ZIMMER MIS™
MINI-INCISION
FOR TOTAL HIP
REPLACEMENT

Posterolateral Approach
Surgical Technique
MIS MINI-INCISION FOR TOTAL HIP REPLACEMENT POSTEROLATERAL APPROACH SURGICAL TECHNIQUE

THIS SURGICAL TECHNIQUE WAS DEVELOPED IN CONJUNCTION WITH:

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INTRODUCTION
As you begin to perform minimally invasive Total Hip Arthroplasty (THA), it is important to shorten your skin incision gradually. Start with a patient who is generally smaller and less muscular. Typically, females are more suitable candidates than males. In addition, varus femoral neck angles facilitate this approach, while long valgus femoral necks make minimal-incision hip arthroplasty more challenging. Again, it is important to slowly decrease your incision size until you have achieved a true minimal-incision THA.

PREOPERATIVE PLANNING
The importance of preoperative planning and templating cannot be overemphasized. This is particularly true in the case of a minimally invasive total hip arthroplasty where visualization of extra-articular landmarks is limited.

The overall objective of preoperative planning is to enable you to gather anatomic parameters that will allow accurate intraoperative placement of the femoral and acetabular implants. Optimal femoral stem and acetabular component fit, the level of the femoral neck cut, the prosthetic neck length, and the femoral component offset can be evaluated through preoperative radiographic analysis. Preoperative planning also allows the surgeon to have the appropriate implants available at surgery.

The specific objectives of preoperative planning include:

1. Determination of leg length.
2. Establishment of appropriate abductor muscle tension and femoral offset.
3. Determination of the anticipated component sizes.

Determination of Leg Length
Determining preoperative leg length is essential for restoration of the appropriate leg length during surgery. For most patients, leg lengths are not equal. However, if leg lengths are equal in both the recumbent and standing positions, the leg length determination is simplified. If there are concerns regarding other lower extremity abnormalities, such as equinus of the foot or significant flexion or varus/valgus deformities of the knee, perform further radiographic evaluation to aid in the determination of preoperative leg length. The presence of scoliosis may also be the cause of an apparent leg length discrepancy.

As in all total hip arthroplasties, preoperative templating using an A/P view of the pelvis is usually the most accurate method of determining proper leg length. If more information is needed to confirm leg length, a scanogram or CT evaluation of leg length may be helpful. From the clinical and radiographic information about leg lengths, determine the appropriate correction, if any, to be achieved during surgery.

Standard intraoperative osteotomy guides, which are part of the Versys® Hip System, can be easily used through a minimally invasive incision. Many intraoperative leg length confirmation systems may be used with this approach.
**Determination of Abductor Muscle Tension and Femoral Offset**

After determining the desired postoperative leg length, consider the requirement for abductor muscle tension. When the patient has a very large offset between the center of rotation of the femoral head and the line that bisects the medullary canal, the insertion of a femoral component with a lesser offset will, in effect, medialize the femoral shaft. To the extent that this occurs, laxity in the abductor muscles will result.

VerSys Fiber Metal and Beaded Midcoat stems have a specific advantage in this regard. They are offered in three offsets; standard, extended, and extra-extended in a 135° neck angle and a 125° neck angle (low head center). This versatility in offset and length enables the surgeon to reproduce almost any offset encountered.

Although rare, it may not be possible to restore offset in patients with an unusually large preoperative offset or with a severe varus deformity. In such cases, the tension in the abductor muscles can be increased by lengthening the limb. This method is especially useful when the involved hip is shorter than the contralateral hip. If this option is not practical, and there is great disparity between the preoperative offset and the offset achieved at surgery by using the longest head/neck component possible, some surgeons may choose to osteotomize and advance the greater trochanter to eliminate the slack in the abductor muscles.

Another option is to utilize the oblique liners in the Trilogy® Cup. The oblique liner specifically increases offset. Technical variations in the placement of the acetabular component can also reduce the difference in offset.

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**Component Size Selection/Templating**

Preoperative planning for insertion of a cementless femoral component requires at least two views of the involved femur: an A/P view of the pelvis centered at the pubic symphysis, and a frog leg lateral view on an 11x17-inch cassette. Both views should show at least 8 inches of the proximal femur. It may also be helpful to obtain an A/P view of the involved side with the femur internally rotated. This compensates for natural femoral anteversion and provides a more accurate representation of the true mediolateral dimension of the metaphysis.

When templating, magnification of the femur will vary depending on the distance from the x-ray source to the film, and the distance from the patient to the film. The VerSys Hip System Templates (Fig. 1) use standard 20% magnification, which is near the average magnification on most clinical x-ray films.

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**Fig. 1**
Large patients and obese patients may have magnification greater than 20% because their osseous structures are farther away from the surface of the film. Similarly, smaller patients may have magnification less than 20%. To better determine the magnification of any x-ray film, use a standardized marker at the level of the femur. (Templates of 15% and 10% magnification can be obtained by special order.)

**Templat ing the acetabulum**
The initial templating begins with the A/P radiograph. Superimpose the acetabular templates sequentially on the pelvic x-ray film with the acetabular component in approximately 40° of abduction. Range of motion and hip stability are optimized when the socket is placed in approximately 35° to 45° of abduction. Assess several sizes to estimate which acetabular component will provide the best fit for maximum coverage. Mark the acetabular size and position, and the center of the head on the x-ray films. (Refer to the Trilogy Acetabular System surgical technique for further details on acetabular reconstruction.)

**Templat ing the femoral head**
The VerSys Hip System includes six head diameters. In most patients with average-sized acetabula, consider a femoral head with an intermediate diameter, such as 26mm or 28mm, or 32mm. The intermediate femoral heads allow the use of an acetabular component with an outside diameter small enough to seat completely in the bone.

In special circumstances, such as the treatment of small patients and patients with congenital hip dysplasia and small acetabular volume, consider using a 22mm diameter head to allow for adequate polyethylene thickness.

**Templat ing the Femur**
The specific objectives in templating the femoral component include:

1. Determination of the anticipated size of the implant to be inserted.
2. Determination of the height of the implant in the femur and the location of the femoral neck osteotomy.

Consider the position and thickness of the acetabular component in estimating the optimum femoral neck length to be used. To simplify this, the acetabular templates are separate from the femoral templates. This allows any femoral component to be matched with the desired acetabular component by placing the femoral template over the acetabular template. This will provide the best estimation of femoral component size and head/neck length necessary to achieve the correct leg length.
Select the appropriate femoral template. The VerSys Fiber Metal Taper Hip Prosthesis is available in 12 standard body sizes (9mm-20mm) and 10 large metaphyseal (LM) sizes (11mm-20mm); also 10 standard extended offset sizes (11mm-20mm) and 10 LM extended offset sizes (11mm-20mm).

The femoral templates show the neck length and offset for each of the head/neck combinations (-3.5mm to +10.5mm, depending on head diameter). Note that skirts are present on the +7mm configurations of the 26mm, 28mm, and 32mm heads and on the +10.5mm configurations of the 26mm, 28mm, 32mm, 36mm, and 40mm heads.

To estimate the femoral implant size, assess both the distal stem size and the body size on the A/P radiograph, and then check the stem size on the lateral radiograph. Superimpose the template on the isthmus and estimate the appropriate size of the femoral stem. The stem of the femoral component should fill, or nearly fill, the medullary canal in the isthmus area on the A/P x-ray film. Next, assess the fit of the stem body in the metaphyseal area. The medial portion of the body of the component should fill the proximal metaphysis as fully as possible, compatible with the anatomic endosteal contours of that region. Large Metaphysis (LM) bodies are available in the VerSys Porous Primary Hip System.

Check the fit of the stem on the lateral x-ray film. If the lateral x-ray film reveals that the A/P dimension of the isthmus is greater than the mediolateral dimension shown on the A/P film, it may be helpful to increase the size of the stem to better fill the proximal region. Template the next larger size femoral component on the A/P radiograph to determine the amount of cortical bone that would be removed by reaming (optional) to this size.

After establishing the appropriate size of the femoral component, determine the height of its position in the proximal femur. Generally, if the leg length is to remain unchanged, the center of the head of the prosthesis should be at the same level as the center of the femoral head of the patient’s hip. This should also correspond to the center of rotation of the templated acetabulum. To lengthen the limb, raise the template proximally. To shorten the limb, shift the template distally.

Once the height has been determined, note the distance in millimeters from the most proximal aspect of the porous surface to the top of the lesser trochanter by using the millimeter scale on the template. For example, from the templating, one might choose a 52mm OD acetabular component, with a size 15 femoral stem and a +3.5 x 28mm diameter femoral head placed 15mm above the lesser trochanter.

Proximal/distal adjustments in prosthesis position can reduce the need for a femoral head with a skirt. (The skirted heads allow less range of motion than the nonskirted heads, which may increase the possibility of dislocation.)
SURGICAL TECHNIQUE

Positioning and Incision

Before beginning a minimally invasive THA, it is critical to confirm that the patient's pelvis is in a predictable, stable position. As little as 5° of A/P tilt of the pelvis can create significant challenges in exposure of both the acetabulum and femur. In particular, forward tilt of the pelvis will limit visualization of the acetabulum. As such, it is important to use some form of pelvis-stabilizing device such as the McGuire hip holder, a Montreal hip holder, or a peg board. Be aware that the use of most of these devices creates approximately 20° of flexion of the pelvis. It is important to compensate for this increased pelvic flexion when positioning the acetabular component. In addition, it is recommended that a carpenter's level be used to confirm that the patient's pelvis is positioned exactly perpendicular to the floor with no anterior/posterior or proximal/distal tilt.

Once the patient is draped and prepped on the operating table, determine the landmarks for the surgical incision. Mark the high point of the pelvis, which is the point at which the lumbar paraspinal muscles meet the lateral border of the posterolateral ilium. This point can usually be palpated in minimally invasive arthroplasty patients. Mark a second point approximately two finger breadths posterior to the high point of the pelvis and directed towards the center of the apex of the greater trochanter. Then mark the most proximal border of the greater trochanter.

Make a slightly oblique incision, measuring approximately 7-8cm, with 70% of the incision distal to the proximal pole of the greater trochanter and 30% proximal to the proximal pole of the greater trochanter (Fig. 2). The incision is typically made obliquely so as to make a straight line from the incision to the posterior/superior iliac spine. It is important to center the incision over the greater trochanter. If any doubt exists as to the exact application, it is best to err slightly posteriorly. An excessively anterior incision will compromise visualization of the femoral neck and collar.

Exposure

Once the skin incision has been made, divide the subcutaneous tissue using electrocautery to achieve hemostasis. Identify and incise the gluteus maximus muscle and fascia lata in the direction of the incision. Bluntly split the gluteus maximus muscle. You may extend the fascial incision distally beyond the level of the skin incision, undermining the skin incision approximately 1 cm in this area. This will significantly improve exposure. Proximal extension is unnecessary.

Identify and protect the sciatic nerve by placing the Charnley-type retractor (Initial Skin Incision Retractor) into position. It is important to use the Long Arm Retractors, which have been modified from the standard Charnley retractors because the arms of the standard device will not engage in a minimal position.
Hold the lower extremity in neutral extension, gravity adduction, and forced internal rotation. Identify the tendon of the piriformis muscle. Position a Cobb elevator along its superior border and push it anteriorly to separate the gluteus minimus muscle from the hip capsule. Along the piriformis fossa, incise the piriformis tendon, conjoined tendon and, if necessary, the proximal 5mm of the quadratus femoris tendon. Carry this dissection down through pericapsular fat and the hip capsule. Do not separate the rotators from capsule.

Perform a radial capsulotomy along the superior border of the piriformis muscle. Then, place a long Kocher clamp onto the internal surface of the posterior capsular flap. Slide a scalpel blade on a long knife handle under the previously placed Cobb elevator (separating the gluteus minimus muscle from the hip capsule), and divide the superior capsule from posterior to anterior. Incise the remaining posterior/inferior capsule with electrocautery.

**Determination of Leg Length**

Establish landmarks and obtain measurements before dislocating the hip so that, after reconstruction, a comparison of leg length and femoral shaft offset can be obtained. From this comparison, adjustments can be made to achieve the goals established during preoperative planning. There are several methods to measure leg length, and the choice of method is dependent on individual surgeon preference.

**Osteotomy of the Femoral Neck**

One potential technical error in total hip replacement surgery is insertion of the femoral component in a varus position. The likelihood of this error can be reduced by improving visualization of the posterior femoral neck. To accomplish this, remove all of the remaining soft tissue from the posterior femoral neck, exposing the intertrochanteric crest and the junction between the femoral neck and greater trochanter (Fig. 3). Release some of the inferior capsule to expose the lesser trochanter. This is facilitated by extension of the hip by the 1st assistant. This will move the lesser trochanter into your incision. When the ideal position of the appropriately selected femoral component was determined during the preoperative planning, the distance between the top surface of the lesser trochanter and the proximal level of the porous surface was noted. In the example used, this measurement was 15mm. Use this information to determine the level for the femoral neck osteotomy.

Dislocate the hip posteriorly with gentle hip flexion, adduction, and internal rotation. Place the tibia perpendicular to the femur. Then direct the foot toward the ceiling to deliver the proximal femur into the wound.
Superimpose the VerSys Osteotomy Guide (Fig. 4) on the femur. This guide is a metal replica of the acetate template. There are two criteria for positioning the guide:

1. Determine the varus or valgus relationship so the center line of the femoral stem overlies the diaphyseal midline bisecting the longitudinal axis of the medullary canal. In the region of the isthmus, palpate both the medial and lateral cortices of the femur through the bulk of the vastus lateralis muscle group to determine the distal position of the Osteotomy Guide.

2. Once neutral alignment has been determined, move the Osteotomy Guide proximally or distally to the correct height, as determined by preoperative planning. The Osteotomy Guides have a linear scale starting at the collar and running distally along the medial edge. This scale is identical to that used preoperatively on the template. The center hole, marked “STD” (standard), should be aligned with the center of rotation of the femoral head. (The “REV” and “LD” markings correspond to the center of rotation of the revision and low demand/fracture implants.) The tip of the greater trochanter should coincide with the mark designated as “S” (for standard) on the lateral edge of the Osteotomy Guide.

(The “R” and “L” markings correspond to the revision and low demand/fracture implants.)

This alignment of the Osteotomy Guide would be appropriate for most femurs that have a neck shaft angle of 135°. However, if the femur has a neck shaft angle more than or less than 135°, adjustments to the position of the Osteotomy Guide should be made. Since, in the example used, the desired position of the height of the femoral component is 15mm proximal to the top of the lesser trochanter, adjust the template proximally and distally until that relationship has been established. At that point, use electrocautery to inscribe a line across the femoral neck parallel to the undersurface of the Osteotomy Guide.

Using the inscribed line as a guide, perform the osteotomy of the femoral neck (Fig. 5). A single side sharp reciprocating saw should be used for next osteotomy. To prevent possible damage to the greater trochanter, stop the cut as the saw approaches the greater trochanter. Remove the saw and either bring it in from the superior portion of the femoral neck to complete the osteotomy cut, or use an osteotome to finish the cut.

Fig. 4

Fig. 5
Preparation of the Acetabulum

Acetabular Exposure

Note: During acetabular reaming, it is important to ensure that the proximal femur has been adequately retracted anteriorly. For this reason, a number of specially configured anterior acetabular retractors are available with this system to provide the most appropriate degree of anterior retraction.

To maximize anterior retraction of the proximal femoral metaphysis and facilitate acetabular exposure, incise the inferior capsule down to the transverse acetabular ligament. Then place the Single Point Anterior Retractor or the Flanged Retractor along the anterior wall of the acetabulum to retract the proximal femoral metaphysis anteriorly. The flange-type extension on the retractor should point caudal and will keep the anterior/inferior capsule from overlying the field of view.

Place a Lit Inferior Retractor, held by an assistant, on the internal aspect of the transverse acetabular ligament (Fig. 6).

Resect the acetabular labrum and the overhanging superior capsule. Osteophyte resection may be performed before or after the acetabular shell has been inserted. Furthermore, it is often easier to remove significant posterior/inferior osteophytes once the trial reduction of components has been performed and tension has been reestablished across the hip joint and soft tissues. Use a slightly curved 1.5cm curved-on-flat osteotome to remove anterior osteophytes, and a straight 1.5cm osteotome for posterior and posteroinferior osteophytes. Care must be taken to identify and protect the sciatic nerve during excision of the posterior osteophytes.

Place a large Charnley curette into the acetabulum and remove any remaining islands of articular cartilage and identify the true medial wall of the acetabulum.
**Acetabular Reaming**

To protect the distal corner of the skin incision, insert the Skin Protector, pull it down fully distally, and ensure that it is engaged.

Begin reaming the acetabulum with the largest Low-profile Acetabular Reamer that will bottom out in the acetabulum (Fig. 7).

**Note:** Hold the reamer steady and apply pressure in the same direction that the prosthesis will be implanted (Fig. 8). Be careful to avoid leveraging the reamer shaft against soft tissue while reaming. This may cause eccentric reaming of the acetabulum.

In cases of a significant shelf osteophyte, transversely ream the acetabulum to obtain appropriate acetabular component depth. The acetabulum is generally reamed to 2mm less than the size of the selected Trilogy Acetabular Component.

**Note:** The shells of the Low-profile Acetabular Reamers are more than hemispherical. The perimeter edge extends an additional 4mm beyond the level of a hemisphere. Be careful to avoid reaming through the medial wall of the acetabulum. An etched line on the reamers indicates the level of a typical hemispherical reamer. Be sure to check this line before reaming a profused acetabulum to prevent inadvertant medial cup position.

Assess bone quality and determine the appropriate implant size and type. Determining proper fit for press-fitting must be guided by surgical judgement to avoid fracturing the acetabulum.
Shell Insertion
Check to make sure the patient is correctly positioned on the table. Connect the final prosthesis to the Offset Shell Inserter by tightening the knurled knob. Be sure to position the acetabular shell in the inserter so that the locking mechanism will be easily visible superiorly or posterosuperiorly (eleven o’clock on a right hip or one o’clock on a left hip) after the shell has been inserted. Attach the Lateral Alignment Frame to the inserter by tightening the thumb screw.

Insert the shell into the prepared acetabulum. With the Lateral Alignment Frame parallel to the body, align one arm of the A-frame with the long axis of the body (Fig. 9). This will achieve 45° abduction and 20° forward flexion (Fig. 10). Impact the shell with numerous short strikes from a small mallet. The impact required to safely seat the implant is dictated by the bone quality. During impaction, it may be necessary to periodically retighten the knurled knob on the shell inserter. The Lateral Alignment Frame may be removed to complete the final seating. Use the screw holes, or the positioner hole on the spiked shell, to determine if the shell is fully seated.

If desired, accessory acetabular fixation screws may be used without modifying the standard technique. Neurologic and vascular injury can be minimized by using the posterior quadrants for transacetabular screw placement. The cluster-holed shell should be positioned to allow screw placement in the posterior/superior and/or posterior/inferior quadrants of the acetabulum.

Fig. 9

Fig. 10
Preparation of the Femur

Femoral Exposure

Remove the Flanged Retractor, the Single Point Large Retractor, and the Kocher clamp.

Technique Tip

Be sure that the dependent lower extremity has been fully flexed on the operating table to allow more adduction of the operated limb in neutral flexion and thereby maximizes visualization. This additional adduction delivers the proximal femur into the wound and minimizes the tendency to abrade the proximal pole of the skin edge. Additionally, placing a sterile bolster in the peroneal area of the patient may further maximize adduction of the operated limb. It is important to avoid significant flexion of the operated limb. The position of actual flexion, adduction and internal rotation will center the femur in the incision and avoid excessive pressure on the sciatic nerve.

To maintain exposure during broaching, place an Army-Navy, or a similar retractor may be placed along the medial border of the calcar to be held by the assistant. Position the Long Femoral Elevator/Proximal Skin Protector into the wound to elevate the proximal femur and protect the proximal pole of the incision (Fig. 11).

Insert the VerSys Tapered Awl (Fig. 12). Be careful to avoid excessive posterior (superficial) positioning of the awl as this would tend to direct the tip of the prosthesis anteriorly and, theoretically, may increase the risk of impingement of the distal tip on the endosteum, thereby increasing the possibility of thigh pain.
Use the Box Osteotome to remove bone from the medial portion of the greater trochanter and the lateral femoral neck (Fig. 13). Direct the chisel slightly laterally and in the appropriate rotation. The opening must be large enough for the passage of each sequential rasp to ensure neutral rasp/implant alignment. If preferred, use the Side Cutting Reamers to remove the medial portion of the lateral trochanter (Fig. 14).

The smooth bullet tip is designed to engage in the metaphysis superior to the diaphysis. Choose the reamer that is one size larger than the x-ray templating. If the femur is templated to 14mm, then choose the 15mm Side Cutting Reamer. Undersizing the reamer allows the reamer to enter the diaphysis and this may cause removal of bone in the femoral canal (Fig. 15). Ensure that the reamer is well seated before engaging the medial trochanter to avoid excessive removal of bone.
Once the reamer is chosen, insert the reamer in a neutral position to ensure no medial, anterior or posterior bone is removed (Fig. 16). Start the reamer, and bring the cutting edges of the reamer to the medial portion of the greater trochanter until enough bone is removed to insert the rasp.

**Note:** When preparing the femur for rasping, be sure that the opening is large enough to accommodate the appropriate rasp, as an insufficient opening may result in varus stem positioning. If the opening is too small, use the Box Osteotome or Side Cutting Reamer again. It is also important to ensure that the opening is not significantly larger than the rasp or implant.

Incise any retained soft tissue or stumps of short external rotators from the piriformis fossa using a scalpel blade or electrocautery.
**Attachment of the Rasp Alignment Tip (Optional)**

Note: The Rasp Alignment Tip is necessary only if intramedullary reaming is performed.

Thread the Rasp Alignment Tip onto the end of the rasp ensuring that the tip is fully engaged with the distal rasp threads (Fig. 17). The Rasp Alignment Tips are labeled to correspond with their mating rasp, e.g., a 14mm rasp requires a 14mm Rasp Alignment Tip. The purpose of the Rasp Alignment Tip is to centralize the rasp within the reamed canal and minimize malalignment of the rasp which may cause the prosthesis to be positioned in varus or valgus. The Rasp Alignment Tips measure 1mm in diameter less than their labeled size to maintain appropriate distal clearance with a femoral canal while still centralizing the rasp in a reamed canal.

**Femoral Rasping**

Note: The VerSys Fiber Metal Taper Stem should be implanted with the VerSys System Rasps (7892-009/018), or LM Rasps (7892-012/016-30). Do not use the VerSys Enhanced Taper Rasps (7892-09/19-50) to implant the Fiber Metal Taper Hip Prosthesis.

Note: Consider using the Straight Rasp Handle during the rasping procedure to minimize impingement of the handle with the proximal posterior pole of the skin incision. There is a tendency for the proximal pole of the incision to apply a retroverting force onto the rasp handle. To facilitate control of the rasp, the detachable alignment handle can be inserted into one of the three holes in the striking end of the Straight Rasp handle. These holes (0°, 7.5°, and 15°) can also be used to check anteversion.

Note: It is very important to protect the proximal pole of the incision during insertion and removal of rasps from the wound. Without appropriate care it is quite easy to lacerate the proximal pole of the incision on the sharp rasp teeth. Use the Long Femoral Elevator to help avoid injury to the proximal pole of the wound.
Attach the 9mm rasp to the Straight Rasp Handle and begin broaching the femoral canal (Fig. 18). This small rasp facilitates creation of a channel within the proximal femur. As a general rule, after the 9mm rasp, use a rasp that is at least two sizes smaller than the estimated implant size that was determined during preoperative templating. **Be very careful during the rasping process to avoid retroversion.**

Increase the size of each rasp by one millimeter until the appropriate sense of fit and fill is achieved (Fig. 19).

When inserting a rasp be sure it advances with each blow of the mallet. If the rasp can be seated at least 5mm below the osteotomy, progress to the next rasp size and repeat until the predicted final rasp size has been seated. If the predicted final rasp size can be countersunk more than 5mm and adequate cancellous bone is available in the metaphyseal region, two choices are available for improved fit:

1. Progress to the next larger rasp size. This is recommended for cases where adequate cancellous bone is available on the anterior and posterior sides of the proximal femur, and the distal medullary canal has enough room to accept the next larger size rasp. The distal canal may need to be reamed to a larger diameter to accept the next size implant.

2. Progress to the same size large metaphyseal (LM) rasp. (These are available in sizes 11mm through 20mm only.) This option is recommended for cases where there is at least 4mm of cancellous bone medially, and adequate cancellous bone on the anterior and posterior sides of the implant. Additional reaming is not required to use the corresponding LM implant.

Note: Once the LM rasp has been inserted, a standard rasp of any size cannot be used to prepare the femoral canal and provide adequate fit with a standard implant.

Note: To countersink a size 9 or 10 rasp, it may be necessary to use the Rasp Adapter to avoid the overhang of the Straight Rasp Handle impinging on cortical bone. The Rasp Adapter attaches to the trunnion of the rasp and connects to the Straight Rasp Handle. Before extracting the rasp, calcar planing may be necessary. Also, the Straight Rasp Handle must be attached directly to the rasp trunnion for extraction.
**Trial Reduction**

Insert the Liner Provisional in the acetabular shell to determine the appropriate liner elevation. The antirotational slots on the Liner Provisional should line up with the two antirotational tabs and black etch marks located on the rim of the shell.

Thread the selected size Slotted Cone Provisional onto the Cone Provisional Inserter, and insert the provisional onto the trunnion of the rasp. Grasp the selected Slotted Provisional Head with the Provisional Head Inserter so the tabs of the inserter fit into the holes on the sides of the provisional head (Fig. 20). The slots in the provisional head, and the design of the inserter, allow the head to be inserted from the side. Insert the provisional head and perform a trial reduction (Fig. 21).

Alternatively, attach the appropriately sized Porous/Enhanced Taper (POR/ET) Neck Provisional and Femoral Head Provisional to the rasp and perform the trial reduction.

Check the leg length and offset of the femur by referencing the lengths measured before the hip was dislocated. It is important to reposition the leg exactly where it was during the first measurement. Adjust the neck length by changing Femoral Head Provisionals to achieve the desired result. For example, for the 28mm Femoral Head, the VerSys Hip System has five neck lengths (-3.5mm to +10.5mm) which provide a total range of 14mm of neck length. When satisfactory leg length, offset, range of motion, and stability have been achieved, dislocate the hip.
**Liner Insertion**
Consider inserting the acetabular liner and dial it into appropriate rotation free-hand before impacting it into the outer shell. To achieve complete congruency, dry the inner shell thoroughly. It is important to ensure that no capsule is enfolded before introducing the acetabular liner. Watch for the locking ring tabs to open and then close together. There will be a 2-3mm gap between the locking ring tabs. The prosthetic liner is fully seated when the locking ring tabs can be moved from side to side with a probe.

**Femoral Component Insertion**
After choosing the definitive size, open the actual prosthesis. Remove the rasp and gently apply a D&C curette to the internal surface of the lateral femoral metaphysis to remove any fibrous tissue that may have inadvertently been delivered down the femoral canal. As a rule, do not irrigate when noncemented implants are used.

Press the implant down the canal by hand until it will no longer advance. Place the Implant Driver in the implant insertion slot located on the stem shoulder (Fig. 22). Then use a mallet to begin carefully seating the femoral component.

If desired, before the final 1 cm of prosthesis seating, insert a rotation control bar into the extraction hole of the prosthesis, and confirm correct rasp rotation (Fig. 23). Remove the control bar about 1-2mm before definitive component seating. Then tap the Implant Driver with a mallet until the prosthesis is fully seated or until the implant will no longer advance.
The prosthesis is fully seated when the most proximal part of the porous surface is level with the osteotomy line. If the implant is not advancing with each blow of the mallet, stop insertion and remove the component. Then rasp or ream additional bone from the areas that are preventing the insertion, and insert the component again.

The rasps and corresponding implants are sized such that a press-fit is created proximally. The most distal portion of the porous surface (medial side) is flush with the implant and gradually increases to 0.5mm proud (per surface) in the most proximal area. Thus, the implant is 1mm larger than the rasp in both the A/P and M/L dimensions. This relationship can be seen on the templates. Therefore when the implant is seated, a 0.5mm press-fit per surface is achieved. Note that the metaphyseal press-fit engagement provides the implant with greater rotational stability than the rasp.

**Technique Tip**

Occasionally, particularly in hip incisions that are 7cm or less, or when larger femoral components are used, it is difficult to see the neck of the femoral component below the skin and fascial edge when the stem is initially introduced. In such cases, because of the highly tapered nature of the VerSys Fiber Metal Taper Component, it is possible to initially introduce the femoral component in a retroverted position. The maneuver of extending the hip and bringing it into neutral abduction will facilitate seating of the component neck below the level of the skin and fascia. As the prosthesis is seated in the femur, it is dialed into the appropriate anteverision. This way, the neck of the femoral component can pass under the edges of the skin and fascia without injuring either.

Use the Provisional Head Inserter to sequentially seat the side-loading Slotted Provisional Heads on the femoral neck until appropriate leg length, joint tension, and joint stability have been achieved.
**Femoral Head Attachment**

When the stem is fully inserted, check to ensure that the 12/14 taper is clean and dry. Then place the selected femoral head on the taper and secure it firmly by twisting it and striking it once with the Head Impactor (Fig. 24). The Offset Head Seater may be used to facilitate this step (Fig. 25). Test the security of the head fixation by trying to remove it by hand.

**Note:** Do not impact the femoral head onto the taper before driving in the prosthesis as the femoral head may loosen during impaction.

Reduce the hip, and assess leg length, range of motion, stability and abductor tension for the final time.
Wound Closure
After obtaining hemostasis, insert a Hemovac® Wound Drainage Device and close the wound in layers. Capsule and short external rotators should be closed en masse. Place a figure of 8 sutures in the proximal corner of the posterior capsular flap and piriformis tendon and a second suture approximately 1 cm distal, through capsuled and conjoined tendon and suture them to each other through drill holes in the greater trochanter.

POSTOPERATIVE MANAGEMENT
The postoperative management of patients with a VerSys Fiber Metal Taper Implant is determined by the surgical technique, patient’s bone quality, fit of the implant, and the surgeon’s judgment.
GENERAL INSTRUMENTS

**Prod. No.** | **Description**
--- | ---
7804-00-01 | MIS Hip General Instrument Set (Includes one each of the following:)
7803-22-01 | Femoral Head Provisonal -2.0x22
7803-32-02 | Femoral Head Provisonal -6.0x22
7803-22-03 | Femoral Head Provisonal -3.0x22
7803-28-01 | Femoral Head Provisonal -3.5x28
7803-26-02 | Femoral Head Provisonal -0x28
7803-28-03 | Femoral Head Provisonal -3.5x26
7803-29-04 | Femoral Head Provisonal -7.0x26
7803-28-05 | Femoral Head Provisonal -10.5x26
7803-28-01 | Femoral Head Provisonal -3.5x28
7803-28-03 | Femoral Head Provisonal -3.5x26
7803-28-04 | Femoral Head Provisonal -7.0x28
7803-30-08 | Femoral Head Provisonal -9.0x28
7803-30-09 | Femoral Head Provisonal -11.0x29
7803-30-05 | Femoral Head Provisonal -11
7803-30-07 | Femoral Head Provisonal -13
7803-30-06 | Femoral Head Provisonal -11
7803-30-04 | Femoral Head Provisonal -3.5x28
7803-30-01 | Femoral Head Provisonal -3.5x26
7803-30-03 | Femoral Head Provisonal -7.0x26
7803-30-02 | Femoral Head Provisonal -10.5x26
7803-30-01 | Femoral Head Provisonal -3.5x28
7803-30-00 | Femoral Head Provisonal -3.5x26
7803-29-01 | Femoral Head Provisonal -7.0x26
7803-29-03 | Femoral Head Provisonal -3.5x28
7803-29-02 | Femoral Head Provisonal -3.5x26
7803-29-04 | Femoral Head Provisonal -7.0x28
7803-28-01 | Femoral Head Provisonal -10.5x26
7803-28-02 | Femoral Head Provisonal -3.5x28
7803-28-03 | Femoral Head Provisonal -3.5x26
7803-28-04 | Femoral Head Provisonal -7.0x28
7803-28-05 | Femoral Head Provisonal -10.5x26
7803-28-01 | Femoral Head Provisonal -3.5x28
7803-28-02 | Femoral Head Provisonal -3.5x26
7803-28-04 | Femoral Head Provisonal -7.0x28
7803-28-05 | Femoral Head Provisonal -10.5x26
7803-28-01 | Femoral Head Provisonal -3.5x28
7803-28-02 | Femoral Head Provisonal -3.5x26
7803-28-04 | Femoral Head Provisonal -7.0x28
7803-28-05 | Femoral Head Provisonal -10.5x26
7803-32-01 | Femoral Head Provisonal -3.5x22
7803-32-02 | Femoral Head Provisonal -0x22
7803-32-03 | Femoral Head Provisonal -3.5x22
7803-32-04 | Femoral Head Provisonal -7.0x22
7803-32-05 | Femoral Head Provisonal -10.5x22
7804-26 | Rasp Handle, qty. 2
7803-54-09 | Cone Provisional 8/10
7803-54-11 | Cone Provisional 11
7803-54-12 | Cone Provisional 12/13
7803-54-14 | Cone Provisional 14/15
7803-54-16 | Cone Provisional 16/17
7803-54-18 | Cone Provisional 18-22
7803-56 | Provisional Neck Inserter
7803-57 | Provisional Head Inserter
7803-58 | Implant Driver
7804-15 | Offset Shell Inserter
7804-18 | Offset Head Seater
7805-70 | MIS Hip General Instrument Case

**SIDE CUTTING REAMERS**

**Prod. No.** | **Description**
--- | ---
7804-00-02 | MIS Side Cutting Reamer Set (Includes one each of the following:)
7803-50 | Skin Protector Tube
7803-50-09 | Side Cutting Reamer, 9mm
7803-50-11 | Side Cutting Reamer, 11mm
7803-50-13 | Side Cutting Reamer, 13mm
7803-50-15 | Side Cutting Reamer, 15mm
7803-50-17 | Side Cutting Reamer, 17mm
7804-17-01 | Skin Protector Tube - Long
7804-17-02 | Skin Protector Tube - Extra Long
7806-80 | MIS Side Cutting Reamer Case

**ACETABULAR REAMERS**

**Prod. No.** | **Description**
--- | ---
7803-00-07 | MIS Low Profile Acetabular Reamer Set (Includes all items listed below:)
7803-00-42 | Low Profile Acetabular Reamer, Size 42
Through ↓ | Through ↓
7803-00-64 | Low Profile Acetabular Reamer, Size 64
1206-90-10 | Reamer Shaft, qty. 2
7806-85 | MIS Low Profile Acetabular Reamer Case

**MINI INSTRUMENTS**

**Prod. No.** | **Description**
--- | ---
7804-00-54 | MIS Mini Instrument Set (replace set 7804-00-04) (Includes one each of the following:)
7804-05 | Lit Inferior Retractor
7804-06 | Lit Single Point Retractor - Sharp/Wide
7804-07 | Lit Single Point Retractor - Dull/Narrow
7804-08 | Lit Double Point Retractor - Even Points/Wide
7804-10-03 | Lit Offset Double Point Retractor - Left Long/Twisted
7804-10-04 | Lit Offset Double Point Retractor - Right Long/Twisted
7804-11-01 | Lit Flanged Retractor Left
7804-11-02 | Lit Flanged Retractor Right
7804-12-01 | Contoured Femoral Elevator
7804-12-02 | Contoured Femoral Elevator - Deep
7804-15-02 | Lateral Alignment Frame
7804-30 | Bifurcated Light Cable (with Adapter A,B,C,D)
7804-33-03 | Light Pipe, Inferior (Black)
7804-33-04 | Light Pipe, Long (Green), qty. 4
7805-90 | MIS Mini Instrument Case

**Prod. No.** | **Description**
--- | ---
7804-00-21 | MIS Fork Set (Includes one each of the following:)
7804-01-01 | Long Arm Contoured 4-Tooth Retractor
7804-01-02 | Long Arm Contoured 5-Tooth Retractor, Deep
7804-01-05 | Contoured Small Blade
7804-01-06 | Contoured Small Blade, Deep

**Prod. No.** | **Description**
--- | ---
7804-00-22 | MIS Claw Set (Includes one each of the following:)
7804-01-03 | Long Arm Contoured Claw Retractor
7804-01-04 | Long Arm Contoured Claw Retractor, Deep
7804-01-05 | Contoured Small Blade
7804-01-06 | Contoured Small Blade, Deep

**Prod. No.** | **Description**
--- | ---
7804-00-25 | MIS 2-Incision Hip Instrument Add-on Set (Includes one each of the following:)
7804-04 | Retractor Extenders, qty. 2
7804-13 | Ligamentum Tertes Cutter
7804-14-01 | Corkscrew
7804-14-02 | Stabilizer
7804-19 | Bonehook
7805-95 | MIS 2-Incision Hip Instrument Case

**Prod. No.** | **Description**
--- | ---
7804-00-05 | MIS 2-Incision Hip Set (Includes one each of the following:)
7804-01 | Initial Incision Pointer
7804-02-01 | Lit Anterior Retractor - Straight/Narrow
7804-03-01 | Lit Anterior Retractor - Bent/Wide - Qty. 2
7804-03-02 | Lit Anterior Retractor - Bent/Wide - Qty. 2
7804-03-03 | Lit Anterior Retractor - Bent/Extra Wide
7804-04 | Retractor Extenders - Qty. 2
7803-41-04 | Anterior Retractor Curved
7803-45-01 | Curved Awl
7803-86 | Angled Hex Driver
7803-09 | Cable Passer
7804-12 | Ligamentum Tertes Cutter
7804-14-01 | Corkscrew
7804-14-02 | Stabilizer
7804-19 | Bonehook
7804-15-01 | Supine Alignment Frame
7804-33-01 | Light Pipe, Bent (Blue) - Qty. 4
7804-33-02 | Light Pipe, Straight (Green)
1714-09 | Bandage Scissors
7806-95 | MIS 2-Incision Hip Instrument Case
<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Description</th>
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| 7804-00-17 | 36mm Slotted Head Provisionals Set (includes each of the following:)
| 7804-00-17 | 36mm Slotted Head Provisional 12/14 36mm x -3.5
| 7804-00-17 | 36mm Slotted Head Provisional 12/14 36mm x 0
| 7804-00-17 | 36mm Slotted Head Provisional 12/14 36mm x +3.5
| 7804-00-17 | 36mm Slotted Head Provisional 12/14 36mm x +7
| 7804-00-17 | 36mm 12/14 Slotted Provisional Head Tray
| 7804-00-08 | 40mm Slotted Head Provisionals Set (includes each of the following:)
| 7804-00-08 | 40mm Slotted Head Provisional 12/14 40mm x -3.5
| 7804-00-08 | 40mm Slotted Head Provisional 12/14 40mm x 0
| 7804-00-08 | 40mm Slotted Head Provisional 12/14 40mm x +3.5
| 7804-00-08 | 40mm Slotted Head Provisional 12/14 40mm x +7
| 7804-00-08 | 40mm Slotted Head Provisional 12/14 40mm x +10.5
| 7806-99-20 | 40mm 12/14 Slotted Provisional Head Tray
| 7804-00-06 | Six Degree Taper Set (includes each of the following:)
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +0.5
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +3.5
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +7
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +11.5
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +2.5
| 7804-00-06 | Six Degree Taper Provisional 6 deg. 22mm x +14
| 7804-00-09 | Six Degree Slotted Cone Provisionals Set (includes each of the following:)
| 7804-00-09 | Six Degree Slotted Cone Provisional - 6 deg. 9/10
| 7804-00-09 | Six Degree Slotted Cone Provisional - 6 deg. 12/13
| 7804-00-09 | Six Degree Slotted Cone Provisional - 6 deg. 14/15
| 7804-00-09 | Six Degree Slotted Cone Provisional - 6 deg. 16
| 7804-00-09 | Six Degree Slotted Cone Provisional Tray
| 7804-00-10 | Slotted Cone Provisionals 12/14 Extended Set (includes each of the following:)
| 7804-00-10 | Slotted Cone Provisional - EXT 11
| 7804-00-10 | Slotted Cone Provisional - EXT 12/13
| 7804-00-10 | Slotted Cone Provisional - EXT 14/15
| 7804-00-10 | Slotted Cone Provisional - EXT 16/17
| 7804-00-10 | Slotted Cone Provisional - EXT 18/22
| 7808-99-20 | Slotted Cone Provisionals - EXT Tray

**REPLACEMENT ITEMS**

<table>
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<tr>
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| 4033-43-01 | Frame*
| 7804-16 | Osteotomy Guide*
| 7804-18-02 | Replacement Head Seater Cap
| 7804-15-03 | Replacement A-Frame Knob
| 7804-35-01 | Replacement Adjustment Set Screw
| 7803-69-01 | Small Cable Passer
| 7803-70-04 | Set Screw (Old Shell Inserter)
| 7803-70-05 | Threaded Shaft (Old Shell Inserter)
| 7803-88-01 | Light Cable Adapter A
| 7803-88-02 | Light Cable Adapter B
| 7803-88-03 | Light Cable Adapter C
| 7803-88-04 | Light Cable Adapter D
| 7803-88-05 | Offset Head Seater Cap (Old Style)
| 7803-88-06 | Torque Handle (Or Nasal Handle)
| 7803-70-06 | Connecting Shaft (Old Shell Inserter)
| 7804-44-01 | Disposable Light Pipe, Bent (Blue)
| 7804-44-02 | Disposable Light Pipe, Straight (Yellow)
| 7804-44-03 | Disposable Light Pipe, Inferior (Black)
| 7804-44-04 | Disposable Light Pipe, Long (Green)
| 7803-86 | Inflatable Pillow
| 7804-44-05 | Disposable Light Cable (Old Style)*

* Limited availability depending on country release.