

CLINICAL STUDY FOR MEASUREMENT OF STEM ANTEVERSION DURING TOTAL HIP ARTHROPLASTY. CT FREE NAVIGATION VS G-GUIDE

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INTRODUCTION

Implant positioning is one of the critical factors influencing the postoperative outcome in total hip arthroplasty (THA) [1,2]. In our previous study, we evaluated the Combined anteversion (CA) value in patients who underwent THA using an image-free navigation for the cup with manual adjustment of the stem. Consequently, the AT value showed wide variability [3]. Since March 2013, we have measured stem antetorsion (AT) with CT free Navigation system (OrthoPilot Navigation System THA Pro Ver4.2, B/Braun Aesculap Germany: Navi). In order to attain consistency in intraoperative stem AT adjustment, we have employed two different procedures. First, we developed a simple instrument, Gravity-guide (G-guide), for intra-operative assessment of stem AT. Secondly, navigation software could measure intraoperative stem AT values. We have used these two methods concomitantly to control stem AT intraoperatively. In the present study, we evaluated the accuracy and effectiveness of G-guide and navigation software as referenced to postoperative CT evaluation with 3D template system (Zed hip, LEXI, Japan).

MATERIALS AND METHODS

Between March 2013 and December 2014, 50 patients underwent primary THA were evaluated. Surgeries were performed with routine techniques with a modified Hardinge approach with the patient at a lateral decubitus position in all cases. All THAs were performed with cementless cup (Plasma cup, B/Braun-Aesculap, Germany) and stem (Bicontact, B/Braun-Aesculap, Germany). During surgery, AT value was determined with navigation at the time of final rasping of the femur. Additionally, the G-guide was also utilized to evaluate the AT as determined by the final rasp. The G-guide consists of two parts; one attached to the lower leg and the other attached to the handle of the rasp (Figure 1). One part attached to the lower leg was utilized to ascertain perpendicularity of the lower leg axis. The other part provides the information for AT of the rasp. Intraoperative set up of this instrument system is shown in Figure 2. Postoperatively, all included patients underwent postoperative CT examination, and the prosthetic alignment was assessed using Zed Hip. The stem AT evaluation with Zed Hip was based on the posterior femoral condylar tangential line. While, intraoperative G-guide assessment was based the clinical epicondylar axis. The angle of discrepancy between posterior condylar line and femoral transepicondylar axis needs to be taken into consideration. Therefore, correction by the angle between the trans-epicondylar and posterior condylar lines (correction angle) was required for each patient when the intraoperative AT as measured by the G-guide. Therefore, the correction angle should be added to the AT value obtained from the G-guide for comparison with postoperative value measured with Zed Hip.



For rasp handle



For lower leg

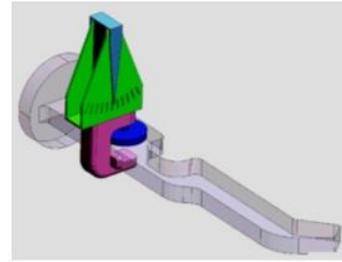


Fig 1: Gravity-guide



G-guide angle



Fig 2: During surgery

RESULTS

The average G-guide angle and correction angle were $16.4^{\circ} \pm 8.5^{\circ}$ and $5.9^{\circ} \pm 1.5^{\circ}$, respectively. The average intraoperative stem AT value (the sum of the intraoperative G-guide angle and the correction angle), Navi AT value and postoperative Zed hip evaluation was $21.0^{\circ} \pm 8.8^{\circ}$, $13.7^{\circ} \pm 9.7^{\circ}$ and $17.7^{\circ} \pm 9.1^{\circ}$ respectively. The discrepancy between the intraoperative G-guide with correction angle and postoperative Zed Hip measurements was $4.7^{\circ} \pm 3.9^{\circ}$. The discrepancy between Navi AT and postoperative Zed HIP measurements was $5.9^{\circ} \pm 4.1^{\circ}$. A discrepancy was 10° or more were 7 cases in Navi and 4 cases in G-guide. However, there was no statistically significant correlation between the values obtained by G-guide, navigation and post-operative evaluation.

DISCUSSION

Determination of the stem AT is one of the critical factors influencing the outcome of THA. In our previous studies, we also reported satisfactory results with cup setting

angle with the use of the image-free navigated THA [4]. Conventional (manual) intraoperative stem adjustment may result in variability and inaccuracy of stem antetorsion [5]. The use of both OrthoPilot THApro and G-guide was equally effective in reducing the variability of the stem AT compared to the results with manual adjustment. However, there was some discrepancy between intraoperative measurement and postoperative CT evaluation. The loosening of the clamp at major trochanter or registration error before surgery was hypnotized in case of the discrepancy with Navi. In G-guide, we could not evaluate the knee OA and tibial bowing in each patient. It might be possible that these occur due to deformities of the posterior femoral condyle and changes in the femoral tilt. In conclusion Navi and G-guide measured intraoperative stem antetorsion was comparable utility.

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DISCLOSURES

The authors have nothing to disclose or conflict of interest of this work.