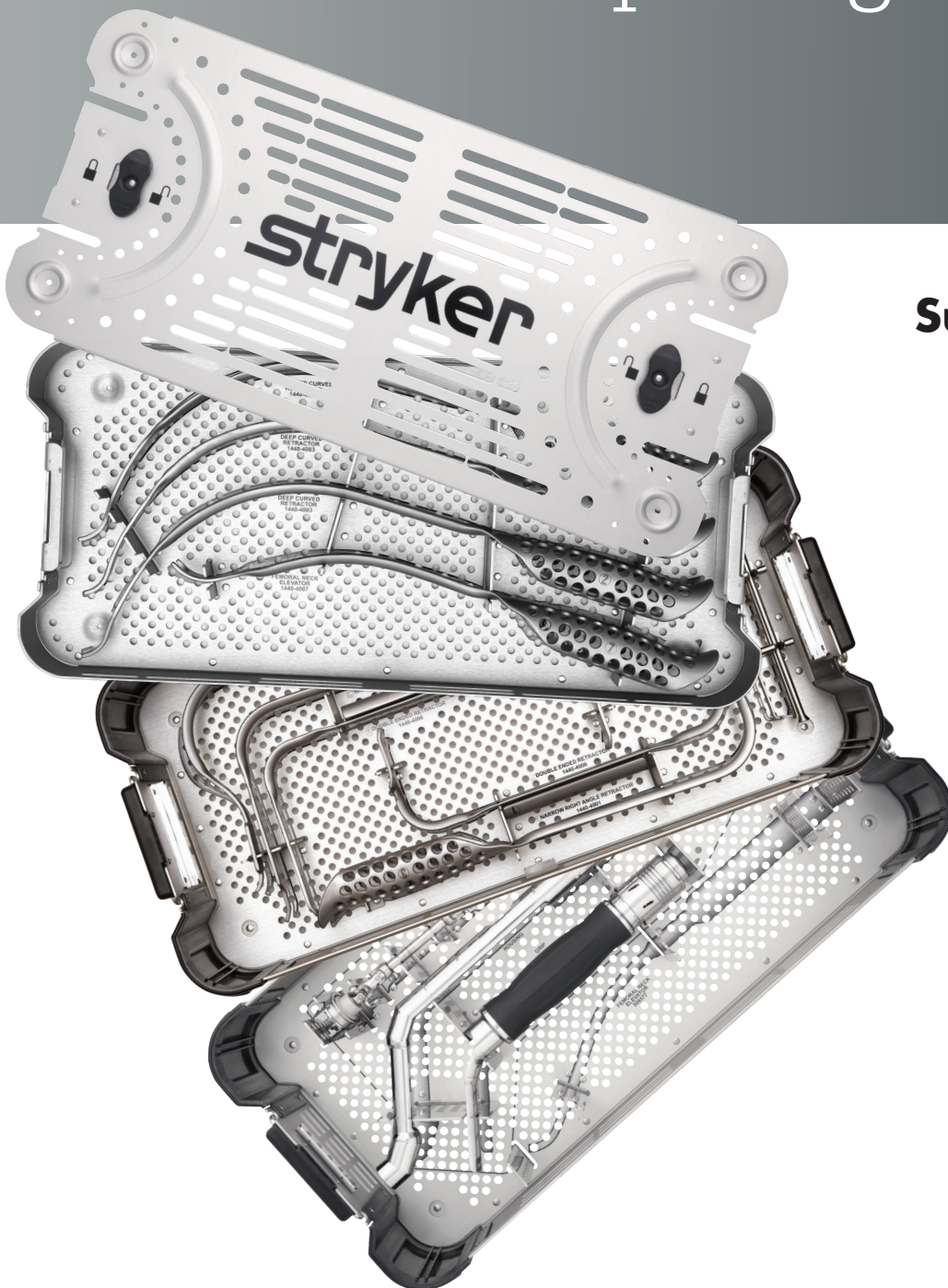


Direct Superior

An iliotibial band and muscle sparing approach



Surgical technique

Direct Superior

An iliotibial band and muscle sparing approach

Surgical technique

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Scientific advice

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Intended use / contraindications

- The intended user profile is a licensed orthopaedic surgeon or trained OR support under the supervision of a licensed orthopaedic surgeon.
- The intended use of this instrumentation is for performing a Direct Superior Approach total hip arthroplasty. All medical and surgical indications, contraindications and precautions customarily observed for total hip arthroplasty are applicable.
- The intended patient population includes patients who meet the indications provided in the respective implant IFU (see Product Compatibility).

Warnings and precautions

- The instrumentation in this technique should not be used to implant any other manufacturer's components. Any such use will negate the responsibility of Stryker Orthopaedics for the performance of the resulting implant.
- See package insert for warnings, precautions, adverse effects, information for patients and other essential product information.

Product compatibility

- Compatible femoral stems include:
 - Accolade II
 - Anato
 - Secur-Fit Advanced
 - Exeter
- Compatible acetabular systems include:
 - Trident
 - Tritanium
 - Trident II
- For specific indications and device descriptions, please refer to implant specific surgical techniques.

Cleaning & sterilization

Before using Direct Superior instrumentation, verify:

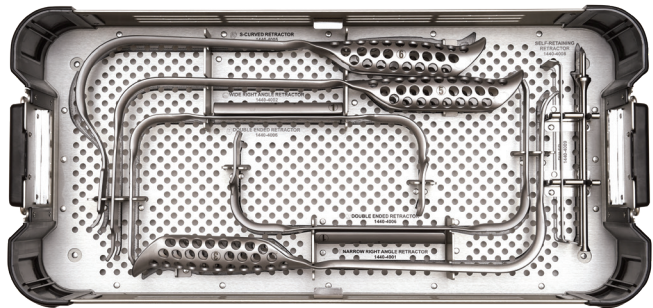
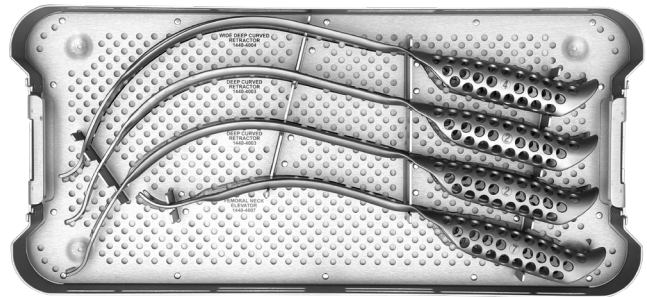
- Instruments have been properly disassembled prior to cleaning and sterilization;
- Instruments have been properly assembled post-sterilization;
- Instruments have maintained design integrity; and,
- Proper size configurations are available.

For instructions for cleaning, sterilization, inspection and maintenance of orthopaedic medical devices, refer to LSTPI-B and for the Incipio OEM High Offset Reamer Handle (#1440-4010) refer to the supplied Assembly/Disassembly Instructions: Incipio Document # 00-502-944-06.

Direct Superior Instrumentation

Retractor Tray[†]

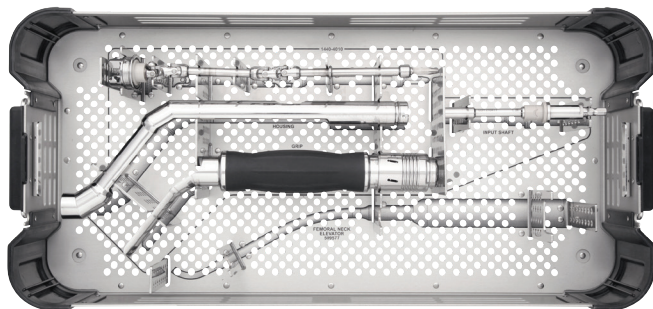
Description	Catalog no.	Qty
Narrow Right Angle Retractor (3)	1440-4001	1
Wide Right Angle Retractor (5)	1440-4002	1
Deep Curved Retractor (2)	1440-4003	2
Wide Deep Curved Retractor (4)	1440-4004	1
S-Curved Retractor (6)	1440-4005	1
Double Ended Retractor (1)	1440-4006	2
Femoral Neck Elevator (7)	1440-4007	1
Pin	1440-4008	2
Angled Ruler	1440-4009	1
Direct Superior Retractors Case	4845-9-000	1



High Offset Reamer Handle Tray[†]

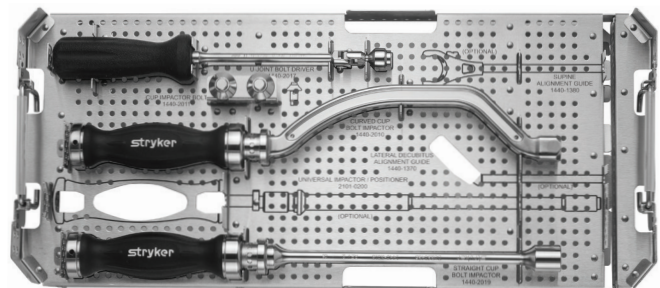
Description	Catalog no.	Qty
High Offset Reamer Handle*	1440-4010	1
High Offset Reamer Handle Case	4845-9-100	1

*OEM medical device



Acetabular Tray[†]

Description	Catalog no.	Qty
U-Joint Bolt Driver	1440-2017	1
Straight Cup Bolt Impactor	1440-2019	1
Curved Cup Bolt Impactor	1440-2010	1
Lateral Decubitus Alignment Guide	1440-1370	Optional
Cup Impactor Bolt	1440-2011	2
Case	4845-7-600	1
Internal Cup Impactor Tray	1440-2093	1



[†]Stryker Orthopaedics has validated these reusable instrument trays with Aesculap's SterilContainer™ System and with CSR wrap. Refer to LSTPI-B (Instructions for Cleaning, Sterilization, Inspection, and Maintenance of Reusable Medical Devices).

Direct Superior Instrumentation/Intended use

Retractors

- A variety of retractors are supplied in the set.
- These include retractors of different widths and profiles to accommodate various exposure objectives and should be used at the discretion of the operating surgeon.



1 1440-4006
Double Ended
Retractor



2 1440-4003
Deep Curved
Retractor



3 1440-4001
Narrow Right Angle
Retractor



4 1440-4004
Wide Deep Curved
Retractor



5 1440-4002
Wide Right Angle
Retractor



6 1440-4005
S-Curved
Retractor



7 1440-4007
Femoral Neck
Elevator



1440-4008
Pin



1440-4009
Angled Ruler

Direct Superior Instrumentation/Intended use (continued)

For acetabular preparation



**1440-4010
High Offset Reamer
Handle**



**1440-2019
Straight Cup Bolt Impactor**



**1440-2010
Curved Cup Bolt Impactor**



**1440-2017
U-Joint Bolt Driver**



**1440-2011
Cup Impactor Bolt**



**1440-1370
Lateral Decubitus Alignment Guide (optional)**

- The Cup Impactors interface with Stryker acetabular shells via a modular bolt. The bolt provides a method for repeated attachment and detachment of the cup impactor.

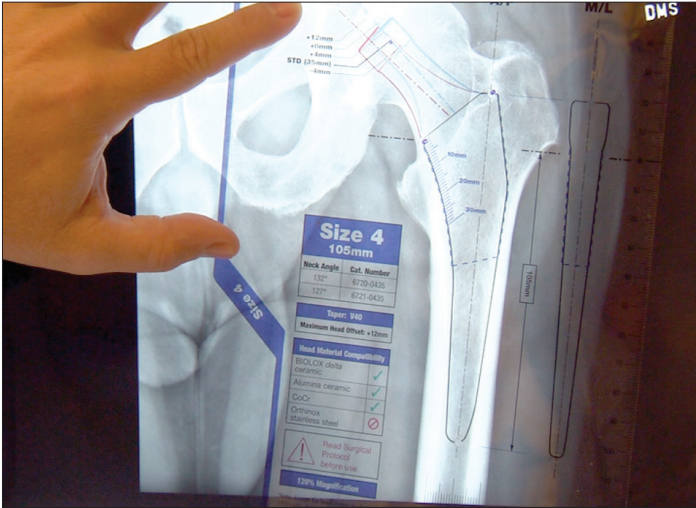


Figure 1



Figure 2



Figure 3

Step 1 - Pre-operative planning and templating

Preoperative planning aids in the selection of the appropriate implant style and size for the patient's hip pathology. It is also used to evaluate:

- Optimal femoral stem fit
- Neck offset
- Acetabular component sizing
- Leg Length
- Assessment of peri-acetabular osteophytes requiring removal

The location of the acetabular component is determined as the initial reference point. From this location, the center of rotation is established. The femoral template is then applied using the center of rotation as the initial landmark (**Figure 1**). The size of the femoral component is selected according to the respective surgical technique. Once the femoral component size is selected, the distance from the center of rotation to the femoral neck cut is determined. The distance from the lateral shoulder of the femoral prosthesis to the tip of the greater trochanter can be used as a secondary guide, since the lesser trochanter cannot be seen or directly palpated during the procedure as it is covered by the external obturator tendon, which is preserved in the DSA approach.

Step 2 - Patient positioning and draping

The patient is positioned in the lateral decubitus position. The patient is positioned as anterior as possible on the operative table (**Figure 2**). This is done to facilitate intra-operative adduction of the operative leg. Pelvic positioners are placed anteriorly on the anterior superior iliac spine, and posteriorly on the sacrum.

The operative leg is flexed to 90 degrees prior to draping in order to ensure that there is no impingement on the anterior pelvic positioner. It is also adducted to 40 degrees and internally rotated to 40 degrees to ensure that the patient is positioned anteriorly enough on the table, and to confirm that the 40-40-40 position can be achieved intra-operatively (**Figure 3**).

Note: The 40-40-40 position refers to 40 degrees of flexion, 40 degrees of adduction, and 40 degrees of internal rotation. This position allows for optimal exposure during femoral preparation.



Figure 4

Step 3 - Skin incision and superficial dissection

The anterior, posterior, and superior margins of the greater trochanter are identified and marked on the skin. The initial incision is made from the posterosuperior corner of the greater trochanter and it extends proximally approximately 9–12cm, in line with the fibers of the gluteus maximus. **(Figure 4).**

Note: The incision should be straight when hip is flexed to 50-60 degrees.

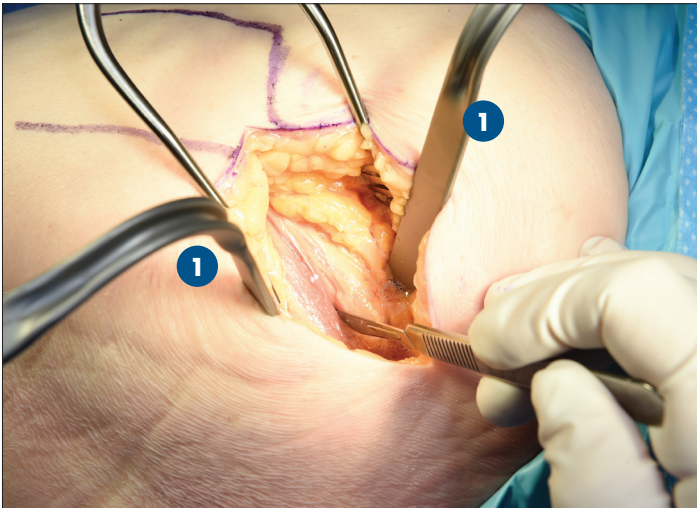


Figure 5

The gluteus maximus fibers are then spread in line with the fascial incision along the longitudinal axis of the muscle fibers. This separation starts at the posterior border of the greater trochanter, and it extends posteriorly for a distance of approximately 8cm **(Figure 5)**. The deep gluteus maximus fascia is then divided bluntly using a Cobb Elevator, exposing pericapsular fat which is deep to it.

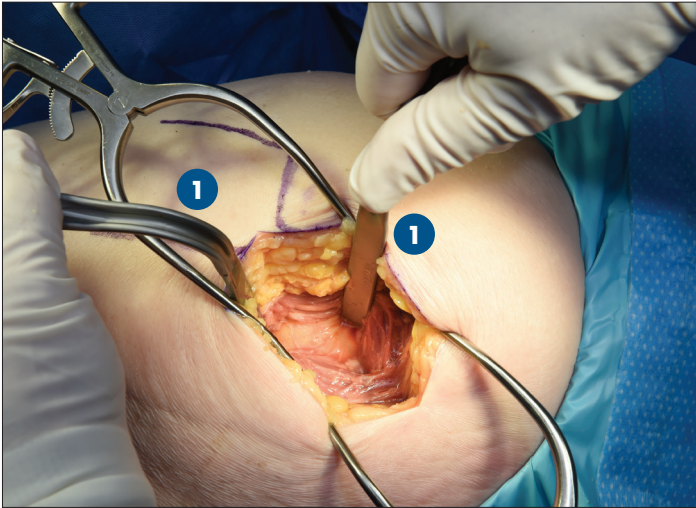


Figure 6

Step 4 - Deep surgical dissection

A (1) Double Ended Retractor (**1440-4006**) is placed superior to the tip of the greater trochanter to retract the gluteus medius anteriorly. A second (1) Double Ended Retractor (**1440-4006**) is placed along the posterior border of the proximal femur, retracting the soft tissue inferiorly (**Figure 6**). The pericapsular fat that is just posterior to the greater trochanter is removed using electrocautery. Care is taken not to stray too posteriorly during this portion of the procedure in order to avoid injury to the sciatic nerve. It is not necessary to surgically expose the sciatic nerve. The sciatic notch is superior and posterior to the field of surgical dissection.

Caution: Due to the proximity of the sciatic nerve it is important to be cautious when removing the pericapsular fat.

Tip from Douglas Roger, MD:

The posterior tip of the greater trochanter should be visualized and palpated and can be used as a landmark to excise the pericapsular fat and expose the underlying tendons.

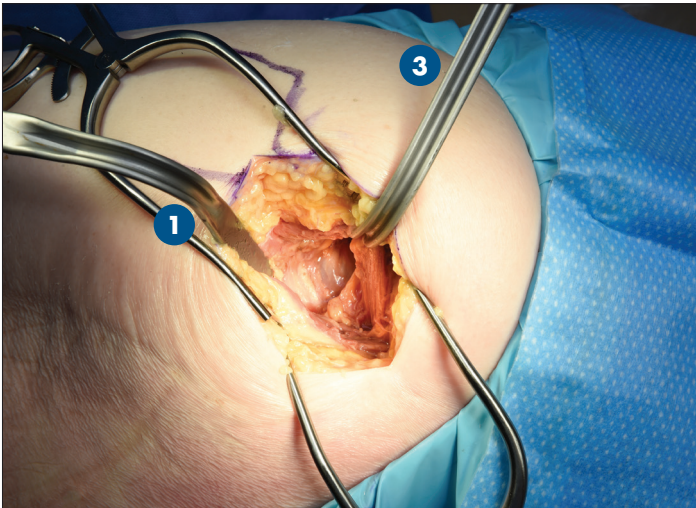


Figure 7

There is a natural plane between the gluteus medius muscle and the gluteus minimus muscle that is deep to it. The (3) Narrow Right Angle Retractor (**1440-4001**) is placed in this plane, taking care not to injure the gluteus medius or gluteus minimus muscles (**Figure 7**).

The piriformis is then identified adjacent to the greater trochanter. It is round and relatively mobile. The obturator internus is identified, which is flat and relatively fixed (**Figure 8**). A (1) Double Ended Retractor (**1440-4006**) is placed along the inferior border of the obturator internus tendon, retracting the inferior gemellus muscle inferiorly.

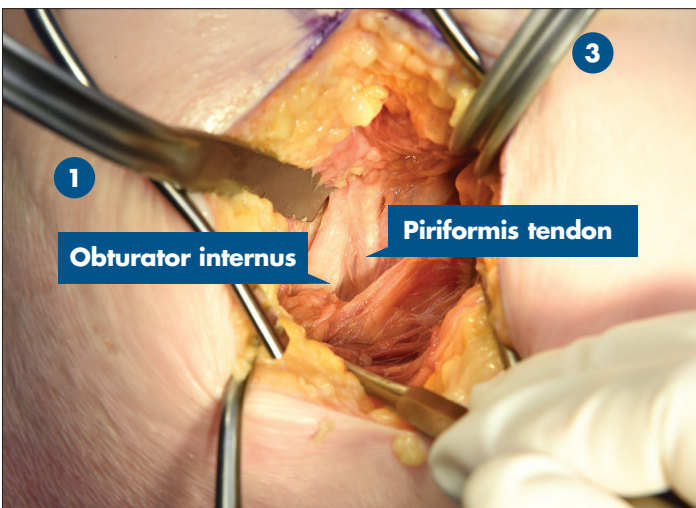


Figure 8

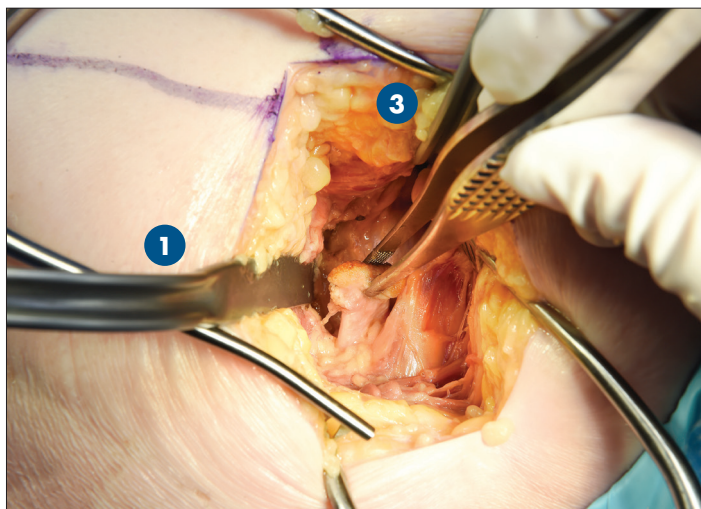


Figure 9

Step 5 - Tendon detachment and capsulotomy

The confluence of the obturator internus tendon and the piriformis tendon is detached as close to its femoral insertion as possible (**Figure 9**). The tendons are then reflected posteriorly, off the hip capsule. The tendons are then sutured to the subcutaneous tissue of the posterior skin flap, and this retracts the sciatic nerve away from the field of surgical dissection (**Figures 10 and 10a**).

Note: As an alternative to suturing the tendons, you have the option to tag them with a hemostat and retract posteriorly to protect the sciatic nerve.

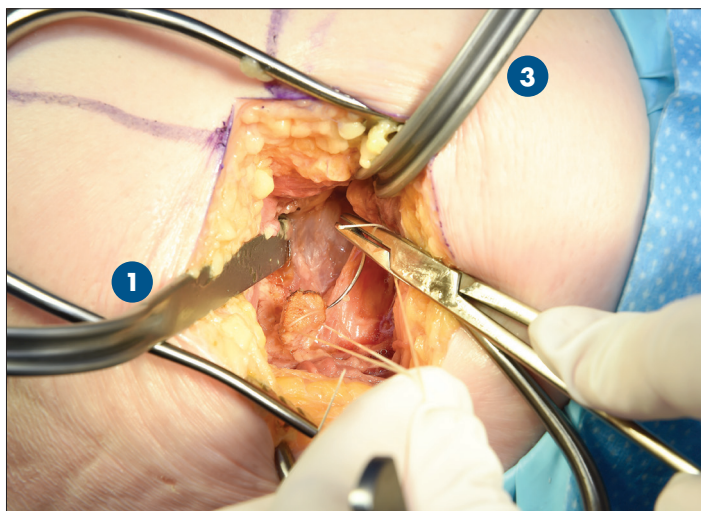


Figure 10

The capsule is then incised from anterior distal to posterior proximal, angled superiorly (**Figure 11**). The superior capsular flap is then elevated subperiosteally, from posterior to anterior, resecting the superior labrum. A similar elevation is done for the inferior capsular flap, resecting the posterior labrum. The capsular flaps should be elevated as much as possible prior to dislocation of the hip.

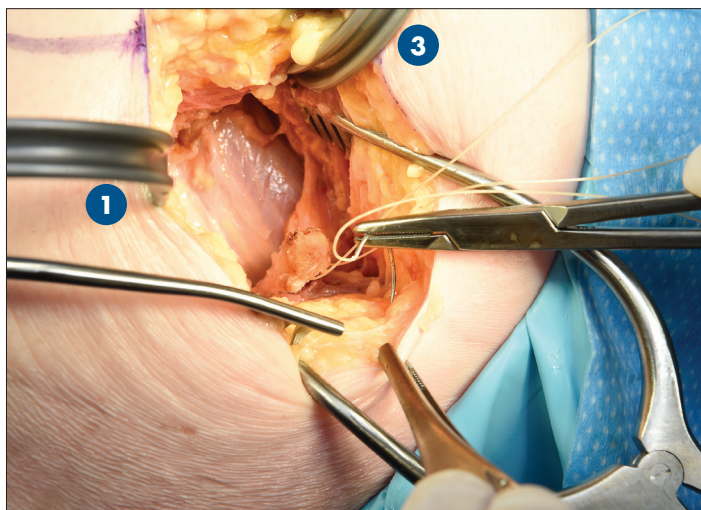


Figure 10a

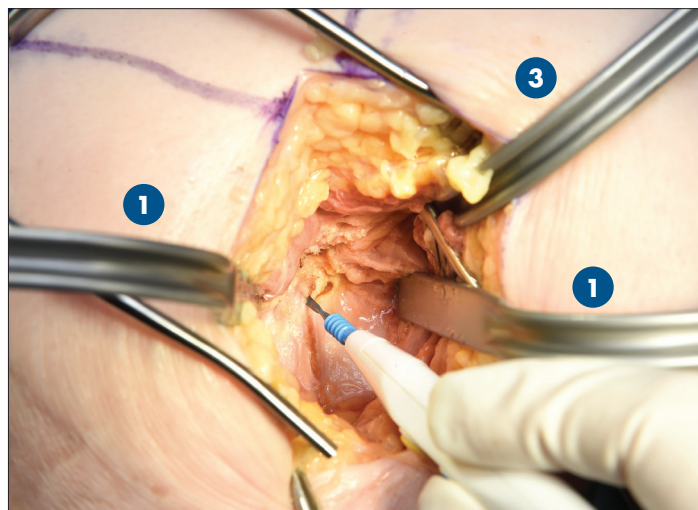


Figure 11

Step 6 - Dislocation and femoral neck resection

Tip from Anthony Hedley, MD:

Once the femoral head and neck are exposed, the synovial tissue along the femoral neck is resected to facilitate maximum exposure.

Prior to dislocation of the hip, the (4) Wide Deep Curved Retractor (1440-4004) is placed inside the capsule along the inferior femoral neck. The (2) Deep Curved Retractor (1440-4003) is placed inside the capsule along the superior femoral neck (Figure 12). The hip is then dislocated by flexion, adduction, and internal rotation.

Once the appropriate level for neck resection is determined, the femoral neck cut is made according to the surgical technique for the femoral implant. The femoral head fragment is then removed using a threaded steinmann pin or tenaculum. After the fragment is removed, it is re-measured from the center of rotation to the cut surface of the femoral neck, to confirm the length of the femoral neck resection.

Tip from Douglas Roger, MD:

There are many techniques for determining the level of the neck resection. It may be helpful to utilize the Angled Ruler (1440-4009) to measure neck resection level from a point established on a preoperative plan (Figures 12a and 12b).

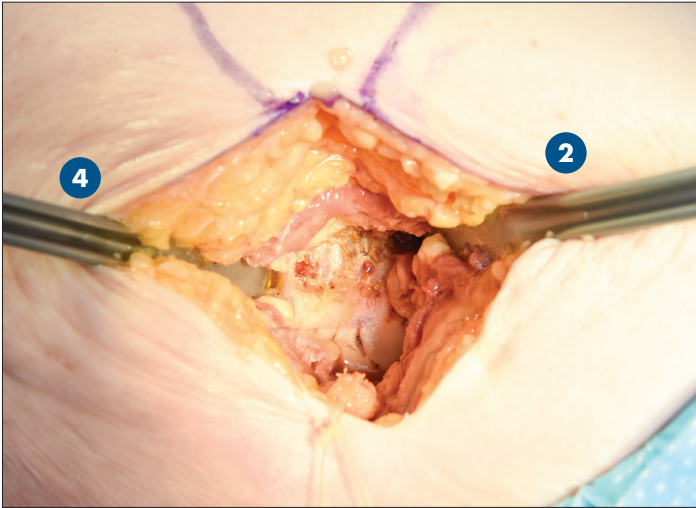


Figure 12

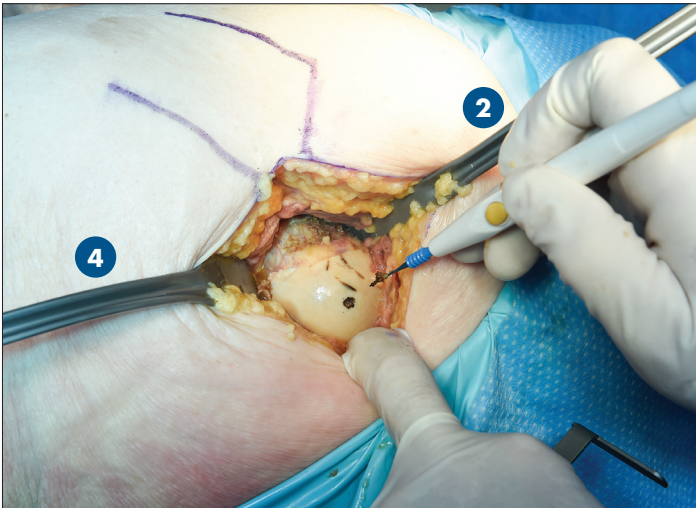


Figure 12a

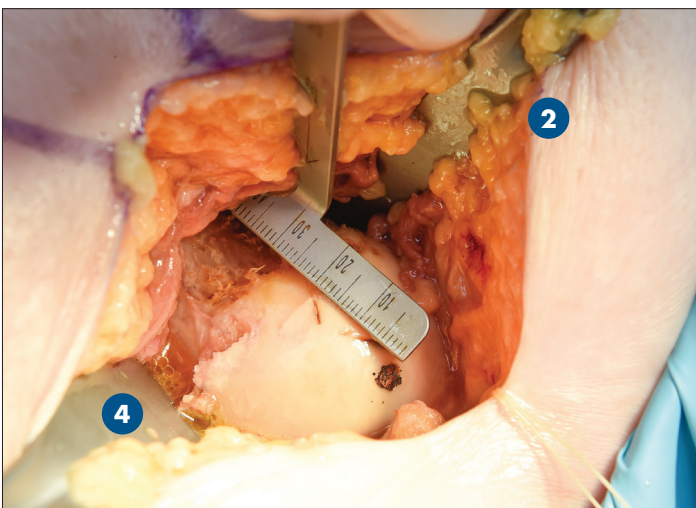


Figure 12b

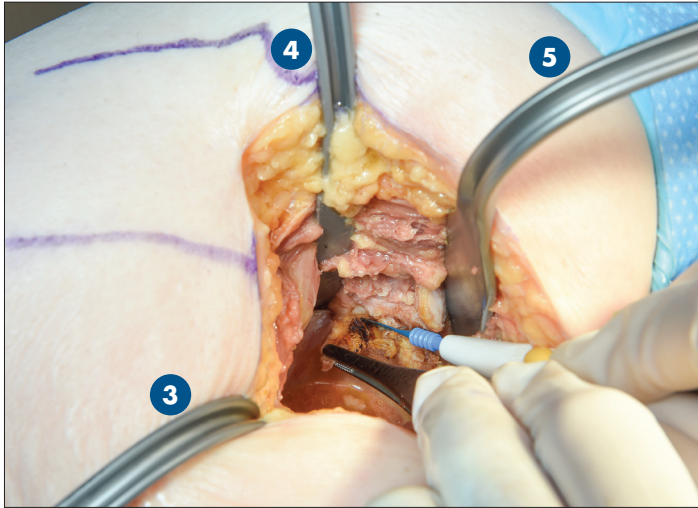


Figure 13

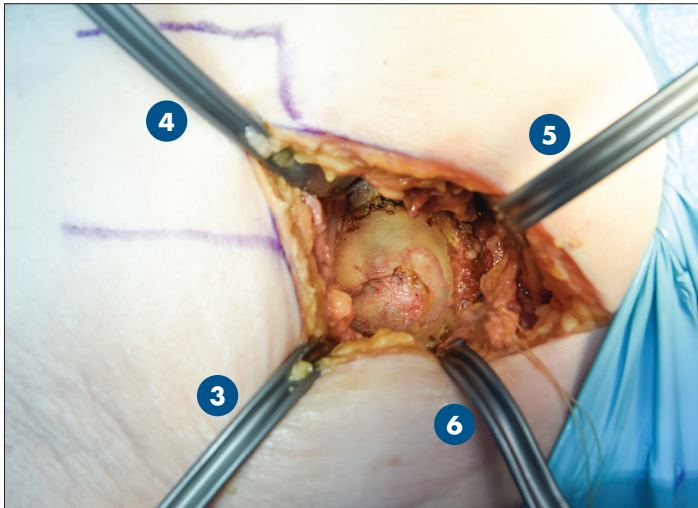


Figure 14

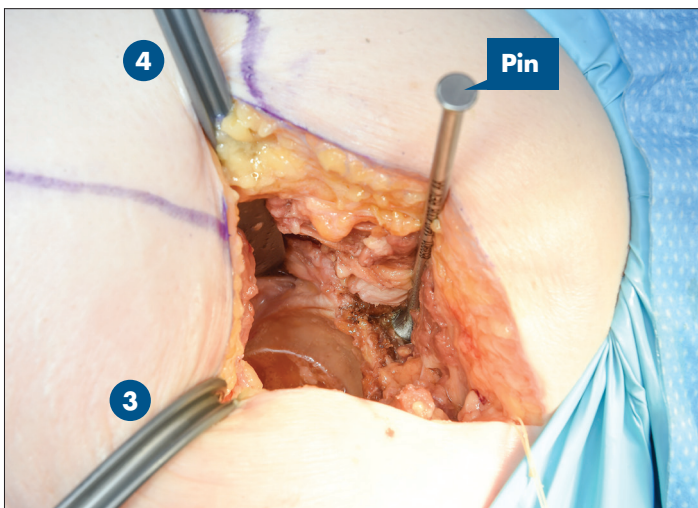


Figure 15

Step 7 - Exposure of the acetabulum and retractor placement

After osteotomy of the femoral neck, retract the proximal femur anteriorly and laterally. The (4) Wide Deep Curved Retractor (**1440-4004**) is placed over the anterior acetabular rim at the 3 o'clock position for the right hip and 9 o'clock position for the left hip.

The (3) Narrow Right Angle Retractor (**1440-4001**) is then placed intracapsular at the inferior margin of the acetabulum.

The hip is then abducted in order to relax the hip abductor muscles and the superior capsule. A (1) Double Ended Retractor (**1440-4006**) is then placed deep to the superior capsule. The superior capsule is then elevated subperiosteally with a Cobb Elevator for a distance of approximately 1–2cm from the superior margin of the acetabulum. A punch is used to create an indentation 1–2cm above the superior rim of the acetabulum, at the 12 o'clock position.

Place the (5) Wide Right Angle Retractor (**1440-4002**) into the indentation, deep to the superior capsule and insert into the ilium, approximately 1cm superior to the superior rim of the acetabulum.

The hip is then placed into extension and internal rotation. After additional subperiosteal elevation of the inferior capsular flap and resection of posterior labrum, an optional fourth retractor, an (6) S-Curved Retractor (**1440-4005**), may be placed on the posterior aspect of the acetabulum. See Figures 13 and 14 for suggested retractor placement.

Tip from Douglas Roger, MD:

To aid in limiting the number of retractors needed, it may be helpful to utilize the Pin (**1440-4008**) in lieu of the superior acetabular retractor. (Figure 15) When using the Pin, placement should be superior enough from the superior acetabular rim so as not to protrude into the acetabulum and interfere with the reaming process. Care must also be taken to not damage surrounding tissue and bone when removing the Pin. As the end of the Pin is sharp, caution should be observed when using.

Caution: When using retractors, rest your hand on the handle and do not push.

Note: While the pin may be impacted, none of the retractors are to be impacted.

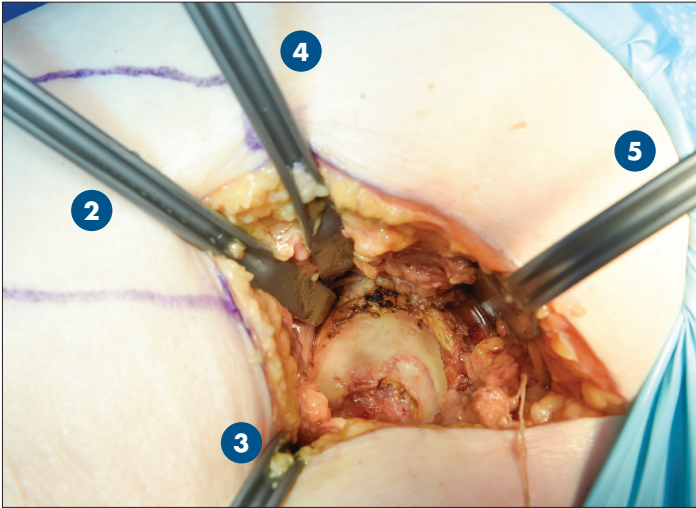


Figure 15

Step 8 - Preparation of the acetabulum

Any remaining anterior labrum is resected at this time. Identify the medial wall at the base of the cotyloid notch, and the transverse acetabular ligament.

An exchange retractor technique is used for the (4) Wide Deep Curved Retractor (**1440-4004**). A (2) Deep Curved Retractor (**1440-4003**) is placed at the 1 o'clock position for a right hip or at the 11 o'clock position for a left hip at the level of the anterior inferior iliac spine. After this retractor has been placed, the previously placed (4) Wide Deep Curved Retractor (**1440-4004**) is removed. This is done in order to prevent impingement of the reamer on the 3 o'clock / 9 o'clock retractor (**Figure 15**).

It is recommended to initially use a straight reamer for medial acetabular reaming.

Next, the High Offset Reamer Handle (**1440-4010**) is utilized for sequential reaming to the required size, according to the surgical technique of the selected acetabular component. The High Offset Reamer (**1440-4010**) is designed to facilitate the reaming process while preserving the DSA anatomy (**Figure 16**). The specific anatomy of each patient, such as pelvic tilt, may influence orientation of the reamer handle. It is recommended that the reamer be pulled away from the acetabular bone initially, so that the reamer rotates freely prior to actual contact with the bone.

Reaming sequence should be determined based on the surgical technique corresponding to the acetabular implant.

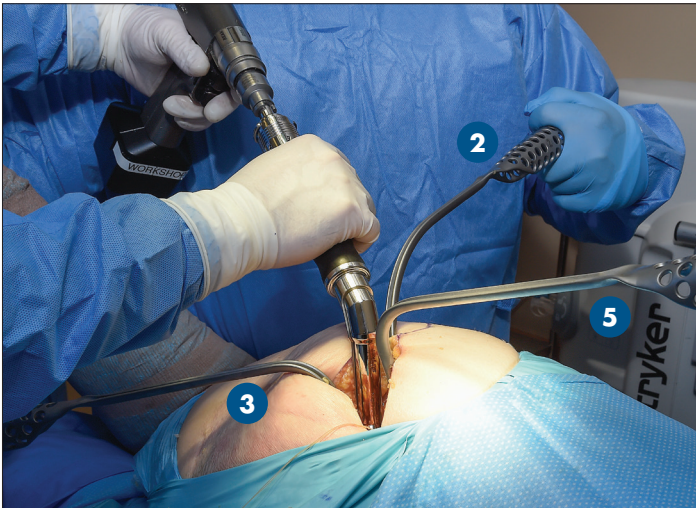


Figure 16



Figure 17

Step 9 - Cup insertion

Implant the cup using the Curved Cup Bolt Impactor (1440-2010) with the Cup Impactor Bolt (1440-2011).

Fully thread the bolt onto the cup, then place the cup in the preferred orientation before attaching the impactor (**Figure 17**).

Alternatively, insert the cup using the impactor, positioning the cup on the impactor so that any screw holes are oriented as desired (**Figures 18-19**). Impact the cup in a manner consistent with its respective surgical technique. Avoid misdirected or excessive force.

The impactor may be detached from the bolt. By keeping the bolt attached to the cup, the cup may be assessed for orientation and quickly reattached to the impactor if needed.

To remove the bolt, partially loosen it by rotating the impactor counterclockwise. Remove by hand, with the Straight Cup Bolt Impactor (1440-2019) or with the U-Joint Bolt Driver (1440-2017) if access to the bolt is limited.

Note: Do not rotate the impactor clockwise as this will further tighten the bolt into the cup. This may make bolt removal more difficult (Figure 19)

If the cup needs to be repositioned after trial reduction, use the Straight Cup Bolt Impactor (1440-2019) or the U-Joint Bolt Driver (1440-2017) to re-insert the bolt. Screw forceps will help control the U-Joint Bolt Driver (1440-2017) during reinsertion.

Tip from Anthony Hedley, MD:

The cup may appear slightly horizontal from this angle. An intraoperative x-ray may be helpful at this point in determining accurate orientation of the acetabular component.

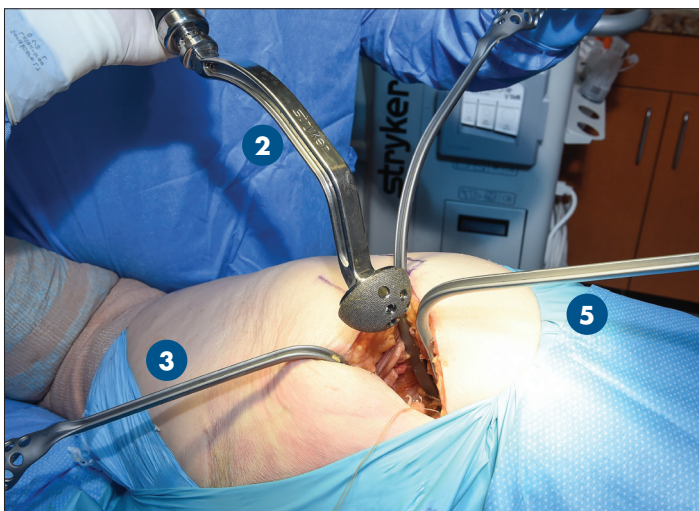


Figure 18

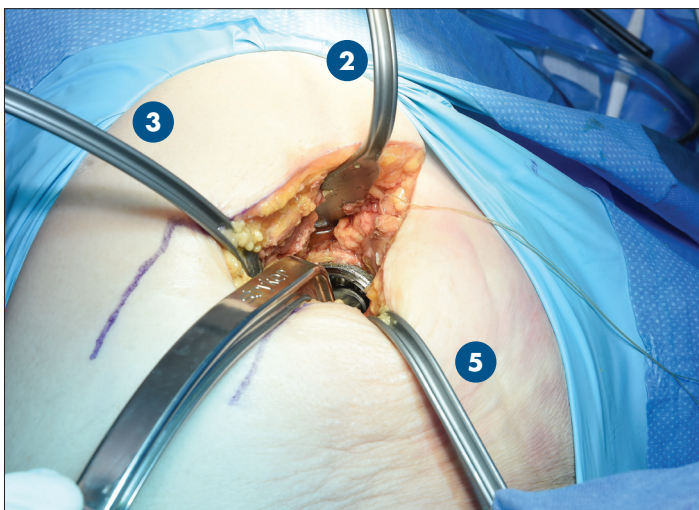


Figure 19

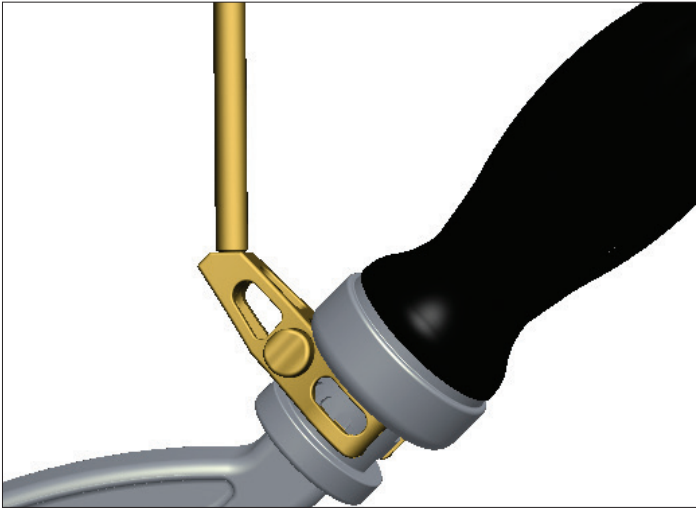


Figure 20

Step 9 - Cup insertion (continued)

Lateral decubitus alignment guide (optional)

Note: The Lateral Decubitus Alignment Guide offers a visual reference to estimate cup inclination and anteversion.

Slide the Alignment Guide onto the Cup Impactor and rotate it around the spindle to the desired location (**Figure 20**). Align the plane of the two crossbars (line A) parallel to the mid-sagittal plane of the pelvis (line B). The mid-sagittal plane can be approximated as the long axis of the patient. This provides a visual approximation of 45° of cup inclination. Be sure to account for pelvic tilt when aligning the crossbars to the floor or OR operating table (**Figures 21 & 22**). Align the side-specific crossbar (marked "LEFT" or "RIGHT"; line C) so that it is parallel to the long axis of the patient (line D). This alignment provides a visual approximation of 20° of cup anteversion (**Figures 21 & 22**).

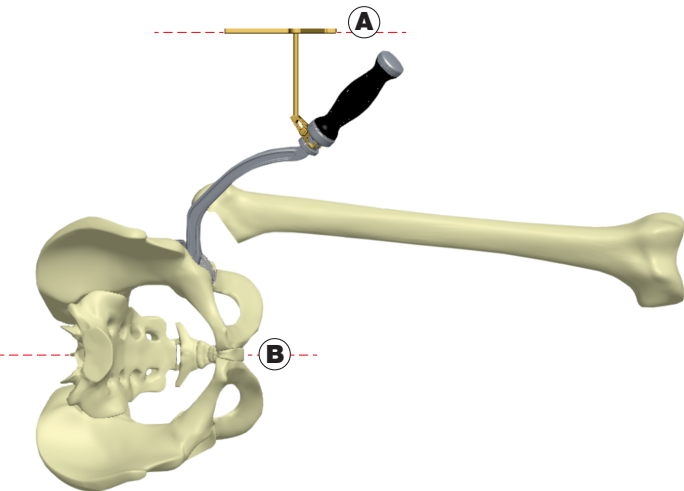


Figure 21

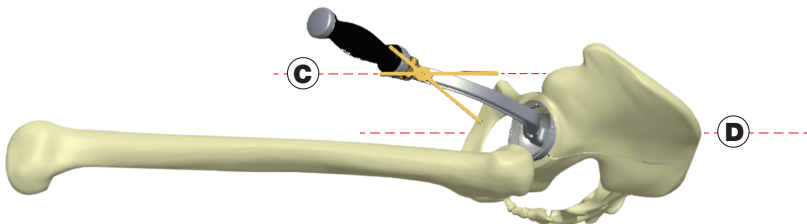


Figure 22

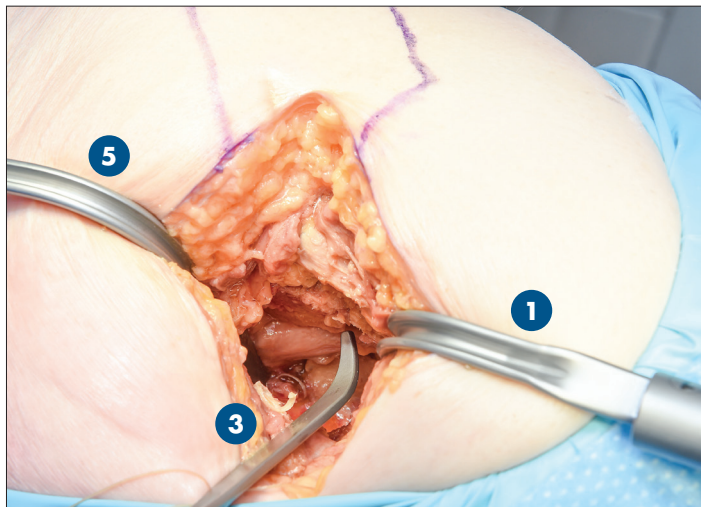


Figure 23



Figure 24

Step 10 - Femoral exposure

Tip from Douglas Roger, MD:

For optimal femoral exposure, it may be helpful to loosen the anterior pelvic positioner to allow for slight forward rotation of the pelvis once the acetabular component has been correctly implanted.

Transitioning from acetabular exposure to femoral exposure is done without allowing the wound to close.

The (3) Narrow Right Angle Retractor (**1440-4001**) is removed, and replaced with a (1) Double Ended Retractor (**1440-4006**) (**Figure 23**). The (2) Deep Curved Retractor (**1440-4003**) is then removed, which allows the proximal femur to be brought in to a more posterior and superior position in the wound. The hip is placed in to the 40-40-40 position, with 40 degrees of flexion, 40 degrees of internal rotation, and 40 degrees of adduction, and adjusted as necessary, with particular emphasis on adduction of the hip (**Figure 24**). If visualization of the cut surface of the neck is limited, further internally rotate the hip.

The (3) Narrow Right Angle Retractor (**1440-4001**) placed over the anterior cortex of the proximal femur, at the junction of the base of the anterior trochanter and the anterior femoral neck.

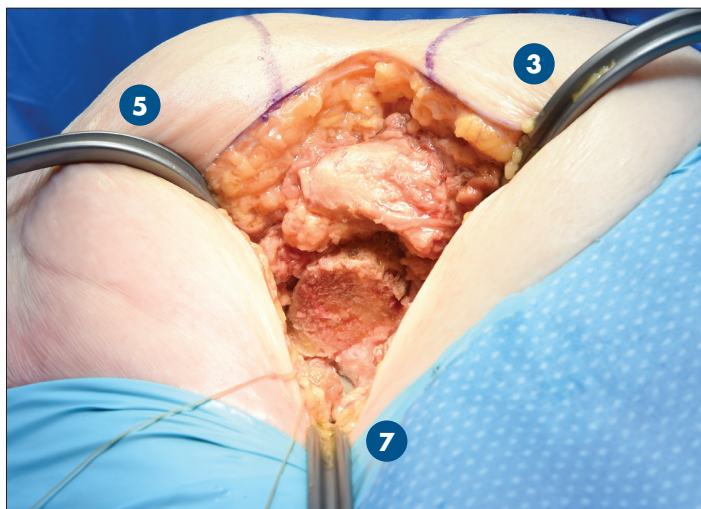


Figure 26

Step 10 - Femoral exposure (continued)

The proximal femur should now be in the central portion of the wound. The (7) Femoral Neck Elevator **(1440-4007)** is then placed under the anterior femoral neck. An optional (5) Wide Right Angle Retractor **(1440-4002)** can be placed intracapsular at the inferior margin of the acetabulum to retract the quadratus femoris and the obturator externus away from the proximal femur, replacing the (1) Double Ended Retractor **(1440-4006)** **(Figure 26)**.

During preparation of the femur, spatial orientation is critical for femoral anteversion, since the leg is at the 40-40-40 position compared to a position of 90 degrees of flexion, 90 degrees of internal rotation **(Figure 27)**.

For femoral preparation and sequential broaching, please refer to the surgical technique for the implant.

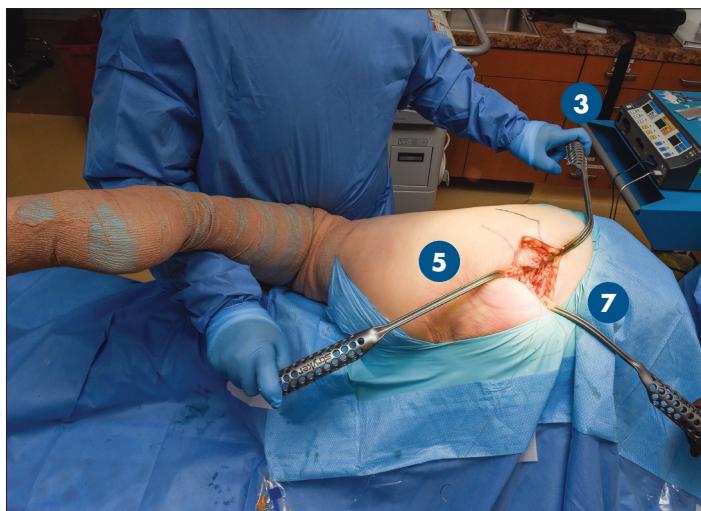


Figure 27

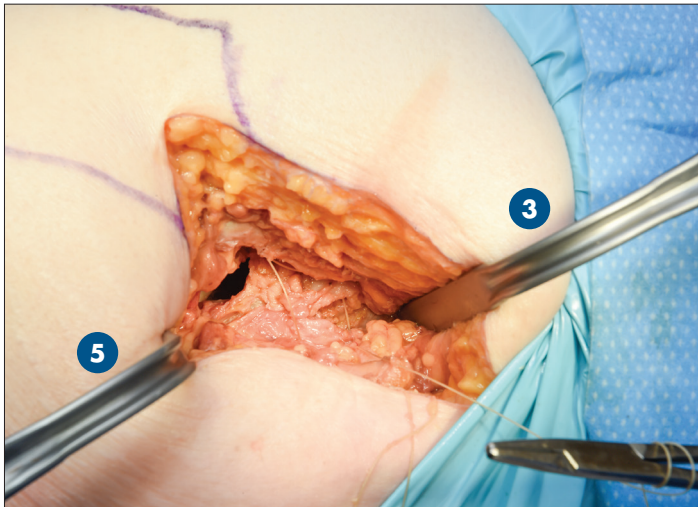


Figure 23

Step 11 - Capsular repair

The hip is placed into extension and slight internal rotation. A (1) Double Ended Retractor (**1440-400**) is used to retract the gluteus medius superiorly. The anterior portion of the superior capsular leaflet is identified. The anterior portion of the superior and inferior leaflets are sutured. The capsule is then closed using a running suture from anterior to posterior (**Figure 28**).

Step 12 - Tendon repair

The obturator internus tendon and piriformis tendon are repaired (**Figure 29**). The superficial gluteus maximus fascia is closed from anterior to posterior. Tissue and skin are closed according to surgeon preference.

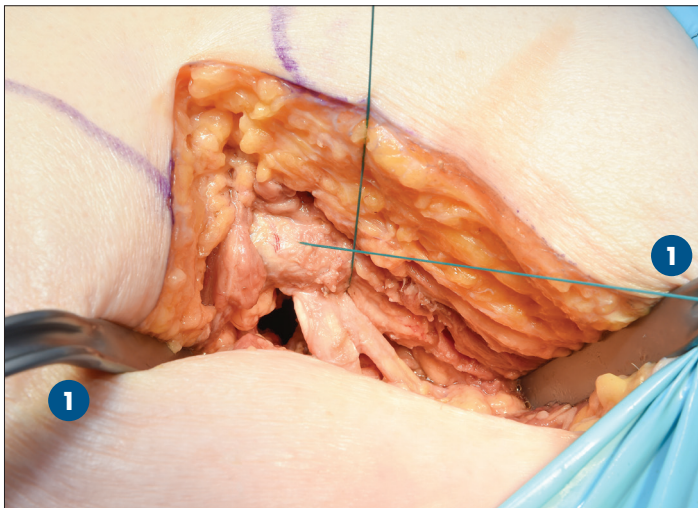


Figure 24

Notes

[illegible]

Joint Replacement

A surgeon must always rely on his or her own professional clinical judgment when deciding whether to use a particular product when treating a particular patient. Stryker does not dispense medical advice and recommends that surgeons be trained in the use of any particular product before using it in surgery.

The information presented is intended to demonstrate the breadth of Stryker's product offerings. A surgeon must always refer to the package insert, product label and/or instructions for use before using any of Stryker's products. The products depicted are CE marked according to the Medical Device Directive 93/42/EEC. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your sales representative if you have questions about the availability of products in your area.

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