

Avantage™ Acetabular System

Surgical Technique



This technique is for use with the instrumentation upgrade.

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Quick Reference Technique



Step 1:
Preoperative Planning



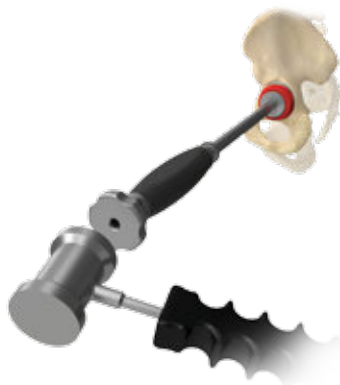
Step 2:
Reaming



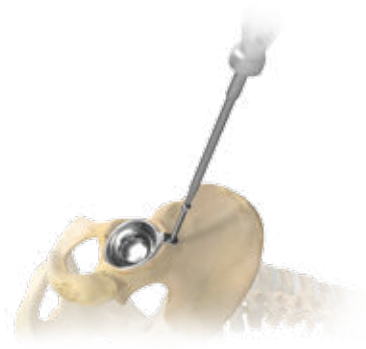
Step 3:
Acetabular Gauging and Alignment



Step 4:
Provisional Bearing Trialing



Step 5:
Shell Insertion



Step 6:
Additional Fixation
(3P Shell Optional)



Step 7:
Provisional Bearing Trialing



Step 8:
Bearing Assembly



Step 9:
Final Reduction



Figure 1

Device Description

The Avantage Acetabular System is available in cementless and cemented fixation. This non-constrained system design is an option for patients at risk of dislocation and includes extended head coverage in the superior region. Three shell variants are available (Figure 1) into which E1[®] antioxidant or ArCom[®] polyethylene bearings may be used with metal or BIOLOX[®] *delta* ceramic modular heads.



Figure 2

Preoperative Planning

Accurate preoperative planning and acetabular templating help determine the size, desired location and position of the acetabular shell and are an essential part of the surgical process (Figure 2). Templating is best performed with an A/P pelvis radiograph with the limb internally rotated approximately 15 degrees. This allows more accurate determination of femoral offset, radiographic leg length inequality, and referencing of contralateral hip, if required.

When examining the A/P radiograph, the shell should be positioned against, but not medial to, the radiographic teardrop at 40 degrees of inclination. Acetabular shell size is best determined on a cross table lateral radiograph. If the patient's anatomy is obscured, it may be helpful to check the acetabular component size on the contralateral hip radiograph, as well.

Make note of the shell size that fills the acetabular space appropriately and fits the anterior to posterior diameter of the native acetabulum, keeping in mind that final decision on shell size should be made during surgery when adequate visualization of the acetabulum is achieved.

Note: If existing components are present, an assessment should be made of the removal method, extent of bone loss and the suitability of the replacement device.

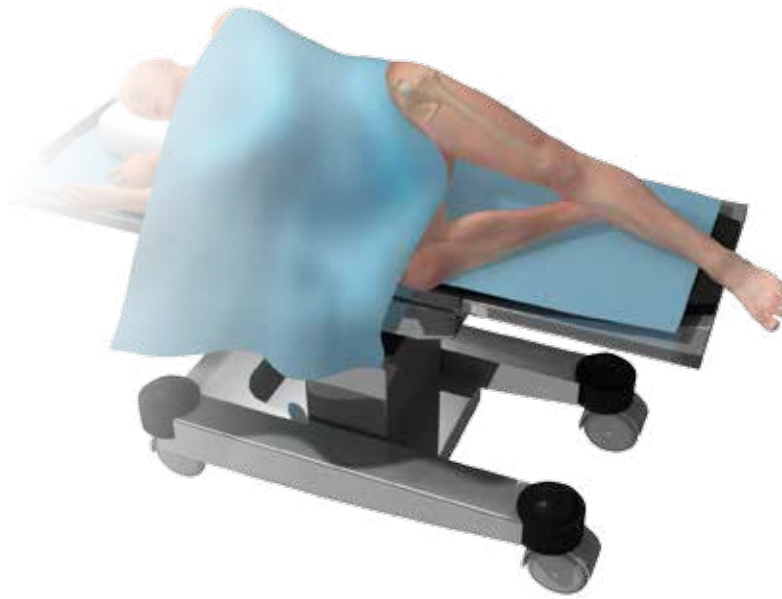


Figure 3

Patient Positioning

The Avantage Acetabular System is designed to be used with all surgical approaches (Figure 3).

Acetabular Exposure

Prior to reaming, acetabular exposure should be adequate and the anterior, posterior and superior walls should be directly visible. The medial acetabular wall, which dictates the depth of the reaming, should be uncovered of floor osteophytes or pulvinal pad. Specialized acetabular retractors are available to help facilitate exposure for whichever approach is chosen.



Figure 4

Reaming Guideline

Shell	Ream Diameter	Provisional Diameter	Definitive Implant Diameter
Avantage Reload and Avantage 3P	50 mm	50 mm	50 mm*
Avantage Cemented	50 mm	50 mm	48 mm**

Acetabular Reaming

Determine a starting reamer size from the preoperative template and from the measured diameter of the resected femoral head. This is typically 6–8 mm smaller than the femoral head diameter. Reamer handles are straight or curved (offset), and use is dictated by surgeon preference, surgical exposure and patient body composition. During the reaming process, frequently determine the amount of anterior and posterior acetabular bone remaining to avoid reaming away the wall and compromising fixation.

Beginning with a small reamer, apply constant pressure first toward the medial wall, appropriately medializing the acetabulum for optimal hip biomechanics and the normal center of hip rotation. Gradually progress to larger reamers, while maintaining concentricity within the acetabular cavity until bleeding subchondral bone is exposed (Figure 4).

The preferred acetabular orientation is 40 degrees inclination and 20 degrees of anteversion, but final acetabular position depends on patient anatomy and may vary slightly with approach. Final orientation of the acetabular implant is also dictated by the amount of version of the femoral implant (i.e., greater anteversion of the acetabular component may be required in the case of a retroverted stem). The Avantage shell is implanted size-to-size*, therefore under-reaming of the acetabulum is dependent on bone quality and should be determined by the surgeon intraoperatively as soft bone will more readily accommodate a larger press fit than harder, sclerotic bone. The above reaming recommendation may be used as an initial guideline.

* The Avantage Reload and Avantage 3P shells have peripheral fins that are oversized relative to the acetabular reaming and therefore enhance the initial press-fit and rotational stability.

** The Avantage Cemented shell should be undersized relative to the acetabular reaming to provide adequate cement mantle.

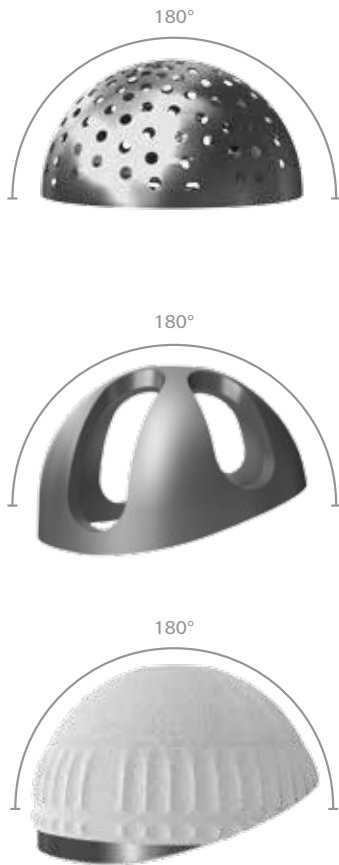


Figure 5

Acetabular Reaming (cont.)

Once reaming is complete, use the provisional shells to confirm the position and accuracy of the reaming. Final shaping must be achieved using the hemispherical reamer to ensure a congruent fit between the shell and the acetabulum (Figure 5).



Figure 6

Acetabular Gauging and Alignment

Once the desired ream has been achieved, the provisional shell impaction handle can be threaded to the acetabular shell provisional and used to gauge the size of the reamed acetabulum. The selected acetabular shell provisional should match the ream diameter that correlates with the size of acetabular component (Figure 6).

Note: The Avantage Cemented definitive implant will be undersized by 2 mm relative to the acetabular shell provisional to ensure adequate cement mantle. Gauging is only an indication of ream size and shape.



Figure 7

Acetabular Gauging and Alignment (cont.)

Impact the provisional shell into the reamed acetabulum. The machined slot on the rim of the acetabular shell provisional indicates the future position of the superior rim of the definitive implant. This slot must be positioned toward the superior rim of the acetabulum (Figure 7). The Lateral and Anterior Supine positioning guides are available to aid in insertion of the provisional shell (reference pages 9 and 10).

Once impacted, the provisional shell should remain stable in the acetabulum. Should the provisional shell be unstable, it is recommended to use the Avantage 3P Shell with the supplementary pegs and a 4.5 mm screw to enhance acetabular primary fixation.

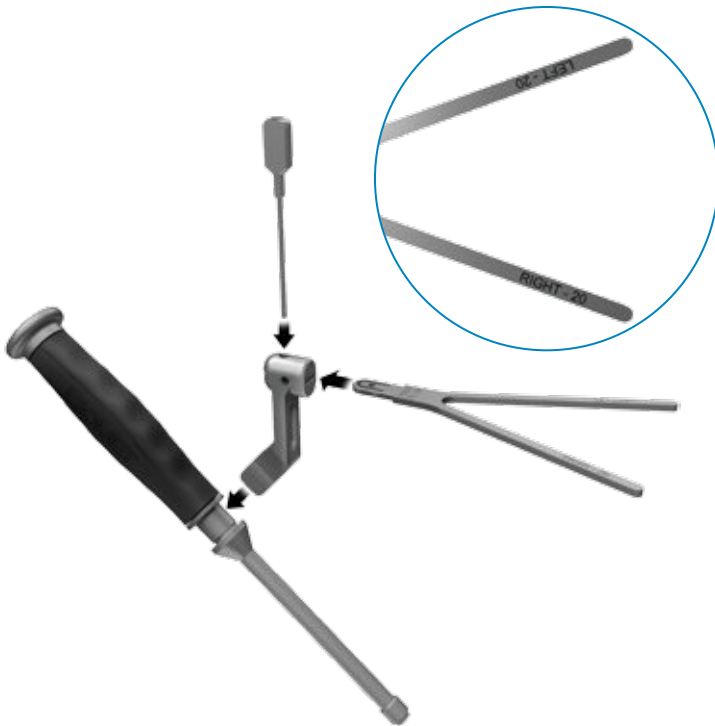


Figure 8

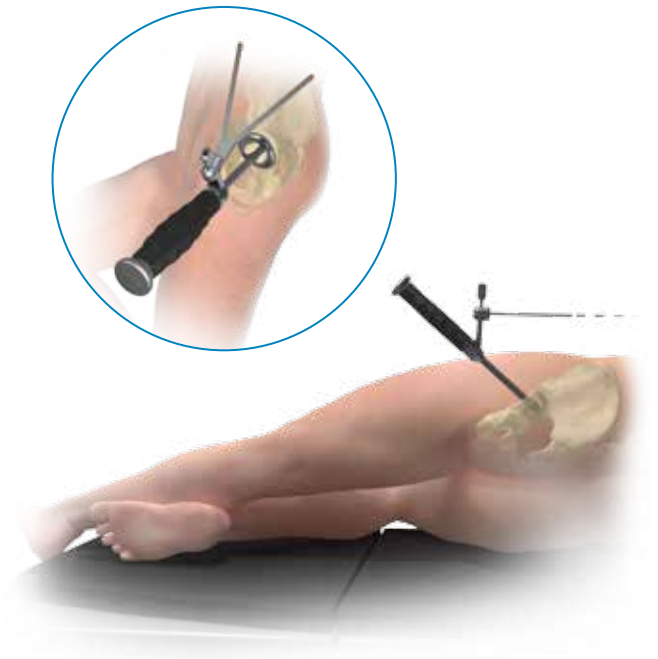


Figure 9

Acetabular Gauging and Alignment (cont.)

Positioning Guide

The lateral and anterior supine positioning guides are designed to aid in proper insertion of the acetabular component.

Assemble the positioning guide on the back table before securing to the insertion handle. Connect the body of the positioning guide to the insertion handle by sliding the guide into the opening between the handle grip and shaft on the inserter handle. Slide the positioning guide into the flat opening on the guide body. When the guide is in place, tighten the positioning guide rod to secure the guide to the handle (Figure 8).

Lateral Guide

When positioning the acetabular shell, the **lateral** guide arms should be parallel to the table, aimed toward the patient's ipsilateral shoulder (Figure 9).

For the **right hip**, use the reference arm of the "V" shaped guide labeled "**RIGHT**." For the **left hip**, use the reference arm of the "V" shaped guide labeled "**LEFT**" (Figure 8).

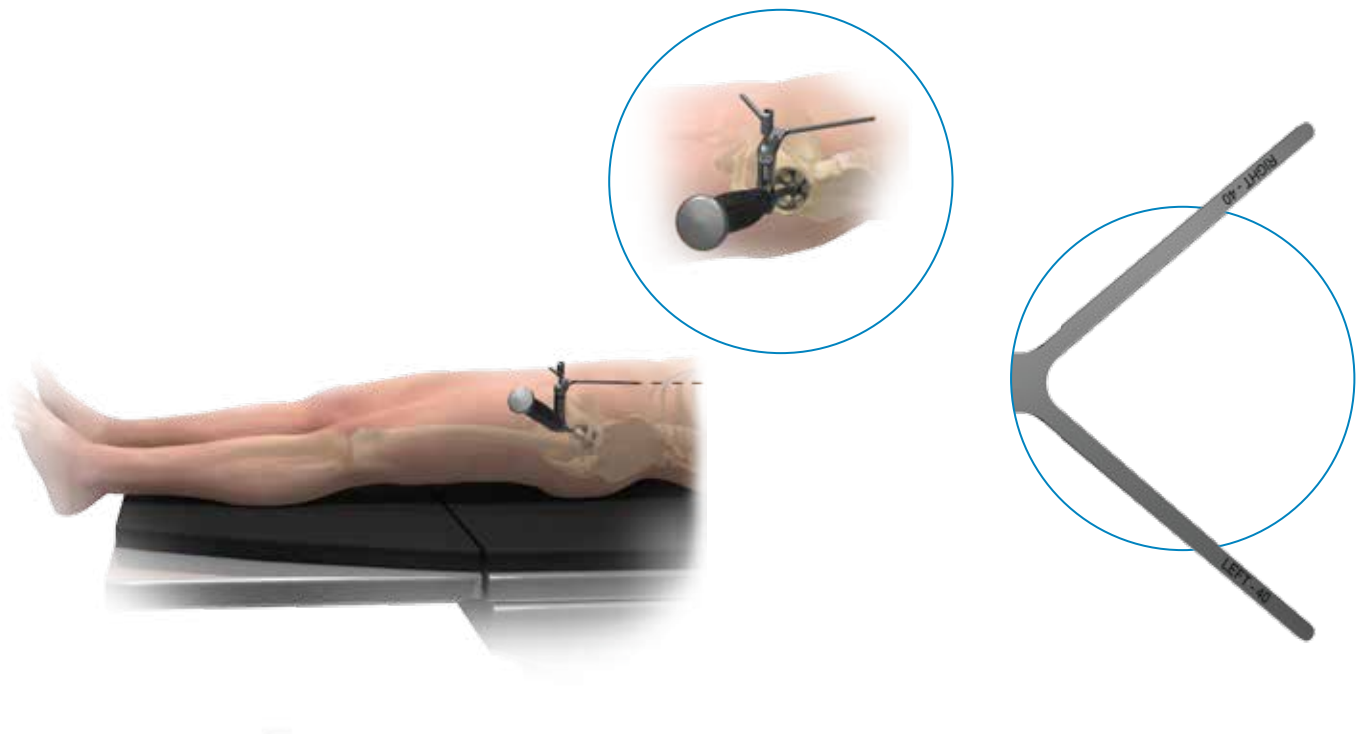


Figure 10

Acetabular Gauging and Alignment (cont.)

Supine Guide

When positioning the acetabular shell, the **anterior supine** positioning guide arms should be parallel to the table, aligned with the patient's spinal column (Figure 10).

For the **right hip**, use the reference arm of the "V" shaped guide labeled "**RIGHT**." For the **left hip**, use the reference arm of the "V" shaped guide labeled "**LEFT**" (Figure 10).

ⓘ **Note:** The primary reference for acetabular shell position should be based on the patient's anatomy. These instruments rely significantly on patient position and are designed to be used only as a secondary verification. If at any time there is concern about acetabular position, the orientation may be verified with intraoperative fluoroscopy or with intraoperative radiographs. A true A/P pelvis without rotation is best indicated when the tip of the coccyx lines up with the pubic symphysis and is within 1–2 cm of the symphysis.



Figure 11

Head Provisional Sizes

Type 1		12/14	
22.2 mm	28 mm	22.2 mm	28 mm
-	-	-	+ 7 mm
-	+ 6 mm	-	-
-	-	-	+ 3.5 mm
-	+ 3 mm	-	-
-	-	+ 2 mm	-
+ 0 mm	+ 0 mm	+ 0 mm	+ 0 mm
-	-	- 2 mm	
- 3 mm	- 3 mm	-	-
-	-	-	- 3.5 mm
- 5 mm	-	-	-
-	- 6 mm	-	-



Figure 12

Bearing Trialing with Provisional Shell

It is possible to perform provisional bearing trialing with the provisional shell. The provisional bearings are compatible with provisional modular heads. Provisional modular heads are available in Type 1 and 12/14 Taper and the associated “non-skirted” offsets available in these ranges. See chart above for available head provisional sizes (Figure 11).

The provisional bearing and provisional modular heads allow the full replication of the dual mobility motion.

Note: It is recommended that provisional bearing trialing is repeated following definitive implant insertion to determine the definitive offset required.

Trial Reduction and Range of Motion

Select the appropriate provisional modular head, bearing diameters and neck length to create equal leg length and needed lateralization as determined by the surgeon. These determinations can be made during preoperative templating, but final adjustments are made intraoperatively. Insert the provisional bearing construct onto the implanted stem or broach and reduce the hip (Figure 12).

Ensure the provisional bearing construct is seated fully on the trunnion. Check for joint stability and range of motion, making any necessary adjustments to restore joint mechanics. Make certain that prominent impinging bone and/or osteophytes are removed from the periphery of the acetabulum to maximize range of motion and stability. Make note of all provisional components used and then remove all provisional components.



Figure 13



Figure 14

Acetabular Shell Insertion

Shell impaction can be achieved using either the straight or curved Avantage Impaction Handle and Impaction Tips.

Instrumentation Assembly - Straight or Curved Impaction Handle

Push the strike plate retaining button and insert the strike plate into the handle, releasing the button to secure it in place (Figure 13). Insert the threaded expansion rod into the handle and turn the impactation plate clockwise to engage the thread (Figure 14).

ⓘ **Note:** Do not over-tighten the thread prior to the placement of the tip as this will prevent assembly of the impaction tip to the handle.



Figure 15



Figure 16

Acetabular Shell Insertion (cont.)

Instrumentation Assembly - Impactation Tip (Straight or Curved Handle) (cont.)

Select the corresponding impactation tip determined through provisional shell trialing or based on the last sized reamer utilized. Assemble the impactation tip over the expansion rod taking care to align the bayonette correctly and secure with a quarter clockwise turn (Figures 15 and 16).

Note: The expansion rod can be tightened as far as the engraved mark on the expansion tip by turning the impactation plate clockwise.

There are three shell options available in the Avantage Acetabular System including the Avantage Reload, Avantage 3P and Avantage Cemented Shell. Prior to assembling the shell to the impactation handle, ensure you are familiar with the variations in insertion steps relative to the Avantage 3P and Cemented Shells.



Figure 17



Figure 18

Acetabular Shell Insertion (cont.)

Instrumentation Assembly - Impactation Tip (Straight or Curved Handle) (cont.)

Place the definitive implant flat on the table and insert the impactation tip into the definitive shell perpendicular to the table. Take care to align the shape of the impactation tip to the rim of the shell and the impactation tip cut out to the laser mark (or screw hole on the 3P shell) indicating the center of the superior lip of the shell (Figure 17).

Turn the impactation plate in a clockwise direction to expand the impactation tip inside the shell and fully tighten the shell onto the impactation handle (Figure 18).

Note: Ensure the impactation handle remains perpendicular to the table and the impactation tip profile remains in contact with the shell rim while tightening.

Use of Positioning Guide

With the shell assembled, the positioning guides can be assembled to the handle. The lateral and anterior supine positioning guides are designed to aid in proper insertion of the acetabular component. Utilizing the positioning guide as a reference, determine the correct position and alignment of the acetabular shell. (See positioning guide section pages 9 and 10). Position of the acetabular shell is crucial for optimizing wear and reducing impingement, dislocation and potential adverse outcomes.



Figure 19



Figure 20

Acetabular Shell Insertion (cont.)

Avantage Reload Shell

Use a mallet to impact the handle on the strike plate, driving the shell into the acetabulum. While impacting, note the position of the superior rim and inferior aperture (Figure 19).

Gently toggle the insertion handle to make certain the shell is stable. Once the implant is fully seated, turn the impaction plate counter-clockwise to advance the expansion wedge and release the shell.

Continue to bearing trialing with definitive shell on page 20.

Shell Re-Positioning

If necessary, the implanted shell can be repositioned without removal using the Avantage Shell Positioner and the Provisional Impaction Handle.

Thread the shell positioner onto the provisional impactor and position it on the rim of the implanted shell (Figure 20). Use gentle taps on the strike plate to make minor adjustments to the shell position.

Note: If the shell cannot be repositioned or the shell fixation is not considered to be suitable following adjustment, it is recommended to remove the shell and reinsert or utilize additional fixation.



Figure 21

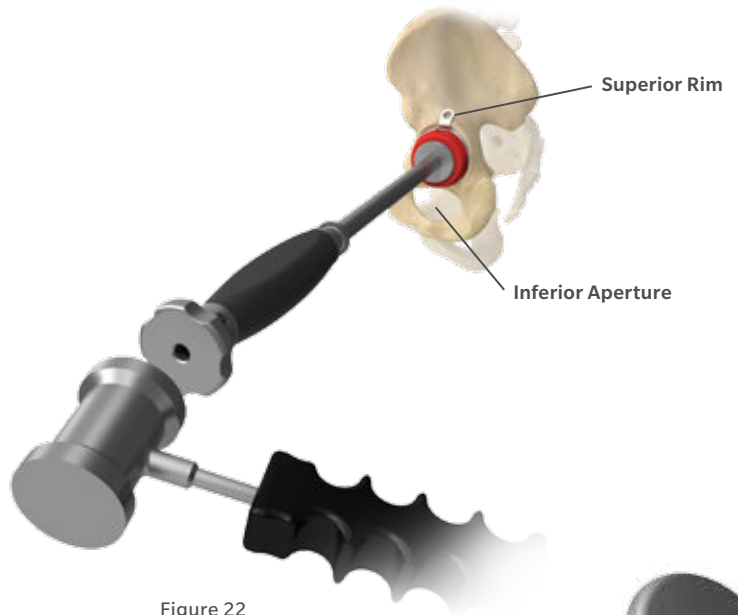


Figure 22

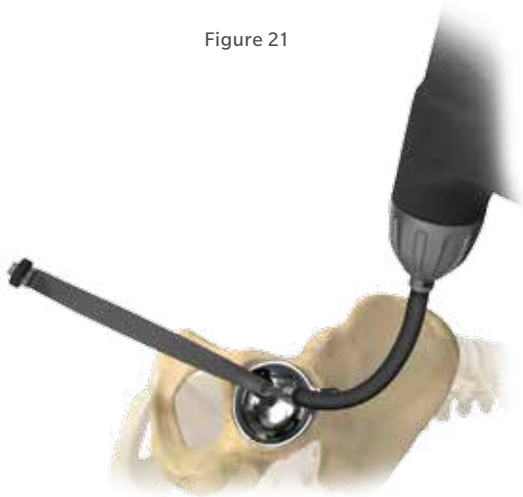


Figure 23



Figure 24

Acetabular Shell Insertion (cont.)

Avantage 3P Shell

Note: The Avantage 3P shell requires additional instrumentation provided in the Avantage 3P Supplementary Tray.

The Avantage 3P Shell offers supplementary fixation through the superior plate screw-hole and the inferior pegs.

Prior to impaction, it is necessary to bend the superior plate to fit the anatomy of the acetabulum contour. Use the bending iron while securely holding the shell (Figure 21).

Once assembled onto the impaction handle, use a mallet to impact the handle on the strike plate, driving the shell into the acetabulum. While impacting, note the position of the superior rim and inferior aperture (Figure 22).

Gently toggle the insertion handle to make certain the shell is stable. Once the implant is fully seated, turn the impaction plate counter-clockwise to advance the expansion wedge and release the shell.

Once impacted, use the flexible drill shaft, the short drill and the drill guide to drill through the two shell holes (Figure 23). Prepare the holes to accept the pegs with the peg shaper (Figure 24).



Figure 25

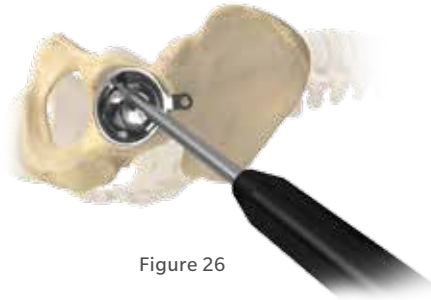


Figure 26



Figure 27



Figure 28

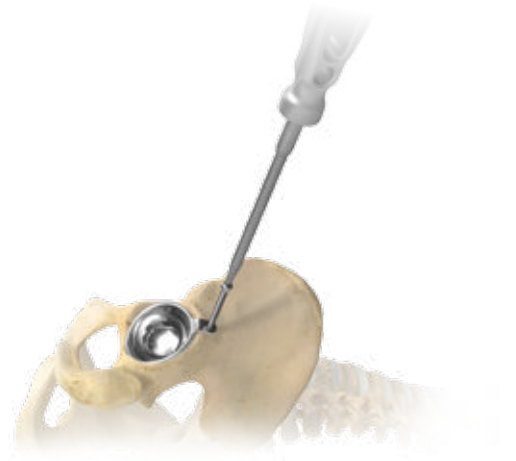


Figure 29

Acetabular Shell Insertion (cont.)

Avantage 3P Shell (cont.)

Insert the pegs into the shaped hole with the peg clamp (Figure 25). Seat the pegs to engage the taper fixation utilizing the straight or curved peg impactor with gentle mallet strikes (Figure 26).

ⓘ **Note:** Ensure that the pegs are sufficiently inserted and do not protrude or disturb the bearing mobility.

Once the pegs are placed, drill the hole for the superior plate screw using the long 3.2 mm drill through the drill guide and the superior plate (Figure 27). Measure the required screw length with the depth gauge (Figure 28) and insert the corresponding 4.5 mm screw, tightened firmly with the screwdriver (Figure 29).

Continue to bearing trialing with definitive shell on page 20.



Figure 30

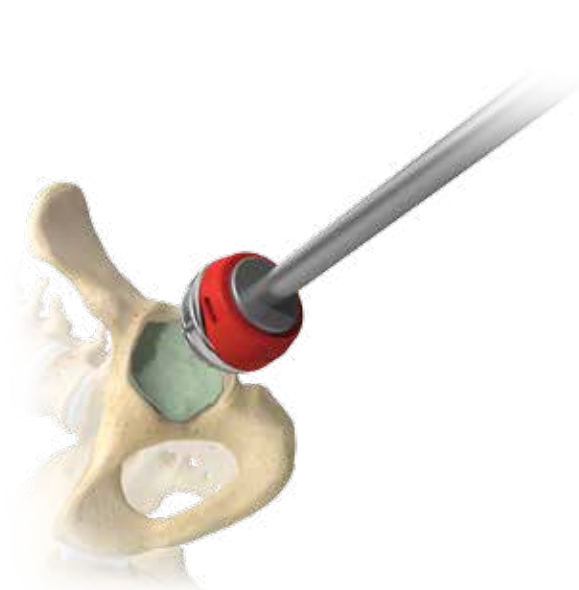


Figure 31

Acetabular Shell Insertion (cont.)

Avantage Cemented Shell

The Avantage Cemented Shell offers cemented fixation for use in primary and fracture indications as well as revision applications with or without additional revision implants (augments, cages and constructs). Acetabular preparation and insertion instruments remain the same. However, the surgical technique is modified to include the following modern cementing technique:

The prepared acetabular surface should expose cancellous bone wherever possible with the exception of the true medial wall. Additional anchorage holes can then be drilled or impacted into the acetabulum for increased surface area contact between cement and bone. Thoroughly clean the bone bed using high pressure pulse lavage. Dry the acetabulum and pack with swabs while the bone cement is mixed.

The use of a high quality, high viscosity, antibiotic-loaded bone cement is recommended to reduce the risk of aseptic loosening and infection. 40g of cement should be sufficient for the average acetabulum. However, more might be needed for revision applications.

It is recommended to mix bone cement in a closed vacuum mixing system to reduce cement porosity and exposure to monomer fumes. This also prevents direct contact with the bone cement prior to introduction in the prepared acetabulum. Introduce the cement into the acetabulum using a cement gun and short nozzle as a bolus, based on the manufacturers recommended delivery time (Figure 30).

Once delivered, the cement should be pressurized to optimize the micro-interlock and enhance the bone cement interface strength. High pressure should be applied to encourage micro-interlock until the cement is sufficiently doughy, at which point the shell can be introduced (Figure 31).



Figure 32

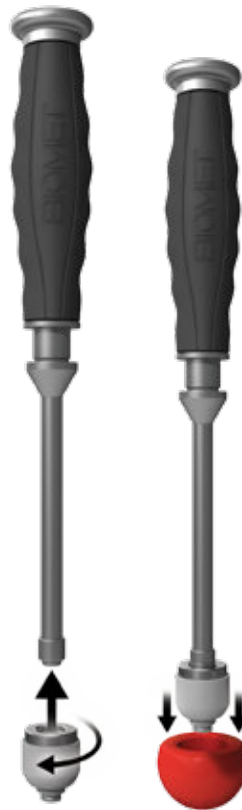


Figure 33



Figure 34

Acetabular Shell Insertion (cont.)

Avantage Cemented Shell (cont.)

An even cement mantle around the shell is desired for better stress distribution and to reduce the risk of cement mantle failure. Care should be taken to achieve an even cement mantle when introducing the shell.

ⓘ **Note:** The Avantage Cemented Shell used should be 2 mm smaller than the prepared acetabulum to achieve an adequate cement mantle.

ⓘ **Note:** The Avantage Cemented Shell does not have cement spacers.

Release the shell from the introducer as soon as possible after insertion and positioning. This prevents disturbance of the cement mantle during the curing phase caused by small movements magnified by the large lever arm of the introducer.

Turn the impaction plate counter-clockwise to advance the expansion wedge and release the shell (Figure 32).

Assemble the ball impactor to the inserter handle with clockwise turns. Attach the provisional bearing to the inserter handle assembly (Figure 33) and utilize the inserter handle assembly to maintain pressurization during the curing phase (Figure 34).



Figure 35

Head Provisional Sizes

Type 1		12/14	
22.2 mm	28 mm	22.2 mm	28 mm
-	-	-	+ 7 mm
-	+ 6 mm	-	-
-	-	-	+ 3.5 mm
-	+ 3 mm	-	-
-	-	+ 2 mm	-
+ 0 mm	+ 0 mm	+ 0 mm	+ 0 mm
-	-	- 2 mm	
- 3 mm	- 3 mm	-	-
-	-	-	- 3.5 mm
- 5 mm	-	-	-
-	- 6 mm	-	-



Figure 36

Bearing Trialing with Definitive Shell

It is possible to perform provisional bearing trialing with the definitive shell. The provisional bearings are compatible with both provisional modular heads. Provisional modular heads are available in Type 1 and 12/14 Taper and the associated “non-skirted” offsets available in these ranges. See chart above for available head trial sizes (Figure 35).

The provisional bearing and provisional modular heads allow the full replication of the dual mobility motion.

Trial Reduction and Range of Motion

Select the appropriate provisional modular head, bearing diameters and neck length to create equal leg length and needed lateralization as determined by the surgeon. These determinations can be made during preoperative templating, but final adjustments are made intraoperatively. Insert the provisional bearing construct onto the implanted stem or broach and reduce the hip (Figure 36).

Ensure the provisional bearing construct is seated fully on the trunnion. Check for joint stability and range of motion, making any necessary adjustments to restore joint mechanics. Make certain that prominent impinging bone and/or osteophytes are removed from the periphery of the acetabulum to maximize range of motion and stability. Make note of all provisional components used and then remove all provisional components.



Figure 37

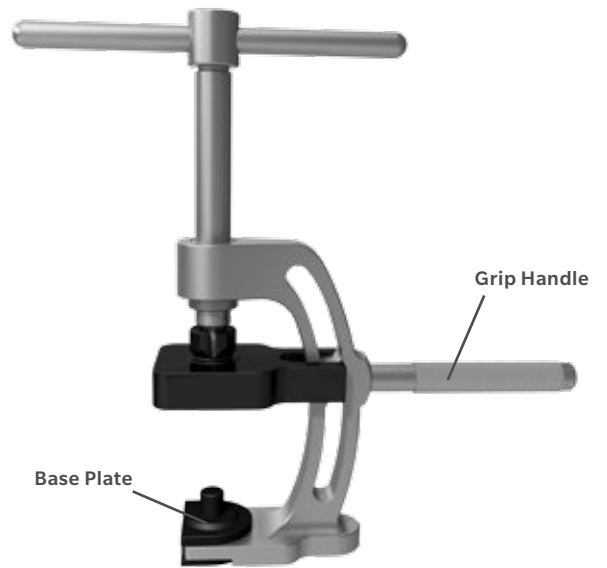


Figure 38

Definitive Bearing Assembly

The definitive bearing and femoral head are assembled using the Avantage Head Press.

Thread the head press T-handle clockwise through the press body and click the head press top plate onto the inferior end of the T-handle (Figure 37). Reverse the T-handle counter-clockwise to its maximum position. Click the base plate into position on the inferior aperture of the head press body. Then thread the grip handle into position (Figure 38).

Note: If using a monoblock stem, a monoblock head press plate is available.



Figure 39



Figure 40

Definitive Bearing Assembly (cont.)

Place the press on a level surface and place the monoblock head on the spigot of the base plate (Figure 39). Position and hold the selected bearing above the modular head. Rotate the T-handle clockwise to hold the bearing in position.

Ensure the base of the bearing is parallel to the base plate and head press top plate by holding the press handle grip while turning the T-handle clockwise. Rotate clockwise until the head is forced into the bearing (Figure 40) and a distinctive “pop” is heard.

Open the press by rotating the T-handle counter-clockwise. Check that the femoral head rotates freely within the bearing. If it does not rotate freely, the femoral head is not properly engaged. In this case, place the construct back on the bearing press and repeat the compression steps.

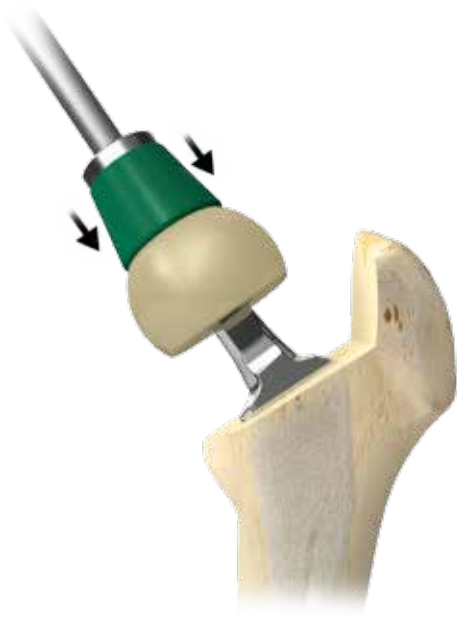


Figure 41



Figure 42

Definitive Implant Reduction

With the definitive shell in place and upon completion of femoral implantation and provisional reduction, the construct can now be implanted. After fully seating the femoral component, position the assembled bearing onto the dry and clean trunnion. Fully seat the construct by means of firm axial impaction utilizing the head impactor and firm mallet strikes to engage the taper (Figure 41).

Final Reduction

Once all final implants have been placed, perform the final reduction of the hip using the head pusher and shell provisional impaction handle if required. Check for joint stability and range of motion making any necessary adjustments to restore joint mechanics (Figure 42).

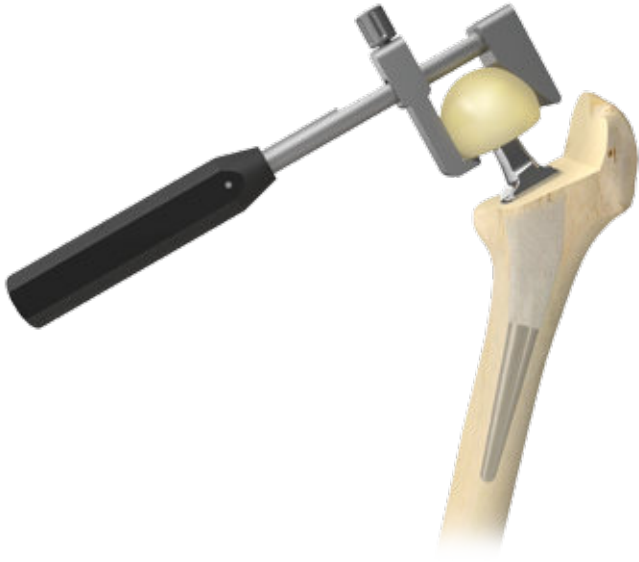


Figure 43

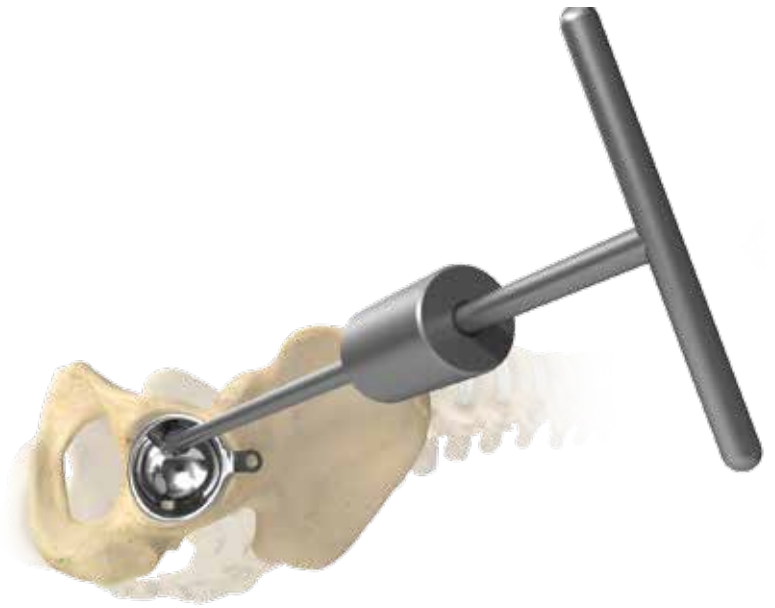


Figure 44

Liner or Shell Revision

In the event of a revision, additional instruments are available to assist in the removal of the Avantage bearing and the 3P pegs.

Bearing Removal

In revision cases, the bearing can be disassembled from the femoral head using the bearing extractor.

Adjust the jaws of the bearing extractor around the bearing and close the jaws tightly, making sure the sharp pin penetrates the bearing and that the femoral head is securely attached to the femoral stem (Figure 43).

Lever the handle of the bearing extractor to disassemble the bearing from the femoral head.

Note: The removed bearing must not be re-implanted.

3P Peg Removal

In revision cases, the pegs can be removed by threading the tip of the peg extractor inside the pegs (Figure 44). The handle can then be pulled and/or gently tapped with a mallet to remove the pegs from the shell.

INDICATIONS

AVANTAGE range acetabula can be used for the following indications of total hip arthroplasty:

- Primitive or secondary coxarthrosis;
- Inflammation of the hip; rheumatoid arthritis, etc.;
- Sequelae from previous hip operations, osteotomies, etc.;
- Congenital hip dysplasia;
- Femoral neck fracture;
- Femoral head necrosis.

Revision of the bearing – AVANTAGE cup;

Only AVANTAGE E1 P0560Exx and P0561Eyy (xx=44 to 66, yy=50 to 66) inserts may be used for a revision of the bearing (revision of the head and insert) when an AVANTAGE cup has already been fitted.

Revision of the bearing – RECAP/MAGNUM cup:

The AVANTAGE E1 P0560Ezz and P0561Ezz (zz=44 to 66) inserts may be used for revisions of the bearing when a RECAP/MAGNUM cup has already been fitted following the failure of the metal/metal association.

Note: AVANTAGE E1 inserts – sizes 44/46/48 Ø 28 mm - are only intended to be used with a RECAP/MAGNUM cup that has already been fitted and not for an AVANTAGE cup revision.

AVANTAGE range acetabula are double mobility and are therefore particularly recommended for patients presenting the following profiles:

- Patients of any age with a high risk of dislocation.
- Pathology exposing a patient to a risk of dislocation:
 - Neck fracture;
 - Tumor surgery;
 - Neuromuscular disorder (Parkinson's, buttock muscle paralysis, etc.).
- Hip prosthesis revision especially for recurring dislocations.

The choice between the different versions of AVANTAGE ACETABULUM depends on the acetabulum bone defect which gives the following grades using the Paprosky classification:

AVANTAGE ACETABULUM Paprosky Classification

AVANTAGE RELOAD Cup + AVANTAGE or AVANTAGE E1 Insert	1–2A
AVANTAGE 3P Cup and 3P Ti+HA + AVANTAGE or AVANTAGE E1Insert + AVANTAGE Pins	1–2A–2C
CEMENTED AVANTAGE Cup + AVANTAGE or AVANTAGE E1 Insert	1–2A

CONTRAINDICATIONS

- Local or systemic infections.
- Severe muscular, neurological or vascular deficiencies of the extremity involved.
- Bone destruction or poor bone quality that is likely to affect implant stability (Paget's disease, osteoporosis).
- Any concomitant disease that is likely to affect implant function.
- Allergy to any of the components of the implant.
- Patients incapable of following surgeon's recommendations.
- Patients weighing over 110 kg for the AVANTAGE cup/ AVANTAGE insert association.
- Patients weighing over 100 kg for the RECAP/ MAGNUM cup/ AVANTAGE E1 insert association.
- The AVANTAGE Insert and AVANTAGE E1 Insert are not cleared for use with the Magnum Tri-Spike.

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