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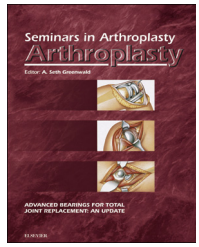

Highly porous metal shells and augments in revision hip surgery: Big hopes for big holes

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ABSTRACT

Incidence of total hip revision surgery is increasing with acetabular failure being the most common cause of revision, with or without loosening of the shell. Acetabular defects at time of surgery can be challenging to treat and different techniques have been described with no clear consensus on the best modality. Trabecular metal implants, and especially the use of augments provide a unique option to manage these conditions efficiently with less morbidity, improved function and better survivability. Previous literature has suggested that the survival of this combination (trabecular metal revision shell and augment) is around 94–100% at 2 years, 92–100% at 5 years and 92% at 10 years with revision due to aseptic loosening as an end-point. We hence recommend continued the use of trabecular metal shells and augments for managing large acetabular bone defects found during revision hip arthroplasty.

1. Introduction

The incidence of revision hip replacement is increasing steadily along with some complex cases needing more specialized reconstruction. It is estimated that in the US alone, primary total hip arthroplasty procedures are going to increase by 174% with consequent increase of revision procedures by 137% by the year 2030 [1,2]. The most common causes of a failing total hip replacement are due to osteolysis, aseptic loosening, infection or instability [3]. However, the survival of a revision arthroplasty has not been as good as the primary procedure. For example a large retrospective study by Lie et al. [4] from the Norwegian Arthroplasty Register suggested that 58% of revisions were that of the acetabular component and the risk of re-revision rate was 25% at 10 years. One of the challenges in revision of acetabular components is the presence of bone loss, especially when they are uncontained. These defects are frequently classified by using the Paprosky classification, which categorizes the acetabulum into 3 types depending on the degree of osteolysis affecting the acetabular teardrop and ischium, as well as the amount and direction of component migration [5]. Different techniques have been described to manage these defects, which can be mainly cemented or uncemented. Common cemented techniques involve either impaction bone grafting or bulk allograft with a cemented component, or reconstruction reinforcement rings with allograft and a cemented cup. These techniques produce acceptable results but can be difficult to execute and have some reports of early failure especially in Type III defects [2,6]. Uncemented acetabular sockets have good results in primary THR and similar technology has been used in revision scenarios. They can

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be used in the form of a jumbo cup, bi-lobed cup, cup in cup stacking or reconstruction cages [7–14]. The challenges include

(1) development of adequate healthy host bone to achieve bone ingrowth;
(2) replacement of segmental bone loss (Paprosky 3A and 3B); and
(3) reproduction of a normal or close to normal hip centre of rotation.

To optimize the chance for biologic fixation of the interface, techniques in surface technology such as hydroxyapatite and porous coatings have been used. However, some of these implants encourage bony on-growth rather than in-growth, where as ingrowth is a better situation in the long term. Recently a new generation of technology has been developed and introduced: porous metal technology with characteristics that are similar to bone (strength, flexibility, three-dimensional infrastructure) (Fig. 1). They have a high co-efficient of surface friction, which assists the surgeon in achieving initial interface stability. They also have impressive bone ingrowth and incorporation characteristics, best demonstrated in the canine model [15,16]. In addition to using a highly porous coated shell, use of trabecular metal augments can replace bone loss, hence less reliance on structural allografts reducing the risk of graft resorption and potential disease transmission (Figs. 2–4).

The first example of this technology available for general use was Trabecular metal (Zimmer, Warsaw, IN). We began using it in 2002 and have carefully evaluated its performance over time. The following will highlight its use in our hands and will summarize the published results from other centers.

2. Indications and technique of using a trabecular metal cup and augment

The main indications for using an augment with a cup are in acetabular defects Type II B, C and III A and B, using the Paprosky classification. The most common locations of the defects are in the superolateral and posterosuperolateral parts of the acetabulum. Less commonly they affect the superomedial segment, in which setting it is imperative to rule out pelvic discontinuity before operation. This will profoundly influence management and outcome, and will often necessitate a cup–cage reconstruction. The need for an augment is anticipated based on preoperative templating on an anteroposterior pelvic radiograph; however, a definitive decision to use an augment intraoperatively can be made, if an oblong bone defect is recognized that cannot be supported by the hemispheric component without augmentation of acetabular bone stock. The addition of Judet views to the preoperative work up is useful when dealing with segmental bone loss to help characterize the location and extent of bone loss. Uncommonly a CT scan is required in cases of greater complexity.

To effectively insert an augment, the normal acetabulum, in its normal location is first prepared and the shell size determined based on the anteroposterior dimension, not the oblong superoinferior dimension. The trial is next positioned and the location and extent of the segmental defect characterized. The defect is then prepared to accept an augment of suitable size such that it has good contact with the remaining host bone and provides the required support for the

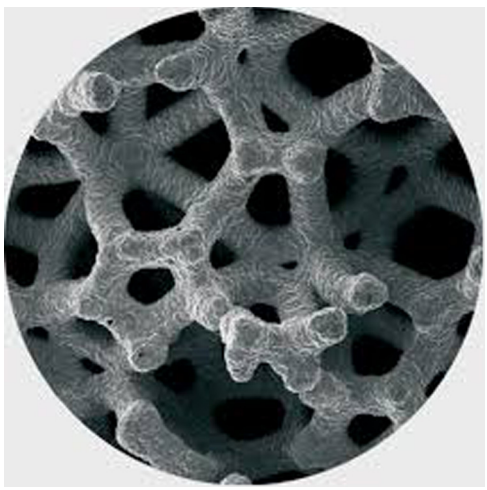

Figure 1 – Surface micro-architecture of trabecular metal as shown by an electron microscope photograph. (*Copyright Zimmer*).

Figure 2 – Trabecular metal roof and rim augments.

Figure 3 – Trabecular metal buttress augments.