# Clinical accuracy of component alignment using the three-dimensionally planned and controlled insertion of IM alignment rod in TKA

SATO T[1], MURAYAMA T[1], KOGA Y[1], OMORI G[2], WATANABE S[3]

[1]*Department of Orthopaedic Surgery, Niigata Medical Center, Niigata, Japan*
[2]*Center for Transdisciplinary Research, Institute for Research Promotion, Niigata University, Niigata, Japan*
[3]*Department of Orthopedic Surgery Department of Regenerative and Transplant Medicine, Niigata University Graduate School of Medical and Dental Science, Niigata, Japan*

taku409@skyblue.ocn.ne.jp

**Introduction:** Intramedullary alignment rod (IMR) is widely used in TKA. However, IMR technique can be affected by its entry point and variations of bone geometry. Then, we developed a technique to 3-dimensionally plan the insertion of IMR preoperatively and reproduce it during surgery. Based on this technique, a new method to control the 3D component alignment with several related jigs was developed and utilized for clinical cases. The purpose of this study was to examine the accuracies of above technique in clinical cases.

**Materials & Methods:** 50 knees that underwent TKA were evaluated. 3D digital models of femur and tibia were generated from CT images. Using the preoperative planning software, the target 3D component alignment was firstly determined. Then, computer simulations of IMR insertion were performed. For both femur and tibia, the orientation, entry point, and insertion depth of IMR were three-dimensionally controlled so that the target component alignment was achieved (figure 1). After the alignment of IMR was determined, by calculating the spatial relationship between IMR and the target component alignment, the all values for jig setting (e.g., valgus angle, rotation angle from posterior condylar axis) were calculated. During surgery, IMR was inserted to the planned depth from the planned entry point. Then, several related jigs to those above values were set were attached to the IMR and osteotomies were performed. After surgery, the 3D component alignment was examined by the 3D image matching technique using biplanar computed radiography that was previously reported by authors [1, 2] and errors in component orientation compared with preoperative planning were examined.

**Results:** For femoral component, the mean (± SD) error of component alignment in coronal, sagittal, and axial (rotation) plane were 1 (± 0.8) º, 1.8 (± 1.1) º, and 1.9 (± 1.1) º, respectively. Only 2 knees (4%) showed the error more than 3 degrees in sagittal plane and another one knees (2%) showed that in axial plane. For tibial component, the mean (± SD) error of component alignment in coronal, sagittal, and axial (rotation) plane were 0.8 (± 0.4) º, 1.8 (± 1.9) º, and 3.2 (± 1.5) º, respectively. Only 2 knees (4%) showed the error more than 5 degrees in axial plane.

**Discussion:** The results of this study indicated that this technique enables us to accurately control component alignment without use of any navigation system or patient specific instrument. Comparing with previous studies that evaluated the accuracies of existing navigation systems, the results of this study were comparable or superior. Being different from the conventional methods by ordinal insertion of IMR, component could be accurately aligned for any geometry (e.g., severe anterior or lateral bowing) because both component alignment and instruments were adjusted according to the geometry of each case. Improved component alignment could be achieved by the planned and controlled insertion of IMR and the related jigs.

## References

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