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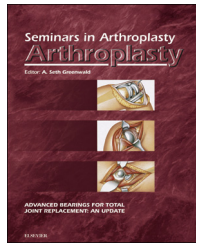

The use of porous metal cones in revision total knee arthroplasty

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ABSTRACT

Massive bone defects represent a major problem in revision total knee arthroplasty. Traditionally, structural allograft has been used for this purpose; however, this is technically demanding and is associated with a failure rate. Metaphyseal tantalum cones have been a major advancement. They have made surgery easier and have yielded better results when compared to reconstruction with allograft. Adding the ability to comfortably use these implants to one's armamentarium should be a priority for surgeons who regularly revise total knee replacements. These implants have completely replaced the use of structural allografts in the authors' practice.

1. Reconstruction with structural allograft

Massive bone defects represent a major problem in revision total knee arthroplasty (TKA) (Figs. 1 and 2). Traditionally around the knee these have been treated with structural allograft for uncontained defects and morsellized impacted allograft for contained defects [1-4].

The use of allograft for these defects has been less than optimal for several reasons. Firstly, preparing structural allografts can be a technically challenging and labour-intensive process. In addition, there have been serious concerns about the results of allografts, specifically resorption of morsellized grafts and mechanical failure of structural grafts. Finally, the availability of allograft tissue, and disease transmission are also of significant concern.

The complication rate of allograft for defect management exceeds 20% in the literature. A study by Bauman et al. [5] in 2009 for revision total knee replacements attributed most of these complications to the use of structural graft. Clatworthy showed a 72% survivorship at 10 years in a series of 50 patients. Failures were due to graft resorption and subsequent implant loosening (five patients), infection (four patients), and nonunion between host bone and allograft (two patients), with the majority of failures again related to allografts [1]. In another series of 68 patients with structural grafts used in revision TKA at a mean follow-up of 5.4 years,

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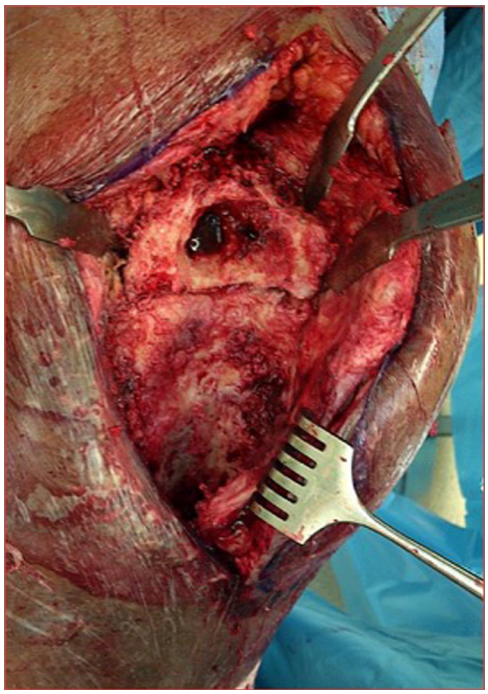

Figure 1 – Intraoperative photograph demonstrating large metaphyseal femoral defect and large metadiaphyseal tibial defect after removal of previous implants and nonviable tissue.

there were 13 failures requiring revision. The causes included one graft nonunion, three cases of aseptic loosening, four cases of infection, three cases of periprosthetic fracture, and two patients with instability [2]. Engh's series of 35 patients with an average follow-up of 4.2 years had three cases of component subsidence but no cases requiring revision surgery [3].

2. Reconstruction with trabecular metal

A modern solution to managing large bone defects in revision total knee arthroplasty is the use of porous metal cones. These are made out of tantalum with a very high friction coefficient and high porosity similar to trabecular bone. This allows for an ideal interface between the metal cone and bone, achieving fixation almost immediately. It also has good potential for bone ingrowth.

3. Surgical technique

The previous implants, cement, membrane and all nonviable tissue are carefully removed. Then it is important to delineate the exact location and nature of the bony defects on both the femoral and tibial sides. It is crucial to know whether the defects are contained or uncontained and whether the defects are purely metaphyseal or more extensive into the metadiaphysis or diaphysis.

The femoral and tibial canals are then sequentially reamed and trial stem extensions are impacted into place. Trabecular metal cone broaches are then used over the trial stem extensions. These are primarily for obtaining a diaphyseal fit. A high-speed burr is used to shape the metaphysis to accommodate the cone. The remainder of the femoral and tibial preparation is performed.

The medial epicondyle is used as a landmark for re-establishing the joint line, roughly 25–28 mm distal to the medial epicondyle. The distal femur is recut to freshen the bony surfaces, if necessary. The goal is to perform minimal bone resection during revision surgery. Traditional metal augments may be used in conjunction with trabecular metal cones if needed. Trial components are then placed and assessed. The definitive trabecular metal cone is impacted into the defect over the stem extension to ensure that it is in the correct location (Fig. 3). Cement is placed in the centre of the cone, confirming that there is a cement interface between the implant stem and the cone centre.

The outer edge of the cone is in direct contact with bone and does not have any cement, thus allowing for bony ingrowth. Morsellized autologous graft, allograft, or bone

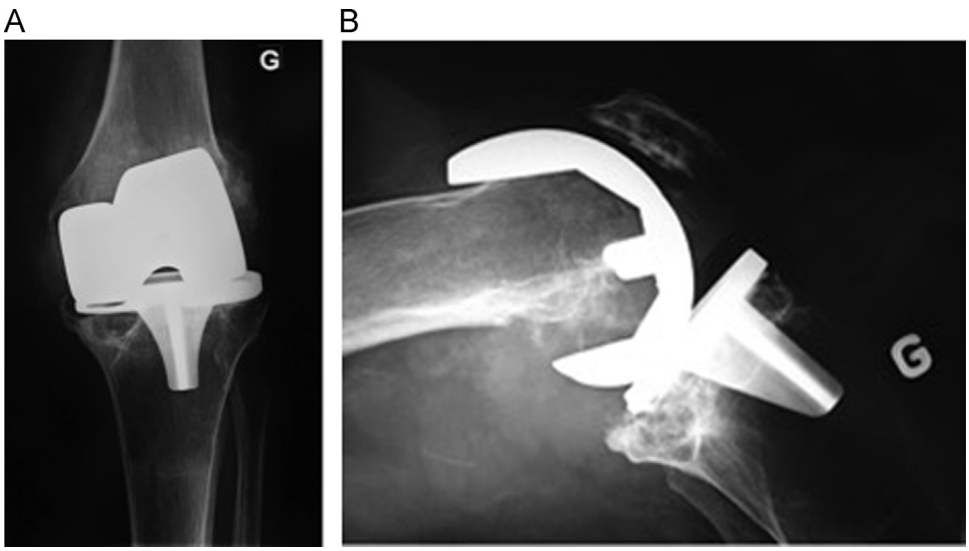

Figure 2 – Preoperative AP and lateral radiographs of a knee with a loose tibial component and large metaphyseal defect.