Tibial Fixation Without Screws in Cementless Knee Arthroplasty

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Abstract: This study reexamines the clinical and radiologic results of the first 216 cases of a cementless fixed-bearing tibial tray without screw holes in 191 patients at 7.6-year follow-up (range, 5-10 years). Mean Hospital for Special Surgery scores improved from 54/100 preoperatively to 84/100 postoperatively. Four tibial baseplates were revised. Five polyethylene inserts were revised. The overall reoperation rate was 12%. Four percent of tibial baseplates had incomplete nonprogressive radiolucent lines involving 1 or 2 of 10 defined zones. Overall tibial osteolysis rate was 4.1%. All tibial components were stable by radiographic technique. We conclude that this tibial tray provides reliable stability without the use of screws at medium-term follow-up. The polyethylene failure rate is a concern. **Keywords:** knee arthroplasty, tibial fixation, cementless fixation, hydroxyapatite.

Cementless fixation has been shown to be successful in total knee arthroplasty [1-6]. Reliable tibial fixation has historically been difficult to achieve [7], and primary stability has often been obtained with the use of screws. The screw holes have been associated with the formation of osteolysis [8-10]. We have previously reported excellent short-term results using a cementless tibial tray with a dual porous and hydroxyapatite-coated tibial component without screw fixation [11]. This article reports results of the same cohort of patients at a minimum of 5 years. We hypothesize that reliable fixation is possible with screwless cementless tibial fixation.

Materials and Methods

A total of 191 patients underwent 216 cementless primary total knee arthroplasties from November 1995 through December 1997. All patients who underwent primary total knee arthroplasty had the same implant regardless of age or bone quality. The underlying pathology was osteoarthritis in 201 cases (93%) and inflammatory arthritis in 15 (7%). The average age at surgery was 71 years (range, 42-98 years), 62% of cases were women, 55% were right-sided, and the average weight was 77.2 kg (range, 41-117 kg). Seven cases had undergone a previous high tibial osteotomy.

Implant

The components used were the cementless Anatomic Modular Knee femoral component with the Duofix tibial tray (both from Depuy, Warsaw, Ind). The tibial tray was manufactured from a titanium alloy (TiVaAl) and consisted of a central polished stem and 4 peripheral pegs. The undersurface of the tray and the pegs had a sintered porous surface that was coated with 50 μm of hydroxyapatite. The femoral component had a porous coating but no hydroxyapatite. The polyethylene was secured onto the tibial baseplate using a tongue-in-groove locking mechanism and was further stabilized with a central locking pin.

Surgical Technique

The surgery was performed by 2 of the senior authors (BZ and WKW) in all cases. A medial parapatellar approach was performed on all except 9 cases. These cases had a lateral parapatellar approach because of lateral patellar maltracking. Patellar resurfacing was performed in 166 cases (76%), using a cemented all polyethylene component. All tibial and femoral components were

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cementless. Combined tibial component thickness (tibial baseplate and polyethylene insert) was a minimum of 10 mm, of which 6.96 mm was polyethylene. All implants were posterior cruciate sacrificing. Surgery was performed with a tourniquet after administration of prophylactic antibiotics. Postoperative management consisted of early range of motion exercises and unrestricted weight bearing.

Follow-Up

Patients were initially seen at 6 weeks then recommended for follow-up at 1, 2, 5, and 10 years. At clinical review, patients filled in a questionnaire including the Hospital for Special Surgery score [12] and visual analog scales of knee pain and satisfaction.

Radiographs were taken at each follow-up. Fluoroscopically guided anteroposterior and lateral views were taken to perpendicularly image the interface of the baseplate with the tibia. Assessment was based on the Knee Society evaluation and scoring system [13]. Osteolysis was defined as any progressive lytic lesion extending into the bone of the proximal tibia. Radiographic evidence of bone ingrowth was defined as the absence of any lucent line between the implant and the bone, quantified in 6 zones across the anteroposterior view of the implant and in 3 zones from anterior to posterior, excluding the stem.

The operating surgeon examined the patient for their range of motion, alignment, stability, and gait. All radiographic and clinical scores were performed prospectively and recorded on a relational database.

Of the 215 cases, 44 cases were lost to follow-up despite repeated attempts to contact them. Four tibial base plates were revised. Fifty-nine other patients are known to have died. After excluding patients who were revised, had died, or who were lost to follow-up, a total of 108 (50%) patients had complete clinical follow-up and 98 (46%) had complete radiologic follow-up at a minimum of 5 years.

Results

Complications

Revision surgery was required in 7 patients due to polyethylene failure at an average of 8 years from the index operation (range, 6-9 years). All of these patients had stable implants based on radiographic assessment. Of these patients, 2 required revision of femoral and tibial components because of metallic damage secondary to full-thickness wear of the polyethylene (see Fig. 1). Both of these patients were noted to have osteolytic lesions of the tibia. The other 5 patients had a synovectomy and exchange of tibial polyethylene insert. Two patients required additional grafting of osteolytic lesions related to otherwise well-fixed implants in the distal femur at the time of polyethylene exchange. All of these 5 patients are functioning well at latest follow-up.

The tibial polyethylene inserts that were revised were all sterilized using gamma irradiation in air, they had a delay from manufacture to insertion of an average 6 years (range, 3-9 years), and they were not vacuum packed. This was standard industry practice at the time of

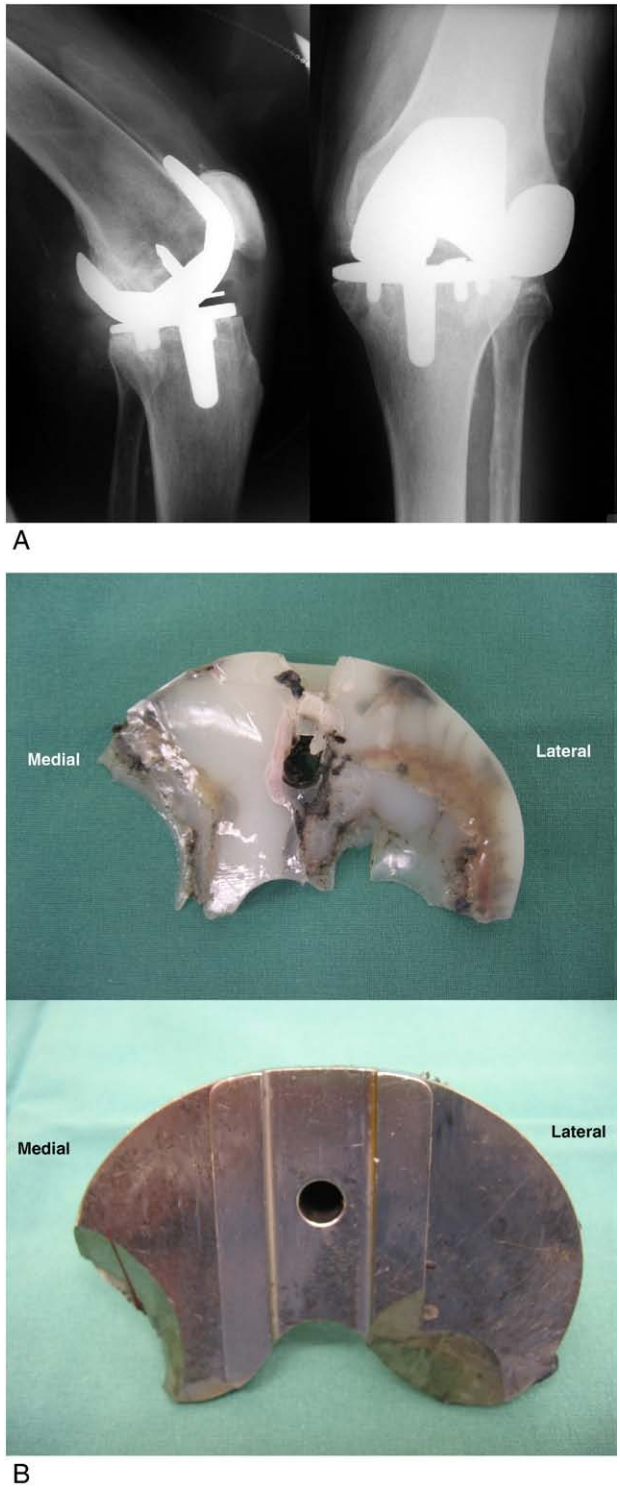

Fig. 1. Severe polyethylene wear evident on radiographs before revision surgery (A) and on explanted components removed at revision surgery (B).