

# Midterm results of cruciate retaining total knee arthroplasty in patellectomized patients

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## ABSTRACT

**Background:** Total knee arthroplasty (TKA) in patellectomized patients gives inferior results when compared with those in which the patella is present. The literature is ambiguous about the role of cruciate retaining or sacrificing implants for these knees. In this study, we assessed the midterm results of TKA in patellectomized knees using a cruciate retaining implant.

**Materials and Methods:** Thirty three patients with a prior patellectomy underwent a cruciate retaining TKA and were followed up for an average of 9.3 years (range 2-14 years). At each followup visit, they were evaluated clinically, radiologically and by the Hospital for Special Surgery Scoring System.

**Results:** Twenty one knees did not have any pain or difficulty in climbing stairs, 10 knees were slightly painful on stairs but pain free on walking on flat ground and two knees experienced mild to moderate pain on walking up and down stairs as well as on flat ground. The average range of motion preoperatively was 87°, which postoperatively increased to 118°. The average Hospital for Special Surgery Knee scores increased from 52 to 89 points. None of the knees showed any progressive radiolucencies or evidence of any loosening/osteolysis or fractures in followup.

**Conclusion:** Cruciate retaining TKA offers good results at midterm followup in patients with a prior patellectomy.

**Key words:** Cruciate retaining total knee arthroplasty, total knee arthroplasty, patellectomy

## INTRODUCTION

The patella improves the efficiency of the quadriceps muscle by increasing the moment arm of the extensor mechanism.<sup>1</sup> Post patellectomy, the efficiency of the extensor mechanism decreases by 50%.<sup>1</sup> This leads to pain in the knee and anteroposterior instability.<sup>1</sup> There is also a loss in range of motion of the knee joint, which may be related to the surgery (patellectomy) or to the accompanied soft tissue injury at the time of injury or immobilization after the surgery.<sup>1</sup> The significance of this is noticed when these knees undergo total knee arthroplasty (TKA) on account of degenerative osteoarthritis. The choice of implant is debatable in the published literature, with no clear

evidence as to the preferred option of cruciate retaining<sup>2,3</sup> or sacrificing implant.<sup>4-7</sup>

This study was conducted to assess the midterm results of TKA in patellectomized knees in which a cruciate retaining implant (Nexgen CR, Zimmer, Warsaw, Indiana) was used. They were evaluated clinically and radiologically, and the results were compared with the studies published in the literature.

## MATERIALS AND METHODS

Thirty-three consecutive primary TKA were performed for primary osteoarthritis of knees between 1998 and 2010 in 33 patients who had undergone a previous patellectomy. They were retrospectively reviewed at the time of the study. There were 19 women and 14 men in the group. The average age of the patients was 58 years (range: 42-77 years). The reason for patellectomy was a comminuted fracture of the patella in all the patients. The average interval between the patellectomy and TKA was 11 years (range: 5-23 years). All the surgeries were conducted by the senior author (AR).

All patients were operated under combined spinal epidural anesthesia. A tourniquet was used after exsanguinating the limb in each surgery. Preexisting skin incision over the knee

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was used if longitudinal ( $n = 29$ ). In cases of a transverse incision ( $n = 4$ ), a midline longitudinal skin incision was used. The arthrotomy was completed using a medial parapatellar incision, as is done when the patella is present. The extensor mechanism was retraced laterally and the knee was flexed to expose the knee joint. The femur was prepared using intramedullary instruments and the tibia by means of extramedullary jigs. The femoral implant was placed 2 mm anteriorly and slightly flexed. Postoperatively, weight bearing as per tolerance of pain using a walker and active knee range of motion exercises were started on the day of surgery. The goal was to achieve an active range of motion of 5-90 degrees and independent ambulation to the toilet one day prior to discharge.

X-rays of the knee (standing anteroposterior, lateral views) were taken prior to discharge. The patients were evaluated after 3 months, 6 months, 1 year and then yearly thereafter. At each visit, the Hospital for Special Surgery Knee Scores were tabulated and X-rays were taken. The scores were compared with those obtained in the previous visits. The radiographs were evaluated for alignment, any loosening or osteolysis.

Informed consent and Institutional Review Board (IRB) approval was taken for the study.

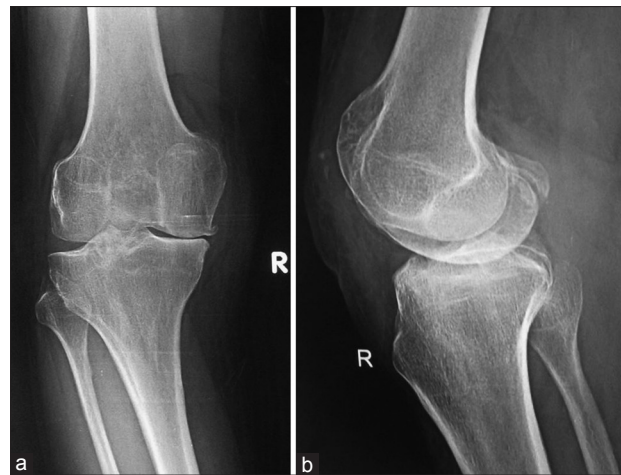
## RESULTS

Two patients were lost to followup after 5 and 7 years of surgery, but they were also included in the study as a minimum of 2 year followup was present. The average time of followup was 9.3 years (range 2-14 year). The average Hospital for Special Surgery Scores preoperatively was 52 points (range 39-52 points), which increased to an average of 89 points at the time of last followup. Twenty one knees did not have any pain or difficulty in climbing stairs, 10 knees were slightly painful on stairs but pain free on walking on flat ground and two knees experienced mild to moderate pain on walking up and down stairs as well as on flat ground. Twelve patients (36%) needed a support of their arms to get up from a seated position. This was presumably on account of a weaker extensor mechanism. The average range of motion preoperatively was 87 degrees (range 50°-105°), which, postoperatively, increased to 118° (range 85-130°). Ten knees had an extensor lag of 5 degrees. None of the painless knees ( $n=21$ ) were unstable in the anteroposterior plane in full extension and flexion of 90 degrees. Of the 12 knees that were painful, three had an anteroposterior instability of up to 5 mm in flexion, but were stable in extension. The rest of the knees ( $n=9$ ) were stable. None of the knees required revision.

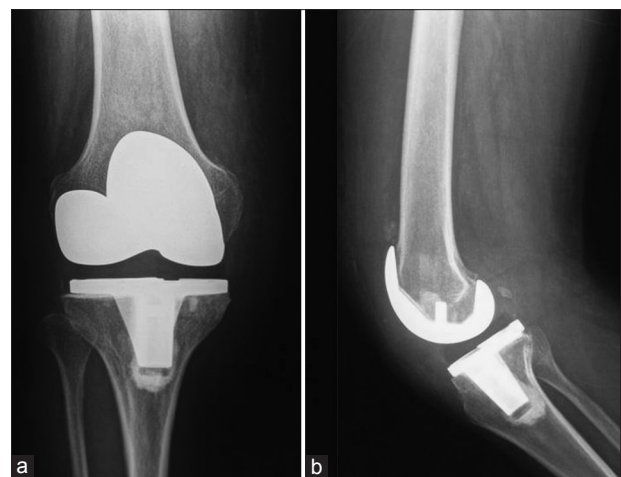
The preoperative radiographs revealed a mean varus deformity of 130 (range of 7-26°) in 24 knees and a mean valgus deformity of 100 (range of 7-15°) in nine knees. Postoperatively, at the time of last followup, 31 knees had a normal alignment (5°-7° of valgus) and two knees were in varus alignment of three and six degrees. None of the knees showed any progressive radiolucencies or evidence of any loosening/osteolysis [Figures 1a,b and 2a,b].

## DISCUSSION

Sledge and Ewald<sup>8</sup> put forth their theory of the four bar linkage system of the knee comprising of the quadriceps and patellar tendons and the cruciate ligaments. In a knee with an intact patella in 90 degrees of flexion, the patellar tendon is parallel to the posterior cruciate ligament and the quadriceps tendon is parallel to the anterior cruciate ligament. This four bar linkage provides stability in a flexed



**Figure 1:** Preoperative standing anteroposterior view (a) and lateral view (b) showing absence of patella and degenerative changes of right knee



**Figure 2:** 7 years followup X-ray standing anteroposterior view (a) and lateral view (b) showing implant *in situ* without any radiolucencies loosening or osteolysis

knee and prevents anterior displacement of the femur in flexion. Loss of the patella leads to decreased efficiency of the quadriceps mechanism by 30-50%, leading to inability to support the flexed loaded knee.<sup>1</sup>

Bayne *et al.*<sup>9</sup> reported on the results of TKA in 17 knees following a patellectomy. Six of these knees were revised on account of continuing pain. Good results correlated with increase in constraint of the implant. They recommended that because the patellar mechanism with the cruciates functions as a four bar linkage, if the patella is excised, the cruciates are essential to maintain anteroposterior stability. In case of incompetent cruciate ligaments, a constrained implant may be required.

Lennox *et al.*<sup>10</sup> found that quadriceps and hamstring torque and strength were reduced in the patellectomy group. They reported good to excellent results in only five of the 11 knees who underwent a TKA postpatellectomy. Railton *et al.*<sup>4</sup> reported on the satisfactory results of seven knees who underwent a posterior stabilized TKA after a patellectomy. Six of the seven knees were pain free at the time of the report, but four of them needed support of their arms to raise themselves up from a chair, suggesting a residual weakness in their extensor mechanism. None of these patients reported on any subjective feelings of instability. Larson *et al.*<sup>11</sup> reported that patients without a patella may be at a higher risk for failure of the implant (unconstrained or constrained). This group of 26 TKA included 14 primary TKA and 12 revision TKA. They recommended the use of a posterior stabilized implant.

Kang *et al.*<sup>2</sup> reported that the knee and function scores were lower in the patellectomized patients (82.5 points) when compared with the control group in whom the patella was present (93.9 points). The lower scores reflected the patients' difficulty in independently climbing or descending stairs. They also found no difference in results between a cruciate retaining or a cruciate substituting implant (82.5 points and 86.5 points, respectively). In our study, the average Hospital for Special Surgery Knee Scores was 89 points, which is consistent with the results reported in the study by Kang *et al.* Thirty-six percent of the patients did have a difficulty in rising up from a chair without support. Joshi *et al.*<sup>3</sup> reported on the results of TKA in 19 knees who had previous patellectomy. They compared the results with a matched group of patients in whom the patella was intact. At a followup of 63 months, there was an overall complication rate of 36%. The knees with a patellectomy had a greater range of motion when compared with those with an intact patella. They also observed a higher rate of supracondylar femoral fractures (16%) in the patellectomy group. This was attributed to an increase in forces across

the femoral condyles because of an absent patella. Among the various implant designs used, there was a marginal difference in the result and complication rate between the cruciate retaining and substituting knees. The average range of motion was 118 degrees in our study, and we encountered no supracondylar femoral fractures.

Paletta *et al.*<sup>5</sup> reported that the performance of a posterior stabilized implant in a patellectomized knee was similar to the result of TKA without a patellectomy when compared at 5 years. Cruciate retaining implant had a less successful result in terms of relief of pain, motion, stair climbing and late-onset anteroposterior instability. They disagreed with the views of Sledge and Ewald, who hypothesized that in the absence of a patella it is the posterior cruciate ligament that prevents the anterior translation of the femur on the tibia in a flexed knee. Only three knees out of the 33 knees in our study had late-onset anteroposterior instability of up to 5 mm.

Martin *et al.*<sup>6</sup> reported on the good results of TKA after patellectomy. There was a significant decrease in pain after surgery and the functional scores also increased. They cautioned that the expectations must be realistic and the results will not match those with an intact patella. Omar *et al.*<sup>7</sup> reported on the more predictable results after using a posterior stabilized implant in knees with a prior patellectomy. They recommend the use of posterior stabilized implants for these knees.

The results of a cruciate retaining TKA in patellectomy patients gives a good result and is comparable to the results obtained when the posterior cruciate ligament is excised. A subset of patients will have a weakened extensor mechanism, which will need an external support while climbing stairs or while getting up from a seated position.

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