarafından yapılan ve minimum izlem süresi iki yıl olan ardışık 52 hasta (104 diz) retrospektif olarak değerlendirildi. Hastalar iki gruba ayrıldılar. MV grubu midvastus yaklaşımı uygulanan 27 hastadan oluşuyordu. Bunun yanında MPP grubu her iki dize mediyal parapatellar yaklaşım uygulanan 25 hastadan oluşmaktaydı. **Sonuçlar:** Ortalama izlem süresi MV ve MPP grubunda, sırasıyla, 40.2 (27-66 ay) ve 42.3 aydı (25-61 ay). Diz Derneği Klinik Derecelendirme Sistemi (Diz ve Fonksiyon Skoru), hareket aralığı, patellofemoral ağrı anketi, hasta doyum anketi ve radyolojik incelemeler her iki grubun değerlendirilmesi için kullanıldı. Lateral retinaküler serbestleştirme (LRP) MPP grubunda dört dizde uygulanırken, MV grubunda hiçbir dizde uygulanmadı. İki grup arasında LRP oranı açısından anlamlı bir farklılık mevcuttu ( $p=0.034$ ). Aksiyel grafilerde postoperatif dönemde lateral yer değiştirme MPP grubunda altı patellada, MV grubunda ise bir patellada gözlemlendi ( $p=0.039$ ). **Tartışma:** Normal patellar çizgisel yerleşimin korunması TKA'da önemlidir. Bu çalışmada midvastus yaklaşımının mediyal parapatellar yaklaşıma göre anlamlı düzeyde daha az LRR'ye gereksinim gösterdiği gözlemlendi.

**Anahtar Kelimeler:** Artroplasti, yerine koyma, diz; ortopedik prosedürler

The surgical approach is one of the several factors affecting prognosis in total knee arthroplasty (TKA). Although the most commonly used approach for primary TKA is a medial parapatellar (MPP) approach, this technique has several disadvantages such as disturbance of the extensor mechanism, interference with patellar blood flow and a more frequent need for lateral retinacular release (LRR).<sup>1-5</sup> Alternative methods of exposure have been described to reduce patellofemoral complications and facilitate the return of quadriceps function postoperatively.<sup>2</sup> The midvastus (MV) approach has been made popular by Engh et al.<sup>6</sup> The major advantage of this approach is the preservation of the extensor mechanism from surgical trauma.<sup>1,7-9</sup> It has been reported that the MV approach is easier to perform, does not interfere with the blood supply to the patella, decreases patellofemoral tracking problems and the need for LRR, increases postoperative range of motion (ROM), facilitates earlier return of the straight leg raise (SLR), allows early rehabilitation and causes less pain in the early post-operative period as compared to the medial parapatellar approach.<sup>2,6,8,10-13</sup> As a counterpart, injuries to neural and vascular structures could occur because of the incision in the vastus medialis. Therefore, the technique must be performed correctly.<sup>6</sup>

This study is different from other studies in the literature. In our study, we compared two different patient groups in whom the same surgical approach was used in both knees of a given patient. Therefore, patellar scoring can be effectively assessed in tests that involve the use of both knees, such as climbing stairs. In patients who underwent a different surgical approach on each knee, functional scoring can be challenging because a problem in one knee will affect the function of the other.

The purpose of this study was to compare the early outcomes of TKA performing MV and MPP approaches in two groups of patients.

## MATERIAL AND METHODS

In this retrospective study, we reviewed the results of 57 consecutive patients (114 knees) underwent single-stage bilateral TKA performed by two surgeons between August 2004 and December 2007.

Written informed consents were obtained from all patients and the study was approved by the Local Research Ethics Committee. Selection criteria included all patients with osteoarthritis with an indication for single-stage bilateral primary TKA. Three patients had died and two patients were lost before the minimum 24-month follow-up period, and hence were excluded from the study. A minimum follow-up duration of 24 months was an essential criterion for the inclusion in this study. As a consequence, remaining 52 patients (104 knees) were included in the analysis. The MV group consisted of 27 patients who underwent single-stage bilateral TKA, with the MV approach used for both knees by surgeon A. The MPP group consisted of 25 patients who underwent single-stage bilateral TKA, with the MPP approach used for both knees by surgeon B. Patients who previously had a patella realignment operation or tibiofemoral realignment operation such as high tibial osteotomy, hip arthroplasty, severe co-morbidities and clinically severe arthritis in hip or back were excluded from the study. Demographic characteristics of the patients are shown in Table 1.

## SURGICAL PROCEDURE

The same type of posterior-stabilised primary fixed bearing prosthesis (Maxim, Biomet, Inc., Warsaw, IN, USA) was implanted with cement in each patient. Spinal-epidural anaesthesia was performed. All patients were managed with the same perioperative regimen, including administration of antibiotics (cefazolin sodium, 1 g) before tourniquet inflation and prophylaxis against venous thrombosis (enoxaparin sodium, 4000 IU /per day, for ten days). The MPP approach and the MV approach were performed through a straight anterior skin incision. The MPP approach involved an arthrotomy that began in the proximal quadriceps tendon (4-5 cm proxi-

**TABLE 1:** Demographic characteristics of the patients.

	MV group Mean±SD	MPP group Mean±SD	p value
Age (year)	67.51 ± 5.23	68.08 ± 6.52	0.653
BMI	31.18 ± 2.26	31.29 ± 2.83	0.883
Sex (F/M)	20/7	18/7	0.866

BMI: Body mass index, F: Female, M: Male, MV: Midvastus, MPP: Medial parapatellar.

mally from the superior border of the patella) and divided the tendon longitudinally, running between the medial and middle third of the quadriceps tendon.<sup>3</sup> The MV approach was performed according to the technique described by Engh et al.<sup>6</sup> The fascia overlying the vastus medialis obliquus was dissected free from the subcutaneous fat. The vastus medialis obliquus muscle belly was then split in the direction of its fibers, using a knife, from a point at the superior-medial border of the patella. This incision was then extended medially toward the intermuscular septum. The femoral component was positioned at 3° of external rotation in all cases.

The degree of patellar chondromalacia was examined intraoperatively and scored according to Outerbridge (Table 2).<sup>14</sup> All patients were treated without patellar resurfacing; only peripheral denervation of the patella and patelloplasty including removal of all osteophytes was performed. The intraoperative decision to perform a LRR was made based on patellar tracking using the no-thumb technique.<sup>15</sup> LRR was performed in the following cases: 1. If the medial facet of the patellar-bearing surface does not contact the medial femoral condyle throughout the range of knee motion, 2. If the patella does not tract in the midline without any force holding it in place. An intraarticular Hemovac drain was placed before closure of the retinaculum and removed after 1.3 days postoperatively on average (range: 1-3 days). Continuous passive motion was used while the patient was hospitalised, for approximately six hours a day, alternating each knee; knee immobilisers were not used postoperatively. All patients wore elastic stockings and received enoxaparin sodium for the first ten days. Afterwards, they received aspirin for the consecutive six weeks in order to prevent deep vein thrombosis. During all pre-

operative and postoperative visits, a clinical score was determined using the Knee Society Clinical Rating System, which includes a knee score and a function score, each ranging from 0 to 100 points.<sup>2,16</sup> Additionally, a specific patellofemoral pain questionnaire that includes the patella score was performed.<sup>17</sup> ROM was evaluated preoperatively and postoperatively in all cases. Preoperative data regarding age, sex, body mass index (BMI), and operative time were recorded. In the remaining 52 patients, amount of blood loss from drains was provided from the medical records. Preoperative and postoperative standing anteroposterior, lateral and axial radiographs were obtained (Figures 1, 2). Varus-valgus deformation, patellar sclerosis, patellar tilt, as well as patellofemoral angle and position of the femoral and tibial components were assessed. Patient satisfaction was determined with the Levitsky et al.'s questionnaire during the last follow-up.<sup>18</sup>

For statistical analysis, preoperative and final follow-up results were used. For patient based independent comparison of the groups, the average values of the both knees in each group were evaluated. Statistical analysis was performed with the SPSS 16 computer program (SPSS® for Windows 16.0, Chicago, IL). Continuous variables are expressed as mean  $\pm$  SD. The normality of distributions was evaluated with the one-sample Kolmogorov-Smirnov test. The chi-squared test ( $\chi^2$ ), Mann-Whitney test (MWU), independent samples t-test, and paired samples t-test were used. The power of the study was calculated. A p-value  $<0.05$  was considered significant.

## RESULTS

We evaluated 52 consecutive bilateral primary total knee replacement patients. Demographic characteristics were similar between the groups. The surgical approach used (MV or MPP) did not affect the duration of operations ( $t= 1.05$   $p= 0.299$ ). The mean blood loss in the suction drain was  $462 \pm 50$  ml and  $480 \pm 60$  in the MV and MPP groups, respectively. There was no significant difference between the groups ( $t= 0.853$   $p= 0.398$ ).

The mean follow-up period was 40.2 months (27-66 months) and 42.3 months (25-61 months) for the MV and MPP groups, respectively

**TABLE 2:** Patellar chondromalacia distribution within the groups.

Grade	MV group	MPP group
I	6	5
II	16	17
III	22	19
IV	10	9

MV: Midvastus, MPP: Medial parapatellar.

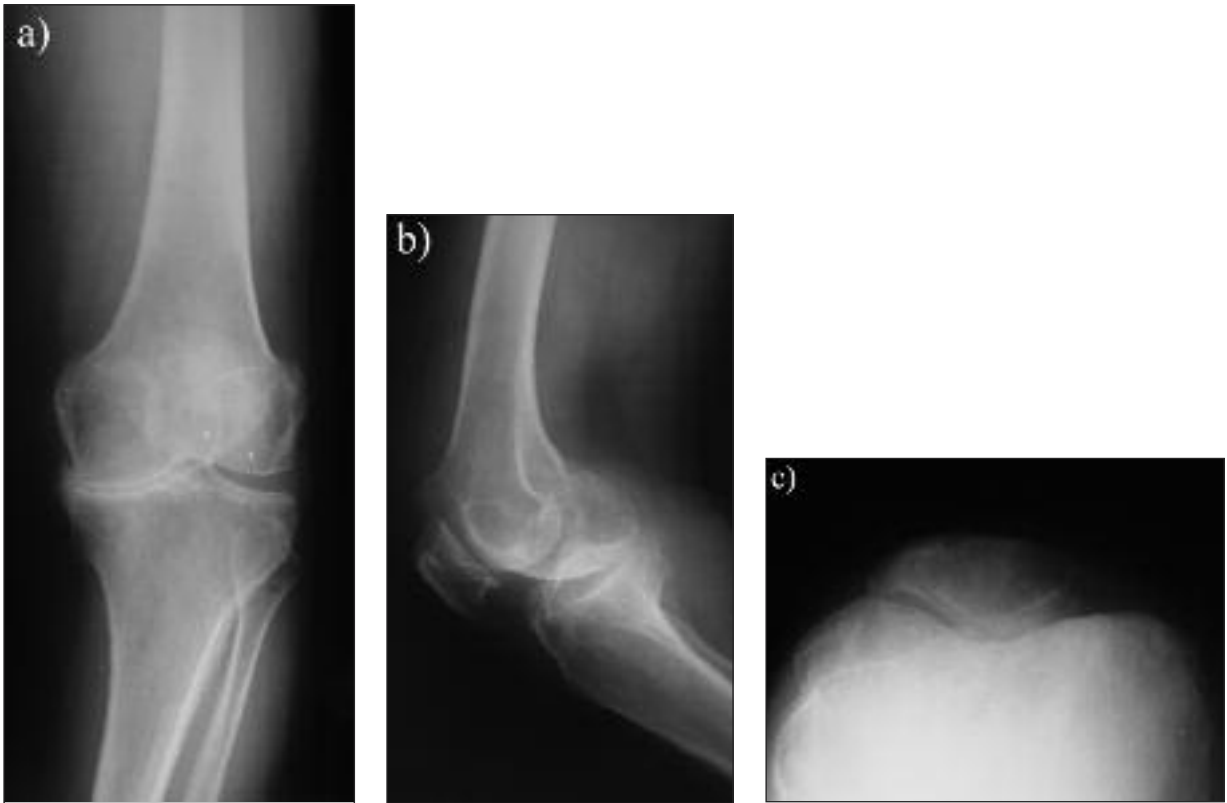


FIGURE 1: Preoperative a) anteroposterior, b) lateral and c) axial views.

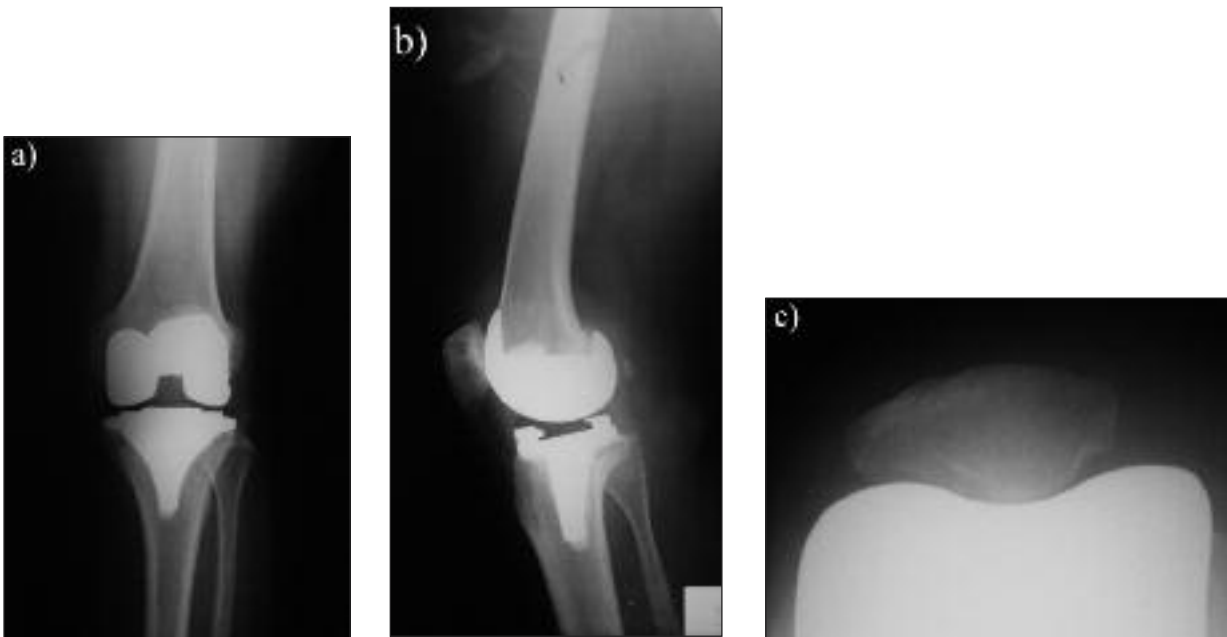


FIGURE 2: a) Anteroposterior, b) lateral and c) axial views at the final follow-up visit.

(MWU=1181 p= 0.271). There were no revisions and no reoperations. There were no deep infections, patellar fractures or patellar dislocations.

All knees were examined radiologically. Preoperative alignment was  $0^{\circ}$  in the MV group (range:  $6^{\circ}$  varus to  $12^{\circ}$  valgus) and  $2^{\circ}$  valgus in the MPP gro-

up (range: 5° varus to 13° valgus). Postoperative alignment was 5° valgus for the MV group (range: 0° to 15° valgus) and 6° valgus for the MPP group (range: 2° to 16° valgus). There were no signs of loosening on antero-posterior and lateral radiographs. The evaluation of axial radiographs revealed that, preoperatively, there were no patellar dislocations or subluxations in either group. However, six patellas in the MPP group and one in the MV group exhibited lateral displacement postoperatively ( $\chi^2=4.259$   $p=0.039$ ) (Figure 3).

Although the same femoral component position was used in both groups, LRR was performed in four knees in the MPP group. However, it was not performed in the MV group. Two of the knees that underwent LRR exhibited a postoperative hematoma. There was a significant difference between the two groups with regard to the need for LRR ( $\chi^2=4.493$   $p=0.034$ ). There was no significant difference between the groups with regard to the preoperative degree of patellar chondromalacia ( $\chi^2=0.113$   $p=0.737$ ).

In both groups, the Knee Society Clinical Rating System scores and ROM increased significantly when preoperative values and those obtained in the course of final follow-up were compared (Table 3). All patients were able to perform a full SLR.

Preoperative patellar scores were  $18.2 \pm 2.1$  and  $17.6 \pm 2.4$  in the MV and MPP groups, respectively. Postoperative patellar scores were  $25.7 \pm 1.9$  and  $24.9 \pm 2.4$  in the MV and MPP groups, respectively. In both groups, there was a significant increase postoperatively ( $t=-13.419$   $p<0.001$ ). However, there was no significant difference between the postoperative scores of the two groups ( $t=-1.337$   $p=0.187$ ). Although there was an overall trend toward faster postoperative recovery of ROM, anterior knee pain and quadriceps strength in the MV group when compared to the MPP group, the observed differences did not reach any significance.

When the surgical results were rated 78% of patients in the MV group and 72% in the MPP group were “extremely” or “very” satisfied. At the sa-

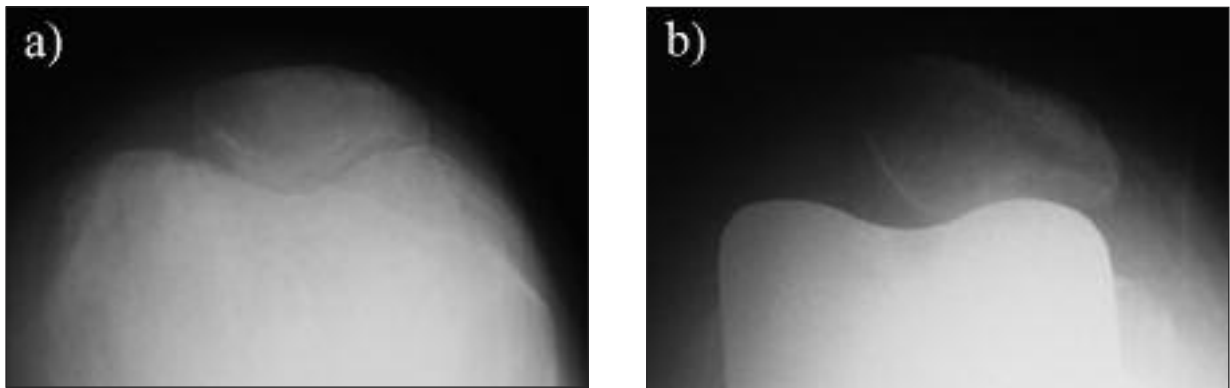


FIGURE 3: Preoperative a) normal and postoperative b) lateral displacement of the patella.

TABLE 3: Comparison of MV and MPP groups.

	MV group Mean $\pm$ SD	MPP group Mean $\pm$ SD	t value	p value
Surgical period (minute)	72.50 $\pm$ 6.27	74.60 $\pm$ 8.09	1.05	0.299
Preop knee	46.55 $\pm$ 5.29	45.42 $\pm$ 5.75	-0.74	0.462
Postop knee	90.18 $\pm$ 5.36	88.42 $\pm$ 6.81	-1.04	0.303
Preop function	47.40 $\pm$ 5.07	46.00 $\pm$ 5.63	-0.94	0.348
Postop function	88.14 $\pm$ 7.86	88.80 $\pm$ 6.65	-0.32	0.749
Preop ROM	82.11 $\pm$ 8.38	80.84 $\pm$ 8.45	-0.54	0.589
Postop ROM	120.74 $\pm$ 5.99	119.16 $\pm$ 7.33	-0.85	0.398

Preop: Preoperative, Postop: Postoperative, ROM: Range of motion, MV: Midvastus, MPP: Medial parapatellar.

me time, there were no “very dissatisfied” patients with the outcome. We did not find a significant difference concerning the rating scores between the groups ( $\chi^2= 0.231$   $p= 0.631$ ) (Table 4). The power of the study was calculated as 42.5%.

## DISCUSSION

Surgical approach to the knee for TKA has traditionally focused on the desire to minimise disturbance of the extensor mechanism. TKA has been traditionally performed through a standard MPP approach, which offers excellent exposure; however, problems associated with this approach have been reported.<sup>2,4,10,19</sup> More recently, the midvastus approach, which attempts to spare the quadriceps tendon, has been found in some studies to reduce postoperative pain, allow earlier return of SLR, to increase postoperative ROM, and to decrease the need for LRR.<sup>8,11,13,20,21</sup> In our previous study, we retrospectively evaluated 48 knees of 42 patients, and we found that LRR was not a requirement in order to achieve a proper patellar tracking in TKA with the MV approach, and in addition to this, to achieve satisfactory clinical and radiographic results.<sup>22</sup> Most studies reported a lower incidence of LRR with the MV approach as compared to the conventional MPP approach;<sup>1,5,6,9,23</sup> Keating et al. however did not find any difference.<sup>11</sup> They reported a considerable difficulty performing the MV approach in obese patients with lower preoperative knee and functional scores and less preoperative ROM. We did not encounter any similar difficulties while performing the MV approach in obese patients. Several studies concluded that LRR

effectively reduced the number of subluxations and dislocations in TKA and was necessary to correct patellar maltracking in TKA.<sup>13,24</sup> However, we obtained favourable and satisfactory results during the postoperative period with both MPP and MV approaches. We found a significant difference between the two groups given the same femoral component position with regard to the need for LRR. It is important to preserve patellar tracking as normal as possible; therefore, we suggest application of the MV approach for TKA, as it rarely necessitates a LRR. It leaves the entire extensor mechanism intact, which is an advantage in early rehabilitation.<sup>1,9</sup>

TKA still presents problems related to patellar tracking. One study has found that the superiority of the MV approach in achieving a normal patellofemoral tilt angle becomes more obvious during the late postoperative period.<sup>5</sup> During the last follow-up, we observed six patellar lateral displacements in the MPP group and one in the MV group. Postoperative knee and function scores of these patients were  $73.85 \pm 12.81$  and  $72.86 \pm 13.18$ , respectively. In the functional evaluation, one patient had excellent, four patients had good and two patients had moderate results. Additionally, there were no complications including patellar dislocation or patellar fracture. However, long term follow up is needed for more precise information about the functional results of the patellar tracking problems. We suppose that more lateral displacement of the patella in MPP group compared to MV group was due to the quadriceps tendon injury associated with the MPP approach.

Residual anterior knee pain after TKA is a common cause of early revision. An incidence of patellofemoral complications as high as 20% has been reported after TKA.<sup>25,26</sup> In this present study, patellar resurfacing was not performed in any patient; they had peripheral denervation of the patella and a patelloplasty with removal of all osteophytes. There was no significant difference between the patellar scores of both groups.

Some authors have reported that vascular injury could occur due to the incision in the vastus medialis that is necessary with the MV approach.<sup>6</sup> Jousponis et al. found mean operation time for the

**TABLE 4:** Patient satisfaction.

Questionnaire response	Number (%)	
	MV group	MPP group
Extremely satisfied	14(52)	11(44)
Very satisfied	7 (26)	7 (28)
Somewhat satisfied	3 (11)	3 (12)
Neutral	2 (7)	3 (12)
Somewhat dissatisfied	1 (4)	1 (4)
Extremely dissatisfied	0	0

MV: Midvastus, MPP: Medial parapatellar.

MPP approach shorter than the MV approach because the latter required more surgical steps to achieve sufficient visualisation of anatomical landmarks in order to ensure secure implantation.<sup>27</sup> We did not find any statistically significant differences for operation duration and blood loss between the two groups. Postoperative hematoma developed in two knees in the MPP group, which we thought that might be related with the LRR.

At the end of the six-month follow up period, Berth et al. stated that the faster recovery from pain in the midvastus group might increase patient satisfaction.<sup>7</sup> In our study after a mean follow up period of 41.2 months for both groups, we found 78% of patients in the MV group and 72% of patients in the MPP group were “extremely” or “very” satisfied with the surgical result. Although there was no statistically significant difference, we found

slightly greater patient satisfaction in the MV group. These results may show that there is no significant effect of surgical approach on patient satisfaction in TKA.

Limitations of the study include the short duration of follow-up and the limited number of patients included in the study.

## CONCLUSION

In this retrospective study, the MV approach was found to offer several advantages compared with the MPP approach. These advantages could be observed early on and include a reduced requirement for LRR. We suggest that the MV approach could be used safely in primary TKA due to the decreased necessity for LRR. Long-term comparative studies are required to assess the delayed effects of both approaches on vastus medialis and overall quadriceps function.

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