

# Evaluation of components alignment during total hip arthroplasty with CT-based fluoro matched navigation system

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**Introduction:** Total hip arthroplasty (THA) represents one of the most successful orthopaedic surgery. A survival rate of the implant after THA has been documented 93% at 20 years. However, dislocation is a major complication after THA. Impingement between the implants and/or bones is critical factor of dislocation. Therefore, the accurate components positioning is important during THA. Recently, computer navigation in arthroplasty has been increasing over the past several years. These navigation techniques use sophisticated computer algorithms and tracking systems. There have been reported several studies focused on acetabular components. However, few studies have been reported about accuracy of femoral components with navigation system. In this study, we analyzed accuracy of both acetabular and femoral components alignment during THA with CT-based fluoro matched navigation system

**Materials & Methods:** All the patients (22 joints on 22 patients) underwent THA with using CT fluoro matched navigation system (Vector Vision Hip, Brain LAB). The inclination and anteversion angle of acetabular socket were measured by cup verification function of navigation system at post-screw insertion after press fit of socket. The antetorsion, varus-valgus and flexion-extension angle of femoral components were measured by stem verification function of navigation system after press fit of stem. Further, we checked the accuracy of distance by touching the bone surface around acetabular edge and proximal femur prior to insertion of components. All data were expressed as mean  $\pm$  standard deviation (SD) unless otherwise indicated. Statistical analysis was performed by student's t-test for comparisons between the two groups.

**Results:** In acetabular components alignment, navigation system showed the average inclination angle was  $40.6 \pm 5.4^\circ$ , and anteversion angle was  $14.9 \pm 7.0^\circ$  during THA. However actual inclination analyzed by 3D template was  $36.3 \pm 7.4^\circ$ , and anteversion was  $11.5 \pm 9.9^\circ$ . The absolutely difference of inclination was  $5.5 \pm 3.7^\circ$ , and anteversion was  $6.0 \pm 4.7^\circ$ . We also compared the absolutely difference of cup alignment and the accuracy of distance around acetabular component during THA with navigation. There was no significant correlation between cup alignment and distance accuracy. In femoral components alignment, navigation system showed the average antetorsion angle was  $32.1 \pm 17.1^\circ$ , varus-valgus angle was  $0.2 \pm 2.0^\circ$  (varus), and flexion-extension angle was  $0.1 \pm 0.5^\circ$  (extension) during THA. Actual antetorsion analyzed by 3D template was  $33.1 \pm 9.0^\circ$ , varus-valgus was  $0.4 \pm 1.4^\circ$ , and flexion-extension angle was  $0.3 \pm 3.0^\circ$  (extension). The absolutely difference of antetorsion was  $6.0 \pm 4.0^\circ$ , varus-valgus was  $1.9 \pm 1.4^\circ$ , and flexion-extension was  $2.1 \pm 1.9^\circ$ .

We also compared the absolutely difference of stem alignment and the accuracy of distance around stem during THA with navigation. There was significant correlation between varus-valgus alignment and distance accuracy. But, no correlation was found in antetorsion and flexion-extension alignment.

**Discussion:** We showed accuracy of accuracy of both acetabular and femoral components alignment during THA with CT-based fluoro matched navigation system. The accuracy of acetabular components was similar accuracy in comparison with other reports. However, we firstly reported the accuracy of femoral components, and the discrepancy of navigation and actual alignment was  $6.0^\circ$  in antetorsion,  $0.4^\circ$  in varus-valgus and  $0.3^\circ$  in flexion-extension. These differences may be clinically valuable. Further, checking accuracy of distance by touching the bone during surgery may be useful prediction for accuracy of navigation system in each patient.