CHARNLEY® MODULAR
Charnley in the 21st Century

Product Rationale
Surgical Technique

CHARNLEY®,
THE WORLD'S
MOST SUCCESSFUL
HIP IMPLANT

DePuy
a johnson & johnson company
Sir John Charnley was one of the first surgeons to recognise that the overall life of the arthroplasty would be extended if implant fixation could be maintained and the production of wear debris reduced to a minimum.

The Charnley® Hip is designed to maximise cement mantle integrity and reduce Polyethylene wear, and the success of today’s implant is undoubtedly the result of adhering to these sound principles.

The only differences between the Charnley® Stem and the Charnley® Modular Stem is the modular taper and stem insertion hole.
The Charnley® Hip is the product of over thirty years considered development, during which time, design changes have been incorporated only as a response to painstaking research and clinical experience; Sir John Charnley was methodical in his approach to the elimination of those factors which can affect the survival of an implant.

The number of true innovations is remarkable: from the first use of acrylic cement as a grout; the introduction of High Density Polyethylene bearings; the design of the flanged Ogee® socket; and the progressive improvement in stem metallurgy. Each new development making a first in design and materials specification.

The outcome is unique. No other hip replacement is associated with such a track record of success.

Charnley® Modular Stem is the modular taper and stem insertion hole.
Clinically Proven

80.9% survivorship at 25 years
86.5% survivorship at 25 years (revision for aseptic loosening)


77% survivorship at 20 years (stem)
73% survivorship at 20 years (cup)


95.6% survivorship at 7 years (stem)
98.1% survivorship at 7 years (cup)

73 surgeons (implanting variety of prostheses)


8% revision rate at 7 years


91% survivorship at 25 years (revision for aseptic loosening)
1 surgeon


92% survival at 14 years


Over 1 Million
Fixation

85.1% survivorship at 20 years


< 55 years: 73% survivorship at 17 years
< 55 years: 22% revision rate for aseptic loosening
> 55 years: 86% survivorship at 17 years
> 55 years: 4.2% revision rate for aseptic loosening

81% survivorship at 25 years
2 surgeons


91.9% survivorship at 15 years


3% revision rate at 9.9 years
1.6% revision rate at 9.9 years for aseptic loosening


1% revision rate at 16 years for aseptic loosening
1 surgeon


89% survivorship at 20 years
3.3% revision rate for aseptic loosening
1 surgeon


96% survivorship at 10 years
0.45% revision rate (stem) at 10 years for aseptic loosening


84% survivorship at 16 years


94.5 % survivorship at 10 years
7.2% revision rate at 10 years for aseptic loosening


87% survivorship at 16 years (stem)
83% survivorship at 16 years
85% survivorship at 18 years (revision for aseptic loosening)

87% survivorship at 16 years
85% survivorship at 18 years

92% survivorship at 22 years (revision for aseptic loosening)
1 surgeon


84% survivorship at 20 years


95.8% survivorship at 12 years


89.3% survivorship at 20 years
3.3% revision rate at 17.6 years for aseptic loosening


91% survivorship at 11 years

86% survivorship at 20 years
(revision for aseptic loosening)


89% survivorship at 10 - 12 years


87.3% survivorship at 12 years


<1% revision rate at 10.3 years for stem loosening


10.5% revision rate at 12 years


88% survivorship at 10 years


92% survivorship at 13 years


89.5% survivorship at 11.5 years

5.7% revision rate at 11.5 years for aseptic loosening

8 surgeons


96% survivorship at 10 years


91% survivorship (stem) at 15 years

96% survivorship (cup) at 15 years


16% revision rate at 15-17 years


92% graded as clinically successful at 10 years


97% survivorship at 10 years


6% revision rate at 10-12 years

2% revision rate at 10-12 years for aseptic loosening


83% survivorship at 10 years


95.4% survivorship at 10 years

Under the care of 56 consultants; 18 NHS and 6 private hospitals


8.2% revision rate at 12 years


92% survivorship at 10 - 12 years

Fixation

18% revision rate at 18 years
26 surgeons

4.8% revision rate at 15 years
2.4% revision rate at 15 years for aseptic loosening

29% revision rate at 20 - 25 years
23% revision rate at 20 - 25 years for aseptic loosening
5% revision rate (stem) at 20 - 25 years for aseptic loosening

73% survivorship at 25 years (stem)
68% survivorship at 25 years (cup)

87% survivorship at 15 years (revision for aseptic loosening)

16% revision rate at 20 years for femoral loosening

Stems Implanted
Total Cemented Hip

Charnley in the 21st Century
Total Hybrid Hip

Charnley in the 21st Century
Surgical Technique
Charnley in the 21st Century
Pre-operative Templating

Make a thorough radiographic examination of the contralateral side, taking into consideration any anatomical anomalies, dysplasia or previous osteotomy for example, using both A/P and M/L projections. The radiographs should be at 20% magnification and clearly demonstrate the acetabular configuration and the endosteal and periosteal contours of the femoral head, neck and proximal femur.

Femoral Implant Size

A radiograph showing the AP view of the proximal femur, internally rotated 15°, provides the most important information: a level for the neck resection which will restore leg length; the appropriate neck offset for a natural position of the femoral head; and the lateral/medial dimensions of the femoral canal which determine the overall size of the implant.

The AP view also presents the position of the femur relative to the bony landmarks of the pelvis, and the correct anatomical position of the acetabular component relative to landmarks such as the tear drop.

The lateral view showing the amount of femoral bow, helps to confirm the diameter of the femoral canal and highlights abnormalities in this plane which might affect the position of the implant (Figure 8).

For sizing cement restrictor see page 27.

For sizing centraliser see page 29.
Templating for Cemented Acetabular Implant Size
Select an appropriate sized acetabular template and align it with the superior, and then inferior border of the acetabulum. This will ensure that the template is medialised at the level of the teardrop. Once the correct template has been determined, note the centre of rotation and size of the acetabulum on the X-rays (Figure 9).

Templating for Cementless Pinnacle™ Acetabular Implant Size
Using the A/P radiograph, position the Pinnacle™ template at 35 - 45° to the inter-teardrop or interischial line so that the inferomedial aspect of the cup abuts the teardrop. Ensure that the superior-lateral aspect of the cup is not excessively uncovered (Figure 10).
Anterolateral Approach

Use the approach with which you are most familiar and achieve the best surgical result. The Charnley® Modular Hip System Instrumentation was designed to accommodate all surgical approaches.

For the anterolateral approach, place the patient in the lateral decubitus position and execute a skin incision that extends from distal to proximal, centred over the anterior aspect of the femur, continuing over the greater trochanter tip (Figure 11).

The iliotibial band is split under the skin incision, extending proximally into the gluteus maximus or in between the maximus and the tensor fascia lata muscles (Figure 12).

Palpate the anterior and posterior borders of the gluteus medius. The gluteus medius is split from the trochanter, parallel to its fibres, releasing the anterior 1/2 to 1/3 of the muscle (Figure 13).

The gluteus medius should not be split more than 4 cm from the tip of the greater trochanter. Care must be taken to ensure the inferior branch of the superior gluteal nerve is not damaged. The gluteus minimus is exposed and released either with or separate from the gluteus medius (Figure 14).
Flexion and external rotation of the leg facilitates exposure of the hip capsule, which is incised or excised depending on surgeon preference. Dislocate the hip with gentle adduction, external rotation and flexion (Figure 15).

The patient’s leg is now across the contralateral leg and the foot is placed in a sterile pouch. If dislocation is difficult, additional inferior capsule may be released.

The femoral neck should now be exposed. Exposure of the acetabulum is accomplished by placing the leg back on the table in slight flexion and external rotation. Use a self-retaining retractor to spread the medius and minimus anteriorly and the hip capsule posteriorly (Figure 16).

Carefully place another retractor over the anterior inferior wall of the acetabulum. The final retractor is placed in the acetabular notch beneath the transverse ligament and pulls the femur posteriorly (Figure 17).
Surgical Approaches
Posterolateral Approach

Use the approach with which you are most familiar and achieve the best surgical result. The Charnley® Modular Hip System Instrumentation was designed to accommodate all surgical approaches.

For the posterolateral approach, place the patient in the lateral decubitus position. Ensure that the operating table is parallel to the floor and that the patient is adequately secured to the table to improve accuracy of the external alignment guides. Centre the skin incision over the greater trochanter, carrying it distally over the femoral shaft for about 15 cm and proximally in a gently curving posterior arc of about 30° for about the same distance (Figure 18).

Fascial Incision
Incise the iliotibial tract distally following the skin incision. Develop the incision proximally by blunt dissection of the gluteus maximus along the direction of its fibres (Figure 19).

Initial Exposure
Place the leg in extension and internal rotation. Utilise self-retaining retractors to facilitate the exposure. Gently sweep loose tissue posteriorly, exposing the underlying short external rotators and quadratus femoris.
Identify the posterior margin of the gluteus medius muscle proximally and the tendon of the gluteus maximus distally (Figure 20). Use caution to protect the sciatic nerve.

Incise the quadratus femoris, leaving a cuff of tissue for later repair (Figure 21). This exposes the terminal branch of the medial circumflex artery, which lies deep to the proximal third of the quadratus femoris. Identify the piriformis tendon, the obturator internus tendon (conjoint with the gemelli tendons) and the tendon of the obturator externus, and free them from their insertions at the greater trochanter. The piriformis and the conjoint tendon may be tagged for subsequent reapproximation.

**Posterior Capsulotomy**

Retract the short rotator muscles posteromedially together with the gluteus maximus (with consideration to the proximity of the sciatic nerve), thus exposing the posterior capsule (refer to Figure 21). Place cobra retractors anteriorly and inferiorly (Figure 22).

Open the capsule posteriorly starting at the acetabular margin at about the 12 o’clock position and heading to the base of the neck, around the base of the neck inferiorly and back to the inferior acetabulum, creating a posteriorly based flap for subsequent repair. Excise additional anterior/superior capsule to enhance dislocation of the hip. Alternatively the capsule can be excised.
Femoral Preparation

**Femoral Canal Initiation**
Attach the IM Initiator to the T-Handle. Centralise the initiator at piriformis fossa in line with the long axis of the femur in both the A/P and lateral projections and make an entry point into the proximal femur (Figures 23 & 24). Accurate positioning of the entry point will avoid instrument and implant malalignment later.
Femoral Alignment
Attach the Canal Probe to the T-Handle. Introduce the probe into the femoral canal, maintaining neutral orientation. If the entry hole has been positioned correctly, the probe should easily pass down the femur (Figure 25). If the probe impinges, enlarge the entry point using the IM initiator.

*The Charnley® Modular Hip System is designed as a broach-only system, to maximise the strength of the bone/cement interface. Charnley® Modular Hip System reamers are available for surgeons who prefer to ream the intramedullary canal (see page 33). The Flanged 35 prosthesis requires the use of the recommended broach as a rasp to prepare the femur and a trial prosthesis is used to assess joint function and stability.*

*Charnley® Broach/Charnley® Modular Trial heads accommodate up to size 32 mm heads. Use of the trial prostheses is necessary to perform the assessment of joint function with 36 mm trial heads.*

Neck Resection
The neck resection guide is used to establish the level (normally in the region of 1.5 cm above the lesser trochanter) and the angle of the neck resection. The straight edge of the guide is aligned with the long axis of the femur, the resection level is marked using diathermy and the neck is resected using an oscillating saw.

*Note: The approach through piriformis fossa leads to neutral A/P and lateral stem positioning with the stem centralised within an even cement mantle.*
Acetabular Preparation for Cemented Cup Fixation

Clear the acetabular rim of soft tissues so that the rim is fully exposed. A retractor can be placed in the teardrop to improve access if required.

The goal of acetabular reaming is to restore the centre of the original acetabulum. Progressively ream the acetabulum with the reamers introduced centrally, in 45° of abduction and 15° of anteversion. Over ream the acetabulum by 4 - 6 mm to ensure 2 - 3 mm cement mantle. It is important to remember that if the posterior approach is employed the pelvis will be in approximately 20° of anteversion and this must be compensated for during both acetabular reaming and cup placement (Figure 27).

Ream the acetabulum to a hemispherical dome of healthy, bleeding subchondral, cortico-cancellous bone that will contain the cup and its surrounding mantle. A balanced approach is needed to create the right bony surface for a good cement interlock, while retaining sufficient subchondral bone to maintain the load bearing strength of the socket.

Clear away any remaining soft tissues and capsule. Remove any osteophytes or cysts from the acetabular bed and repair the defects using a cancellous bone block. Sclerotic bone should also be removed at this stage since this will prevent cement penetration.

Introduce multiple drill holes in the roof of the acetabulum superiorly and posteriorly in the safe quadrant. Use the collared acetabular preparation drill to encourage intrusion of cement into acetabular bone (taking care to avoid the medial wall of the acetabulum - the triangle of bone based on the transverse ligament, figure 28). Smooth the edges of the drill holes and remove debris using a small curette. A spoon may be used to feel for cysts that may not have been revealed by reaming or radiological examination.

Cup Sizing

Size the acetabulum using a phantom cup (and trimming aid for the Ogee cup) attached to the cup introducer. Once the size is established, trim the rim of the Ogee trimming aid so that it just fits within the rim of the acetabulum. Use the trimming aid as a guide to trim the definitive Ogee cup (Figure 29).
Bone Preparation
Use pulsatile or continuous lavage within the acetabulum to remove fat and debris from the cancellous bone interface. Use a brush to remove loose cancellous bone if necessary. Employ suction and dry swabs to clean and dry the bone surface.

When the acetabular surface is dry and the bone surface is open, pack the socket with hydrogen peroxide impregnated swabs. These will prevent blood clots adhering to the bone and leave the surface ready for cement introduction.

Cement Technique
The majority of surgeons introduce cement into the acetabulum by hand. Don clean gloves to avoid contaminating the cement. Take the bolus of mixed cement and knead to assess the viscosity in addition to visual evaluation. The cement is ready for insertion when it has taken on a dull, doughy appearance and does not adhere to the surgeon’s glove. Remove the peroxide swabs from the acetabulum and use a dry swab to remove excess peroxide. Introduce the cement in one piece, distribute it to follow the acetabular hemisphere and push cement deep into the fixation holes. This should only take a few seconds.

Cement Pressurisation
Using an appropriately sized acetabular pressuriser, completely seal the acetabulum and apply maximum pressure to encourage interdigitation of bone cement into the cancellous bed. Retain a small piece of cement to finger test to assess the viscosity of the cement. When the cement can be pressed together without sticking to itself, implant the cup.

Cup Implantation
Attach the cup to the cup introducer and align the introducer in 10° to 15° of anteversion (if the posterior approach is employed, the pelvis will be in approximately 20° of anteversion and this must be compensated for). The flange should occlude the acetabulum, with the flange rim sitting just within the border of the acetabulum, so that the cement is contained behind the flange. Place a finger on the flange prior to insertion, to avoid air being trapped behind the flange. The cement should be contained behind the rim of the cup, and the rim fully supported by the cement.

The cup pusher is then located on the back of the cup introducer and the cement is pressurised until polymerisation is complete (Figure 30).
Acetabular Preparation

Acetabular preparation for Pinnacle™ cementless implantation is essentially the same as the cemented technique, with the following strategy in mind.

Begin with a reamer 6 - 8 mm smaller than the anticipated acetabular component diameter and deepen the acetabulum to the level determined by pre-operative templating. Increase the reamer sizes in 1 - 2 mm increments (Pinnacle™ instruments are marked with true dimensions), centring the reamers to deepen the acetabulum until it becomes a true hemisphere (Figure 31).

Depending on bone quality, it is usually sufficient to underream 1 mm in smaller sockets, while a larger socket may require 1 - 2 mm under-ream. Soft bone will more readily accommodate a greater press-fit of the acetabular component than sclerotic bone. Use a curette to free all cysts of fibrous tissue. Pack any defects densely with cancellous bone.

Acetabular Cup Trialing and Positioning

Pre-operative templating, using the A/P projection will help determine the ideal abduction angle.

The lateral ilium is a useful intra-operative landmark. In a normal acetabulum with good lateral coverage, the abduction angle will be correct if the socket lies flush with a normal lateral pillar (Figure 32).

The implanted cup should be slightly more anteverted than the pubis / ischial plane. This relationship should remain constant regardless of the depth of reaming (Figure 33).
Select a cup trial that is equal to or 1 mm larger in diameter than the final reamer. Screw the cup introducer into the threaded apex hole and introduce the cup trial in an anatomic orientation, with an abduction of 35 - 45° to the transverse plane. Confirm that the cup trial is fully seated by sighting through the holes and cut-outs in the acetabular cup trial. Appropriate trial cup orientation can also be verified with external alignment guides.

**Definitive Cup Implantation**

Once the correct cup size is confirmed, extract the trial, attach the appropriate definitive cup to the introducer and repeat the process. Once its position and alignment have been checked, impact the cup into place. Insert the apex hole eliminator using a standard hex head screwdriver.

At this point in the procedure a decision can finally be made whether to screw the cup into place (sector and multihole). This should be carried out with due consideration to bone quality, ensuring the appropriate length of screws are located within the ‘safe’ quadrant.

**Insert Trial Introduction**

Place the appropriate insert trial into the trial cup (Figure 34). Secure the insert trial to the cup trial through the apical hole screw using a standard hex head screwdriver.

A full description of this technique and the range of cup and insert options is available in the Pinnacle™ Surgical Technique Cat No: 9068-080-050.
Clearing the Anatomical Calcar
In order to achieve an optimal cement mantle, clear the anatomical calcar (the cortical condensation overlying the endosteoal entry into the lesser trochanter) using an osteotome or curette. Avoid excavating the lesser trochanter (Figures 35 & 36).

The broaches used for femoral preparation are the same as the Charnley® broaches.

Femoral Broaching
A broach, smaller than that determined during pre-operative templating is attached to the in-line broach handle and passed down the canal. It is essential that the broach is introduced as close to the greater trochanter as possible, and is in line with the long axis of the femur with 10° to 15° of anteversion. If the broach enters the femur too medially, the cavity will be undersized, and the implant malaligned. Again, broaching should not be so aggressive that it strips away strong cortico-cancellous bone in the proximal femur.

To achieve a good cement mantle, the anatomical calcar may be cleared using a curette, extending the medullary canal toward the lesser trochanter, but avoiding excavation of the lesser trochanter.

The final broach should confirm the size templated pre-operatively and determine the final implant size.
Femoral Neck Trial Head
Attach the appropriate trial head to the broach. Multiple trial heads are available to allow for proper restoration of hip biomechanics (28 mm heads: -3 mm, +0 mm, +3 mm and +6 mm neck lengths).

Charnley Modular Trial Head
Note: For Surgeons who use trial stems please use the Elite™ trial heads.

The Flanged 35 prosthesis requires the use of the recommended broach as a rasp to prepare the femur and a trial prosthesis is used to assess joint function and stability.

Charnley® Broach/Charnley® Modular Trial heads accommodate up to size 32 mm heads. Use of the trial prostheses is necessary to perform the assessment of joint function with 36 mm trial heads.
Trial Reduction

Use the trial head with different size offsets to restore joint stability with an adequate range of motion. 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° of flexion with internal rotation. Once adequate stability is achieved, note the neck segment (standard or high) and the trial head chosen (Figure 39).

If the Pinnacle™ Cementless Cup System is to be implanted, a comprehensive range of trial inserts is available which offers a further dimension for adjustment at this stage (see Pinnacle™ Surgical Technique Cat No: 9068-080-050).

Broach Removal

Remove the broach using the broach handle or broach extractor. Clean the canal to remove loose cancellous bone using a curette.

Cement Restriction

Inserting the Cement Restrictor

Use pulsative lavage to clear the femoral canal of debris and open the interstices of the bone.

Attach the size of trial cement restrictor selected during pre-operative templating to fit the distal canal. Attach it to the cement restrictor inserter and insert the trial to the planned depth. Check that it is firmly seated in the canal. Remove the trial and replace it with the corresponding restrictor implant. Insert the restrictor implant at the same level as the restrictor trial (Figures 40 & 41).
Irrigate the canal using pulsatile lavage with saline solution, ensuring that all debris is removed (Figure 42).

Pass a swab down the femoral canal to help dry and remove any remaining debris. The swab may also be pre-soaked in an epinephrine or hydrogen peroxide solution.

**Insertion Depth Table**

<table>
<thead>
<tr>
<th>Size</th>
<th>Stem Length (Crotch Point to Distal Tip)</th>
<th>Restrictor Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDH</td>
<td>111 mm</td>
<td>131 mm</td>
</tr>
<tr>
<td>SNS35</td>
<td>112 mm</td>
<td>132 mm</td>
</tr>
<tr>
<td>Flanged 35</td>
<td>112 mm</td>
<td>132 mm</td>
</tr>
<tr>
<td>Flanged 40</td>
<td>112 mm</td>
<td>132 mm</td>
</tr>
<tr>
<td>Extra Heavy Flanged 40</td>
<td>112 mm</td>
<td>132 mm</td>
</tr>
<tr>
<td>Roundback 40</td>
<td>113 mm</td>
<td>133 mm</td>
</tr>
<tr>
<td>Roundback 40 Narrow</td>
<td>113 mm</td>
<td>133 mm</td>
</tr>
<tr>
<td>Roundback 45</td>
<td>113 mm</td>
<td>133 mm</td>
</tr>
<tr>
<td>Flanged 45</td>
<td>113 mm</td>
<td>133 mm</td>
</tr>
<tr>
<td>Extra Heavy Flanged 45</td>
<td>113 mm</td>
<td>133 mm</td>
</tr>
</tbody>
</table>
Attaching the Centraliser

Select the Charnley® Modular Centraliser that corresponds to the diameter of the femoral canal (refer to table). After selecting the right size of centraliser, slide it over the distal tip of the stem and push the end over the tip of the stem (Figure 43).

<table>
<thead>
<tr>
<th>Size</th>
<th>Centraliser 1 Canal Size</th>
<th>Centraliser 2 Canal Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDH</td>
<td>11.0-12.5 mm</td>
<td>13.0 mm+</td>
</tr>
<tr>
<td>SNS35</td>
<td>12.0-13.5 mm</td>
<td>14.0 mm+</td>
</tr>
<tr>
<td>Flanged 35</td>
<td>14.5-16.0 mm</td>
<td>16.5 mm+</td>
</tr>
<tr>
<td>Flanged 40</td>
<td>13.0-14.5 mm</td>
<td>15.0 mm+</td>
</tr>
<tr>
<td>Extra Heavy Flanged 40</td>
<td>15.0-16.5 mm</td>
<td>17.0 mm+</td>
</tr>
<tr>
<td>Roundback 40</td>
<td>13.0-14.5 mm</td>
<td>15.0 mm+</td>
</tr>
<tr>
<td>Roundback 40 Narrow</td>
<td>13.0-14.5 mm</td>
<td>15.0 mm+</td>
</tr>
<tr>
<td>Roundback 45</td>
<td>13.0-14.5 mm</td>
<td>15.0 mm+</td>
</tr>
<tr>
<td>Flanged 45</td>
<td>13.0-14.5 mm</td>
<td>15.0 mm+</td>
</tr>
<tr>
<td>Extra Heavy Flanged 45</td>
<td>15.0-16.5 mm</td>
<td>17.0 mm+</td>
</tr>
</tbody>
</table>
Cement Technique

Mix CMW® bone cement using the Cemvac® Vacuum Mixing System. Attach the syringe to the Cemvac® cement injection gun. Assess the viscosity of the cement; the cement is ready for insertion when it has taken on a dull, doughy appearance and does not adhere to the surgeon’s glove. Start at the distal part of the femoral canal and inject the cement in a retrograde fashion, allowing the cement to push the nozzle gently back, until the canal is completely filled and the distal tip of the nozzle is clear of the canal (Figure 44).

Cut the nozzle and place a DePuy femoral pressuriser over the end. The CMW® cement should be pressurised to allow good interdigitation of the cement into the trabecular bone. Continually inject cement during the period of pressurisation (Figure 45). Use the Femoral Prep Kit curettes to remove excess bone cement. Implant insertion can begin when the cement can be pressed together without sticking to itself.

A full description of this technique is available in the CMW® Cementing Surgical Technique Cat No: 4010-030-000.
Inserting the Charnley® Modular Implant

Place the stem inserter in the oval location hole. Angle the inserter tip slightly to help push the stem into a neutral position (Figure 46).

Introduce the implant in line with the long axis of the femur. Its entry point should be lateral, close to the greater trochanter. Do not use the neck cut as a reference. During insertion, thumb pressure is maintained on the cement at the medial femoral neck.

The stem is introduced until it reaches the templated level, and is seated approximately at the neck resection. Pressure is maintained until polymerisation is complete. A final trial reduction is carried out to confirm joint stability and joint movement.

The stem is correctly seated when the pre-operatively determined level is reached. Remove excess cement with a curette. Maintain pressure until the cement is completely polymerised.
Impacting the Femoral Head

Next, place the trial head on the implant and perform a final trial reduction (Figure 47). 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 (Figure 48).

Note: A ceramic head should be twisted on the stem and lightly impacted.

Closure

Closure is based on the surgeon’s preference and the individual case. The closure should be tested throughout the hip range of motion.
The Charnley® Modular Hip System is designed as a broach-only system, to maximise the strength of the bone / cement interface. Charnley® Modular Hip System 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 bone cement interdigitation (Figure 49).

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 centred 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 centraliser.

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

Set the calliper to the distance measured during pre-operative templating between the superomedial point of the femoral head and the level of resection. Place one leg of the calliper on the superomedial point of the femoral head. Mark the level of resection where the point of the other leg touches the medial cortex (Figure 50).

Introduce the neck resection guide over the canal probe or distal reamer. Ensure the guide touches the femoral head and the anterior cortex of the greater trochanter.

Align the appropriate saw guide with the resection mark. There are two saw guide slots, one for Standard and the other for CDH stems (Figure 51). 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 of the femoral head.
### Ordering Information

#### Femoral Heads

- **22.225 mm 9/10 Ceramax™ Head**
  - 136522110 22.225 mm 9/10 Ceramax™ Head Neck Length -3
  - 136522120 22.225 mm 9/10 Ceramax™ Head Neck Length +0

- **28 mm 9/10 Ceramax™ Head**
  - 136528110 28 mm 9/10 Ceramax™ Head Neck Length -3
  - 136528120 28 mm 9/10 Ceramax™ Head Neck Length +0
  - 136528130 28 mm 9/10 Ceramax™ Head Neck Length +3

- **32 mm 9/10 Ceramax™ Head**
  - 136532110 32 mm 9/10 Ceramax™ Head Neck Length -3
  - 136532120 32 mm 9/10 Ceramax™ Head Neck Length +0
  - 136532130 32 mm 9/10 Ceramax™ Head Neck Length +3

- **36 mm 9/10 Ceramax™ Head**
  - 136536110 36 mm 9/10 Ceramax™ Head Neck Length -3
  - 136536120 36 mm 9/10 Ceramax™ Head Neck Length +0
  - 136536130 36 mm 9/10 Ceramax™ Head Neck Length +3

- **28 mm 9/10 Ultamet™ Head**
  - 962700100 28 mm 9/10 Elite™ Head Neck Length -3
  - 962701100 28 mm 9/10 Elite™ Head Neck Length +0
  - 962702100 28 mm 9/10 Elite™ Head Neck Length +3
  - 962703100 28 mm 9/10 Elite™ Head Neck Length +6

- **36 mm 9/10 Ultamet™ Head**
  - 962710000 36 mm 9/10 Ultamet™ Head Neck Length -3
  - 962711000 36 mm 9/10 Ultamet™ Head Neck Length +0
  - 962712000 36 mm 9/10 Ultamet™ Head Neck Length +3
  - 962713000 36 mm 9/10 Ultamet™ Head Neck Length +6

- **22.25 mm Elite™ Modular Heads 9/10 Taper**
  - 962730000 22.225 mm Elite™ Modular Head -3
  - 962567000 22.225 mm Elite™ Modular Head +0
  - 962731000 22.225 mm Elite™ Modular Head +3
  - 962529000 22.225 mm Elite™ Modular Head +6

- **26 mm Elite™ Modular Heads 9/10 Taper**
  - 962569000 26 mm Elite™ Modular Head -3
  - 962570000 26 mm Elite™ Modular Head +0
  - 962732000 26 mm Elite™ Modular Head +3
  - 962529000 26 mm Elite™ Modular Head +6

- **28 mm Elite™ Modular Heads 9/10 Taper**
  - 962572000 28 mm Elite™ Modular Head -3
  - 962573000 28 mm Elite™ Modular Head +0
  - 962734000 28 mm Elite™ Modular Head +3
  - 962747000 28 mm Elite™ Modular Head +6

- **32 mm Elite™ Modular Heads 9/10 Taper**
  - 962574000 32 mm Elite™ Modular Head -3
  - 962575000 32 mm Elite™ Modular Head +0
  - 962735000 32 mm Elite™ Modular Head +3

- **28 mm Elite™ Modular Alumina Heads 9/10 Taper**
  - 962173000 28 mm Biolox® Forte Ceramic Head -3
  - 962174000 28 mm Biolox® Forte Ceramic Head +0

For Complete Code Listings for Pinnacle please use:
- 908010000 Pinnacle Reference Guide

#### Femoral Head Trials

- **Trial Heads 22.225 mm**
  - 252222001 Elite™ Trial Head 22.225 mm, -3
  - 252222002 Elite™ Trial Head 22.225 mm, +0
  - 252222003 Elite™ Trial Head 22.225 mm, +3
  - 252222004 Elite™ Trial Head 22.225 mm, +6

- **Trial Heads 26 mm**
  - 252226001 Elite™ Trial Head 26 mm, -3
  - 252226002 Elite™ Trial Head 26 mm, +0
  - 252226003 Elite™ Trial Head 26 mm, +3

- **Trial Heads 28 mm**
  - 252228001 Elite™ Trial Head 28 mm, -3
  - 252228002 Elite™ Trial Head 28 mm, +0
  - 252228003 Elite™ Trial Head 28 mm, +3
  - 252228004 Elite™ Trial Head 28 +6

- **Trial Heads 32 mm**
  - 252232001 Elite™ Impl Trial Head 32 mm, -3
  - 252232002 Elite™ Impl Trial Head 32 mm, +0
  - 252232003 Elite™ Impl Trial Head 32 mm, +3

#### Charnley® Modular Trial Heads

- **22.225 mm**
  - 962736000 Charnley® Modular Excel™ Trial Head 22.225 mm, -3
  - 962615000 Charnley® Modular Excel™ Trial Head 22.225 mm, 0
  - 962737000 Charnley® Modular Excel™ Trial Head 22.225 mm, +3
  - 962550050 Charnley® Modular Excel™ Trial Head 22.225 mm, +6

- **26 mm**
  - 962617000 Charnley® Modular Excel™ Trial Head 26 mm, -3
  - 962616000 Charnley® Modular Excel™ Trial Head 26 mm, 0
  - 962738000 Charnley® Modular Excel™ Trial Head 26 mm, +3

- **28 mm**
  - 962620000 Charnley® Modular Excel™ Trial Head 28 mm, -3
  - 962619000 Charnley® Modular Excel™ Trial Head 28 mm, 0
  - 962739000 Charnley® Modular Excel™ Trial Head 28 mm, +3
  - 962751000 Charnley® Modular Excel™ Trial Head 28 mm, +6

- **32 mm**
  - 962623000 Charnley® Modular Excel™ Trial Head 32 mm, -3
  - 962622000 Charnley® Modular Excel™ Trial Head 32 mm, 0
  - 962740000 Charnley® Modular Excel™ Trial Head 32 mm, +3

#### Femoral Implants

- **Charnley® Modular Femoral Prosthesis**
  - 962562000 Charnley® Modular Femoral Prosthesis, CDH
  - 962535001 Charnley® Modular Femoral Prosthesis, SNS 35
  - 962535002 Charnley® Modular Femoral Prosthesis, Flanged 35
  - 962550000 Charnley® Modular Femoral Prosthesis, Flanged 40
  - 962540000 Charnley® Modular Femoral Prosthesis, Ex H 40
  - 962566000 Charnley® Modular Femoral Prosthesis, RB 40
  - 962565000 Charnley® Modular Femoral Prosthesis, RB Narrow 40
  - 962578000 Charnley® Modular Femoral Prosthesis, RB 45
  - 962579000 Charnley® Modular Femoral Prosthesis, Flanged 45
  - 962545001 Charnley® Modular Femoral Prosthesis, Ex H 45
### Femoral Trials

**Charnley® Modular Trial Femoral Prosthesis**
- [96305000](#) Charnley® Modular Trial Femoral Prosthesis, CDH
- [96305002](#) Charnley® Modular Trial Femoral Prosthesis, SNS 35
- [96305001](#) Charnley® Modular Trial Femoral Prosthesis, Flange 35
- [96301000](#) Charnley® Modular Trial Femoral Prosthesis, Flanged 40
- [96304000](#) Charnley® Modular Trial Femoral Prosthesis, Ex H 40
- [96303000](#) Charnley® Modular Trial Femoral Prosthesis, Flanged 45
- [96304500](#) Charnley® Modular Trial Femoral Prosthesis, Ex H 45

### Acetabular Cups

- [965120038](#) Charnley® LPW Cup 22.225/38 mm
- [965120040](#) Charnley® LPW Cup 22.225/40 mm
- [965120043](#) Charnley® LPW Cup 22.225/43 mm
- [965120047](#) Charnley® LPW Cup 22.225/47 mm
- [965120050](#) Charnley® LPW Cup 22.225/50 mm
- [965120053](#) Charnley® LPW Cup 22.225/53 mm
- [965220040](#) Charnley® Flanged Cup 22.225/40 mm
- [965220043](#) Charnley® Flanged Cup 22.225/43 mm
- [965220047](#) Charnley® Flanged Cup 22.225/47 mm
- [965220050](#) Charnley® Flanged Cup 22.225/50 mm
- [965220053](#) Charnley® Flanged Cup 22.225/53 mm
- [965320040](#) Charnley® Ogee® Cup 22.225/40 mm
- [965320043](#) Charnley® Ogee® Cup 22.225/43 mm
- [965320047](#) Charnley® Ogee® Cup 22.225/47 mm
- [965320050](#) Charnley® Ogee® Cup 22.225/50 mm
- [965320053](#) Charnley® Ogee® Cup 22.225/53 mm
- [96518040](#) Elite Plus™ LPW Cup 28/40 mm
- [96518043](#) Elite Plus™ LPW Cup 28/43 mm
- [96518047](#) Elite Plus™ LPW Cup 28/47 mm
- [96518050](#) Elite Plus™ LPW Cup 28/50 mm
- [96518053](#) Elite Plus™ LPW Cup 28/53 mm
- [96528040](#) Elite Plus™ Flanged Cup 28/40 mm
- [96528043](#) Elite Plus™ Flanged Cup 28/43 mm
- [96528047](#) Elite Plus™ Flanged Cup 28/47 mm
- [96528050](#) Elite Plus™ Flanged Cup 28/50 mm
- [96528053](#) Elite Plus™ Flanged Cup 28/53 mm
- [96536040](#) Elite Plus™ Ogee® Cup 26/40 mm
- [96536043](#) Elite Plus™ Ogee® Cup 26/43 mm
- [96536047](#) Elite Plus™ Ogee® Cup 26/47 mm
- [96536050](#) Elite Plus™ Ogee® Cup 26/50 mm
- [96536053](#) Elite Plus™ Ogee® Cup 26/53 mm
- [96538040](#) Elite Plus™ Ogee® Cup 28/40 mm
- [96538043](#) Elite Plus™ Ogee® Cup 28/43 mm
- [96538047](#) Elite Plus™ Ogee® Cup 28/47 mm
- [96538050](#) Elite Plus™ Ogee® Cup 28/50 mm
- [96538053](#) Elite Plus™ Ogee® Cup 28/53 mm
- [96571000](#) Elite Plus™ Ogee® Cup 32/47 mm
- [96571000](#) Elite Plus™ Ogee® Cup 32/50 mm
- [96571000](#) Elite Plus™ Ogee® Cup 32/53 mm

### Centralisers

- [960092000](#) Charnley® Size 1 Centraliser (Pmma)
- [960093000](#) Charnley® Size 2 Centraliser (Pmma)

### Cement Restrictors (Polyethylene)

- [546010000](#) Cement Restrictor Size 1
- [546012000](#) Cement Restrictor Size 2
- [546014000](#) Cement Restrictor Size 3
- [546016000](#) Cement Restrictor Size 4
- [546018000](#) Cement Restrictor Size 5
- [546020000](#) Cement Restrictor Size 6
- [546022000](#) Cement Restrictor Size 7
- [546024000](#) Cement Restrictor Inserter

### Cement Restrictor Trials

- [546030000](#) Cement Restrictor Trial 1
- [546032000](#) Cement Restrictor Trial 2
- [546034000](#) Cement Restrictor Trial 3
- [546036000](#) Cement Restrictor Trial 4
- [546038000](#) Cement Restrictor Trial 5
- [546040000](#) Cement Restrictor Trial 6
- [546042000](#) Cement Restrictor Trial 7

### Instruments

- [962040000](#) Charnley® Neck Osteotomy Guide
- [2522000506](#) Elite™ In-Line Broach Handle
- [962901000](#) Excel™ Broach Rb40n
- [962902000](#) Excel™ Broach Rb40
- [962903000](#) Excel™ Broach Fl40
- [962582000](#) Excel™ Broach Rd45
- [962583000](#) Excel™ Broach Fl45
- [962913000](#) Excel™ Broach Cd4
- [962045000](#) Charnley® Currette Small
- [962046000](#) Charnley® Currette Medium
- [962047000](#) Charnley® Currette Large
- [200142000](#) Excel™ T Handle
- [200143000](#) Excel™ IM Initiator
- [235410000](#) Muller Awl Reamer With Hudson End
- [210512000](#) Canal Reamer 10
- [210514000](#) Canal Reamer 11
- [210515000](#) Canal Reamer 12
- [210516000](#) Canal Reamer 13
- [200225000](#) Anteversion Osteotome Medium
- [200165000](#) Excel™ Femoral Head Impactor
- [252200502](#) Elite Plus™ Stem Introducer

### X-ray Templates

- [963056001](#) X-ray Templates Charnley® Modular
References


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