Use of the Fitmore® Hip Stem Bone-Preserving System for the Minimally Invasive Anterior-Supine Approach in Hip Replacement

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Abstract

Total hip arthroplasty through a single-incision anterior approach is a minimally invasive surgical (MIS) technique that allows component placement without violation of the posterior hip capsule or "hip deltoid." This allows faster recovery without dislocation precautions. The Fitmore® hip stem (Zimmer, Warsaw, Ind) is a bone-conserving stem designed for use in MIS techniques. The technique described here is a single-incision anterior approach with the Fitmore stem using a special orthopedic table.

Total hip arthroplasty (THA) is one of the most successful orthopedic procedures. The first anterior-approach hip replacement was performed by Judet in 1947.[1] At that time, he implanted an acrylic femoral head prosthesis with a stem following the axis of the femoral neck. This construct was not biomechanically sound and did not perform well over the long term. Also at that time, Charnley was developing a procedure for a hip arthroplasty (the low-friction hip prosthesis) that would be more durable than Judet's acrylic prosthesis.[2]

In Charnley's technique, the patient was positioned supine with the operative leg draped free, and a trochanteric osteotomy allowed access to the joint. Complications with the osteotomy led to a modification, use of the posterior approach, which most surgeons in the United States use today. This approach allows for good access to the joint but comes with a variable risk of hip dislocation. Another common technique for hip joint replacement is the anterolateral, or Hardinge, approach. This approach provides for excellent stability but requires detachment and reattachment of the hip abductors. This causes a delay in recovery and occasionally a permanent deficit in abductor function.

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The modern anterior-approach THA is a merger of the ideas of two founding fathers of hip arthroplasty. With today's low-friction bearing surfaces providing improved durability, attention has been turned to surgical technique. Judet's original technique has been popularized in the United States in recent years, most notably by Matta.[3,4] Judet referred to the surgical approach as the *Heuter approach,* which likely refers to Heuter Volkmann and the approach used for drainage of tuberculosis abscess of the hip. In the United States, the approach is commonly referred to as the *Smith-Peterson approach*. For hip arthroplasty, the technique is slightly different from a traditional Smith-Peterson approach, using only the distal limb of the incision. Judet's original procedure was facilitated by the Judet/Tasserit table. This table is no longer in production, but a modern version, the Hana table (Mizuhosi, Union City, Calif), is currently used as an additional surgical tool for the procedure (Figure 1).

The major benefit of the anterior approach is preservation of natural muscle attachments and the posterior capsule of the hip. With the posterior capsule intact, hip precautions are not needed, and patients are allowed to position the leg as tolerated immediately. The gluteus medius and minimus attachments are preserved as well as the "hip deltoid." This structure, created by the joining of the tensor fascia lata and gluteus maximus by the iliotibial band, is extremely important as a pelvic stabilizer and abductor of the hip.[5] Preserving the hip deltoid and abductors allows for earlier functional recovery.

The anterior approach allows for use of many different implant designs, both uncemented and cemented.

Figure 1. The Hana table (Mizuhosi, Union City, Calif), which aids in femoral exposure by controlling the operative leg, is shown with leg externally rotated, extended, and adducted, as it would be positioned for femoral broaching. Photo reprinted with permission of Mizuhosi.

Figure 2. The Fitmore® hip stem (Zimmer, Warsaw, Ind) is a short curved stem that follows the calcar anatomy and relies on complete apposition on the calcar region with a single point of contact on the lateral cortex. Illustration reprinted with permission of Zimmer, Inc.

My personal experience ranges from shorter, abbreviated femoral stems to long, modular revision femoral components. With experience, all types of stems are implantable, but there is little doubt that shorter implants with a reduced lateral shoulder are the easiest to use. One of the newer stems specifically designed for minimally invasive surgery (MIS) is the Fitmore® hip stem (Zimmer, Warsaw, Ind). The stem is short and curved to reduce the amount of bone removed during rasping, specifically in the region of the greater trochanter (Figure 2). Because of the curved silhouette, which is designed to match the curve of the calcar, very little bone needs to be removed laterally, which is more difficult to access with the anterior approach. In addition to technical ease with the anterior approach, the stem also allows for multiple offset options, including reduced, standard, high, and extra extended. This allows for better control for soft-tissue balancing of the hip, which is critical for stability and function. In this article, I describe the surgical technique for implantation of the Fitmore hip stem using an anterior approach with the Hana table.

Surgical Technique

The patient is placed supine on the Hana table with boots locked into the leg spars. The padded perineal post is positioned, and the arms are placed straight out to the side, perpendicular to the table. The operative leg is placed in slight internal rotation to accentuate the bulge of the tensor fascia lata and in slight hip flexion to reduce tension across the rectus femoris. The incision is typically 10 cm in length, starting 2 cm posterior and 1 cm distal to the anterior superior iliac spine (ASIS). The incision is angled to follow the tensor fascia lata muscle as it originates from the ASIS and inserts into the iliotibial band (Figure 3).

Dissection is carried down to the fascia lata. This thin fascia is translucent blue and should be incised in line with the skin incision. An Alice clamp is used to grasp

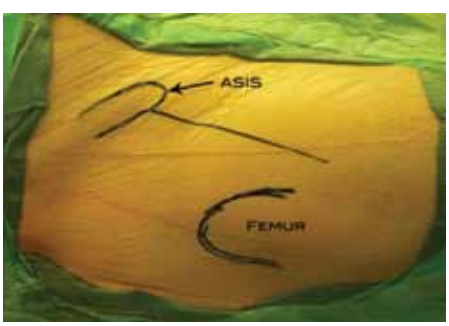

Figure 3. Incision is started lateral to the anterior superioriliac spine and is angled distally and laterally, following the orientation of the tensor fascia lata muscle.

Figure 4. Lateral femoral circumflex vessels, in inferior portion of exposure, run transversely across incision and must be identified, isolated, and controlled.

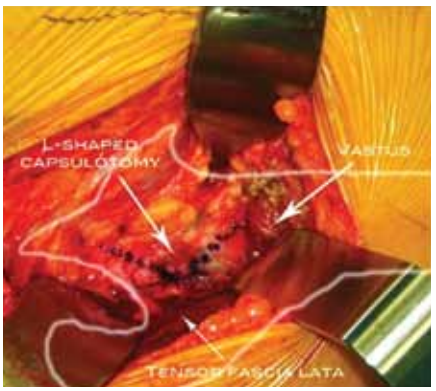

Figure 5. L-shaped capsulotomy follows intertrochanteric line just above vastus intermedius, then parallels femoral neck across acetabular rim. Reflected head of rectus femoris can be preserved or transected according to surgeon preference.

the medial edge of the fascia lata, and blunt dissection with a finger is used to strip it off the tensor fascia lata muscle belly and expose the muscular interval. Blunt dissection is used to feel the femoral neck and create a pocket superolateral to the femoral neck for placement of a blunt Cobra retractor. A Cobb elevator is used to elevate the rectus femoris from the anteromedial femoral neck, and another blunt Cobra retractor is placed under the rectus femoris around the inferomedial femoral neck. At this time, the lateral femoral circumflex vessels can be identified in the inferior portion of the operative field (Figure 4) as transverse structures at the superior border of the vastus intermedius. It is critically important to control the vessels with cautery or suture ligation.

The entire anterior hip capsule is now exposed, and an L-shaped capsulotomy is performed with one limb following the intertrochanteric line along the superior border of the vastus intermedius and the other limb paralleling the femoral neck up to the edge of the acetabulum (Figure 5). The proximal portion of the capsulotomy crosses the acetabular rim and reflected capsular origin of the rectus femoris. It is an option to retract the reflected head of the rectus to preserve it, but, in my experience, this action neither decreases pain or improves functional recovery. The anterior and lateral capsule edges are then tagged with suture for retraction and later repair. At this point, I prefer to release the capsule from the "saddle" of the femur. This is the region laterally where the femoral neck curves upward into the greater trochanter. Performing this release now makes the later femoral exposure easier. The leg is exter-

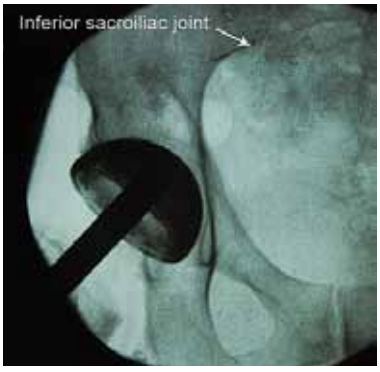

Figure 6. Cup is inserted under fluoroscopy. Apex of cup is directed toward inferior sacroiliac joint to obtain proper cup abduction. Anteversion is estimated by oval opening of cup or by using angle of insertion handle to floor, which should be 10° to 15°.

nally rotated approximately 45°, and the medial femoral neck is cleared of the capsule and the anterior iliofemoral ligament. With proper release, the lesser trochanter should be easily palpable. A sagittal saw is then used to cut the femoral neck with reference made from the "saddle" of the femur. For surgeons comfortable using the lesser trochanter as a guide, the cut can be verified with palpation of the lesser trochanter. Slight traction can be applied to the leg to distract the osteotomy, and the leg is placed in slight external rotation to clear the femoral neck. A corkscrew is placed into the cut end of the femoral neck, and the head is removed.

Retractors are then placed anterior and posterior to the acetabulum for exposure. Standard removal of the labrum and remaining soft tissue in the acetabular fossa is performed. Care should be taken to cauterize the acetabular branch of the obturator artery as it enters from the acetabular notch. I prefer to ream under fluoroscopy and perform reaming without retractors in the wound. Between each reamer, the reamed rim is palpated, and, after the final reamer, retractors can be placed around the acetabulum again to confirm complete removal of cartilage. The acetabular shell is also placed with fluoroscopy for proper positioning. My ideal cup position is 45° of abduction and 10° to 15° of anteversion. The anteversion can be measured using the floor and lifting the cup insertion handle to 10° to 15° off the neutral plane of the floor. The abduction can be estimated by pointing the apex of the acetabular shell at the inferior portion of the sacroiliac joint on the fluoroscopic image (Figure 6). A neutral acetabular liner is always used, as proper implant position is confirmed with image intensifier.

Figure 7. Shape and size of Fitmore raspers facilitate rasping of femoral canal without removing bone laterally. Rasps are inserted along calcar, preserving bone in greater trochanter. This rasping technique is easily performed through the anterior approach. Illustration reprinted with permission of Zimmer, Inc.

Attention is then turned to the femur. The femoral hook for the Hana table is placed around the femur just below the abductor tubercle. The hook is placed external to the vastus lateralis and most easily placed with the leg in a neutral rotation. After placement of the hook, the leg is externally rotated to at least 90°, extended toward the floor, and maximally adducted under the contralateral leg. The hook is locked into the bracket arm, which is attached to the femur lift on the table. The femur lift is used when elevating the proximal femur into the wound. The femur lift should not be used as a "crane" to lift the femur, as it could cause fracture. The proximal femur is lifted by hand, and the mechanical lift is brought up to the level achieved by manual elevation. A Müeller retractor is placed over the medial calcar, and a bent Hohlman is placed over the tip of the greater trochanter. The Hohlman should be placed outside the lateral hip capsule and inside the gluteus minimus muscle. The hip capsule should be completely released from the inside of the greater trochanter until the inside portion of the bone is visualized. For the most part, exposure of the femur is the rate-limiting step of the operation. Before proceeding, surgeons must be able to see clearly the entire inside of the greater trochanter. The piriformis and obturator internus tendons can be released if additional exposure is needed. The posterior capsule and the obturator externus, which inserts more distal, should never be released.

Broaching with the Fitmore system through the anterior approach is slightly different from standard broaching techniques. First, the starting point should be in the posterior middle third of the cut femoral neck. The rasp should be inserted in a curved fashion to follow the medial calcar and proximal femur (Figure 7).

Figure 8. Fluoroscopic images of operative **(A)** and nonoperative **(B)** hip are printed during surgery and superimposed to confirm length and offset with trial implants in place **(C)**.

Figure 9. Final postoperative radiograph shows good component positioning with good reproduction of length and offset.

The entire medial aspect of the implant should be in contact with the medial border of the proximal femur with only one point of lateral contact. Fluoroscopy is used for leg length and offset confirmation. I prefer to use printed pictures of the trial side and the nonoperative side as intraoperative overlays (Figure 8). This is my personal preference; alternative techniques with fluoroscopy are widely used. Once length and offset have been confirmed, trials are removed, and permanent implants are inserted to the level of the trial femoral component. Again, fluoroscopy is used for confirmation.

The anterior hip capsule is then closed using the previously placed tag sutures. A deep drain is placed, and the fascia lata is closed with absorbable suture. The skin is then closed with absorbable suture and Dermabond (Johnson & Johnson, New Brunswick, NJ). I prefer using Quill (Angiotech, Vancouver, Canada) for closure, as it requires no suture knots, and I have found it to be extremely strong, withstanding wound dehiscence even in the obese. After surgery, patients are allowed weightbearing as tolerated, and no dislocation precautions are followed. A postoperative radiograph is shown in Figure 9.

I have performed more than 1400 primary THAs with the anterior approach along with almost 50 hip surface replacements and 70 revision THAs. There have been no dislocations in my consecutive series of more than 1400 primary hip replacements.

This procedure should not be considered an MIS procedure applicable only to primary hip replacement. With experience, it can be used for any hip arthroplasty procedure that does not require augmentation of the posterior acetabulum.

Conclusion

It is necessary to stress that, while this approach has proven effective, there is no published data on the success of this stem. Further study will be needed to document the outcomes with the Fitmore stem.

Author's Disclosure Statement

Dr. Yerasimides wishes to note that he is a paid consultant to Zimmer.

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