

Total knee replacement—cementless tibial fixation with screws: 10-year results



Önder Ersan, Alper Öztürk*, Mehmet Faruk Çatma, Serhan Ünlü, Mutlu Akdoğan, Yalım Ateş

University of Health Sciences, Dışkapı Yıldırım Beyazıt Training and Research Hospital, Ankara, Turkey

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ABSTRACT

Background: The aim of this study was to evaluate the long term clinical and radiological results of cementless total knee replacement.

Methods: A total of 51 knees of 49 patients (33 female and 16 male; mean age: 61.6 years (range, 29–66 years)) who underwent TKR surgery with a posterior stabilized hydroxyapatite coated knee implant were included in this study. All of the tibial components were fixed with screws. The HSS scores were examined preoperatively and at the final follow-up. Radiological assessment was performed with Knee Society evaluating and scoring system. Kaplan–Meier survival analysis was performed to rule out the survival of the tibial component.

Results: The mean HSS scores were 45.8 (range 38–60) and 88.1 (range 61–93), preoperatively and at the final follow-up respectively. Complete radiological assessment was performed for 48 knees. Lucent lines at the tibial component were observed in 4 patients; one of these patients underwent a revision surgery due to the loosening of the tibial component. The 10-year survival rate of a tibial component was 98%. **Conclusion:** Cementless total knee replacement has satisfactory long term clinical results. Primary fixation of the tibial component with screws provides adequate stability even in elderly patients with good bone quality.

Level of evidence: Level IV, Therapeutic study.

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Introduction

A cementless total knee replacement (TKR) has been shown to provide reliable results and is a good alternative treatment option for patients with gonarthrosis.¹ A cementless total knee arthroplasty was first used in 1970s and has gradually become a preferred procedure over time. Currently, cemented fixation is the gold standard procedure for a TKR,^{2–7} although loosening of implants is a common problem, particularly in young and active patients.^{8–12}

However, there are concerns regarding the long-term durability of cemented fixation among such patients because of the weak resistance of the cement to tension and shear forces; furthermore, the cement may deform and degrade over the years leading to osteolysis and loosening.¹³ In comparison, cementless fixation has potential benefits of preserving the bone stock, shorter operating time and none of the cement-related complications.¹⁴

Tibial component fixation can be performed with or without screws for a cementless TKR. Although using screws for a tibial component fixation enhances the early stability of the implant,^{15–19} it has been reported to be related to increasing osteolysis around the screws.^{20–24} Synovial fluid and polyethylene debris reaching the cancellous bone through the screw holes are thought to be the potential causes of this failure.¹ Using screws for the primary fixation of cementless tibial components remains controversial; particularly regarding hydroxyapatite (HA) coated implants. In this study, we examined the long-term clinical and radiographic results of the cementless TKR to explore the survival of cementless tibial fixation with screws.

* Corresponding author. University of Health Sciences, Dışkapı Yıldırım Beyazıt Training and Research Hospital, Department of Orthopaedics and Traumatology, Şehit Ömer Halisdemir St., 06110 Dışkapı - Altındağ/Ankara, Turkey.

E-mail addresses: onersan@gmail.com (Ö. Ersan), dr_alperozturk@yahoo.com (A. Öztürk), farukcatma@hotmail.com (M.F. Çatma), serhanunlu@yahoo.com (S. Ünlü), mutluakdogan@yahoo.com (M. Akdoğan), dryalimates@msn.com (Y. Ateş).

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Materials and methods

We included 51 knees of 49 patients who underwent a cementless TKR between May 2003 and July 2007. Patients with gonarthrosis that caused knee pain, which was unresponsive to conservative treatment and affecting daily living activities, were recommended surgery in this study.

Patients

All the patients scheduled for a TKR surgery between May 2003 and July 2007 are evaluated for uncemented total knee replacement procedure. Patients with adequate bone quality were elected for cementless fixation. All patients were evaluated for their bone quality before and during the surgery. Patients with history of osteoporosis, steroid use and chronic diseases (renal diseases, diabetics, ASA scores over II) were excluded from the study and cemented fixation was preferred for these patients. All patients over 60 years of age underwent for a bone mineral density scan to determine bone quality. Patients with lower T and Z scores were excluded from the study (T score < -1, Z score < -2). After determination of the bone quality; 51 knees of 49 patients were included in the study and cementless TKR performed for these patients.

Implants

Posterior stabilized cementless knee system implants (Stryker Howmedica Osteonics, Mahwah, NJ) were used for all patients. Uncemented femoral components without an HA coating were used. Tibial components were an HA-coated baseplate of an unporous cobalt–chromium alloy with a light bead-blasted satin finish. The tibial baseplate had four holes for screw implementation. Six of the 51 tibial components were fixed with four screws, one was fixed with one screw, and the rest 44 were fixed with two screws. The number of screws needed for fixation was determined by the senior author with regard to the manual testing of the tibial component stability. Patellar replacement with a cemented polyethylene component was performed for 10 knees with severe patellar degeneration.

Surgical technique and postoperative care

All surgical procedures were performed using a medial parapatellar approach by the same surgical team. Surgeries were carried out with tourniquet control after administration of prophylactic antibiotics (first generation cephalosporins). In all cases, low-molecular-weight heparin was used for deep venous thrombosis prophylaxis. The day after surgery, early active and passive range-of-motion exercises were applied and all patients were allowed weight-bearing.

Patient follow-up, clinical, and radiological evaluation

Patients were prospectively followed-up at postoperative day 15, 3 months, 1 year, and 10 years and were requested a hospital visit for clinical and radiological evaluations at the final follow-up. The Hospital for Special Surgery (HSS) scores of each patient were obtained preoperatively as well as at 10 years postoperatively. The scores were considered as follows: 80–100, excellent; 70–79, good; 60–69, fair; and below 60, poor.

The radiological assessment was based on the Knee Society evaluation and scoring system. Lucent lines and osteolysis were examined on anteroposterior (AP) and lateral radiographs obtained at final follow-up. The absence of lucency between the implant and bone was accepted as bone ingrowth. Any asymmetry

in the distance between the femoral condyles and tibial component in the medial and lateral components was defined as polyethylene wear.

Statistical analysis

Survival rates of the tibial components were determined using a Kaplan–Meier survival analysis with SPSS ver. 20.0 for Windows (IBM SPSS Inc., NY/USA).

Results

In total, 51 knees of 49 patients were prospectively followed in this study. The average follow-up duration was 121.2 months (range, 101–139 months). Of 49, 33 patients (67.3%) were female, while 16 (32.7%) were male. The right side was operated on in 22 patients, the left side in 25, and bilateral knees in 2 patients. The mean patient age at the time of the surgery was 61.6 years (range, 29–66 years). One patient died during the follow-up period, and two lost follow up. Thus, 48 knees of 46 patients had full set of radiographic and clinical evaluations.

At the end of the 10-year follow-up period, only one patient had undergone revision surgery hence loosening of the tibial component. The 10-year survival rate of a tibial component with screw fixation was 98%.

Clinical results

Clinical results and patient demographics are presented in Table 1. The mean range-of-motion at the final follow-up was 110° (range, 65°–135°) (Fig. 1). None of the patients exhibited fixed flexion or extension deformity. The mean HSS score was 45.8 (range, 38–60) and 88.1 (range, 61–93) preoperatively and at the final follow-up examination, respectively. Five patients (10.4%) had “fair” and the remaining patients (89.6%) had “good” and “excellent” HSS scores.

Radiographic results

For 48 knees, complete radiographic results were available. We observed lucent lines at the medial aspect of the tibial component (zone 1) in four patients (8.3%) (Fig. 2). Lucent lines were observed between 12 and 15 months after surgery. These lines did not extend during further follow-up in three of the patients; however, in one of these patients, the tibial component had loosened, and a revision surgery was performed after 2 years of primary surgery (Fig. 3). At postoperative year 2, we observed an asymmetry between the medial and lateral femoral condyles and the tibial component in one patient and no medial or lateral instability was observed in this patient. This patient underwent a revision surgery for polyethylene change. During the surgery, the tibial and femoral components were tested for stability, and there was no evidence of loosening.

Table 1
Clinical outcomes.

Total patients/knees	49/51
Age	61.6 (29–66)
Sex (female/male)	33/16
Side (left/right/bilateral)	22/25/2
Follow-up (months)	121.2 (101–139)
Range of motion	110° (65–135)
HSS Score; preoperative	45.8 (38–60)
HSS score; last follow up	88.1 (61–93)

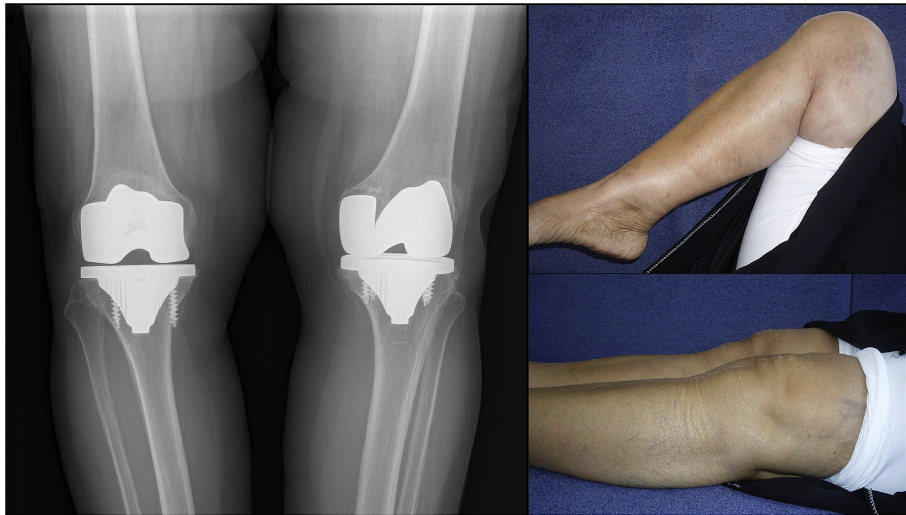


Fig. 1. Clinical and radiological result of a 10 year follow-up patient.

Complications

One patient developed cellulitis 1 week postoperatively; thus, i.v. antibiotics were administered, and the symptoms were resolved within 2 days. Patellar component loosening was observed in two patients at 25 and 34 months postoperatively; thus, patellar component revision was performed for them. No tibial or femoral loosening was detected during the surgery.

Discussion

The incidence of TKR surgery has been increasing in younger patients,^{25–27} and these implants have to resist increased stress levels due to the higher physical activity level and longer life

expectancy.^{28,29} Many studies have reported failure of the cemented implants in younger and active patients.^{10,30} With this perspective, we suggest that biological fixation with cementless implants is a candidate gold standard method, particularly for younger patients in the near future.

The main finding of this study is that cementless tibial fixation augmented with screws provides a secure implant fixation with a long survival time. In addition, the cementless fixation ensures long-term clinical outcomes as good and perfect as the cemented fixation. Furthermore, screw fixation of cementless implants is suitable for elderly patients with good bone quality considering the mean age of the patients in this study and that reported by Whiteside.³¹

While performing a cementless TKR, the major concern of the surgeon is aseptic loosening. Fibrous tissue overgrowth with unsuccessful osteointegration instead of bone overgrowth results in lucent lines on radiographs that may lead to osteolysis and

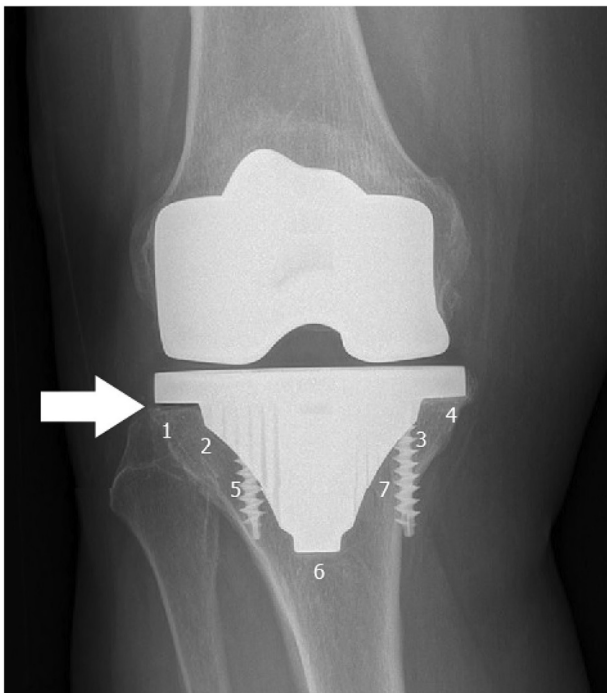


Fig. 2. Lucent lines seen under the tibial component.



Fig. 3. Tibial component loosening via osteolysis.

loosening of the implants over time.²² Although we observed this situation in some of our patients, lucent lines advanced to osteolysis and component loosening in only one patient. Previous studies have demonstrated a dramatic reduction of lucent lines with HA, as observed in this study.³²

Using screws for the primary fixation of the tibial component is controversial. Screws may restrict the micromotion between the bone and implant and may enhance primary fixation. An improvement in the initial stability of the tibial component has been shown in *in vitro* studies,^{15–19} and our clinical outcomes support these findings. At the same time, tibial osteolysis around the screws has been reported in some clinical studies,^{20,21} although we observed osteolysis in only one patient. Kjell et al.³³ reported that using additional screws for primary fixation of an HA coated tibial implant is unnecessary. The decision regarding the use of screws for HA-coated implants can be made during surgery by evaluating the stability of the component fixation. As this study demonstrates long survival time and low complication rates for screws in cementless total knee replacement surgery; we recommend using screws for cementless tibial components particularly in young patients with good bone quality and stock to increase initial stability.

Limitations of this study were lack of follow-up time, absence of a control group that includes patients with cementless total knee replacement without screws and absence of body mass index of patients that may influence the results. Further follow-up of these patients may change the survival rates of cementless fixation with screws.

In conclusion, this study contributes to the literature regarding long-term results of cementless tibial fixation with HA and screws. Tibial component fixation with screws provides sufficient long-term clinical and radiological results and may be preferred for patients with good bone quality to enhance the initial stability.

Compliance with ethical standards

Each author certifies that his institution approved the human protocol for this investigation that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

Ethical approval

Ethical approval of the Dışkapı Yıldırım Beyazıt Training and Research Hospital is attached below.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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