Editorial on "Determination of the accuracy of navigated kinematic unicompartmental knee arthroplasty: a 2-year follow-up"

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The article entitled "Determination of the accuracy of navigated kinematic unicompartmental knee arthroplasty: a 2-year follow-up" (1) published in the *Journal of Arthroplasty* was reviewed in detail. We would like to commend the authors on taking on such an important topic. This investigation retrospectively reviewed prospective data collected over a 4-year period on consecutive patients that underwent minimally invasive unicompartmental knee arthroplasty (UKA) with the Stryker (Mahwah, NJ, USA) Triathlon partial knee arthroplasty (PKA) prosthesis with the use of the Stryker precision computer navigation (PCN) system. The primary outcome goal of the procedure was to restore the pre-operative stress value as the final alignment of the knee. Secondary outcomes included Western Ontario and McMaster Universities (WOMAC), Knee Society Score (KSS) and range of motion (ROM) pre-operatively, 1 year post-operatively, and 2 years post-operatively. The authors found there to be no significant differences between the stress value and the postoperative alignment, suggesting that their surgical technique allowed them to recreate the pre-disease alignment. Furthermore, they found there to be a significant improvement in the WOMAC and KSS, but no changes were seen in ROM.

The importance of this topic stems from variability in surgical technique being one of the largest remaining barriers to the re-creation of an anatomic and functional joint in the modern era of arthroplasty. Variability to a certain degree is important, because no two patients are alike, and decisions must be made pre-operatively, and intra-operatively in order to determine the best option for the patient. However; physicians have used imaging modalities and tools to attempt to move forward in all aspects of medicine. This is where the introduction of technology into the operating room can help. The use of navigation in this investigation showed that reproducing pre-planned limb alignment post-operatively is possible. Furthermore, the navigation system allowed the authors to do this in a minimally invasive fashion.

Computer assistance in joint replacement began in 1992 with the introduction of the ROBODOC (THINKSurgical, originally by Integrated Surgical Systems) to improve acetabular cup placement during total hip arthroplasties. This was an active robotic system, which means no surgical assistance is needed once the exposure is completed. However, this system was discontinued due to technical complications (2). In the early 2000's robotic assisted devices were introduced (3). These devices combined the skills of the surgeon and the abilities of the robotic system in order to produce the ideal implant position to enable excellent tracking and dynamic ligament balancing. Improved accuracy of component placement was demonstrated with early results with UKA. Bell *et al.* (4) recently published level 1 data demonstrating this in all three planes of alignment when compared to a conventional manual UKA. This is in accordance with earlier studies investigating this same topic (5-7). In addition to the increased accuracy of component placement, others have demonstrated accurate ligament balancing with the assistance of this technology (8). The use of a navigation system to re-create the pre-disease alignment of the joint demonstrates a significant step forward. However, the data in larger comparative trials using navigation has been conflicting when comparing alignment to conventional methods (9,10). Navigation systems assist with preoperative planning, simulation, and intraoperative guidance (3). The main difference between the navigation systems and the robotic assisted systems stems from the fact that the navigation system cannot mitigate the effects of mechanical human error. The robotic assisted systems allow the surgeons to have autonomy during the procedure, but will not allow bone cutting outside the pre-planned area; whereas the navigation systems inform you where cuts need to be made in order to achieve the planned component placement, but no safeguards are in place to assure this is done to the exact specifications. Furthermore, while navigation is very useful in obtaining static ligament balancing; robotic assisted systems allow dynamic balancing to be achieved.

This investigation certainly adds to the literature and demonstrates a significant step forward. Further comparative studies should be performed to identify if in fact this navigation system produces superior results when compared to other techniques. However, due to the variability in the literature it is our opinion that the optimal way of achieving accurate placement of components and planned limb alignment in UKA is through the use of a robotic assisted system with haptic feedback. Although, it is important to note that long term results have not yet demonstrated any difference in patient reported outcomes when compared to conventional manual techniques.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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