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Outcome of revision total knee arthroplasty with the use of trabecular metal cone for reconstruction of severe bone loss at the proximal tibia

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ABSTRACT

Background: The relative effectiveness of different methods for reconstructing large bone loss at the proximal tibia in revision total knee arthroplasty (rTKA) has not been established. The aim of this study was to evaluate the clinical and radiological outcome after the use of trabecular metal technology (TMT) cones for the reconstruction of tibial bone loss at the time of rTKA.
Methods: Thirty-six patients had rTKA with the use of a TMT Cone. Bone loss was classified according to the AORI classification and 25% of the patients suffered from T3 AORI defects and 75% of the patients from T2 AORI defects. Implants used were from the NexGen® series. At follow-up, radiographs were evaluated according to the Knee Society Roentgenographic Scoring System. Knee and function score was calculated using the Knee Society Clinical Rating System. Average follow-up time was 47 months (range 3–84 months).
Results: Clinical and radiological follow-up data were available in 30 patients and missing in six patients: two died and four patients had re-revision (reinfection (n = 2), aseptic loosening (n = 1), and knee hyperextension (n = 1)). Knee- and function scores (follow-up 43 months (range 12–84 months)) improved from 42 to 77 points ($p < 0.0005$) and 19 to 63 points ($p < 0.0005$) respectively. Twenty-seven patients (follow-up 44 months (range 12–72 months)) showed no signs of radiological loosening of rTKA components.
Conclusion: Based on our study, it was concluded that the use of TMT Cones provided an effective treatment in terms of surgical efficacy, clinical results and radiological results and was evidently at least as effective as the other options reviewed in the literature.
Level of evidence: IV.

1. Introduction

Bone loss at the proximal tibia at the time of revision total knee arthroplasty (rTKA) can be present ranging from minor contained defects to severe large uncontained defects. Surgical treatment options of bone defects depend on the severity of bone loss, extending from the use of morselized bone, bone impaction grafting, structural allograft, cementation, sleeves and/or augments and long stems to mega-prostheses [1–3]. The challenge is to restore the joint line level and secure a stable platform before implanting the revision implants. However, large bone loss defects call for careful preoperative planning evaluating the size and type of the bone loss defect and choice of surgical technique. The relative effectiveness for different methods of reconstructing large bone loss at the proximal tibia is still not established.

Trabecular metal cones made of trabecular structured tantalum were developed with the purpose of reconstruction of severe bone loss at the tibia (TMT Cone) and the femur (TMF Cone) during rTKA. The combination of the biomechanical properties of tantalum, close to cancellous bone, and the macroscopic porous structure of the implant, gives the advantage of a rigid implant that allows bone in-growth [4,5] (Fig. 1).

The aim of this study was to evaluate the clinical and radiological outcome after the use of trabecular metal tibial cones for the reconstruction of tibial bone loss at the time of rTKA.

2. Materials and methods

From October 2005 to June 2011, 310 knee revisions were performed at our department. Thirty-six patients (mean age 69 (51–84) years, (F/M = 11/25)) with severe bone loss at the proximal tibia had rTKA with the use of a TMT Cone during the same period. Prior to rTKA the patients suffered from aseptic loosening (n = 15), had deep infection (n = 15), suffered from knee instability (n = 5), or severe knee pain without loosening of the implant (n = 1). Knee instability without loosening and knee pain without loosening can lead to bone loss at the proximal tibia during removal of the existing prosthesis (primary- or revision-prosthesis).

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Fig. 1. Trabecular metal tibial cone (TMT Cone).

Bone loss of the proximal tibia was classified according to the Anderson Orthopedic Research Institute classification [1] (AORI) on conventional pre- and postoperative X-rays. In addition, the tibial bone loss was divided into contained or uncontained defects (Fig. 2). According to the AORI classification, the 36 patients suffered from T3 defects (n = 9 (25%)) or T2 defects (n = 27 (75%)), and 25 (69%) had contained defects whereas 11 (31%) had uncontained defects.

An experienced senior consultant in orthopedic surgery (Schrøder, H.M.) performed all operations. The surgical procedure of rTKA using TMT Cone is identical with the conventional rTKA procedure, except for the implantation of the TMT Cone (reconstructing the bone loss of the proximal tibia). Failed implants are removed, all surfaces are carefully debrided, and the bone loss of the proximal tibia is assessed and classified (Fig. 3). Then the intramedullary canals are reamed and the joint is prepared for a prosthesis of relevant size and constraint.

TMT Cone has only been used for the management of type T2 and T3 bone loss defects. A provisional cone of relevant size is placed in the defect cavity to make sure it fits. A high-speed burr is often used to shape the cavity of the often sclerotic bone to obtain optimal adaptation. By press-fit, the TMT Cone is implanted in the bone defect. The cranial surfaces of the TMT Cone and proximal tibia are ideally a close fit. Morselized bone graft is used to fill out gaps between the TMT Cone and proximal tibia in order to prevent cementation between host bone and TMT Cone. Once the TMT Cone is implanted, cementation of

Fig. 2. Pre- and postoperative radiographs (anterior–posterior and lateral view). A. Left knee. 68 year-old female with AORI T2 bone loss defect at proximal tibia. rTKA with Legacy Posterior Stabilized Knee and TMT Cone. B. Right knee. 72 year-old male, AORI T3 bone loss defects at proximal tibia. rTKA with Rotating Hinge Knee and TMT Cone.