Mobile-bearing Unicondylar Knee Arthroplasty: The Oxford Experience

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KEYWORDS

• Knee • Mobile bearing • Unicompartmental arthroplasty • Oxford

KEY POINTS

- Partial knee arthroplasty is growing in popularity, especially in active adults and those patients seeking less invasive surgery and rapid recovery.
- The mobile-bearing, fully congruent design of the Oxford knee has less wear than fixed-bearing designs.
- The long-term outcome data of the Oxford knee rival those of total knee arthroplasty without the inherent morbidity, mortality, and other risks. This success of the Oxford has begun to challenge the dogma surrounding total knee arthroplasty.
- The Oxford partial knee is ideal for outpatient procedures.
- The modern design and instrumentation allows for minimally invasive implantation.

INTRODUCTION

The past 2 decades have seen a resurgence of interest in unicompartmental knee arthroplasty (UKA) for the treatment of isolated knee arthritis. The resurgence of medial UKA is in part due to a movement toward less invasive techniques, quicker recovery, less overall morbidity, and preservation of normal knee kinematics.[1–4] This growth in popularity, combined with recent reports of long-term success with medial UKA, has also begun to challenge the dogmatic belief that total knee arthroplasty (TKA) is the gold standard treatment of all knee arthrosis.[5–7]

The Oxford mobile-bearing UKA (Biomet, Inc, Warsaw, IN) is an implant with a unique design that has a spherical femoral component, a polished flat tibial component, and a fully congruent polyethylene meniscal bearing. This design is in sharp contrast with most medial UKA devices that use an aspherical femoral component and fixed polyethylene tibial component. The traditional fixed-bearing design creates

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the opportunity for polyethylene wear secondary to high-contact stresses over low surface area.[8] The fully congruent mobile-bearing design of the Oxford UKA has been shown to reduce polyethylene wear to 0.01 to 0.02 mm per year while maintaining more normal knee kinematics.[9]

OXFORD DESIGN HISTORY AND RATIONALE

Goodfellow and colleagues[10] developed the concept of the Oxford knee in the early 1970s. The initial premise of the design was to reduce polyethylene wear by reproducing the congruent nature of the native meniscus. This congruent design increased the contact area but greatly reduced the contact stresses. However, in order to achieve full congruency on both interfaces with a solid polyethylene meniscus, the femoral side needed to be spherical and the tibial side needed to be flat.

The implant was originally used as a bicompartmental knee replacement with poor survivorship.[11] The survivorship of the Oxford knee was markedly improved once its use was limited to the medial compartment of ligamentously stable knees with bone-on-bone osteoarthritis.[5] White and colleagues[12] defined this distinct pattern of medial disease as anteromedial osteoarthritis and only observed this pattern in patients with an intact anterior cruciate ligament (ACL). Those patients with ACL deficiency tended to have a posteromedial wear patterns secondary to the chronic anterior subluxation of the medial tibia that occurs when the ACL is incompetent. This pattern of anteromedial osteoarthritis is now the primary indication for a medial Oxford UKA.

The Oxford UKA has undergone a series of modifications since the 1970s. However, the original concepts remain unchanged since its initial development (**Fig. 1**A). Femoral milling was developed in 1987 to accurately and safely prepare the medial femoral condyle and allow for minimally invasive implantation (see **Fig. 1**B). The third phase of development in the late 1990s created additional femoral component sizes and a more anatomic meniscal bearing that improved tracking and diminished bearing impingement and rotation (see **Fig. 1**C). This phase III design also incorporated anatomic femoral sizes and a novel instrumentation platform specifically designed for minimally invasive implantation.

The most recent phase of Oxford development started in 2009 and focused on improving the reliability of the instrumentation, eliminating impingement of the meniscal bearing, and slight modifications to the femoral design (see **Fig. 1**D). The new Microplasty Instrumentation (Biomet, Inc, Warsaw, IN) of the Oxford UKA uses an intramedullary reference for preparing the femur and a reproducible stylus to create a more consistent tibial resection. The new twin-peg femoral design maintains the same spherical design concept but has an additional peg for rotational stability; a longer radius of curvature to maintain bearing congruency in high flexion angles; and smoother, rounded edges to reduce soft tissue irritation and impingement (see **Fig. 1**D).

INDICATIONS

The typical radiographic evaluation of an Oxford UKA candidate is seen in **Fig. 2**. It is important to notice that, in this case example, the knee corrects to a normal valgus alignment with valgus stress and that the lateral joint space is maintained. **Fig. 3** shows patients who are not candidates for UKA based on the failure of the valgus stress film and the presence of a posteromedial wear pattern in ACL deficiency.

The indications for medial Oxford UKA as defined by Goodfellow and colleagues[10] are: