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CORR Insights®: A New Method for Calculating Femoral Anterior Cortex Point Location and Its Effect on Component Sizing and Placement

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Where Are We Now?

The study by Mahfouz and colleagues provides a number of interesting arguments regarding distal femoral preparation in TKA. Traditional instrumentation

systems provide surgeons with flexibility in component placement; however, these systems can introduce potential errors in alignment and bone resection planes. Different knee systems have variable implant thicknesses and progression between sizes, making instrumentation comparisons even more difficult. The use of computer navigation or patient-specific guides may eliminate some of these errors but can potentially create new ones. With computer navigation, inaccuracies in registration may create erroneous alignment and resection planes. Any movement of fixed referencing guides can also lead to incorrect resection planes. For patient-specific guides, incorrect templating for surgical planning, or incorrect placement of the cutting guide may lead to incorrect resection planes. Furthermore, to balance the ligaments with patient-

specific guides, additional bone resection is often required. In addition, the distal femoral anatomy shows significant variation between individuals and current total knee implants can only approximate that anatomy. While alignment is important, the success of a TKA may be better defined by the kinematics of the reconstructed whole.

This paper demonstrates some of the variability that can occur based on the use of specific landmarks for distal femoral bone preparation. The greatest variation detected was in the amount of posterior condylar bone resected with the various techniques. This error is inherent in systems that use anterior cortical referencing and is clearly shown by the data. The use of a PCA+3 posterior condylar resection may be correct in many knees, but when using a ligament balancing technique could be shown to be incorrect as much as 40% of the time. The distal femoral flexion discrepancy between the mechanical axis (MA)-1 and MA-2 technique raises an important point with regard to positioning of the femoral implant. Relative extension of the distal femoral cut will alter

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the anterior flange resection plane. Different implants may have different anterior flange divergence angles which can affect the potential for anterior cortical notching. This risk may be increased when using a computer navigated center of the hip to knee alignment technique.

Where Do We Need To Go?

Going forward, a reconciliation of implant design based on traditional instrumentation concepts and computer navigated or patient-specific

guided techniques needs to be made in order to address potential kinematic problems that might be introduced through these techniques. The altered femoral implant position that can occur with these techniques may have profound influence on the joint stability and long-term function of the knee arthroplasty. Additionally, the errors that can occur with computer navigation, patient-specific cutting guides, and other referencing systems need to be identified to improve our understanding of how the contact forces and kinematics of the reconstructed knee will be affected.

How Do We Get There?

Studies should be designed to show how different techniques affect the femoral implant position relative to the host anatomy and the effect on knee stability postarthroplasty. Joint contact stresses and ligament strain with these alterations need more study. Additionally, the ideal alignment goals for a given knee need further clarification to maximize potential outcomes, be it mechanical or kinematic alignment. Answering these questions may enhance total knee outcomes in the future.