THE POSITION OF THE DISTAL END OF THE EXTRAMEDULLARY ALIGNMENT GUIDE FOR THE TIBIA IN TOTAL KNEE ARTHROPLASTY

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INTRODUCTION
Extramedullary alignment guides are commonly used for the tibia during total knee arthroplasty (TKA), however, it is difficult to place the distal end of the guide properly because surgeons are not able to see the center of the ankle joint. This study evaluated the ideal position of the extramedullary alignment guide for the tibia using 3-dimensional bone model reconstructed from the preoperative computerized tomography (CT) scans data.

PATIENTS AND METHODS
Forty-five osteoarthritic knees with varus deformities in 45 patients (35 OA, 10 RA) were evaluated using CT scans before TKA. This study was approved by the Institutional Review Board. Patients were informed of the risk of exposure to radiation and informed consent was obtained for participation in the study. The mean patient age was 73.4 ± 6.7 (60-84) years at the time of the proposed surgery. The mean preoperative maximum flexion angle was 117.6 ± 14.9 (90-140) degrees. None of the patients had an ipsilateral knee surgery prior to the TKA. Patients with greater than 10 degrees of flexion deformity were excluded from this study. Computerized tomography scans were taken of the knee and of the ankle with 2 mm thick slices.

Reconstruction of 3-dimensional bone model with skin from the preoperative CT scans data
The bone (the knee joint and the ankle joint) and the skin (the ankle joint) were extracted respectively. Outer shape of the extracted images was coordinated by a house-written software, and then loaded on a CAD software (CATIA Ver 5.12, Dassault Systemes, France) (Figure. 1).

Definition of two anteroposterior (AP) axes of the proximal tibia
Axis 1 was AP axis which connected the posterior notch and the medial one-third of the patellar tendon.
Axis 2 was perpendicular to and passed through the midpoint of Line P-CEA.

Definition of the AP axis of the ankle joint
We selected the ankle slice level at which the anterior cortical bone of the talus was approximately a straight line (Figure. 4).

Positioning the extramedullary alignment guide for tibia on the 3-dimensional bone model
The proximal end of the guide was placed on the line of the extended AP axis of the proximal tibia. Alignment in the sagittal plane was parallel with the tibial mechanical axis. In this situation, the distal end of the guide was positioned ideally. (Figure. 5).

Measuring the position of the distal end of the extramedullary alignment guide
We analyzed the position of the distal end of the guide on the two coronal plane (Plane A and B) (Figure. 6 and 7).

DISCUSSION
The ideal position of the distal end of the guide has been recommended variously. These values were affected by surgeon’s viewpoint and the rotational mismatch between the proximal tibia and the ankle joint. (Figure. 8).

From this study, the ideal position of the distal end was 5-6 mm medial from the midplane-malleolar point when we see the ankle joint in the line of AP axis of the ankle joint. This is the point that has been classically recommended. The ideal position of the distal end was 1-2 mm medial from the midplane when we see in the line of AP axis of the proximal tibia. However, there are considerable differences between individuals the position in the line of AP axis of the ankle joint.

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