Femoral sagittal alignment of total knee arthroplasty: how much do we know about that?

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Background: Coronal and rotational alignments of total knee arthroplasty (TKA) are well known, but little is known about femoral sagittal alignment. In particular, few studies elucidated the relationship between anatomical and mechanical axes of the femur in the sagittal plane and the effects of sagittal alignment of femoral component on functional outcomes of TKA. We hypothesized that (1) deviations between mechanical and anatomical sagittal axes may exist and can influence postoperative sagittal alignment of femoral component, (2) application of navigation technology could not improve radiographic alignment of the femoral component in the sagittal plane, and (3) sagittal alignment of a femoral component influences the functional outcomes and its effects differ with implant types.

Methods: We measured angles between the mechanical and anatomical axis on 200 true lateral radiographs of the whole femur preoperatively and femoral component flexion angles with reference to anatomical axes postoperatively (navigated=97, conventional=99). Deviations between mechanical and anatomical axes were explored. Femoral component flexion angles between navigated and conventional group were compared and regression analyses were carried out to identify the influencing factors on the sagittal alignment of the femoral component. Correlation analyses were performed between femoral component flexion angle and functional outcome and outcomes were compared among subgroups divided by femoral component flexion angle in all TKA as a single group and each group divided by implant type (Genesis II and e.motion-PS).

Results: Mean preoperative angular deviations between two axes were as much as 3.8° and as little as 0.0°, and had ranges of wide variations. These deviations were strongly associated with sagittal alignment of femoral component in navigation TKA. No difference was found in femoral component flexion angles in navigation and conventional group. Weak correlation between femoral component flexion angle and functional outcome was found, and slightly better outcome scores were found in flexed group in all TKAs group. The e.motion-PS group showed correlations for outcome scores signifying that flexed positioning had better functional outcomes. In the subgroup comparisons, flexed group had significantly better WOMAC scores in the e.motion-PS group.

Conclusions: Surgeons should consider differences between the mechanical and anatomical axes when they set the sagittal plane position of a femoral component in navigated cases. These deviations inherently cause the variability of femoral component position in postoperative radiographic evaluation. Navigation technology does not improve radiographic alignment of femoral component in sagittal plane with reference to anatomical axes. Our findings also demonstrate sagittal alignment of a femoral component influences functional outcomes of TKA and the effects differ with the implant type.

Summary: This study indicates that surgeons should consider differences between the mechanical and anatomical axes when they set the sagittal plane position of a femoral component in navigated cases.

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. Yehyawi TM, Callaghan JJ, Pedersen DR, et al: Variances in sagittal femoral shaft bowing in patients undergoing TKA. Clin Orthop Relat Res 2007;464:99.