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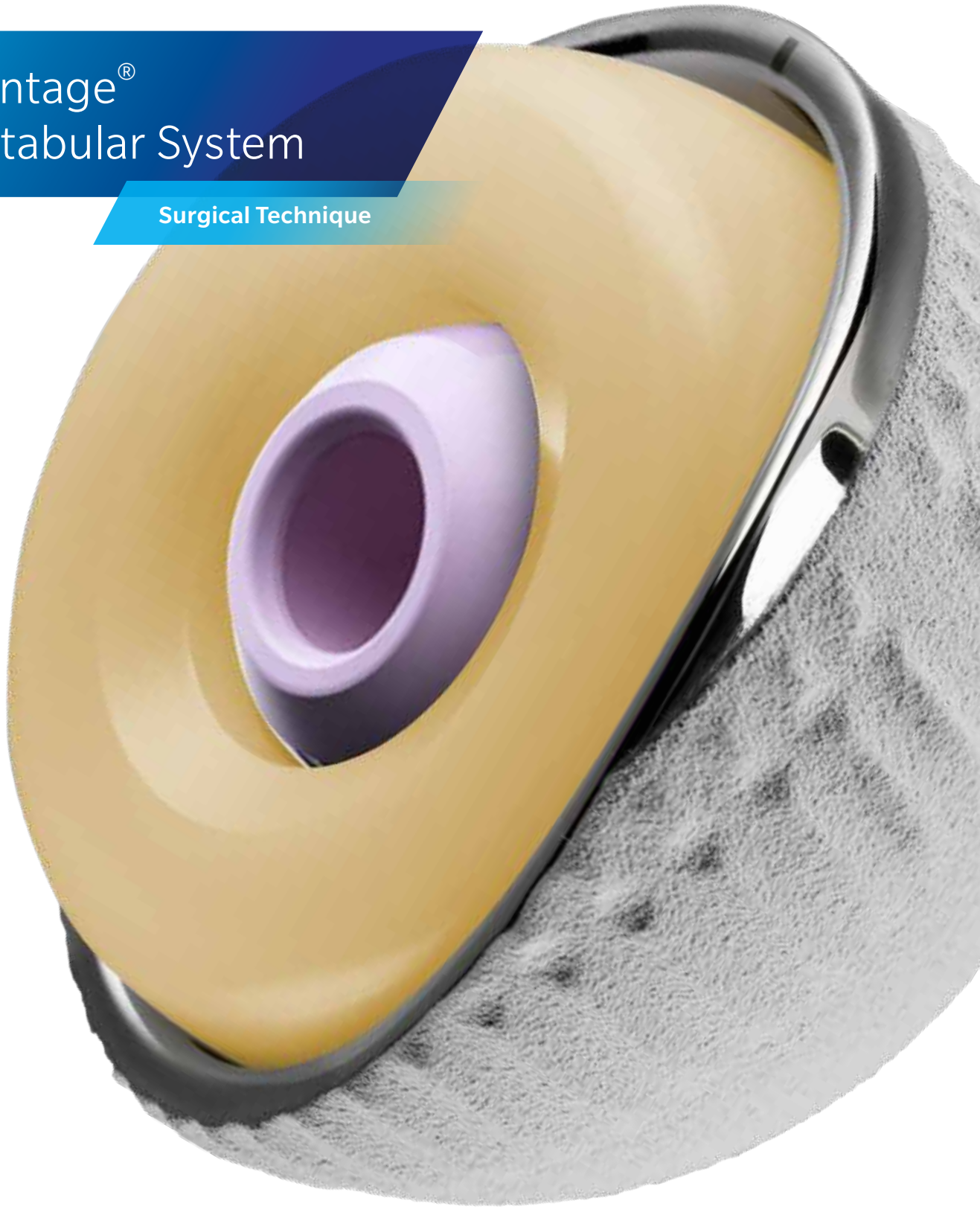
Avantage®
Acetabular System

Surgical Technique



This technique is for use with Avantage Legacy and Upgrade Instrumentation.

Table of Contents

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:
Bearing Assembly

Step 8:
Final Reduction

Avantage Reload Cementless Shell | Avantage 3P Cementless Shell | Avantage Cemented Shell

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.

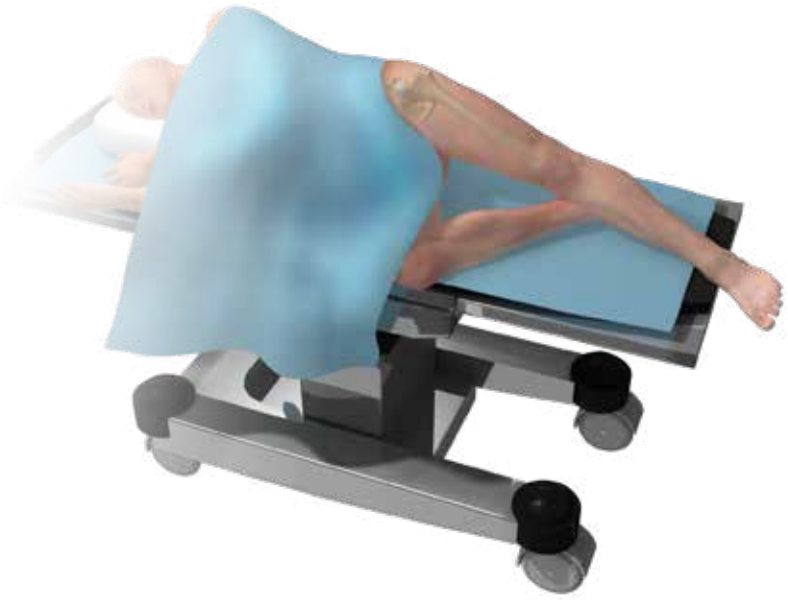


Figure 3

Patient Positioning

The Avantage Acetabular System can be implemented using any of the standard approaches for total hip replacement (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 pulvinar 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.

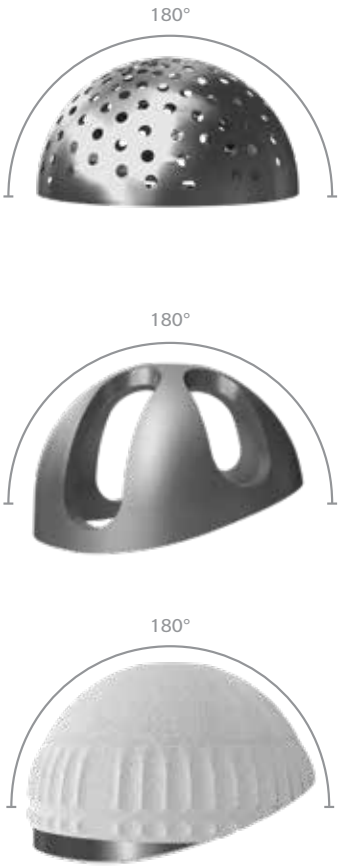


Figure 5

Figure 6

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).

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.

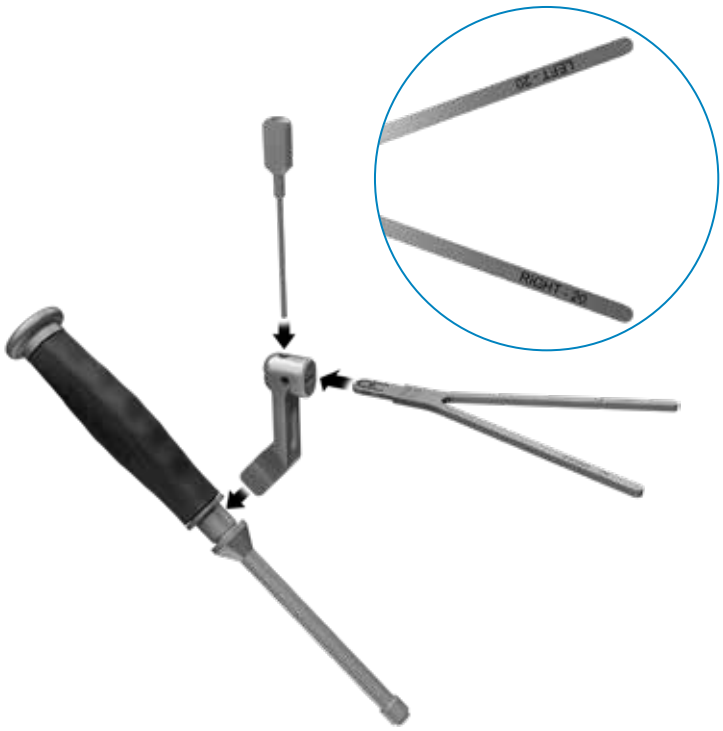


Figure 8

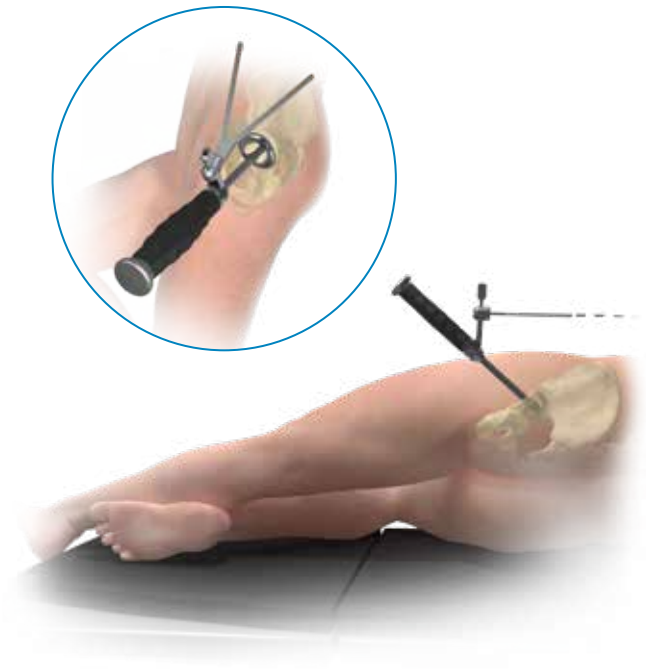


Figure 9

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).

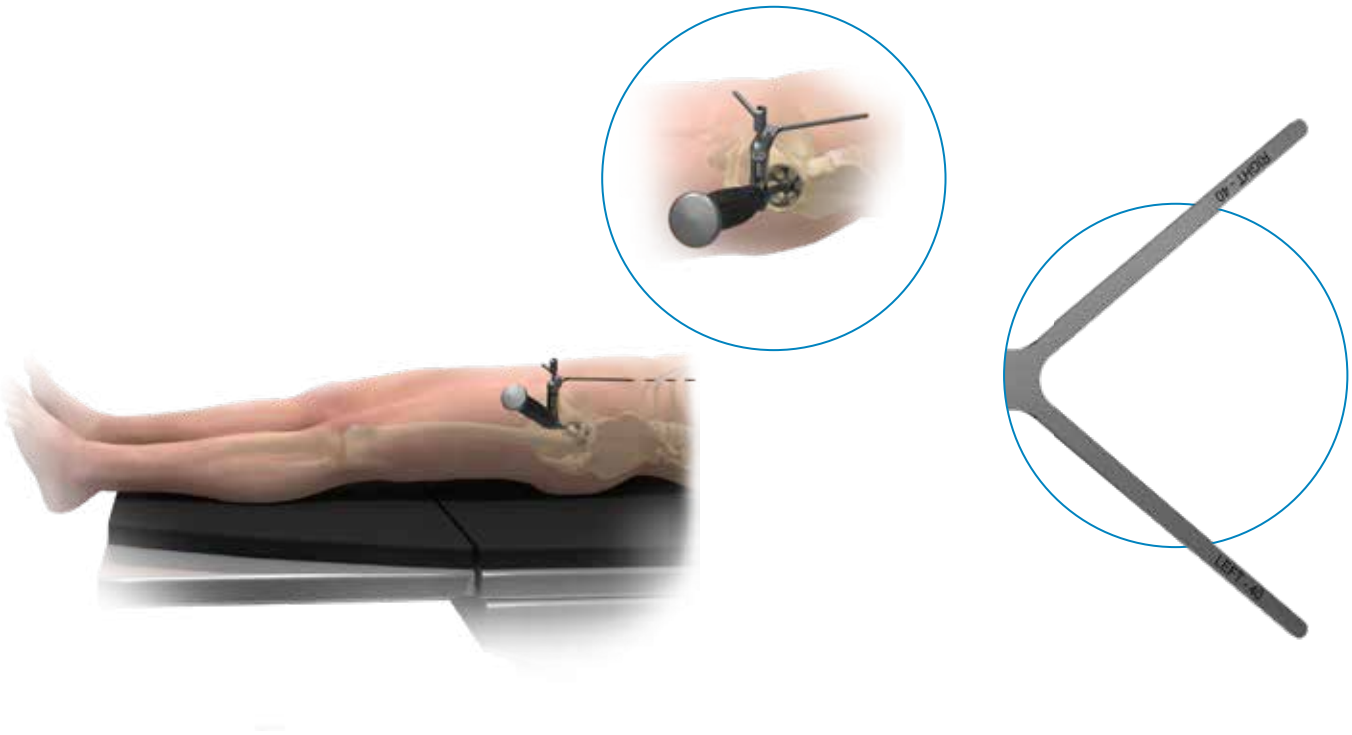


Figure 10

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	–	–

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 trialling is repeated following definitive implant insertion to determine the definitive offset required.

Figure 12

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.

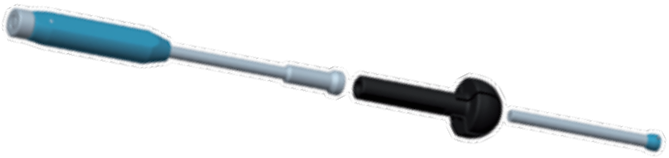


Figure 13

Figure 14

Acetabular Shell Insertion

Shell impaction can be achieved using the legacy Avantage Impaction Handle and Impaction Tips.

Instrumentation Assembly

Assemble the black impactor tips, corresponding to the definitive acetabular component size, with the impaction handle using the expansion rod (Figure 13).

Partially engage the thread of the tip of the expansion rod into the impaction handle through the black impactor tip. Care must be taken not to expand the diameter of the black impactor tip.

Mount the final implant onto the impaction assembly. Align one of the black impactor tip slots with the laser mark on the superior rim of the definitive implant and fully screw the impaction handle until the cup is secured on the expanded tip (Figure 14).

Care must be taken to position the flat surface of the black impactor tip flush with the superior rim of the cup.

Figure 15

Figure 16

Acetabular Shell Insertion (cont.)

Avantage Reload Shell

The 45-degree angulation guide can be mounted onto the impaction handle for accurate cup inclination (Figure 15).

Using a mallet, impact the handle on the strike plate, driving the shell into the acetabulum. While impacting, note the position of the superior rim and the the inferior aperture.

Once the implant is fully seated, partially unscrew the impaction handle and tap it gently to release the black impaction tip from the cup.

Continue to bearing trialing with definitive shell on page 18.

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 16). 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 17

Figure 18

Figure 19

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 17).

The cup is positioned, oriented and impacted in the same way as the Avantage Reload implant.

Once impacted, use the flexible drill shaft, the short drill and the drill guide to drill through the two shell holes (Figure 18). Prepare the holes to accept the pegs with the peg shaper (Figure 19).

Figure 20

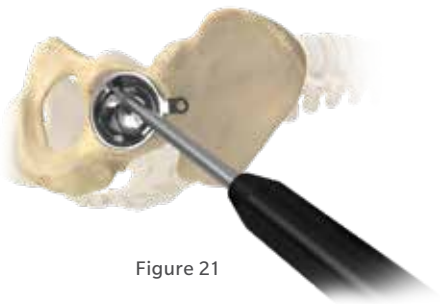


Figure 21

Figure 22

Figure 23

Figure 24

Acetabular Shell Insertion (cont.)

Avantage 3P Shell (cont.)

Insert the pegs into the shaped hole with the peg clamp (Figure 20). Seat the pegs to engage the taper fixation utilizing the straight or curved peg impactor with gentle mallet strikes (Figure 21).

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 23). Measure the required screw length with the depth gauge (Figure 24) and insert the corresponding 4.5 mm screw, tightened firmly with the screwdriver (Figure 24).

Continue to bearing trialing with definitive shell on page 18.

Figure 25

Figure 26

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.

To select the final implant size, it is recommended to choose a cup smaller than the trial cup in order to allow a minimal cement mantle around the implant (Figure 25).

The final implant and impaction device assembly remains unchanged. However, the impaction tip should be one size smaller than that of the final cup.

Example

Reamer	54 mm
Trial cup	54 mm
Definitive implant	52 mm
Impaction tip	50 mm

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 26).

Figure 27

Figure 28

Acetabular Shell Insertion (cont.)

Avantage Cemented Shell (cont.)

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.

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.

Note: Release and remove the impaction tip without waiting for the cement to become hard.

To apply additional pressure, assemble the ball impactor to the inserter handle with clockwise turns. Attach the provisional bearing to the inserter handle assembly (Figure 27) and utilize the inserter handle assembly to maintain pressurization during the curing phase (Figure 28).

Figure 29

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 30

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 29).

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 30).

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 31

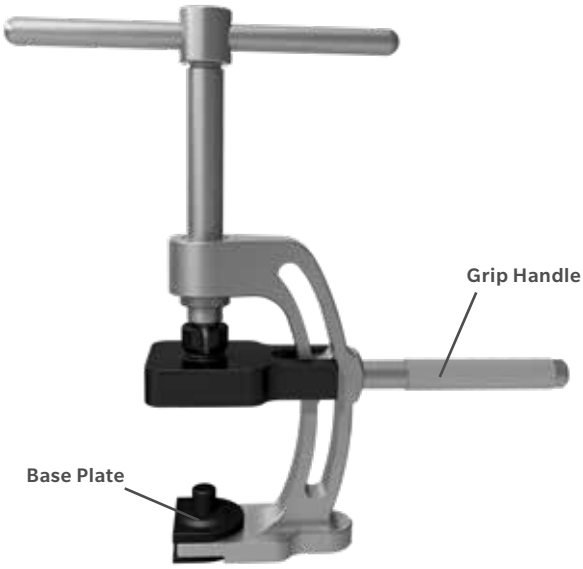


Figure 32

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 31). 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 32).

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

Figure 33

Figure 34

Definitive Bearing Assembly (cont.)

Place the press on a level surface and place the monoblock head on the spigot of the base plate (Figure 33). 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 34) 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.

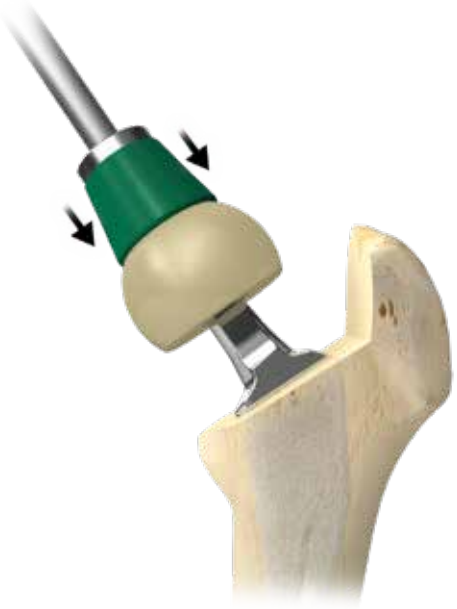


Figure 35

Figure 36

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 35).

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 36).

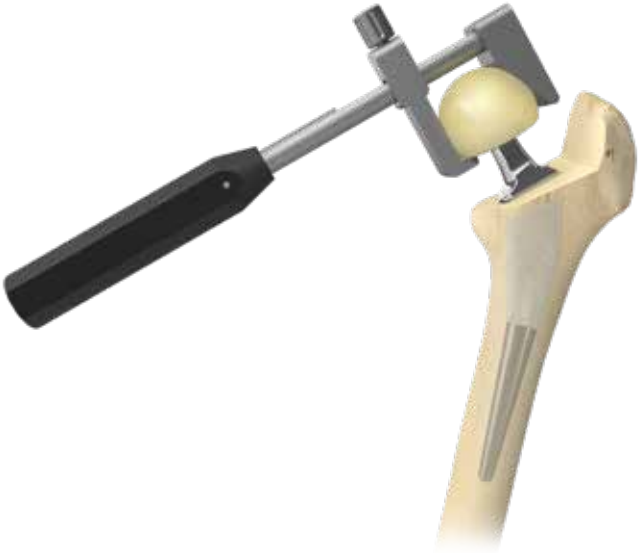


Figure 37

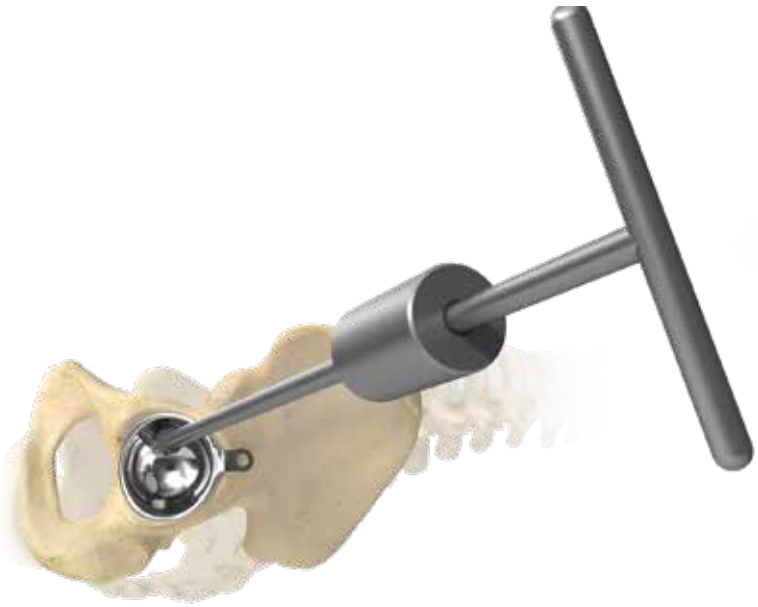


Figure 38

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 37).

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 38). The handle can then be pulled and/or gently tapped with a mallet to remove the pegs from the shell.

Zimmer Biomet does not practice medicine. This technique was developed in conjunction with health care professionals. This document is intended for surgeons and is not intended for laypersons. Each surgeon should exercise his or her own independent judgment in the diagnosis and treatment of an individual patient, and this information does not purport to replace the comprehensive training surgeons have received. As with all surgical procedures, the technique used in each case will depend on the surgeon's medical judgment as the best treatment for each patient. Results will vary based on health, weight, activity and other variables. Not all patients are candidates for this product and/or procedure. Caution: Federal (USA) law restricts this device to sale by or on the order of a surgeon. Rx only.

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