Acetabular Bone Defects
Total Joint Arthroplasty
Cage/Cup Reconstruction

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Classification of Bone Defects: Revision Arthroplasty of the Acetabulum

I. No Significant Loss of Bone Stock
II. Contained loss of Bone Stock
   (columns / rim intact)
III. Uncontained Loss of Bone Stock
   (<50% Acetabulum)
IV. Uncontained loss of Bone Stock
   (>50% Acetabulum)

Saleh, Gross: JBJS 2001, 83-A, p1040
Contained Loss of Bone Stock
Type II

*Morsellized bone graft in Conjunction with...*

- Uncemented cup - contact with 50% host bone
- Cemented cup with Mesh
- Cemented cup with Ring
Acetabular Defect Type II -

[Two images of X-rays showing a hip implant and bone structure]
Choice of Ring...

Depends on Size of Contained Defect

Roof Reinforcement Ring
if contact can be made with host bone
superiorly and infero-medially

Reconstruction Ring
for global effect where contact must
be made with ilium superiorly and
ischium inferiorly
Elemental tantalum metal and vapour deposition techniques create a porous metal similar to trabecular bone (80% porous)

Basic Research –

Bobyn, Tanzer, JBJS (Br) Sept/99
Bobyn, Tanzer, J of Arthroplasty, April/99
Acetabular Defect Type II
Reconstruction Ring
Un-Contained Loss of Bone Stock

Less Than 50% Acetabulum
Type III

- High Hip center with uncemented cup
- Oblong Cup
- Structural Allograft (minor column or shelf graft) with Cemented or Uncemented cup
Acetabular Defect

Type III

High Hip Center
High Hip Centre

1. Non anatomic restoration for leg length
2. No restoration bone stock
3. High dislocation rate
4. Increased incidence of component loosening
Outcome of revision hip arthroplasty in patients with a previous total hip replacement for developmental dysplasia of the hip

Morag, Zalzal, Liberman, Safir, Flint, Gross

JBJS 87-B, August 2005
At an average follow-up of ten years, functional outcome and survivorship were better in patients with a hip centre less than 3.5 cm above the anatomic level.
Acetabular Defect Type III

Oblong Cup
Acetabular Defect
Type III

Minor Column Allograft
Acetabular Defect
Type III

Pre Op

Post Op 11 years
Minor Column Structural Acetabular Allografts in Revision Hip Arthroplasty

Woodgate I. and Gross A.E.

Results

- Survivorship for Cups: 78%
- Survivorship for Grafts: 94%
The Use of Structural Distal Femoral Allograft for Acetabular Reconstruction

Average 10 Year Follow-up

Sporer, Paprosky, p760 JBJS (A) April 2005

Type III (A) defect

Average 10 year follow-up – 23 patients

74% 10 year survivorship
For segmental loss of bone stock involving less than 50% of acetabulum:

- **Low demand patient unlikely to require another revision**
  - trabecular metal cup and augment
- **High demand patient that might require another revision**
  - trabecular metal cup and minor column (shelf) allograft
Un-Contained Loss of Bone Stock
Type IV
Greater than 50% of Acetabulum

- Structural allograft (major column graft) with reconstruction ring and cemented cup
Acetabular Defect
Type IV

Pre op

Post op 15 years
Advantages of the Cage

- Places hip at correct anatomic level.
- Restoration of bone stock
  - morsellized and structural.
- Allows use of cement w/ antibiotics
- Ability to adjust version
- The cage is a cementless device
Advantages of the Cage

- Allows the use of a constrained cup.
- Can be used in irradiated bone.
- When a cage fails, revision is potentially possible at the correct anatomic level because of restoration of bone stock.
Indications for a Cage vs. A Cementless Cup

- When after reaming there is not enough superior and posterior host bone support to provide initial stability and eventual biologic fixation for a cementless device.
Precautions When Using a Cementless Cup:

- Don’t ream away a significant amount of host bone especially posterior column
- In order to get healthy host bone, do not ream to an excessively high hip centre
- Do not place cementless device against >50% morsellized or structural graft
Disadvantages of the Cage

- Technically more difficult
  - exposure of ischium is required
- If not supported by host bone or graft, the cage will fracture or loosen.
- The cage can fail at the cage bone interface, the cement cage interface, or the cup cement interface.
- The present generation of cages do not unite to host bone and will eventually fail.
Complications of Ilioischial Rings

55 Iliosischial Rings
1984-1999
Average follow-up - 4.6 years
12% of Acetabular Revisions

Complications of Ilioischial Reconstruction Rings in Revision Total Replacement
Goodman S, Saastamoinen H, Shasha N, Gross A
Journal of Arthroplasty 19(4); 436-46, 2004
Bone Grafts

- 48/61
  - structural and morsellized
- 13/61
  - morsellized

All grafts healed with no fractures or resorption
27/55
- no complications

3/55
- medical complications

5/55
- complications related to femoral revision

20/55
- complications related to ring reconstruction
Complications Related to Ring Reconstruction

- 6 nerve injuries (4 sciatic, 2 peroneal)
  - all partial or complete recovery
- 4 loss of fixation (4 revised / awaiting revision)
- 1 possibly loose ring
- 3 fractured flanges (1 revised)
- 3 loose cups (3 revisions)
- 7 dislocations (2 infected - resected)
- 3 deep infections (2 resected, 1 debrided)
Success

Stable reconstruction with no further revision of the acetabular side of the hip and incorporation of the acetabular bone graft without fracture of resorption.
42/55 = 76%

4 additional patients still had ring and bone graft in situ with revision of cup only = partial success

= 46/55 = 84%
1. Consider cementing a constrained cup into ring if there are predisposing factors for dislocation.

2. Slot the inferior flange into the ischium to avoid nerve injury.

3. Ring must be well supported by bone graft.
Cages will be modular with a range of diameters to which flanges can be attached to obtain purchase in available bone stock.

Cages will be made of a metal that is optimal for bone ingrowth or ongrowth, eg. trabecular metal.

Bone substitutes will be used to supplement the bone induction properties of allograft bone.