



Revision Total Hip Arthroplasty Using Imageless Navigation with the Concept of Combined Anteversion

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Purpose

Cup position plays an important role in the short- and long-term outcomes of total hip arthroplasty (THA). More attention should be paid to avoid malposition of acetabular components during revision THA. Imageless navigation systems have demonstrated their ability to significantly reduce the number of outliers in positioning the acetabular component in THA. In addition, the combined anteversion technique may provide more accurate mating of the femoral head and acetabular cup into a correct anteversion position. The purpose of the study is to evaluate the implant positions and clinical results in revision THA using the imageless navigation with the concept of combined anteversion.

Materials and Methods

We evaluated the implant positions and clinical results of 40 patients (24 men and 16 women) who consecutively underwent a cementless revision THA using an imageless navigation with the concept of combined anteversion. The mean age of patients was 58.4 ± 9.4 years at surgery. The mean body weight was 62.6 ± 12.6 kg and their mean body mass index (BMI) was 23.6 ± 3.7 kg/m². The imageless navigation (VectorVision, BrainLab, Heimstetten, Germany) was used to carry out the procedures. All patients were operated in lateral decubitus position.

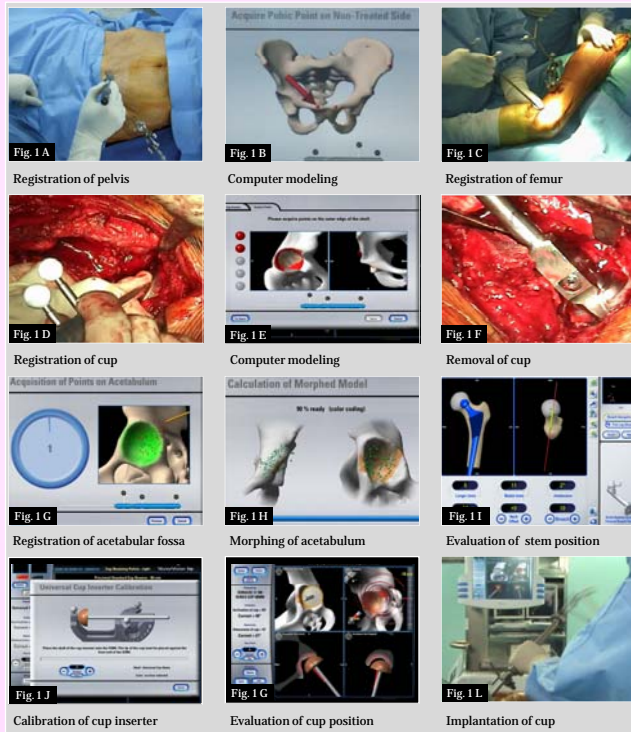


Fig. 1 (A-L) Stepwise procedures for revision THA using imageless navigation with the concept of combined anteversion

Goal of implant position according to Widmer's equation

Acetabular cup and femoral stem revision (30 cases)
 Stem anteversion: 20°, Cup anteversion: 23°
 Combined anteversion: $23 + (0.7 \times 20) = 37$

Acetabular cup revision only (10 cases)
 Cup anteversion = 37° - (Remained stem anteversion x 0.7)
 Remained stem anteversion was evaluated with preop. CT

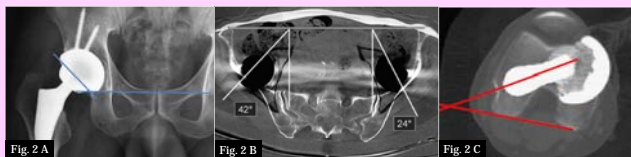


Fig. 2 Measurement with X-ray and CT

Post-operatively, the inclination of the cup was evaluated on the standard anteroposterior (AP) view of radiograph (Fig. 2 A) and the anteversion of the cup and femoral stem was evaluated on the CT scan. $40^\circ \pm 10^\circ$ in inclination and $37^\circ \pm 10^\circ$ in combined anteversion calculated based on Widmer's equation were regarded as the safe zone (Fig. 2 B, C). Clinically, the Harris hip score and the complications were evaluated. The mean follow-up was 50.7 months (range 24 – 79 months).

Results

After revision THA, the average inclination and anteversion of the cup were $42.3^\circ \pm 3.1^\circ$ and $25.0^\circ \pm 2.9^\circ$, respectively. The average anteversions of the revised femoral stems and the remained femoral stems were $15.3 \pm 2.9^\circ$ and $17.4 \pm 9.7^\circ$, respectively. The combined anteversion based on Widmer's equation was $36.1^\circ \pm 3.4^\circ$. There were no outliers in the inclination and the combined anteversion of the cup. The mean post-operative Harris hip score was 90.7. There were no dislocation and osteolysis during follow-up period. One hip was re-revised for stem loosening with late infection. In 12 hips, minor complications were observed: 3 intra-operative periprosthetic fractures, 2 nonunions of extended trochanteric osteotomy, 3 breakages of wires, and 4 heterotopic ossifications.

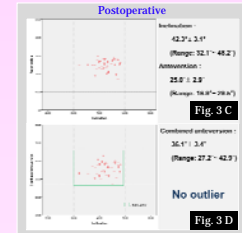
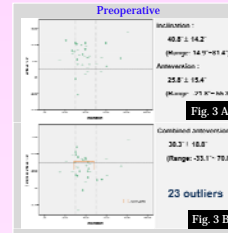


Fig. 3 Before revision THA Inclination and anteversion (Fig. 3A) Combined anteversion and outliers (Fig. 3B)
 Fig. 4 After revision THA Inclination and anteversion (Fig. 4A) Combined anteversion and outliers (Fig. 4B)

CASE I

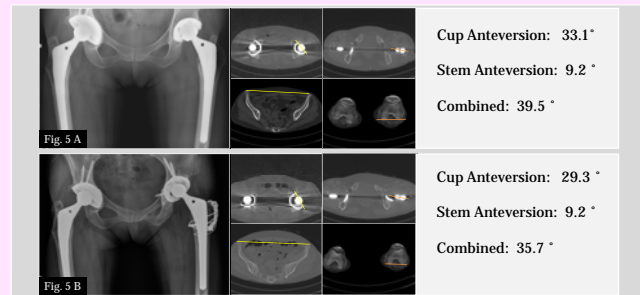


Fig. 5 53-year-old female patient with osteolysis; Revision of the cup only Preoperative (A) and Postoperative (B) X-ray and CT

CASE II

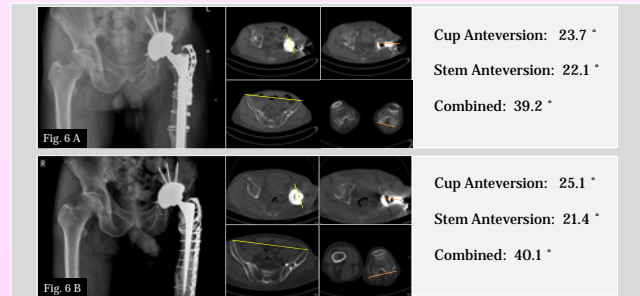


Fig. 6 61-year-old male patient; Revision of loosened stem only Preoperative (A) and Postoperative (B) X-ray and CT

CASE III

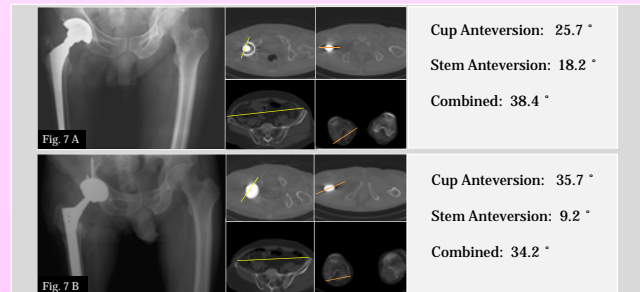


Fig. 7 62-year-old male patient; Revision of both stem and cup Preoperative (A) and Postoperative (B) X-ray and CT

CONCLUSION

The imageless navigation is useful for applying the concept of combined anteversion in revision THA. This study demonstrated that the results of revision THA using imageless navigation with the concept of combined anteversion are favorable. Further studies with long-term follow-up data are warranted.