APR® Anatomical Hip System

Surgical Technique

The anatomic solution for bone matching

zimmer
Confidence in your hands®

Surgical Technique

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Introduction

The anatomic solution for bone matching

For almost two decades, the *APR* Anatomical Hip System has offered hip solutions to fit varying patient anatomies and all bone types. The stem combines the advantages of an anatomical shape with technological refinements in design. The vast majority of patients enjoy excellent fixation for long-term stability and performance, reduced bone loss and no thigh pain[1]. Surgeons will appreciate the superior proximal fill and anatomic fit, the ease of implantation, and the comprehensive system to address all primary arthroplasty needs. A wide range of stems provide the proper solution for every patient.

Converge® Acetabular System with *Metasul*® Head

APR Porous Distally Textured Stem

Converge Acetabular System with *Durasul*® highly crosslinked polyethylene liner

APR Cemented CoCr Stem

The key benefits of the APR Hip System:

- An anatomic solution of 3 different stem geometries to fit variable patient anatomies and all bone types
- Clinical success with 99.9% survivorship[2]
- Proximal *Cancellous-Structured Titanium™* (*CSTi™*) porous coating for bone ingrowth and distal grit-blasted texturing for augmented fixation[1,3]
- Simple, easy-to-use, reproducible instrumentation used for cementless and cemented applications

The following surgical technique is for the Press-Fit *APR* Anatomical Hip Porous-Coated/Distally Textured, Press-Fit HA/Porous Coated, Press-Fit Nonporous Fully Textured and Cemented *APR* Hip CoCr stems.

The femoral reconstruction goals when using the *APR* Hip are to restore hip length and offset, achieve proximal anterior-to-posterior femoral cortical fill and obtain distal stability. From preoperative templating, one should determine the size of prosthesis and body type needed. The decision to use a standard body, large body or oversized prosthesis is usually made at surgery. A choice between a porous coated, fully textured or cemented stem can be made intraoperatively since all instrumentation is the same.

Preoperative Planning

Primary Objectives

Performing preoperative planning on x-rays can significantly reduce the intraoperative time for the operation. Using templates on the x-rays permits an estimation of implant size and instruments to be used, therefore increasing Operating Room efficiency. The primary objectives of the preoperative planning are to determine the following:

1. Patient's bone type
2. Implant selection and type of fixation
3. Estimated sizing of implant(s)

Preoperative X-rays and Templating

Preoperative planning should be done on both an A/P pelvis and a lateral x-ray. The A/P pelvis should be taken with the hip in internal rotation with the legs internally rotated to project the femoral neck - shaft angle (tape around the feet if necessary). The beam is centered on the pubis, not the umbilicus, to demonstrate proximal femoral anatomy. Because many patients have external rotation contractures, this can be difficult, but should be obtained. If one hip is arthritic and the other is not, the more normal hip may be internally rotated for radiographic determination of the femoral neck resection.

The lateral x-ray should show a lateral of the acetabulum and femur. Again, because arthritic patients have contractures of the hip, it is usually necessary to have the patient turn into an oblique position. This position allows the patient's leg to lie flat on the x-ray table in the externally rotated and abducted position to obtain a true lateral of the femoral bone and to get an outline of the subchondral bone of the acetabulum.

Dorr Bone Type Classification[4,5]

To determine bone quality, the cortex is assessed on both the anterior and lateral radiographs. Bone classification by the A-B-C system characterizes metabolic differences in proximal femoral bone that will influence the fill of the prosthesis in the canal and bone-metal relationship. Bone quality is assessed by classification into three types:

Type A bone (Fig. 1) is normal, healthy bone. There are large cortices in both views with a large medial and posterior fin, which results in a narrow diaphyseal isthmus of nearly equal M/L and A/P diameters and a distinct funnel shape of the intramedullary (I/M) canal.

Type B bone (Fig. 2) has thick cortices with a funnel-shaped I/M canal on the A/P view, but diminished posterior cortical bone on the lateral view. The medial and posterior cortices are smaller, with more bone loss in the posterior cortex so that the I/M canal's A/P diameter (lateral X-ray) is greater than the M/L diameter (A/P X-ray). A remnant of the original posterior cortex may be seen on the lateral X-ray.

Type C bone (Fig. 3) is the weakest bone. It shows cortical thinning in both views. The bone has thin cortices, and a loss of anterior and posterior bone definition may be indicated on the lateral x-ray so that the bone has a "fuzzy" appearance. Obvious loss of mineralization of both cortical and cancellous bone has occurred. In both the A/P and lateral X-rays, the I/M canal has become nearly cylindrical.

As bone deteriorates from type A to type C, the diameter of the intramedullary canal widens. This widening is more apparent in the anterior-posterior canal (as seen on lateral X-rays) than in the medial-lateral canal (A/P X-ray), because bone is lost more rapidly and in greater volume from the posterior cortex. The difference in width seen on the lateral and A/P x-rays makes it increasingly difficult to match fit and fill in type B and C bone.

Previously, in order to obtain good fit in type B and C bone a prosthesis was cemented. However, the design of the *APR* Hip stem accommodates variable bone types by offering a large number of proximal sizing options (standard, large, oversized) to maximize metaphyseal fill without additional distal diaphyseal reaming.

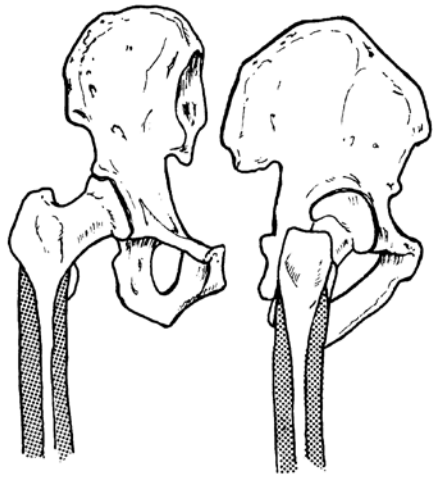


Fig. 1

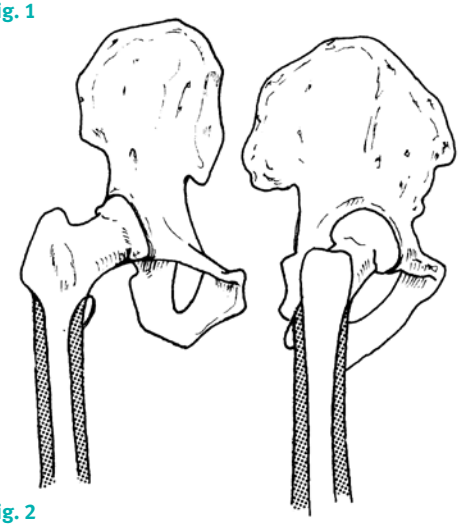


Fig. 2

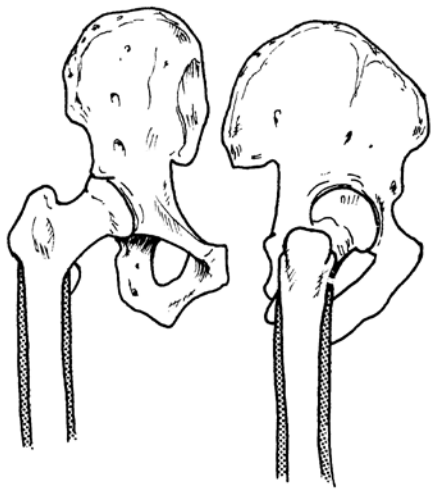


Fig. 3

Templating the Femur

The *APR* hip system x-ray templates are available for both cementless and cemented femoral components with an 18% magnification that enhances accuracy when using typical x-rays.

Femoral component templating begins on the A/P pelvis x-ray that includes the proximal femur. For the *APR* cementless stems, the fit is judged on both the A/P and lateral x-ray (Fig. 4). In some type A bones, the intramedullary canal is actually smaller on the lateral x-ray and the size should be selected based on that intramedullary canal size. In those hips in which the intramedullary canal size is smaller on the lateral x-ray, the stem may have an appearance of some varus on the postoperative A/P x-ray, although the fit is optimal.

To achieve the correct placement of the template on the A/P view of the involved hip, the axis of the stem should be centered in the femoral canal. The central axis of the stem should intersect the junction of the superior femoral neck and the greater trochanter (Fig. 5). The center of the femoral head, indicated by dots on the tapered neck, should be centered at that point at which the compression trabeculae of the femoral head crosses the old epiphyseal line.

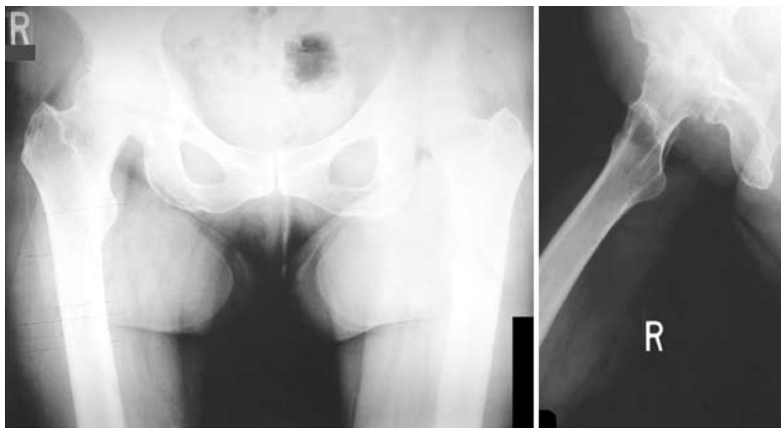


Fig. 4

Fig. 5

We recommend positioning the template to the +0 position matched to the femoral head center. Then intraoperative tensioning adjustments will be no more than +/- 4.

This combination of centering the stem in the intramedullary canal combined with the correct placement of the center of rotation for the femoral head permits an estimate of the size to be used, and allows the surgeon to visualize placement of the femoral stem within the femoral bone. On the lateral x-ray the template should be placed so that the level of the femoral neck, to be retained, is maintained. This will allow the surgeon to determine the stem fit into the intramedullary canal. It also ensures that there is no risk of fracture of the femoral bone by the stem impinging into the anterior cortex (Fig. 6).

Fig. 6

Templating the Press-Fit Stem

To determine the femoral implant size and type, select the femoral template size that best fits the proximal and distal femur to equalize leg lengths. Adjust the template proximally and distally until the axis of the neck of the stem is in line with the axis of the patient's femoral neck. Center the *APR* Hip's geometry in the femoral canal and select the component that will offer maximum filling of the metaphysis and diaphysis (from the medial to lateral cortical wall). Ideally, the proximal medial aspect of the implant should parallel the contour of the medial neck. Verify that the stem chosen in the A/P plane also fits in the lateral plane.

Fig. 7

Templating the Femoral Offset

With the template overlaid on the femoral bone as described above (axis of the stem in the central axis of the canal and center of head at the center of the femoral head) determine the offset by measuring the distance from the tip of the greater trochanter to the center of the femoral head (Fig. 7).

Templating the Femoral Neck Cut

After the fit of the stem within the canal has been determined (using templates), measure the level of the femoral neck.

Mark the level of the neck cut by measuring from the superior aspect of the lesser trochanter (which is easily available at surgery, even with a mini-incision) to the staged line of the prosthesis, which is the undersurface of the collar in the collared *APR*. This is the level of neck that should be left to maintain the correct offset and hip length at the time of surgery.

Using the scribed measurement lines on the template (5mm, 10mm, 15mm, or 20mm) mark the appropriate resection line at which the femoral neck cut is to be made. In valgus hips, the level of the femoral neck cut will be higher whereas in varus hips, the neck cut will be lower (closer to the lesser trochanter). Therefore, clearly, in valgus hips a shorter femoral head length will be used to re-establish offset and neck length, whereas with a varus hip a longer head length will be necessary (Fig. 8).

NOTE: Intraoperatively, a metal template (osteotomy guide) may be used to replicate this preoperative measurement and assist in positioning the proper neck cut. If one hip is arthritic and the other is not, the more normal hip may be more internally rotated and should be used to determine the femoral neck cut.

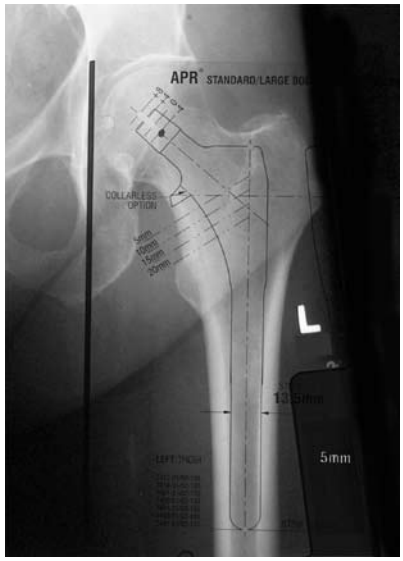


Fig. 8

Templating the Cemented Stem

When planning cement fixation, use the cemented stem templates and allow for at least a 3mm cement column around the stem (Fig. 9 and Fig. 10).

NOTE: The cemented stem should never fill more than two-thirds of the intramedullary canal. The proximal fill will always be correct using this rule; the cement column will be 2-3mm and the stiffness of the stem will be minimized.

Fig.9

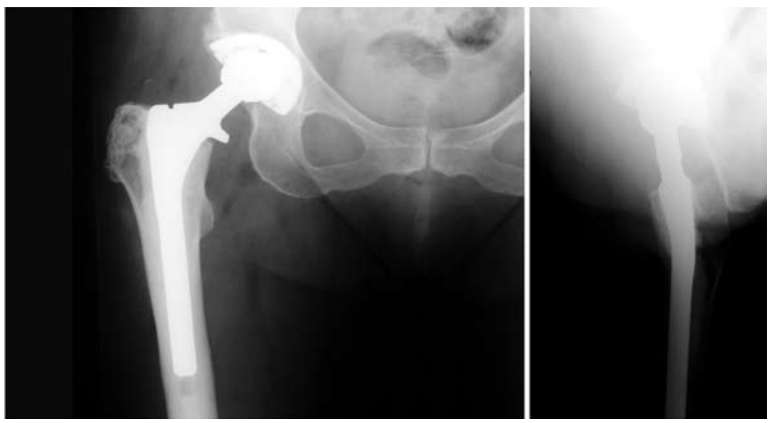


Fig. 10

Final Preoperative Evaluation and Verification

The final step in the preoperative planning process is to determine the head-neck length options that will closely reestablish the center of rotation restoring the patient's leg lengths and joint function. Neck length adjustments can be made intraoperatively by selecting one of the four appropriately-sized head/neck components (-4mm, neutral, +4mm or +8mm). Templating to +0 head size will prove most productive and still allow adjustments as the clinical circumstance dictates.

Patient Positioning

The patient is placed on the operating table in a true lateral position in which a straight line can be drawn between the tip of the shoulder through the high point of the iliac crest and the tip of the greater trochanter (Fig. 11). The patient is stabilized both at the chest and the pelvis (Fig. 12). Auxiliary roll protection of the brachial plexus and padding of vulnerable neurological structures is imperative.

Alternative Exposure

The *APR* Hip System Prosthesis can be implanted using a variety of surgical approaches; the specific approach used depends on surgeon preference. The system is compatible with *Zimmer®* *Minimally Invasive Solutions™* (*MIS™*) techniques taught through the Zimmer Institute. Please contact your Zimmer representative for information on these surgical techniques.

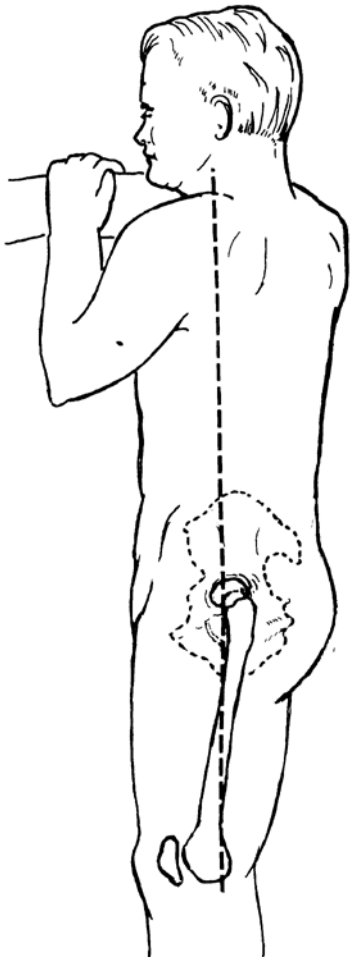


Fig. 11

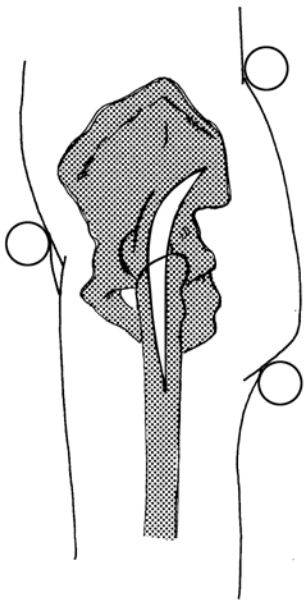


Fig. 12

Femoral Press-Fit Implant Surgical Technique Summary

The steps for femoral preparation and press-fit stem implantation are enhanced by using efficient power instrumentation and multiple proximal body options. These options provide surgeons with methods to ensure excellent fit and stability of the implant once the diaphyseal size has been determined. The press-fit technique for the press-fit stems is as follows:

Resect Neck

1. Using the Osteotomy Guide, resect the level of femoral neck as determined by the preoperative plan.

Prepare Canal

2. Remove bone wax that was placed on the cut femoral neck during acetabular preparation to prevent bleeding from the femoral bone.

3. Remove remaining lateral neck with a box chisel. It is important to get back into the trochanter to get down in a straight manner and prevent varus positioning.

Open IM Canal

4. Use the power burr to open the intramedullary canal. A manual T-handle reamer could be used if desired.

Ream Canal

5. Place straight reamers into the diaphysis to determine the diaphyseal diameter needed for the implant. It is usually easiest to begin 3 sizes below the estimated size of stem to be used (10mm reamer for a 13.5mm stem). The reamers should be used in 1mm increments so when the reamer begins to contact femoral bone, it can easily be felt by the surgeon. The straight reamer is used until there is solid contact over 4-5cm of femoral bone.

   NOTE: Using the reamers in 0.5mm increments can reduce the tactile feedback to the surgeon.

6. The trochanteric reamer is then used prior to using the straight reamer for the final size. If the final size is estimated to be 13.5mm, the 13.0mm trochanteric reamer is used to ream the trochanteric bed which makes the impaction of the broach and stem much easier and ensures axial alignment.

7. Use the final straight reamer that is identical to the selected stem size. For a 13.5mm stem, use a 13.5mm reamer.

Broach Canal

8. Broaching is initiated with the broach that is one size down from the preoperatively planned final stem size. For a 13.5mm stem, use a 12.0mm broach. This broach removes metaphyseal cancellous bone and makes insertion of the final broach size easier.

9. The correct size broach for the diaphysis is implanted. If the 13.5mm reamer was used, use the 13.5mm broach. Once this broach is inserted, it is necessary to determine the appropriate proximal body size. If the standard broach size is stable to manual rotational stress, and the standard broach size fills the proximal metaphysis, then a standard implant is used. If the standard broach is stable to rotational stress, but there remains 2-3mm of anterior cancellous bone, then the large body implant is used. If the standard broach is unstable to rotational stress, then the oversized broach should be used.

   NOTE: If the diaphyseal sizing has been correct then one of these proximal body sizes will be correct. The only time that an oversized broach would still be unstable is if the diaphyseal sizing is too small.

Trial Reduction

10. Plane the femoral neck off the broach. To assure collar-calcar contact, a trial neck and head are inserted onto the broach to perform a trial reduction.

Femoral Cemented Implant Surgical Technique Summary

The cement technique for the cemented stem is as follows:

Clean the Canal

1. Loose cancellous bone is removed with a curette.
2. While the cement is being mixed, the medullary canal is thoroughly cleaned using a femoral brush and pulsatile lavage system.
3. Suction any remaining fluid and debris. Dry with a dry lap or sponge.

Insert the Plug

4. Insert the appropriate-size intramedullary plug into the femur, 2 canal diameters below the tip of the *APR* Hip Stem. A cement plug restricts the flow of bone cement and enhances cement pressurization.

   TIP: Inserting the reamer shaft marking past the calcar will result in 20mm of clearance past the tip of the stem. This is where the cement plug should be positioned.

Prepare the Cement

5. Mix the bone cement according to the manufacturer's instructions. Remove the sponge from the femoral canal.

Insert the Cement

6. Extrude the bone cement into the femoral canal by filling the femoral canal, distal to proximal. This technique is critical to prevent embolization of intramedullary femoral canal debris, such as air and bone marrow. Pressurize the proximal bone cement using a pressuring nozzle or if manually pressurized, until strong back pressure is felt.

   NOTE: Please use the proper insertion rod with the implant holder. The etching on the impactor rod will state "For use with nonporous stem only".

Cemented Femoral Stem Implantation

7. Attach the selected implant to the nonporous rod with the implant holder. The appropriate-sized femoral component with distal centralizer is now inserted. The appropriately sized centralizer should fill 60 - 65 percent of the canal.
8. The distal centralizer is chosen at the time of surgery and the size is determined by manual insertion of the reamers or by measurement of the canal diameter on preop x-ray using the template ruler (magnified 18%). Select the largest possible distal centralizer and attach it to the selected *APR* Hip Stem with one fin pointed laterally to assume correct axial alignment.

   NOTE: If a distal centralizer is not used, plug the distal hole on the stem with bone cement. Insertion of the femoral component further pressurizes the cement and maximizes cement intrusion.

   TIP: The cement should be doughy enough that the stem will need to be malleted into its final position. Over the final few millimeters of insertion, use a scalpel to remove cement from under the collar as it is impacted.

9. Remove excess bone cement with a scalpel. Leave the *APR* Hip Implant Holder positioned in place, with pressure applied, until the bone cement is almost set.
10. Remove the *APR* Hip Implant Holder from the stem. Remove any remaining bone cement.

Femoral Preparation

Femoral Neck Resection

The level of the femoral neck cut is determined by the preoperative plan. Preoperative templating can be confirmed intraoperatively by measuring the neck length. Neck length (less trochanter to center of head) relative to neck cut recommendations are as follows:

Neck Length	Neck Cut
50mm	15mm
50mm to 59mm	20mm
60mm to 65mm	25mm
65mm to 70mm	30mm
above 70mm	35mm

NOTE: Measure the center of the head to the greater trochanteric tip. The center of the femoral head is estimated at the center of the ball. Take into account any flattening of the head that has occurred. Make a mark over the bone on the tip of the greater trochanter. Next, measure the neck length from the lesser trochanter to the center of the head parallel to the femoral neck, and the offset from the tip of the greater trochanter to the center of head. In about 80 percent of hips, this will be 50mm to 55mm for both measurements. At the completion of the surgery, these measurements should have been reproduced (Fig. 13).

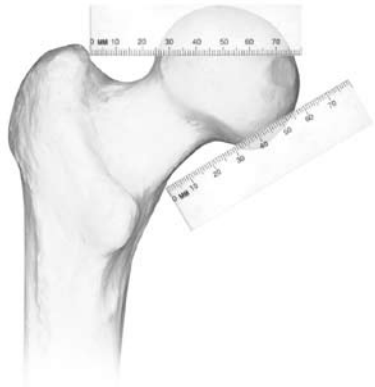


Fig. 13

The femur should be rotated in a neutral position with the knee straight. Align the Universal Femoral Neck Osteotomy Guide straight down the long axis of the femur so that the arrow of the instrument points to the mid-knee. Place the reference line ("0 line") at the proximal level of the lesser trochanter (Fig. 14).

Fig. 14

If desired, the guide may be fixed to the bone using two Steinmann pins, one through the distal hole and the other into the femoral head. The measurement of the femoral neck osteotomy is made from the reference line up to the level of the preoperatively planned femoral neck length (5mm, 10mm, 15mm, or 20mm) (Fig. 15).

Fig. 15

Preparation of the Intramedullary Canal

Open the intramedullary canal utilizing the power burr. Align the burr with the tip of the greater trochanter in line with the axis of the intramedullary canal and position it in the posterior lateral corner of the femoral neck (Fig. 16). Remove the remaining lateral neck cortex by using the universal box chisel or a Rongeur (Fig. 17).

IMPORTANT: Removing the lateral femoral neck prevents varus positioning of the stem.

Fig. 16

Fig. 17

Femoral Canal Reaming

There are two types of reamers (straight and trochanteric) in the *APR* Hip System to prepare the diaphyseal canal prior to broaching.

APR/Universal straight reamers are available in 0.5mm increments from 9.5-21mm. Each reamer is proportionally sized by its distal diameter and is self-centering for use with a power reamer. A blunt, tapered tip, short-side cutting blade and a narrow diameter drive shaft allow the reamer to cut the distal femur without removing proximal bone stock (Fig. 18).

Trochanteric reamers with individual handles are available with a built-in burr/stop combination. The trochanteric reamers are available in 1.5mm increments in six sizes (10mm, 11.5mm, 13mm, 14.5mm, 16mm and 17.5mm). They aid in clearing the greater trochanteric area, which facilitates the insertion of the broach and the final implant, thus reducing the risk of varus alignment. The stop precisely indicates correct reaming depth (Fig. 19).

Fig. 18

Fig. 19

Press-Fit Stem

Begin reaming with a straight reamer that is one to two sizes below the preoperatively templated size to open the intramedullary canal. The straight reamers are sized by and correspond to the distal diameter of the stem. The circumferential depth grooves on the proximal straight reamers also correspond to the implant sizes (10.5-18.0mm). Insert the reamer to the level of the medial neck or slightly deeper (Fig. 20). Continue using the *APR*/Universal straight reamers (available in 0.5mm increments) until cortical bone contact over 4-5cm is obtained.

TIP: Any adjustments in reaming depth should be made on the deep side. A canal reamed too deep will not create a procedural problem; one reamed too shallow will prevent proper seating of the broach and/or implant.

The next reamer used is the trochanteric reamer. The trochanteric reamers are used to clear the trochanteric bed. The distal reamer diameter is 0.5mm under the preoperatively templated stem size. (See the recommended reaming chart below). Ream using the trochanteric reamer until the calcar stop fully engages with the calcar cut, thus reducing the risk of varus alignment (Fig. 21). The stop precisely indicates correct reaming depth.

The last reamer used is a straight reamer and should match the size of the diaphysis of the selected stem (for instance, 13.5 reamer for 13.5 stem). See the recommended reaming chart.

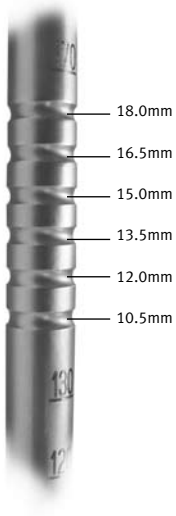


Fig. 20

There are six circumferential depth grooves on the proximal reamer shaft to indicate the reaming depths of the six stems (see chart below).

Fig. 21

Recommended Diameter Reaming Chart

APR Implant Sizes	10.5mm	12.0mm	13.5mm	15.0mm	16.5mm	18.0mm
Begin with Straight Reamer Diameter	9.5mm	11.0mm	12.5mm	14.0mm	15.5mm	17.0mm
Next Trochanteric Ream Diameter	10.0mm	11.5mm	13.0mm	14.5mm	16.0mm	17.5mm
End with Straight Reamer Diameter	10.5mm	12.0mm	13.5mm	15.0mm	16.5mm	18.0mm

Cemented Stem

Never perform diaphyseal reaming for a cemented stem. A cemented stem size is determined by preoperative planning. The reamers can be used for intraoperative size verification, but should only be inserted manually.

Broaching

Attaching the broach to the Universal Trigger Broach Holder, begin broaching with one size smaller than the reamed diaphysis (for instance, if the diaphysis is reamed 13.5mm, begin with a 12.0mm broach) (Fig. 22).

Fig. 22

Orienting the Broach

Orient the *APR* Hip Broach laterally toward the greater trochanter. Align with the posterior face of the broach parallel to the posterior cortex of the femoral neck to match the patient's normal anteversion (posterior approach). For an anterior approach, simply align the anterior edge of the broach parallel to the anterior cortex (Fig. 23). Confirm the orientation of the broach by using the traditional method of evaluating the tibia at 90 degrees (by palpation of the epicondyles of the femur).

NOTE: If there is severe dysplasia of the femur, orient the broach to cut into the posterior cortex of the femoral neck so anteversion does not exceed 15 degrees.

Fig. 23

Inserting the Broach

Although the *APR* prosthesis is an anatomic stem, impact the broach into the femoral canal like a straight stem, i.e., the broach is simply hit in an axial fashion directly into the femur. Insert the broach as lateral as possible to avoid varus positioning, making the insertion easier and permitting a determination of the fit of the broach (Fig. 24).

Fig. 24

TIP: The implant will follow the path created by the broach, so keep the broach as lateral as possible. The broach should be fully seated with one insertion.

Assessing Proximal Body Size

The *APR* femoral broaching system allows intraoperative determination of optimal proximal sizing by offering standard/large and oversized broaches. The final stem size selected will be determined first by the distal fit and then by the proximal fill.

Standard Proximal Body

Begin by inserting the standard size broach 1 - 2 sizes smaller than the anticipated final broach. The last broach size will correspond to the diameter of the femoral canal (for instance, for 13.5mm reaming, use a 13.5mm broach) (Fig. 25). This broach will fit distally.

TIP: The lateral side of the broach at final seating should be immediately under the tip of the greater trochanter.

If the broach is rotationally stable when manually torqued or tested, then the surgeon's choice is between the standard and the large body size implant. The proper proximal size will be determined by the proximal fit. If the M/L fill is satisfactory, the standard/large size broach is correct (Fig. 26).

Fig. 25

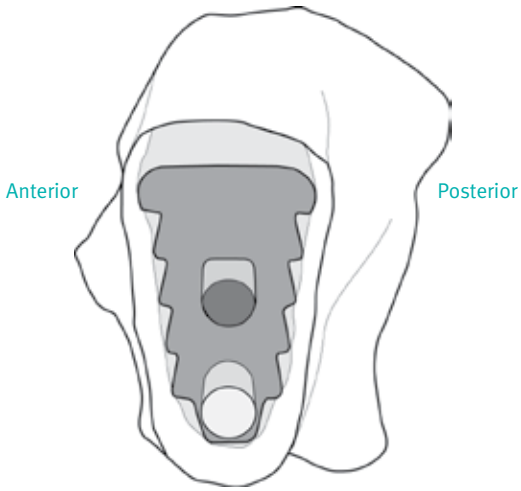


Fig. 26

If the standard/large broach fills the M/L dimension, but 2-3mm of anterior bone remains, proceed with the technique to prepare the canal for a large body prosthesis.

Large Proximal Body

The large body size is selected if there are 2-3mm of remaining cancellous bone between the broach and the anterior neck (Fig. 27). If a large body stem is used, then the appropriately sized large body punch should be threaded onto the implant holder with rod, then malleted into the proximal femur to compact the anterior cancellous bone to receive the large body implant (Fig. 28).

NOTE: This step is not necessary except in the hardest of type A bone. For most hips, the large body implant will compact the cancellous bone as the stem is implanted.

Oversized Proximal Body

If the standard broach is ***not*** rotationally stable to manual testing and ›3mm of anterior cancellous bone remains, then the oversized broach is used and will provide rotational stability unless the distal reamed size is not correct. If the oversized stem is selected, then the oversized broach should be impacted to prepare the proximal diaphysis for the oversized stem. Again, the oversized broach is used when the standard broach is not rotationally stable. The oversized broach will fill M/L and A/P. The oversized stem is a combination of one size distal with the next largest size proximal (i.e. 15.0mm distal X 16.5mm large body proximal). This option is most useful in "Type A" bone because the oversized stem achieves proximal sizing (fit and fill) without unnecessary reaming of additional diaphyseal bone and allows use of a monoblock stem which avoids the potential risks associated with a modular stem[6] (Fig. 29).

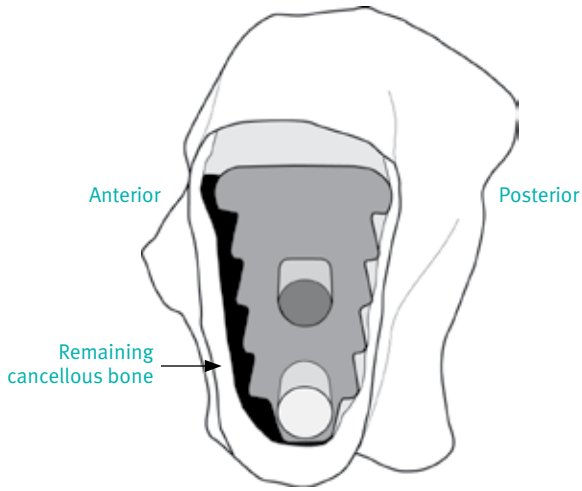


Fig. 27

Fig. 28

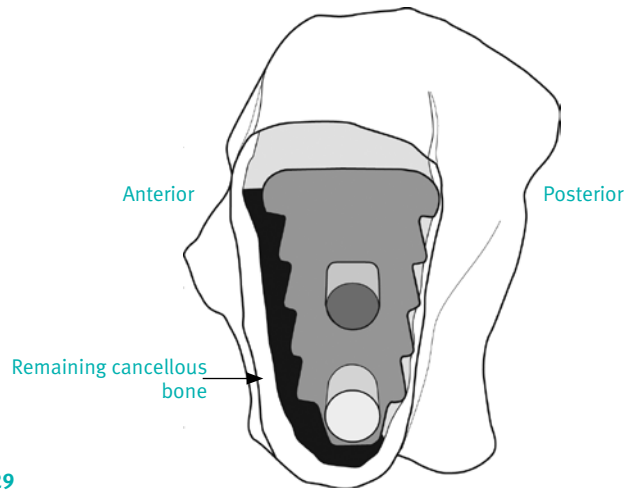


Fig. 29

Calcar Planing

Once the broach has been seated into its correct position, remove the broach holder and position the small *APR* Calcar Planer over the trunion of the *APR* Hip Broach, followed by the large *APR* Calcar Planer (Fig. 30). Calcar planing can be done to level off the neck osteotomy surface or to adjust the neck lengths. Continue planing until the bone is level with the medial side of the seated broach. If a collared *APR* Hip stem is used, mill the calcar flat to the broach face to allow for proper seating of the collar onto the proximal calcar. The purpose of the calcar planer is to prepare the medial neck bone for optimal contact of the collar on the medial neck. Calcar planing should also be done if it is necessary to shorten the neck length and/or to obtain a perfect fit of the collar on the medial femoral bone (Fig. 31).

NOTE: With a collarless stem, planing is done only if it is necessary to shorten the bony femoral neck. If a collarless *APR* Hip stem is used, the mill of the calcar will stop at the correct position for a line-to-line fit of the stem.

Any residual lateral femoral neck or anterior neck osteophytes should be removed at this time. Measure the amount of remaining femoral neck above the lesser trochanter using a metal ruler. If necessary, countersink the *APR* Hip broach further below the calcar cut until the preoperatively planned length is achieved.

Fig. 30

Fig. 31

Intraoperative Radiographs

An intraoperative cross-table A/P x-ray of the pelvis and the femur may be obtained at the surgeon's discretion to assess placement of the final femoral and acetabular components, and to estimate leg length.

Head/Neck Adapter Selection

12/14 head/neck adapters and trial heads are available to assess proper component position, joint stability, range of motion, and leg length. 35mm or 40mm neutral neck segments (collared and collarless) are available. The stem size determines which neck length will be used.

NOTE: For collarless prostheses, perform trial reduction with the appropriately sized dedicated collarless head/neck adapters (35mm or 40mm).

After the calcar is planed, the appropriate taper head/neck adapter (35mm or 40mm neutral neck) is placed onto the broach (Fig. 32). The selected head trial is seated onto the adapter, enabling a trial reduction. The length of the neck should be measured parallel to the neck from the lesser trochanter to the center of the trial head. This measurement should restore the preoperative and intraoperatively planned lengths that were made prior to the neck cut. The length from the tip of the greater trochanter to the center of the femoral head is also measured for proper offset.

Fig. 32

Trial Reduction

Select the appropriate Head Trial and seat it onto the *APR* Hip Head/Neck Adapter placed on the stem (Fig. 33). Head trials are available in sizes 22, 26, 28, 32, 38 and 44mm.

Fig. 33

Testing for the correct head length size is done by inserting the trial head and neck segment onto the broach (either the standard/large or oversized broach). The range of motion and any impingement can be determined by this trial test.

Femoral Implantation

Press-fit Technique

The cementless femoral stem is attached to the *APR* Implant Impactor Holder with the Porous Impactor Rod; a threaded mechanism with anti rotation pins assures solid attachment. The holder should be fully threaded into the implant to avoid damaging the threads (Fig. 34). The implant is manually inserted to the level of the bend of the prosthesis and mechanically inserted using a mallet or the Universal Implant Impactor/Extractor "Slaphammer" Tool.

The collarless *APR* Hip stem is fully-seated when the top of the *CSTi* Porous coating is at the same level of the calcar. It is important to maintain correct axial alignment to prevent varus implantation.

Cement Technique

The same instruments used for the porous-coated stems are also used with the cemented stem, with the exception of the nonporous implant holder which is used for the cemented device only. Attach the cemented femoral stem to the Femoral Implant Holder with the Nonporous Impactor Rod. The holder should be fully threaded into the implant to avoid damaging the threads (Fig. 35).

Fig. 34

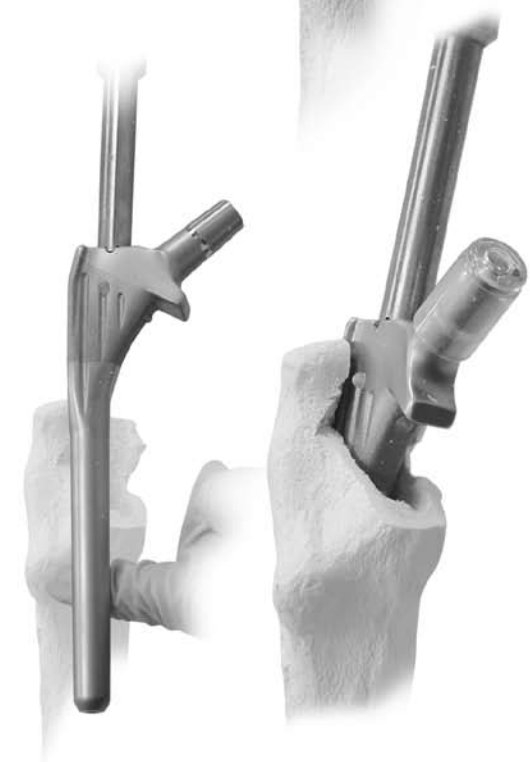


Fig. 35

Trial Range of Motion and Joint Stability

Once the appropriate head/neck adapter and trial head have been selected, bring the hip into full extension and external rotation. Test the hip's stability with the following maneuvers:

Palpate the femoral head in the acetabulum. Palpation should reveal no more than 50% of the femoral head uncovered. Avoid dislocating the femoral head out of the acetabulum to prevent the risk of postoperative anterior dislocation.

Position the hip with 90 degrees of flexion in the neutral position, and 30-40 degrees of internal rotation without dislocation. Confirm that one finger-breadth is present between the femur and the pelvis with no impingement of the femur against the pelvis. To help prevent postoperative dislocation, slightly lengthen the leg to prevent impingement of the femur against the pelvis in flexion and extension, and maintain stability during the push/pull and adduction test.

After reduction, there should be less than 2 - 3mm of push-pull of the joint. Perform the "shuck test" with the leg in a neutral position (the anterosuperior spine and the patella are in the axial alignment of the body) to determine that the head does not distract from the acetabulum. If the leg lengths are correct and there is a positive shuck test (that is, the head distracts from the acetabulum) this commonly means that there is excessive combined anteversion of the femoral and acetabular components. To correct this, reduce the anteversion of the cup (unless the femoral component is determined to be in anteversion of greater than 15 degrees). Take the hip through a full range of motion. It is important that the extreme of range of motion be tested for all positions to insure that impingement and instability is not present. Initially, the leg can be brought into full extension and external rotation and in this position the surgeon should feel some tension within the leg. If, in this position, the hip and leg do not have some feeling of tightness, then there is risk of anterior dislocation and again, the combined anteversion needs to be checked.

Move the hip into flexion to 90 degrees and internal rotation should be available to 50-70 degrees without dislocation. Also, a finger should fit between the greater trochanter and the anterior pelvis in flexion and between the trochanter and the posterior pelvis in extension to insure that there is no impingement of femoral bone onto pelvic bone. It is also important to feel the metal femoral neck against the edges of the cup through the range of motion to determine if the metal neck impinges against the cup. Throughout the range of motion the femoral head should be palpated and the femoral head should be at least 50% covered in all of the extremes of motion.

Finally, the leg should be laid in adduction (across the opposite leg) and axial pressure put through the femur by pushing on the tip of the greater trochanter. The femoral head should not dislocate or distract out of the acetabulum with this stress. If the hip is stable in this position, then the patient can cross the leg or have the leg cross the opposite leg (such as when lying on one's side in bed) without the risk of dislocation.

Leg Length

To check leg length, position the leg into a neutral position and check the level of the lesser trochanter relative to the tip of the ischium. Compare this leg length to the preoperatively determined leg length.

Second, leg length can be measured to the opposite leg (assuming the patient is in the lateral position) by laying the operated leg on top of the underlying opposite leg and comparing the level of the patellae and the bottom of the feet. The superior pole of the patella on the operated leg should be proximal by one finger breadth from the superior pole of the underlying leg and the bottom of the operated foot should be superior to the bottom of the underlying foot by one finger breadth. In other words, the top leg should feel short of the lower leg because it is adducted onto that leg.

As another alternative measurement method, a pin can be drilled into the ilium and left in place during the operation. The length from the pin to a mark made on the greater trochanter is used to measure the leg length. It is possible to bend the pin and also determine off-set before and after implantation.

Soft Tissue Balancing

Hips with severe contractures preoperatively may have stiffness, even after the implants are placed. That stiffness can diminish the quality of the patient's result and also give the patient a feeling of a long leg (functional leg length difference). It is important to determine if these contractures need additional release in conjunction with the hip replacement reconstruction.

An easy test for this is to hold the leg in a neutral axial position and bend the knee. If the knee cannot bend easily beyond 90 degrees then the tensor fascia (and rectus femoris muscle) should be released. If the hip cannot be brought to a neutral position, the iliopsoas tendon is too tight (as well as the anterior capsule) and the iliopsoas should be partially or completely released from the lesser trochanter to prevent groin pain.

If the soft tissues are contracted, release the tensor fascia by gripping and incising it transversely to the rectus femoris muscle, which can be palpated.[7] This procedure should allow the thigh to lie easily against the opposite leg and the knee to bend more easily, and will also increase the abduction and external rotation of the leg. If the knee still does not bend to 120 degrees, divide the body of the rectus femoris at the same level as was done with the tensor fascia muscle or release the tendon from the anterior pelvis. If the leg still can not be brought to full extension, palpate the iliopsoas tendon and if it feels tight, then release it from the lesser trochanter. Leaving the iliopsoas tight can cause it to rub against the anterior acetabulum and cause potential groin pain.[8]

These releases will significantly increase the patient's postoperative comfort level and significantly reduce the occurrence of a "functional leg length discrepancy."

TIP: If the trochanter impinges despite correct leg lengths, osteotomy and lateral trochanteric transfer should be performed, or use a longer neck length. If full extension is not possible because of preoperative flexion contracture, the iliopsoas tendon and anterior capsule (and if necessary, the rectus tendon) should be released. If the tensor fascia is excessively tight, based on the Ober Yount test, it should be transected to prevent lateral knee pain and functional leg length difference.

Once trial placement is satisfactory and reduction is complete, remove the Head/Neck Adapters and *APR* Hip Broach. The broach leaves a finely machined anatomical envelope for proper implantation of an *APR* Hip cementless prosthesis or a cement column for the cemented stem.

Femoral Head Implantation

Attach the Universal Impactor Handle to the Universal Head Impactor. Place the femoral head onto a clean, dry taper using a slight rotational movement until firmly seated. Lightly tap the CoCr or ceramic femoral head on the *APR* Hip Stem using the Universal Impactor (Fig. 36).

Reduce the joint again to check for joint stability and range of motion. Make a final inspection of the joint to ensure that no residual material or osteophytes are present. Inspect the acetabulum to confirm that no debris remains in the articulating surface. Reduce the hip and initiate closure.

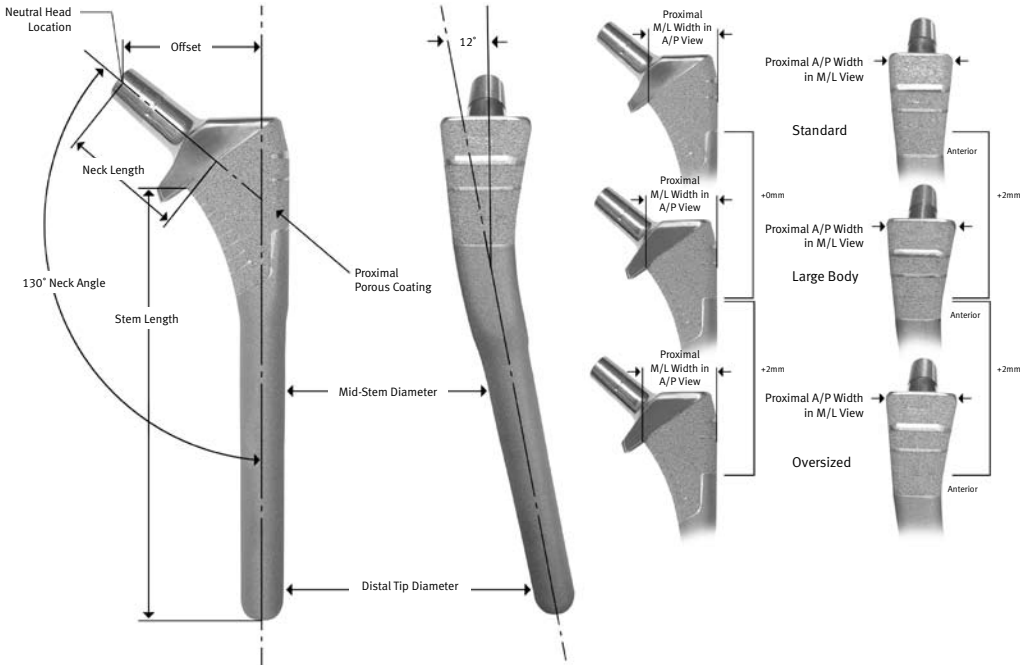
Rehabilitation

With a posterior approach, ambulation is started on the first postoperative day using a walker and permitting full weight bearing. The patient may advance to one crutch when capable. No assistive device is usually necessary outdoors at three weeks. A cane is used indoors until the limp is gone. Patients are encouraged to progressively increase their walking distance to one mile daily. A cane is recommended with an anterolateral approach until limp is gone.

No formal physical therapy is needed unless, after 6-12 weeks, the hip is stiff and needs flexibility exercises.

Fig. 36

APR Press-Fit Stems Implant Specifications and Dimensions



Stem Type	Standard	Large	Oversized
Porous - Distally Textured	X	X	X
Porous HA - Distally Textured	X	X	X
Porous Collarless - Distally Textured	X	X	
Nonporous - Fully Textured		X	X

Standard and Large Body Stem

Size (mm)	Suggested Ream (mm)	Mid-stem Diameter (mm)	Distal Tip Diameter (mm)	Neck Length (mm)	Offset (mm)	Distal Hole Diameter (mm)	Stem Length (mm)	Proximal M/L Width (mm) in A/P view	Proximal A/P Width (mm) in M/L view	
									Standard	Large
10.5	10.5	10.5	10.0	35	42	No	135	29	18.0	20.0
12.0	12.0	12.0	11.5	35	42	No	140	31	20.0	22.0
13.5	13.5	13.5	13.0	35	42	No	145	33	22.0	24.0
15.0	15.0	15.0	14.5	40	47	Yes - 9.5	150	35	24.0	26.0
16.5	16.5	16.5	16.0	40	47	Yes - 9.5	155	37	26.0	28.0
18.0	18.0	18.0	17.5	40	47	Yes - 12.5	160	39	28.0	30.0

Standard Body: Designed to fill the metaphysis in B- and C-type bone *Large Body: Increased anterior and posterior fill over the standard design*

Oversized Body Stem

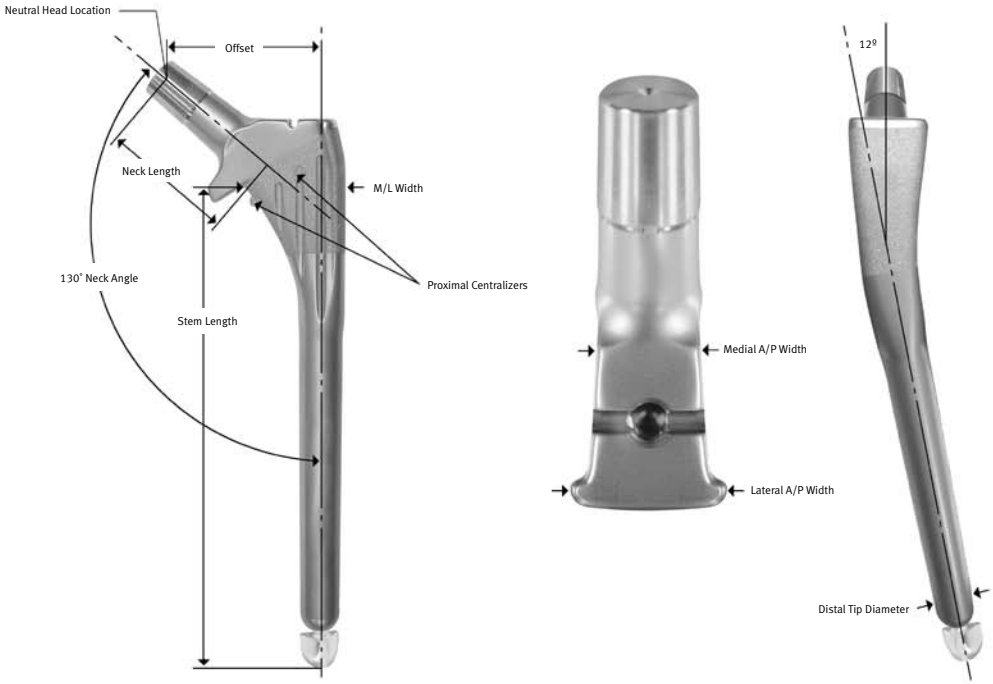
Size (mm)	Suggested Ream (mm)	Mid-stem Diameter (mm)	Distal Tip Diameter (mm)	Neck Length (mm)	Offset (mm)	Distal Hole Diameter (mm)	Stem Length (mm)	Proximal M/L Width (mm) in A/P view	Proximal A/P Width (mm) in M/L view
10.5 (x 12.0)	10.5	10.5	10.0	35	42	No	135	31	12.0
12.0 (x 13.5)	12.0	12.0	11.5	35	42	No	140	33	24.0
13.5 (x 15.0)	13.5	13.5	13.0	40	47	No	145	35	26.0
15.0 (x 16.5)	15.0	15.0	14.5	40	47	Yes - 9.5	150	37	28.0
16.5 (x 18.0)	16.5	16.5	16.0	40	47	Yes - 9.5	155	39	30.0

Oversized: Proximally one size larger (large body) for a given distal size for A-type bone

- Stem size is based upon mid-stem diameter
- Variable proximal body options for each distal size maximizes proximal fit and fill
- Double wedge anatomic design with a 12-degree anterior proximal bend
- 10-degree (built-in) neck anteversion
- Titanium (Ti-6Al-4V) with a distal hole on larger sizes to reduce stiffness
- 130-degree neck angle to closely replicate normal anatomy
- 12/14 Morse taper
- 1mm press-fit in the metaphysis both M/L and A/P
- Circumferential *CSTi* porous coating / distally textured stem
- Collared and Collarless options to address surgeon preferences for proximal loading and fixation
- HA coated stems are coated proximally (50 microns) over *CSTi* surface
- Textured stem has fully grit-blasted surface

APR Cemented Stems Implant Specifications and Dimensions

- Forged CoCr stem for cemented application
- 12-degree anatomic bow, double-wedged design promotes cement compression and centering within distal canal
- Proximal lateral cobra flange and full collar for further cement compression
- Roughened proximal surface with cement channels for enhanced cement bonding and interdigitation
- Proximal 2.5mm PMMA cement spacers permit a 2-3mm proximal cement mantle
- Distally undersized stem relative to broach provides uniform distal cement mantle of 1-2mm
- Cylindrical distal shape provides an even cement column on both A/P and lateral x-rays
- Distal centralizer for correct distal canal orientation
- 130-degree neck-shaft angle
- 12/14 Morse taper



Standard and Large Body Stem

Stem Size (mm)	Broach Size (mm)	Stem length/ with Centralizer (mm)	Neck Length (mm)	Offset (mm)	Proximal Width (mm)			Mid-Stem Diameter**	Distal Tip Diameter (mm)
					A/P Medial	A/P Lateral	M/L		
10.5	10.5	126/135*	34	42	8.5	14.0	18.0	9.5	8.5
12.0	12.0	131/140*	34	42	10.0	15.5	20.5	11.0	10.0
13.5	13.5	136/145*	34	42	12.0	17.5	23.5	12.5	11.5
15.0	15.0	141/150*	40	47	13.5	19.0	26.0	14.0	13.0
16.5	16.5	146/155*	40	47	15.5	20.5	29.0	15.5	14.5

** Length includes 9mm distal centralizer* *** Distal stem gradually tapers from mid-stem to distal tip*

Surgical Pearls

- Use reamers for sizing canal only
- Same *APR* Hip Instrumentation used for all stem implantations (press-fit and cemented stems)
- Don't undersize the broach when cementing; it minimizes the cement mantle
- If a larger cement mantle is desired, use a smaller stem size or increase distal reaming

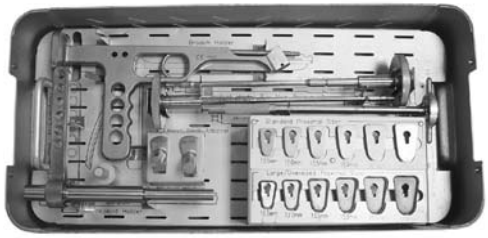
Ordering Information

UNIVERSAL HIP INSTRUMENT CASE NO. 1 OF 2

Catalog No.	Description
9400-99-219	Universal Hip Instrument Case 1 of 2
9400-99-220	Universal Hip Instrument Tray
9400-00-030	Universal Femoral Neck Elevator
9200-01-006	Universal T-Handle Zimmer Fitting
9400-00-001	Universal Calcar Planer SM (APR Design)
9400-00-002	Universal Calcar Planer LG (APR Design)
9200-01-008	Universal Zimmer To Hudson Fitting Adapter
9200-01-009	Universal Zimmer To Jacobs Fitting Adapter
9301-00-002	Universal Box Chisel - Small
9301-00-004	Universal Box Chisel - Large
9301-01-001	Universal T-Handled Femoral Canal Finder – Small - Optional
9301-01-003	Universal T-Handled Femoral Canal Finder – Large - Optional
9301-10-101	Universal Femoral Neck Osteotomy Guide

UNIVERSAL HIP INSTRUMENT CASE NO. 2 OF 2

Catalog No.	Description
9400-99-221	Universal Hip Instrument Case 2 of 2
9400-99-222	Universal Hip Instrument Tray
9326-00-001	Universal Trochanter Burr SM
9326-00-002	Universal Trochanter Burr LG
9666-26-000	Head Trial - Size 26mm/Neutral (12/14 Taper)
9666-26-035	Head Trial - Size 26mm/-3.5mm (12/14 Taper)
9666-26-350	Head Trial - Size 26mm/+3.5mm (12/14 Taper)
9666-28-000	Head Trial - Size 28mm/Neutral (12/14 Taper)
9666-28-004	Head Trial - Size 28mm/-4mm (12/14 Taper)
9666-28-400	Head Trial - Size 28mm/+4mm (12/14 Taper)
9666-28-800	Head Trial - Size 28mm/+8mm (12/14 Taper)
9666-32-000	Head Trial - Size 32mm/Neutral (12/14 Taper)
9666-32-004	Head Trial - Size 32mm/-4mm (12/14 Taper)
9666-32-400	Head Trial - Size 32mm/+4mm (12/14 Taper)
9666-32-800	Head Trial - Size 32mm/+8mm (12/14 Taper)
9210-01-001	Universal Head Distractor
9210-02-001	Universal Head Distractor Wedge - Small
9210-02-002	Universal Head Distractor Wedge - Medium
9210-02-003	Universal Head Distractor Wedge - Large
9206-02-100	Universal Impactor Handle
9206-02-005	Universal Head Impactor

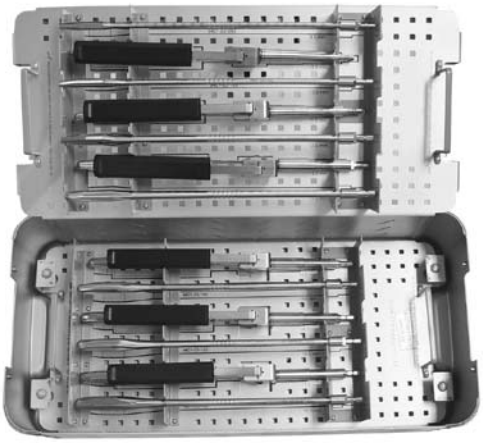


APR ANATOMICAL HIP STANDARD INSTRUMENTATION

Catalog No.	Description
9400-99-210	*APR* Miscellaneous Instrument Case
9400-99-211	*APR* Miscellaneous Instrument Tray
9400-00-132	*APR* Collared 12/14 Taper Head/Neck Trial Adapter - Size 35mm Standard/Large 10.5 - 13.5mm Oversized 10.5 - 12.0mm
9400-00-142	*APR* Collared 12/14 Taper Head/Neck Trial Adapter - Size 40mm Standard/Large 15.0 - 18.0mm Oversized 13.5 - 16.5mm
9400-00-143	*APR* Collarless 12/14 Taper Head/Neck Trial Adapter- Size 35mm Standard/Large 10.5 - 13.5mm Oversized 10.5 - 12.0mm
9400-00-141	*APR* Collarless 12/14 Taper Head/Neck Trial Adapter- Size 40mm Standard/Large 15.0 - 18.0mm Oversized 13.5 - 16.5mm
9300-01-005	Universal Trigger Broach Holder
9326-00-210	*APR* Implant Impactor Handle
9326-00-211	*APR* Implant Impactor Rod-Porous
9326-00-212	*APR* Implant Impactor Rod-Nonporous

APR ANATOMICAL HIP STANDARD INSTRUMENTATION

Catalog No.	Description
9400-99-200	*APR* Broach Instrument Case
9400-99-201	*APR* Broach Instrument Tray
9401-01-105	*APR* Femoral Standard/Large Broach - Size 10.5mm - Left
9401-01-120	*APR* Femoral Standard/Large Broach - Size 12.0mm - Left
9401-01-135	*APR* Femoral Standard/Large Broach - Size 13.5mm - Left
9401-01-150	*APR* Femoral Standard/Large Broach - Size 15.0mm - Left
9401-01-165	*APR* Femoral Standard/Large Broach - Size 16.5mm - Left
9401-01-180	*APR* Femoral Standard/Large Broach - Size 18.0mm - Left
9401-02-105	*APR* Femoral Standard/Large Broach - Size 10.5mm - Right
9401-02-120	*APR* Femoral Standard/Large Broach - Size 12.0mm - Right
9401-02-135	*APR* Femoral Standard/Large Broach - Size 13.5mm - Right
9401-02-150	*APR* Femoral Standard/Large Broach - Size 15.0mm - Right
9401-02-165	*APR* Femoral Standard/Large Broach - Size 16.5mm - Right
9401-02-180	*APR* Femoral Standard/Large Broach - Size 18.0mm - Right
9402-01-105	*APR* Large Body Punch - Size - 10.5mm - Left
9402-01-120	*APR* Large Body Punch - Size - 12.0mm - Left
9402-01-135	*APR* Large Body Punch - Size - 13.5mm - Left
9402-01-150	*APR* Large Body Punch - Size - 15.0mm - Left
9402-01-165	*APR* Large Body Punch - Size - 16.5mm - Left
9402-01-180	*APR* Large Body Punch - Size- 18.0mm - Left
9402-02-105	*APR* Large Body Punch - Size - 10.5mm - Right
9402-02-120	*APR* Large Body Punch - Size - 12.0mm - Right
9402-02-135	*APR* Large Body Punch - Size - 13.5mm - Right
9402-02-150	*APR* Large Body Punch - Size - 15.0mm - Right
9402-02-165	*APR* Large Body Punch - Size - 16.5mm - Right
9402-02-180	*APR* Large Body Punch - Size - 18.0mm - Right



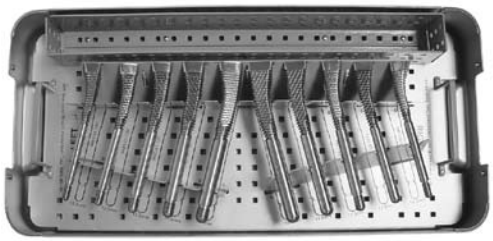
APR ANATOMICAL HIP TROCHANTERIC REAMERS

Catalog No.	Description
9400-99-180	*APR* Trochanteric Straight Reamer W/Stop Case
9400-99-181	*APR* Trochanteric Straight Reamer W/Stop Tray (Top)
9400-99-182	*APR* Trochanteric Straight Reamer W/Stop Tray (Bottom)
9401-04-100	*APR* Trochanteric Straight Reamer - Size 10.0mm**
9401-04-115	*APR* Trochanteric Straight Reamer -Size 11.5mm**
9401-04-130	*APR* Trochanteric Straight Reamer - Size 13.0mm**
9401-04-145	*APR* Trochanteric Straight Reamer - Size 14.5mm**
9401-04-160	*APR* Trochanteric Straight Reamer - Size 16.0mm**
9401-04-175	*APR* Trochanteric Straight Reamer - Size 17.5mm**
9354-20-010	*Natural-Hip*® Reamer Stop Handles (QTY: 6)
9200-01-003	Universal *Zimmer* Retachable Fitting** (QTY: 6)

APR ANATOMICAL/UNIVERSAL HIP STRAIGHT REAMERS

Catalog No.	Description
9401-03-095	*APR* Straight Reamer - Size 9.5mm
9401-03-100	*APR* Straight Reamer - Size 10.0mm
9401-03-105	*APR* Straight Reamer - Size 10.5mm
9401-03-110	*APR* Straight Reamer - Size 11.0mm
9401-03-115	*APR* Straight Reamer - Size 11.5mm
9401-03-120	*APR* Straight Reamer - Size 12.0mm
9401-03-125	*APR* Straight Reamer - Size 12.5mm
9401-03-130	*APR* Straight Reamer - Size 13.0mm
9401-03-135	*APR* Straight Reamer - Size 13.5mm
9401-03-140	*APR* Straight Reamer - Size 14.0mm
9401-03-145	*APR* Straight Reamer - Size 14.5mm
9401-03-150	*APR* Straight Reamer - Size 15.0mm
9401-03-155	*APR* Straight Reamer - Size 15.5mm
9401-03-160	*APR* Straight Reamer - Size 16.0mm
9401-03-165	*APR* Straight Reamer - Size 16.5mm
9401-03-170	*APR* Straight Reamer - Size 17.0mm
9401-03-175	*APR* Straight Reamer - Size 17.5mm
9401-03-180	*APR* Straight Reamer - Size 18.0mm
9401-03-185	*APR* Straight Reamer - Size 18.5mm
9401-03-190	*APR* Straight Reamer - Size 19.0mm
9401-03-195	*APR* Straight Reamer - Size 19.5mm
9401-03-200	*APR* Straight Reamer - Size 20.0mm
9401-03-205	*APR* Straight Reamer - Size 20.5mm
9401-03-210	Universal Straight Reamer - Size 21mm

** Requires *Natural-Hip* Reamer Stop (9354-20-010) and Universal *Zimmer* Detachable Fitting (9200-01-003)



APR ANATOMICAL HIP OVERSIZED INSTRUMENTS

Catalog No.	Description
9400-99-190	*APR* Oversized Broach Instrument Case
9400-99-191	*APR* Oversized Broach Instrument Tray
9403-01-105	*APR* Femoral Oversized Broach - Size - 10.5mm Distal x 12.0mm Proximal - Left
9403-01-120	*APR* Femoral Oversized Broach - Size - 12.0mm Distal x 13.5mm Proximal - Left
9403-01-135	*APR* Femoral Oversized Broach - Size - 13.5mm Distal x 15.0mm Proximal - Left
9403-01-150	*APR* Femoral Oversized Broach - Size - 15.0mm Distal x 16.5mm Proximal - Left
9403-01-165	*APR* Femoral Oversized Broach - Size - 16.5mm Distal x 18.0mm Proximal - Left
9403-02-105	*APR* Femoral Oversized Broach - Size - 10.5mm Distal x 12.0mm Proximal - Right
9403-02-120	*APR* Femoral Oversized Broach - Size - 12.0mm Distal x 13.5mm Proximal - Right
9403-02-135	*APR* Femoral Oversized Broach - Size - 13.5mm Distal x 15.0mm Proximal - Right
9403-02-150	*APR* Femoral Oversized Broach - Size - 15.0mm Distal x 16.5mm Proximal - Right
9403-02-165	*APR* Femoral Oversized Broach - Size - 16.5mm Distal x 18.0mm Proximal - Right

IMPLANTS: CSTI POROUS DISTALLY TEXTURED STEMS

Catalog No.	Description
Standard Body	
7417-01-105	*APR* Femoral Standard Body Distally Textured - Size 10.5mm - Left
7417-01-120	*APR* Femoral Standard Body Distally Textured - Size 12.0mm - Left
7417-01-135	*APR* Femoral Standard Body Distally Textured - Size 13.5mm - Left
7417-01-150	*APR* Femoral Standard Body Distally Textured - Size 15.0mm - Left
7417-01-165	*APR* Femoral Standard Body Distally Textured - Size 16.5mm - Left
7417-01-180	*APR* Femoral Standard Body Distally Textured - Size 18.0mm - Left
7417-02-105	*APR* Femoral Standard Body Distally Textured - Size 10.5mm - Right
7417-02-120	*APR* Femoral Standard Body Distally Textured - Size 12.0mm - Right
7417-02-135	*APR* Femoral Standard Body Distally Textured - Size 13.5mm - Right
7417-02-150	*APR* Femoral Standard Body Distally Textured - Size 15.0mm - Right
7417-02-165	*APR* Femoral Standard Body Distally Textured - Size 16.5mm - Right
7417-02-180	*APR* Femoral Standard Body Distally Textured - Size 18.0mm - Right
Large Body	
7418-01-105	*APR* Femoral Large Body Distally Textured - Size 10.5mm - Left
7418-01-120	*APR* Femoral Large Body Distally Textured - Size 12.0mm - Left
7418-01-135	*APR* Femoral Large Body Distally Textured - Size 13.5mm - Left
7418-01-150	*APR* Femoral Large Body Distally Textured - Size 150mm - Left
7418-01-165	*APR* Femoral Large Body Distally Textured - Size 16.5mm - Left
7418-01-180	*APR* Femoral Large Body Distally Textured - Size 18.0mm - Left
7418-02-105	*APR* Femoral Large Body Distally Textured - Size 10.5mm - Right
7418-02-120	*APR* Femoral Large Body Distally Textured - Size 12.0mm - Right
7418-02-135	*APR* Femoral Large Body Distally Textured - Size 13.5mm - Right
7418-02-150	*APR* Femoral Large Body Distally Textured - Size 15.0mm - Right
7418-02-165	*APR* Femoral Large Body Distally Textured - Size 16.5mm - Right
7418-02-180	*APR* Femoral Large Body Distally Textured - Size 18.0mm - Right
Oversized Body	
7419-01-105	*APR* Femoral Oversized Distally Textured - Size 10.5mm Distal x 12.0mm Proximal - Left
7419-01-120	*APR* Femoral Oversized Distally Textured - Size 12.0mm Distal x 13.5mm Proximal - Left

7419-01-135	*APR* Femoral Oversized Distally Textured - Size 13.5mm Distal x 15.0mm Proximal - Left
7419-01-150	*APR* Femoral Oversized Distally Textured - Size 15.0mm Distal x 16.5mm Proximal - Left
7419-01-165	*APR* Femoral Oversized Distally Textured - Size 16.5mm Distal x 18.0mm Proximal - Left
7419-02-105	*APR* Femoral Oversized Distally Textured - Size 10.5mm Distal x 12.0mm Proximal - Right
7419-02-120	*APR* Femoral Oversized Distally Textured - Size 12.0mm Distal x 13.5mm Proximal - Right
7419-02-135	*APR* Femoral Oversized Distally Textured - Size 13.5mm Distal x 15.0mm Proximal - Right
7419-02-150	*APR* Femoral Oversized Distally Textured - Size 15.0mm Distal x 16.5mm Proximal - Right
7419-02-165	*APR* Femoral Oversized Distally Textured - Size 16.5mm Distal x 18.0mm Proximal - Right

IMPLANTS: HA/CSTI POROUS TEXTURED STEMS

Catalog No.	Description
Standard Body	
7440-01-105	*APR* HA Femoral Standard Body Distally Textured - Size 10.5mm - Left
7440-01-120	*APR* HA Femoral Standard Body Distally Textured - Size 12.0mm - Left
7440-01-135	*APR* HA Femoral Standard Body Distally Textured - Size 13.5mm - Left
7440-01-150	*APR* HA Femoral Standard Body Distally Textured - Size 15.0mm - Left
7440-01-165	*APR* HA Femoral Standard Body Distally Textured - Size 16.5mm - Left
7440-01-180	*APR* HA Femoral Standard Body Distally Textured - Size 18.0mm - Left
7440-02-105	*APR* HA Femoral Standard Body Distally Textured - Size 10.5mm - Right
7440-02-120	*APR* HA Femoral Standard Body Distally Textured - Size 12.0mm - Right
7440-02-135	*APR* HA Femoral Standard Body Distally Textured - Size 13.5mm - Right
7440-02-150	*APR* HA Femoral Standard Body Distally Textured - Size 15.0mm - Right
7440-02-165	*APR* HA Femoral Standard Body Distally Textured - Size 16.5mm - Right
7440-02-180	*APR* HA Femoral Standard Body Distally Textured - Size 18.0mm - Right
Large Body	
7441-01-105	*APR* HA Femoral Large Body Distally Textured - Size 10.5mm - Left
7441-01-120	*APR* HA Femoral Large Body Distally Textured - Size 12.0mm - Left
7441-01-135	*APR* HA Femoral Large Body Distally Textured - Size 13.5mm - Left
7441-01-150	*APR* HA Femoral Large Body Distally Textured - Size 150mm - Left
7441-01-165	*APR* HA Femoral Large Body Distally Textured - Size 16.5mm - Left
7441-01-180	*APR* HA Femoral Large Body Distally Textured - Size 18.0mm - Left
7441-02-105	*APR* HA Femoral Large Body Distally Textured - Size 10.5mm - Right
7441-02-120	*APR* HA Femoral Large Body Distally Textured - Size 12.0mm - Right
7441-02-135	*APR* HA Femoral Large Body Distally Textured - Size 13.5mm - Right
7441-02-150	*APR* HA Femoral Large Body Distally Textured - Size 15.0mm - Right
7441-02-165	*APR* HA Femoral Large Body Distally Textured - Size 16.5mm - Right
7441-02-180	*APR* HA Femoral Large Body Distally Textured - Size 18.0mm - Right
Oversized Body	
7442-01-105	*APR* HA Femoral Oversized Distally Textured - Size 10.5mm Distal x 12.0mm Proximal - Left
7442-01-120	*APR* HA Femoral Oversized Distally Textured - Size 12.0mm Distal x 13.5mm Proximal - Left
7442-01-135	*APR* HA Femoral Oversized Distally Textured - Size 13.5mm Distal x 15.0mm Proximal - Left
7442-01-150	*APR* HA Femoral Oversized Distally Textured - Size 15.0mm Distal x 16.5mm Proximal - Left
7442-01-165	*APR* HA Femoral Oversized Distally Textured - Size 16.5mm Distal x 18.0mm Proximal - Left
7442-02-105	*APR* HA Femoral Oversized Distally Textured - Size 10.5mm Distal x 12.0mm Proximal - Right
7442-02-120	*APR* HA Femoral Oversized Distally Textured - Size 12.0mm Distal x 13.5mm Proximal - Right
7442-02-135	*APR* HA Femoral Oversized Distally Textured - Size 13.5mm Distal x 15.0mm Proximal - Right
7442-02-150	*APR* HA Femoral Oversized Distally Textured - Size 15.0mm Distal x 16.5mm Proximal - Right
7442-02-165	*APR* HA Femoral Oversized Distally Textured - Size 16.5mm Distal x 18.0mm Proximal - Right

IMPLANTS: COLLARLESS CSTI POROUS DISTALLY TEXTURED STEMS*

Catalog No.	Description
Standard Body	
7430-01-105	*APR* Collarless Femoral Standard Body Distally Textured - Size 10.5mm - Left
7430-01-120	*APR* Collarless Femoral Standard Body Distally Textured - Size 12.0mm - Left
7430-01-135	*APR* Collarless Femoral Standard Body Distally Textured - Size 13.5mm - Left
7430-01-150	*APR* Collarless Femoral Standard Body Distally Textured - Size 15.0mm - Left
7430-01-165	*APR* Collarless Femoral Standard Body Distally Textured - Size 16.5mm - Left
7430-01-180	*APR* Collarless Femoral Standard Body Distally Textured - Size 18.0mm - Left
7430-02-105	*APR* Collarless Femoral Standard Body Distally Textured - Size 10.5mm - Right
7430-02-120	*APR* Collarless Femoral Standard Body Distally Textured - Size 12.0mm - Right
7430-02-135	*APR* Collarless Femoral Standard Body Distally Textured - Size 13.5mm - Right
7430-02-150	*APR* Collarless Femoral Standard Body Distally Textured - Size 15.0mm - Right
7430-02-165	*APR* Collarless Femoral Standard Body Distally Textured - Size 16.5mm - Right
7430-02-180	*APR* Collarless Femoral Standard Body Distally Textured - Size 18.0mm - Right
Large Body	
7431-01-105	*APR* Collarless Femoral Large Body Distally Textured - Size 10.5mm - Left
7431-01-120	*APR* Collarless Femoral Large Body Distally Textured - Size 12.0mm - Left
7431-01-135	*APR* Collarless Femoral Large Body Distally Textured - Size 13.5mm - Left
7431-01-150	*APR* Collarless Femoral Large Body Distally Textured - Size 150mm - Left
7431-01-165	*APR* Collarless Femoral Large Body Distally Textured - Size 16.5mm - Left
7431-01-180	*APR* Collarless Femoral Large Body Distally Textured - Size 18.0mm - Left
7431-02-105	*APR* Collarless Femoral Large Body Distally Textured - Size 10.5mm - Right
7431-02-120	*APR* Collarless Femoral Large Body Distally Textured - Size 12.0mm - Right
7431-02-135	*APR* Collarless Femoral Large Body Distally Textured - Size 13.5mm - Right
7431-02-150	*APR* Collarless Femoral Large Body Distally Textured - Size 15.0mm - Right
7431-02-165	*APR* Collarless Femoral Large Body Distally Textured - Size 16.5mm - Right
7431-02-180	*APR* Collarless Femoral Large Body Distally Textured - Size 18.0mm - Right

*Oversized Body Not Available

IMPLANTS: FULLY TEXTURED STEMS**

Catalog No.	Description
Large Body	
7421-01-105	*APR* Femoral Large Body Fully Textured - Size 10.5mm - Left
7421-01-120	*APR* Femoral Large Body Fully Textured - Size 12.0mm - Left
7421-01-135	*APR* Femoral Large Body Fully Textured - Size 13.5mm - Left
7421-01-150	*APR* Femoral Large Body Fully Textured - Size 150mm - Left
7421-01-165	*APR* Femoral Large Body Fully Textured - Size 16.5mm - Left
7421-01-180	*APR* Femoral Large Body Fully Textured - Size 18.0mm - Left
7421-02-105	*APR* Femoral Large Body Fully Textured - Size 10.5mm - Right
7421-02-120	*APR* Femoral Large Body Fully Textured - Size 12.0mm - Right
7421-02-135	*APR* Femoral Large Body Fully Textured - Size 13.5mm - Right
7421-02-150	*APR* Femoral Large Body Fully Textured - Size 15.0mm - Right
7421-02-165	*APR* Femoral Large Body Fully Textured - Size 16.5mm - Right
7421-02-180	*APR* Femoral Large Body Fully Textured - Size 18.0mm - Right

Oversized Body	
7422-01-105	*APR* Femoral Oversized Fully Textured - Size 10.5mm Distal x 12.0mm Proximal - Left
7422-01-120	*APR* Femoral Oversized Fully Textured - Size 12.0mm Distal x 13.5mm Proximal - Left
7422-01-135	*APR* Femoral Oversized Fully Textured - Size 13.5mm Distal x 15.0mm Proximal - Left
7422-01-150	*APR* Femoral Oversized Fully Textured - Size 15.0mm Distal x 16.5mm Proximal - Left
7422-01-165	*APR* Femoral Oversized Fully Textured - Size 16.5mm Distal x 18.0mm Proximal - Left

IMPLANTS: CEMENTED COCR STEMS

Catalog No.	Description
7414-01-105	*APR* CoCr Nonporous Femoral - Size 10.5mm - Left
7414-01-120	*APR* CoCr Nonporous Femoral - Size 12.0mm - Left
7414-01-135	*APR* CoCr Nonporous Femoral - Size 13.5mm - Left
7414-01-150	*APR* CoCr Nonporous Femoral - Size 15.0mm - Left
7414-01-165	*APR* CoCr Nonporous Femoral - Size 16.5mm - Left
7414-02-105	*APR* CoCr Nonporous Femoral - Size 10.5mm - Right
7414-02-120	*APR* CoCr Nonporous Femoral - Size 12.0mm - Right
7414-02-135	*APR* CoCr Nonporous Femoral - Size 13.5mm - Right
7414-02-150	*APR* CoCr Nonporous Femoral - Size 15.0mm - Right
7414-02-165	*APR* CoCr Nonporous Femoral - Size 16.5mm - Right

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2 Dorr LD. Podium presentation: Cementless anatomic stem THA: Long-term results. The 2003 Hip, Knee & Shoulder Symposium. 2003.

3 Zweymuller KA, Lintner FK, Semlitsch MF. The biological fixation of press-fit titanium hip joint endoprosthesis. Clin Orthop. Rel. Res. 1988;235:195-206.

4 Dorr L. Total Hip Replacement using APR System. Technique in Orthopedics. 1986;1(3):22-34. Bone types.

5 Dorr LD, Faugere MC, Mackel AM, Gruen TA, Bognar B, Malluche HH. Structural and cellular assessment of bone quality of proximal femur. Bone. 1993;May-Jun,14(3):231-42.

6 Mallory TH. When modularity is at risk in revision arthroplasty. Paper #57 presented at Current Concepts in Joint Replacement, Winter 2002.

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