A cementless femoral component may allow for a smaller surgical incision when a minimally invasive approach is used during primary total knee arthroplasty. Fixation by cement is the gold standard for total knee arthroplasty. The results of cementless total knee arthroplasty are mixed. Cementless femoral components have done well. Although some tibial components have performed well at long-term follow-up, others have been plagued by high rates of loosening and revision. The question remains whether the results of hybrid total knee arthroplasty, consisting of an uncemented femoral component and a cemented tibial component, will equal those of total knee replacement fixed with cement at long-term follow-up. The authors reviewed 148 hybrid total knee arthroplasties performed by a single surgeon between 1993 and 1995. At a mean follow-up of 14 years (range, 10-16) 5 knees (4%) had undergone revision of both the femoral and tibial components. Only 1 knee required revision for aseptic loosening. Two knees were revised for sepsis; 1 knee had been revised for fracture and 1 for instability. No additional femoral or tibial components were loose by radiographic criteria. Mild focal femoral osteolysis was identified in 3 knees (2%), and minor tibial osteolysis was present in 2 knees (1%). The rate of survivorship with revision for aseptic loosening as the end point was 99% (95% confidence interval, 0.97-100) at 16 years for both the femoral and tibial components. In this series, hybrid total knee arthroplasty showed excellent fixation at 16 years.
The use of cemented components in primary total knee arthroplasty has been associated with excellent results.\textsuperscript{1-4} The prevalence of aseptic loosening in several published series has been reported to range from 0\% to 9\% at a follow-up of greater than 20 years.\textsuperscript{1,3,4} Published results with cementless components in primary total knee arthroplasty have shown substantial variability.\textsuperscript{5-11} In these reviews, the incidence of femoral loosening has been low. The incidence of revision of the tibial component, however, has ranged from 0\% to 28\%.\textsuperscript{8,9,11-14} Hybrid total knee arthroplasty uses an uncemented femoral component and a cemented tibial component to maximize the longevity of fixation and allow the use of a smaller surgical incision. The authors report their results with hybrid total knee arthroplasty at a mean follow-up of 14 years.

**Materials and Methods**

Two hundred-fifty consecutive primary hybrid total knee arthroplasties were performed by a single surgeon (J.R.M.) in 218 patients between 1993 and 1995. None of the original cohort of 218 patients (250 knees) was lost to follow-up. Ninety patients (102 knees) died before obtaining a minimum 10-year follow-up, and the outcome of each of these knees was determined. Therefore, 128 patients (148 knees) were followed for a mean of 14 years. The hybrid total knee arthroplasty used in all cases combined a cementless femoral component with cemented tibial and patellar components. The Maxim Knee System (Biomet, Warsaw, Indiana), a cruciate-retaining design, was used in all cases (Figure). The femoral component was a cobalt-chrome alloy porous coated with a titanium alloy (Ti-6Al-4V; Biomet) applied with a plasma spray technique. The modular metal-backed tibial tray was titanium. These components are in current use. The bearing materials, tibial tray design, and locking mechanism of this construct are used in more contemporary femoral geometries, providing a good clinical foundation for the use of this construct. All surgeries were performed with a standard medial parapatellar approach. The procedures for the study were approved by the institutional review board, and written informed consent was obtained from all patients.

Patients were evaluated clinically with the Knee Society Score.\textsuperscript{15} Complete clinical follow-up was obtained for all 128 living patients (148 knees) at a mean of 14 years (range, 10-16). Radiographic analysis included standing anteroposterior, lateral, and Merchant views. Minimum 10-year radiographic follow-up was obtained in 130 of the 148 knees. In the remaining 18 knees, radiographs were obtained at 7 years in 17 knees and at 5 years in 1 knee. Radiographs were evaluated for radiolucencies, osteolysis, and loosening per the Knee Society protocol.\textsuperscript{15} The Kaplan-Meier method was used to generate survivorship curves with 95\% confidence intervals, with revision of the femoral and tibial components for aseptic loosening as the end point.\textsuperscript{16} In all 90 deceased patients, the outcome of total knee arthroplasty with regard to retention or revision was determined.

**Results**

At the time of final follow-up, at a minimum of 10 years, 128 patients (148 knees) were still living and 90 patients (102 knees) had died. Of the original cohort of 250 knees, 6 (2\%) required revision of all components. Three well-fixed knees were revised for sepsis at 8, 9, and 12 years postoperatively. One knee was revised for loosening of all components at 14 years postoperatively, 1 knee was revised for instability at 5 years, and 1 knee was revised for fracture at 8 years. In addition, 7 tibial bearings had been exchanged because of polyethylene wear, and 3 patellar components had been revised because of loosening.

At an average follow-up of 14 years (range, 10-16), 128 patients (148 knees) were alive. Five knees (4\%) had undergone revision of all components, and only 1 knee (1\%) had undergone revision for aseptic loosening. Two knees were revised for sepsis, 1 for fracture and 1 for instability. At a mean follow-up of 14 years, 96\% (143 knees) remained in place. The mean Knee Society clinical score was 88 at final follow-up. The average functional score was 69.

Radiographs were obtained of all 148 knees in living patients who had not undergone revision. The average period of follow-up was 13.5 years (range, 7-16). Three patellar components were determined to be loose by radiographic criteria. No femoral or tibial components were loose. Small focal osteolytic lesions were identified around 3 femoral components (2\%) and 2 tibial components (1\%). Kaplan-Meier survivorship analysis with revision for aseptic loosening as the end point was 99\% (confidence interval, 0.97-1.00) at 16 years for both the femoral and tibial components.

Ninety patients (102 knees) died before obtaining a minimum follow-up of 10 years. Of these, 5 knees (4\%) had undergone revision of all components, and only 1 knee (1\%) had undergone revision for aseptic loosening. Two knees were revised for sepsis, 1 for fracture and 1 for instability. At a mean follow-up of 14 years, 96\% (143 knees) remained in place. The mean Knee Society clinical score was 88 at final follow-up. The average functional score was 69.

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years that was required for this review. Of these, only 1 knee (1%) required revision for sepsis 8 years postoperatively.

**Discussion**

Site-specific insertion of cemented and cementless components in hybrid total hip arthroplasty is well established.\(^{17}\) Likewise, hybrid total knee arthroplasty uses site-specific strategies for fixation of the femoral and tibial components. Excellent long-term results with cemented total knee replacement have been reported at more than 20 years of follow-up.\(^{1,3,4,18}\) Several authors reported excellent results with well-designed cementless total knee arthroplasty components.\(^{12-14}\) Other authors reported high rates of revision, especially of the tibial component.\(^{8,9,11}\) This diversity of results may be the result of differences in surgical technique and implant design.

In the current series of 148 hybrid total knee arthroplasties, the authors found a 1% incidence of aseptic loosening of both the femoral and tibial components. Minor osteolytic lesions were identified in approximately 2% of the femoral components and 1% of the tibial components. These results show that primary hybrid total knee arthroplasty can achieve excellent fixation and a low incidence of osteolysis at 16 years of follow-up.

**References**