Orthopaedics & Traumatology: Surgery & Research 102 (2016) 429–433

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article

Total knee arthroplasty revision with trabecular tantalum cones: Preliminary retrospective study of 51 patients from two centres with a minimal 2-year follow-up

D. Girerd [a], S. Parratte [a,*], A. Lunebourg [a], F. Boureau [b,c], M. Ollivier [a], G. Pasquier [b,c], S. Putman [b,c], H. Migaud [b,c], J.N. Argenson [a]

[a] *Université Aix-Marseille, Hôpital Sainte-Marguerite, Institut du Mouvement et de l'appareil Locomoteur, Service de chirurgie orthopédique et traumatologie, UMR CNRS 787/AMU, 270, boulevard Sainte-Marguerite, 13009 Marseille, France*
[b] *Centre Hospitalier Régional Universitaire, Service de chirurgie orthopédique et traumatologie, avenue Oscar-Lambret, 59037 Lille cedex, France*
[c] *Université de Lille, rue Paul-Duez, 59000 Lille, France*

ARTICLE INFO

Article history:
Received 3 August 2015
Accepted 16 February 2016

Keywords:
Revision
Total knee arthroplasty
Knee
Trabecular metal cones
Tantalum
Bone defect

ABSTRACT

Background: Successful management of large bone defects is of crucial importance when performing revision total knee arthroplasty (TKA). Trabecular tantalum cones may improve prosthesis fixation via their potential for reconstructing a stable metaphyseal support. The objective of this study was to evaluate the clinical and radiological outcomes and the complications of tantalum cones in revision TKA.
Hypothesis: Trabecular tantalum cones provide stable and durable metaphyseal reconstruction when used during revision TKA.
Material and methods: Trabecular Metal™ cones (Zimmer, Warsaw, IN, USA) were used for 52 revision TKAs in 51 patients (mean age, 68 ± 9 years) managed in two centres between 2008 and 2013. A rotating hinge prosthesis was chosen for 38 (73%) knees and a condylar constrained knee prosthesis for 14 (27%) knees, with 37 tibial and 34 femoral cones. The two most common reasons for revision surgery were aseptic loosening ($n = 22$, 42%) and infection ($n = 19$, 37%). The bone loss was severe in most cases. At each centre, after a mean follow-up of 34 months (range, 24–52 months), two independent observers assessed the Knee Society Score (KSS), range of motion, mechanical axis, and osteo-integration for each patient.
Results: Mean KSS increased from 46 preoperatively to 77 ($P = 0.001$) at last follow-up and the mean KSS function from 39 to 57 ($P = 0.007$). Mean range of motion improved from 93° (45°–120°) to 110° (65°–130°) ($P = 0.001$). Mean postoperative mechanical axis was 180° (172°–190°). Radiographic evaluation showed evidence of osteo-integration for all cones. Four revisions were performed for recurrence of infection but none for mechanical failure.
Discussion: The findings of our study confirm the biomechanical and biological reliability of Trabecular Metal™ cones used to fill metaphyseal bone defects during revision TKA.
Level of evidence: IV, retrospective therapeutic study.

1. Introduction

The current increase in total knee arthroplasty (TKA) procedures inevitably generates a growing need for revision TKA to treat septic or aseptic failures [1,2]. With recently developed revision implants, the degree of constraint can be adjusted and the joint line and mechanical axis restored using augments and stems [3,4]. Stability, although improved by the use of stems and extension rods, may be jeopardised by persistent metaphyseal bone defects. No reference standard exists for reconstructing these defects [5]. Cement and morselized or structural bone allografts are the most widely used materials but are associated with high mid-term failure rates [5,6].

Trabecular Metal™ tantalum cones (Zimmer, Warsaw, IN, USA) were developed as biomechanically and biologically reliable solutions to reconstruct metaphyseal bone defects and to ensure stable prosthesis fixation [7,8]. Few studies, most done in small numbers of patients, are available for this recently introduced method [9–17].

The objective of this work was to evaluate the clinical and radiological outcomes and the complications of tantalum cones used in

* Corresponding author.
E-mail address: sebastien@parratte.fr (S. Parratte).

http://dx.doi.org/10.1016/j.otsr.2016.02.010
1877-0568/

revision TKA. It was our hypothesis that trabecular tantalum cones can provide a stable and durable metaphyseal reconstruction when used during revision TKA.

2. Patients and methods

2.1. Patients

This retrospective study involved patients operated on in two centres between 2008 and 2013. Inclusion criteria were one- or two-stage revision TKA for any reason, implantation of a total knee prosthesis and metaphyseal reconstruction using one or more Trabecular Metal™ cones (Zimmer), and a minimum follow-up of 2 years. Exclusion criteria were revision TKA without a Trabecular Metal™ cone, Trabecular Metal™ cone implantation during primary TKA, revision of unicompartmental knee arthroplasty with implantation of a total knee prosthesis and of a Trabecular Metal™ cone, or less than 2 years' follow-up. Of the 352 revision TKA procedures performed during the study period, 52 met our selection criteria, in 51 patients with a mean age of 68 ± 9 years (range, 42–89). The mean number of previous surgical procedures on the knee was 4 (range, 1–10). Table 1 provides information on the patients' characteristics.

2.2. Operative technique

The size and type of the bone defect were determined preoperatively according to the Anderson Orthopaedics Research Institute (AORI) classification (Table 2) [18]. The 23 revisions for septic loosening were performed in two stages with implantation at the first stage of a fixed or mobile antibiotic-loaded spacer (Zimmer Biomet, Warsaw, IN, USA) [19]. The type of implant at the time of the revision was selected based on ligament stability and bone defect size. A constrain condylar total knee prosthesis (Nexgen LCCK, Zimmer) was used in 14 cases and a rotating-hinged total knee prosthesis (Nexgen RHK, Zimmer) in 38 cases.

For revision surgery, the subvastus approach was chosen in 35 (67%) cases and the trans-quadricipital approach in 17 (33%) cases. Three-step joint reconstruction was performed as described by Vince [20]. The required number of tantalum cones was determined based on the extent of bone loss as estimated on preoperative imaging studies and during the intra-operative assessment after implant removal. A total of 37 tibial cones and 34 femoral cones were used (tibial cones only in 17 cases, femoral cones only in 14 cases, and both tibial and femoral cones in 21 cases). Filling of the femoral defect was achieved by assembling a metaphyseal cone and a diaphyseal cone in 12 cases [21]. The cone implantation site was prepared using a rasp and power burr when needed to optimise the contact with the host-bone and to obtain primary press-fit stability. The final implants were cemented through the cones, with a long stem cemented only to the metaphysis [22]. Tight press-fit of the cone is of the utmost importance to ensure that no cement penetrates between the cone and the bone. Stem length and diameter were selected intra-operatively to ensure strong anchoring to the diaphysis; mean length was 100 mm (range, 100–200 mm) at the tibia and 176 mm (range, 100–200 mm) at the femur. A drain was routinely inserted into the joint. Anticoagulant therapy was given for 42 days.

Table 1
Patient characteristics and reasons for revision surgery.

Age, years, mean ± SD (range)	68 ± 9 (42–89)
BMI, kg/m^2, mean ± SD (range)	28 ± 4.9 (18–39)
Gender distribution	26 females/25 males
Time to revision, months, mean ± SD (range)	64 ± 44 (6–156)
Type of initial implant, *n*	
Hinge	24
Posterior stabilised condylar constrained	6
Posterior stabilised	12
Ultra-congruent	5
Posterior cruciate ligament-retaining	5
Number of previous surgical procedures on the knee, mean (range)	4 (1–10)
Reason for revision	
Aseptic loosening	22
Tibial	8
Femoral	7
Bifocal	7
Prosthetic infection	19
Instability	1
Abnormality of the patella or extensor mechanism	2
Unexplained pain	2
Osteolysis and/or polyethylene wear	3
Mechanical implant failure	1
Stiffness	1
Other	1

BMI: body mass index.

Table 2
Distribution of bone defects requiring filling with a trabecular metal cone, according to the Anderson Orthopaedic Research Institute classification (AORI) [18].

AORI grade	Tibia	Femur
IIa	2 (6%)	0
IIb	21 (53%)	10 (29%)
III	15 (41%)	24 (71%)

2.3. Assessment methods

Radiographs were taken routinely after 3 months, 6 months, 1 year, 2 years, and 5 years (Fig. 1). The hip-knee-ankle angle (HKA) was measured on the long-leg radiograph. Radiographic osteointegration at last follow-up was defined as absence of a lucent line between the bone and tantalum cone (Fig. 2). It was assessed according to the Knee Society evaluation system modified for long-stemmed prostheses [23].

The KSS was determined routinely before surgery then 1, 2, and 5 years after surgery. At last follow-up, both the KSS and the Knee injury and Osteoarthritis Outcome Score (KOOS) [24–26] were assessed. Flexion and extension lag were measured using a goniometer [18,24].

Complications were assessed based on surgical revision with or without implant removal. Data at last follow-up were available for all 52 knees. Three patients died 24 to 26 months postoperatively, for reasons unrelated to the revision TKA; the last data collected from these patients were used for the analysis. Mean follow-up was 34 months (range, 24–52 months).

2.4. Statistical methods

Patient characteristics were described by computing the mean, standard deviation, and range of each variable. Student's *t*-test was chosen to compare values collected preoperatively and at last follow-up, with values of $P < 0.05$ being considered significant.

3. Results

3.1. Radiographic outcomes

Stress shielding around a femoral stem with a cortical reaction at the stem tip developed in 1 knee. Stable radiolucent lines were visible around 4 tibial implants with tibial cones (zones 5a and 7a on the antero-posterior view and zones 1a, 2, and 2a on the lateral views). Stable and incomplete radiolucent lines were seen around 5 femoral extension stems with femoral cones (zones 1, 2, and 3 on the antero-posterior view and zones 5a, 5b, 7a, and 7b on lateral