



## Early results of total knee arthroplasty performed through the midvastus approach

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**Objectives:** The aim of this study was to evaluate the early results of total knee arthroplasty (TKA) performed through the midvastus approach.

**Methods:** This retrospective study included 48 knees of 42 patients (29 females, 13 males; mean age 69 years; range 54 to 82 years) who underwent TKA for grade 4 knee osteoarthritis. All TKA operations were performed by the same orthopedic surgeon through the midvastus approach. Preoperatively, 40 patients (95.2%) had primary osteoarthritis, and two patients (4.8%) had rheumatoid arthritis. In all cases, a posterior stabilized cemented prosthesis with a fixed insert was used. Patellar resurfacing was performed in seven knees (14.6%). All the knees were rated according to the Knee Society knee and function scores before surgery and at the final follow-up. Postoperative radiographic evaluations were performed on anteroposterior and lateral radiographs according to The Knee Society TKA Roentgenographic Evaluation and Scoring System. The mean follow-up period was 26 months (range 12 to 49 months).

**Results:** The mean knee score significantly improved from  $49.0 \pm 9.3$  preoperatively to  $87.5 \pm 9.9$  postoperatively ( $p=0.000$ ). The corresponding increase in the knee function score was from  $48.8 \pm 9.9$  to  $79.6 \pm 14.0$  ( $p=0.000$ ). The mean increases in the knee and function scores were 38.5 and 30.8 points, respectively. The knee and function scores were excellent or good in 46 knees (95.8%) and 42 knees (87.5%), respectively. The mean knee flexion significantly increased by  $28.6^\circ$ , from  $84.3 \pm 14.7^\circ$  preoperatively to  $112.9 \pm 11.9^\circ$  postoperatively ( $p=0.000$ ). Among patients with bilateral osteoarthritis, the knee function scores were significantly higher in patients who had undergone bilateral versus unilateral TKA ( $90.0 \pm 11.5$  and  $78.8 \pm 10.8$ , respectively;  $p=0.007$ ). None of the patients had patellar tracking abnormality intraoperatively; thus, there was no need for lateral retinacular release. Postoperative clinical and radiographic assessments showed no signs of instability or loosening. Clinical and radiographic loosening of the patella and osteolysis were not observed in patients who had undergone patellar replacement. No changes were observed in the tracking and position of the prostheses. Neurovascular injury did not occur. One patient who developed early infection of the knee that required a two-stage revision was assessed as failure.

**Conclusion:** In our study, lateral retinacular release was not needed due to achievement of proper patellar tracking in TKA operations with the midvastus approach, and satisfactory clinical and radiographic results were obtained.

**Key words:** Arthroplasty, replacement, knee/methods; knee joint/surgery; muscle, skeletal/surgery.

Total knee arthroplasty (TKA) is widely used to relieve pain and to obtain a stable knee joint by improving knee functions in severe knee osteoarthritis.<sup>[1]</sup> Me-

dial parapatellar arthrotomy is the most commonly used approach and provides a satisfactory exposure. However, different alternatives such as the subvastus

or midvastus approaches have been developed due to some problems associated with the medial parapatellar approach, such as the increasing need for lateral retinacular release (LRR) owing to the instability in the patellofemoral tracking, and increases in patellar complications due to disruption of vascularity in the medial part of the patella.<sup>[2,3]</sup> As the midvastus approach provides a more stable patellar tracking, the need for LRR decreases, which significantly affects the success of TKA.

The aim of this study was to evaluate the early results of TKA performed by the midvastus approach.

### Patients and methods

This retrospective study included 48 knees of 42 patients (29 females, 13 males; mean age 69 years; range 54 to 82 years) who underwent TKA for grade 4 knee osteoarthritis from January 2004 to 2008. All TKA operations were performed by the same orthopedic surgeon through the midvastus approach. Surgery involved 23 right knees (47.9%) and 25 left knees (52.1%). Preoperatively, 40 patients (95.2%) had primary osteoarthritis, and two patients (4.8%) had rheumatoid arthritis. Anteroposterior and lateral weight-bearing radiographs were obtained from all cases preoperatively (Fig. 1a, b).

Under spinal anesthesia and following pneumatic tourniquet application, a midline longitudinal skin incision was made and arthrotomy was performed through the midvastus approach (Fig. 2). The posterior cruciate ligament of the knee was excised and a posterior stabilized cemented prosthesis with a fixed insert (Genesis II posterior stabilized, Smith &

Nephew; Memphis, Tenn; USA) was used. Pneumatic tourniquet was released following closure of the joint capsule. After ensuring that there was no abnormal bleeding at the operation site, the skin was closed. Patellar resurfacing was performed in seven knees (14.6%). Aggressive patelloplasty was performed as described by Şener et al.<sup>[4]</sup> in 41 knees (85.4%) in which patellar resurfacing was not performed.

Low-molecular-weight heparin (enoxaparin sodium) was administered routinely for at least 10 days for prophylaxis of possible development of deep vein thrombosis. Antibiotic prophylaxis was begun with 2 g of intravenous cefazolin sodium one hour before the operation and continued for three days with a maintenance dose of 1 g every eight hours. Two patients with rheumatoid arthritis received a single daily dose of 400 mg teicoplanin instead of cefazolin sodium. An aspiration drain was used for 24 hours.

Isometric exercises were begun on the first postoperative day and full weight bearing ambulation with a walker was allowed on the second postoperative day. All the knees were rated according to the Knee Society criteria before surgery and at the final follow-up,<sup>[1]</sup> which included the knee score (severity of pain, range of motion and stability of the knee) and the function score (functional capacity during walking and climbing stairs), each having a maximum score of 100 points. Thus, scores of 85 or above were rated as excellent, 70-84 as good, 60-69 as moderate, and less than 60 as poor (failure).

Postoperative radiographic evaluations were made on anteroposterior and lateral radiographs according



Fig. 1. (a, b) Preoperative and (c, d) postoperative anteroposterior and lateral knee radiographs of a patient.



**Fig. 2.** Separation of the vastus medialis muscle with the midvastus approach intraoperatively.

to The Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System. Patellar tangential radiographs were not routinely obtained due to the lack of postoperative patellofemoral complaints. Clinical and radiographic controls were made at 3, 6, and 12 months postoperatively. Radiolucent spaces between the cement and bone were evaluated according to the zones defined by the Knee Society.<sup>[1]</sup> The mean follow-up period was 26 months (range 12 to 49 months).

For statistical analysis, pre- and postoperative knee and function scores and knee flexion degrees were compared using the paired sample t-test.

## Results

The mean operation time was 87 minutes (range 70 to 110 minutes). The mean amount of postoperative hemorrhagic drainage was 800 ml (range 500-1200 ml).

The mean knee score significantly improved from  $49.0 \pm 9.3$  preoperatively to  $87.5 \pm 9.9$  postoperatively ( $p=0.000$ ). The corresponding increase in the knee function score was from  $48.8 \pm 9.9$  to  $79.6 \pm 14.0$  ( $p=0.000$ ). The mean increases in the knee and function scores were 38.5 and 30.8 points, respectively. According to the Knee Society criteria, the knee and function scores were excellent or good in 46 knees (95.8%) and 42 knees (87.5%), respectively.

The mean knee flexion was measured as  $84.3 \pm 14.7^\circ$  preoperatively and  $112.9 \pm 11.9^\circ$  at the final follow-up ( $p=0.000$ ). The increase in the mean flexion was  $28.6^\circ$ . None of the patients developed flexion or extension losses postoperatively.

Among patients with bilateral osteoarthritis, the knee function scores significantly differed between patients who had undergone bilateral and unilateral TKA, being  $90.0 \pm 11.5$  and  $78.8 \pm 10.8$ , respectively ( $p=0.007$ ).

None of the patients had patellar tracking abnormality intraoperatively after the insertion of the components. Thus, there was no need for LRR in any of the cases. Postoperative clinical and radiographic assessments showed no signs of instability or loosening. Clinical and radiographic loosening of the patella and osteolysis were not observed in patients who had undergone patellar replacement. No changes were observed in the tracking and position of the prostheses (Fig. 1c, d). Furthermore, there were no signs of thinning or polyethylene-induced erosion indicating insufficiency of the tibial insert. Neurovascular injury did not occur. One patient who developed early infection of the knee requiring a two-stage revision was assessed as failure.

## Discussion

Total knee arthroplasty aims to achieve a painless, stable, and functional joint, which is closely related to the surgical technique.<sup>[1,5,6]</sup> Medial parapatellar arthrotomy is generally the standard surgical approach in TKA; it allows the patella to evert laterally, in addition to providing integrity of the extensor mechanism.<sup>[1,3,7-9]</sup> However, in the medial parapatellar approach, the vastus medialis is separated from the patella with an intratendinous incision, resulting in the separation of the descending genicular artery and medial genicular artery from the patella, both of which provide blood flow to the patella.<sup>[8,10-12]</sup> Moreover, it has been reported that additional problems can arise in parapatellar closure due to the separation of the vastus medialis, and that an abnormal patellar tracking may ensue.<sup>[7]</sup> A stable patellar tracking is mandatory for a satisfactory outcome in TKA with or without the use of a patellar component.<sup>[13]</sup> Abnormal patellar tracking can cause severe complications such as patellar dislocation or subluxation, component erosion, patellar fracture, and soft tissue compression.<sup>[14,15]</sup>

If a lateral drifting of the patella is observed intraoperatively, a patellofemoral mismatch is confirmed using the no-thumb test and can be corrected by LRR.<sup>[13-15]</sup> However, LRR is associated with reduced blood flow to the patella and delay in wound healing.<sup>[16-18]</sup>

Muscle atrophy can also be considered among the disadvantages of LRR. Thus, there has been an increasing interest in the subvastus approach defined by Hofman et al.<sup>[2]</sup> and the midvastus approach defined by Engh et al.<sup>[3]</sup> for preservation of a steady quadriceps mechanism.

Hofman et al.<sup>[2]</sup> reported that the subvastus approach provided a better patellar tracking and preservation of the quadriceps mechanism. Fauré et al.<sup>[19]</sup> found that patellar tilt was less with the subvastus incision compared to the medial parapatellar incision, and the need for LRR was lower. Avascular necrosis of the patella is not expected in the subvastus approach, which is regarded as a more anatomical approach.<sup>[13]</sup> However, the subvastus approach may be associated with postoperative hematoma, muscle ischemia, and difficulties in the lateral eversion of the patella due to the medial shift of the arthrotomy distance. Furthermore, separation or detachment can be seen at the insertion of the patellar tendon.<sup>[2,19]</sup>

The midvastus approach was defined by Engh et al.<sup>[3]</sup> as a variation of the medial parapatellar approach in an attempt to provide a better opening in the knee joint. It is suggested that, owing to oblique separation of the muscle fibers of the vastus medialis, there is less harm to the extensor mechanism in the midvastus approach compared to the medial parapatellar approach. Several studies favored the midvastus approach over the medial parapatellar approach in terms of ease of application, early rehabilitation, and less pain in the early postoperative period.<sup>[5,6,20,21]</sup>

Engh et al.<sup>[3]</sup> emphasized that, despite the advantages of the midvastus approach, injuries to neural and vascular structures could occur because of the incision in the vastus medialis and thus, the procedure should adhere well to the technique. Cooper et al.<sup>[22]</sup> investigated the relationship between the midvastus approach and the proximal popliteal vascular and neural structures supplying the vastus medialis and found that the midvastus approach was safe due to the distance between the patella and the popliteal vessels. Yet, they recommended that the first 4 cm of the incision beginning from the superior margin of the patella be made with sharp dissection and, subsequently, separation be continued with blunt dissection.

Dalury et al.<sup>[23]</sup> compared patients undergoing bilateral surgery through the midvastus approach or

medial parapatellar approach and found no differences between the two groups with respect to the Knee Society scores and function scores, and also found no abnormal electromyographic (EMG) findings associated with the midvastus approach three months postoperatively. In our study, we did not perform EMG studies in the postoperative period, we evaluated our cases with clinical examination and did not find any neurological abnormality.

Bäthis et al.<sup>[24]</sup> observed early initiation of rehabilitation, less pain, and better proprioception postoperatively in cases of the midvastus approach versus the medial parapatellar approach. In our cases, isometric exercises were begun on the first postoperative day and rehabilitation was started under supervision of a physiotherapist following removal of the drain.

Keating et al.<sup>[21]</sup> compared the midvastus and medial parapatellar approaches in 100 patients undergoing simultaneous bilateral TKA and found no differences between the two groups in terms of the frequency of LRR, range of motion, and straight leg raising capacity of the patients. Hube et al.<sup>[25]</sup> found excellent or good knee scores in 95% of 276 knees treated with TKA through the midvastus approach and without the need for LRR. The patella was replaced in all cases and, on postoperative tangential radiographies, maintained its central position in 91% of the cases.

Kelly et al.<sup>[26]</sup> reported that LRR was required in one (4.5%) of 22 cases with the midvastus approach, and in 13 (45%) of 29 cases with the medial parapatellar approach. However, they detected abnormal EMG changes six months postoperatively in nine cases in the midvastus group, of which seven cases had normal, and two cases had subclinical EMG findings at the end of a five-year follow-up. The lack of intraoperative LRR need was considered an issue of satisfaction in our series.

In the present study, the mean knee and function scores were found as 87.5 and 79.6, respectively, according to the Knee Society criteria. The discrepancy between the knee and function scores might result from the relatively high mean age of the patient group (mean age 69 years), and from the lack of TKA for the contralateral knee at the final follow-up of patients having bilateral osteoarthritis. This was manifest by the fact that, among patients with bilateral osteoarthritis, the knee function scores were significantly

higher in patients who had undergone bilateral versus unilateral TKA. This suggests that both knees of the patients with bilateral osteoarthritis be operated as early as possible, and if possible simultaneously, to obtain higher knee function scores.

Despite the limitations of this study, including its retrospective and noncomparative design and short follow-up period, we believe that it would contribute to the evaluation of benefits expected from the midvastus approach for surgeons performing knee arthroplasty.

Prospective and comparative studies on the midvastus approach, reporting mid- and long-term results, with utilization of tangential patella radiographs will definitely provide more conclusive data. In addition, comprehensive studies including gait analysis for evaluation of possible weakening of the quadriceps muscle or myopathy may also be required.

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