INTRODUCTION:
Since 2005, we have used OrthoPilot (B. Braun Aesculap, Tuttlingen, Germany) CT free navigation system ver.1.1 to achieve improved acetabular cup orientation during the surgery. Reliability of this system in achieving consistent cup placement has been reported.1 A new version software “OrthoPilot THAplus” has been developed to enable the surgeon to adjust the leg length intraoperatively. We examined the accuracy of this system in a preliminary study and reported the results at the last ORS meeting. In this study, accuracy and reliability of this newly developed system were evaluated in 50 consecutive primary THAs implanted using the OrthoPilot THAplus as compared with the results of another 50 patients who underwent primary THAs using the OrthoPilot ver 1.1 that was not equipped with the leg length adjustment system.

METHODS:
(Study design)
In this study, only the patients undergoing unilateral primary THA without subluxation or dislocation on the contralateral side were selected. Fifty consecutive patients meeting these inclusion criteria who were operated with the OrthoPilot THAplus software constituted the basis of this study (Group 1). Another 50 consecutive patients meeting the inclusion criteria who underwent primary THAs with the OrthoPilot ver. 1.1 were served as a group for comparison (Group 2). In the Group 1 patients, the acetabular cup was oriented with the navigation system, while the stem was replaced without navigation attempting to equalize the leg length. Postoperative leg length discrepancy was compared between the two groups to examine the efficacy of the OrthoPilot THAplus navigation system.

(Surgical procedure)
All THAs were performed with cementless cup (Plasma cup B™, B/Braun-Aesculap, Germany) and stem (BiContact™, B/Braun-Aesculap, Germany). Before surgery, a tracker was placed at the iliac crest in the supine position. The OrthoPilot THAplus has been developed to eliminate the need for a tracker fixation at the femur. We used MIS direct lateral approach with a skin incision of 8 cm or less in the lateral position. Position of the cup was targeted at the original acetabular position, while this positioning was not attainable for patients with high hip center. For the intraoperative measurement of the leg length in Group 1 patients, 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.

(Radiological evaluation for leg length discrepancy)
Preoperative and postoperative leg length discrepancy was measured by the same routine method. The postoperative leg length was aimed at equal length to that of the contralateral unaffected side. We measured the distance between the line connecting the both tear drops and medial apex of the minor trochanter at neutral position in the anterior-posterior radiograph.

(Statistical analysis)
Comparison between the patient groups was made with Mann-Whitney U test. In the analyses, p<0.05 was considered significant.

RESULTS SECTION:
In all patients, the operated leg was shorter than the contralateral leg before surgery. The average preoperative leg length discrepancy was 10.9 mm (range: 0 mm to 35 mm) in Group 1 and 6.7 mm (range: 0 mm to 26 mm) in Group 2. After surgery, the average leg length discrepancy in Group 1 was 0.9 mm (range: -5 mm to 5 mm), while the corresponding value in Group 2 was 5.6 mm (range: -13 mm to 15 mm) with a significant difference between the groups. After the surgery, side-to-side discrepancy of 5 mm or less was achieved in all cases in Group 1, while the comparable leg length of this level was attained in only 26 cases (52%) in Group 2. Additionally, in Group 2 patients, a substantial discrepancy of 10 mm or more was observed for 12 cases (24%).

In the comparison of intraoperative assessment by the navigation and the postoperative radiological evaluation, agreement with the difference of 5 mm or less was confirmed in 46 out of 50 cases (92%).

DISCUSSION:
Leg length discrepancy is not uncommon after THA and can be a cause of patient dissatisfaction. In the previous studies, leg length discrepancy after THA has been reported to be associated with inferior clinical outcome. Williamson2 noted that 27% of the patients with this problem required heel lifts in daily living activities. Edeen3 described that 32% of the THA implanted patients were aware of leg length discrepancy and more than half of these patients felt this problem to be troublesome.

Several measures to adjust the leg length in THA have been proposed. First, precise preoperative templating is mandatory and emphasized. In the attempts to measure the leg length intraoperatively, use of markers (or trackers) has been also reported. Conventionally, the system of this kind requires insertion of two devices to the pelvis and the operated limb, which goes against the recent trend of MIS surgery. Elimination of the tracker on the proximal femur in this novel navigation system helps to minimize the surgical invasion. There have been only a few studies examining the accuracy of this system. Concerns have been voiced over its accuracy and reproducibility because this system recognized the leg length only palpation of the patella through the skin. In this study, accuracy of this leg length adjustment system and superiority of this system over the conventional navigation system have been shown.

REFERENCES:

Fig1 For the intra-operative measurement of the leg length using the navigation system, the distal end of the patella was palpated through the skin with the pointer while the knee was the 90 degrees of flexion.

Fig2-A Final leg length discrepancy in Group 1. Discrepancy of more than 5mm was not in any case.

Fig2-B Final leg length discrepancy in Group 2. Discrepancy of more than 5mm was detected in 26 cases (52%).