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Technical note

Tantalum cones and bone defects in revision total knee arthroplasty

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ABSTRACT

Management of bone loss is a major challenge in revision total knee arthroplasty (TKA). The development of preformed porous tantalum cones offers new possibilities, because they seem to have biological and mechanical qualities that facilitate osseointegration. Compared to the original procedure, when metaphyseal bone defects are too severe, a single tantalum cone may not be enough and we have developed a technique that could extend the indications for this cone in these cases. We used 2 cones to fill femoral bone defects in 7 patients. There were no complications due to wear of the tantalum cones. Radiological follow-up did show any migration or loosening. The short-term results confirm the interest of porous tantalum cones and suggest that they can be an alternative to allografts or megaprostheses in case of massive bone defects.

1. Introduction

The increase in the number of total knee arthroplasties (TKA) is associated with an increase in the number of revisions [1]. In case of massive metaphyseal bone loss, the use of premolded porous tantalum implants is a technical option that provides better immediate resistance than bone allografts or bone cement [2]. Because of the porosity of this material, osseointegration and penetration of the cement is improved [3]. Metaphyseal filling provides more balanced transfer of peripheral loads, reducing the risk of repeat loosening [4]. Meneghini et al. [5] described the use of a porous tantalum cone for tibial bone defects during revision TKA. We modified this filling technique for the treatment of massive distal femoral bone loss, and used one or two overlapping components, as necessary, in particular in certain cases presenting with bone defects whose height and diameter were too extensive to ensure filling and stability with a single cone.

2. Surgical technique

The surgical approach should make it possible to remove the existing components without fracture or injury to the extensor apparatus. If positioning of initial components was correct, which should always be evaluated on preoperative CT, their height and rotation should be marked before removal (Fig. 1). Assessment of bone defects is performed after debridement and excision of interposing soft tissue. In case of massive or uncontained bone defects, or defects which create instability due to metaphyseal involvement including the insertion of the peripheral ligament (types B and C of the SoFCOT classification) [6], filling with a porous tantalum cone is indicated (Zimmer, United States, Warsaw; Fig. 2; Video). The correct size of the final cone is determined by using trial components (Fig. 3A and B; Video).

Immediate stability is obtained by press-fit of modular tantalum cones, sometimes requiring debridement by a power reamer (Video).

Massive femoral bone loss can require two porous tantalum cones, one next to the other, which can help stabilize the fragile metaphyseal area and provide primary stability to the femoral component (Fig. 4A and B). Before press-fitting of the final cones, the bone is prepared with a bone-compactor (Video). Primary stability of the final tantalum cones should be good. There should be no interposing tissue between the bone and the tantalum (Fig. 5). Additional trials with revision components can be performed (Fig. 6; Video). The final components are cemented by hand on the metaphyseal part of the prosthesis and the intramedullary part of the tantalum, preventing any direct contact between the tantalum and the prosthesis to prevent metallosis. The autologous graft harvested during prepatory reaming can be used as filling between the bone and the tantalum components, but can never provide stability (Video).

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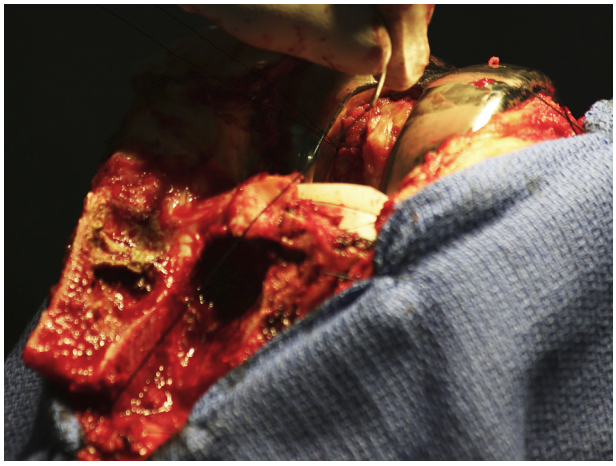

Fig. 1. The height of the prosthetic joint space is measured (here in relation to the tibial tuberosity).

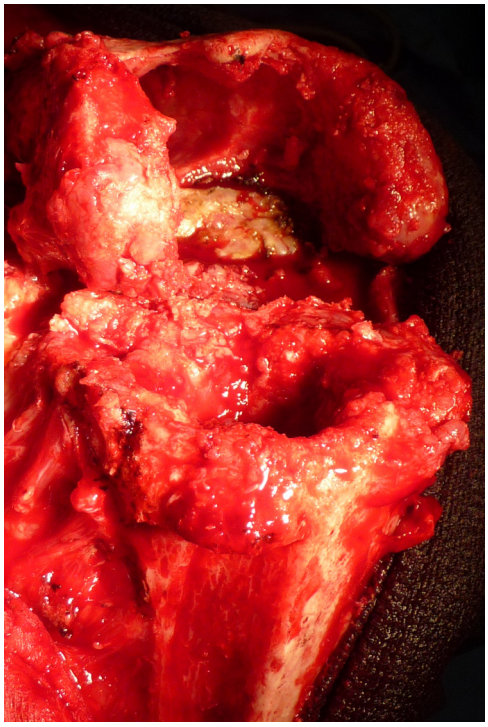

Fig. 2. Femoral bone defect F2B.

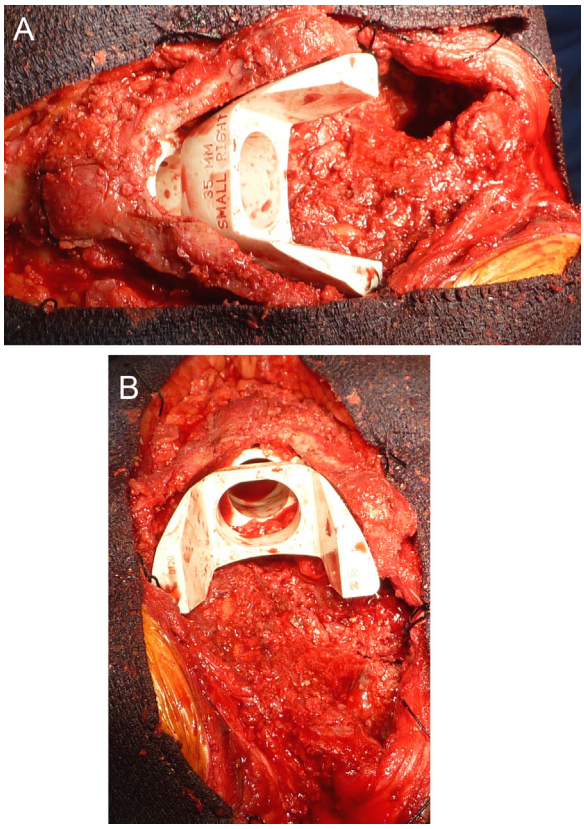

Fig. 3. A and B. Trial filling the femoral defect with 2 overlapping cones.

3. Results

We used this 2-cone technique for filling the femoral epiphysis in 7 cases of severe bone defects (Fig. 7A and B). According to the SoFCOT classification [6], there were 2 type B and 5 type C bone defects. There were 3 women and 4 men, mean age 65 years old (51–79). There were 4 cases of aseptic revision TKA and 3 septic revisions. There were no cracks or fractures during surgery, despite the use of two cones. Metaphyseal filling associated with the rigidity of the device provided stabilization of the implant and more gradual transfer of stresses than the use of a stem extension alone. There was no problem passing intramedullary stem extensions through the tantalum components. A morselized autograft was also used in 2 cases, and a mixed graft (allograft and morselized autograft) in 2 cases. Weight-bearing was immediate in 5 cases and delayed for 6 weeks in 2 others due to a femorotomy performed for removal of the initial hardware. After a mean follow-up of 17 months (12–25 months) there was no loosening of the bone-tantalum interface (Table 1). No radiolucencies were identified on the bone-tantalum interface and there was no migration of the femoral components.

4. Discussion

These porous tantalum components provide immediate metaphyseal stabilization of the implant, allowing early weight-bearing. The high porosity of these cones results in satisfactory primary fixation on recipient bone and cement fixation on the intramedullary side to seal the component [3]. For massive femoral bone loss according to the Engh and Ammeen [7] or the SoFCOT [6] classifications, local filling of metaphyseo-diaphyseal bone defects by cones can limit the use of massive allografts or megaprostheses (like those used for tumors) while filling with simple epiphyseal augments would be insufficient. The cost is a limitation for the use of porous tantalum cones, even if they cost less than custom-made megaprostheses [9]. Surgery is shorter than for massive allografts because of the modular components [10]. Initial results suggest that there is a decrease in repeat revisions for this type of surgery (Table 2). Our short-term results support those of the literature [11–15]. Based on our limited follow-up, we recommend close monitoring of these cases to confirm the interest of this technical alternative and to extend the indications for these tantalum cones.