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Trabecular metal patella in total knee arthroplasty with patella bone deficiency

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ABSTRACT

This study evaluates results following patellar resurfacing using trabecular metal (TM) patella in marked deficiency or weakness of patellar bone that precludes patellar resurfacing with a standard cemented patellar button. Ten consecutive patients undergoing primary (3 cases) or revision (7 cases) total knee arthroplasty with patella augmentation were evaluated at a mean follow-up of 45 months (range 18–65). Nine patients had marked patellar bone deficiency and one had had previous patellectomy. No intra-operative complications occurred. There was no displacement of the patellar component and no patellar fractures when at least 50% of bone contact was possible. We observed loosening of the patella augmentation 17 months after the index procedure only in the case of previous patellectomy. When bone was present the fixation appeared excellent by radiographic evaluation already at 3 to 6 months after surgery; afterward bone contact was uniform in the peripheral regions in both lateral and Merchant radiographic views without signs of loosening. Finally, the mean Knee Society scores improved in all patients.

1. Introduction

Compromised patellar bone stock poses significant technical problems in primary and revision knee arthroplasty. In revision knee surgery bone deficiency is normally secondary to loosening of the patellar button and osteolysis that affects severely the patella. In primary cases it is rare that the patella has been so eroded that resurfacing is not possible. This happens in severe patello-femoral arthritis or inflammatory arthropathy, when the patella may be thin and track laterally before and during arthroplasty. In these cases traditional approaches have included non-resurfacing, thus leaving a thin patellar shell, or total patellectomy [1,2]. Both solutions have been associated with lower functional results compared with resurfaced patella. Recently, a patellar bone grafting procedure has been described to provide patellar bone for possible future revision [3]. The "gull-wing" patellar osteotomy [4] has also been proposed in case of low demand patients, whereas in some cases it is possible to rebuild a damaged patella with K-wires in a reinforcing configuration to support the pegs of the patellar implant using the so called "rebar" technique [5].

A new material, trabecular metal (TM), made using tantalum metal and the vapour deposition technique to create a metallic configuration with 80% porosity, and physical and mechanical properties similar to bone introduced in the late nineties [6–9]. The aim of this study was to evaluate the results of TM patella augmentation in primary and revision total knee arthroplasty (TKA) in patients with marked patellar bone loss or poor bone quality that precludes patellar resurfacing.

2. Materials and methods

2.1. Study group

A cohort series of 10 consecutive patients, with at least 18 months of follow-up, treated with trabecular metal augment patella for marked deficiency or weakness of patella that precluded patella resurfacing with a standard cemented patellar button, made the basis of the present study. All the operations were performed by a single surgeon (DT) from February 2003 to March 2007. Three patients underwent primary TKA whereas seven knees were submitted to a revision procedure. In all cases the decision to implant the TM patella was made during surgery according to the residual amount and consistency of the patellar bone.

In the primary group the diagnosis was poliomyelitis with multi-directional knee instability in two cases and severe arthritis in valgus knee with a thin patella tracking laterally in one patient that had already had a tibial tubercle realignment. The two poliomyelitis patients received a rotating hinge knee prosthesis (Nex Gen RHK, Zimmer, Warsaw, USA). The third patient underwent a primary posterior stabilized arthroplasty (Nex Gen Legacy, Zimmer, Warsaw, USA).

In the revision group all patients underwent femoral and tibial revision at the time of TM patella implantation. Four patients were affected by aseptic loosening of previous implants, one reported the hardware failure of a megaprosthesis ten years after an en bloc resection for tumor and two cases presented a malrotation of at least one of the components. In this group three patients had already

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undergone patellar resurfacing, which had resulted in marked patellar bone loss, another patient was previously submitted to patellectomy, whereas in the remaining three patients the patella was so eroded and thin that standard resurfacing was no possible. A rotating hinge knee arthroplasty (Nex Gen RHK, Zimmer, Warsaw, USA) was used in four patients, two cases received a modular condilar constrained prosthesis (Nex Gen LCCK, Zimmer, Warsaw, USA). Finally, one patient was treated for hardware failure of a megaprosthesis ten years after an en bloc resection for tumor. At the time of revision, both femoral and tibial components were loosed and then revised with a modular rotating hinge megaprosthesis (GMRS Stryker-Howmedica, Usa). As the patella was extremely dug out, long, thin and tracking laterally, an augmented patella was implanted in the half upper pole of the residual bone (Fig. 1A–B).

Demographic data for the study groups are shown in Table 1.

Table 1
Demographic data of primary and revision groups

	Age/gender	Diagnosis	Prosthesis	FU	Primary or revision
1	56/M	Polio	Zimmer RHK	57	Primary TKA
2	54/F	Polio	Zimmer RHK	63	Primary TKA
3	68/F	OA	Zimmer LPS	36	Primary TKA
4	65/M	Loosening	Zimmer RHK	56	Revision
5	73/F	Loosening	Zimmer RHK	60	Revision
6	77/M	Loosening	Zimmer RHK	17 failure	Revision
7	76/M	Malrotation	Zimmer LCCK	60	Revision
8	77/F	Malrotation	Zimmer LCCK	65	Revision
9	45/M	Hardware failure	Stryker GMRS	32	Revision
10	78/F	Loosening	Zimmer RHK	18	Revision

2.2. Surgical technique

In all cases where some amount of bone was present the remaining shell was reamed using an appropriate diameter-hemispherical reamer in an attempt to provide a healthy hemispherical surface for the attachment of the trabecular metal shell. Trials were made to restore normal patellar thickness, the metal base-plate was then placed on the residual bone and fixed with a non-absorbable suture through the holes of the peripheral tantalum ring. The reconstruction was completed by cementing the polyethylene patellar component into the trabecular metal surface.

Eight patients received a medium-sized trabecular metal patella (five were 19.5 mm thick and three were 22 mm thick and made from a combination of metal and polyethylene), and two patients received a large 20 mm thick patella.

After surgery, patients were treated with a routine total knee replacement protocol that consisted unrestricted passive and active assisted range of motion, isometric muscular exercises and

Fig. 1. (A) Lateral radiograph showing hardware failure of the femoral stem and patella extremely dug out, long and thin. (B, C) Lateral radiograph following revision TKA with a trabecular metal patellar implant at 3 and 24 months.