Clinical outcome of revision of the patellar component in total knee arthroplasty. A 2- to 7-year follow-up study

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Abstract: The objectives of this study were to determine the relationship between the thickness of the residual patellar bone and the composite patella-patellar component, and the clinical outcome in patients who had undergone revision total knee arthroplasty (TKA) with a biconvex patellar component. Clinical outcome after at least a 2-year follow-up was determined using the Knee Society pain and functional scores, and radiographically, with the thicknesses of the patellar bone and composite measured in 23 knees (22 patients). The thickness of the patellar bone after preparation for a biconvex patellar component was significantly less for revised patellae (average, 5.0 mm) than the primary patellae (average, 7.9 mm; P < 0.01). Differences in thickness between preoperative patellae, primary composites, and revision composites did not significantly affect postoperative results. There were no patellar fractures, despite the relatively thin bone remnant in the revision patients. Radiolucency was observed in 8% of the revisions. A patella with a thickness of residual bone of as little as 5 mm can provide favorable clinical results in revision TKA with restoration of the composite thickness of the patella achieved using a thick but small-diameter biconvex patellar component.

Key words: revised patellar component, patellar bone thickness, total knee arthroplasty, clinical outcome

Introduction

Failure of the patellar component is one of the major problems in total knee arthroplasty (TKA). Complications with the patellofemoral articulation include implant loosening, patellar fracture, avascular necrosis, patellar subluxation or dislocation, and malalignment of the extensor mechanism. The thickness of the patella is thought to be a factor in causing these complications. Restoration of the original patellar thickness is necessary in TKA for achieving normal patello-femoral kinematics. Passick and Dorr16 recommended that the composite thickness of the patella and patellar component should not exceed 25 mm. Marmor14 reported that the use of a too-thick patellar component could result in the loss of flexion due to abnormal tightening of the extensor mechanism. Star et al.21 indicated that patellar thickness differences of even 10% significantly altered patellofemoral forces at higher knee flexion angles. Reuben et al.18 reported that thickness of the patellar bone of less than 15 mm resulted in a significant increase in anterior patellar surface strain. Excessive removal of the peripheral bone of the patella can lead to a stress fracture. As a result of these reports, a patellar bone thickness of 15 mm and a composite patella-implant thickness of 25 mm have been recommended. Inadequate restoration of the patellar thickness may increase the potential for loosening of the patellar component, and the risk of patellar fracture.

The first objective of this study was to measure radiographically the thickness of the residual bone and the patella-patellar component composite after revision TKA performed using a biconvex patellar component. The second objective was to determine the relationship between the bony or composite thickness of patellae and clinical outcome in the patients.

Patients and methods

Clinical evaluation

We retrospectively reviewed 25 patients who had had 26 revision TKAs with revised patellae performed by the senior author (R.B.G.) at our institution between 1988
and 1994. Three patients died during the follow-up period; therefore, the clinical records of 23 knees in 22 patients (12 men and 10 women) who had more than a 2-year follow-up after revision surgery were analyzed. The average time to follow-up was 46 months (range, 24–79 months). The mean age of the patients at revision surgery was 70 years (range, 50–89 years). The diagnoses leading to the primary TKA were: degenerative joint disease in 14 knees, rheumatoid arthritis in 8 knees, and post traumatic arthritis in 1 knee. The indications for revision TKA were loosening in 13 knees, infection in 9 knees, and reasons unrelated to the patella in 1 knee. Six metal-backed and 17 all-polyethylene flat-surfaced patellar components were revised. A lateral release was performed at revision surgery in 14 knees (60%), with no release done in 9 knees. The Knee Society clinical rating system was used to assess knee pain and function.

Surgical technique

The Genesis TKA System (Smith & Nephew Orthopedics, Memphis, TN, USA) was used at revision surgery. Femoral, tibial, and patellar components were revised in all patients. After removal of the patellar component, a patellar clamp with reamer guide was used to obtain precise reaming. If the old cement was still present, the reaming was continued until the cement was completely removed. A biconvex patellar prosthesis was then implanted with cement. There were four extra-small (thickness, 13 mm), 11 small (14 mm), and 8 medium (15 mm) patellar components. If the patella was noted to sublux without a medially directed force, lateral patellofemoral release was performed with preservation of the lateral superior genicular artery.

Radiographic measurements

Roentgenographic assessment of the patellofemoral joint was performed from a skyline view taken at 30° knee flexion. Corrections were made for differences in magnification between the films, based on the known geometry of the implanted patellar components.

The thickness of the preoperative patellar bone was determined as the distance from the anterior cortex to the posterior margin of the patella. The thickness of the bony remnant of the primary or revised patella was measured as the shorter distance from the anterior cortex of the patella to the anterior surface of the cement layer adjacent to the top of the central peg of the biconvex patella. The composite patellar thickness was determined from the anterior cortex to the posterior margin of the patellar component (Fig. 1). The cement mantle thickness was obtained by subtracting the known thickness of the patellar component and the bony remnant from the composite thickness.

The angle between a line from the anterior limits of the femoral condyles and the equatorial line of the patella or equatorial line of the patellar component was measured as patellar tilt.

The joint line and patellar height were measured according to the method of Figgie et al.7,8 The preoperative joint line was the perpendicular distance from the weight-bearing surface of the tibial plateau to the tibial tubercle of the natural tibia. The postoperative joint line was the distance from the weight-bearing surface of the prosthetic tibial component to the tibial tubercle. Patellar height was the distance from the line parallel to the weight-bearing surface of the prosthesis to the inferior pole of the patellar implant (Fig. 2).

Radiographs of the patella were examined for radiolucent lines at the latest follow-up.6 Zone 1 represents the medial side, zone 2 the lateral side, and zone 3 the fixation 1µg.

Statistical analysis

The global difference in radiographic measurements between the preoperative, primary, and revision groups was determined using one-way analysis of variance. Individual comparisons between groups were based on the two-sample Student’s t-test (for unpaired data).