New Instrumentation Reduces Operative Time in Medial Unicompartmental Knee Arthroplasty Using the Oxford Mobile Bearing Design

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Abstract

Redesigned instrumentation has become available for implantation of the Oxford Mobile Bearing Medial unicompartmental knee arthroplasty. To assess the benefit of these changes, we compared operative time of 200 Phase III and 176 Microplasty UKA done 2008-2011. An average time savings of 8.6 minutes was seen with the Microplasty design. Additionally, the standard deviation in operative times, minimum and maximum operatives were lower in knees in which Microplasty instrumentation was utilized. A 15% savings in operative time was seen with the new Microplasty instrumentation.

Keywords: unicompartmental knee arthroplasty, surgical technique, instrumentation, mobile-bearing, operative time

Level of Evidence: AAOS Therapeutic Level III – Retrospective comparative therapeutic study

Introduction

Multiple publications cite excellent results in terms of survivorship and functional outcomes with a medial-mobile bearing unicompartmental partial knee arthroplasty design utilizing the Phase III minimally invasive instrumentation platform (Zimmer Biomet, Warsaw, IN) (Figure 1A-D) [1-13]. The most recent modifications to the mobile-bearing Oxford Partial Knee Arthroplasty (Zimmer Biomet) were intended to enhance the stability and mechanics of the femoral component and improve the process of implantation and reproducibility of implant positioning. Previous reports have demonstrated good early outcomes and more accurate and reproducible femoral component alignment and implantation using this newer design and improved instrumentation [14,15]. Specific design changes to the instrumentation platform include siz-

ing spoon-stylus system to decrease the need to recut the tibial plateau (Figure 2A-B), an intramedullary based femoral alignment guide (Figure 3A-B) and an accurate and efficient guide for reducing impingement (Figure 4A-B) (Microplasty Instrumentation; Zimmer Biomet). In addition to improved accuracy, the Microplasty instrumenta-

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Figure 1. The Phase III instrumentation: Tibial resection (1A), femoral alignment lateral view (1B), femoral alignment A/P view (1C), femoral alignment distal femoral view (1D) (Reproduced courtesy of Zimmer Biomet, Inc.)

Figure 2. Microplasty instrumentation tibial resection guide with spoon/stylus and "G-clamp" for setting resection depth: lateral view (2A), A/P view (2B). (Reproduced courtesy of Zimmer Biomet, Inc.)

Figure 3. Microplasty intramedullary linked femoral alignment guide: lateral view (3A), A/P view (3B). (Reproduced courtesy of Zimmer Biomet, Inc.)

Figure 4 Microplasty impingement removal device: Removal of anterior impingement (4A), removal of posterior impingement (4B). (Reproduced courtesy of Zimmer Biomet, Inc.)

Figure 5. For the Phase III instrumentation, anterior osteophytes and potential impinging bone were removed with the use of an osteotome: Removal of anterior impingement (5A), removal of posterior impingement (5B). (Reproduced courtesy of Zimmer Biomet, Inc.)

tion platform was intended to streamline the surgical procedure making it more efficient. The purpose of this study is to determine if the new Microplasty instrumentation allows for a more efficient surgical procedure that would translate into reduced operative time.

Materials and Methods

A query of our practice's arthroplasty registry revealed 176 knees in patients who signed an institutional review board-approved general research consent allowing retrospective review, and underwent medial unicompartmental knee arthroplasty (UKA) performed with the Microplasty instrumentation between July 2011 and December 2011. A matched group of 200 UKA in patients who signed an IRB-approved general research consent allowing retrospective review, implanted using the Phase III instrumentation and the single-peg femoral component from 2008 to 2011, was selected. Only procedures in which unilateral UKA were performed were examined; 38 simultaneous bilateral procedures were excluded (Table 1). The surgeons (KRB, AVL, JMH, MJM) began using the Phase III instrumentation in July of 2004, and thus the Phase III group represents procedures that are well beyond the initial learning curve.

The preoperative diagnosis was avascular necrosis in 1 knee (enhanced twin-peg group) and osteoarthritis in

all others. The groups were well matched in terms of gender, age, body mass index, preoperative ROM, and Knee Society pain and clinical scores. Forty-six percent of patients were males and 54% were females. Mean patient age at surgery was 63.7 years overall (stdev 9.1; range 29-88 years), mean BMI was 32.3 kg/m² (stdev 6.6, range 17-57 kg/m²), and mean ROM was 116.3° (stdev 7.7, range 90°-135°).

Operative time was recorded for each procedure. Operative time was defined as the time from initial incision until the final dressing was applied. Operative time between the Microplasty group and the Phase III group was compared using the Satterthwaite method and the Folded F test. Statistical significance was defined as $p < 0.05$.

Results

The mean operative time was significantly shorter with the Microplasty instrumentation (49 minutes) compared with the Phase III (58 minutes). This difference was significant (t value 5.23; $p < 0.0001$ and F value 1.41; $p = 0.02$). Additionally, the standard deviation was significantly lower in the Microplasty group (14 minutes) versus the Phase III (17 minutes). The minimum and maximum operative times were also less in the Microplasty group compared with the Phase III (24-88 minutes versus 30-126 minutes).

Table 1. Demographics and results

Characteristic	Phase III Instrumentation	Microplasty Instrumentation	P value
Knees	200	176	
Patients	177	164	
Gender by patients			
Male patients	76 (43%)	81 (49%)	0.322
Female patients	101 (57%)	83 (51%)	
Gender by knees			
Knees in male patients	84 (42%)	86 (49%)	0.182
Knees in female patients	116 (58%)	90 (51%)	
Mean age (years)	62.9 (± 9.6 , 29-88)	64.5 (± 8.5 , 44-81)	0.086
Mean height (inches)	66.7 (± 4.0 , 59-76)	66.8 (± 4.0 , 59-75)	0.759
Mean weight (pounds)	202.0 (± 42.0 , 120-330)	207.6 (± 47.0 , 116-375)	0.227
Mean body mass index (kg/m ²)	31.9 (± 6.0 , 17-52)	32.7 (± 7.3 , 17-57)	0.235
Mean preoperative range of motion (degrees)	116.5 (± 7.8 , 90-135)	116.1 (± 7.6 , 90-130)	0.640
Mean preoperative Knee Society pain score (0-50 possible)	9.8 (± 11.8 , 0-50)	9.5 (± 10.6 , 0-45)	0.834
Mean preoperative Knee Society clinical score (0-100 possible)	41.0 (± 14.1 , 18-83)	40.4 (± 12.7 , 23-94)	0.637
Mean operative time (minutes)	58.0 (± 17.1 , 30-126)	49.4 (± 14.4 , 24-88)	<0.001

Discussion

Unicompartmental knee arthroplasty (UKA) using the Oxford Phase III medial mobile-bearing knee has enjoyed excellent results [1-13]. Price and Svard reported 91.0% all cause cumulative survival rate at 20 years in a series of 543 patients (682 knees) [12]. Our center previously reported 95.2% survival at a mean of 3.7 years in 688 patients with 839 medial Oxford III UKA [1]. We have also previously reported that use of the new Microplasty instrumentation results in more accurate and reproducible femoral component placement [15]. White et al reported 100% survival and 97% patient satisfaction at 2 years postoperative utilizing the Microplasty instrumentation and twin-peg femoral design [14]. An additional goal of the new instrumentation was to allow for a more efficient procedure. The current study demonstrates that this new instrumentation platform reduces operative time.

Specifically, the three steps of the procedure in which we believe this improved efficiency and decreased operative time are gained include the tibial resection, femoral alignment, and removal of impingement. The spoon-based Microplasty instrumentation (Figure 2) references the posterior femoral condyle and acts as a stylus to accurately remove 6.5 (3 “G-clamp”) or 7.5mm (4 “G-clamp”) of tibial resection. This accuracy reduces the number of time the tibial plateau requires re-resection. Further, in our previous study, we noted that this bone-conserving approach to tibial preparation resulted in a greater number of thinner 3 and 4 mm bearings utilized in the Microplasty group [15]. This provides the added benefit of not only less operative time, but a more conservative tibial resection and less bone removal.

With Phase III instrumentation, femoral alignment required visualization and adjustment of 6 separate variables or alignment measurements (Figure 1A-D). This individual adjustment required checking each alignment position while manually holding the other 5 positions. With the intramedullary alignment guide, not only is the alignment more accurate and reproducible, but this step requires less operative time (Figure 3A-B). With Phase III instrumentation, anterior osteophytes and potential impinging bone were removed with the use of an osteotome (Figure 5A-B). This was inaccurate and frequently required checking the bearing in extension multiple times to ensure an appropriate amount of bone was removed. The Microplasty guide for removing impingement (Figure 4A-B) allows for this step to be performed once with no need to recheck impingement-free range of motion, thus reducing operative time. These efficiencies resulted in an average of almost 9 minutes less operative time or a 15% reduction.

Microplasty instrumentation decreases operative time for implanting the Oxford mobile-bearing medial unicompartmental knee. A 15% reduction in operative time could translate into the ability to perform more surgeries, decreased risk of infection, and decreased length of tourniquet use, all of which would have positive benefits to surgeon and patient.

Disclosure Statement

One or more of our authors have disclosed information that may present potential for conflict of interest with this work. For full disclosures refer to last page of this journal.

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