Introduction

This brochure presents the Anterior Approach in the supine position for hip arthroplasty. The approach uses the internervous plane between the femoral nerve on the medial, superior and inferior gluteal nerve on the lateral side. There is no resection of any muscular attachment making this a truly tissue sparing approach.

Hueter in 1882 first described the Anterior Approach making this the oldest approach to the hip joint. The approach gained popularity in France in the early fifties with LeTournel and the Judet brothers, who recognised the importance of preserving the muscles surrounding the hip joint. They advocated the use of an orthopaedic traction table to facilitate access to femur and acetabulum, however this has certain disadvantages. In this brochure we describe the Anterior Approach, without the need for an orthopaedic traction table.

The supine position gives optimal control of acetabular cup placement, stability and leg length. The procedure can be done with standard Operating Room equipment, but specific instruments as described in this brochure help facilitate the operation. Fluoroscopy can also be used to improve accuracy of cup and stem placement. This approach allows placement of both cemented and uncemented stems and may be considered for all patients regardless of Body Mass Index. There is however a learning curve with the Anterior Approach and it is advised to follow a dedicated learning journey and begin with selected simple cases.

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Bone Preserving Hip Systems

The DePuy Synthes portfolio of hip products offers bone preserving options for patients undergoing the Anterior Approach. When evaluating the Anterior Approach, an overall plan to maximise soft tissue preservation and bone preservation should be considered.

The Anterior Approach, when combined with a bone preserving femoral stem, achieves both soft tissue preservation and bone preservation for the patient. DePuy offers two bone preserving stems, which complement the Anterior Approach; the CORAIL® Hip System, which has 25 years of clinical success and the TRI-LOCK® Bone Preservation Stem. Both stems provide options to treat a spectrum of patient anatomies.

The PINNACLE® Acetabular Cup System also offers an ideal solution for tissue sparing surgery, with flexible bearing options and specialised instrumentation.
Preoperative Planning

The primary goal of total hip arthroplasty is the anatomic reconstruction of the hip joint, resulting in favourable prosthetic joint load and function. Mechanically, the goals are to create a stable articulation with optimised range of motion, restored biomechanics for muscular efficiency and equalised limb lengths. Meeting these goals begins with a thorough analysis of the hip with comparison to the contralateral side in anterior/posterior (A/P) and lateral projections.

Please see the surgical techniques for the TRI-LOCK Bone Preservation Stem (0612-88-600) and the CORAIL Hip System (9066-35-025) for further information on preoperative planning.

Patient Positioning

This approach may be considered for all patients. The patient lies in a supine position, preferably on a radiolucent table that can extend/break at the position of the anterior superior iliac spine (ASIS). The arm on the operative side can be positioned as shown in Figure 2a or positioned over the patient’s body as shown in Figure 2b. It is important to drape both legs individually so they are mobile throughout the procedure. As shown in Figure 2c.
Initial Incision Planning

Three landmarks need to be identified (Figure 3):

1. The anterior superior iliac spine (ASIS).
2. The tip of the greater trochanter.
3. The lateral side of the patella.

The interval between the tensor fascia lata (TFL) laterally and the sartorius muscle medially can be palpated following a line between the ASIS and the lateral side of the patella (Figure 4).

The incision starts 2-3 cm posterior and 1-2 cm distal to the anterior superior iliac spine and extends in a distal direction 2-3 cm below the greater trochanter. The incision should be lateral to the interval between the tensor and sartorius muscle avoiding the lateral femoral cutaneous nerve that runs variably in the fascia over the sartorius muscle (Figure 5).

Generally the incision should run centrally along the muscle belly of the TFL. However, ensure the fascia incision is somewhat anterior to avoid damage to the perforating artery supplying the skin dorsal to the incision.
Initial Skin Incision

Make the initial skin incision and divide the subcutaneous tissue in line with the incision. When the fascia and tensor muscle is identified the surgeon can palpate the ASIS. Start the fascia incision two finger breaths from the ASIS. A longitudinal incision is made through the translucent facia lata in line with the fibres over the belly of the muscle. (Figure 6).

The fascia on the medial side is lifted from the muscle itself and the intermuscular interval between the tensor laterally and the sartorius muscle medially is entered using your finger, making sure to stay within the TFL sheath. (Figure 7).
Capsule Exposure

There is a thin fascia overlying the capsule which has to be opened first, to expose the pericapsular fat, underneath which is the joint capsule itself.

The capsule of the hip on the lateral side and the anterior part of the greater trochanter can now be palpated. A retractor is positioned extracapsularly underneath the gluteus minimus and lateral to the neck, retracting the tensor muscle. During the whole procedure care should be taken to protect the tensor muscle from tearing.

The lateral femoral circumflex vessels cross the intermuscular interval just distally of the intertrochanteric line (Figure 8). These vessels must be clamped or cauterised; “If you can’t find them, they will find you!”. The vessels indicate the level of a plane that is just superficial of the fat pad, over the anterior capsule. Once these vessels have been cauterised you can identify the fat pad under the rectus femoris muscle, removal of the fat pad will identify the anterior capsule. This will allow identification the reflected femoral head of the rectus femoris muscle, which follows the anterior acetabular rim and can be elevated from the anteromedial part of the capsule using a raspatory. A second retractor can now be placed extracapsularly on the medial side proximal to the trochanter minor retracting the rectus femoris muscle medially exposing the whole anterior part of the capsule (Figure 9).
Capsule Incision

The capsule can be incised in an inverted T or H shape or excised at surgeons will. The intertrochanteric line forms the inferior border and is identified distally by the junction of the capsule and the origin of the vastus lateralis muscle. Two retractors can now be placed intracapsularly on both sides of the femoral neck.

Tip: On the lateral side a weight can be used on the retractor to retract the tensor muscle.

Figure 10
The intertrochanteric line, which can also be seen on the X-ray can be used as a reference for the osteotomy of the femoral neck. Reposition the laterally placed retractor to protect the greater trochanter. Use a long narrow saw blade to cut the femoral neck at a level that is appropriate for the chosen femoral stem (Figure 11).

After completing the osteotomy a chisel can be used to flip the femoral neck towards the front. This will allow the introduction of a corkscrew into the femoral head.

Before the femoral head can be removed, it may be necessary to release the posterior capsule attached to the femoral head. The corkscrew can be used as a joystick. Twist the head several times before removing it. In a case where the hip is stiff or there are acetabular osteophytes hampering the removal of the head, a slice of bone from the femoral neck, can be taken out first; creating space for the femoral head to be removed (Figure 12).

Caution: Try to prevent levering on the tensor muscle with the corkscrew to avoid damaging the anterior fibers.

In a case of difficulty in retrieving the head you can cut the labrum and remove more antero-superior capsule.

Alternatively you can place the corkscrew in the head/neck junction anteriorly and pull in the direction of the socket.
Acetabular Preparation and Reaming

The preparation of the cup is similar to any other approach. Insert a retractor just over the anterior acetabular rim retracting the reflected head of the rectus muscle. A second retractor is placed underneath the posterior rim of the acetabulum. A third retractor may be placed under the transverse ligament to hold down the femur.

In cases where the reflected head of the rectus muscle obstructs good visualisation of the acetabulum an additional retractor can be placed over the anterior inferior acetabular rim. The reflected head of the rectus muscle can be sharply detached from the capsule.

Caution: be aware of the femoral nerve about 2 cm medial of the anterior acetabular rim and the Psoas tendon that can be damaged if the retractor is wrongly placed.

Remove the acetabular labrum and remaining soft tissues obstructing good visualisation before acetabular reaming. Reaming can be done with either a straight or angled reamer. The transverse acetabular ligament and antero-lateral acetabular rim can be used as landmarks. In difficult cases an image intensifier can be used.
Acetabular Trial and Implantation

To check the quality of the acetabular reaming a Pinnacle trial shell can be impacted before the definitive PINNACLE cup is placed. The orientation of the cup can be checked using the anatomical landmarks of the antero-lateral acetabular rim and the transverse acetabular ligament. Be certain the PINNACLE cup is well seated in the acetabulum and does not overhang anteriorly causing impingement of the Psoas tendon. An image intensifier can be used easily in the supine position.

Caution: be aware that in this approach the femur can force the cup into too much inclination and anteversion.

Please refer to the PINNACLE Surgical technique for full details.
Peer reviewed publications highlight the importance of acetabular component positioning in relation to short and long term outcomes during total hip arthroplasty for all types of bearing materials.\textsuperscript{1-8}

Cup positioning should be varied to optimise fixation, range of motion and dislocation resistance and minimise the likelihood of subluxation, impingement and edge loading. This may be assessed during pre-operative planning, acetabular preparation and cup trialling. Sub-optimal component positioning may lead to edge loading, dislocation, increased wear, elevated metal ion release, ceramic squeaking and polyethylene fracture.\textsuperscript{1-8}

The target cup inclination (as measured on radiographs) should be 40-45° taking into account local soft tissue and anatomic landmarks. The target cup anteversion (as measured on radiographs) should be 15-20° taking into account local soft tissue and anatomic landmarks.

An alignment guide is provided to assist with cup positioning; however, cup orientation in the patient depends on patient position. The alignment guide does not allow for variation in patient position with respect to the operating table and it should be noted that patient orientation can vary throughout the procedure.
Leg Positioning

For the femur, the critical step is the release of the capsule at the postero-superior neck remnant and fossa Piriformis. This can be accomplished by pulling the femur forward using a bone hook and electrocautery to release the capsule. Care should be taken not to release the Piriformis tendon. The insertion of the Piriformis tendon can be seen medially of the neck-trochanter junction when the leg is in (90°) external rotation.

Pull the femur upwards and laterally judging the effect of the release as you cut. The proximal femur is presented within the wound by putting the leg in a “lazy figure of four” position, extending / breaking the operating table by 20–30°, elevating the femur with a bone hook and stabilising this position with a double bent retractor behind the greater trochanter (Figure 18).

A second retractor is placed on the medial side of the calcar pushing the femur laterally.

Tip: An inadequate release of the posterior capsule exposing the proximal femur can be hampered when the greater trochanter is stuck behind the pelvis. This can be solved by pulling the proximal femur lateral and then forward while releasing the capsule. When the exposure is not good, look at positioning in terms of adduction.
CORAIL Hip System
Femoral Canal Preparation

Use the CORAIL broaches to create the femoral cavity by compacting the cancellous bone. To avoid varus positioning, it is important to enter the femoral canal as laterally as needed. Similarly, to avoid three point fixation in the lateral plane, insert the broach handle along the posterior wall of the proximal femur. This also allows the broach to follow the correct anteversion. Note that the posterior wall is located medially in the wound when the femur is externally rotated. Use a chisel or a canal finder to check the correct entry alignment (Figure 20). Begin with the smallest broach attached to the broach handle and increase the size of broaches one at a time. Stop broaching when axial and rotational stability are achieved in order to preserve cancellous bone and encourage osteointegration (Figure 21).

The anteversion is automatically set by the anatomy of the femur. Please refer to the CORAIL Surgical Technique for full details (Cat. No.: 9066-35-001).

The CORAIL system offers additional offset handles for patients where the iliac crest tends to obstruct a straight entrance to the femoral shaft (Figure 22).

Caution: be aware that the lazy figure of four can put the patient’s femur into internal rotation which can influence stem anteversion. Anteversion can be checked by referring to the epiphyseal line between the distal femur and the patella.
CORAIL Hip System
Trial Reduction & Implantation

With the last broach in situ, attach the selected neck and femoral head trials (Figure 23) and reduce the hip. When desired stability is achieved, remove the broach, the femoral head and neck trials. Do not irrigate or dry the femoral canal. This will help to preserve the quality of the compacted cancellous bone that encourages osteointegration. First insert the definitive liner into the cup. Insert the CORAIL stem and impact it for the last centimetres until stability is achieved (Figure 24).

**Clean and dry the taper thoroughly to ensure it is completely free of debris.** Place the appropriate femoral head onto the taper. Using the head impactor, engage the head with moderate blows. Clean the bearing surfaces, and reduce the hip. Please refer to the CORAIL surgical technique for full details (Cat. No.: 9066-35-001).

The supine position gives you optimal control of stability and leg length. The reduction should be effortless. However, the hip should remain stable throughout a full range of motion including extension, external rotation and maximum flexion and internal rotation.

Leg length can be assessed by either looking at the knees, the malleoli or the heels.
Utilise the modular box osteotome to enter the femoral canal and to establish version. If needed the box osteotome can be used to clear bone laterally. In some cases, particularly in hard bone, the femoral canal can be developed using a small instrument such as a Canal Finder (Cat. No. 9400-80-001).

The TRI-LOCK Bone Preservation Stem offers several broach handles that enable the many surgical approaches for hip replacement. The Curved and Dual Offset broach handles are available for the anterior approach technique.

Begin using a broach at least two sizes smaller than the preoperatively templated stem size. The starter broach can be used when needed for small femoral geometries, or for clearing bone laterally. While taking care to maintain proper alignment and version, sequentially advance the broaches down the femoral canal. Continue to increase broach size until intimate contact is made between the broach and the medial and lateral cortices. The final size is achieved when the broach maintains axial and rotational stability, and is at a seating level that recreates proper leg length.

Calcar planing is optional, as the TRI-LOCK Bone Preservation Stem is a collarless design. With the final broach fully seated, place the planer over the broach stud. Apply power prior to engaging the calcar to prevent the planer from binding. Mill the calcar to the level of the broach face.

*Caution: be aware that the “lazy figure of four” can put the patient’s femur into internal rotation that can influence stem anteversion. Anteversion can be checked by referring to the epiphyseal line between the distal femur and the patella.*
TRI-LOCK Bone Preservation Stem

Trial Reduction & Implantation

Trial neck segments and trial heads are available to assess proper component position, joint stability, range-of-motion and leg length. Standard and high offset options are available for each stem size. Offset increases 6-8 mm (depending on stem size) from the standard to the high offset option, via direct lateralisation. With the final broach in-situ, attach the appropriate trial neck and trial head. First insert the definitive liner into the cup. Reduce the hip and assess what adjustments, if any, are required to ensure stability through a full range of motion. When stability is achieved, note the broach size and head/neck offset.

Stem inserters are available with various geometries, this enables each surgeon to decide according to their surgical preference. The retaining stem inserter can be used if a positive connection between the implant and instrument is required. Select the stem size that corresponds to the final broach. In the area of GRIPTION® coating, the implant is oversized by 0.25 mm per side relative to the broach. Introduce the implant into the femoral canal by hand. Take care to orient the implant with proper alignment and version. Using moderate mallet blows, advance the stem into position. The implant is fully seated when the top of the GRIPTION coating reaches the level where the face of the broach previously sat and the implant is stable. Excessive force should not be needed to seat the stem.

Following the final trial reduction, clean and dry the taper thoroughly to ensure it is completely free of debris. Place the appropriate femoral head onto the taper. Using the head impactor, engage the head with light taps. Clean the bearing surfaces, and reduce the hip.

Please refer to the TRI-LOCK Bone Preservation Stem surgical technique for full details (Cat. No. 0612-88-600).

The supine position gives you optimal control of stability and leg length. The reduction should be effortless. However, the hip should remain stable throughout a full range of motion including extension, external rotation and maximum flexion and internal rotation. Leg length can be assessed by either looking at the knees, the malleoli or the heels.
Capsular closure can be performed if desired. The fascia lata is closed with a running suture, followed by subcutaneous and skin sutures. A wound drain can be used at will.
Surgical Tips

Hans-Erik Henkus
• During the whole procedure care should be taken to protect the tensor muscle from tearing.
• Make use of an image intensifier in difficult cases when you can not rely on the patient’s anatomy.
• Beside an inadequate release of the posterior capsule exposing the proximal femur can be hampered when the greater trochanter is stuck behind the pelvis. This can be solved by pulling the proximal femur lateral and then forward while releasing the capsule.
• When broaching the femoral canal, The direct anterior approach tends to force you in a varus position. Enter the femoral canal as lateral as needed and use the canal finder.
• Do not start broaching until you are absolutely certain about the position of the proximal femur.
• You can extend the incision proximally towards the anterior superior iliac spine and then bending laterally following the iliac crest doing a classic Smith-Peterson approach.
• You can extend the incision distally going laterally reaching the femur behind the vastus lateralis muscle.
• This approach can be done in almost every patient. However attention should be given to the very obese, especially when there is overhanging paninculus hampering the entrance of the femoral canal. The hardest cases are muscular males and cases with a short femoral neck or extreme coxa vara.

John Van Overschelde
• Before draping, assess patient positioning on table and look for leg length discrepancy.
• Make the incision of the facia over the purple muscle belly, avoid the white region medial and lateral of it otherwise you will end up in the wrong plane.
• While resecting the capsule clean the fossa digitalis completely so you can hook the tip of the greater trochanter with your index finger.
• Protect the tensor facia lata with a retractor during osteotomy of the femoral neck and be careful when taking out the head not to tear the tensor with some sharp ends of the neck.
• Use a curved reamer and impactor to avoid steep positioning of the cup.
• When lifting the femur push the retractor in the direction of the fibres of the facia lata muscle so you avoid tearing the muscle.
• Resect enough lateral cortical bone before broaching to avoid varus positioning of the stem.
• At the end of the intervention take a second look at the circumflex vessels and coagulate them if necessary.
References


