**Arthroscopically Assisted, Meniscal Sparing Tibiofemoral Knee Resurfacing**

**Review of Treatment Concept, Surgical Technique, and Early Outcomes**

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**Summary**

Tibiofemoral joint arthrosis has debilitating effects, in particular for active middle-aged patients who have failed the conservative and biological procedures commonly used to treat mono-compartmental arthrosis. There are many treatment options available to manage localized articular defects in the knee. Historically, the transition from conservative and biological interventions to joint replacement has not been well defined in the literature.

In order to provide continuing joint preservation for knee arthrosis, an innovative, FDA approved, meniscal sparing tibiofemoral resurfacing technology was introduced to the market in March 2008. The benefits of Arthroscopically assisted Knee Resurfacing (AKR) are based on the use of a three-dimensional, intraoperative surface mapping technology and the implantation of patient specific, congruent inlay components. The low-profile articular implants accurately reconstruct a load sharing surface without altering the volume or natural biomechanics of the knee. Precision reamed implant beds result in a minimum amount of bone and cartilage removal so that the impact on future conversion to standard joint arthroplasty is not compromised. Conservation of healthy meniscal, articular, and ligamentous tissues preserves a more natural feel of the knee. The arthroscopic tibial approach and small femoral arthrotomy, combined with congruent surface replacement enable a faster recovery.

Patient selection is key. The target patient has mono-compartmental arthrosis, ligamentous stability, adequate mechanical alignment, satisfactory meniscal function, and a normal body mass index. Particular consideration needs to be given to the compounding effect of combined risk factors when determining patient indications.

A multicenter review of 51 implantations in 48 patients (3 bilateral) demonstrated encouraging results in patient and surgeon satisfaction, pain relief and postoperative recovery at an average follow-up of 3 months following the procedure (range 1-10). Patients returned to work at an average time of 6 weeks (non-retirees). Future studies are necessary to determine the medium and long-term benefits of the procedure and provide detailed guidance in regards to positive and negative outcome predictors.

Key words: Articular resurfacing, joint preservation, tibiofemoral arthrosis, joint replacement

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**Introduction**

Surgical management of tibiofemoral arthrosis in middle aged and older patients remains challenging due to the declining effect of biologic treatment options in this patient population. Martin and Buckwalter reported an age-related decline in chondrocyte synthesis, mitotic activity, and responsiveness to anabolic cytokines and mechanical stimuli, which may add to the explanation of an age-related increase in the prevalence of osteoarthritis and decrease in cartilage repair efficacy. At the same time conventional knee arthroplasty should be delayed taking into consideration that patients lead more active lifestyles and have
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Figure 1: Tibiofemoral resurfacing components. Postoperative AP and lateral radiographs

a longer life expectancy. Early revisions should be avoided, particularly in patients with mono-compartmental degeneration.

Approximately 21 million people in the United States suffer from osteoarthritis and a total of 533,808 total knee replacements (TKR) were performed in the US. Several reports indicate that approximately 5-6% of arthritic knees are suitable for unicompartmental knee arthroplasty. From 1998 to 2005, US unicompartmental implantations grew from 6570 to 44990.

Historically, satisfying results in UKR have been reported for over three decades. Initial reports were mixed leading to a decline of the procedure in the 1970s. Promising long-term results and newer design configurations led to a resurgence of the procedure. Implant registries report a 10-year survival rate ranging from 73-81%.

Advantages of UKR versus TKR include preservation of normal knee kinematics, accelerated patient rehabilitation and recovery, and higher functional levels. UKR has lower perioperative morbidity with smaller incisions, less tissue trauma and preservation of bone stock in both affected and unaffected compartments and allows for conversion to an augmented primary total knee replacement in patients with disease progression.

In order to further enhance this treatment concept, a new minimally invasive, arthroscopic assisted tibiofemoral resurfacing system was introduced to the US and international markets in 2008. The UniCAP™ Arthroscopic Knee Resurfacing System (AKR) (Arthrosurface, Inc. Franklin, MA) is based on a platform technology utilizing intraoperative, three-dimensional joint surface mapping in order to fit and implant a set of matching, off-the-shelf, contoured articular inlay components. The fully cannulated instrument set provides stepwise preparation of shallow implant beds and final delivery of low-profile articular components. The procedure offers a number of clinical benefits, including a high degree of precision and flexibility, matching the implant components to the existing anatomy, and a more physiologically normal joint in terms of load and force distribution.

Prosthetic Design

The femoral resurfacing module is composed of a bone anchoring fixation post (Ti-6A-4V) and a large range of femoral articular components (Co-Cr-Mo alloy, Ti undersurface coating) which are based on validated male and female condyle curvatures. This permits contoured and patient specific inlay resurfacing of condylar defects with a coverage area of 40 x 20 mm (Figure 1).

The circular, tibial, all-polyethylene inlay component (UHMWPE) allows localized tibial surface reconstruction (20mm diameter) while preserving healthy meniscal and articular structures (Figure 1). The undersurface is slightly slanted and keeled to increase stability and resistance to rotational forces.
Basic Science

The UniCAP™ system demonstrates significant similarities to the existing HemiCAP® knee system in terms of device configuration, material composition, manufacturing, fixation method, and instrumentation concept, allowing certain correlations to various basic science results. In a controlled comparison, Kirker-Head et al. reported on the safety, biological and functional response to focal, contoured articular inlay resurfacing on the medial femoral condyle in the adult goat model. Animal comparison at 26 to 52 weeks follow-up showed promising results for implant fixation and host incorporation: The histological review demonstrated trabecular bone abutting to the implant. A chondral membrane was seen crossing the periphery of all articular implants showing a metachromatic matrix with singular and clustered chondrocytes (Figure 2). Opposing articular surfaces remained intact supporting the use of a contoured metallic inlay resurfacing implant for localized full thickness defects.

Koh et al. raised the issue on angled and slightly raised osteochondral plug implantation used in the management of focal weight bearing condylar defects in a younger patient population and showed an increase in trans-articular pressure. Similar findings were reported by Becher et al. for proud implantation of a focal femoral condyle resurfacing implant. (Figure 3) The authors stressed a flush or slightly recessed placement of the inlay implant in order to avoid a significant trans-articular pressure increase at the implant cartilage interface in particular when combined with a non-functional meniscal defect. (Figure 4) Slightly recessed implant margins for metallic inlay resurfacing components are therefore critical for the clinical application of this treatment concept.
Patient Selection

Arthroscopic assisted knee resurfacing (AKR) is intended for patients with clinically significant baseline pain symptomatic and functional limitations that require surgical intervention to address further mono-compartmental degeneration. The target patient population is middle-aged, has failed previous arthroscopic interventions and conservative treatment modalities.

The preoperative physical examination shows good joint stability in the affected knee, normal or near normal range of motion, and a mechanical malalignment of less than 5 degrees. Patients with evidence of advanced bony deformities, erosions, large cystic bone formations, rapid joint destruction, marked bone loss, or bone resorption, including metabolic disorders like Paget's and Charcot's disease, osteomalacia, and severe osteoporosis should not be considered for AKR due to possible impairment of bone healing and implant fixation. Other specific contraindications include widespread symptomatic degeneration which cannot be effectively covered by the resurfacing procedure.

Rather than providing strict patient selection criteria for outcome influencing factors, we believe the procedure warrants a careful review on an individual patient basis. Patient expectations and their activity demands should be combined with an age appropriate concept of long-term joint preservation ranging from focal biology to end stage total knee arthroplasty. Generally speaking, the procedure functions as a bridging treatment between focal defects in younger patients and diffuse degeneration in older patients.

The low-profile resurfacing system is intended to link focal biological procedures to traditional arthroplasty solutions with the goal to delay possible early revision scenarios in conventional knee replacement. All patients should undergo careful pre- and intraoperative evaluation of proper indication and coexisting risk factors such as angular deformity, high body mass index (BMI), meniscal insufficiency, ligament laxity, and metabolic disorders affecting bone quality including osteopenia, osteoporosis and associated fractures. Preoperative bone mineral density scans may be indicated in a select group of patients to further study treatment eligibility. The compounding effects of risk factor combinations should be respected. Conventional knee arthroplasty with larger component coverage may provide a longer lasting treatment benefit in those patients.
Surgical Technique

The patient is positioned and prepared for standard knee arthroscopy allowing for deep knee flexion during femoral preparation. The antero-lateral portal is established first assisting in visualization of the medial compartment. Once the proper indication is confirmed (Figure 5, 9), a full length antero-medial skin incision is placed vertically 1 cm medial to the patella tendon extending proximally from the mid pole of the patella down to 1 cm distal to the joint line. Capsular integrity is maintained by limiting the capsulotomy to the antero-medial portal for the arthroscopic tibial preparation. The full length skin incision is performed initially in order to aid in tissue dissection and avoid challenges associated with extravasation during arthroscopy. Extending the skin incision distally below the joint line facilitates exposure, avoids posterior pin deviation and skin interference during reaming of the posterior femoral implant bed. Once concomitant findings have been addressed, attention is first directed towards the tibial defect.

Arthroscopic Tibial Resurfacing

Normal knee kinematics include a tibial roll back19 phenomenon during knee flexion whereby access to the tibial plateau can become challenging. Consequently, arthroscopically assisted tibial preparation greatly facilitates visualization and workflow.

With the knee in 20 - 30 degrees of flexion and valgus stress, the Tibial Templates are trialed through the antero-medial incision until the underside curvature matches the plateau surface with full contact in all planes.

Avoid a too anterior or posterior placement of the tibial component and maintain a bony rim (≥ 5mm) around the implant in order to avoid compromising tibial plateau stability and associated risk of reaming through the anterior cortex.

The arthroscopic tunnel placement varies in comparison to standard ACL reconstruction. The Tibial Drill Guide is attached and aligned front to back with the tibial plateau rather than diagonally across the proximal tibia.

A small incision is placed over the proximal antero-medial tibia ensuring that the distal Bullet is fully engaged into the cortical bone and the Tibial Template is parallel to the tibial plateau. A Drill Pin is placed through the center of the Tibial Template, defining the axis of the tibial tunnel. Care must be taken to maintain proper axis without excessive torque to avoid pin deviation. The Tibial Pilot Drill is advanced over the Drill Pin into the center of the tibial defect. The Tibial Pilot Drill is removed. The Introducer, Driver, and Blade Stop are assembled and advanced into the prepared tunnel until the tip of the Introducer is flush with the tibial plateau. The Introducer and Driver are removed leaving the Blade Stop set at the appropriate depth for reaming the tibial implant. A Blade Drive Shaft is moved through the tunnel and connected to the Tibial Cutting Blade which is introduced through the antero-medial portal.

Using a high speed drill, initial counterclockwise rotation ensures an even cutting engagement into the plateau (Figure 6). Preparation of the tibial implant bed through clockwise rotation is completed when the Cutting Blade reaches the proximal end of the Blade Stop. A congruent, slightly recessed fit of the Tibial Component is verified with the appropriate Sizing Trial while the Tibial Cutter remains in place (Figure 7). Proud margins are lowered by adjusting the Blade Stop clockwise with a Wrench (Figure 8): A 90 degree turn lowers the Blade Stop and implant floor by 1 mm after re-reaming. Before placing the final Tibial Implant, attention is directed to the preparation of the Femoral Component.
### Table 2A: Technical Considerations

**Surgical Approach**

2. Perform medial incision and tissue dissection at the onset of the procedure while maintaining capsular integrity.
3. Prepare tibial side first, then femoral side.

**Tibial Resurfacing**

1. Target tibial component placement with adequate peripheral bone rim greater than 5.0mm
2. Ensure Drill Guide Bullet has full cortical bone contact on proximal tibia.
3. Maintain tunnel axis during tibial pin placement while avoiding torque on the pin.
4. Start with counterclockwise rotation during reaming of tibial implant bed to ensure an even cutting engagement into the plateau.
5. Tibial Cementation:
   - Recess tibial sizing trial 0.5 – 1.0mm to accommodate adequate peri-prosthetic cement mantle volume.
   - Use the Tibial Template to create downward pressure on the implant during pressurized retrograde cement injection; observe small peri-prosthetic extrusions into the joint to ensure even cementation around the implant (cement mantle). A curette can be used to remove intra-articular cement excess.
   - Continue retrograde pressurized cementation of the smaller diameter tibial tunnel to provide cement integration into the trabecular bone matrix for additional component support.
6. Final component placement: Slightly recessed implant margins to avoid an increase in trans-articular pressure at the implant cartilage interface.

### Figure 7: Verification of recessed implant margins with Tibial Sizing Trial placed on the retrograde Cutting Blade. Tibial Blade Stop controls depth of implant bed.

### Table 2B: Technical Considerations

**Femoral Resurfacing**

1. Ensure functional coverage of articular surface during Drill Guide Placement: Too far posterior placement can be limiting in full extension during gait cycle, too far anterior may have limitations in deep flexion.
2. Ream central circle (implant bed) first, followed by the posterior circle to avoid posterior pin bending on skin. Ream anterior implant bed last.
3. Final component placement: Slightly recessed implant margins to avoid an increase in trans-articular pressure at the implant cartilage interface.

### Figure 8: Left: Blade Stop Wrench adjusting depth of implant bed.
Right: Tibial Blade Stop and retrograde Cutting Blade
Femoral Resurfacing

The Femoral Drill Guide is placed over the defect with four points of contact to establish a perpendicular working axis to the joint surface (Figure 9, 10). Adequate defect coverage is confirmed and a Threaded Pin is advanced into the bone. The Femoral Centering Shaft is driven over the Pin until the laser mark line is flush with the original articular surface. The 40 mm Contact Probe is placed over the Femoral Centering Shaft to map the anterior-posterior (AP) curvature (Figure 11); medial-lateral (ML) mapping is repeated with the 20 mm Contact Probe. The average medial-lateral offset will determine the appropriate Central Femoral Reamer which is advanced over the Centering Shaft until it contacts the stop. All instruments are removed and the appropriate Guide Block is selected based on the average anterior-posterior offsets. The Guide Block is attached to the Femoral Drill Guide and realigned on the distal femur under four points of contact to ensure accurate Guide Pin placement. Pin Sleeves are inserted into the Guide Block. The anterior Pin, followed by the posterior Short Threaded Pin are both advanced into the bone to the level of the laser mark line. The Guide Block and Pin Sleeves are removed and proper Pin alignment is confirmed. analogue to the Central Reamer, the posterior implant bed is reamed based on the average medial-lateral offsets, followed by the anterior implant bed. Both reamers have a pin stop visible through the slotted window in the reamer shaft. Slightly recessed implant margins are confirmed with the corresponding Femoral Sizing Trial. The Femoral Pilot Drill is advanced through the Sizing Trial Handle to the level of the laser mark line and left in place. The Handle is removed and the Femoral Step Drill is advanced over the Femoral Pilot Drill down to the stop in the slotted window. The pilot hole is tapped and the Fixation Component is inserted into the Sizing Trial handle and advanced into the bone with the Hex Driver (Figure 12).

The final tibial implant is cemented first before the final femoral component is implanted. The Tibial Component is inserted into the implant bed and both Suture and Suture Retriever are passed through the tibial tunnel exiting on the distal drill hole. A Slotted Driver is used to adjust the final axial rotation of the tibial poly implant. A Cement Injector is advanced through the distal tibial tunnel. The tibial implant bed and tunnel are cemented under pressure ensuring an even fixation and support column for the Tibial Component. A small amount of bone cement is applied to the underside of the Femoral Articular Component and impacted engaging the morse taper between the components (Figure 13, 14).
Perioperative Care and Postoperative Rehabilitation

Depending on surgeon preference, the procedure is conducted under general or regional anesthesia and can be augmented by intra-articular narcotics and local anesthetics for immediate postoperative pain control.20-23

The use of postoperative cold-compression treatment has shown to provide a reduction of postoperative use of analgesics and improved quality of life in the early postoperative period through better day and nighttime pain control. Furthermore, a decrease in postoperative swelling may provide a faster functional return.24-26 Cold compression is used continuously for the first 48 hours, and continued four to five times per day for 20 min thereafter. The patient may sleep with cold compression applied throughout the night. After three weeks, this modality is discontinued or applied as needed.

The patient is kept on crutches for two to six weeks and progressed to full weight bearing as tolerated while slowly weaning off from using crutches. Range of motion exercises are initiated immediately. Based on surgeon preference, this can be accomplished through physical therapy combined with home exercises and/or using continuous motion machine several times a day for the first 2 weeks.

Strengthening exercises are also started immediately after surgery as pain and swelling allows. Patients are instructed to refrain from sporting or other high demand activities until postoperative symptoms have subsided, full range of motions has been achieved, and adequate knee stability has been regained through sports specific strengthening exercises.

A subset of patients with abnormally high BMI or other risk factors, who, after careful review may be suitable for AKR, should undergo a conservative rehabilitation program with a prolonged protective phase transitioning from partial to full weight bearing after six weeks. The literature reports a higher incidence of tibial plateau fractures following unicompartmental knee replacement in patients with a high BMI and poor bone quality.27,28 A delayed recovery period may accommodate postoperative bone remodeling and limb strengthening.

Clinical Review

A preliminary multicenter retrospective review was performed on patients treated with AKR between March 2008 and January 2009 at three different institutions. 48 patients (61% female, 39% male) underwent arthroscopic assisted knee resurfacing. The average age at the time of surgery was 54 years (range: 37-62). Left and right extremities were evenly distributed. Three patients had bilateral implantations resulting in 51 procedures. Preoperative duration of symptoms averaged 24.5 months (range 3-144) with a non-traumatic, gradual onset during activities of daily living in most patients. All procedures were graded by the investigators in regards to implant fit to the surrounding articular surface, overall satisfaction with the knee resurfacing system, and assessment of outcomes at last follow-up. Current results were reviewed based on patients’ satisfaction, pain relief, postoperative recovery and return to work.

**Early Results**

Surgeon satisfaction with the implant fit to the surrounding articular surface demonstrated a good to excellent contour match in all cases. The overall surgical satisfaction with the knee resurfacing system was rated as very good to excellent in all procedures. No intraoperative complications were encountered.
Short-term follow-up at a mean of 3 months (range 1-10) showed good to excellent outcomes based on surgeon and patient satisfaction ratings (Graph 1, 2). Postoperative symptoms were still influenced by the expected perioperative morbidity of the surgical intervention, yet all, but 4 patients indicated substantial pain relief when comparing their pre- and postoperative knee pain. The frequency in consumption of pain medication for the involved knee was reduced from a preoperative “daily” in 79% of the patients to a postoperative “never” in 63%. The recovery period was short following the outpatient procedure in the ambulatory surgery setting - 6/48 patients stayed beyond 23 hours. Partial weight bearing with crutches was initiated on the same day, full weight bearing was typically achieved at 8-10 days (range 2-18) and those patients who were not retired during the postoperative follow-up period returned to work at an average time of 6 weeks (range 2-20). Three patients indicated that it was too early for them to assess their postoperative success; all others rated their satisfaction with the treatment results as good to excellent at last follow-up, would undergo the procedure again, and would recommend this treatment option to their friends and family.

Case Report

A 51 year old male professional pilot presented with severe medial knee pain and episodic joint effusions. Physical examination showed full range of motion, a mild effusion, a normally aligned, ligamentously stable knee, and a normal body mass index. The patient had no retro-patellar crepitus or pain and a negative McMurray sign indicating an articular source for his symptoms. One year prior, the patient had undergone arthroscopy with excision of a plica and debridement at another facility. At that time, the medial femoral condyle had shown a Grade 3-4 defect with a low grade tibial kissing lesion. Following arthroscopy and rehabilitation modalities, the patient had minimal resolution of symptoms and was referred for further assessment.

Preoperative radiographs demonstrated adequate joint space and normal mechanical alignment (Figure 15). A recent MRI indicated a full thickness defect of the medial femoral condyle and lower grade changes of the tibial plateau. (Figure 16) The patient was taken to the operating room for arthroscopic assisted tibiofemoral resurfacing. Initial arthroscopy revealed a full thickness defect of the medial femoral condyle (Figure 17) and an opposing full thickness defect of the medial tibial plateau (Figure 18). The medial meniscus had minimal changes in its posterior aspect; the lateral compartment was nearly normal, with a normal tibia and meniscus and superficial chondromalacia of the lateral femoral condyle. The asymptomatic patellofemoral joint demonstrated a small area of grade 2-3 changes. Arthroscopic knee resurfacing was performed with full tibiofemoral defect coverage and meniscal preservation (Figure 19-21). Postoperative rehabilitation was followed according to the previously described protocol. Physical examination at last follow-up 8 weeks after surgery demonstrated no pain during full weight bearing, no effusion, no locking, or giving way, and full range of motion. Postoperative radiographs demonstrated anatomic component placement with excellent peri-prosthetic tibial cement penetration (Figure 22, 23).
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Discussion

Currently, we believe the following criteria describe the ideal patient population suitable for AKR: Middle-aged, non-obese patients who demonstrate a desire to continue an active life style and consider themselves too young for conventional unicompartamental or total knee arthroplasty. These patients have failed conservative treatment including rehabilitation, visco-supplementation, and other modalities and may have a history of biologic surgical interventions. A continued joint preservation approach is warranted with mono-compartmental arthritis, limited full thickness degeneration of the tibial plateau without bony erosions, full thickness cartilage or osteochondral defects of the weight bearing condylar surface, a normal or near normal mechanical axis, and functional meniscal tissue.

Future Considerations

Due to the increasing incidence of symptomatic medial compartment degeneration and concurrent anterior cruciate ligament (ACL) deficiency, a combined resurfacing / ACL reconstruction procedure may benefit younger and active patients. Isolated ACL rupture has been reported to significantly increase the risk of developing osteoarthritis, in particular when combined with loss of meniscal tissue leaving 50 to
70% of patients with radiographic precursor changes in the long-term. Even short term follow-up (mean 3.9 years) in a young patient population (mean age 26 years) showed an increase in radiographic osteoarthritis changes for patients with ACL tears and concomitant cartilage damage, in particular when combined with loss of meniscal tissue after partial meniscectomy. The treatment of these patients is controversial and includes arthroscopic debridement, ACL reconstruction, high tibial osteotomy with or without ACL reconstruction, unicompartmental (UKR) and total knee replacement (TKR). Isolated arthroscopic management may only provide temporary relief of symptoms and ACL reconstruction may primarily deal with instability, without addressing articular degeneration. High tibial osteotomy, with or without ACL reconstruction, may provide symptomatic benefits, but poses the risk of lateral compartment degeneration. TKR is not ideal because of implant wear, loss of bone stock and associated activity reduction in a relatively young and active patient population.

Goodfellow et al. reported a survival rate of 95% at six years in patients with normal ACL and unconstrained UKR. In contrast, the survival rate dropped to 81% in patients with ACL deficiency. Consequently, Pandit et al. combined ACL reconstruction and UKR and recently reported early results with successful outcomes and high functional levels. Due to the advantages of patient specific inlay resurfacing, AKR and ACL reconstruction (Figure 24-28: 52 year old patient with medial compartment arthritis and ACL deficiency) may provide similar results however future kinematic assessment is warranted to support the clinical validity. Concomitant ACL reconstruction will require a dedicated rehab protocol for postoperative strength/stability training.

Patients with symptomatic medial compartment arthritis and a mechanical mal-alignment of greater than 5 degrees may benefit from a concomitant realignment procedure after careful review of all patient selection criteria (Table 1). A combined high tibial osteotomy with AKR may provide future treatment benefits for a subset of patients who are still in the early degenerative disease stage with limited mono-compartmental arthrosis. Care must be taken to avoid over correction in mechanical alignment to avoid progression to bi- or tri-compartmental disease.

Lateral mono-compartmental knee arthritis is estimated to represent 5-10% of all unicompartmental arthroplasties. In order to avoid the challenges associated with the surgical approach several authors suggested a medial para-patellar arthrotomy with successful lateral
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unicondylar arthroplasty.\(^{38-42}\) Sah et al. developed critical concepts on patient selection and technical pitfalls. The authors limit their indications for lateral UKR to non-inflammatory unicompartmental arthritis which is confirmed by clinical symptoms and intraoperative inspection. Patients must have ligamentously stable knees, a flexion deficit of less than 10 degrees, and a fixed axial deformity of less than 10 degrees from the neutral mechanical axis.\(^{37}\) Due to the higher constraints of the lateral compartment, the procedure is more sensitive to technical aspects of onlay UKA placement as it relates to cartilage and bone resection, component sizing and orientation. The current experience with the AKR system is too early to recommend lateral implantation of UniCAP™ inlay components.

The Arthrosurface knee resurfacing system provides a novel solution for a disease specific joint reconstruction with continued focal treatment in patients between 40 and 60 years old. Joint conservation is supported through tissue preservation and congruent surface reconstruction. At the same time, these advantages also pose challenges regarding patient selection and implant placement with functional defect coverage as this resurfacing method may be less forgiving than complete surface replacement in conventional arthroplasty. Compared to traditional UKR, UniCAP™ AKR resurfacing demands a higher degree of proper mechanical alignment, more contained articular degeneration, limited bony erosions in particular for tibial defects, and functional meniscal tissue in order to leverage the advantages of tissue preservation and a minimal invasive approach.

**Conclusion**

As seen with the early results, arthroscopically assisted knee resurfacing is a promising new treatment option for middle aged patients with limited compartmental joint degeneration. Patient selection and proper component placement for functional surface coverage play an intricate role in successful treatment outcomes. The shallow implant bed and small footprint of component fixation pose little or no limitations in future conventional unicompartmental or total knee arthroplasty for patients who may undergo disease progression. The benefits of the procedure are based on intraoperative joint surface mapping and implantation of patient specific inlay components combined with soft tissue and bone preservation. The concept may have biomechanical advantages with positive effects on implant stability, patient recovery, activity level and long-term management of osteoarthritis. Future clinical studies are necessary to determine the medium and long-term success of the procedure.

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**Table 3: Key Benefits of UniCAP Resurfacing**

1. Joint preservation maintaining healthy articular cartilage, meniscal tissue and viable bone stock.
2. Inlay resurfacing leaves biomechanics intact, avoids “overstuffing” of the joint and keeps joint height and soft tissue tension unaltered.
3. Outpatient procedure which can be performed in ambulatory surgery
4. Accelerated recovery through arthroscopic assisted approach and limited tissue dissection.

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