

The accuracy of custom-fit total knee arthroplasty using a navigation system

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Introduction: Precise restoration of leg alignment offers the best opportunity for achieving good long-term results in total knee arthroplasty (TKA). For that, computer assisted techniques have been developed to place the components closer to the mechanical axis and minimize mal-alignment. Nowadays, advances have been made to better match individual knee anatomy by changing the size and shape of components. In this regard, more recently, studies have begun to assess the use of custom-fit alignment guide that use magnetic resonance imaging to determine component placement for TKA. This new technology allows the surgeon to place total knee replacement components into each patient's pre-arthritis natural alignment. Accordingly, the aims of present study were to evaluate the accuracy of alignment and cutting thickness of femur and tibia in custom-fit TKA using a navigation system.

Materials & Methods: Thirty patients had a sagittal MRI of their arthritic knee to make custom-fit guide to determine component placement for a total knee replacement (TKR). After cutting tibia and femur using a custom-fit guide, we evaluated intra-operatively coronal inclination of femoral cutting surface by using a navigation system and notching or overhanging of anterior cortex of the femur. We also measured coronal and sagittal alignments of tibial cutting surface by using a navigation system. And we also measured cutting thickness for femur and tibia by using a navigation system. The outcome was defined as "outlier" when $>\pm 3^\circ$ of optimum in alignment and 2mm of preoperative planning value in cutting thickness. We evaluated the peri-operative complications during the surgery.

Results: The mean coronal inclination of the femoral distal cutting was 89.52° to the mechanical axis with no outlier result. Moreover, we could not find any case of anterior notching or overhanging of the femur. While coronal inclination of tibial cutting surface was 90.12° to the mechanical axis of the tibia, there were two outliers. Also, the mean sagittal inclination of the tibial cutting was 84.56° . However, four outliers were observed in the sagittal inclination of the tibial cutting surface. The thickness of the distal femoral cut was 8.7mm and the thickness of the tibial cut was 9.4mm. However, five outliers of femoral cut thickness and four cases of the tibial cut thickness were observed by using a navigation system. There were no intra-operative or acute post-operative complications.

Conclusion: The custom-fit guide can provide good accuracy in coronal alignment of femoral and tibial cutting surface, but not sagittal alignment of tibial cutting. Moreover, the cutting thickness of distal femur and proximal tibia by custom-fit guide was not accurate as our planning. This technique appears to be consistent in reproducing correct coronal alignment in TKA. However, it needs to be improved for better accuracy of sagittal alignment and cutting thickness.

References

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