CEMENTED ROTATING-PLATFORM TOTAL KNEE REPLACEMENT: A CONCISE FOLLOW-UP, AT A MINIMUM OF FIFTEEN YEARS, OF A PREVIOUS REPORT*  

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Abstract: We previously evaluated 119 consecutive total knee arthroplasties that were performed in eighty-six patients with use of the cemented LCS (low contact stress) rotating-platform system with an all-polyethylene patellar component. The average age of the patients at the time of surgery was seventy years (range, thirty-seven to eighty-eight years). The purpose of this study was to report the updated results at a minimum follow-up of fifteen years.  

Thirty-seven patients (fifty-three knees) were living, and no patient was lost to follow-up. No knee was revised because of loosening, osteolysis, or wear. Three knees required a reoperation (two for periprosthetic fractures and one for infection). No component was revised as a part of the reoperations. Osteolysis was present in three knees. No knee had radiographic signs of component loosening, and there were no dislocated bearings. The average range of motion was from 1° of extension to 105° of flexion. The average clinical and functional Knee Society scores were 43 and 49, respectively, at the preoperative evaluation and 85 and 58 at the time of the final follow-up. We concluded that the cemented LCS rotating-platform knee performed well, with durable clinical and radiographic results at a minimum follow-up of fifteen years.  

Level of Evidence: Therapeutic Level IV. See Instructions to Authors for a complete description of levels of evidence.  

Background  

We previously described the minimum nine-year results after total knee arthroplasty with the cemented LCS (low contact stress) rotating-platform design (DePuy, Warsaw, Indiana) in a cohort of eighty-six patients (119 knees)1. In that study, we reported on a prospective consecutive series of selected patients who were treated for osteoarthritis by a single surgeon. All patients who were deemed to require a total knee arthroplasty between 1985 and 1988 received the cemented LCS rotating-platform tibial and femoral implants mated with a cemented Townley all-polyethylene dome patellar component (Fig. 1). During the same time-period, seventy-five unicompartmental knee arthroplasties were performed in selected patients.  

At the time of the previous report, no revision had been performed and no knee had aseptic loosening of a component. Of the sixty-four patients (eighty-six knees) who were alive at the time of the nine-year follow-up, forty-five (70%; sixty-six knees) returned for radiographic evaluation. The average clinical and functional Knee Society scores had improved from 30 and 44 points, preoperatively, to 90 and 75 points. The average range of motion of the knee was 8° of extension to 102° of flexion. There were no complications of bearing dislocation or so-called spin-out.  

The purpose of this study was to provide the longer-term results of this cohort at a minimum follow-up of fifteen years with an emphasis on the rates of revision, reoperation, and osteolysis.  

Methods  

Demographic data on the patients and the surgical technique have been previously described5. Clinical evaluations included the Knee Society clinical and functional scores, the Hospital for Special Surgery score, and the use of standard-terminology questionnaires preoperatively and at the final follow-up examination3. The Western Ontario and McMaster University Osteoarthritis Index (WOMAC) scores were obtained only at the final follow-up examination.  

Anteroposterior and lateral radiographs were evaluated for limb alignment, component position, radiolucent lines, polyethylene wear, and osteolysis6. Osteolysis was defined as a radiolucent lesion that was a minimum of 5 mm in size with
The LCS rotating-platform tibial and femoral components and the Townley dome single-post patellar component (DePuy).

loss of the trabecular pattern and a corticated margin that was not present on the preoperative or immediate postoperative radiograph.

Kaplan-Meier survivorship analysis was performed with reoperation as the end point. No other survivorship analysis was performed because no component was revised or became loose.

Results
The original study cohort included eighty-six patients (119 knees) with an average age of seventy years (range, thirty-seven to eighty-eight years) at the time of index surgery. Since the time of the original report, thirty additional patients (thirty-seven knees) died and the four previously lost patients were found. Thus, the subjects in this update included thirty-seven patients (fifty-three knees) who were still living and had a mean age of eighty-one years (range, fifty-nine to ninety-seven years); forty-eight patients (sixty-five knees) who had died; and one patient, who had not had a revision or reoperation, who refused to participate in the study.

Data on the clinical examination and radiographs made at a minimum of fifteen years (range, fifteen to eighteen years) postoperatively were available for thirty-nine knees (74%) in twenty-eight living patients. Of the twenty-eight patients, eight (twelve knees) had been examined by the authors and the rest had been examined by physicians at outside institutions. Clinical outcome questionnaires (the WOMAC) were completed for all thirty-seven living patients (fifty-three knees). The living patients were followed radiographically for an average of thirteen years (range, 0.1 to eighteen years) and the patients who had died had been followed radiographically for an average of four years (range, 0.1 to eleven years).

Functional Results
The average preoperative Knee Society clinical and functional knee scores for the living patients were 43 points (range, 17 to 70 points) and 49 points (range, 30 to 70 points), respectively. At the final clinical examination, the functional Knee Society scores were 85 points (range, 41 to 99 points) and 58 points (range, 0 to 100 points), respectively. The preoperative and final follow-up scores on The Hospital for Special Surgery knee-rating system were 61 points (range, 41 to 77 points) and 79 points (range, 56 to 95 points), respectively. At the final follow-up evaluation, the average scaled WOMAC score was 21 points (range, 0 to 63 points). At that time, thirty-one knees were pain-free, six were mildly painful, one was moderately painful, and one was severely painful.

The average preoperative active range of motion was \(-7^\circ\) (range, \(-30^\circ\) to \(+15^\circ\)) of extension to \(114^\circ\) (range, \(85^\circ\) to \(140^\circ\)) of flexion. At the final follow-up examination, the average active

Reoperation

![Graph showing Kaplan-Meier survivorship curve with reoperation as the end point, showing 97% survival at fifteen years (95% confidence interval, 89% to 100%).]
Revision or Reoperation
No knee had a revision of an implant. Three knees underwent a reoperation to treat a supracondylar femoral fracture (two knees) or an infection (one knee) (Fig. 2). The latter knee was seen fourteen years after the index surgery because of a late hematogenous infection (Peptostreptococcus) and was treated successfully with open debridement, polyethylene exchange, and implant retention. Both patients with a supracondylar femoral fracture were treated successfully with open reduction, internal fixation, and retention of the components. The three knees requiring a reoperation had stable bone-cement interfaces on the final follow-up radiograph, with no radiolucentcies at the bone-cement interface.

Aseptic Loosening
No knee had aseptic loosening of the femoral, tibial, or patellar component. Zonal analysis of the radiographs of the thirty-nine knees showed no radiolucentcies that were >1 mm thick at the bone-cement interfaces; no radiolucentcies were progressive (see Appendix). No knee had a circumferential radiolucency around any of the three components, and no component had migrated. One knee had a healed, nondisplaced asymptomatic patellar fracture.

Osteolysis or Wear
Three knees had osteolytic lesions (one at the anterior femoral flange [1 cm by 1 cm on the lateral radiograph], one involving the tibia [2.5 cm by 1 cm on the lateral radiograph and 2 cm by 2 cm on the anteroposterior radiograph], and one involving the patella [2 cm by 1 cm]). No knee had discernible asymmetrical wear of the tibial or patellar polyethylene.

Conclusions
Rotating-platform mobile-bearing knee prostheses were designed to reduce contact stresses in the polyethylene by decoupling sagittal plane motion and rotation and by minimizing bone-prosthesis stresses at the tibial surface.

The present study demonstrates the durability of the cemented LCS rotating-platform mobile-bearing total knee replacement at a minimum follow-up of fifteen years. These results are comparable with the fifteen-year results reported for fixed-bearing devices. No implant failed secondary to loosening, and no implant had been revised since the time of the last follow-up. No knee demonstrated instability or had excessive wear of the polyethylene. The Knee Society clinical and functional scores deteriorated since the minimum nine-year follow-up study, but we suggest that these changes are most likely associated with factors related to the aging of the patients. We observed minimal evidence of osteolysis (only three small lesions) despite a critical assessment of the radiographs.

This rotating-platform design appears to be safe as well as efficacious in an older population. This study cannot completely address the long-term performance of this device with cement fixation in the younger patient as only three patients were less than fifty years of age at the time of the primary arthroplasty.

Appendix
A table presenting the data on the radiolucentcies is available with the electronic versions of this article, on our website at jbjs.org (go to the article citation and click on "Supplementary Material") and on our quarterly CD-ROM (call our subscription department, at 781-449-9780, to order the CD-ROM).

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