A Comparison of Computer-based Anatomic Registration Techniques in TKA: CAS and Customized Instrumentation

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Introduction: Computer-assisted surgery (CAS) is a tool developed to allow accurate limb and implant alignment in TKA. The accuracy of this ligament balancing technology depends upon an accurate determination of femoral component size. This size is established with intraoperative surface registration techniques. Customized instrumentation (CI) is a measured resection technique in which component size is established on preoperative 3D MRI reconstructions. The purpose of this study is to determine how these two computer-based technologies compare with regard to the accuracy with which femoral component size is established in TKA.

Methods: 67 TKA were performed using CI and 30 TKA were performed using CAS by a single surgeon. CI-predicted and CAS-predicted femoral component size were compared to actual component selection. The process by which CI and CAS perform an anatomic registration was evaluated.

Results: The CI and CAS systems accurately predicted surgeon-selected femoral component size in 89% and 43% of cases, respectively (p<0.001). The discrepancy between predicted and actual femoral component size with CI and CAS was 0.1 and 0.8 sizes, respectively (p<0.001) with the maximum discrepancy greater in CAS.

Discussion: The CI system was both more accurate and more precise than the CAS navigation system in predicting femoral component size in TKA. CI bases implant sizing solely on reproducing an anatomical fit and a measured resection technique, whereas CAS attempts to balance an anatomic fit with optimal soft tissue balancing. In this study, the surgeon’s final component selection was more likely to be in accordance with the CI rather than the CAS sizing algorithm. This study suggests that intraoperative surface registration may not be as accurate as preoperative 3D MRI reconstructions for establishing optimal femoral component sizing.