

Navigation does not improve radiographic sagittal alignment of a femoral component in TKA

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Background: Despite well-known improvement in coronal alignment of the femoral component, variable results have been published on the sagittal alignment of the femoral component after total knee arthroplasty (TKA). During computer-assisted TKA, sagittal alignment of a femoral component is established by mechanical axis identified by navigation system, but radiographic sagittal alignment is measured with reference to anatomical axes of the distal femur. We asked whether the application of navigation technology could improve radiographic alignment of the femoral component in the sagittal plane and whether femoral anatomical features influence radiographic femoral sagittal alignment. We hypothesized that femoral component sagittal alignment after navigated TKA is not superior to that of conventional TKA, and that preoperative radiographic deviations between mechanical axes and anatomical references influence postoperative femoral component position in the sagittal plane.

Methods: In 196 knees undergoing TKA (navigated=97, conventional=99), femoral component flexion angles with reference to two anatomical references were measured on lateral radiographs. Two anatomical references representing postoperative radiographic assessments of femoral component positioning were identified. The distal anterior cortical axis was defined as the line connecting two points on the anterior cortex at 5 cm and 10 cm proximal to the knee joint line, and the distal medullary axis was defined as the line connecting midpoints of the outer cortical diameter at 5 cm and 10 cm proximal to the knee joint line. Using these definitions, we defined the angles between the two anatomical references and distal box of each of the two types of femoral components. Anatomical data of patients including deviation between anatomical and mechanical axis, femoral bowing, and femoral length were measured in preoperative radiographs. Radiographic femoral sagittal alignments measured with reference to the anatomical reference were compared between the navigated and conventional groups. Univariate and multivariate regression analyses were carried out to identify the influencing factors on the sagittal alignment of the femoral component.

Results: No difference was found in radiographic sagittal alignment of femoral component in navigation and conventional group, having wide ranges of data in both groups. Deviation between anatomical and mechanical axis and femoral bowing were strongly associated with sagittal alignment of femoral component in navigation TKA. Accordingly, as the deviation between anatomical and mechanical axis and femoral bowing increased, the femoral component was implanted in a more extended position.

Conclusions: This study demonstrates that image-free navigation does not improve radiographic sagittal alignment with reference to anatomical references. We also found that deviations between mechanical axis and anatomical references of the femur inherently cause the variability of femoral component position in postoperative radiographic evaluation. Accordingly, surgeons that perform navigation TKA should consider individual patient variations before surgery by carefully analyzing preoperative radiographs. Future studies are warranted to elucidate the clinical implications of the lack of sagittal alignment improvement in navigated TKAs.

Summary: This study shows that image-free navigation does not improve radiographic sagittal alignment of femoral component in TKA.

References

1. Chung BJ, Kang YG, Chang CB, et al: Differences between sagittal femoral mechanical and distal reference axes should be considered in navigated TKA. Clin Orthop Relat Res 2009.
2. Haaker RG, Stockheim M, Kamp M, et al: Computer-assisted navigation increases precision of component placement in total knee arthroplasty. Clin Orthop Relat Res 2005;433:152.
3. Tang WM, Chiu KY, Kwan MF, et al: Sagittal bowing of the distal femur in Chinese patients who require total knee arthroplasty. J Orthop Res 2005;23:41.
4. Yehyawli TM, Callaghan JJ, Pedersen DR, et al: Variances in sagittal femoral shaft bowing in patients undergoing TKA. Clin Orthop Relat Res 2007;464:99.