

Technical Note

The Combined Anteversion Technique for Acetabular Component Anteversion

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Abstract: The combined anteversion technique for acetabular component placement of total hip arthroplasty is beneficial because of the surgeons' limited ability to control the anteversion of a cementless femoral stem. Our data show that the cementless stem anteversion can be 15° different than anticipated. By determining femoral stem anteversion before positioning cup anteversion, the cup anteversion can be adjusted for the stem anteversion. The combined anteversion technique should provide a mean near 35° with a safe zone of 25° to 50°. **Key words:** combined anteversion, acetabular component anteversion.

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Unlike cemented stems where anteversion is controlled by the surgeon, cementless stems require a rigid metal design to conform to the rigid shape of the native proximal femur [1]. This results in a wide variability of stem anteversion [2,3]. Our data from 82 primary total hip arthroplasties (THAs), with postoperative computed tomography scans as the measuring tool, found cementless femoral stem anteversion was a mean $10.7^\circ \pm 7.6^\circ$ (range, -8.6° to 27.1°). Of the 82 stems, 35 (43%) had 10° to 20° of anteversion; 8 (10%) were in absolute retroversion (-2.9° to -8.6°); 41.5% had anteversion of 0° to 9° ; and 5.5% had more than 20° (21° to 27°). Young men have more retroverted femurs.

There is thus the potential for cementless stem anteversion to be 10° to 15° different than the anticipated 15° of anteversion. If the stem has an outlier of 10° and the cup also has a 10° outlier of

anteversion, the combined anteversion could be 20° different than expected. This possibility is the reason for considering the combined anteversion technique for component positioning in THA, which prepares the femur first so that femoral stem anteversion is known before cup implantation. The cup is then anteverted according to the stem anteversion to give a combined anteversion between 25° and 50° , lower for men and higher for women.

Our mean combined anteversion in 82 hips with postoperative computed tomography scans was 37.8° (range, 25° to 50°). These cups were oriented on the radiographic coronal plane of Murray [4] to provide a functional cup position. We have established a safe zone of combined anteversion of stem and cup of 25° to 50° . We experienced 3 anterior dislocations in hips with combined anteversion greater than 50° so we do not want to exceed that number. Others have studied the use of combined anteversion and its benefits [2,5-7].

Surgical Technique

The paradigm shift for THA with the combined anteversion method is that the femur is prepared first. The anteversion of the femur is judged with the trial implant in the femur. The estimation of femoral anteversion is more accurate if a trial neck is used,

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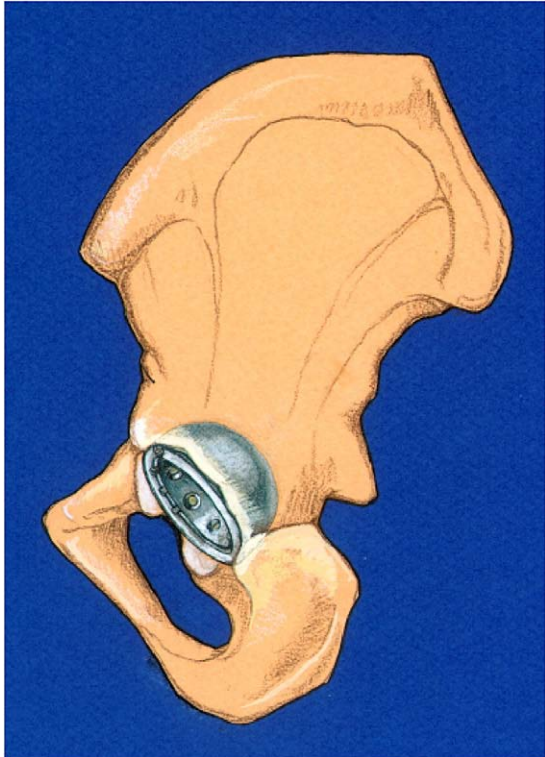


Fig. 1. Correct coverage means the cup edge inferomedially is just inside the transverse acetabular ligament; superior-anteriorly, the cup cannot be proud of the edge of the ilium. A narrow edge of bone should be maintained above the anterior edge of the cup to protect the iliopsoas tendon. Posterior-Superior, there may be 3 to 5 mm of cup which protrudes beyond the bone. Posterior-inferiorly the cup should be below the cortex of the ischium.

either on a broach or with a trial stem. The femoral anteversion is judged against the axis of the thigh determined by palpating the 2 epicondyles at the knee. We became proficient at estimating the stem anteversion within 5° with a learning curve of 15 hips. After the femur has been prepared and the stem anteversion has been judged, the trial stem or broach is removed from the femur and the femoral cavity is packed with a thrombin-soaked sponge to minimize bleeding from the femur into the acetabulum during acetabular preparation.

The acetabulum is prepared with reamers and the acetabular implant is anteverted according to the stem anteversion. If stem anteversion were neutral to 5° anteversion, the cup would be anteverted near 30° . If the stem were anteverted 20° to 25° , the cup would be anteverted 15° . These positions provide a combined anteversion near 35° . The anatomy of the acetabulum does not permit anteversion of a cup much beyond 30° . Therefore, when the stem is retroverted beyond 5° , the surgeon must make a

choice between a different cementless stem, most likely a modular stem, or cementing the stem so that anteversion can be obtained. This choice does not occur in more than 5% of hips.

The cup is most accurately oriented by computer navigation with a precision of 5° [8] to ensure that we are within the safe zone of combined anteversion. The cup can be simply visually implanted with more or less anteversion depending on the stem anteversion. The key is knowing the stem anteversion. Cup coverage must be achieved in combination with inclination and anteversion (Fig. 1).

The thrombin-soaked sponge is removed from the femoral canal; a trial reduction may now be done if deemed necessary. Our only indication for a reduction is if we have concern for leg length and offset. The stem should be implanted and a trial head placed for reduction. We use the largest head size possible for the cup size used with highly cross-linked polyethylene. We accept 5-mm thickness of polyethylene.

After implantation of the femur, the hip is put through a range of motion to test for impingement (Fig. 2). Postoperative rehabilitation for patients operated with this technique does not use traditional dislocation precautions but should avoid soft sofas

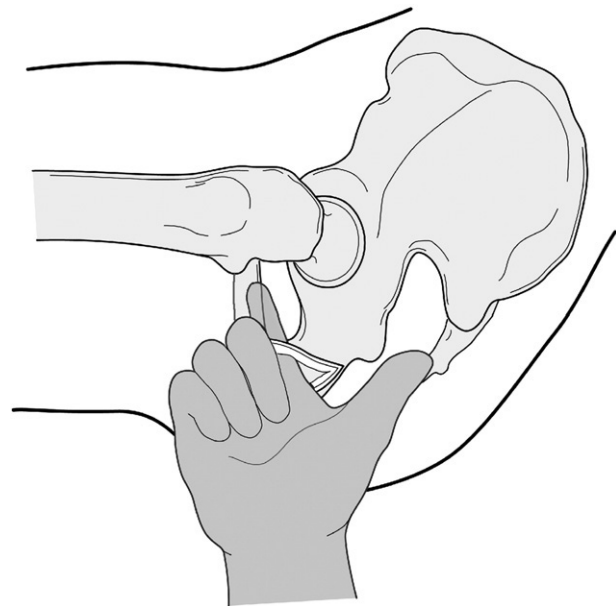


Fig. 2. The lesser trochanter should not impinge on the ischium in full extension and should be one fingerbreadth above the tip of the ischium for correct leg length. In external rotation and abduction, the metal neck should not impinge on the cup nor the greater trochanter on the posterior ilium. In flexion and internal rotation, the metal neck should not impinge on the anterior-superior cup or the greater trochanter on the anterior ilium.

and chairs where they have to rock forward to arise from the chair. The other limitation for patients is that they cannot lean and reach to their foot and ankle, or to the floor, on the outside of the knee on the operated leg. Sinking into a low soft sofa, or reaching to the outside of the leg, has created the only risk for impingement and dislocation in the early post-operative period for these patients. The only physical therapy we use is a walking program with a goal of 1 mile; 80% of patients achieve that by 3 weeks. If walking is not possible, pool therapy is prescribed.

Conclusions

The combined anteversion method is a simple paradigm shift for performing THA. It provides more accurate mating of the femoral head and acetabular cup into a correct anteversion position when using a cementless stem. It makes the decision easier for correct cup anteversion. It can eliminate the necessity of a trial reduction with the broach or trial stem. We do use a trial reduction to determine the correct modular head length for offset and leg length. It is now our routine method for this operation.

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