Adjustment of Leg Length Discrepancy in THA Using CT-Free Navigation System without the Use of a Femoral Tracker

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INTRODUCTION:
Since 2005, we have used OrthoPilot (B. Braun Aesculap, Tuttlingen, Germany) CT-free navigation system for improved and consistent acetabular cup orientation in THA. In order to achieve success of the THA, adjustment of leg length discrepancy is another important factor influencing the operative result. Currently, when the navigation system is utilized for this adjustment, installation of an additional device (tracker or clamp) for the femur is required. Fixation of such measurement device to the femur is associated with additional surgical invasion and contradicts the current trend of minimally invasive surgery (MIS). To solve this problem, a new software “OrthoPilot THA plus” has been developed to eliminate the need for a tracker fixation to the femur in the intraoperative leg length adjustment. In this study, we analyzed the accuracy of this leg length adjustment system by comparing the intraoperative data and the postoperative data obtained from the radiological measurement.

METHODS:
Forty-one consecutive patients (41 hips) who underwent primary THA using OrthoPilot THA plus software were included in the study. The average age at the surgery was 65 years (range, 18 to 83 years). Thirty-six hips out of the 41 hips were diagnosed as secondary osteoarthritis due to acetabular dysplasia. Based on the Crowe’s morphological classification system, these 36 dysplastic hips were classified as type1, 2, and 3, for 12, 14, 10 hips respectively. Before surgery, a tracker was attached to the iliac crest in the supine position. For THA procedure, we used MIS direct lateral approach with a skin incision of 8 cm or less with the patient at a lateral position. All THAs were performed with cementless cup (Plasma cup B™, B/Braun-Aesculap, Germany) and stem (Biocontact™, B/Braun-Aesculap, Germany). Position of the cup was aimed at the presumptive original acetabular site and a high hip center positioning was not adopted. For the intraoperative measurement of the leg length using the navigation system, a point at the distal end of the patella was palpated through the skin by the pointer while the knee was in 90° of flexion. An equal leg length was attempted at the initial process of the navigation at surgery. However, the final length of the operated leg was set to be slightly longer than the contralateral side in some cases, considering a soft tissue balance to reduce the risk of the dislocation.

In the radiological assessment of leg length discrepancy using the anteroposterior radiograph, the distance between the line connecting both tear drops and the level of medial apex of the minor trochanter was measured bilaterally and a side-to-side difference was calculated as a parameter of the leg length discrepancy. Finally, we compared the values obtained from intraoperative navigation and pre- and postoperative radiological measurements.

RESULTS:
Preoperatively, the leg length on the affected side was equal to or shorter than the length on the contralateral side in all cases. The average preoperative leg length discrepancy was 9.7 mm (range, 0 mm to 25 mm). The intraoperative leg length discrepancy value obtained by the navigation system averaged -0.9 mm (range, -6 to 5 mm) after intraoperative adjustment of 9.6 mm (range, -1 to 25 mm). In the postoperative radiological measurement, the final leg length discrepancy averaged 0.7 mm (range, -4 mm to 5 mm). Discrepancy of 5 mm or more was detected for 2 cases (4.8%). Comparison of intraoperative and postoperative values showed the average difference between the two measurements was 2.1 mm (range, 0 to 6 mm).

DISCUSSION:
There have been a number of studies examining the accuracy of the navigation system in THA(1). However, most of these studies dealt with acetabular cup orientation, and some studies have been reported regarding the navigation results for femoral side. Moreover, only few studies have examined the accuracy of the femoral side navigation without the use of the measurement device attached to the femur(2,3). In this study, a new soft ware enabling intraoperative leg length assessment while eliminating the need for a femoral tracker was used, and the accuracy of this system was examined. Concerns have been voiced over its accuracy and reproducibility because this system recognized the leg length only palpation of the patella through the skin. Based on the results of this study, however, a good agreement between the intra- and postoperative values was shown, assuring the accuracy of this new system.

Fig1. Navigation monitor showing the adjustment of leg length and offset values: Figures on the left side (13,15,18, and 21) shows the amount of lengthening corresponding to the length of the femoral neck (S,M,L, and XL). Figures on the right side (3,1,-1, and -4) indicate the offset value.

References: