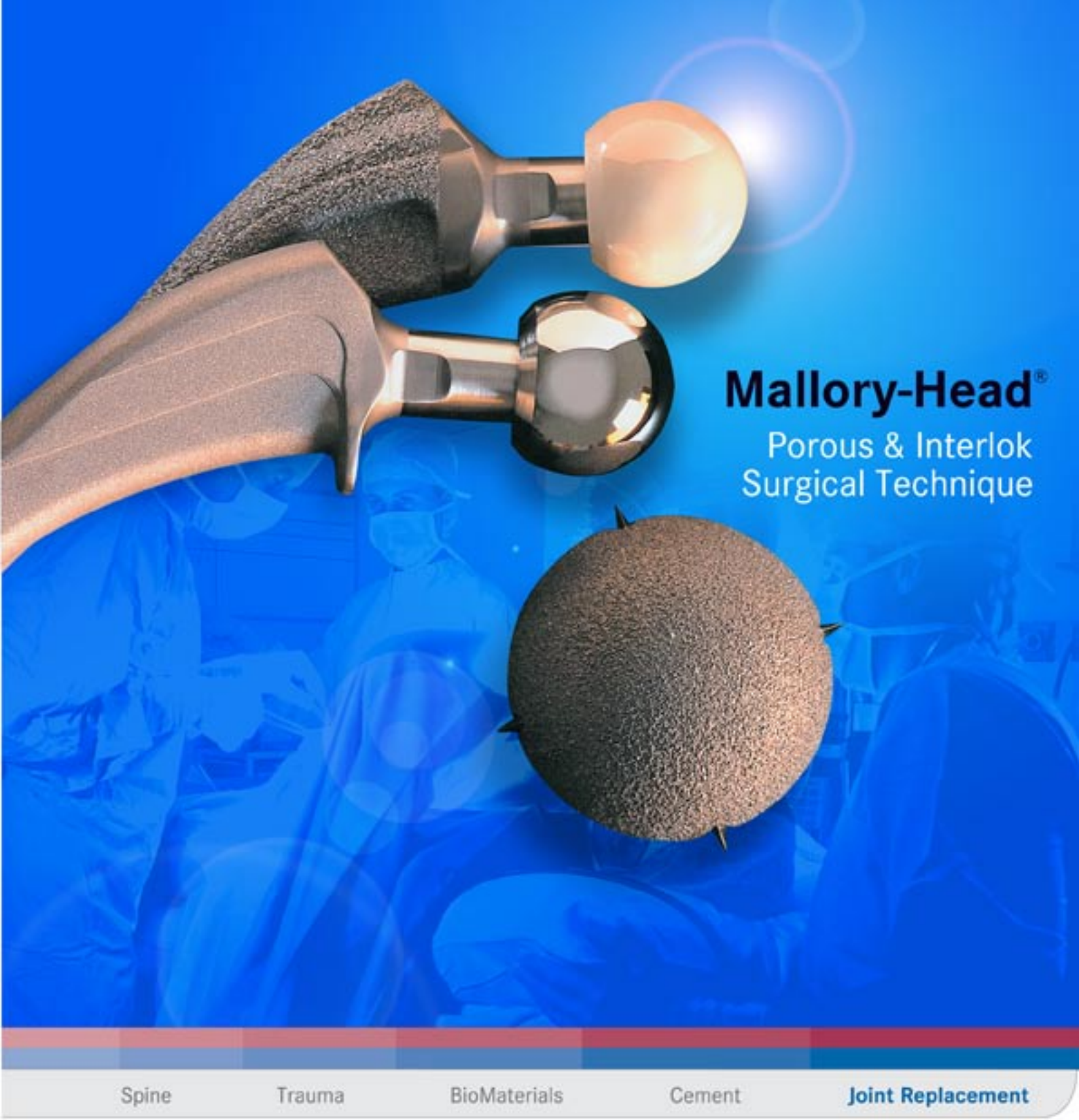


Spine Trauma BioMaterials Cement **Joint Replacement**

BIOMET Europe

Mallory-Head®

Porous & Interlok Surgical Technique

Contents

BIOMET Europe

Disclaimer

The Mallory-Head System was developed in cooperation with Thomas H. Mallory, M.D., F.A.C.S., Clinical Assistant Professor Orthopaedic Surgery at The Ohio State University; Chairman of Section Joint Implant Surgeons at Grant Medical Center, Columbus, Ohio and William C. Head, M.D., Assistant Clinical Professor, Department of Orthopaedic Surgery, University of Texas Health Science Center, Dallas, Texas and staff surgeon at Presbyterian Hospital of Plano, Plano, Texas.

Biomet, as the manufacturer of this device, does not practice medicine and does not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs any implant procedure is responsible for determining and utilizing the appropriate techniques for implanting the prosthesis in each individual patient. Biomet is not responsible for selection of the appropriate surgical technique to be utilized for an individual patient.

The Mallory-Head porous primary implants are proportionally sized in 1mm increments from 6 to 19mm diameters.

The dual-tapered geometry features a large lateral-to-medical taper and a three-degree included taper from proximal-to-distal.

Porous

Proximal loading of the femur to recreate near-normal bone stresses is the primary goal of the Mallory-Head porous total hip prosthesis. This concept has proven to deliver excellent clinical results since its conception in 1984.[1,2,3,4]

Proximal Fixation For Immediate Stability

The proximal geometry of the Mallory-Head porous component is designed to promote filling of the metaphysis and proximal off-loading. This is achieved through quadrilateral fixation in the proximal femur. The quadrilateral fixation is created by an anterior and posterior flange, a wide lateral fin and the shape of the medial aspect of the stem. This proximal configuration will ensure that normal circumferential or hoop stresses will be exerted on the femur, while bending and rotational forces are resisted.

Gradual Load Transfer To Minimize Stress Shielding

All Mallory-Head porous primary stems feature a bi-planer taper. The lateral-to-medial taper, augmented with the finned geometry, enhances proximal stress off-loading and initial stability. Unlike fully porous coated cylindrical stems that tend to transmit most of the load distally and may stress shield proximally, the Mallory-Head porous implants taper from proximal-to-distal paralleling the natural contours of the canal allowing a gradual decrease in the stresses transferred to the bone. This three degree taper allows the prosthesis to achieve three point fixation for immediate stem stability, and contributes to the reported low incidence of thigh pain and stress shielding with this implant.[2]

Proximal Circumferential Seal May Help Prevent Osteolysis

The surface treatments of the primary porous stem are consistent with its design objective, which is a gradual decrease in the forces transferred to the bone from proximal to distal. The surface areas are treated independently to provide secure fixation where it is most needed to restore normal stresses in the bone. The proximal area is circumferentially porous coated with a titanium alloy plasma spray, which greatly increases the surface area of the stem for improved fixation. This circumferential porous coating is a “closed pore” design which acts as a barrier to the migration of particulate debris.[6] Tanzer and Harris have hypothesized that this barrier may prevent osteolysis clinically reported for other stem designs.[7] The middle one-third has a roughened Interlok finish created through a blasting technique that allows firm fixation in the diaphysis to prevent torsional stresses. The distal portion of the stem is smooth, allowing the majority of forces to be offloaded proximally.

Titanium Alloy For Improved Bone Response

The metal of choice for the porous primary stem is titanium alloy, chosen for its superior biocompatibility. Titanium also possesses a modulus of elasticity which more closely approximates that of actual bone. This allows the stem to transfer stresses to the proximal portion of the bone, resulting in a femur which bears load and preserves cortical density.

Titanium alloy, not only as a porous coating but as a substance, plays a critical role in implant performance. A titanium substance and titanium closed-pore, circumferential porous coating designed to lock in the femoral implant and create a seal to particulate debris migration may help to reduce osteolysis and improve long-term fixation.[1,7]

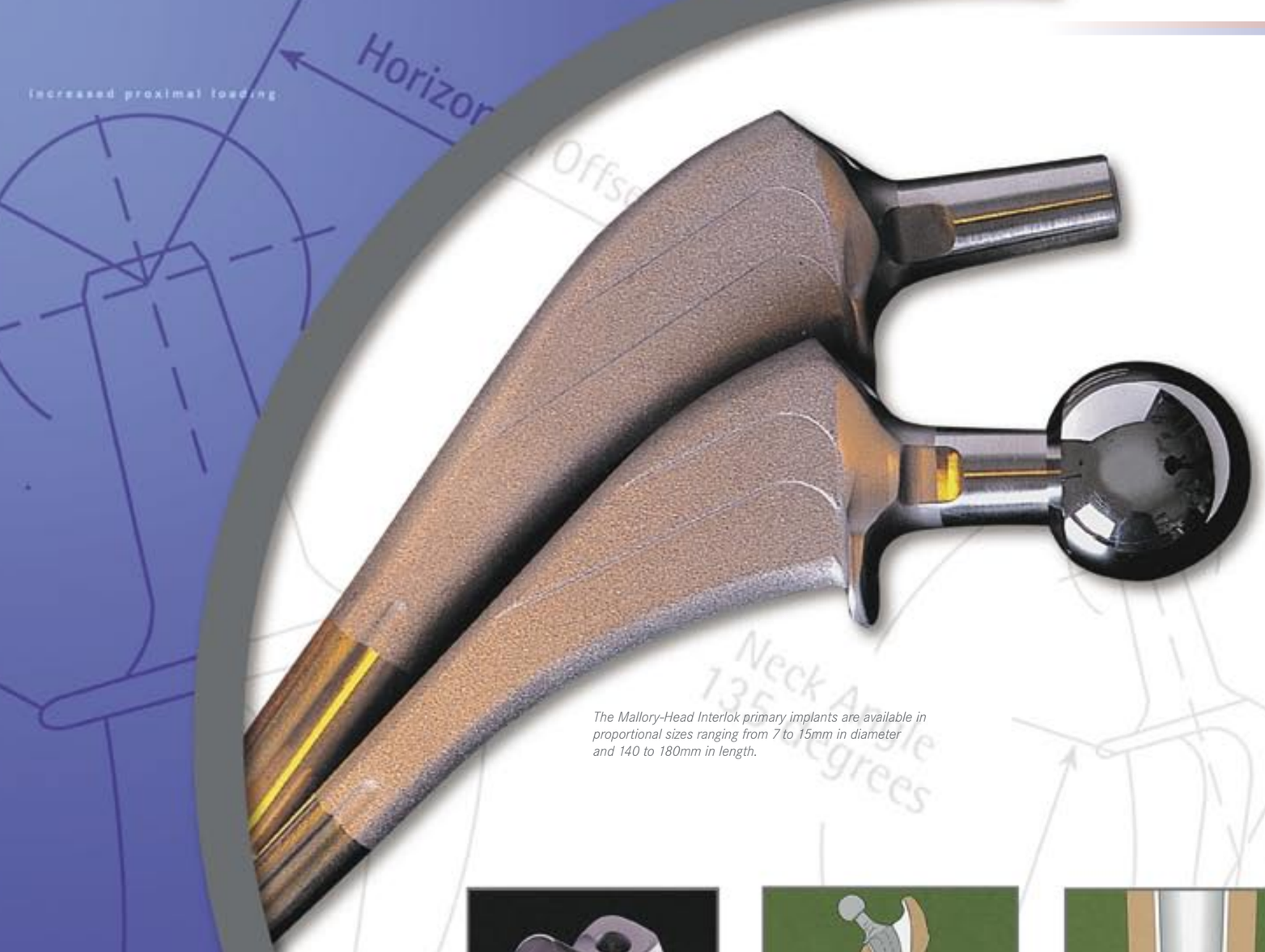
The unique proximal fin geometry of the stem ensures circumferential stress transfer to the femur, while resisting rotational and bending forces. The proximal lateral fin is designed to minimize rotation due to torsional loads.

Quadrilateral fixation is illustrated showing maximum canal filling in the proximal region. The distal cross-section shows how the Mallory-Head porous stem fills the canal and allows for close contact of the stem to bone.

CoCr moduar heads are available in 22, 26, 28 and 32mm outer diameters. Zirconia modular heads are available in 28 and 32mm diameters.

The plasma spray porous coating is applied to the implant at a low temperature, preserving the strength of the implant material. The result is a dramatically increased surface area proximally, to enhance initial stability and the bone-to-bone interface. This surface is visualized above in a SEM photograph at 100x magnification.

Mallory-Head porous plasma sprayed components are marketed for non-cemented use in skeletally mature patients undergoing primary hip replacement surgery as a result of non-inflammatory degenerative joint diseases.



The Mallory-Head Interlok primary implants are available in proportional sizes ranging from 7 to 15mm in diameter and 140 to 180mm in length.

All Interlok stems feature a biplaner taper to promote increased proximally off-loading.

Interlok®

In order to recreate near-normal bone stresses in cemented total hip arthroplasties, it is necessary to design a primary component that allows the bone stresses to be off-loaded or transferred proximally. With the Mallory-Head Interlok system, this concept is achieved by the design of the tapered femoral component, which results in increased proximal loading.[3]

Proximal Design Improves Cement Integrity

The proximal geometry of this stem incorporates a prosthetic duckbill collar in the medial aspect. On the anterior and posterior aspects of the prosthesis there exits a slight recess in the proximal stem/collar region. As cement is compressed, a total collar is created consisting of the medial collar and the surrounding cement.

This medial collar protects the cement mantle by preventing the prosthesis from subsiding, and acts as an anchor to the prosthesis against the medial cortex. The collar provides for a balanced transfer of forces through the cement mantle. Proximally, a lateral-to-medial taper, coupled with a series of ribs running twenty degrees to the long axis of the prosthesis, help to compress the cement medially where the forces naturally occur.

Rotational Stability

To resist rotational forces, the design of the Interlok stem has been engineered with the distal portion of the prosthesis assuming an I-Beam configuration. This I-Beam configuration incorporates a recessed channel, that when coupled with the broad proximal cross sectional stem design, resists rotational forces that are present within this implant region.

Axial Alignment

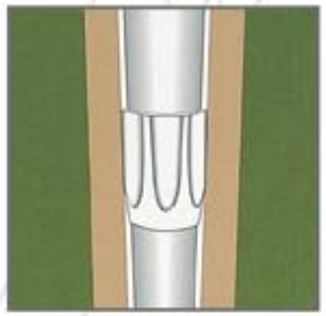
To achieve axial alignment with the prosthesis in the neutral position, a PMMA centering sleeve is positioned on the distal one-third portion of the femoral implant. Utilizing this optional centering sleeve will allow for and even 1.5mm mantle of cement around the prosthesis within the canal, and helps to ensure axial alignment for the prosthesis once it is inserted into the cement-filled femoral canal.

Implant/Cement Interface

All Mallory-Head Interlok femoral components are available in a chromium cobalt material to provide excellent wear characteristics and increased strength.[5] The Interlok stem strives to achieve its strongest fixation proximally with the cement mantle. Thus, its proximal one-third incorporates Interlok finish. This roughened blast finish creates a textured surface to allow for a stronger interface between the prosthesis and cement. The distal two-thirds is smooth to allow for easier removal of the stem in the event of symptomatic loosening.

The Mallory-Head Intelok prosthesis offers an enhanced proximal design to promote increased proximal loading. This is achieved through a latera-to-medial taper augmented with anterior and posterior "ribs" angled at 20 degrees to help force cement into compression medially. The entire proximal geometry features an Intelok roughened surface for increased cement/stem fixation.

The Mallory-Head Interlok stems are designed to accommodate an even cement mantle around the implant both proximally and distally. The duckbill collar anchors the implant on the bone and directs the cement in the distal canal.



The PMMA centering sleeve positioned on the distal one-third of the stem creates an even 1.5mm cement mantle around the prosthesis within the intramedullary canal, and provides axial alignment for the prosthesis into the cement-filled femoral canal.

The Intelok surface is a textured surface that has been created by the bombardment of sized particles propelled by high-pressure air. The roughened surface provides enhanced fixation in cement beyond that of a smooth blast finish. This surfaces is visualized above in a SEM photograph at 100x magnification.

Mallory-Head finned RingLoc acetabular shells are available from 40-80mm diameters in both solid and screw hole geometries.

Cemented acetabular cups are available in total ArCom polyethylene or in molded metal-backed designs.

Acetabular

The criteria for long term success of acetabular replacements are well established and provide the foundation for the design of the Mallory-Head finned, solid and holed acetabular components. These shells offer unique solutions to the problems of stable acetabular fixation.

Peripheral Fixation Provides Initial Stability

The Mallory-Head porous acetabular shell is made from titanium alloy and is hemispherical in shape, allowing a uniform transfer of forces to the bone throughout the acetabular vault. Initial fixation is achieved through the use of four peripheral fins which engage the anterior and posterior columns in the superior rim, pubis, and ischium to prevent rotation.

The Mallory-Head finned components offer both holed and solid shell geometries. The holed shell design allows the use of 6.5mm dome and the 5.0mm rim screws for optional supplemental fixation when needed. The solid shell configuration has no dome holes and provides a more complete interface and support mechanism for the polyethylene liner. This reduces the potential for debris migration and increases the surface area of the porous plasma spray coating. This ensures immediate component fixation and bone-to-implant contact.

Maximum Congruency, Minimal Micromotion

Biomet's RingLoc technology achieves two important goals: liner stability and congruency between the liner and the shell.

All porous finned acetabular shells feature a metal locking ring for stability at the shell/liner interface. The RingLoc mechanism securely locks the polyethylene liner into the shell resisting push-out and lever-out forces well over 650 psi.[8] Each shell is designed with between six and eight semicircular tabs on the rim that create a positive interlok with the liner, minimizing rotation and micromotion.

The RingLoc component design allows for a constant and maximum polyethylene thickness in each shell/liner configuration. RingLoc also provides the highest percentage of polyethylene supported by metal available in a modular acetabular component.[9] This shell-to-liner congruency coupled with unparalleled stability may reduce the potential for significant long-term wear of these components.

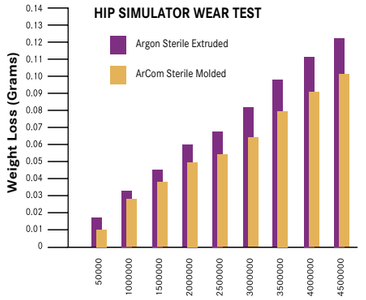
The RingLoc acetabular shell is designed with four anti-rotational fins that engage the superior rim, the pubis and the ischium for initial stability. A metal ring washer securely locks the liner into the shell and peripheral tabs keep the liner rotationally stable.

RingLoc acetabular components provide uniform and maximum polyethylene thickness as well as complete liner-to-shell congruency.

ArCom RingLoc liners offer 22, 26, 28 and 32mm inner diameters and standard, Hi-Wall, 10-degree and 10-degree with Hi-Wall configurations.

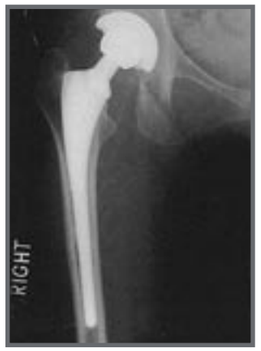
ArCom Polyethylene Reduces Wear

The RingLoc liners used in the Mallory-Head finned shells and the polyethylene cemented cups are both made out of ArCom polyethylene. ArCom is the result of an improved polyethylene manufacturing process designed to deliver consistent physical properties and improved wear resistance. This compression moulded manufacturing process offers better consolidation of polyethylene particles, higher ultimate tensile strength and improved resistance to degradation and discoloration. ArCom components are packaged and sterilized with argon, an inert gas which helps to reduce oxidation and improves wear resistance.



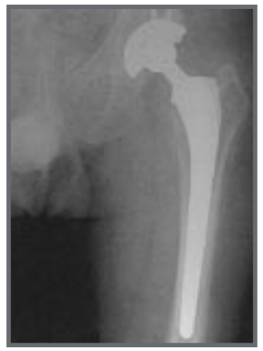
Hip joint simulator testing shows 20% reduction in wear at 5 million cycles over conventional extruded bar polyethylene.[10]

Clinical Evaluations



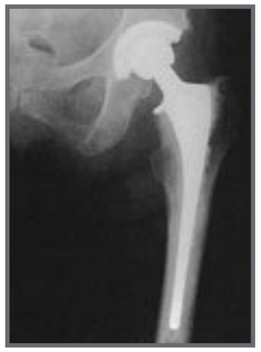
Porous, non-cemented femoral component with Zirconia ceramic head and porous acetabular finned/solid shell.

Post-operative A/P X-ray demonstrates a Mallory-Head primary pressfit total hip replacement in place with a ceramic femoral head. The acetabular shell is a solid shell that is well contained within the acetabulum. The acetabular component is well positioned at 45 degrees of abduction. The femoral component is in place with neutral alignment. Both components demonstrate radiologic evidence of bony ingrowth. This is evident by the lack of any radiolucent lines at either the acetabular or femoral component interface. Streams of new bone formation can be seen at the interfaces of both the acetabular and femoral devices. Note the absence of any evidence of a distal pedestal.



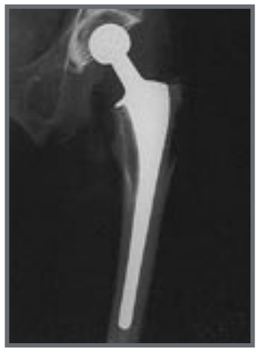
Porous, non-cemented femoral component with porous acetabular finned/holed shell.

Post-operative A/P X-ray demonstrates a holed acetabular shell that is well seated and positioned in 45 degrees of abduction. The patient had a deficiency of the anterior wall of the acetabulum necessitating the need for screws. Screws are recommended in the acetabular component when the cup is not completely contained and all four peripheral fins are not engaged into the rim of the acetabulum. Two screws are located in the superior and posterior/superior positions. The femoral component is in neutral alignment with excellent fit and fill both proximally and distally. Note the absence of radiolucent lines around either component and note the radiologic evidence of progressive bone ingrowth at the prosthetic interface.



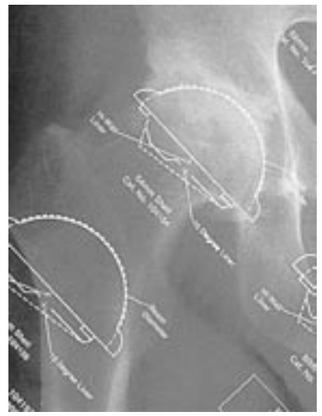
Interlok cemented femoral component with Zirconia ceramic head and porous acetabular finned/solid shell.

Post-operative A/P X-ray of the left hip demonstrates a hybrid hip replacement in place. The acetabular component is a solid shell design and is well contained within the acetabulum, in a position of 40 degrees of abduction. The cemented femoral component is stable and firmly in place with neutral alignment and a uniform cement mantle. The cement mantle has no voids present. A ceramic femoral head is in place and there is no evidence of radiolucent lines.

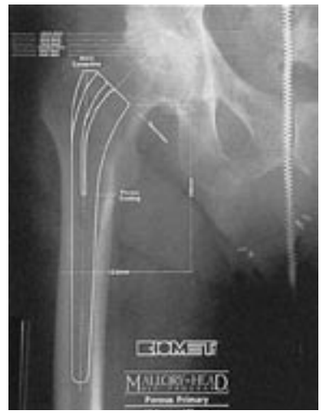


Interlok, cemented femoral component with cemented all poly acetabular cup.

Post-operative A/P X-ray demonstrates a cemented acetabular and femoral total hip replacement. The acetabular component is well seated in 45 degrees of abduction with a uniform cement mantle in place. The femoral component has excellent collar/calcar contact with a uniform cement mantle around the stem and a distal plug in place. Note the restoration of hip bone mechanics with anatomic offset of the prosthetic device and a similar intersection line between the greater trochanter and the femoral head maintaining equal leg lengths.



Acetabular



Porous

Pre-Op Planning

Pre-operative planning can easily be performed with templates for both acetabular and femoral sizing. It is recommended that a radiographic marker be used to assess X-ray magnification on an individual basis so that the proper templates can be selected.

First, the acetabular shell size that best fills the acetabulum without excessive subchondral bone removal is positioned in the anatomic location (referenced from the tear drop) with an abduction or inclination angle of approximately 30 to 45 degrees, thus maximizing superolateral bone coverage. The centre of rotation of the hip joint can then be marked from the template.

Next, the appropriate femoral template which best fills the canal both proximally and distally on both the A/P and lateral projections is chosen. As a point of reference, the position of the neck cut is placed to allow the use of a standard neck prosthesis. Reference for the cut can also be based off the anatomic centre of the patient's femoral head. The longitudinal axis can also be used to allow for correction of appropriate lateral offset.The perpendicular distance from the axis to the centre of the patient's femoral head can be used to determine proper offset which can then be recreated intraoperatively.

In the vast majority of cases the line drawn perpendicular to the femoral shaft axis through the tip of the greater trochanter will intersect the centre of the femoral head. In cases of coxa vara or coxa valga, this may vary and either the level of the neck cut, or selection of the neck length can be varied to achieve the desired leg length equalities. Using the technique of varying the level, correct leg length can be re-established as well as re-established the normal lateral offset.

Porous Stem Templating

Should a pre-operative decision based on the best interests of the patient deem a porous implant to be appropriate, the proper size can be selected in the following manner.

Having determined the magnification of the patient's X-ray, the appropriate porous stem templates are used as overlays on the patient's A/P and lateral radiographs. The largest size stem that can be used without sacrificing cortical bone is used.

The appropriate level of neck cut and the re-establishment of leg length and lateral offset are also established at this time.

Interlok Stem Templating

To cement the femoral component, the appropriately sized component can be selected in the following fashion. The dotted line provided on the template indicates the diameter of the reamed envelope. The solid line represents the profile of the Interlok stem.

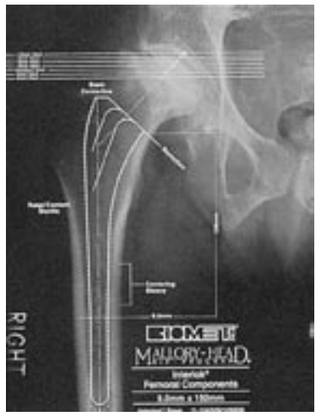
The correct femoral component size is represented by the template which best fills the canal without requiring excessive cortical bone removal. Planning should include templating for an appropriate distal cement mantle. Cement should extend one to two centimetres below the tip of the implant. An intramedullary canal plug should also be used. The distal implant diameter should be three to four millimetres less than the diameter of the bone at the isthmus. The appropriate level of the neck cut and reconstitution of leg lengths and lateral offset are then determined.

Once these simple measurements are made and the best implant size is determined, few surprises will be encountered intra-operatively.

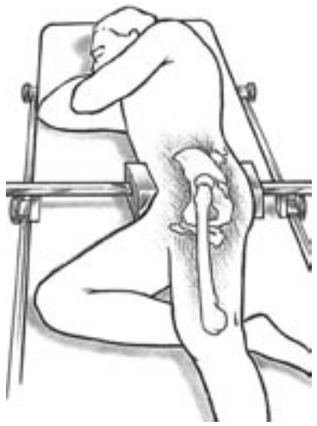
Patient Positioning and Surgical Incision

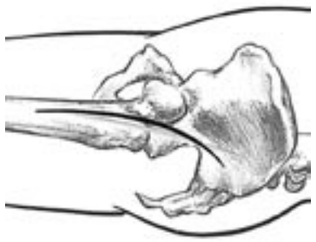
The patient should be placed in the full lateral decubitus position using an anterolateral approach through a long lateral curvilinear incision.[11] In more routine cases, the hip can be exposed by leaving the greater trochanter intact. This is routinely accomplished through an anterolateral approach. The upper portion of the vastus lateralis and vastus intermedius are reflected anteriorly with an anterior cuff of the abductor musclature. This muscle unit is kept intact. The abductor split is only 1-2cm above the tip of the greater trochanter. The capsule is debrided and the hip can then be dislocated anteriorly.

In situations where major acetabular reconstruction must also be done, a trochanteric osteotomy is required. The trochanter osteotomy should be done in one of two ways: either 1) via a trochanteric slide in which the greater trochanteric is left attached to the abductor musclulature proximally and the vastus lateralis and the vastus intermedius musculature distally and the whole unit taken forward as a muscle cuff or 2) via an extended trochanteric osteotomy in which a tongue of lateral femoral bone is taken with the trochanter. This will allow the trochanteric adjustment with regard to leg length and also provides a much better facility for trochaneric reattachment. When the extended osteotomy is utilized, cerclage wires around the upper femur, including the tongue of the lateral cortex, is a very useful way to achieve rigid trochanteric stability post surgery.

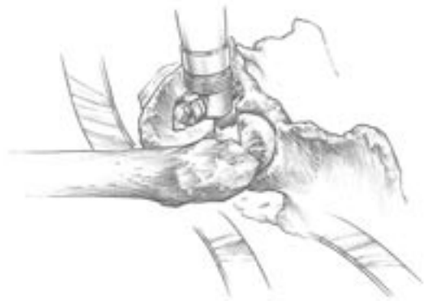


Interlok

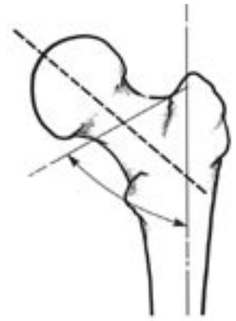




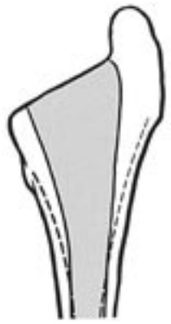
Place a retractor between the abductor muscle and the greater trochanter.



Additional retractors are used for better visual reference of the femoral shaft axis.



The resection level is made at 45-50 degrees off the anatomical axis.



Cone-shaped cancellous media.

Proximal view of cancellous media.

Porous Surgical Technique

Femoral Head Resection

With access to the hip joint completed, the femoral head is dislocated either anteriorly or posteriorly by external rotation, flexion and abduction. A retractor is positioned between the abductor muscle and the greater trochanter to protect the mass and provide a better working access. The relationship of the natural head to the greater trochanter should be reviewed and noted as a reference for implant anterversion.

To proceed with the resection of the femoral head, verify the location of the lesser trochanter and place the index finger adjacent to the superior border of the lesser trochanter. A mark is then made on the medial edge of the femur so the cut will be at least 1-2cm (depending on pre-operative evaluation and leg length) above the lesser trochanter. The cut will be performed at an angle of 45-50 degrees to the femoral shaft axis at the tip of the greater trochanter. At the completion of the cut, the head is removed. With the resection, the femur will be in the shape of a cone, which off-loads the stress through the entire femur rather than directly to the distal isthmus area.

With the retractor positioned between the abductor muscle and the greater trochanter, the proximal femur is rotated to provide a clear access to the femoral canal.

Two additional retractors are placed on either side of the greater trochanter to evelvate the shaft above the wound site for optimum visual reference to the shaft axis.

Reaming the Acetabulum

After adequate acetabular exposure, the acetabulum is prepared for the component. It is essential that any remaining cartilage be removed from the acetabulum with either a power reamer or acetabular osteotomes. If acetabular osteotomes are used, the final shaping is done with the hemispherical reamer.

When the reaming of the acetabulum commences, a small starting reamer is utilized for the initial step. After the acetabulum has been sufficiently started, subsequent reaming is done in progressive stages, building to the reamer size that matches the final prosthesis. If, for example, the diameter of the reamer is 54mm, the acetabular component will be 54mm. The hemispherical reamer is essentially a provisional prosthesis for checking coverage and sizing, with the prosthesis of choice identical (in diameter) to the reamer.

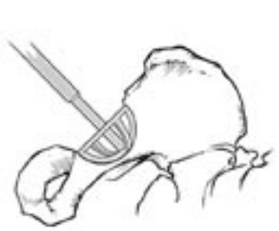
The goals of acetabular preparation are to remove peripherical soft tissue and any remaining acetabular cartilage, to create some bleeding bone on the acetabular surface, and to preserve as much of the subchondral bone as possible. It is essential that coverage of the acetabular component be accomplished. Some sacrifice of subchondral bone may be necessary in order to achieve this goal. If subchondral bone sacrifice is necessary, it is desirable to preserve as much of the peripheral subchondral bone as possible.

At times, a superior or posterior bone graft may be required for a deficient acetabulum. This should be fixed to the acetabulum with titanium bone screws, and final shaping done with the power reamer following the screw fixation. When reaming the acetabulum, the reamer should be approximately 30-45 degrees off the vertical axis of the body and at 10-15 degrees of anteversion.

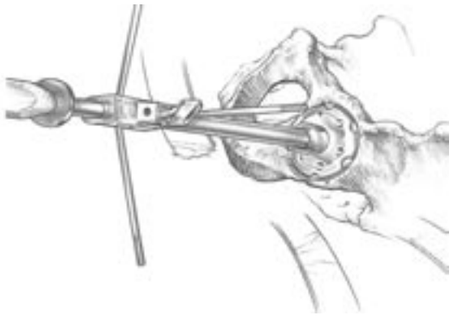
Progressive hemispherical reaming prepares the acetabulum for the final prosthesis.

A small starter reamer prepares the acetabulum for subsequent reamers.

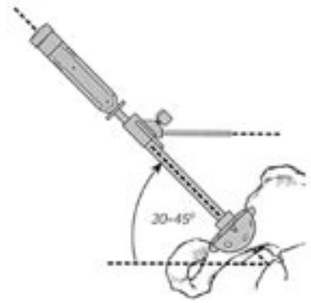
A hemispherical reamer is utilized to reach the subchondral bone and attain proper sizing.



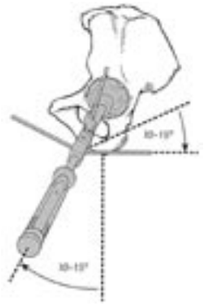
A trial metal frame shell gauge is used to determine final shell diameter.



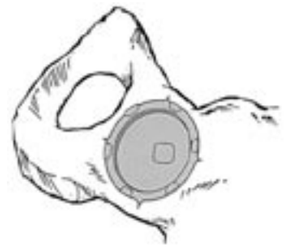
The acetabular component is inserted using an impactor plate on the face of the shell.



The long handle should lie in 30-45 degrees off the vertical centre of the patient's trunk.



The long handle should also lie in 10-15 degrees of anterversion off the patient's trunk.



The Mallory-Head solid acetabular shell is shown seated in proper position.

Acetabular Component Insertion

The component is driven into place, utilizing the RingLoc inserter with the angle guide positioned over the shaft of the driving instrument in order to achieve correct positioning. The correct position is 30-45 degrees off the patient's vertical axis with 10-15 degrees of anteversion. Shell impactor plates should be used to drive from the periphery of the shell and are attached to the end of the inserter. The inserter may also be screwed directly into the dome of the shell making sure the square end of the inserter is completely seated into the recess in the apex of the shell with the threads thoroughly engaged. The cup is inserted so that its final position will be 30-45 degrees of abduction. The long handle and guide are used to establish this position. The shell is then inserted with steady, consistent blows of the mallet. The surgeon should rest briefly between blows to let the bone acclimate to the new stress.

The acetabular component itself should be positioned so that the cutting fins engage the pubic area, the ischial area and so that two fins engage the anterior column and two engage the posterior column. Slowly tap the component into place, checking the position of the shell as it advances. If orientation is acceptable, solidly impact the inserter and fully seat the component. Confirm that full seating of the component is achieved by viewing the central acetabular bone through the screw holes in the acetabular shell. When using a solid finned shell, confirming apposition is still necessary but slightly more challenging. The final reamer or trial gauge should be marked with a Bovie or methylene blue pen at the peripheral rim. Seating can be confirmed when the solid shell is driven to the same level or when the pitch of the mallet changes significantly. After the acetabular shell is driven into place and full seating has been confirmed, the acetabular shell is again checked to ensure proper orientation. Whenever possible, the fins should be anchored in the rim of the acetabulum in the cortical bone of the outer table and in any remaining subchondral bone.

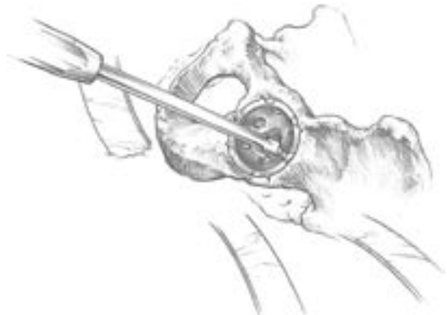
Acetabular Component Insertion

The inserter and plate are then carefully removed to avoid moving the cup. If the plates are not used with the inserter for the holed shell, unthread the centre shaft of the inserter from the apex, then lift the inserter off the shell. The holed cup can be checked again with a depth gauge or hemostat placed through the holes to be sure it is completely seated.

The shell should be firmly fixed within the acetabulum. There should be no gaps between the shell and the acetabulum. If the shell can be rotated within the acetabulum, a larger shell should be selected.

Note: If the surgeon desires a change in either the anteversion or inclination, **an impactor or punch is not to be used against the rim of the titanium shell.** This can damage the groove for the locking ring and cause the locking mechanism to function improperly. The shell impactor plates should be used instead. The appropriate impactor plate attached firmly to the inserter is placed over the orifice of the titanium shell to protect the rim of the shell. Impaction to allow minor changes in anterversion or inclination can now proceed safely. In situations where all four fins are not engaged, the Mallory-Head finned shell with holes should be used to allow for supplemental screw fixation.

The Mallory-Head acetabular finned shell with screw holes is shown in final proper position.



The holed shell allows insertion of optional bone screws for supplemental fixation.

Optional screw preparation is achieved with a drill guide and flexible drill shaft/bit.

Acetabular Screw Insertion

In primary cases where there is good bony coverage of the acetabular component, and the four fins are engaged, supplemental screw fixation is not necessary. Whenever possible, the fins should be anchored in the rim of the acetabulum in the cortical bone of the outer table, and in any remaining subchondral bone. In a situation where all four fins are not engaged, supplemental screw fixation is advised.

When dome screws are utilized, they should be used superiorly into the thick part of the ilium, and also posteriosuperiorly. This is the direction of the compression forces on the acetabulum and on the cup, and is the most desirable position for dome screws.

The appropriate length drill bit is attached to the flexible shank, and the drill guide is used to direct the drill bit into the holes of the cup. When drilling the posteriosuperio dome screw, a finger should be placed posteriorly and into the sciatic notch to ensure that the screw does not penetrate too deeply. The superiorly placed dome screw is directed into the thick part of the ilium, which is regarded as a safer area. Generally, a screw length of 30mm to 50mm is used in this direction. A universal swivel-hex screwdriver with a 3.5mm hex is used to insert the 6.5mm diameter dome screws through the holes in the dome of the shell.

Rim screws are an excellent source of fixation in both primary and revision situations. They can be used alone or in combination with dome screws. The ability to further secure the component about the periphery of the acetabulum is not only an effective method of adding additional fixation, but also gives the advantage of screw fixation when dome screws are not feasible. The superior area of the acetabulum, which is also the compression area, is the proper location for rim screws. The desirable entry portals for rim screws are on the left or right side, from approximately ten o'clock to two o' clock. In both primary and revision cases, this is usually an excellent area to encounter cortical bone.

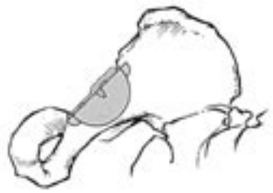
The first rim screw should go into the superior portion of the innominate bone. The second screw is placed superiorly and posteriorly. By using at least two screws in the peripheral fixation mode, the cup remains well balanced. The flexible depth gauge is used to determine the proper screw length appropriate for fixation (30mm to 40mm is the general length). It is not unusual to see the peripheral fin settle deeper into the bone as the rim screws are tightened. The rim holes accept 5.0mm diameter screws. Screw forceps (not shown) are used to hold the screw for insertion into the hole. A screwdriver with a 2.5mm hex is used to insert the rim screws.

When supplemental screw fixation is desired, two to four screws are suggested depending upon the quality of bone and the clinical impression with regard to the fixation of the screw. **SCREWS SHOULD NEVER BE PLACED IN THE ANTERIOR-MEDIAL AREA OF THE ACETABULUM.** Extreme care should be taken during drilling or placement of screws in the pelvis to protect from penetrating or piercing any vital structures.

The trial liner and the final liner are usually inserted with the Hi-Wall or 10-degree face positioned to protect from posterosuperior dislocation. The polyethylene Hi-Wall offers an extended articulating surface to prevent dislocation. The 10-degree face allows correction of orientation in the event of minor shell malalignment or extreme vertical placement. The 10-degree liner will also push the centre of rotation out or away from the shell. This additional shift or offset changes depending on the size of the liner (see chart). Due to the configuration of the liner, there are between twelve and sixteen possible locations for the insertion. The trial liner will fit loosely around the rim tabs and will not engage the metal locking rim. The trial liner can be easily inserted and reinserted into the RingLoc shell. The final liner will engage the metal locking rim and fit snugly around the tabs on the rim of the shell.

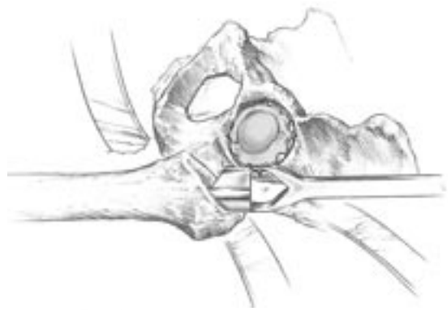
With the acetabular trial or final liner in place, and once femoral reconstruction has been completed, a trial reduction can then be carried out to determine if the correct neck length has been chosen for the femoral component.

Rim and dome screws can be used for additional fixation. The Hi-Wall is used for added stability posteriorly.



The Mallory-Head acetabular solid finned shell is shown in final proper postion with trial liner in place.

10 Degree Liner Size	Additional Offset Provided
20	3.2mm
21	3.5mm
22	3.7mm
23	4.1mm
24	4.4mm
25	4.8mm
26	5.1mm
27	5.5mm
28	5.8mm



The Moore hollow chisel is used to open the femoral canal posteriorly and laterally.

The chisel is positioned within the medial aspect of the greater trochanter.

Proximal view of the Moore hollow chisel opening the posterior/lateral medullary canal.

NOTE: Placing fingers at the distal wound provides a good reference to the femoral shaft's orientation.

Accessing the Femoral Canal

Prior to opening the femoral canal, a hollow chisel is utilized to access the lateral section of the proximal femoral shaft. The femoral neck is referenced to establish the correct anteversion of the chisel. The chisel should be positioned laterally to clear a channel for advancement of the tapered reamers without interference from the dense bone surrounding the trochanter.

A common difficulty in maintaining correct reamer orientation within the proximal femoral shaft axis, and consequently achieving correct positioning of the component, is insufficient bone removal at the medial aspect of the greater trochanter. Failure to create an adequate channel in this dense bone can cause the reamer tip to wander toward the lateral cortex.

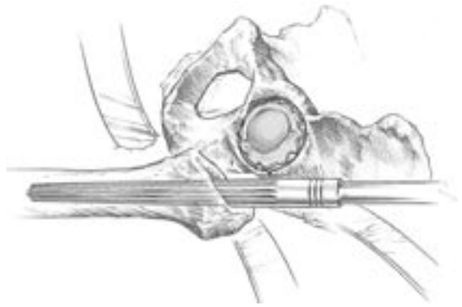
Prior to initiating the entry portal, an assistant should place a gloved index finger along either side of the femoral shaft at the distal termination of the wound. This provides a reference to the shaft's orientation, since adjacent tissue overlaps the shaft at this joint and restricts visual confirmation.

Reaming the Femoral Canal

The objective for using the straight starter reamer is to open the femoral canal distally, and determine the correct component size. The spiral tapered reamer is then used to allow for the proper cement mantle. Careful pre-operative planning is essential for femoral stem sizing with the selection of the reamer size based on this process.

In order to open the canal of the femur in the axis of the bone, a small straight cylindrical reamer is moved against both the medial portion of the greater trochanter and posteriorly against the resected neck of the femur. The straight cylindrical reamer should be used as a sizing device to determine the diameter of the isthus. The final prosthesis should be no larger than this pre-determined diameter.

The first tapered reamer is then utilized to begin stem sizing and to achieve contact with the distal cortex. Canal reaming may begin with the reamer that is 3-4mm smaller than the size of the pre-operatively selected implant. The reaming continues with progressively larger reamers until contact with the distal cortex is achieved. The pre-operatively determined depth is achieved by reaming the femoral canal to the appropriate reference band on the reamer. The reamer is then used to create a cone within the proximal portion of the femur. By guiding the tapered reamer in a circular, clockwise/counterclockwise motion, the proximal canal opens to a “cone” configuration.

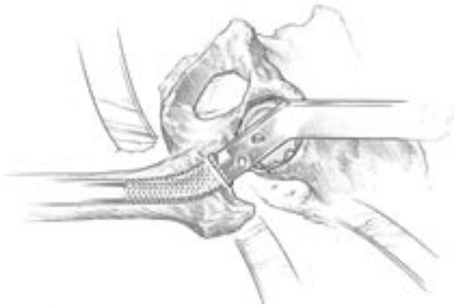


Tapered conical reamers are used to open the femoral canal distally.

Utilise the straight starter reamer to enter the femoral canal.

Reference bands on the tapered reamer locate the pre-operative depth. Progressive tapered reaming gradually removes cancellous bone

Rim and dome screws can be used for additional fixation. The Hi-Wall is used for added stability posteriorly.



The rasp handle locks onto the rasp provisional pin.

The rasp/provisional complete fills the reamed femoral canal.

Trial Primary Stem.
The trial primary stem is identical to the final implant minus the prorus coating.

Contouring the Stem Envelope

Upon the completion of the reaming process, the rasp is used to contour the proximal stem envelope. Select the appropriate rasp that matches the final reamer size and insert the rasp in the corridor created by the reamer.

Maintain the rasp in-line with the proximal shaft axis, as was done in the reaming sequence. Do not attempt to seat the rasp upon insertion. Gradually advance the rasp until snug, then withdraw and repeat the sequence, occasionally irrigating the teeth of the rasp.

Since the isthmus has already been prepared with the reamer, the resistance to the advancement of the rasp is created by the upper rasp body enlarging the medial area of the proximal femur. It is essential that the rasp advance each time it is struck by the mallet. If it doesn’t, the rasping must stop: to continue would greatly increase the risk of fracturing the femur.

Never force the rasp down the canal.

If the rasp will not continually advance to the point where it is completely encased within the canal, a smaller rasp must be used to finish the envelope. The rasp should be used as a finishing tool and a proximal sizer. The implant to be used would correspond to the size of the final rasp used.

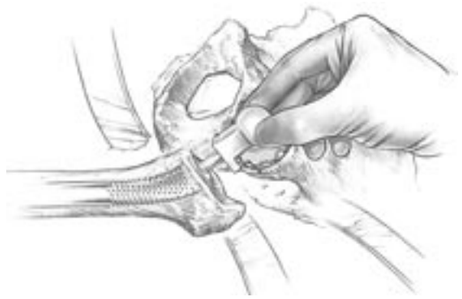
Trial Reduction

After the Mallory-Head rasp has been secured within the intramendullary canal, place the appropriate head/neck trial onto the pin extending from the rasp (an additional pin is present to prevent the trial from rotating). The hip is then reduced and the range of motion - flexion, abduction and internal rotation – is thoroughly checked. If either the joint tension or range of motion check is unsatisfactory, choose alternative head/neck trials to adjust the neck length.

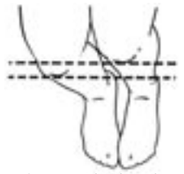
After satisfactory range of motion is achieved, the hip can be dislocated and the head/neck trial removed. The rasp handle is then attached to the pin on the rasp, and the rasp removed from the femoral canal.

Mallory-Head provisional stems are available for a second trial reduction or as an option to the rasp/provisional trial reduction. Thread the insertion tool on the proximal end of the provisional stem and seat the stem into the prepared canal. Place the appropriate trial head onto the provisional stem and reduce the hip. Once again, check range of motion – flexion, abduction and internal rotation. **Note: The rasp/provisional does not account for the A/P fins or the porous coating. Therefore, the provisional stems are recommended because they match the geometry of the final implant exactly, minus the porous coating. If the provisionals seat snugly, the surgeon knows the final implant will be tight and secure. If the provisional will not seat, neither will the implant.**

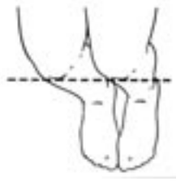
At this time, leg length should also be checked (see diagram). Align both legs in flexion and position both ankles together. Leg length can now be checked by reaching around the patient to feel if the knees are in proper alignment. If alignment is not satisfactory, choose an alternative trial head size to adjust leg length.



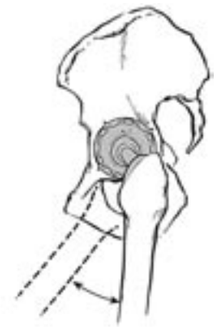
Placement of the collarless head/neck trial on the extended rasp pin.



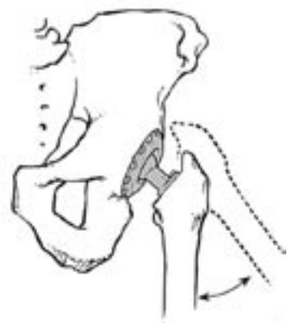
Incorrect leg length



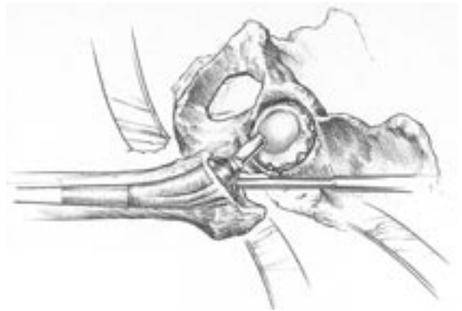
Correct leg length.



Internal rotation.



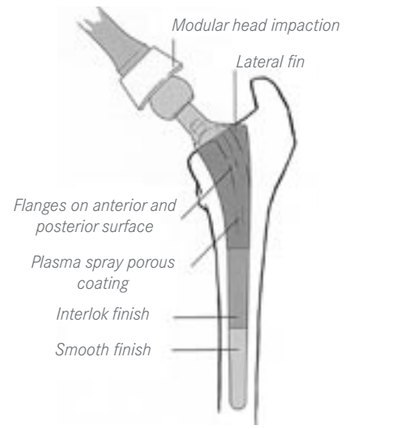
Flexion and abduction.



A threaded inserter/extractor handle introduces the prosthesis into the prepared canal.

Top view of femur and implant.

Distal cross-section view of the implant.



The pre-operatively selected implant fills the envelope established by the rasp. The final component will meet more resistance in the canal than the final stem.

Stem Insertion

Prior to inserting the prosthesis, the threaded insertion tool must be secured to the implant. The insertion tool is screwed snugly into the threaded hole located in the proximal end of the stem on the lateral side of the neck. Attachment of the inserter to the implant provides the best means of controlling the placement of the stem within the prepared canal and achieving complete seating of the component.

The stem should slide distally in the canal without much inserter force until the lateral fin engages the lateral wall of the prepared canal.

NOTE: The stem should be manually inserted with ease until the medial lip of the stem is 1-2cm (about the finger's breadth) from the calcar. If the stem will not easily progress to this point. **DO NOT DRIVE THE STEM IN.** Instead, a smaller stem or additional canal preparation is required.

Remember, the prosthesis will encounter greater resistance than either the rasp or provisional stem.

Continue by gently tapping to gradually seat the prosthesis. Rest momentarily between each blow of the mallet to allow the bone to acclimate to new hoop stresses. Check the proximal stem area to confirm complete seating against the calcar. When the prosthesis has been completely seated, remove the insertion device. With the femoral component fully seated, the trial head component is positioned on the prosthesis neck for the trial reduction sequence. There are several trial head components for the system. Each component establishes a neck length that is duplicated on the final modular head component. First choose the trial head which corresponds to the trial head/neck used on the rasp/provisional. If, for example, a standard neck was chosen as optimal, a standard neck trial modular head should be selected. Any of the remaining heads may be substituted if the range of motion or the involved soft tissue tensioning is unsatisfactory.

Based on the final trial head component used, the corresponding modular head may now be selected.

Interlok Surgical Technique

Femoral Head Resection

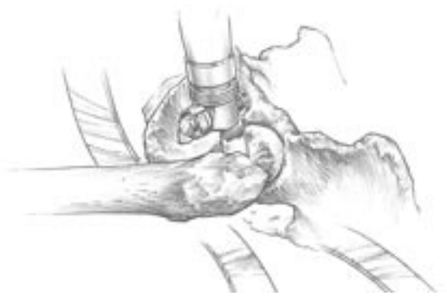
With access to the hip joint completed, the femoral head is dislocated either anteriorly or posteriorly by external rotation, flexion and abduction. A retractor is positioned between the abductor muscle and the greater trochanter to protect the mass and provide a better working access. The relationship of the natural head to the greater trochanter should be reviewed and noted as a reference for implant anterversion.

To proceed with the resection of the femoral head, verify the location of the lesser trochanter and place the index finger adjacent to the superior border of the lesser trochanter. A mark is then made on the medial edge of the femur so the cut will be at least 2cm above the lesser trochanter. The cut will be performed at an angle of 45-50 degrees to the femoral shaft axis at the tip of the greater trochanter. At the completion of the cut, the head is removed. With the resection, the femur will be in the shape of a cone, which off-loads the stress through the entire femur rather than directly to the distal isthmus area.

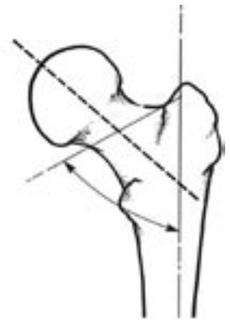
With the retractor positioned between the abductor muscle and the greater trochanter, the proximal femur is rotated to provide clear access to the femoral canal.

Two additional retractors are place on either side of the greater trochanter to elevate the shaft above the wound site for optimum visual reference to the shaft axis.

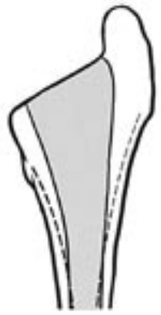
Place a retractor between the abductor mmuscle and the greater trochanter.



Additional retractors can be used for better visual reference of the femoral shaft axis.



The rescetion level is made 45-50 degrees off the anatomical axis.



Pipe shaped cancellous media.

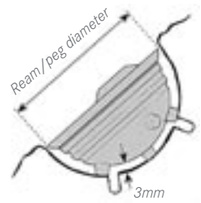
Proximall view of cancellous media.

Progressive hemisherical reaming prepares the acetabulum for the final prosthesis.

A smaller grater reamer prepares the acetabulum for subsequent reamers.

A hemispherical reamer is utilized to reach the subchondral bone and to attain proper sizing.

A trial metal frame shell gauge is used to determine the final shell diameter.



Over-ream outer cup diameter by 6mm to allow for the 3mm polar pegs. The ream/peg diameter 6mm over the final outer shell.

Reaming the Acetabulum

After adequate acetabular exposure, the acetabulum is prepared for the component. It is essential that any remaining cartilage be removed from the acetabulum with either a power reamer or acetabular osteotomes. If acetabular osteotomes are used, the final shaping is done with the hemispherical reamer.

When reaming of the acetabulum commences, a small grater reamer is utilized for the initial step. After the acetabulum has been sufficiently started, subsequent reaming is done in progressive stages, building to the final pre-operatively selected ream diameter.

The goals of acetabular preparation are to remove peripheral soft tissue and any remaining acetabular cartilage, to create some bleeding bone on the acetabular surface, and to preserve as much of the subchondral bone as possible. It is essential that coverage of the acetabular component be accomplished. Some sacrifice of subchondral bone may be necessary in order to obtain this goal. If subchondreal bone sacrifice is necessary, it is desirable to preserve as much of the peripheral subchondral bone as possible.

At times, a superior or posterior bone graft may be required for a deficient acetabulum. This should be fixed to the acetabulum with titanium bone screws, and final shaping done with the power reamer following the screw fixation. When reaming the acetabulum, the reamer should be at approximately 30-45 degrees off the vertical axis of the body and at 10-15 degrees of anteversion.

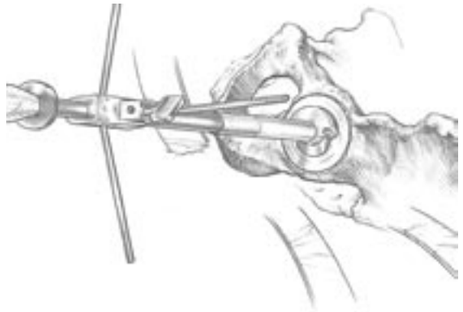
Cemented Acetabular Component Insertion

After reaming of the acetabulum has been completed, several 1/4” primary holes are drilled in the dome of the acetabulum. Additional holes may be added at the surgeon’s discretion.

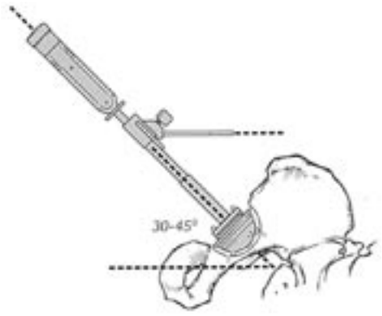
The acetabulum is then lavaged, suctioned and the socket dried thoroughly. The pre-mixed cement is either injected with a gun in a low-viscosity state or hand impacted after achieving a bolus form. The proper cemented acetabular cup is now chosen to correspond to the final reamer diameter. If, for example, the final ream diameter was 60mm, the 28mm (I.D) x 60mm cemented cup would be selected. The peg diameter is also 60mm providing a 3mm cement mantle on all sides of the component (actual cup diameter is 54mm). Utilizing the driving instrument the component is pushed gently but firmly with the angle guide positioned over the shaft of the driving instrument in order to ensure the correct position of the acetabular component (30-45 degrees off the vertical and in 10-15 degrees of anteversion). In cases where there is extreme femoral anteversion, it would be desirable to have the cup in a neutral position with regard to anteversion/ retroversion.

When the acetabular component is in place, the five polyethylene spacer pegs in the dome of the outer cup will bottom out against the acetabular bed. At this time, the acetabular cup is again checked to ensure proper orientation. Any adjustments must be completed before the cement begins to cure. If the component is not in the correct orientation, realign the component with the positioner. (Note: the driving instrument should be left within the acetabular component until the cement is completely cured). It is essential that the cup be compressed into the acetabulum and the positioner be held as still as possible, until the cement has set.

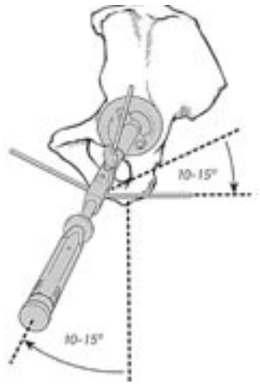
Take special measures to remove all excess cement by utilizing curetts and osteotomes.



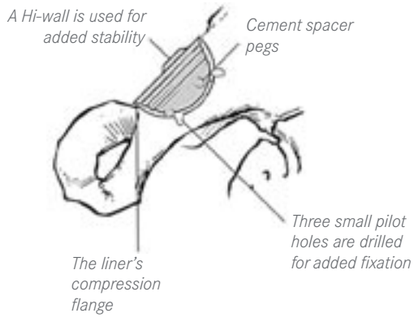
The cemented acetabular cup is inserted with a face plate on the end of the inserter for version control.

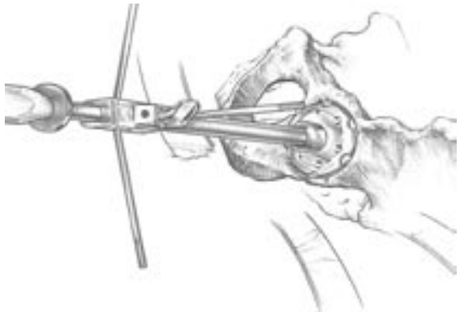


The long handle should lie 30-45 degrees off the vertical from centre of the patient’s trunk.

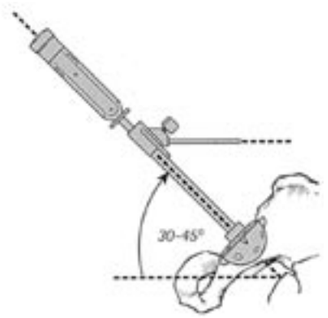


The long handle should also lie in 10-15 degrees of anterversion off the patient’s trunk.

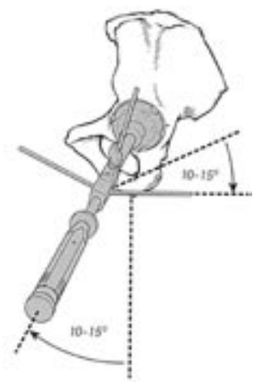




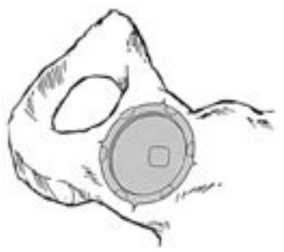
The acetabular component is inserted using an impactor plate on the face of the shell.



The long handle should lie 30-45 degrees off the vertical from centre of the patient’s trunk.



The long handle should also lie in 10-15 degrees of anterversion off the patient’s trunk.



The Mallory-Head solid aceabular shell is shown seated in proper position.

Porous Acetabular Component Insertion

The component is driven into place, utilizing the RingLoc inserter with the angle guide positioned over the shaft of the driving instrument in order to achieve correct positioning. The correct position is 30-45 degrees off the patient’s vertical axis with 10-15 degrees of anterversion. Shell impactor plates should be used to drive from the periphery of the shell and are attached to the end of the inserter. The inserter may also be directly screwed into the dome of the shell making sure the square end of the inserter is complerely seated into the recess in the apex of the shell with the threads thoroughly engaged. The cup is inserted so that its final position will be 30-45 degrees of abduction. The long handle and guide are used to establish this position.

The acetabular component itself should be positioned so that the cutting fins engage the pubic area, the ischial area and so that two fins engage the anterior column and two engage the posterior column. Slowly tap the component into place, being sure to check the position of the shell as it advances. If orientation is acceptable, solidly impact the inserter and fully seat the component. Confirm that full seating of the component is accomplished by viewing the central acetabular bone through the screw holes in the acetabular shell. When using a solid finned shell, confirming apposition is still necessary but slightly more challenging. The final reamer or trial gauge should be marked with a Bovie or methylene blue pen at the peripheral rim. Seating can be confirmed when the solid shell is driven to the same level or when the pitch of the mallet changes significantly. After the acetabular shell is driven into place and full seating has been confirmed, the acetabular shell is again checked to ensure proper orientation. Whenever possible, the fins should be anchored in the rim of the acetabulum in the cortical bone of the outer table and in any remaining subchondral bone.

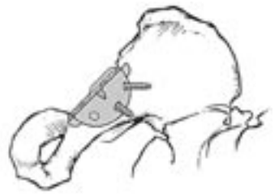
The inserter and plate are then carefully removed to avoid moving the cup. If the plates are not used with the inserter for the holed shell, unthread the centre shaft of the inserter from the apex, then lift the inserter off the shell. The cup should be checked with a depth gauge or hemostat placed through the holes to be sure it is completely seated.

The shell should be firmly fixed within the acetabulum. There should be no gaps between the shell and the acetabulum. If the shell can be rotated within the acetabulum, a larger shell should be selected.

Note: If the surgeon desires a change in either the anteversion or inclination, **an impactor or punch is not to be used against the rim of the titanium shell.** This can damage the groove for the locking ring and cause the locking mechanism to function improperly. The shell impactor plates should be used instead. The appropriate impactor plate, attached firmly to the inserter, is placed over the orifice of the titanium shell to protect the rim of the shell. Impaction to allow minor changes in anteversion or inclination can now proceed safely. In situations where all four fins are not engaged the Mallory-Head finned shell with holes should be used to allow for supplemental screw fixation.

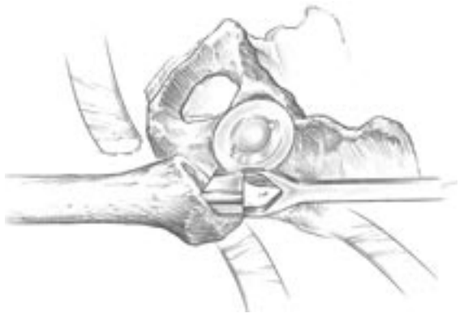
The trial liner and the final liner are usually inserted with the Hi-Wall or 10-degree face positioned to protect from posterosuperior dislocation. The polyethylene Hi-Wall offers an extended articulating surface to prevent dislocation. The 10-degree face allows correction of orientation in the event of minor shell malalignment or extreme vertical placement. The 10 degree liner will also push the centre of rotation out or away from the shell. This additional shift or offset changes depending on the size of the liner (see chart). Due to the configuration of the liner, there are between twelve and sixteen possible locations for the insertion. The trial liner will fit loosely around the rim tabs and will not engage the metal locking ring. The trial liner can be easily inserted and reinserted into the RingLoc shell. The final liner will engage the metal locking ring and fit snugly around the tabs on the rim of the shell.

With the acetabular trial or final liner in place, and once femoral reconstruction has been completed, a trial reduction can then be carried out to determine if the correct neck length has been chosen for the femoral component.



The properly seated component seated showing rim and dome screws used for additional fixation. A Hi-Wall is used for added stability posteriorly.

10 Degree Liner Size	Additional Offset Provided
20	3.2mm
21	3.5mm
22	3.7mm
23	4.1mm
24	4.4mm
25	4.8mm
26	5.1mm
27	5.5mm
28	5.8mm



The Moore hollow chisel is used to open the femoral canal posteriorly and laterally.

The chisel is postioned within the medial aspect of the greater trochnater

Proximal view if the Moore hollow chisel opening the posterior/lateral medullary canal.

NOTE: Placing fingers at the distal wound provides a good reference to the femoral shaft's orientation.

Accessing the Femoral Canal

Prior to opening the femoral canal, a hollow chisel is utilized to access the lateral section of the proximal femoral shaft. The femoral neck is referenced to establish the correct anteversion of the chisel. The chisel should be positioned laterally to clear a channel for advancement of the tapered reamers without interference from the dense bone surrounding the trochanter.

A common difficulty in maintaining correct reamer orientation within the proximal femoral shaft axis, and consequently achieving correct positioning of the component, is insufficient bone removal at the medial aspect of the trochanter. Failure to create an adequate channel in this dense bone can cause the reamer tip to wander toward the cortex.

Prior to initiating the entry portal, an assistant should place a gloved index finger along either side of the femoral shaft at the distal termination of the wound. This provides a reference to the shaft's orientation, since adjacent tissue overlaps the shaft at this point and restricts visual confirmation.

Reaming the Femoral Canal

The objective for using the straight starter reamer is to open the femoral canal distally, and determine the correct component size. The spiral tapered reamer is then used to allow for the proper cement mantle. Careful pre-operative planning is essential for femoral stem sizing with the selection of the reamer size based on this process.

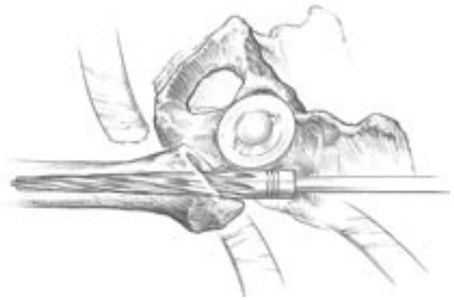
In order to open the canal of the femur in the axis of the bone, a small starter reamer is moved against both the medial portion of the greater trochanter and posteriorly against the resected neck of the femur. After opening the canal, progressively ream with larger starter reamers until cortical bone is reached at the isthmus.

A tapered reamer is then utilized to determine stem sizing and to achieve contact with the distal cortex. The preoperatively determined depth is achieved by reaming the femoral canal to the appropriate reference band on the reamer. Once the size has been established, the reamer is then used to create a cone within the proximal portion of the femur. By guiding the tapered reamer in a circular clockwise/counterclockwise motion, the proximal canal opens to a “cone” configuration. Refer to the diagram and chart below for the correct reamer size and desired cement mantle for each Interlok component.

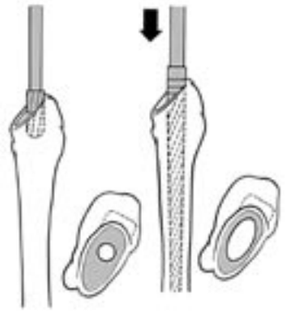
Interlok Stem Size	Interlok Reamer*	Porous Reamer	Porous Reamer
7.0x140mm	7.0mm*	9.0mm	10.0mm
9.0x150mm	9.0mm*	11.0mm	12.0mm
11.0x160mm	11.0mm*	13.0mm	14.0mm
13.0x170mm	13.0mm*	15.0mm	16.0mm
15.0x180mm	15.0mm*	17.0mm	18.0mm
Cement mantle	1.5mm	1.0mm**	1.5mm

* Interlok reamers are marked the same size as the corresponding Interlok implants, but are actually oversized by 3mm to allow for an even cement mantle of 1.5mm circumferentially about the prothesis.

** When using porous instrumentation for 1mm of cement around the prosthesis, the 1.5mm optional PMMA centering sleeve **SHOULD NOT** be used.



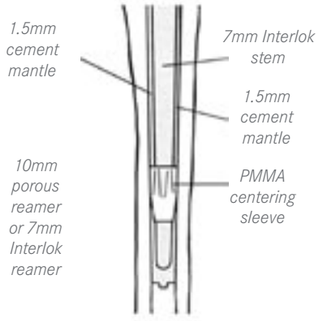
Tapered conical reamers are used to open the femoral canal distally.

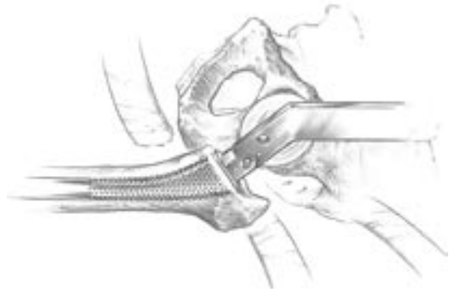


Utilise the straight starter reamer to enter the femoral canal.

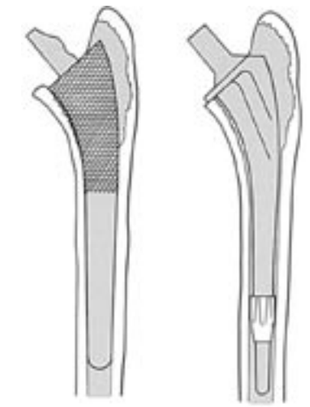
Reference bands on the tapered reamer locate the pre-operative depth. Progressive tapered reaming gradually removes cancellous bone.

The proximal cone configuration is created by an epliptical motion.





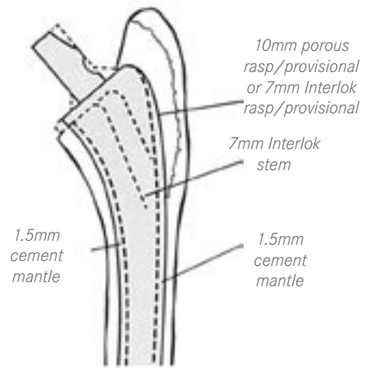
The rasp handle locks onto the rasp provisional pin.



The rasp/provisional completely fills the reamed femoral canal.

Selected implant illustrates the established area for the cement mantle.

Optional calcar trimmer.



Contouring the Stem Envelope

Upon completion of the reaming process, the rasp is used to contour the proximal stem envelope. Select the appropriate rasp that matches the final reamer size and insert the rasp in the corridor created by the reamer. The rasp will be slightly larger than the implant to be utilized, in order to create an established area for the cement mantle.

Maintain the rasp in-line with the proximal shaft axis, as was done in the reaming sequence. Do not attempt to fully seat the rasp upon insertion. Gradually advance the rasp until snug, then withdraw and repeat the sequence, occasionally irrigating the teeth of the rasp.

Since the isthmus has already been prepared with the reamer, the resistance to the advancement of the rasp is created by the upper rasp body enlarging the medial area of the proximal femur. It is essential that the rasp advances each time it is struck. If it doesn’t, the rasping must stop: to continue would greatly increase the risk of fracturing the femur. Rasping is completed and the proper proximal envelope is created when the rasp is fully countersunk and the proximal angled surface is even with the level of the medial ledge.

Interlok Stem Size	Interlok Rasp/Provisional*	Porous Rasp/Provisional	Porous Rasp/Provisional
7.0x140mm	7.0mm*	9.0mm	10.0mm
9.0x150mm	9.0mm*	11.0mm	12.0mm
11.0x160mm	11.0mm*	13.0mm	14.0mm
13.0x170mm	13.0mm*	15.0mm	16.0mm
15.0x180mm	15.0mm*	17.0mm	18.0mm
Cement mantle	1.5mm	1.0mm**	1.5mm

* Interlok reamers are marked the same size as the corresponding Interlok implants, but are actually oversized by 3mm to allow for an even cement mantle of 1.5mm circumferentially about the prosthesis.

** When using porous instrumentation for 1mm of cement around the prosthesis, the 1.5mm optional PMMA centering sleeve **SHOULD NOT** be used.

Trial Reduction

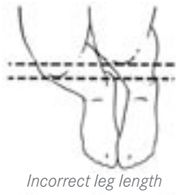
After the Mallory-Head rasp has been secured within the intramedullary canal, place the appropriate head/neck trial onto the pin extending from the rasp (an additional pin is present to prevent the trial from rotating).

The hip is then reduced and the range of motion-flexion, abduction and internal rotation-is thoroughly checked (the trial head should be symmetrical within the acetabulum). If either the hip reduction or range of motion check is unsatisfactory, choose alternative head/neck trials to adjust the neck length.

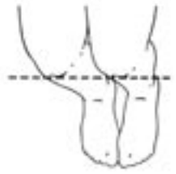
At this time, leg length should also be checked (see diagram). Align both legs in flexion and position both ankles together. Leg length can now be checked by reaching around the patient to feel if the knees are in proper alignment. If alignment is not satisfactory, choose an alternative trial head size to adjust leg length.

After satisfactory range of motion test is achieved, the hip can be dislocated and the head/neck trial removed. The rasp handle is then attached to the pin on the rasp, and the rasp removed from the femoral canal.

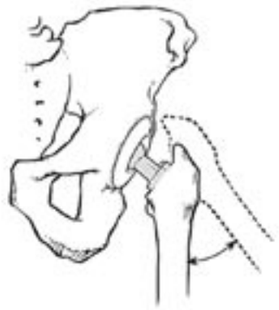
Placement of the collared head/neck trial on the extended rasp pin.



Incorrect leg length



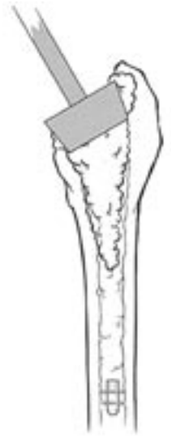
Correct leg length



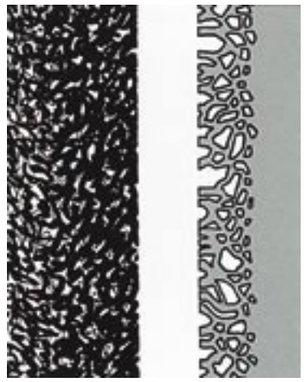
Internal rotation

Flexion and abduction

The cement injector fills the femoral canal with low viscosity cement



Stiff doughly cement compacts low viscosity cement into the canal wall



Interlok Surface *Bone Cement* *Bone*

This illustration shows bond between the Interlok stem and bone cement

Cement Insertion

After the femoral canal has been properly reamed and the trial reduction completed, it is necessary to thoroughly cleanse the canal prior to the insertion of the femoral implant. Utilizing a pulsating lavage/suction unit, remove all blood, fat and osseous debris which may inhibit the canal. Once this has been achieved to satisfaction, use a bone brush to cleanse the canal and remove loose pieces of cancellous bone that may remain within the femoral canal.

To enhance cement pressurization, insert a cement plug that corresponds to the femoral implant and canal to a depth not to exceed 2-3cm below the tip of the femoral stem. Continue to utilize a pulsating lavage and aspirate until a clean bone bed can be seen (it is advisable to use a suctioning device to remove the trapped liquid and debris). With this accomplished, tightly pack the femoral canal with absorbent gauze to allow the canal to remain free form fatty debris and blood during cement preparation.

Using a prepared low viscosity cement, inject it in a retrograde manner from the plug upward. Fill the entire medullary canal, completely saturating the outer cancellous cortical surfaces.

With this accomplished, stiff doughy cement is packed into the canal, compacting the low viscosity cement evenly throughout the femoral recess.

The cement cone is then recompressed with proximal compactors. The bone cement should be fully pressurized within the proximal femur to become well attached to the cancellous interface surface.

Stem Insertion

When the cement has been fully pressurized within the femoral canal, the femoral implant is progressively introduced into the prepared cavity. As the implant descends, the centering sleeve provides an even cement mantle toward the distal portion of the canal, while the stem's parallel ribs and anti-rotational grooves enhance proximal fixation and impede rotational forces within the femoral canal. Upon attaining the desired position, the femoral component should be held motionless until the cement has polymerized, then the excess cement is removed.

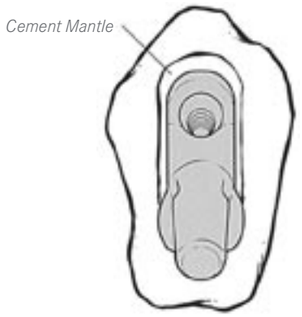
Once the acetabular shell is in place and the femur has been prepared with the femoral component, one of the trial head components is positioned on the prosthesis neck for the trial reduction sequence. There are several trial head components for the system. Each component establishes a neck length that is duplicated on the final modular head component. Choose the trial head which corresponds to the trial head/neck used on the rasp/provisional.

If, for example, a standard neck was chosen as optimal, a standard neck trial modular head should be selected. Any of the remaining heads may be substituted if the range of motion or the involved soft tissue tensioning is unsatisfactory.

Based on the final trial head component used, a corresponding modular head may now be selected.

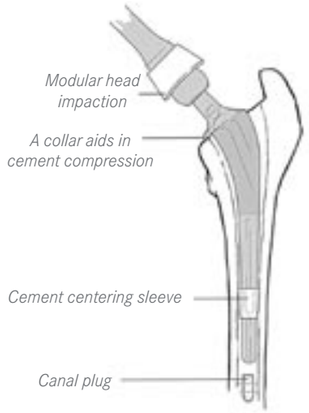
The centering sleeve provides for an even cement mantle distally. Parallel ribs enhance proximal fixation.

The threaded inserter/extractor handle introduces the prosthesis into the prepared canal.



Top view of the femur and implant.
Stem firmly seated in the cement creates a cement composite.

Distal cross-section view of implant.



The pre-operatively selected implant and cement fill the envelope established by the rasp.

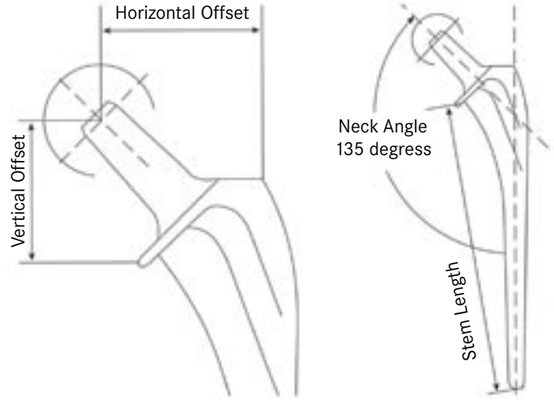
Mallory-Head Porous Femoral Components

Size (mm)	Stem Length (mm)	Neck Size (°)	Horz. Offset 28mm							Vert. Offset 28mm							Neck Length 28mm						
			-6	-3	STD	+3	+6	+9	+12	-6	-3	STD	+3	+6	+9	+12	-6	-3	STD	+3	+6	+9	+12
6	135	135	34	36	38	40	42	44	46	30	32	35	37	39	41	43	28	31	34	37	40	43	46
7	140	135	34	36	38	40	42	45	47	31	33	35	37	39	42	44	28	31	34	37	40	43	46
8	145	135	35	37	39	41	43	45	47	31	33	36	38	40	42	44	28	31	34	37	40	43	46
9	150	135	35	37	39	41	43	46	48	31	33	36	38	40	42	44	28	31	34	37	40	43	46
10	155	135	36	38	40	42	44	46	48	31	33	36	38	40	42	44	28	31	34	37	40	43	46
11	160	135	36	38	40	42	44	47	49	30	32	35	37	39	41	43	28	31	34	37	40	43	46
12	165	135	37	39	41	43	45	47	49	30	32	35	37	39	41	43	28	31	34	37	40	43	46
13	170	135	37	39	41	43	45	48	50	30	32	35	37	39	41	43	28	31	34	37	40	43	46
14	175	135	38	40	42	44	46	48	50	30	32	35	37	39	41	43	28	31	34	37	40	43	46
15	180	135	38	40	42	44	46	49	51	30	32	35	37	39	41	43	28	31	34	37	40	43	46
16	180	135	39	41	43	45	47	49	51	30	32	35	37	39	41	43	28	31	34	37	40	43	46
17	180	135	39	41	43	45	47	50	52	30	32	35	37	39	41	43	28	31	34	37	40	43	46
18	180	135	39	42	44	46	48	50	52	31	34	36	38	40	42	44	28	31	34	37	40	43	46
19	180	135	40	42	44	46	48	51	53	31	33	35	38	40	42	44	28	31	34	37	40	43	46

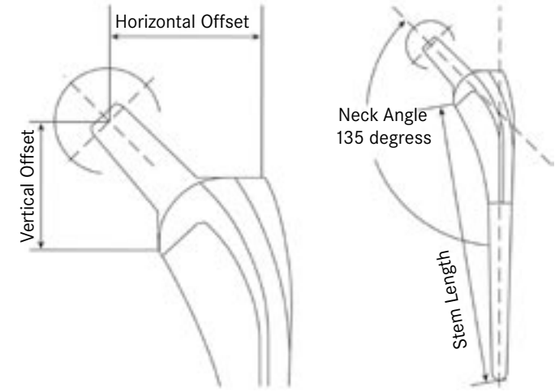
Mallory-Head Interlok Femoral Components

Size (mm)	Stem Length (mm)	Neck Size (°)	Horz. Offset 28mm							Vert. Offset 28mm							Neck Length 28mm						
			-6	-3	STD	+3	+6	+9	+12	-6	-3	STD	+3	+6	+9	+12	-6	-3	STD	+3	+6	+9	+12
7	140	135	34	36	38	40	43	45	47	30	32	35	37	39	41	43	28	31	34	37	40	43	46
9	150	135	35	37	39	41	43	46	48	30	32	35	37	39	41	43	28	31	34	37	40	43	46
11	160	135	36	39	41	43	45	47	49	30	32	35	37	39	41	43	28	31	34	37	40	43	46
13	170	135	37	39	41	43	46	48	50	30	32	35	37	39	41	43	28	31	34	37	40	43	46
15	180	135	38	40	42	44	47	49	51	30	32	35	37	39	41	43	28	31	34	37	40	43	46

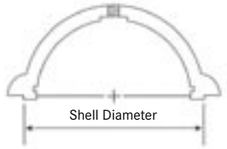
Mallory-Head Interlok Femoral Component



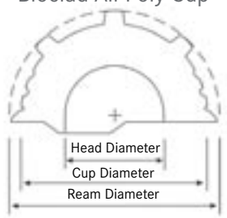
Mallory-Head Porous Femoral Component



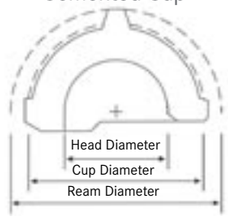
Mallory-Head Finned Acetbular Shell



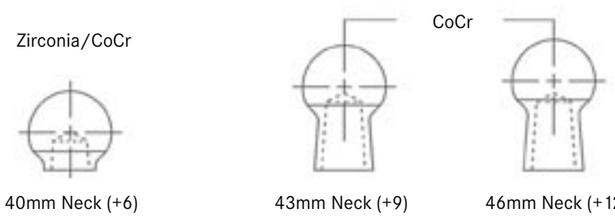
Bioclad All-Poly Cup



Mallory-Head Molded Cemented Cup



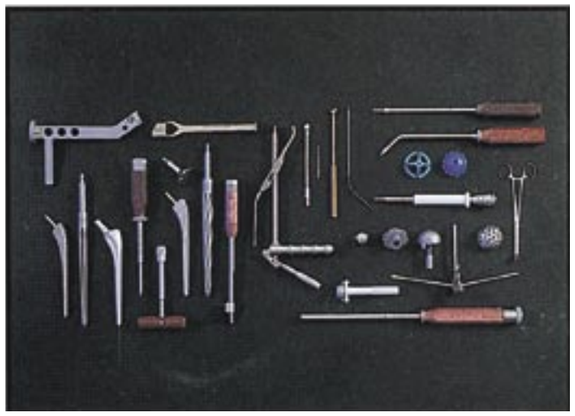
Modular Head Options



Mallory-Head®

The Ultimate Choice

The Mallory-Head Total Hip Program offers surgeons the ultimate primary component selection for maximum results and surgical flexibility.



The Mallory-Head porous and Interlok primay instrumentation provides surgeons with simple, easy to use tools designed to help ensure precise, reproducible results for all of their primary total hip arthroplasties.

Notes

FLH 020 07/04

Mallory-Head®

References

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