Arthroplasty Today xxx (2017) 1–5

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Original research

Long-term results of a porous tantalum monoblock tibia component: clinical and radiographic results at follow-up of 10 years

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ARTICLE INFO

Article history:
Received 24 September 2016
Received in revised form
11 February 2017
Accepted 13 February 2017
Available online xxx

Keywords:
Cementless knee arthroplasty
Trabecular metal
Porous tantalum
MIS knee arthroplasty
Uncemented knee arthroplasty

ABSTRACT

Background: The purpose of this study is to assess the long-term follow-up of cementless total knee arthroplasty with the trabecular metal (TM) monoblock tibial component at an average 10-year follow-up. This report is an extension of our previously reported series of 108 TM tibias reported in 2011 (Unger and Duggan, 2011).
Methods: Fifty-eight of the original 108 knees were available for review. Each follow-up patient was evaluated by radiologic and clinical Knee Society Scores. The average follow-up was 10.2 years.
Results: Our results indicate excellent long-term survivorship (96.5%) with 2 confirmed tibia revisions, and 1 femoral revision for periprosthetic fracture and 1 patella open reduction internal fixation. X-ray evaluation demonstrated one patient with 1 mm medial polyethylene wear and a nonprogressive 1 mm of radiolucency on the medial side. All the other tibial components showed full bone apposition and incorporation. Knee Society Scores were excellent in all the patients seen on follow-up.
Conclusions: Long-term follow-up of TM monoblock tibia components confirm excellent survivorship and biologic implant fixation, with excellent outcomes and knee scores.

Introduction

The success of primary cemented total knee arthroplasty (TKA) is well established, with high survivorship and patient satisfaction [1]. Initial reports with cementless knees were unsatisfactory [2]. Newer implant design and materials, such as trabecular metal (TM), have been proposed to improve the results of cementless knees [3,4].

TM has a high compressive strength and a low modulus of elasticity (3 GPa) that is comparable with trabecular bone (0.1-1.5 GPa) [5,6]. It has a consistent, repeating, highly porous structure with mechanical properties similar to bone [5,7]. The polyethylene bearing surface is direct compression molded to the TM. This unique design has been shown to eliminate backside wear and is mechanically resilient [8,9]. These features may improve long-term survivorship in all populations receiving TKA.

Ghalayini and McLauchlan [10], in 2004, compared a consecutive series of TM tibia monoblock components with an older consecutive series of cemented components. Midterm results showed improved Knee Society Score (KSS) and only 1 revision at 27 months [11]. Minoda et al [12] reported on the bone mineral density in 28 knees receiving a TM tibial component vs a cemented component and found that there was a higher bone mineral density in the TM group, without a difference in KSS or migration.

Registry studies have reported excellent survivorship (100%) at 7 years for aseptic loosening as the primary end-point, and 97% survivorship with revision as the end-point for any reason [13]. In addition, Fernandez-Fairen et al's randomized controlled trial at 5-year follow-up, comparing one group that received a porous tantalum cementless tibial component with a cemented conventional tibial component, reported an increased KSS in the cementless TM group (90.4 ± 1.6 vs 86.5 ± 2.4) [14]. Favorable biomechanical characteristics of TM have shown excellent and rapid ingrowth, and a large prospective study at midterm follow-up showed 100% survivorship and ingrowth [15]. However, concerns do exist in regards to removing a well-fixed ingrown component.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.artd.2017.02.004.
This study was funded by The Alma and Joseph Gildenhorn Orthopaedic Fund.
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http://dx.doi.org/10.1016/j.artd.2017.02.004

When removing any TM ingrown component, whether for instability, infection, or other mechanical etiologies, the goal is to preserve as much bone stock as possible, using the techniques as described by Klein et al [16]. There are case reports of early aseptic loosening of TM components. Tigani et al [17] noted painful aseptic loosening at 7 months postoperative from a primary TKA using TM tibial components. On revision, the authors noted complete lack of ingrowth of the TM tibia component. Etiologies proposed were the age of the patient and possible osteopenia providing a nonfavorable environment for ingrowth, a tibial cut that still showed evidence of sclerotic bone, thus not providing rich cancellous bone suitable for ingrowth, and lastly a type IV hypersensitivity reaction with an abundant lymphocyte response observed perhaps preventing ingrowth. The patient subsequently had a successful revision cemented TKA with relief of pain.

In 2011, the midterm results of a porous tantalum monoblock tibia component of 108 knees was reported, with good/excellent results in 105 knees, and improvement in average KSS from 36-89, with 2 revisions for loose components [18].

The purpose of this study is to analyze clinical and radiographic outcomes at a minimum follow-up of 10 years of the initial cohort of 108 knees that received a TM monoblock tibia component. The hypothesis is that this implant has excellent long-term survival while maintaining good/excellent scores.

Material and methods

Our initial cohort of 95 patients (108 knees) underwent minimally invasive surgery (MIS) TKA from March 2003-2006 with an uncemented porous tantalum monoblock tibia component. The primary indication for surgery was degenerative joint disease with significant pain and disability not responsive to conservative treatment [18]. All patients had a preoperative flexion of at least 115° with minimal deformity (valgus/varus <10°). Body mass index was not an exclusion criterion and all patients enrolled had intact posterior cruciate ligaments by clinical examination. Patients with more deformity (>10° varus/valgus), radiographic osteopenia, previous surgery, and bone loss underwent a standard cemented TKA with a posterior-stabilized implant and were excluded from this study. All procedures were performed with the MIS technique by a single surgeon using a standard medial parapatellar approach [18] with a mechanical axis referencing technique. The primary surgeon had completed 50 total knees with TM tibia components before study initiation.

At an average 10-year follow-up (range 8.4-12.2 years), 11 men (23%) and 36 women (77%), 58 knees were available for evaluation. Ten patients included underwent simultaneous bilateral TKA. The mean age was 71.1 ± 9.95 years (range 35-89 years). The average body mass index was 30.2 kg/m^2 (range 18.3-49.9 kg/m^2), average weight was 173 lbs (range 130-210 lbs), and preoperative knee range of motion was 127° (118°-139°) (Table 1). Of the initial 108 cohorts, 28 patients were lost to follow-up, 11 patients were contacted by phone but unable to return to clinic, 6 patients reported outcome scores by phone and sent in recent x-rays for evaluation, and 5 patients were deceased (Table 2). These patients are categorized as "unconfirmed" from the inability to examine the patient in the office and/or obtain radiographs or operative reports.

Surgical technique

All TKAs were performed as previously described through a minimally invasive midvastus approach [18]. An uncemented TM monoblock tibial component and a cruciate-retaining, uncemented, high flex femoral component was used in all patients. Every patient had a well-padded tourniquet placed. In each case, the quadriceps tendon remained intact and the patella was translated laterally. Intramedullary referencing was used for the femur, with extramedullary guides for the tibia cuts, and a freehand cut for the patella. All flexion and extension gaps were symmetric before implant insertion of the uncemented TM monoblock tibial component system (Fig. 1). All cases received an uncemented cruciate-retaining high flex femoral component and the patella was resurfaced in all cases. Every knee had a single deep drain placed and the arthrotomy was closed with absorbable sutures.

Table 1
Patient demographics and complications.

	Original	11-y follow-up
Total knees	108	58
Total patients	95	47
Avg F/U	4.5	10.2
Avg age	65	71.1
Avg BMI		30.2
KSS score diff	36–>89	36.45–>99.2
Excellent/good rating	105	58
Poor rating	3	0
Patellar revision loose component	2	2
Patellar revision misalignment	1	1
Patellar ORIF	1	1
Femoral revision	1	2
Tibial revision	0	2
Unknown revision	0	4

BMI, body mass index; KSS, Knee Society Score; F/U, follow up; ORIF, open reduction internal fixation.

The postoperative protocol included low-molecular weight heparin or warfarin for 4 weeks as was customary. The drains were all removed postoperative day 1 and physical therapy was begun postoperative day 1. Patients were discharged to either a rehabilitation unit or home with therapy using a team discharge approach (protocol) with nursing, physical therapy, and occupational therapy.

Our long-term follow-up was an average of 10.2 years. In all cases, the operative surgeon completed a follow-up Knee Society Score and repeat x-rays of the operative knee were obtained and scrutinized for subsidence, interval changes, and/or radiolucencies using the Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System [19]. Our postoperative protocol has been previously described with radiographs at 6 weeks, 6 and 12 months, then at 12 months intervals thereafter.

The end-point for survival was defined as revision of the tibia component. Kaplan-Meir survival analysis was performed for all revisions, revisions for confirmed tibial loosening/failure, revisions for extensor mechanism failure, and revisions for unconfirmed revision. Given our age population and the characteristics of a long-term follow-up study, there were 5 patients who stated they underwent total knee revision, but we were unable to confirm the cause or reason for revision without radiographs or operative reports. Two patients underwent tibial revision for loosening confirmed by radiographs or operative reports.

Table 2
Patient follow-up and revisions.

	Original Cohort (=n)	11 Year Follow up (=n)
Total follow-up[a]	6	58
Revision total	5	7
Revision nontibial loosening unconfirmed	X	2
Revision tibial loosening unconfirmed	X	3
Revision tibial loosening confirmed	X	2
Phone call only	4	11
Phone call + x-ray	3	6
Deceased	2	5
Lost to follow-up	1	28

[a] 1 patient 1 mm medial polyethylene wear + 1 mm tibial radiolucency.

Please cite this article in press as: D. Gerscovich, et al., Long-term results of a porous tantalum monoblock tibia component: clinical and radiographic results at follow-up of 10 years, Arthroplasty Today (2017), http://dx.doi.org/10.1016/j.artd.2017.02.004