Evaluation of a new computer-assisted guidance system

Boiardo RA¹, Brax M², Giordano GC³, Hohl NS⁴, Polakovic SV⁵

¹Orthopaedics Department, Saint Michaels Medical Center, Newark, USA
²Haguenau Hospital, Haguenau, France
³Joseph Ducuing Hospital, Toulouse, France
⁴Exactech France, Illkirch, France
⁵Blue Ortho, La Tronche, France

nicolas.hohl@exac.com

Introduction: Total Knee Arthroplasty (TKA) continues to be a popular treatment method with great success rates for most designs. The literature proves that the way the prostheses are implanted have a great impact on the longevity of the devices¹. Navigation has been a great help to the decision making process for surgeons in the OR and new systems should continue to improve to be simpler, faster and cheaper.

Objectives: The goal of this study was to report the in-surgery results for a continuous series of Exactech Optetrak knee prostheses (Exactech Inc., FL, USA) implanted by a three operators between July 2010 and Dec 2012.

Methods: The study analyzed 146 knee prostheses implanted at the Hôpital de Haguenau, Haguenau, France (site 1), Hôpital Joseph Ducuing, Toulouse, France (site 2) and Saint Michaels Medical Center, Newark, NJ, USA (site 3) by three senior surgeons with the help of a new computer-assisted guidance system: the Exactech GPS (Exactech, Inc, FL, USA).

The Exactech GPS features a unique “surgeon profiler” that allows the surgeon to define exactly the steps he wants the computer to help him with during surgery. The three centers did not follow the same surgical technique and therefore had different “profiles”. On site 1, the technique was a tibia first technique with balancing in flexion to determine the external rotation of the femoral component while on site 2, the technique was either the same tibia first technique or a femur first technique. On site 3, the surgeon used a tibia first technique but did not use balancing to determine the external rotation of the femur.

The goal was to determine the error between the planned cuts for both the tibia and the femur compared to the actual cuts digitized using the guidance system. The operating time as well as the chosen external femoral rotation were also analyzed. Finally, the post-operative leg alignment was compared to the pre-operative one.

Results: The mean error between the planned and digitized proximal tibial cuts was 0.36°± 1.09 of valgus and 0.02°± 0.96 of anterior slope on site 1, 0.16°± 0.85 of varus and 0.79°± 0.76 of anterior slope on site 2 and .16°± 0.65 of varus and 0.26°± 0.81 of posterior slope on site 3.

The mean error between the planned and digitized femoral distal cuts was 0.09°± 1.01 of varus and 0.76°± 1.32 of extension on site 1, 0.14°± 0.97 of varus and 0.71°± 1.12 of extension on site 2 and 0.08°± 0.88 of valgus and 0.27°± 1.49 of flexion on site 3.

Average operating time evaluated as the time between the first bony acquisition and the last guided step were 38 minutes on site 1, 33 minutes on site 2 and 31 minutes on site 3.

Femoral component rotations varied from 0 to 18 degrees of external rotation with an average of 3.9 degrees on site 1 and from 0 to 5 degrees of external rotation with an average of 2.6 degrees on site 2 when the chosen protocol was tibia first.

On site 3, the target femoral rotation was always 3 degrees of external rotation from the posterior condyles.
The post-operative Hip-Knee-Ankle angle (HKA) provided by the system varied between 182 and 177 with an average of 179 on site 1, between 184 and 172 with an average of 179 on site 2 and between 183 and 178 with an average of 180 on site 3. Pre-operative HKA varied from 188 to 162.

**Discussion:** The three surgeons, despite different surgical techniques and teams experienced similar results. Their cuts were correctly aligned in the frontal plane but it was harder for them to follow the guidance of the system in the sagittal plane. This can be due to the saw used to perform the cuts that would bend during the resection step.

The average surgical times were similar between the three sites. The addition of the GPS guidance took the surgeons an average of 10 to 15 additional minutes compared to their standard surgical time. All three surgeons agreed that this was a small time to lose to gain the accuracy of the GPS system.

Femoral rotations were similar, with greater variety on site 1. The average rotation on site 1 and 2 was still 3.9 and 2.6 degrees respectively which is close to the accepted standard of 3 degrees external rotation that was used on site 3.

The average post-operative HKA of the study was 179 degrees and was between 3 degrees of perfect alignment in 100% of the cases on site 1 and site 3 and 89% of the cases on site 2. According to the literature\(^1\), an HKA between 177 and 183 degrees is linked with a high survival rate of the knee implants.

**Conclusions:** The Exactech GPS proved to be efficient, fast and easy to use with good results post-operatively.

**References**

1. Merrill Ritter et al., The Effect of Alignment and BMI on Failure of Total Knee Replacement, JBJS Am. 2011; 93:1588-1596