



#### The BUKS Optimization:

- Designed to preserve bone and soft tissue
- Includes instrumentation that is patient specific, intuitive and accurate
- Provides an unconstrained design for a full range of motion
- Has the potential for improved clinical results and patient satisfaction
- Novel serial drilling technique eliminates potential thermal necrosis and errant resection with oscillating saw

## Bodycad Unicompartmental Knee System

By  
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### Precision and Accuracy of BUKS Procedure

The accuracy with which a unicompartmental knee prosthesis (UKP) is implanted is a major determinant of its durability and hence its long-term impact on the quality of life of the patient. In this study, the accuracy obtained using personalized cutting guides was measured and compared to results reported for procedures performed using generic hand tools or robot-assisted means. The UKP implantation accuracy obtained with personalized cutting guides is greater than that obtained using hand-held

instruments; the current standard of care. Additionally, application of computer modeling and 3D manufacturing to patient specific bone resection eliminates the need for large inventories of instruments and robotic systems, thereby reducing cost and increasing OR efficiency. Bone resection with serial drilling and patient-specific guides produce similar accuracy in implant placement as computer assisted and robotic methods at a small fraction of the cost, and is superior to that of manual methods with similar cost.

**bodycad**



## Bodycad Company Profile

"At Bodycad, we are changing the paradigm of joint restoration," says Jean Robichaud, founder and CEO of Bodycad. "A direct relationship between the surgeon and the prosthesis designer must be established, and mutual trust must be created, in order for a customized approach to deliver optimal results. Bodycad is pioneering this relationship."

Bodycad is a Quebec City-based developer and manufacturer of personalized orthopaedic implants and instruments. Its personalized restorations offer patients a high level of conformity to their unique anatomy, providing comfort, fit and durability that make the pursuit of orthopaedic perfection possible.

Learn more at  
→ [www.bodycad.com](http://www.bodycad.com)

## Background Changing the Medical Industry

"In the current orthopaedic environment, we have limitations as it relates to reconstructing a patient's diseased joint. These limitations lead to subtle/less than perfect reconstructions of the joint, which likely directly affects soft tissue balance and overall feel of the joint for the patient. This may result in lower patient satisfaction with the reconstruction."

Dr. Brian Hamlin,  
Orthopaedic Surgeon

### The Target Vision of Bodycad and EOS Technology

"We have started with additive manufacturing as a platform manufacturing technology. EOS provides us with unsurpassed precision and accuracy in 3D printing of nylon and metal instruments and implants. We see EOS as the company to work with as we go more aggressively into 3D manufacturing. We want a high precision, low turnover time, manufacturing tool for mass customization and at the same time being able to decrease cost as we build volume. We believe EOS will continue to evolve and grow additive manufacturing technologies into the future to reduce cycle times, decrease cost, and continue to keep a high standard for precision." *Bodycad*

### The Future of Knee Arthroplasty Techniques

Bodycad's revolutionary Unicompartamental Knee System (BUKS) is designed to optimize personalized restorations of the patient's unique anatomical features and kinematics. The BUKS is based on proprietary 3D rendering of medical images of a patient's anatomy. Recent studies of Unicompartamental Knee Arthroplasty (UKA) have

demonstrated favorable outcomes, shorter hospital stays versus total knee arthroplasty, and lower 30 day readmissions. The BUKS is designed to advance and improve upon this body of clinical evidence. The following study will further explain the process and results of a procedure using the BUKS system.

# Cadaver Study

## R&D Objectives

### Measure precision and accuracy of the BUKS procedure

- Bone resection and cementing of components in sawbones
- Intra-operator repeatability (FEA, bone models, and model implants)
- Surgeon variance based on cadaver surgeries

### Comparison of BUKS accuracy to contemporary methods

## Materials & Methods

Ten thawed cadaver knee specimens were used in the study. Magnetic resonance imaging was used to obtain 3D modelling, which was processed to create cutting guides. Three expert surgeons whose experience with the prosthesis varied from none to over 25 cases carried out the implantations with equal participation.

The final position of the implant was compared with that planned by the computer. The differences are expressed in terms of an overall quadratic average (rms) representing a summation of the following variables: anterior-posterior, medial-lateral and proximal-distal distances for translation, and flexion-extension, varus-valgus and internal-external distances for rotation.

## Method-Steps

### Step 1 of 4:

Personalization of 10 BUKS instruments and implants for the cadaver knees using Bodycad standard operating procedures.

### Step 2 of 4:

Implant per surgical technique by Drs. Belzile, Angers, and Bédard. The cut validator (shown in picture left) was used to confirm the tibial preparation with accuracy of  $\pm 0.5$  mm.

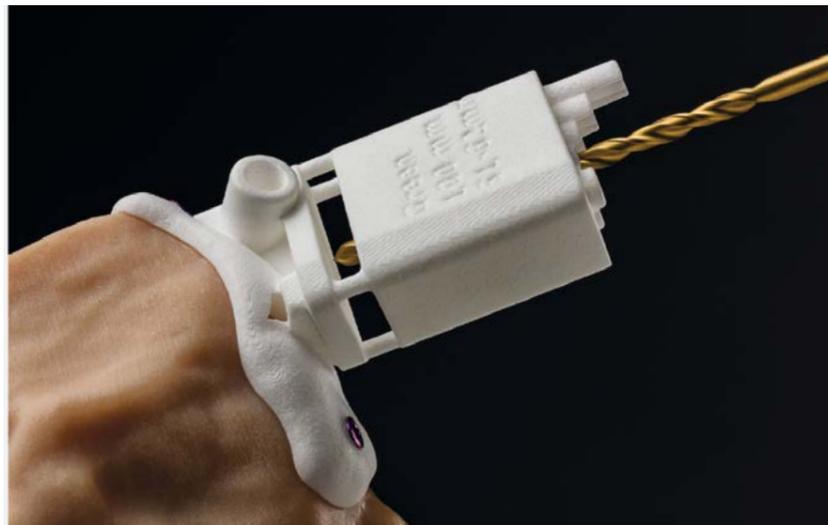
### Step 3 of 4:

Increase exposure and 3D scan implant position, precision  $\pm 5$   $\mu$ m, accuracy  $\pm 7.5$   $\mu$ m.

### Step 4 of 4:

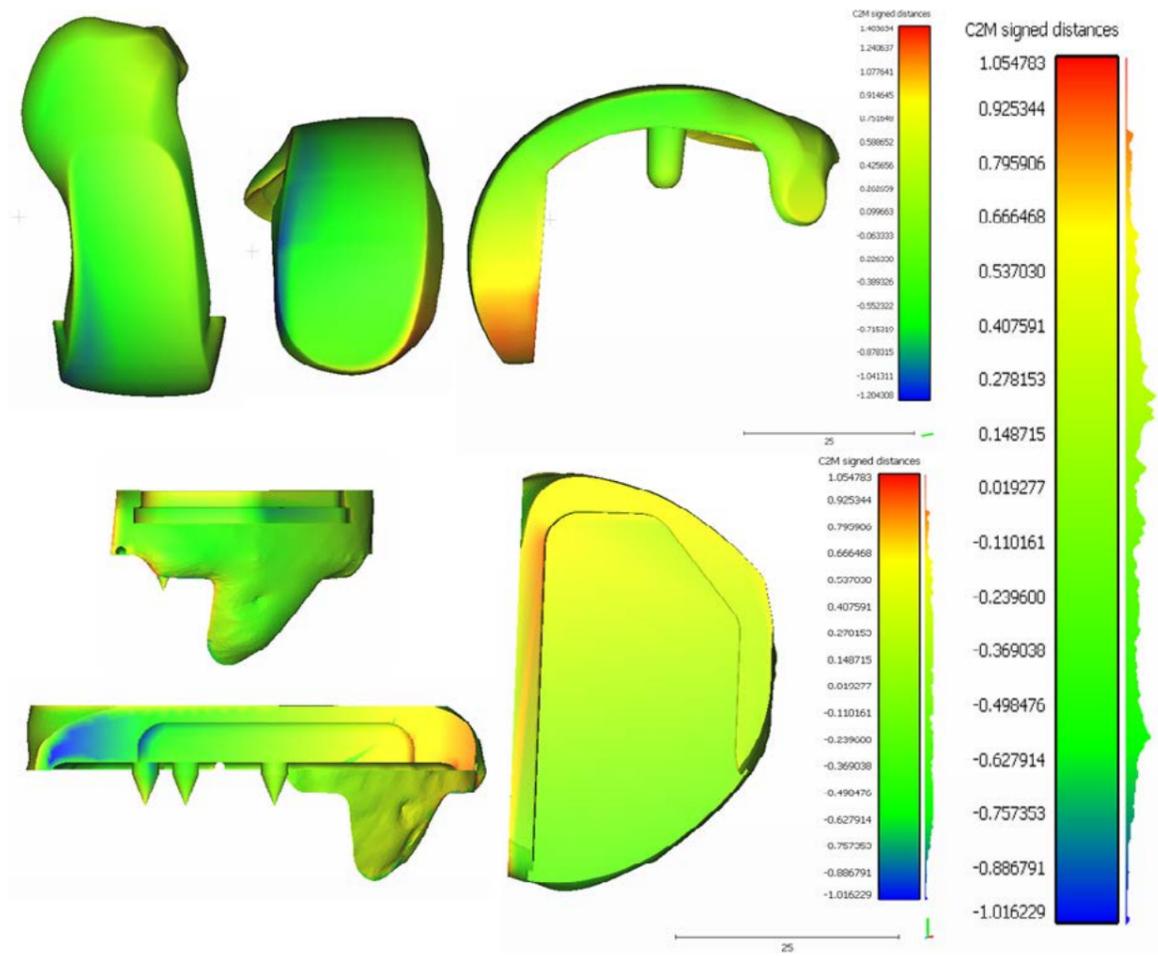
Data analysis and comparison of planned position to measured 3D position (accuracy measurement).

*Bodycad Personalized Tibial Cutting Guide*



*(left)  
Bodycad Cut Validator*

*(right)  
Implanted BUKS in Cadaver Study*



Examples of 3D Deviation Mapping of BUKS Femoral and Tibial Implants

## Results

The average difference in overall translation of the UKP was 0.9 mm (0–2.25; 0.98), while the average difference in rotation was 2.2 degrees (0.04–3.08; 1.03). The technique did not show any difference in precision for the femoral component or for the tibial component. No difference in implantation quality due to the experience of the surgeon was found ( $p = 0.86$ ). The UKP implantation precision obtained with personalized cutting guides is greater than that obtained using hand-held instruments. Cobb et al. report an overall error of 2.2 mm and 5.5 degrees, while the

precision of robot-assisted systems is 1.1–1.3 mm and 2.4 degrees (Cobb and Dunbar). The use of a personalized system provides the same level of precision as robotic assisted systems but at lower cost. In addition, the ex-perience of the surgeon does not influence the quality of the implantation.

## Whitepaper in Brief Bodycad

### Unicompartmental Knee System (UKS)

Revolutionary UKS, designed to optimize personalized restorations of the patient's unique anatomical features and kinematics. Surgical instrumentation to achieve these precise results printed on FORMIGA P 110 made from EOS PA 2201.



#### EFFICIENT

**1 hour** image to proposed personalization compare to 2-3 days



#### COST-EFFICIENT

**1.5 – 2x** gross margin of competitors



#### FAST

**21 day delivery** from the time the surgeon approves the design, compare to 5-6 weeks



#### PRECISE

Novel cutting technique with personalized guides creates **micron precision** without significant capital expense

Project:





**Geoffroy Rivet-Sabourin**  
Research Director Bodycad

Geoffroy Rivet-Sabourin has a PhD in imaging and engineering and is a critical member of the Bodycad team. He has been working in medical technology research and development for more than 10 years with an emphasis on patient specific solutions using imaging technology. He has helped develop and patent creative solutions and research projects in both the orthopaedic and dental domain. He is also a member of the Bone and Joint Replacements committee of the Standards Council of Canada. Mister Rivet-Sabourin has a great passion to manage high-performing teams and to develop innovative technologies to further pioneer the field of personalized orthopaedics.

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If you have any remarks  
or comments,  
please get in touch.