

Primary Total Hip Arthroplasty with a Minimally Invasive Anterior Approach

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Total hip arthroplasty (THA) through the anterior approach is a minimally invasive technique that allows component implantation without muscle detachment from bone. The anterior approach is advantageous because the hip is an anterior joint, closer to the skin anterior than posterior; the approach follows an internervous plane between the superior and inferior gluteal nerves laterally and the femoral nerve medially; and the approach involves no muscle detachment. The anterior approach described here provides good access to the acetabulum and femur through the same incision, preservation of the hip muscular attachments, improved control of acetabular cup position and leg lengths, and no hip dislocation precautions postoperatively.

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Total hip arthroplasty (THA) through the anterior approach is a minimally invasive technique that allows component implantation without muscle detachment from bone. The first hip arthroplasty performed through this approach was by Robert Judet in 1947 at Hospital Raymond Poincare in Garches outside Paris.^{1,2} Judet referred to the surgical approach as the “Heuter Approach.” A published reference for this, however, is unknown, and “Heuter” may refer to Heuter Volkmann and the approach for drainage of a tuberculosis hip abscess. The approach can also be called the “Short Smith-Pete” because it follows the interval of the Smith-Petersen distal and lateral to the anterior superior iliac spine.

Judet used the anterior approach because 1) the hip is an anterior joint, closer to the skin anterior than posterior; 2) the approach follows an internervous plane between the superior and inferior gluteal nerves lateral (tensor fascia lata) and the femoral nerve medial (sartorius); and 3) the approach exposes the hip without detachment of the muscular attachments.

Charnley implanted the first consistently successful THA in the 1960s. The patient was placed in a supine position with the operative leg draped free and manipulated by a scrubbed assistant. This approach required a trochanteric osteotomy, which led to the development of the posterior approach to

avoid the complications associated with the osteotomy. Because of problems with hip dislocation following the posterior approach, some surgeons later adopted the anterolateral Hardinge approach. The disadvantage of the Hardinge approach however is the necessity of detachment of the gluteus minimus and a portion of the gluteus medius from the greater trochanter, which can lead to a delay in functional recovery or, in some cases, incomplete healing of the abductors to the trochanter.

The anterior approach however, preserves posterior structures that are important for preventing dislocation while preserving abductor muscle attachments to the greater trochanter.^{3,4} The surgeon should also consider the role of the gluteus maximus and tensor fascia lata muscles as abductors and pelvic stabilizers. These two muscles insert on the fascia lata/iliotibial band, which joins them and together form a “deltoid of the hip.” This “hip deltoid” is preserved along with the attachments of the gluteus minimus and medius, facilitating earlier functional recovery.⁵

The acetabular access is easy to appreciate through the anterior approach. The femoral access, however, is more difficult, leading to other techniques that require a separate incision for implantation of the femoral stem.⁶ With the single anterior incision, access to both the acetabulum and femur are facilitated by the orthopaedic table used for the procedure.⁷ The original table used in France by Judet was the Judet/Tasserit table. This table is no longer manufactured, which led to the design and production of the PROfx and HANA tables (OSI Inc., Union City, CA), which are improved surgical tools to assist with the procedure (Fig. 1).

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Figure 1 The Hana table is shown with the patient positioned for femoral broaching with the leg hyperextended and externally rotated. The femoral hook attachment, which aids in the delivery of the proximal femur in the wound, is shown. (Courtesy of OSI, Union City, CA)

Advantages

The advantages of the minimally invasive single-incision anterior approach for THA include

- Good access to the acetabulum and femur through one incision;
- Preservation of the hip muscular attachments and “hip deltoid;”
- Improved control of acetabular cup position and leg length;
- No hip dislocation precautions needed postoperatively;
- Ability to perform bilateral THA;
- Allows placement of cemented or uncemented stems; and
- Can be used in all patients regardless of body mass index.

Surgical Technique

The patient is placed in the supine position on the PROfx or HANA table, and a perineal post is placed and the boots are attached to the table. The operative leg is placed in slight internal rotation to accentuate the bulge of the tensor fascia lata muscle, which is used as a landmark for the surgical incision. The normal incision starts 2 to 3 cm posterior and 1



Figure 2 The incision is started lateral and distal to the anterior superior iliac spine, extending over the bulge of the tensor fascia lata.

to 2 cm distal to the anterior superior iliac spine (Fig. 2). On thinner patients the bulge of the tensor fascia lata muscle marks the center of the line of the incision. After incision of the skin and subcutaneous the tensor can be seen through the translucent fascia lata. The fascia is incised over the tensor in line with the skin incision and the muscle is followed medially by direct palpation to the muscular interval.

Dissection by feel is most efficient at this point, and the lateral hip capsule can be easily palpated just distal to the anterior inferior iliac spine. Cobra retractors are placed along the lateral and medial hip capsule to retract the tensor and gluteus minimus laterally and retract the sartorius and rectus femoris muscles medially. The medial and lateral retraction of the two cobra retractors brings the lateral femoral circumflex vessels into view as they cross the distal portion of the wound. These vessels are clamped, cauterized, and transected. The anterior capsule may be either excised or opened as flaps and repaired as part of the closure. The authors prefer to retain the capsule in most cases. The capsule is opened with an incision that parallels the anterolateral fem-



Figure 3 The femoral hook attachment is shown in its typical position around the proximal femur just distal to the vastus ridge. The hook is inserted into the bracket arm of the table for elevation of the proximal femur into the surgical wound.

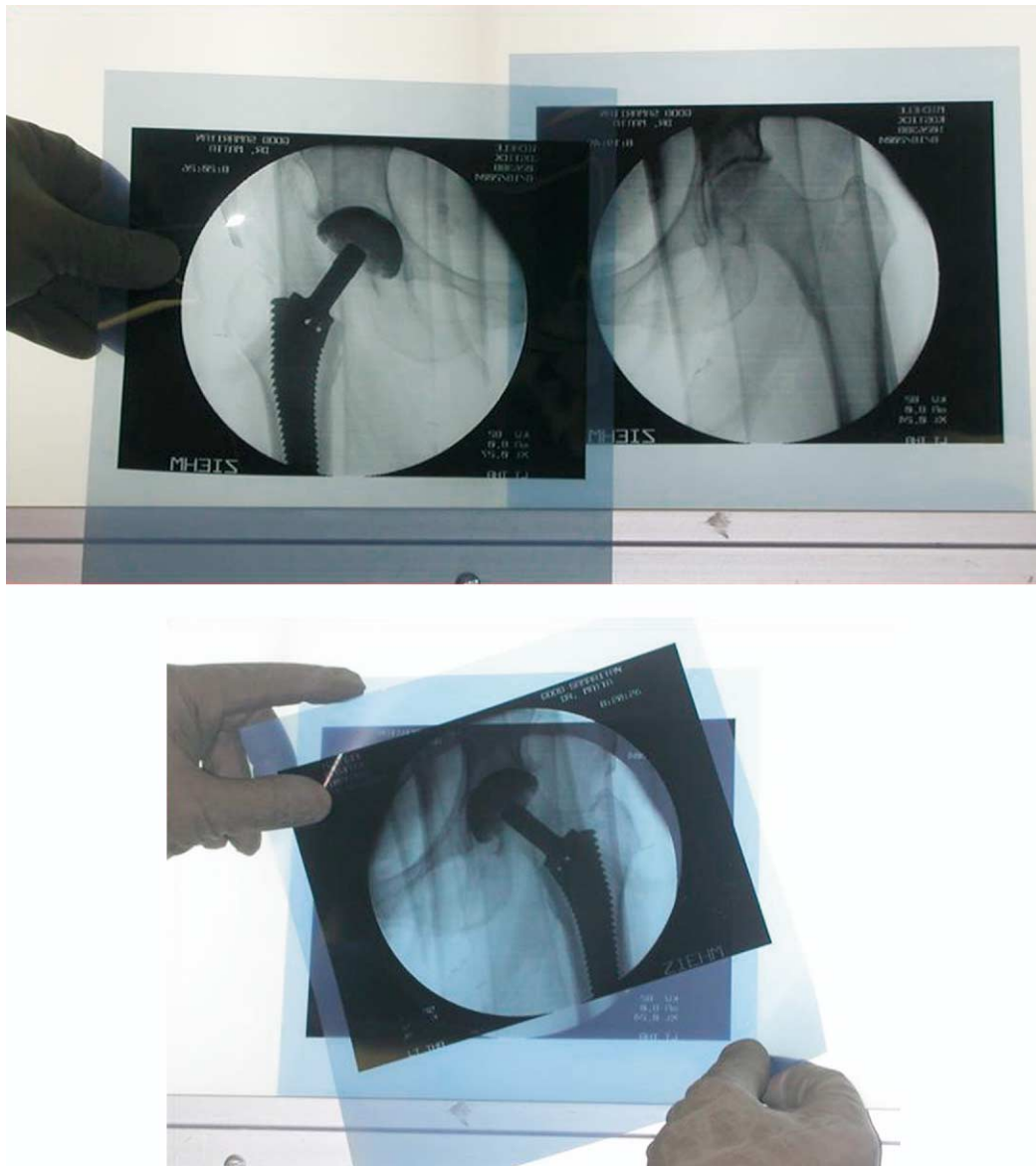


Figure 4 The image intensifier is used to print images of both the nonoperative and operative hip with trial implants in place. The two images are then superimposed to verify the length and offset of the prosthetic hip.

oral neck. The proximal portion of this incision crosses the anterior rim of the acetabulum and the reflected capsular origin of the rectus femoris. The distal anterior capsule is detached from the femur at the anterior intertrochanteric line, and suture tags are placed on the anterior and lateral capsule at the distal portion of the incision that separates them. A femoral head skid is used to free the soft tissue connections of the femoral head in the acetabulum. A corkscrew is placed in the head, and gentle external rotation is applied to the leg, dislocating the hip. This step allows easy removal of the head after the femoral neck cut and more mobility of the proximal femur for broaching. The hip is then relocated and the femoral neck cut performed. Some surgeons prefer to make the neck cut in situ without the initial dislocation step, which is an alternative method.

The acetabulum is now visualized and prepared. External rotation of the femur of about 45° usually facilitates acetab-

ular exposure. Reaming is usually started under direct vision and later checked with the image intensifier to confirm depth of reaming and adequate circumference. The acetabular cup is inserted with an offset inserter that reduces pressure on the distal wound. The image intensifier can be used to watch the position and progressive seating of the prosthesis. Most experienced surgeons can easily recognize a properly positioned cup on x-ray (40-45° abduction and 15-25° anteversion), and good position can be achieved consistently with the image technique.

The use of the image intensifier during the procedure will vary according to the surgeon's preference. It was not used by Robert Judet nor currently used by Thierry Judet. Its use for reaming is probably most controversial but is particularly useful, especially to judge the depth of reaming. It is recommended for acetabular positioning and also to check leg length with the femoral trials. The procedure, however, can



Figure 5 A postoperative radiograph of a patient who underwent bilateral hip replacements shows excellent replication of length, offset, and cup position.

be done completely without it while relying on the traditional methods of preop planning, guides, relation to bony or Steinman pin landmarks as well as soft tissue tension. The image, however, improves accuracy.

After acetabular insertion, the gross traction control on the leg spar is released, and the femur internally rotated to neutral. The vastus ridge is palpated and the femoral hook placed just distal to this and around the posterior femur. The femur is now externally rotated 90° and the hip hyperextended and adducted by dropping the leg spar to the floor. The proximal femur is now raised by the femoral hook until the tissues come under moderate tension (Fig. 3). Release of the lateral joint capsule from the medial greater trochanter allows proper broaching and enhances mobility of the femur.

The most applicable stem instrument systems are “broach only” and have an offset broach handle that does not interfere with the proximal soft tissues and prominence of the anterior superior iliac spine. Currently, the authors prefer the Corail stem (DePuy, Warsaw, IN) because of its ease of femoral preparation and insertion. The tip of the first broach enters the neck near the posterior medial cortex. It is possible to perforate either the posterior or lateral femoral cortex, and the initial entry should guard against this. If in doubt, use the image to confirm the broach position. The plane of broach/prosthesis anteversion should be roughly parallel to the plane of the posterior neck cortex. When the broaching is complete, a trial reduction is made with the neck length estimated from the preop template.

With the trials in place, the image intensifier is used to obtain radiographs of both hips. The nonoperative hip image is saved and placed on the right screen and the operative hip image is saved on the left screen. The x-ray technician prints both images on transparencies for comparison. The transparencies are taken to the view box and the hips compared by overlying the images (Fig. 4, Fig.5). This allows excellent replication of length and offset in the operative hip. The femoral stem is also fully visualized to confirm fill and posi-

tion. Adjustments can be made as needed and the final femoral components are implanted. Range of motion and tissue tension can be checked at this time, but radiographic confirmation of cup position, leg length, and offset is most important.

After surgery the patient does not follow antidislocation precautions. They are encouraged to weight bear immediately and use the hip and discard external support as symptoms permit.

From November 1996 to April 2005, 657 primary anterior THAs were performed, including 67 bilateral. This series of 657 anterior approaches is unselected and consecutive. The surgeries were performed on the Judet/Tasserit table until 2003. Beginning in 2003 the PROfx table became available and is now preferred. All acetabular components were uncemented in the series. Of the 657 femoral components implanted, 129 were cemented and 528 were uncemented. The average age was 66 years and ranged from 29 to 91 years. The largest patient had a body mass index of 57. The incisions averaged 10 cm in length. The average operative time was 1.2 h with an average blood loss of 345 mL. The median hospital time was 4 days, and the mode was 3 days. The median time to doing some ambulation without external support was 8 days. The median time for doing all ambulation without external support was 15 days.

Postoperative radiographic assessment showed an average leg length discrepancy of 3 mm (SD 4) with a maximum of 10 mm. Average acetabular abduction was 41° (SD 4; range 33-49°), and average acetabular anteversion was 23° (SD 5; range 9-38°).

Complications included one deep infection, one femoral nerve palsy that resolved, and three early dislocations. There were two early anterior dislocations and one posterior dislocation that underwent closed reduction and did not recur or require revision. Intraoperative fractures included three greater trochanter, two femoral shaft, two acetabular, and four fractures of the proximal femoral calcar. There were three intraoperative ankle fractures in some of the early surgeries performed. All three were in older, osteoporotic females. These complications prompted the additional dislocation step with the corkscrew. By applying the force for hip dislocation to the proximal femur with the corkscrew, additional ankle injuries have since been averted. There were six femoral stem revisions due to loosening (6 cemented, 0 uncemented) and five acetabular cup revisions (one for polyethylene wear and four recalled implants).

It is our belief that once learned this soft tissue sparing technique is easier than the majority of small incision techniques and can be performed by many surgeons with reproducible results and a low complication rate. Learning the technique, however, requires focus and dedication to detail.

The anterior approach is advantageous for essentially all patients undergoing hip replacement. The hardest cases are muscular males who are also obese, although we believe this difficulty applies in all approaches. The only contraindication regarding anterior hip replacement is with patients with previous acetabular fracture associated with posterior heterotopic ossification (not yet excised) and/or pelvic deformity or

posterior acetabular defects, where extensive posterior access may be necessary.⁸

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