Revision Arthroplasty of the Acetabulum with Restoration of Bone Stock

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Introduction

The goal of revision arthroplasty of the hip is to achieve a stable implant with restoration of anatomy. This may be achieved relatively easily or with great difficulty depending on the available bone stock.

The primary goal is to implant new components against host bone with restoration of anatomy and leg lengths. This can be done with or without the use of cement depending on the characteristics of the patient and the preferences of the surgeon [22, 11, 18, 2, 4, 9, 10, 12, 23, 24, 26, 29, 30, 33, 31, 32].

If the primary goal cannot be achieved, the secondary goal would be to achieve stable components and restore anatomy and leg lengths but with help from bone grafts or prosthetic design. If bone graft is used it is either morsellized or noncircumferential (cortical strut) so that the implant is supported primarily by host bone. Some implants are designed to compensate for minimal to moderate loss of bone stock. Femoral components with calcar replacing stems and several neck lengths, and oblong asymmetric cups are examples of this [32, 3].

When the bone loss is more severe and the implants cannot be stabilized primarily against host bone, then a decision has to be made whether to sacrifice or to restore anatomy and leg length.

If the components can be stabilized primarily against host bone with acceptable sacrifice of anatomy, then the tertiary goal is achieved. The high hip centre is an example of this [32].

If the loss of bone stock is very severe and the components cannot be stabilized against host bone then structural grafts or custom implants must be used to restore anatomy and leg length. This is the quaternary goal [17, 5].

Classification of Bone Defects

It is important to have a functional and relatively simple classification of bone deficits associated with loose hip implants. There are more complicated classifications in the
literature [19, 81] but we have found that all of our defects can be fitted into the following classification.

**Pelvic Side Defects**

a) **Protrusio**: A contained cavitary defect with the acetabular walls and columns intact. Morsellized bone is usually used for this type of defect.

b) **Minor column (Shelf)**: Loss of part of the rim plus the corresponding acetabular wall but less than 50% of the acetabulum. A structural graft is used but less than half of the acetabulum is replaced. This is called a minor column or shelf graft.

c) **Major Column**: Loss of one or both columns with its corresponding acetabular wall involving over 50% of the acetabulum. A major column structural graft involving over 50% of the acetabulum is used.

**Principles of Resolution of Bone Stock in Revision Surgery of the Hip**

Bone grafts are classified into heterografts (bone from another species), allografts (bone from the same species) and autografts (bone taken from one part of the same individual). In the revision situation because of the quantity and quality of bone required allograft is more practical than autograft. There are however certain advantages and disadvantages of each.

Autograft has the advantages of not being immunogenic and even more importantly is best for inducing new bone formation in the host. Its disadvantages are the quantity available, the strength, shape and form which cannot duplicate the deficit.

Allografts on the other hand are available in quantity and can be strong and duplicate the deficit. They are however immunogenic [6, 27, 7] and are not as effective as autografts for inducing new bone formation [15].

Allograft bone can be further classified according to how it is used: (1) morsellized (2) structural—(a) simulated, (b) anatomical.

A simulated structural graft is where bone from another region is shaped to simulate the deficit. For example a distal femur can be sculpted to duplicate an acetabulum.

An anatomical structural graft is when the graft is the actual anatomical part being duplicated. For example an acetabular allograft is used in whole or in part to replace an acetabular defect.

The advantages of a structural graft are restoration of anatomy and they can provide structural support for the implant. The disadvantage of a structural graft is that revascularization and remodelling can lead to resorption and/or collapse and therefore weakens with time.

Structural grafts are indicated for uncontained defects where it is necessary to restore anatomy and leg length and to provide bone support for the implant. Acceptable compromises to the anatomy and leg length are preferable to structural grafts if adequate bone stock is available, i.e., high hip centre [32].

Morsellized bone is indicated for contained defects where it serves as a filler scaffold. It can undergo revascularization and remodelling and strengthens with time. It cannot be used for early structural support.

All reconstructions will eventually fail whether they are synthetic or biological. As surgeons, our role is to prolong the time to failure, and to make sure that when failure occurs further reconstruction is possible. Bone grafts restore bone for future surgery.