



Minimum Two-Year Outcomes of Modular Bicompartamental Knee Arthroplasty

Atul F. Kamath, MD^a, Ashley Levack, MAS^a, Thomas John, MD^b, Beverly S. Thomas, RN^c, Jess H. Lonner, MD^c

^a Department of Orthopaedic Surgery, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania

^b Department of Orthopaedic Surgery, Albert Einstein Medical Center, Philadelphia, Pennsylvania

^c Department of Orthopaedic Surgery, Rothman Institute, Thomas Jefferson University, Philadelphia, Pennsylvania

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ABSTRACT

The purpose of this study was to determine the results of modular unlinked bicompartamental knee arthroplasty (BiKA) for medial (or lateral) and patellofemoral arthritis. Twenty-nine modular BiKAs were followed prospectively, for a mean of 31 months (range, 24–46 months). Outcome measures included Knee Society Knee and Function Scores, KOOS, SF-12, and WOMAC, as well as radiographic assessments and implant survivorship. Two tail paired Student's t test was used to determine statistical differences between preoperative and postoperative scores. Mean range of motion (ROM) improved from 122° to 133° ($P < 0.001$). There was a statistically significant improvement across all functional scores. One patient underwent conversion to total knee arthroplasty at 3 years for knee instability. There were no cases of patellar instability, implant loosening or wear, or progressive arthritis.

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Isolated unicompartamental knee arthroplasty (UKA) and patellofemoral arthroplasty (PFA) are effective for localized arthritis. However, arthritis commonly affects both the medial (or lateral) and patellofemoral compartments. Traditionally, total knee arthroplasty (TKA) has been performed in those circumstances. While some have suggested that patellofemoral arthritis and symptoms can be ignored when performing UKA [1,2], others have not supported that approach. Additionally, the presence of arthritis or painful grade 3 or 4 chondromalacia in the medial or lateral compartments is a contraindication to PFA when treating patellofemoral arthritis, making TKA the conventional treatment in this scenario [3]. Bicompartamental knee arthroplasty (BiKA) is an alternative treatment option that is approved by the United States Food and Drug Administration, but it has had mixed results depending on whether a monolithic or modular approach has been used [4–11]. Nonetheless, BiKA is gaining interest and may become more relevant as techniques improve, designs change, and results emerge.

Early clinical results of BiKA have shown excellent pain relief, knee function, and restoration of appropriate knee alignment [5–8,12,13]. One study which performed gait analysis and isokinetic strength testing indicated that normal knee mechanics and gait are restored after BiKA [14]. Recipients can commonly rise independently and ascend stairs reciprocally [5,14]. Despite encouraging early results, several recent studies have questioned the role of monolithic BiKA, citing a relatively high incidence of patellofemoral complications and need for secondary surgeries [9–11]. These reported outcomes are

likely related to challenges and compromises in sizing and orienting the femoral component vis-a-vis the mechanical axes and morphologies of each compartment [15]. On the other hand, a modular, unlinked trochlear and medial (or lateral) femoral condylar prosthesis (modular BiKA) allows the individual compartmental resurfacing procedures to be performed “independently” of the other, facilitating independent orientation and alignment of the individual components relative to the critical axial and rotational axes of the distal femur [4]

The purpose of this study was to report on the clinical, functional, and radiographic outcomes at a minimum of two years of follow-up of a consecutive series of modular unlinked BiKAs.

Materials and Methods

The results of twenty-nine consecutive modular BiKAs (combined UKA and PFA) in 29 patients performed by the senior surgeon between 2008 and 2010 are reported herein. Approval was obtained by our institution's Institutional Review Board. All patients had radiographic evidence of arthritic change and were clinically symptomatic in two knee compartments: the patellofemoral compartment and either the medial or lateral tibiofemoral compartment (Fig. 1A, B, and C). In each case, the third compartment had neither radiographic evidence of degenerative arthritis nor painful symptoms. All patients received an unlinked modular bicompartamental prosthesis that included a UKA with a metal-backed tibial component, a PFA with an onlay style trochlear component positioned perpendicular to the anteroposterior axis of the femur, and an all-polyethylene dome shaped patellar component. A variety of UKA implants were utilized, including ZUK (Zimmer, Inc., Warsaw, IN) and Mako Restoris MCK (Mako Surgical Inc, Fort Lauderdale, FL); PFA implants included the Gender Solutions PFJ (Zimmer, Inc., Warsaw, IN) and Mako Restoris

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Reprint requests: Jess H. Lonner, MD, Department of Orthopaedic Surgery, Rothman Institute, Thomas Jefferson University, 925 Chestnut Street, Philadelphia, PA 19107.



MCK (Mako Surgical Inc, Fort Lauderdale, FL). During the years of this study, the senior author's percentage of knee arthroplasties were — PFA 10%, UKA 21%, BiKA 3%, TKA 66%. Currently approximately 15% of the surgeon's knee arthroplasty volume is BiKA.

Patients selected for BiKA have similar features as those that may otherwise be selected for UKA or PFA, but with additional disease in the second compartment. The indications for BiKA are degenerative arthritis in one tibiofemoral compartment and the patellofemoral compartment, with no more than grade 2 or 3 chondromalacia in the remaining tibiofemoral compartment. Often, the patient is being considered for either a unicompartmental or patellofemoral arthroplasty, but in the case of the former has painful patellofemoral chondromalacia (usually lateral facet and/or lateral trochlea) or in the latter also has painful unicompartmental tibiofemoral chondromalacia. In those circumstances, rather than performing a single compartment arthroplasty and risking progressive degeneration in the other symptomatic compartment, a BiKA is most often performed. In the case of UKA, if the patient has even grade 4 chondromalacia in the medial patellar facet and/or trochlea, but no lateral patellar facet or lateral trochlear disease and no anterolateral symptoms or pain on examination with patellar grind and inhibition testing, an isolated UKA is typically performed. There should be no pain, tenderness on palpation or crepitus in the third compartment. Range of motion should be more than 90° degrees; flexion contractures no more than 5°; ligaments should be functionally intact; and coronal deformity should be no more than 10° varus for medial OA or 15° valgus for lateral OA. There is no upper age restriction as long as the appropriate criteria are met. Weight bearing radiographs including anteroposterior, midflexion posteroanterior, lateral and sunrise views should be evaluated. Magnetic resonance imaging scans can be useful in evaluating the quality of the articular cartilage in the knee (with particular emphasis on the third compartment that is not going to be resurfaced). Finally, if the patient has had arthroscopic surgery of the knee within a few years of the planned procedure, these should be reviewed.

In terms of the decision-making process and whether the determination to perform the procedure is made entirely preoperatively, in the vast majority of cases the senior author has decided in advance of surgery what is going to be done. For instance, if a patient is being evaluated for a UKA, but has a painful PF compartment due to PF chondromalacia or arthritis and not related to the medial or lateral compartment arthritis (for instance many patients with isolated medial compartment OA also have some anteromedial pain in addition to medial pain), they are consented for and get a bicompartamental knee arthroplasty. If a patient is being evaluated for a PFA but has painful chondromalacia (or arthritis) in the medial or lateral TF compartment, they are consented for and get a BiKA. If a patient does not have much PF pain but there is diffuse PF chondromalacia noted at the time of UKA surgery (particularly involving the lateral trochlea or lateral patellar facet), they will also get a BiKA. If a patient has bicompartamental OA, but severe deformity, thrust, cruciate instability, flexion contracture more than 5° or 10°, limited ROM, and diffuse pain, they are going to get a TKA, not a partial knee arthroplasty. It has been over a decade since the senior surgeon/author abandoned intraoperatively his plan to do a partial knee arthroplasty in favor of a TKA.

The surgical approach is the surgeon's preference, but in this senior surgeon's experience, a mini medial parapatellar or mini-midvastus arthrotomy is used. The exposure is typically a little less than for a TKA, since a large subperiosteal release is not typically needed for a UKA or BiKA. The proximal extent of the incision is typically approximately 1–3 cm above the proximal pole of the patella and the distal extent just

Fig. 1. Pre-operative anteroposterior (A), lateral (B) and sunrise (C) radiographs demonstrate osteoarthritis in the medial tibiofemoral and patellofemoral compartments, with preservation of the lateral compartment joint space.

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