SURGICAL TECHNIQUE

C-Stem™

TRIPLE TAPER-STABILIZED HIP

THE SHAPE

OF THE

FUTURE

DePuy®
a Johnson&Johnson company

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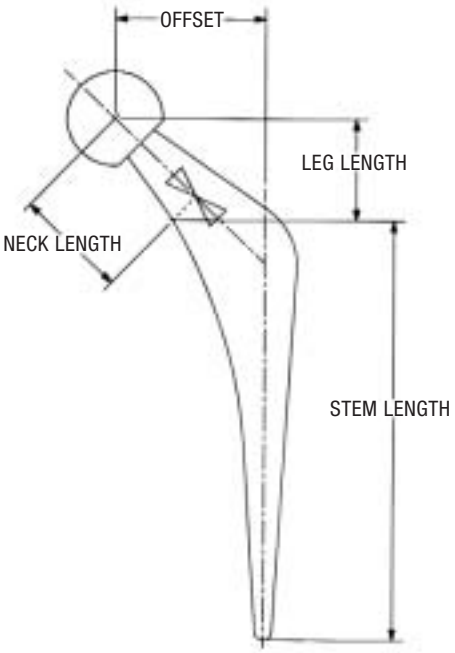
The C-Stem Surgical Technique was written in conjunction with Andrew I. Spitzer, M.D., Los Angeles, CA.



- Triple taper design secures stability within the cement mantle and enhances proximal loading.
- Triple taper inhibits stem movement while allowing for cement creep.

Triple Taper-Stabilized Philosophy

Charnley low-frictional torque arthroplasty continues to be the most successful total hip replacement procedure. Over the past 35 years, clinical results and research have led to improvements in its design and surgical technique. An example of these advances includes the Charnley flanged, Vaquasheened stem in Ortron 90, which virtually eliminated stem fractures. In addition, improvements in cementing techniques have dramatically reduced the incidence of stem loosening.

The C-Stem™ implant builds on the success of Charnley low-frictional torque arthroplasty. Comparative assessment of the relative long-term performance of different implant designs, together with a detailed finite element analysis, provides an understanding of how load is transferred to the bone. Unlike conventional polished, double-tapered designs, the C-Stem implant employs a unique triple taper to secure stability within the cement.

The C-Stem Hip's A/P and M/L tapers act conventionally to transfer compressive load. The critical third taper achieves maximum load transfer from the stem to the proximal femur, improving the prospect of long-term implant security. The triple taper-stabilized philosophy is different than the controlled subsidence philosophy because the third taper inhibits stem movement except that allowed for by the creep of the bone cement.

Biomechanics Chart

Size	*Stem Length*	*Base Offset*	*Base Neck Length*	*Neck Angle*	*Cement Mantle*
CDH	*103mm*	*26mm*	*25.5mm*	*125 degrees*	*2mm per side*
1	*106mm*	*35mm*	*28.9mm*	*134 degrees*	*2mm per side*
2	*110.5mm*	*38mm*	*30.3mm*	*134 degrees*	*2mm per side*
3	*115mm*	*40mm*	*31.3mm*	*134 degrees*	*2mm per side*
3 Hi	*115mm*	*44mm*	*36.5mm*	*130 degrees*	*2mm per side*
4	*119.7mm*	*42mm*	*31.3mm*	*134 degrees*	*2mm per side*
4 Hi	*119.7mm*	*46mm*	*37.3mm*	*130 degrees*	*2mm per side*
5	*124mm*	*44mm*	*33.1mm*	*134 degrees*	*2mm per side*
5 Hi	*124mm*	*48mm*	*38.5mm*	*130 degrees*	*2mm per side*
6	*128.5mm*	*46mm*	*34.2mm*	*134 degrees*	*2mm per side*
7	*133mm*	*48mm*	*35.4mm*	*134 degrees*	*2mm per side*
8	*137.5mm*	*50mm*	*36.7mm*	*134 degrees*	*2mm per side*
4 Rev.	*200mm*	*42mm*	*32.1mm*	*134 degrees*	*2mm per side*
4 Rev.	*240mm*	*42mm*	*32.1mm*	*134 degrees*	*2mm per side*
6 Rev.	*200mm*	*46mm*	*34.2mm*	*134 degrees*	*2mm per side*
6 Rev.	*240mm*	*46mm*	*34.2mm*	*134 degrees*	*2mm per side*
8 Rev.	*200mm*	*50mm*	*36.7mm*	*134 degrees*	*2mm per side*
8 Rev.	*240mm*	*50mm*	*36.7mm*	*134 degrees*	*2mm per side*

Preoperative Templating *[Fig. 1]*

Extensive anthropometric studies define a comprehensive range of stem sizes, neck lengths and offsets to address nearly 100 percent of the populations studied. Preoperative templating ensures accurate implant sizing, placement and alignment.

The C-Stem implant offers a complete range of templates with 20 percent magnification. A radiograph showing the anterior/posterior (AP) view of the proximal femur internally rotated 15 degrees provides a level for the neck resection that will restore leg length. It also provides the appropriate neck offset to anatomically position the femoral head and the femoral canal's medial/lateral dimensions (ML), which determine the overall implant size. The opposite hip, if normal, can be used as a reference. The view presents the pelvis' bony landmarks and the correct anatomical position of the acetabular component relative to landmarks, such as the teardrop. The lateral view confirms the femoral canal diameter and reveals any abnormalities in this plane.

Templating Implant Size

Overlay the template so the implant's center line is in line with the long axis of the femur and the "bow tie mark" is in the neutral position (the center of the mark is level with the proposed neck resection). Ensure the cement mantle outline fills the proximal femoral canal.

Establishing the Neck Resection Level

With the template positioned as shown, the marked center of rotation should overlay the center of the femoral head. Mark the x-ray through the slot to correspond with the center of the bow tie mark. This defines a "neutral" neck resection level to maintain existing leg length. Draw a line across the femoral neck at this level. Also draw a parallel line that just touches the femoral head's superomedial point. Measure the distance between the two lines along the femoral neck axis. Calculate the true length of this line from the known magnification of the x-ray, and set the resection caliper to this length.

Limb Length Adjustment

Leg length may be increased or reduced by 5mm without adjusting the femoral head. This is done by raising or lowering the implant outline along the long axis of the femur to align the slot corresponding to the upper or lower end of the bow tie mark with the neck resection level.

High Offset Option

If the patient has a higher offset than normal, consider the high offset option. With the equivalent size high offset template, femoral neck geometry will move 4mm medially to restore joint stability and reduce the chance of impingement without increasing leg length. The high offset option can also be used during revision surgery to balance lax abductor muscles.

[figure 1]

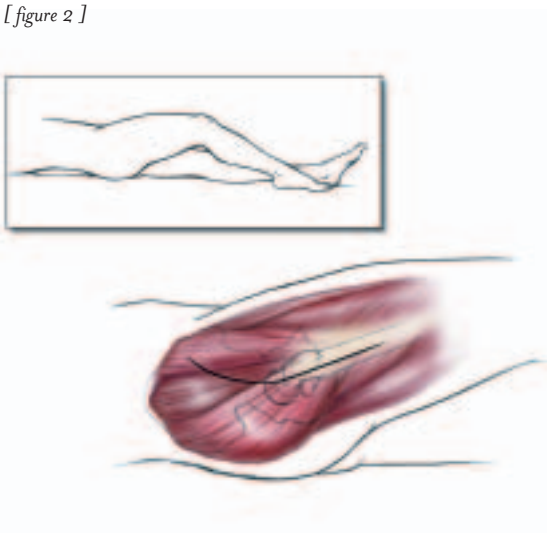
C-Stem standard template

Establishing the neck resection level. (Used with the neck resection caliper.)

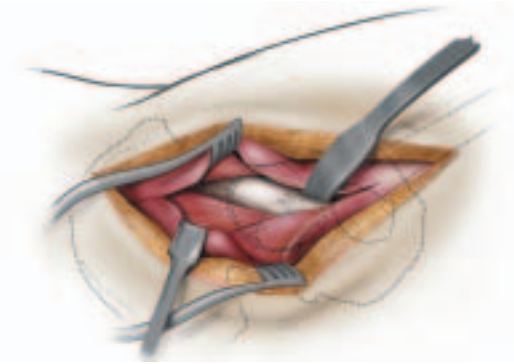
Surgical Approaches *[Fig. 2-4]*

The C-Stem Hip can be implanted using any of the standard surgical approaches for total hip arthroplasty. This technique outlines the surgical procedure for the anterolateral and posterolateral approaches.

[figure 2]



[figure 3]



Anterolateral Approach

Although the patient can be positioned in a variety of ways for the anterolateral approach, the patient is commonly inclined upward from the supine position using a bump near the midline. Make a long curvilinear incision apexed posteriorly at the tip of the greater trochanter that extends to the posterior third of the trochanter and then distally along the femoral axis.

Divide the fascia along the line of the skin incision where the anterior border of the gluteus medius can be readily identified. Beginning at the trochanteric ridge (also know as the vastus ridge) at the insertion point of the anterior fibers of the gluteus medius, dissect proximally up the anterior border of the gluteus medius muscle while separating the fascia lata muscle in an anterior direction. Within approximately the first 3cm of dissection, a minor vascular branch of the superior gluteal trunk will be encountered that extends into the tensor fascia muscle from the gluteus medius. Ligate or cauterize this branch. The more proximal second branch contains a neurovascular bundle and limits the extent of proximal dissection. Preserve this branch since it contributes significant nerve supply from the superior gluteal nerve to the tensor muscle.

With the tensor fascia muscle retracted medial and anterior and the gluteus medius retracted posterior and lateral, expose the deeply located gluteus minimus. Hip flexion relaxes the gluteus medius fibers and reduces tension in the tissue flap that contains the femoral nerve and vessels.

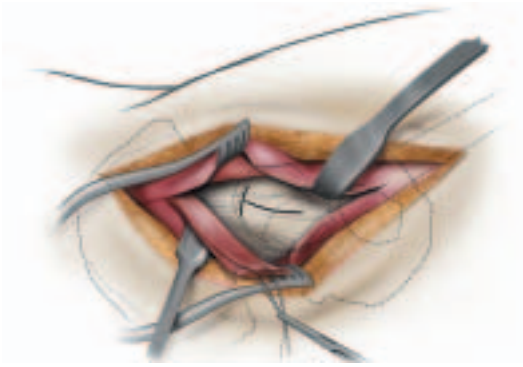
Dissect the hip capsule in a medial direction to the border of the gluteus minimus to expose the hip's anterior capsule as far as the anterior acetabular rim. The tendon of the direct head of the rectus femoris can be easily palpated along the anteromedial border of the hip capsule. To gain exposure of the anterior column, place a blunt cobra retractor beneath the rectus tendon by blunt dissection of anterior soft tissue slightly inferior to the axis of the femoral head over the brim of the anterior column. The blunt rectus retractor can then be safely substituted for the digit over the anterior column and beneath the direct head of the rectus tendon for excellent anteromedial hip capsule exposure. Do not dissect inferiorly along the anterior column below the level of the femoral head and then medially because vascular injury can result to either the femoral vessels in a medial direction or to the femoral circumflex vessels inferiorly.

To improve femoral neck and shaft distal wound exposure, split or release a portion of the vastus lateralis muscle origin from the vastus lateralis ridge and intertrochanteric line. To gain additional exposure of the superior hip, perform a trochanteric osteotomy or more extensive release of the anterior fibers of the gluteus medius. The gluteus medius fibers can be safely split approximately 3cm proximal to the level of the superior acetabular rim. More extensive proximal dissection may injure the superior gluteal neurovascular branches.

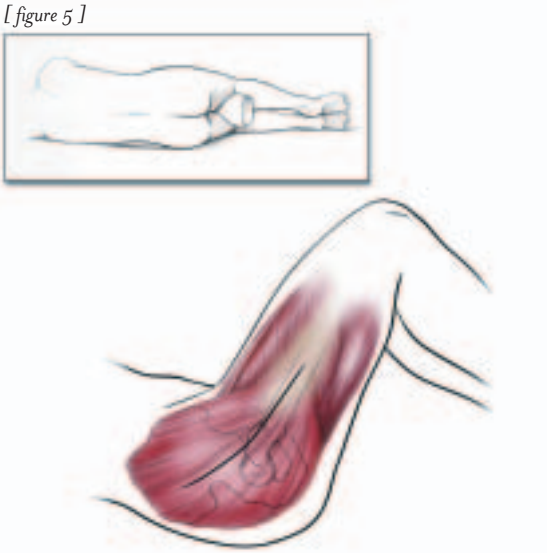
Make sure the anterior, inferior and limited superior hip capsule is thoroughly exposed. Incise the capsule along the superior border of the neck, dissect it from the anterior intertrochanteric line and retract it as a triangular flap to expose the femoral neck. After capsular incision or excision, dislocate the hip anteriorly by externally rotating the femur. For further femoral neck exposure distally, perform subperiosteal elevation of the vastus muscle from the proximal femur.

Neurovascular injury during anterior hip exposure can be caused by placement of anterior retractors over the anterior column. Use a blunt retractor if it is to be placed beneath the direct head of the rectus and over the anterior column of the acetabulum. The retractor tip will commonly lie in an anteroinferior quadrant of the hip and could cause neurovascular injury if the retractor tip is too long or sharp. Alternatively, place a retractor superficial to the direct rectus origin in the superior and anterior quadrant of the hip overlying the anterior column.

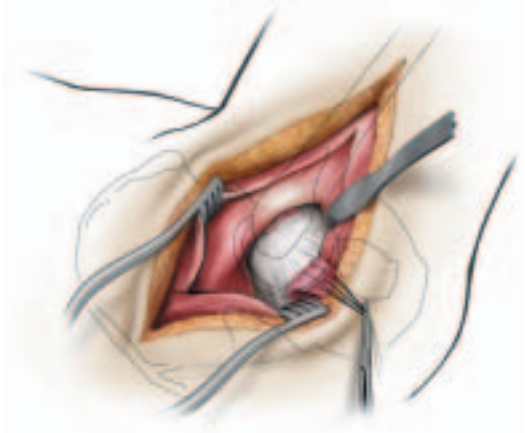
[figure 4]



[figure 5]



[figure 6]



Posterolateral Approach *[Fig. 5-7]*

Place the patient in the lateral decubitus position. Make the posterolateral approach incision with the greater trochanter at the center. The incision runs along the midlateral aspect of the femur, angling posteriorly approximately 30 degrees. It is just superior to the greater trochanter tip and in line with the gluteus maximus fibers.

Incise the skin and subcutaneous tissues down to the deep fascia and the fascia lata in line with the skin incision. Take care to incise only the overlying fascia of the muscle and not the muscle tissue itself. Split the gluteus maximus fibers manually to expose the posterior aspect of the hip.

After the fascia is incised, perform AP retraction of the fascia with a self-retraining retractor, such as a Charnley retractor. Place the posterior portion of the retractor near the musculotendinous border of the gluteus maximus. Avoid deep placement near the sciatic nerve.

With the knee flexed to 90 degrees, rotate the hip internally 30 degrees and then extend it. Hip extension relaxes the gluteus maximus to facilitate broach access to the posterior structures and the sciatic nerve. Incise the veil of thin fascial tissue along the posterior border of the gluteus medius, preserving the entire gluteus medius attachment to the trochanter.

Perform blunt dissection with an elevator or a sponge to cleanly displace fatty tissue overlying the short hip rotators. Dissect close to the posterior border of the trochanter to avoid unnecessary bleeding from the deeper branches lying against the posterior acetabular wall. Release the piriformis tendon near its insertion to expose the underlying posterior capsular insertion of the gluteus minimus. Incise the thin fascial envelope of the gluteus minimus near its capsular insertion. Using an elevator, free the gluteus minimus muscle from the superior hip capsule to help exposure and avoid tearing the muscle during retraction. Place a cobra retractor beneath the gluteus minimus to expose the superior hip capsule.

Sharply release the obturator internus tendon, which is often visible just caudad to the muscle belly of the superior gemellus. The piriformis tendon lies anatomically superficial to the sciatic nerve when reflected toward the midline and cannot be used as a protector. The obturator externus is identified deeply at the posterior-inferior border of the femoral neck as it inserts into the lower portion of the greater trochanter. Hook the obturator externus with a right angle clamp, deliver it out of the wound and release it sharply at its insertion. Adequately expose the obturator externus tendon by detaching a portion or all of the trochanteric insertion of the quadratus femoris down to the level of the lesser trochanter, which is usually at the superior edge of the gluteus maximus sleeve.

The obturator externus is too difficult to reattach and can be safely sacrificed. Place a blunt cobra inferior to the hip capsule and levered caudad to broadly expose the inferior capsule. The extensive exposure now visualizes the superior, posterior and inferior hip capsule. A hip capsulotomy or capsulectomy can be safely carried out with full visualization of the capsule.

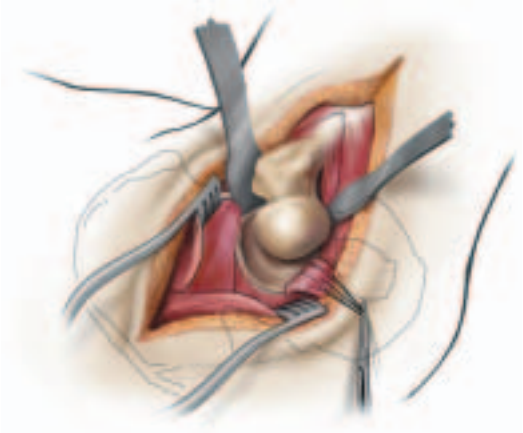
Routinely palpate the sciatic nerve during the deeper approach to check for occasional variation in its location toward the lateral portion of the wound. Easily palpate the nerve by moving a digit from the posterior wall of the acetabulum across the ischium toward the ischial tuberosity. Most sciatic nerves can be palpated without direct nerve exposure.

Dislocate the hip with a combination of internal rotation, flexion and adduction. If necessary, perform an *in situ* osteotomy of the femoral neck to safely dislocate the femoral head. Externally rotate the femur minus the femoral head back to a neutral position and flex the hip to 30 or 40 degrees and adduct it slightly. To expose the acetabulum, carefully place a long cobra retractor over the anterior column of the acetabulum to retract the femur anteriorly. Place the cobra retractor slightly cephalad. Placing the cobra retractor caudad over the anterior rim or column increases the risk of neurovascular damage caused by the retractor penetrating into the vascular sheath and femoral nerve.

Lever the cobra retractor against the femoral neck and not the trochanter to avoid a trochanter fracture. Once the cobra retractor displaces the femur, view the soft tissue below the inferior capsule and electrocauterize branches of the medial circumflex. Place a small blunt cobra retractor below the acetabular teardrop inferior to the transverse acetabular ligament in an extracapsular position to expose the acetabulum. Place a large, deep retractor with a smooth edge against the posterior acetabular lip to protect the sciatic nerve and structures posterior to the acetabulum and provide excellent acetabular exposure.

If necessary to improve exposure, an anterior capsulectomy can be performed. Place a curved instrument anterior to the anterior capsule along the psoas tendon sheath to guide incision of the capsule from its trochanteric insertion. Reflect the capsular flap into the acetabulum to safely excise the flap from the anterior acetabular rim along its anterior surface.

[figure 7]



Femoral Canal Initiation *[Fig. 8 and 9]*

Access the femoral canal at the piriformis fossa using the IM Initiator attached to the T-Handle. Accurately position the entry point to avoid implant malalignment. Centralize the initiator in line with the piriformis fossa in both the AP and lateral projections. Attach the Canal Probe to the T-Handle and introduce the probe into the canal along the neutral femoral axis at the piriformis fossa. Ensure the entry point is positioned in line with the long axis of the femur. Maintain a neutral orientation and ensure the probe does not impinge on the entry hole. If the entry hole is positioned correctly, the probe should easily pass down the femur.

Note: If femoral head resection occurs before canal preparation, use the IM Initiator and the canal probe to lateralize the femoral canal to remove any remaining portions of the lateral femoral neck and to ensure proper stem positioning. Use the neck resection template to determine the proper neck resection angle and level.

[figure 8]

Optional Canal Reaming *[Fig. 10]*

To maximize the strength of the bone/cement interface, the C-Stem Hip System is designed as a broach-only system. C-Stem reamers are available for surgeons who prefer to ream the intramedullary canal; however, aggressive reaming is not recommended. Perform any reaming by hand and not by power, which prevents burnishing of the endosteal surface and compromising the cement's ability to interdigitate into the stable cancellous bone.

Attach the smallest distal reamer to a T-handle and progressively increase the reamer diameter until adequate femoral canal clearing is achieved. Clear the canal without disturbing quality cancellous bone, which is needed for Endurance® Bone Cement interdigitation.

The depth marks along the reamer shaft correspond to stem size, and reaming should stop when the appropriate depth mark is level with the femoral head, which generally corresponds to the tip of the trochanter. Leave the final distal reamer in place. If the reamer is not centered in the pilot hole, the pilot hole is not correctly positioned and should be enlarged. Note the reamer size used since this information will help determine the appropriate restrictor and distal centralizer.

Note: The surgeon may resect the head before canal reaming by using the neck resection template.

[figure 9]

[figure 10]

Neck Resection *[Fig. 11-13]*

Set the caliper to the distance between the superomedial point of the femoral head and the level of resection, which was measured during pre-operative templating. Place one caliper leg on the superomedial point of the femoral head with the other leg touching the medial cortex. Mark the level of resection on the calcar.

Introduce the neck resection guide over the canal probe or distal reamer, ensuring the guide touches the femoral head and the anterior cortex of the greater trochanter. Align the neck resection guide so the saw guide is level with the appropriate resection mark. Two available saw guide slots include one for standard C-Stem implants and a second for CDH stems. Both are clearly marked on the template. Perform an osteotomy on the femoral neck using an oscillating saw. Remove the resection guide and the distal reamer once a sufficiently deep cut has been made. Complete the neck resection and remove the femoral head.

[figure 11]

[figure 12]

[figure 13]

Acetabular Preparation *[Fig. 14 and 15]*

The acetabulum should be fully exposed and soft tissue cleared from the acetabular rim.

[figure 14]

Progressively ream the acetabulum until healthy subchondral bone is reached and a hemispherical dome is achieved. Check that acetabular graters are correctly oriented: approximately 45 degrees of abduction with 15-30 degrees of anteversion. Once the reaming position, and ultimately cup position, is verified according to intraoperative landmarks, the trial cup should be anteverted so that its posterior border is flush with the ischium and abducted so that its inferior border is level with the teardrop. This procedure ensures correct orientation of the newly created acetabulum within the anatomic acetabulum.

Using the cup impactor, place a trial cup sizer of the same diameter, or 1- 2mm larger in diameter than the final reamer used, into the acetabulum and assess its position and cortical bone contact.

[figure 15]

The rim fit of the trial cup should be tight enough to make it difficult to alter its orientation once the trial has been seated. Position the trial liner into the trial acetabular cup using a universal hex screwdriver.

It is recommended that DePuy porous acetabular components be under-reamed by 1mm for cups 54mm or less and 2mm for cups 56mm and larger, contingent upon bone stock and quality.

Metaphyseal Preparation *[Fig. 16 and 17]*

Using the anteversion osteotome positioned laterally toward the greater trochanter, enlarge the entry point of the femoral canal to establish 10 to 15 degrees of anteversion for broach alignment. Reverse the osteotome and extend the entry point medially toward the lesser trochanter. Remove a wedge of cancellous bone that is the approximate size of the proximal segment of the prosthesis. To achieve an optimal cement mantle, clear the anatomical calcar, which is the cortical condensation overlying the endosteal entry into the lesser trochanter, using a curette. Extend the medullary canal toward the lesser trochanter while avoiding lesser trochanter excavation.

Attach a broach smaller than determined during preoperative templating to the broach handle. Impact the broach down the long axis of the canal in neutral orientation. When using the posterolateral approach, incorporate 5-15 degrees of anteversion. To avoid varus alignment or undersizing, position the broach laterally toward the greater trochanter. Ensure that any remaining superior lateral femoral neck portions are cleared to avoid a varus stem placement. Release a small portion of the gluteus medius if needed to facilitate exposure, and trim any overhanging trochanter. Progressively increase the size of the broach until the final broach is seated in the femur. Place the broach's marker point in the neutral position level with the neck resection level.

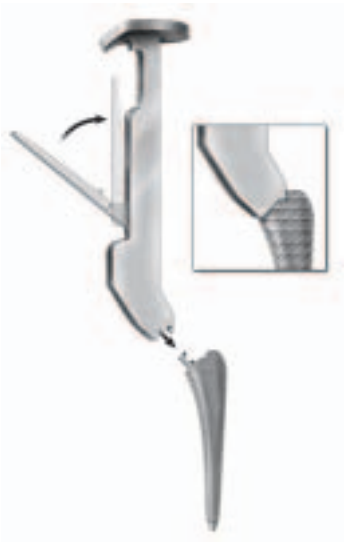
This will prepare a cavity that matches the size planned during preoperative templating. Note that the broach's marker point corresponds to the neck resection level determined preoperatively and corresponds to the center mark on the implant's bow tie. The C-Stem broach was designed to incorporate a circumferential 2mm cement mantle. The cement mantle does not include the added cement mantle created by cement interdigitation into the cancellous bone structure.

Calcar Planing (Optional) *[Fig. 18]*

Position the center hole of the planer over the broach trunnion and plane the bone until it is level with the proximal surface of the broach. Since the C-Stem implant is collarless, use this surgical step only when the neck resection level needs to be adjusted.

[figure 16]

[figure 17]



[figure 18]

Trial Reduction *[Fig. 19]*

Attach the appropriate neck segment to the broach. Multiple trial heads are available to allow for proper restoration of hip biomechanics (28mm heads: -3mm, +0mm, +3mm and +6mm neck lengths). The C-Stem System offers dual offsets (sizes 3, 4, 5) which allows implant lateralization by using either a standard or high offset neck segment. If the femoral neck resection level is correct for proper leg length restoration, but there is still inadequate soft tissue abductor muscle tension, consider a high offset neck segment. This will increase the offset and the soft tissue tension without affecting leg length.

If the high offset neck segment is used, the offset will be increased by 4mm. To determine proper hip biomechanics, evaluate range of motion, leg length and offset using each combination of neck segment and hip ball. To assess stability for each combination, check external rotation in extension to rule out anterior dislocation. Also perform a posterior dislocation test, bringing the hip up to 90 degrees of flexion with internal rotation. Once adequate stability is achieved, note the neck segment (standard or high) and the modular ball chosen. If additional offset is required, a DePuy lateralized offset liner can be used.

[figure 19]

[figure 20]

Placing the Acetabular Component *[Fig. 20]*

Once trial reduction is complete, remove the trial cup sizer and liner. Using the Cup Impactor and alignment guide, orient the cup in approximately 45 degrees of abduction and 15-30 degrees of anteversion. The intraoperative landmarks of the teardrop and ischium may also be used to position the cup. This places the cup face parallel to the opening of the true acetabulum. Remove any large overhanging osteophytes.

Using the polyethylene liner impactor, place the appropriate size liner into the metal shell and tap several times with a mallet, seating it securely into the acetabular shell.

Note: The C-Stem Hip System can also be used with all DePuy acetabular components.

[figure 21]

Broach Removal and Brushing the Canal *[Fig. 21 and 22]*

Remove the broach using the broach handle or broach extractor. Brush the canal using the DePuy Femoral Prep Kit brush and remove loose cancellous bone using a curette from the DePuy Femoral Prep Kit.

Inserting the Cement Restrictor *[Fig. 23]*

If the DePuy Femoral Prep Kit is used, attach the universal cement restrictor to the end of the insertion device. If using the DePuy sized cement restrictor system, attach the correctly sized cement restrictor trial, as determined by templating the distal canal, to the cement restrictor inserter. Insert the restrictor to a level as indicated. Remove the restrictor trial and attach the corresponding restrictor implant. Insert the restrictor implant at the same level as the restrictor trial.

Insertion Depth Table

Size	*Stem Length – Crotch Point to Distal Tip*	*Restrictor Depth*
CDH	*103mm*	*123mm*
1	*106mm*	*126mm*
2	*110.5mm*	*130mm*
3	*115mm*	*135mm*
4	*119.7mm*	*140mm*
5	*124mm*	*144mm*
6	*128.5mm*	*149mm*
7	*133mm*	*153mm*
8	*137.5mm*	*158mm*

Restrictor Table

Size	*Diameter*
Universal Small	*10.5 – 16.0mm*
Universal Large	*16.5 – 22.5mm*
1 DePuy Cement Restrictor	*8.25mm*
2 DePuy Cement Restrictor	*10.75mm*
3 DePuy Cement Restrictor	*13.25mm*
4 DePuy Cement Restrictor	*15.75mm*
5 DePuy Cement Restrictor	*18.25mm*
6 DePuy Cement Restrictor	*20.75mm*
7 DePuy Cement Restrictor	*23.75mm*

[figure 22]

[figure 23]

Irrigating and Drying the Canal *[Fig. 24 and 25]*

Irrigate the canal using pulse lavage with saline solution, ensuring that all debris is removed. Insert the Femoral Prep Kit sponge down the femoral canal to help dry and remove debris. The sponges may also be presoaked in an epinephrine or hydrogen peroxide solution.

[figure 24]

[figure 25]

Trial Reduction Using the Trial Stem (Optional) *[Fig. 26]*

C-Stem instruments include a trial stem, which may be used to assess implant fit. The trial stem has three holes positioned to match the three positions indicated by the bow tie on the template and stem. Select the appropriate trial stem and locate the trial stem peg in the central hole, holding the trial stem in the neutral position (or in the hole which matches the level noted during preoperative templating) and introducing the trial stem into the femur. Place the trial head on the neck of the trial stem, reduce the hip and assess joint stability, range of motion and leg length.

[figure 26]

Attaching a Centralizer and End Cap *[Fig. 27]*

Select the C-Stem Centralizer that corresponds to the diameter of the femoral canal (C-Stem Centralizers increase in 2mm increments from 10-20mm) and slide it over the distal tip of the stem. Note the size of the largest C-Stem reamer and restrictor diameter to help with the selection of the Centralizer. Ensure the Centralizer is placed with the fins distal as shown. Push the end cap firmly over the stem's tip. The end cap is made from a bioresorbable material and should be stored at a temperature below 86 degrees Fahrenheit.

Note: The end cap should not be used if the smallest diameter of the femoral canal is less than 10mm at the level of the stem tip.

[figure 27]

Cement Technique *[Fig. 28 and 29]*

Mix the Endurance Bone Cement using the Prism® Mixing System. Attach the cartridge to the DePuy cement injection gun. Starting at the distal part of the femoral canal, inject cement in a retrograde fashion, allowing the cement to push the gun nozzle gently back, until the canal is completely filled and the distal tip of the nozzle is clear of the canal. Place the Femoral Prep Kit pressurizer over the end of the nozzle. The cement should be pressurized for 30-60 seconds to allow good interdigitation of the cement into the trabecular bone. Continually inject cement during the period of pressurization. Use the Femoral Prep Kit curettes to remove excess bone cement.

Note: As the canal fills, place a thumb over the medial neck to prevent extrusion and provide pressurization.

[figure 28]

[figure 29]

Inserting the C-Stem Implant *[Fig. 30 and 31]*

During stem insertion, maintain thumb pressure on the cement at the medial femoral neck. Introduce the implant in line with the long axis of the femur. Its entry point should be lateral, close to the greater trochanter. The top of the inserter indicates medial/lateral directions with a large "M" and "L."

Place the inserter in the oval driver hole with the "M" pointing to the medial direction. Angle the inserter tip slightly to help push the stem into a neutral position. When the stem reaches the appropriate level indicated by the bow tie mark, gently tap the stem introducer to bring the stem to the level determined during preoperative templating. Remove excess PMMA with a curette. The C-Stem's collarless design allows visualization of the proximal cement mantle and will aid in the assessment of implant alignment. Maintain pressure until the PMMA cures completely. Next, place the trial head on the implant and perform a final trial reduction.

Note: A neutral stem inserter is also available.

[figure 30]

[figure 31]

Impacting the Femoral Head *[Fig. 32 and 33]*

Remove the trial head and irrigate and clean the prosthesis to ensure the taper is free of debris. Place the appropriate head onto the taper and lightly tap the head into place using the head impactor. Reduce the hip to carry out a final assessment of joint mechanics and stability.

Note: Twist ceramic heads on the stem and lightly impact.

Closure *[Fig. 34]*

With the hip reduced, repair the piriformis tendon and the external rotators either by drilling holes in the trochanter or by using the soft tissue on the posterior trochanter. Standard closure with adequate drainage is suggested.

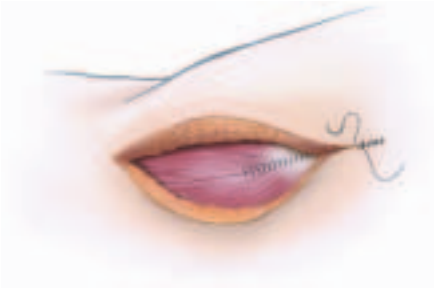
Postoperative Management

Encourage rapid mobilization with weight bearing to tolerance and the use of a walker or crutches for support. Provide appropriate DVT prophylaxis, along with perioperative antibiotics.

[figure 32]

[figure 33]

[figure 34]



The C-Stem is intended for cemented use only.

Caution: Federal Law (USA) restricts these devices to sale by or on the order of a physician.

DePuy Orthopaedics, Inc.
700 Orthopaedic Drive
Warsaw, IN 46580
USA
Tel: +1 (800) 366 8143
Fax: +1 (219) 267 7196

DePuy International Ltd
St Anthony's Road
Leeds LS11 8DT
England
Tel: +44 (113) 270 0461
Fax: +44 (113) 272 4101

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