

Minimally Invasive Lateral Approach to Total Knee Arthroplasty

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Abstract: Minimally invasive knee surgery can be accomplished through several exposures used in standard total knee arthroplasty. These exposures include the medial parapatellar, subvastus, and midvastus approaches. The authors describe a new minimally invasive direct lateral approach in an attempt to minimize soft tissue damage and preserve quadriceps muscle function in 35 patients (35 knees). There were 23 women and 12 men with a mean age of 65 years. At a mean follow-up of 3.8 years, the mean Knee Society objective and functional scores improved to 94 and 92 points, respectively. The assessment of quadriceps muscle strength, anterior knee pain, and patient satisfaction was promising. However, the downside of this pilot cohort was that using instruments and implants that have not been customized for this approach led to a considerable rate of early complications that may limit the potential of this new approach. Thus, further refinements are needed to increase clinical success and allow this technique for general use. **Key words:** lateral approach, minimally invasive surgery, quadriceps sparing, anterior knee pain, outcome.

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Total knee arthroplasty (TKA) using standard approaches has led to excellent long-term results with survival rates of more than 95% [1,2]. Despite these outstanding results, many patients experience a tremendous amount of pain and impaired quadriceps muscle function in the short term that may lead to prolonged rehabilitative efforts until full recovery [3]. Mizner et al [4] analyzed 40 patients who underwent unilateral TKA followed by rehabilitation, including 6 weeks of outpatient physical

therapy. In their study, patients experienced significant worsening of range of motion, quadriceps strength, and performance on functional tests 1 month after surgery. Of all physical measures assessed, quadriceps muscle strength showed the greatest decline and was the most highly correlated measure associated with functional performance at all testing sessions. Likewise, Silva and colleagues [5] assessed quadriceps muscle strength by measuring isometric extension peak torque in 32 knees more than 2 years after TKA. The mean isometric extension peak torque values in their patients were reduced by up to 30.7% ($P = .01$) and the isometric flexion peak torque values were, on average, 32.2% lower than those from control subjects. In addition, the Knee Society functional scores were positively correlated to the mean isometric extension peak torque ($P = .004$).

In an attempt to reduce this muscle strength loss and improve early clinical outcome (reduced pain, reduced length of hospitalization, and earlier return to full function), minimally invasive quadriceps-

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sparing techniques have become increasingly popular [6-8]. Standard TKA are often performed with large incisions and the quadriceps muscle is cut or split, which may lead to permanent muscle damage. In addition, the quadriceps mechanism is everted and the knee joint is dislocated, which possibly affects posterior capsular structures [6]. Minimally invasive techniques are often quadriceps-sparing and various studies have shown beneficial results including reduced postoperative pain, reduced length of hospitalization, and earlier return to full function [8,9].

Although minimally invasive techniques are demanding and associated with a significant learning curve, the benefits may outweigh the difficulties faced during the learning process [10]. The direct lateral approach for performing TKAs was conceived as a minimally invasive technique in an attempt to minimize soft tissue damage and translate into not only potential short-term advantages with less morbidity and rehabilitative efforts needed, but which might also lead to better long-term functional outcome [6,9,11,12]. The present study analyzed the clinical and radiographic outcome of the pilot cohort of knees performed using this minimally invasive direct lateral approach.

Materials and Methods

Study Design and Patient Demographics

After the study protocol had been approved by the institutional review board and patients had given written informed consent, we prospectively followed and collected the data on 35 patients (35 knees) who had a primary TKA using a direct lateral approach. There were 23 women and 12 men with a mean age of 65 years (range, 40-83 years) and a mean body mass index of 27 kg/m² (range, 21-36 kg/m²). The mean follow-up was 3.8 years (range, 3-4 years). The most common preoperative diagnosis was osteoarthritis in 32 (91%) knees. The other diagnoses included osteonecrosis in 2 (6%) knees and rheumatoid arthritis in 1 (3%) knee.

All patients received a Scorpio total knee system (Stryker Orthopaedics, Mahwah, NJ). We started this new technique with standard implants (keel size, 16-25 mm), which required dislocation of the tibiofemoral joint for insertion. With the introduction of reduced size keels (keel size, 10-12 mm) the tibia did not have to be dislocated in front of the femur, which made this surgical technique much easier. This may also minimize capsular damage and aid postoperative pain. In the present study, a total of 18 knees received an implant with a standard keel

and 17 knees received a modified tibial implant with reduced size keels.

Clinical and Radiographic Evaluation

Clinical evaluation was performed with use of the Knee Society rating system [13]. This rating system was reported as 2 scores: an objective score and a functional score. In addition, a functional assessment of various parameters such as straight leg raising test and chair rise test was performed. Evaluations were performed preoperatively, and the clinical outcome was assessed at postoperative day 1, postoperative day 2, 6 weeks, 6 months, 1 year, and annually thereafter. Patients were also asked to complete a short questionnaire evaluating anterior knee pain, satisfaction with the procedure, walking abilities, and if they would undergo the procedure again at the 6-week follow-up visit. If the patient was seen at an outside institution, his or her orthopedist or physical therapy assessed range of motion, straight leg testing and chair rise test, as well as stability of the knee.

Radiographic evaluation included long standing weight-bearing or weight-bearing short films with both feet pointing forward and lateral radiographs of the knee. Radiographs were evaluated by 2 of the authors (TMS and MAM) with regard to the alignment of all 3 components as well as the presence of radiolucent lines as defined according to the Knee Society radiographic scoring system [14].

Surgical Technique

The patient is placed supine on a standard operating table. A pneumatic tourniquet is applied with standard skin preparation and draping undertaken. The tibial rest can be placed against the distal lateral thigh to allow for opening of the medial part of the joint. Before the surgical exposure, the anatomic landmarks such as patella, lateral tibial plateau, Gerdy's tubercle, fibular head, and distal femur are marked. The incision is made from below Gerdy's tubercle to the lateral epicondyle lateral to the patella. This typically allows for an 8- to 10-cm incision length. The skin and underlying subcutaneous tissue is then incised revealing the iliotibial band. This is incised and the surgeon can then easily expose the proximal tibia as well as distal femur from the lateral side. Through the lateral arthrotomy, the Hoffa's fat pad and the anterior horn of the lateral meniscus are excised. This releases the anterolateral knee capsule from the anterior surface of the tibia. Dissection is then continued by placing soft tissue retractors underneath the patellar tendon

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