The native femoral sulcus as the guide for the medial/lateral position of the femoral component in knee arthroplasty

Normal patellar tracking in 690/700 knees—a prospective evaluation

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Background **There are no simple guidelines for the medial/lateral positioning of the femoral component in knee arthroplasty (TKA). I therefore conducted a prospective study to evaluate the use of the native femoral sulcus as a guide for the medial/lateral positioning.**

Patients and methods **Between 1997 and 2001, 700 primary TKAs (Nexgen Zimmer, cruciate retaining prostheses) were performed in 508 patients with the femoral component positioned according to the native femoral sulcus. Intraoperatively, no thumb technique was used to check the patellar tracking. The median follow-up period was 4.5 (4.0–5.5) years.**

Results **Intraoperatively, lateral retinacular release was performed in 3 knees. In the postoperative radiographic evaluation of patellar tracking, 10 knees (1.4%) had lateral tilting of the patella. The postoperative HSS scores were 93 (85–98).**

Interpretation **The native femoral sulcus may be used as an effective and simple guide for the medial/lateral femoral component position.**

There have been many methods proposed to obtain correct rotational alignment of the femoral component in primary total knee arthroplasty (TKA) (Berger et al. 1993, Arima et al.1995, Ranawat and Rodriguez 2002), but none consider the medial-lateral position of the femoral component. It has been shown that the midline of the native femoral sulcus is on average 5 mm lateral to the midline of the femoral condyles (Eckhoff et al. 1996). If we make the femoral entry hole for the intramedullary guide at the midline of lateral/medial femoral condyles, just above the femoral insertion of the posterior cruciate ligament which is medial to the natural femoral sulcus, and if we use this entry hole as the guide for the midline position of the femoral prosthesis, we would position the prosthetic femoral sulcus medial to the natural sulcus. This medialization of the prosthetic sulcus, and thus relative lateralization of the patellar component, would increase the stress and tracking problems in the patellofemoral joint. This prospective study evaluated the effect on patellar tracking when using the native femoral sulcus as a guide for the medial/lateral position of femoral component in primary TKA.

Patients and methods

From 1997 to 2001, 700 consecutive primary TKAs were performed in 508 patients, and all were included in this study. The preoperative diagnoses were osteoarthritis in 631 knees, rheumatoid arthritis in 28, traumatic arthritis in 17, gouty arthritis in 8, osteonecrosis in 15, and psoriatic arthritis in 1 knee. Patients with distal femoral deformity due to prior knee surgery or trauma (6), any kind of lower extremity infection (2), osteomyelitis (1), malignant tumor (2), or who were under treatment of immunosuppressive agents (2) or died during

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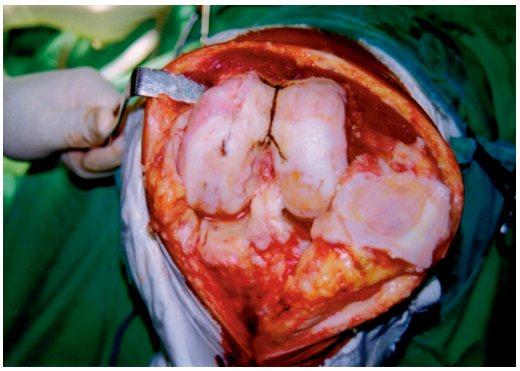

Figure 1. The midline of the native femoral sulcus is marked and the marked midline is measured 6 mm lateral to the midline of the femoral condyle in this case.

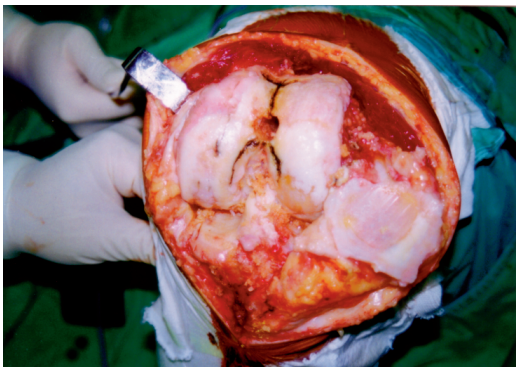

Figure 2. The entry hole for the femoral intramedullary guide is made on the distal one-third of the marked midline.

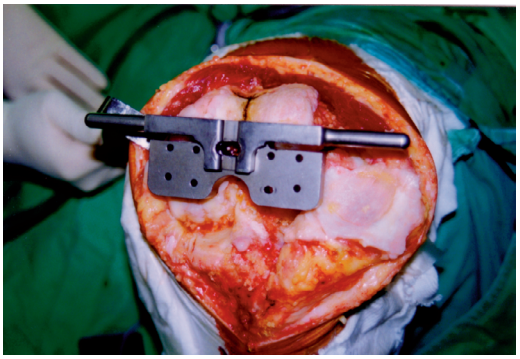

Figure 3. The transverse holding wings of the femoral cutting guide are placed perpendicular to the marked midline.

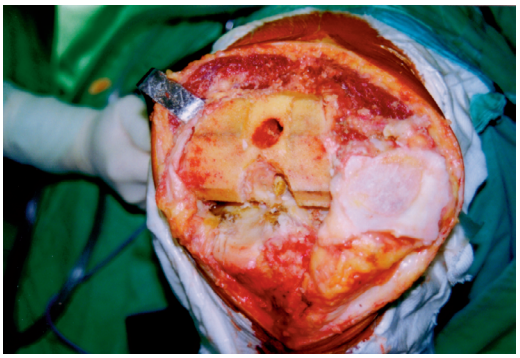

Figure 4. The femoral cuts are completed with the prosthetic sulcus aligned just over the entry hole.

follow-up (4) were excluded. Preoperatively, there were 628 knees with varus deformity and 72 knees with valgus deformity (Table 1). The mean age was 71 (45–96) years. There were 418 males and 282 females. There were 386 left knees and 314 right knees. The study was approved by our Institutional Review Board (VGHIRB No. 93-02-06A), and all patients provided written informed consent prior to the operation.

All the operations were performed by the author in a standard operating room with no special suit using a Nexgen cruciate retaining prosthesis (Zimmer, Warsaw, IN). A midline incision and mid-vastus approach (Engh and Parks 1998, Engh and Ammeen 2003) were used in all cases. The femoral cut was made first. The midline of the native femoral sulcus was first marked (Figure 1), and then the rotational alignment and the medial/lateral position of the prosthetic femoral sulcus were decided on according to the midline of the native femoral sulcus. The intramedullary femoral cutting guide was used with the entry point made at the lower half of the marked midline (Figure 2). The transverse holding wings of the femoral cutting guide were placed perpendicular to the marked midline (Figure 3). A classical distal femoral cut at 7° valgus was made in every case. The femoral cuts were all made according to the midline of the native femoral sulcus, which made the midline of the prosthetic sulcus overlap with the midline of the native femoral sulcus (Figure 4). The midlines of the native femoral sulcuses and the prosthetic sulcuses were measured to be on average 5 (3–8) mm lateral to the midline of the femoral condyle. A tibial cut was made after completion of the femoral cuts, with 7° posterior slope and horizontal classical cut (perpendicular to the axis of the tibial shaft). The midline of the tibial component was positioned along the line made from the medial one-third of the tibial tubercle to the midline of the posterior

cruciate ligament. Flexion and extension gaps were then checked and balanced with soft tissue release. No soft tissue augmentation or plication was done. Every patella was resurfaced with medialization of the patellar component, which makes the medial margin of the patellar component in line with the medial margin of the patella. Cefuroxime-impregnated cement (2 g cefuroxime in 40 g Simplex P cement (Howmedica)) (Chiu et al. 2001, 2002) was used for fixation of all components. No thumb technique (checking the patellar tracking with no additive force to the quadriceps tendon or patella) was used to check the patellar tracking after release of the tourniquet, and a lateral retinacular release was done in 3 knees because of patellar tilting. The patellar joint in these 3 knees was severely worn with patellar subluxation. No other procedure for extensor mechanism was done in this series. The wound was closed in flexion.

Prophylactic antibiotic with cefazolin was given for 7 days. A drain tube was used for 36 h. Immediate weight bearing of the operated knee was allowed, and crutches were used as needed. The average hospital stay was 7 (5–15) days.

Follow-up was at 3 weeks, at 8 weeks, at 6 months, and every 6 months thereafter. The mean follow-up time was 50 (40–68) months. Radiographic evaluations were performed on every follow-up visit with anteroposterior and lateral views, and 60º and 45º tangential view of the patellar joint. If the patellar component was located congruently in the prosthetic femoral sulcus in these tangential views, the patellar position was recorded as being good; otherwise it was recorded as "tilting". A functional evaluation was performed starting at the third postoperative visit, using the Hospital for Special Surgery score.

Results (Table)

During the hospital stay, 6 cardiovascular complications, 6 urological complications, 5 upper gastrointestinal tract complications, 2 cerebrovascular accidents, 1 pneumonia, 1 deep vein thrombosis and 1 pulmonary embolism occurred in 20 patients. All of the 22 complications recovered uneventfully with appropriate management. There were 4 (0.6%) early superficial wound infections which were cured by wound debridement and antibiotics. 1 patellar fracture with minimal displacement occurred after direct trauma and healed after 6 weeks of casting. At the follow-up, no loosening, no patellar clunk, no deep infection, and no other complications were noted.

The final radiographic evaluation showed a slight lateral patellar tilting in 10 knees (1.4%). None of the patients had symptoms. All the other 690 patellar components were seated congruently in the prosthetic femoral sulcus.

General data on 700 knees from 508 study patients

	Median (range)
Preoperative HSS score	42 (20–60)
Preoperative extension	5° (-10°–40°) [a]
Preoperative flexion	112° (75°–145°)
Preoperative anatomic axis	
Varus knees (n=628)	7.5° (20°–1°) varus
Valgus knees (n=72)	15° (9°–21°) valgus
Tourniquet time (min)	30 (21–50)
Operation time (min)	58 (50–75)
Blood loss (mL)	320 (250–1000)
Hospital stay (days)	7 (5–15)
Postoperative anatomic axis	7° (5°–9°) valgus
Postoperative HSS score	93 (85–98)
Postoperative extension	0° (0°–10°) [a]
Postoperative flexion	125 (95–150)

[a] -10 means 10 degrees recurvatum and 0 means full extension with no flexion contracture or recurvatum.

Discussion

Femoral component alignment has been reported to have a distinct effect on patellar tracking, the function of the prosthetic joint, and the overall durability of the prosthesis (Moreland 1988, Rosenberg et al. 1988, Rhoads et al. 1990, 1993, Lotke and Ecker 1997). Thus, it is important to place the femoral component in the proper position. It has been suggested that lateral deviation of the femoral component will facilitate patellofemoral tracking (Rhoads et al. 1990, 1993). However, no clinical studies have reported the effect of the medial/lateral position of the femoral component on patellar tracking and function. I evaluated the use of the native femoral sulcus as the guide for medial/lateral positioning of the femoral com-

ponent in primary TKA with a cruciate retaining type of prosthesis. The rationale was based on several studies reporting that the average midline of the natural femoral sulcus is about 5 mm lateral to the midline of the femoral condyles (Eckhoff et al. 1996). Thus, centering on the femoral condyles would in essence medialize the prosthetic sulcus of the femoral component, and therefore increase patellofemoral stress and impair function of the TKA. I determined rotational alignment by the AP axis as described by Arima et al. (1995). I found that using the native femoral sulcus as the guide for medial-lateral positioning of the femoral component and using the AP axis as the guide for rotational alignment resulted in excellent patellar tracking. I could also confirm previous findings that the native femoral sulcus is approximately 5 mm lateral to the midline of the femoral condyles (Eckhoff et al. 1996).

Many factors affect patellar tracking in TKA (Moreland 1988, Rosenberg et al. 1988, Rhoads et al. 1990, 1993, Lotke and Ecker 1997, Engh and Parks 1998, Engh and Ammeen 2003) and this study focuses only on the effect of the position of the femoral component of just one type of prosthesis (Nexgen CR) in a series with relatively short follow-up. However, the incidence of lateral release in my study (1.4%) was lower than usually reported and this can probably be attributed to the positioning guidelines I used, especially the native femoral sulcus.

No competing interests declared.

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