

ZCA[®]
**RECONSTRUCTION
ROOF RING
AND CAGE**

Surgical
Technique



SURGICAL TECHNIQUE FOR ZCA RECONSTRUCTION ROOF RING AND CAGE

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INTRODUCTION

The ZCA® Reconstruction Roof Ring and Cage were designed to address acetabular reconstruction problems that are not amenable to conventional uncemented or cemented acetabular components. In primary hip replacement, these problems include trauma, dysplasia, protrusio, osteoarthritis with large cysts, or severe osteoporosis such as may be associated with rheumatoid arthritis. In revision arthroplasty, loss of bone stock due to a loose implant with osteolysis may require a Roof Ring or Cage to protect the necessary reconstruction. Though both devices are used to protect contained or uncontained acetabular defects, the Roof Ring is used for smaller defects. Both devices require a cemented cup as the articular surface, but overall this reconstruction can be considered cementless because the Roof Ring or Cage is attached to host bone through screw fixation.

INDICATIONS

Roof Ring

Primary Hip Replacement

- Protrusio: post-traumatic osteoarthritis, rheumatoid arthritis, or idiopathic protrusio in combination with morsellized autograft bone, as long as contact can be made with host bone superoposteriorly and inferomedially.
- Severe osteoporosis: osteoporosis in conjunction with rheumatoid arthritis.
- Dysplasia: to protect a structural graft and provide better coverage for the acetabular cup.

Revision Hip Arthroplasty with Loss of Bone Stock Due to Osteolysis

- Contained defects: in combination with morsellized allograft bone, as long as contact can be made with host bone superoposteriorly and inferomedially.
- Uncontained defects involving less than 50% of the acetabulum: a small structural allograft that supports less than 50% of the cup can be protected by a Roof Ring.

Cage

Primary Hip Replacement

- Severe protrusio in combination with morsellized autograft bone where the defect is so large that it cannot be spanned by a Roof Ring. The Cage is used to protect the graft from ilium to ischium.

Revision Hip Arthroplasty with Severe Loss of Bone Stock Due to Osteolysis

- Large contained defects: contained defects involving the entire acetabulum require a device that extends from ilium to ischium used in conjunction with morsellized allograft bone.
- Uncontained defects involving greater than 50% of the acetabulum. The Cage is used in conjunction with a structural allograft.
- Pelvic discontinuity: a Cage can be used to bridge a discontinuity. If there is an associated bone defect, a graft is also necessary. If the Cage does not stabilize the discontinuity, a reconstruction plate is used in conjunction with the Cage.





SURGICAL TECHNIQUE

Surgical Approach

The Roof Ring may be implanted using any conventional approach since all provide adequate exposure. The Cage requires more extensive exposure from the ilium to the ischium. A traditional transverse trochanteric osteotomy may be necessary, but a trochanteric slide may also be adequate. If additional exposure is needed, the slide can be converted to a transverse trochanteric osteotomy by dissecting the vastus lateralis off the trochanteric fragment. It is important to adequately expose the entire circumference of the acetabulum in order to define the defect as contained or uncontained.¹

Classification of Bone Defects^{2,3}

The bone defect is defined by conventional radiographs (Judet views, if necessary) and intraoperative findings after any implant, cement, or debris have been removed.

The Roof Ring and Cage are usually not necessary for Type 1 Defects (Fig. 1) where a standard primary cup is typically used. The Roof Ring is used for Type 2 Defects (Fig. 2) when contact can be made with host bone superoposteriorly and inferomedially, and sometimes for Type 3 Defects (Fig. 3). The Cage is used for severe Type 2 Defects, and for Type 4 (Fig. 4) and Type 5 Defects (Fig. 5).



Fig. 1 Type 1 Defect: no significant loss of bone.



Fig. 2 Type 2 Defect: contained (cavitary) loss of bone.



Fig. 3 Type 3 Defect: uncontained loss of bone involving less than 50% of acetabulum.

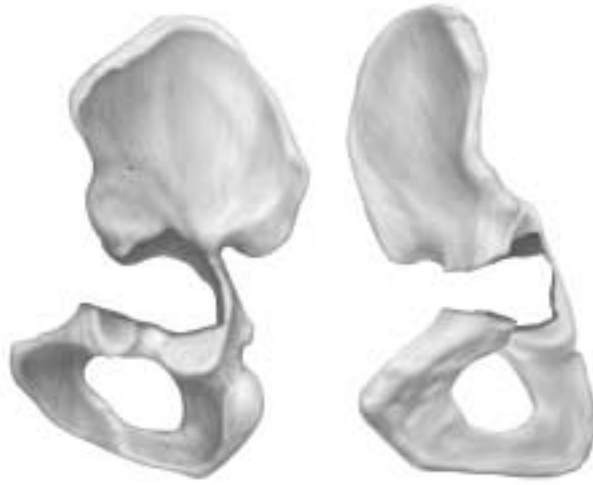


Fig. 4 Type 4 Defect: uncontained loss of bone involving more than 50% of acetabulum.

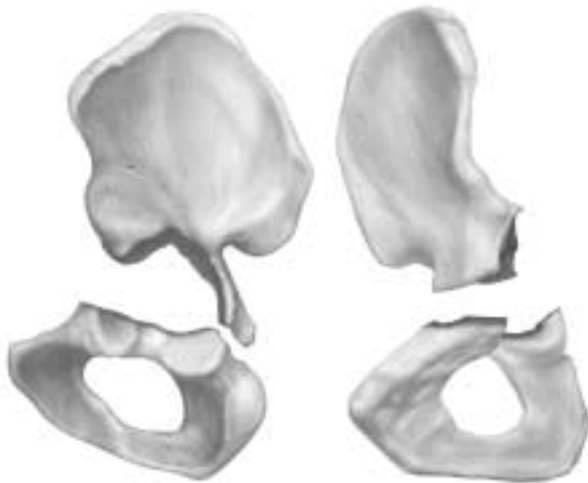


Fig. 5 Type 5 Defect: pelvic discontinuity with uncontained loss of bone.



Reconstructing the Acetabulum

After the defect has been defined, use morsellized bone to restore Type 2 Defects (Fig. 6) and structural graft to restore Type 3 (Fig. 7), Type 4 (Fig. 8), and Type 5 Defects

(Fig. 9). Compact morsellized bone with reverse reaming, and fix structural grafts with two or three 4.5mm or 6.5mm cancellous bone screws. Then, the Roof Ring or Cage can be inserted.



Fig. 6 Type 2: Contained Defect – greater than 50% of acetabulum – repaired with morsellized bone.



Fig. 7 Type 3: Uncontained Shelf Defect – less than 50% of acetabulum – repaired with structural graft.

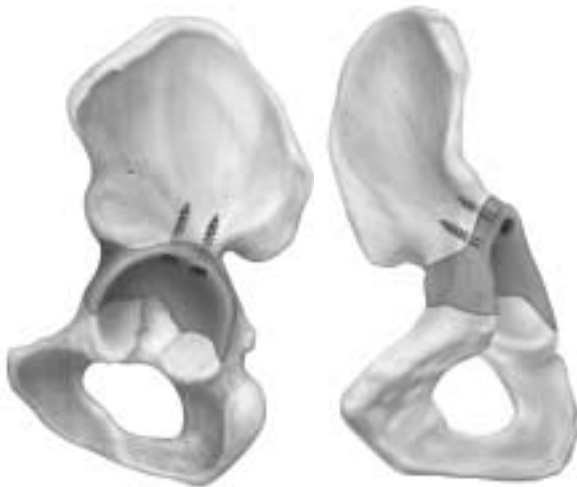


Fig. 8 Type 4: Uncontained Defect – greater than 50% of acetabulum – repaired with structural graft.



Fig. 9 Type 5: Pelvic Discontinuity – repaired with structural graft.

Roof Ring Insertion

After restoration of bone stock, the diameter of the bony bed should match the outer diameter of the Roof Ring. Prior to impaction, hand placement or adjustment can be utilized, if required (Fig. 10). With the Cup Positioner (Fig. 11), impact the Roof Ring with the flange superior and slightly posterior, making sure it is stable against host bone superiorly, posteriorly, and inferomedially. The superior flange and the inferior part of the Roof Ring must not be seated on morsellized bone graft or the Roof Ring will be unstable and the screws may break. In this situation, a Cage should be used.



Fig. 10 Hand placement.

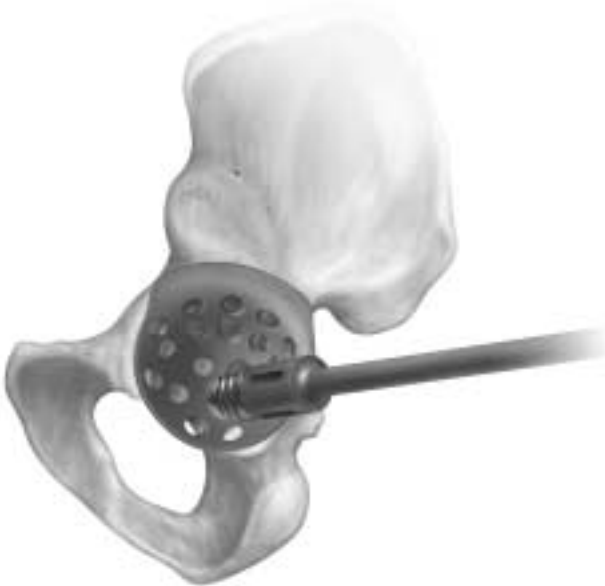


Fig. 11 Cup Positioner.





Fig. 12 Screw insertion.

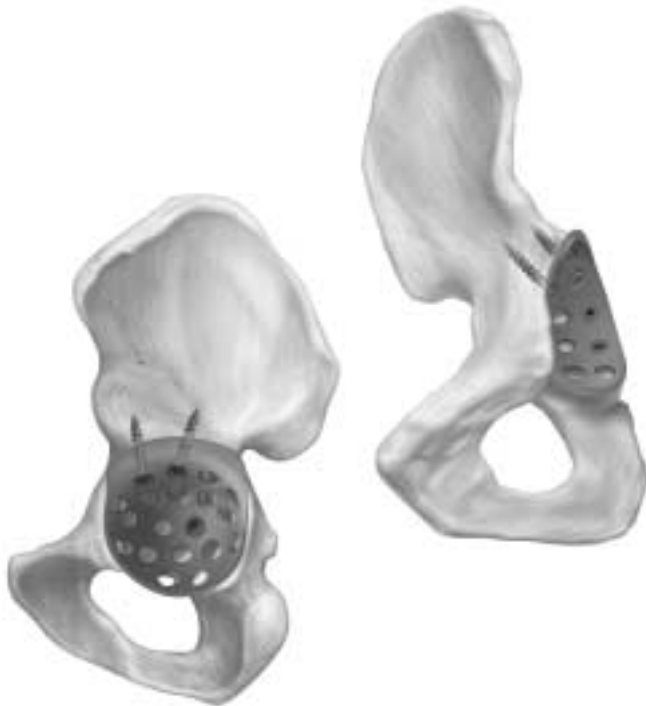


Fig. 13 Two views of screws in place.

Using the provided drill bits and depth gauge, insert at least three screws into the dome of the acetabulum (Fig. 12). Depending on the quality of the bone, it may or may not be necessary to engage the inner cortex. Insert the dome screws superiorly in a load-bearing direction. Additional screws can be inserted around the periphery if good host bone is available (Fig. 13).

Note: Screws must not be inserted anteriorly or medially because of the proximity of major blood vessels.

Cage Insertion

After restoration of bone stock, the diameter of the bony bed should match the outer diameter of the Cage.

It may be necessary to contour the flanges to provide a good fit against host bone. (Figs. 14a & 14b). **Avoid reverse bending as this may weaken or break the flange.**

It is important to do all the contouring before inserting screws, so that screw tightening does not displace the Cage.

Stabilize the Cage in the acetabulum with the superior flanges against the ilium superiorly and slightly posteriorly.

The inferior flange may be slotted into the ischium (Fig. 15) or placed against the ischium (Fig. 16). If the flange is placed against the ischium, the cup may end up in a slightly lateral position.

To prepare a slot for the implant, first identify the ischium by palpating down the posterior rim of acetabulum. The site can be confirmed by drilling a small hole and using a depth gauge. The depth gauge should encounter bone circumferentially to a depth of at least a 4cm. If in doubt, an intraoperative radiograph can be taken. Once the ischium location is confirmed, hold a small osteotome parallel to the ischium and initiate a slot in the bone (Fig 17). Alternatively, multiple drill holes can be created parallel to the ischium. This serves as the starter slot for the implant. Then use the ischial flange of the Cage to complete creation of the slot. A drill hole and depth gauge can be used to verify the position within the body of the ischium before insertion of the flange.



Fig. 15 Inferior flange placed in ischium slot.



Fig. 16 Inferior flange placed against ischium.



Figs. 14a & 14b Contouring Cage – Vice Grip and Plate Bender.



Fig. 17 Slotting ischium.



Fig. 18 Hand placement.



Fig. 19 Cup Positioner.



Fig. 20 Screw insertion.

Prior to impaction, hand placement or adjustment can be utilized, if required (Fig. 18).

With the Cup Positioner, impact the Cage, making sure it is stable against host bone (Fig. 19).

Once the Cage is firmly seated with the flanges against bone, insert one or two screws into the dome. Then, insert two or three screws into the flanges, superiorly first and then, if the inferior flange is placed against the ischium, inferiorly (Fig. 20).

Depending on the bone quality, one or both superior flanges may be fixed with bone screws. It may be necessary for the dome and/or flange screws to engage the inner cortex for adequate fixation.

The inferior flange can be stabilized in three ways. For contained defects, simply buttress the inferior flange against the ischium without screw fixation. For segmental defects and for discontinuity, screw the inferior flange against the ischium with one or two screws, or slot the flange into the ischium (Fig. 21). With either of these techniques, additional fixation should be attempted by inserting one or two screws through the inferior part of the Cage into the inferior rim or the ischium.

Warning: It is important to identify and protect the sciatic nerve, especially if screwing the flange against the ischium.



Fig. 21 Implant and screws in place.

Cemented Cup Insertion for Roof Ring and Cage

Select the ZCA® All-Poly Cup that best restores stability and alignment. Use the ZCA Cup Provisionals to determine correct cup size. (Consult the tables in Order Information for recommended cup sizes.) Cement spacers incorporated into ZCA All-Poly Cups centralize the cup and create a uniform 3mm cement mantle. It is important to orient the cup independent of the Roof Ring or Cage using the same landmarks as if the cup were inserted directly into the acetabulum. Otherwise, the cup may be inserted too vertically.

Prepare bone cement and pack it into the Roof Ring or Cage in its doughy state (Fig. 22).



Fig. 22 Cement placement.





Fig. 23 All-poly cup insertion.

Assemble the selected ZCA All-Poly Cup on the Alignment Guide and insert the cup into the previously placed bone cement (Fig. 23). The cup should be seated in approximately 45 degrees of abduction and 20 degrees of forward flexion independent of Roof Ring or Cage orientation. Maintain pressure on the cup and cement until the cement has hardened. Trim excess bone cement.

Postoperative Care

Postoperative weight-bearing status depends on the type and magnitude of bone grafting and what the patient will tolerate. When the Roof Ring is used with morsellized bone graft, the patient can bear weight as tolerated. When the Roof Ring is used to protect a small structural graft, weight bearing should be delayed for three months. When the Cage is used to protect a graft, morsellized or structural, weight bearing should also be delayed for three months.

1. McGrory BJ, Bal S, Harris WH. Trochanteric osteotomy for total hip arthroplasty: six variations and indications for their use. *J Am Acad Orthop Surg.* 1996;4(5):258-267.
2. Saleh KJ, Holtzman J, Gafni A, et al. Development, test reliability, and validation of a classification for revision hip arthroplasty. *J Orthop Res.* In press.
3. Gross A. Revision arthroplasty of the acetabulum with restoration of bone stock. *Clin Orthop Rel Res.* 1999;369:198-207.

ORDER INFORMATION

RECONSTRUCTION SET

Cat. No.	Description
8005-00-01	Reconstruction Implant Set Includes one each of the following:
8005-00-04	Cage Implant Set
8005-00-03	Roof Ring Set

RECONSTRUCTION CAGE

Cat. No.	Description	Recommended ZCA Cup Size*
8005-00-04	Cage Implant Set Includes one each of the following:	
8005-01	Cage Size 52mm OD x 48mm ID Left	47mm
8005-02	Cage Size 52mm OD x 48mm ID Right	47mm
8005-03	Cage Size 58mm OD x 54mm ID Left	53mm
8005-04	Cage Size 58mm OD x 54mm ID Right	53mm
8005-05	Cage Size 64mm OD x 60mm ID Left	59mm
8005-06	Cage Size 64mm OD x 60mm ID Right	59mm

* ZCA All-Poly Cups must be ordered separately.

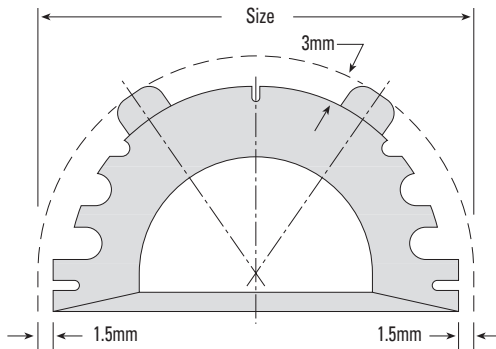
RECONSTRUCTION ROOF RING

Cat. No.	Description	Recommended ZCA Cup Size*
8005-00-03	Roof Ring Set Includes one each of the following:	
8005-46	Roof Ring Size 50mm OD x 46mm ID	45mm
8005-48	Roof Ring Size 52mm OD x 48mm ID	47mm
8005-50	Roof Ring Size 54mm OD x 50mm ID	49mm
8005-52	Roof Ring Size 56mm OD x 52mm ID	51mm
8005-54	Roof Ring Size 58mm OD x 54mm ID	53mm
8005-56	Roof Ring Size 60mm OD x 56mm ID	55mm
8005-58	Roof Ring Size 62mm OD x 58mm ID	57mm
8005-60	Roof Ring Size 64mm OD x 60mm ID	59mm

* ZCA All-Poly Cups must be ordered separately.

ZCA ALL-POLY ACETABULAR CUP SIZING

The ZCA Cup diameter is measured over the cement spacers.



TRILOGY[®] BONE SCREWS

Cat. No.	Description
6250-45-15	Bone Screw 4.5mm x 15mm, Self-Tap
6250-45-20	Bone Screw 4.5mm x 20mm, Self-Tap
6250-45-25	Bone Screw 4.5mm x 25mm, Self-Tap
6250-45-30	Bone Screw 4.5mm x 30mm, Self-Tap
6250-45-35	Bone Screw 4.5mm x 35mm, Self-Tap
6250-45-40	Bone Screw 4.5mm x 40mm, Self-Tap
6250-45-50	Bone Screw 4.5mm x 50mm, Self-Tap
6250-45-60	Bone Screw 4.5mm x 60mm, Self-Tap
6250-65-15	Bone Screw 6.5mm x 15mm, Self-Tap
6250-65-20	Bone Screw 6.5mm x 20mm, Self-Tap
6250-65-25	Bone Screw 6.5mm x 25mm, Self-Tap
6250-65-30	Bone Screw 6.5mm x 30mm, Self-Tap
6250-65-35	Bone Screw 6.5mm x 35mm, Self-Tap
6250-65-40	Bone Screw 6.5mm x 40mm, Self-Tap
6250-65-50	Bone Screw 6.5mm x 50mm, Self-Tap
6250-65-60	Bone Screw 6.5mm x 60mm, Self-Tap

Warning: This device is not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic, or lumbar spine.

RECONSTRUCTION INSTRUMENTS

Cat. No.	Description
8005-00-02	Reconstruction Instrument Set Includes all items listed below:
6260-18	Cup Positioner
4816-60	Ball Spike
1179-11-11	Lever Bender (2 in set)
1179-11	Plate Bender
2371-01	Bending Iron (2 in set)
6260-03-01	Drill Bit 3.2 x 15mm
6260-03-02	Drill Bit 3.2 x 30mm
6260-03-03	Drill Bit 3.2 x 45mm
6260-02	Modular Flexible Shaft
6260-25	Universal Screwdriver Shank, 3.5mm
6260-24	Straight Screwdriver Shank, 3.5mm
6260-26	Modular Ratchet Screwdriver Handle
6260-06	Drill Guide
6611-98	Drill Depth Gauge
6260-07-01	Tap, 4.5mm
6260-07-02	Tap, 6.5mm
6260-10	Modular Tap Handle
6260-08-01	Tap Guide, 4.5mm
6260-08-02	Tap Guide, 6.5mm
8005-90	Reconstruction Instrument Case