PREOPERATIVE PLANNING

The key to successful revision THA is comprehensive planning to prepare for a variety of potential circumstances. The overall objective of preoperative planning is to enable the surgeon to determine anatomic parameters that allow accurate intraoperative placement of the femoral implant. Specifically, the objectives of preoperative planning include:

1. Determination of leg length,
2. Establishment of appropriate abductor muscle tension and femoral offset,
3. Determination of anticipated component sizing and placement,
4. Determination of lateralization into the trochanteric bed to achieve neutral alignment of the implant, and
5. Determination of potential difficulties in implant removal and insertion.

DESIGN PHILOSOPHY

The VerSys Heritage Revision Hip System includes a number of stems that are larger and longer than those typically used for primary arthroplasty. This allows the system to meet the need for a cemented stem revision implant for Type I and Type II femoral deficiencies and, in some cases, Type III deficiencies. The revision system is designed to work with the VerSys Hip System Rasps to achieve optimal placement and fixation. The VerSys Hip System Rasps allow preparation of a bony bed into which the prosthesis can be inserted with an adequate cement mantle. The distal stem tip geometry helps reduce the strains in the cement mantle around the distal tip. The addition of an external distal centralizer helps centralize the implant distally. The prosthesis also incorporates an increased neck length and offset to help restore proper joint kinematics in revision cases.

SURGICAL TECHNIQUE

Incision and Exposure

The incision for revision surgery requires careful planning to minimize the possibility of wound healing complications. Begin by outlining the anatomic landmarks on the skin, including the greater trochanter, femur, iliac crest, anterosuperior iliac spine, and the interval between the tensor fascia lata and the gluteus maximus. Specifically, the objectives of preoperative planning include:

1. Determination of leg length,
2. Establishment of appropriate abductor muscle tension and femoral offset,
3. Determination of anticipated component sizing and placement,
4. Determination of lateralization into the trochanteric bed to achieve neutral alignment of the implant, and
5. Determination of potential difficulties in implant removal and insertion.

The most common exposures for revision THA are (1) the posterolateral approach without a trochanteric osteotomy, (2) the true lateral approach with a standard trochanteric osteotomy, (3) the extended direct lateral approach or, (4) the extended trochanteric osteotomy (ETO). For complex acetabular reconstructions, trochanteric osteotomy provides the best exposure of the supra-acetabular ilium. The extended trochanteric osteotomy is particularly useful for extraction of well-fixed stems and cement.

Alternatively, the posterolateral approach can provide excellent extensile exposure and mobilization of the upper femur for cement removal and bone grafting. This frequently entails partial or complete release of the gluteus maximus tendon, short external rotators, iliosposas tendon and complete capsulotomy.
Determination of Leg Length
After exposing the joint, establish landmarks and obtain measurements before dislocating the hip. This will allow a comparison of leg length and femoral offset after reconstruction to achieve the goals established during preoperative planning. There are several methods to measure leg length. One method is to place one pin in the iliac wing and another pin parallel to the first pin in the greater trochanter. Then measure the distance between them. Perform this measurement with the leg in the neutral position, a position that can be reproduced after the new implant has been inserted.

Stem Removal
Remove the previous implant from the femoral canal. The ease with which a femoral component can be removed will vary, depending on the following circumstances:
1. Whether the stem is loose or well fixed,
2. Whether the stem is cemented or cementless, and
3. Whether the stem length is regular or long.
Each situation has inherent problems that should be anticipated.

Loose, Cemented Femoral Components – Standard Length
Excise all scar tissue and membrane around the femoral neck to completely expose the implant and cement mantle. If the stem has a collar and has subsided, new bone may have grown over the collar. Remove this bone and the wedge-shaped proximal/lateral cement mass before attempting to extract the stem. If the cement is not removed, it will serve as a reverse wedge and, as the stem is backed out, it may fracture the lateral cortex of the femur at the greater trochanter.
The stem removal method will depend on the following factors:
1. Whether the failure occurred at the cement/metal interface or the cement/bone interface,
2. Whether the femoral head is modular or monoblock,
3. Whether there is an extraction hole, and
4. Whether the stem has a collar or flange.
If the failure has occurred at the cement/metal interface, stem removal is usually easy and can often be done manually or with an extraction hook and slaphammer. If the stem has failed at the cement/bone interface, removal may be difficult because of tenacious membrane that forms between the cement and bone. The difficulty arises primarily when the cement/metal interface does not disrupt as the femoral component is being extracted, and removal of the stem brings with it all of the adherent cement.

If areas of osteolysis or angular deformity create a situation in which the distal cement attached to the stem is wider than the medullary canal at any point, there is a possibility of fracturing the femur as the implant with cement is extracted. In this case, it is safer to disrupt the cement/metal interface and remove the stem first. This may be especially difficult if the stem surface has a rough finish.
After stem removal, remove the cement in small sections. If the stem has an extraction hole, use a hook and slaphammer to remove the stem. Exercise patience and great care to avoid damaging the femur during the extraction. The use of a carbide-tip punch can be helpful, as well as the use of the Antonson U-shaped extractor for collared or monoblock stems.

Loose, Cemented Femoral Components – Long Stem
Careful analysis of the A/P and lateral radiographs is important to predict potential difficulty in removing this stem, particularly if it is curved. If segments of the current mantle, which are well fixed to the stem, are also adherent to osteolytic bone, there is a serious risk of fracturing the femur during stem extraction. It is safer to make a window in the femur and remove the cement prior to extracting the stem.
Beware of a long stem cemented femoral component with a mid-stem taper. Removal of this component is particularly difficult and the extended trochanteric osteotomy can help significantly.

Removal of these implants can either be straightforward, or deceptive and challenging. In some cases, the femoral component may be “loose;” yet difficult to remove because of substantial fibrous tissue ingrowth. To disrupt this interface, use long flexible osteotomes, working circumferentially around the proximal portion of the implant. It may be necessary to osteotomize the trochanter for access to the lateral aspect of the stem. It may even be necessary to remove the prosthetic collar with a metal-cutting tool to allow access to the proximal medial interface.
Alternatively, if this problem is anticipated, an extended trochanteric osteotomy down to the level of the distal end of the porous coating can provide excellent access to this interface. This is particularly useful for fully porous coated or textured stems. Expose the lateral femur by first elevating the vastus lateralis. Then mark the osteotomy to mobilize the lateral third of the femur to the length of the failed stem, if it is fully coated. Make a series of 1mm diameter drill holes, 5mm apart, along the planned osteotomy. Then complete the osteotomy with a sharp osteotome or microsagittal saw. Use extreme care when lifting the bone off the underlying porous surface. Disruption of the medial interface can then be accomplished with a Gigli saw.
Preparation of the Femoral Canal

After removing the implant, inspect the metaphyseal and diaphyseal regions for a neocortex, sclerotic bone formation and, in the case of a cemented implant, remaining bone cement. Use this information to choose the appropriate procedure for femoral preparation. Both femoral rasps and implant provisionals are available to guide the preparation of the femoral canal. A traditional rasping technique can be used to remove bone in the same manner as in primary surgery. In some cases with extensive endosteal osteolysis or enlargement, it may not be practical to use rasps. Instead, stem provisionals are used to choose the appropriate size and length of implant. The surgeon can decide intraoperatively which technique is most appropriate for the specific patient.

Femoral Rasping

Use the VerSys Hip System Rasps when preparing the canal for a VerSys Heritage Revision Prosthesis. Sometimes the primary rasps and prosthesis are the appropriate choice. Do not use the LM (Large Metaphyseal) or ET (Enhanced Taper) Rasps. These rasps are engraved with an “LM” or “ET” near the trunnion for easy identification. Also, there is no need to use the Rasp Alignment Tip for the Cemented VerSys Heritage Revision Implants (Fig. 1).

The threads on the tip can be left uncovered when rasping the canal. Antevert the femoral rasp by approximately 15 degrees when driving it into the medullary canal. Start with a rasp one or two sizes smaller than the implant size selected during templating (Fig. 2). The rasp should advance with each moderate tap of the mallet. Rasp the femoral canal with sequentially incremental rasps until the cortical envelope is filled (Fig. 3).

Distal Reaming (Optional)

In some cases, distal reaming may be helpful in preparing the canal to accept the selected implant. Remember that all sizes of the VerSys Heritage Revision Implant extend beyond the rasp envelope. Use straight reamers (Fig. 4) when enlarging the diaphysis. Chart A shows the distal dimensions for the three body sizes. The amount of reaming will depend on the length of implant chosen and the amount of femoral bowing. In all cases, and especially those with excessive femoral bowing, insert the provisionals to make sure the implant passes freely. Care should be used when advancing the provisional in the canal to avoid perforation of the femoral cortex. If the provisional does not pass freely, it may be necessary to ream the distal canal with a flexible reamer by an additional 1-2mm to allow insertion of the stem, or a smaller implant should be used.

Chart A

<table>
<thead>
<tr>
<th>Implant Size</th>
<th>Distal Dimension*</th>
<th>Reamer Diameter for 1.5mm Cement Mantle</th>
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* Dimension measured just above the distal tip.
**Inserting Provisional Stems**

Select the provisional stem based on rasp size or preoperative planning. Use the VerSys IM Sizers to determine the size of the Provisional Distal Centralizer that will pass freely into the canal (Fig. 5). If the IM Sizer is tight in the canal, choose a Provisional Distal Centralizer one size smaller than the size of the IM Sizer. Attach the Provisional Distal Centralizer to the Stem Provisional (Fig. 6). Turn the Provisional Distal Centralizer clockwise on the threads of the Stem Provisional until it will no longer turn. Then make a visual check to ensure that it is completely on.

Provisional Distal Centralizers are available in 1mm increments, from 10mm to 19mm. Be aware that although Distal Centralizers are less effective when used below the isthmus, they still prevent the tip from contacting endosteal cortex. In addition, the function of the Provisional Distal Centralizers is to help stabilize the distal tip of the implant during the trial reduction of the hip.

**Trial Reduction**

Lap pads or Ratex sponges can be used around the provisional to provide stability in the canal. Mark the version on the medial neck with methylene blue. Press the Femoral Head Provisional firmly onto the taper of the Stem Provisional. Adjust the provisional to match the rasp anteversion (Fig. 8). The neck of the Stem Provisional has a C-ring along the taper that holds the Femoral Head Provisional onto the Stem Provisional.

Reduce the hip and choose the appropriate neck length. Carefully evaluate stability and leg length, and ensure that there is good stability and no impingement. If the soft tissue tension is inadequate, choose a longer neck length. Remove the provisional component from the femoral canal.

**Important:** Insert the Stem Provisional assembly into the femoral canal (Fig. 7) to verify that the final implants will fit the femoral anatomy.
Canal Preparation
Prepare the canal with pulsatile lavage irrigation and dry it thoroughly. Place a distal cement restrictor at a depth to allow 1.5-2cm of cement below the tip of the prosthesis. If the tip is below the isthmus, you may want to use a separate, small mixing of cement to secure the plastic restrictor in place. Next, cover or occlude any perforations or windows in the femoral canal. If a Distal Centralizer is to be used, select a Distal Centralizer that matches the size of the Provisional Distal Centralizer used with the provisional implant.

The inner diameter of the Distal Centralizer has a slight taper through its length. Before attaching the Distal Centralizer to the stem, apply a thin layer of cement to the distal tip or fill the hole of the centralizer with cement. This will provide a good bond between the stem and Distal Centralizer. When attaching the centralizer, introduce the tip of the stem through the opening on the flat side of the centralizer (Fig. 9). Advance the centralizer on the stem tip with a minimum force until it comes to rest in its final position. The centralizer does not need to be twisted or forced onto the stem.

Preparation for the Proximal Centralization Sleeve (Optional)
The Proximal Centralization Sleeve slides onto the medial proximal aspect of the stem body just below the osteotomy level, abutting against the minimized collar (Fig. 10). When fully engaged, the Proximal Centralization Sleeve will lock into the anterior and posterior dimples on the implant. Attach it at the same time the Distal Centralizer is positioned, placing doughy cement on the proximal aspect of the stem. The main body of the stem should be protected from the surgical team’s gloved hands while the centralizers are attached.

Cement Introduction and Stem Insertion
Clean and dry the previously plugged femoral canal. This is especially important when doing a cemented revision. When the cement has attained a doughy consistency, inject the cement into the canal with a syringe in retrograde fashion and firmly compress it (Fig. 12).
Check to ensure that the 12/14 neck taper is clean and dry. Place the femoral head on the taper with a twisting motion until it locks onto the taper. Then impact it with one firm strike of the mallet, using the Head Impactor. Check the security of the head by trying to remove it by hand.

During stem insertion, the stem axis should be parallel to the longitudinal axis of the femur. No extraction hole is necessary because the VerSys Heritage Hip Prosthesis is a polished stem, which can be disimpacted from its surrounding cement mantle by removing the cement from the proximal lateral portion of the stem and striking the minimized collar in a retrograde fashion.

Insert the stem with the insertion device to within 1 cm of the neck cut (Fig. 13). Then remove excess cement to provide a clear view of the final seating. Continue seating the implant until the minimized collar reaches the position marked during the trial reduction (Fig. 14).

Note: Impacting the Stem Driver while inserting the implant with the femoral head attached may cause the head to loosen. Test the security of the head fixation by trying to remove the head by hand once the implant is seated. One sharp blow using the Head Impactor and a mallet should be used to ensure that the femoral head is seated on the taper.

After insertion, hold the prosthesis by the neck, or use the Head Impactor to hold the prosthesis in place. This prevents the inadvertent application of torsional forces on the prosthesis while the cement is hardening. The minimized collar often rests on part of the posterior medial cortex of the cut neck, but this is not intended to be load bearing through collar/calcar contact. It is very important to pay attention to the cement/prosthesis composite until the cement has completely hardened. After the cement has completely hardened, reduce the hip. Then check range of motion, stability, leg length, and soft tissue tension. Finally, close the wound layers appropriately.
## VERSYS HERITAGE REVISION HIP PROSTHESIS

![Diagram of the VERSYS HERITAGE REVISION HIP PROSTHESIS](image)

<table>
<thead>
<tr>
<th>VerSys Heritage Revision Prod. No.</th>
<th>Stem Size</th>
<th>A Stem Length (mm)</th>
<th>B Offset (mm) When Head/Neck Component Selected is:</th>
<th>C Neck Length (mm) When Head/Neck Component Selected is:</th>
<th>Average Cement Mantle Thickness (mm)</th>
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All sizes may not be available. Contact your Zimmer representative for additional information.