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The Knee



Oxidized zirconium versus cobalt–chromium against the native patella in total knee arthroplasty: Patellofemoral outcomes

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ABSTRACT

Background: Oxidized zirconium (OxZr) has demonstrated excellent mechanical properties in vitro when used against articular cartilage; less coefficient of friction and less chondral damage have been found when compared with cobalt–chromium (CoCr) implants. However, controversy exists as to whether implants with a zirconium femoral component articulate safely with a native patella in total knee arthroplasty (TKA). To answer this question, the clinical and radiographic results were analysed from a group of patients who underwent a TKA with patella retention; the OxZr versus CoCr femoral components were compared.

Methods: The present study prospectively evaluated 83 knees of 74 patients from 2009 to 2010. Each patient was evaluated clinically (visual analogue scale, Knee Society score, patellar score) and radiographically (long leg standing radiograph, anterior–posterior and latero-lateral projections, axial view of the patella) pre-operatively and postoperatively with a mean follow-up of 4.47 years. The patellar tilt and shift, and progression of patellofemoral osteoarthritis were calculated with the axial view.

Results: There were no patient reported adverse reactions and none of the evaluated prostheses failed. Both the clinical and radiographic evaluations showed no statistically significant between-group differences.

Conclusion: No adverse events were observed clinically or radiologically. These results justify pursuing the use of oxidized zirconium as an alternative bearing surface for a femoral component associated with patellar retention in TKA.

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1. Introduction

Total knee arthroplasty (TKA) is one of the most revolutionary and successful surgical procedures of modern orthopaedics. It provides pain relief, restores joint function and improves the patient's quality of life [1–3]. The major cause of TKA failure is aseptic loosening by polyethylene wear and osteolysis, especially in younger and athletically active patients and in those with suboptimal component alignment [4–6].

In an attempt to reduce polyethylene wear and secondary osteolysis, and improve the longevity of TKAs, oxidized zirconium (OxZr) has been introduced as an alternative bearing for the femoral component of TKA [7–10]. Preliminary in vitro studies have indicated excellent mechanical properties for this material, with a high resistance to roughening and reduction of polyethylene

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wear from 55% to 42% when compared with a cobalt–chromium (CoCr) femoral component for total knee replacement. Moreover, an in vitro study showed that OxZr had a 30% less coefficient of friction of cartilage than CoCr [11]. It has therefore been postulated that the lower coefficient of friction against the cartilage and greater lubricity of OxZr compared with the CoCr femoral component could allow better coupling with native articular cartilage and thus with a non-resurfaced patella.

However, all of these theoretical findings should be confirmed by clinical investigation. It is well known that preclinical laboratory testing of materials has limitations, sometimes leading to failure, and that proof for all new technologies must come from clinical trials. In the current literature, no studies have reported clinical results of OxZr femoral implants articulating with a native patella.

Therefore, the purpose of this study was to investigate the clinical and radiographic results of a group of patients who underwent a TKA with retention of the native patella, and to compare OxZr with the CoCr femoral component. It was hypothesised that the OxZr femoral component would be suitable when used as the counterface against articular cartilage, and therefore would result in a better patellofemoral outcome.

2. Patients and methods

The study prospectively evaluated 118 knees of 109 patients undergoing TKA at the authors' institution from January 2009 to October 2010. All patients received the same prosthetic model (Genesis II₁, Oxinium_{TM}; Smith & Nephew, Memphis, TN) with patellar retention randomly allocated for the CoCr or OxZr femoral component.

The indication for surgery was severe knee osteoarthritis resistant to medical, infiltrative and/or rehabilitative therapy. Exclusion criteria were patients with: secondary knee osteoarthritis; secondary, post-traumatic osteoarthritis; and severe patellar chondral degeneration, abnormal patellar shape and incongruent intraoperative patellar tracking, where patellar resurfacing was necessary and not decided according to randomisation.

Twenty-five patients (25 knees) were lost to follow-up at a minimum of one year (mean, 1.7; range, one to three years) after the operation. Overall, 83 knees of 74 patients were available for inclusion in the current study with a minimum follow-up of 36 months (mean, 4.47 years; range, three to 6.5 years).

A CoCr femoral component was implanted in 44 knees (53.01%) and an OxZr in 39 knees (46.99%). The affected side was the right in 40 patients (48.19%) and left in 43 (50.81%). The pre-operative alignment in the frontal plane resulted in an average of 4.2° varus (range five degree valgus and 17° varus). No statistical between-group differences were recorded for all demographic data, as shown in [Table 1](#).

2.1. Surgical technique

All the operations were performed by the same surgeon (MI) through a medial para-patellar approach with eversion of the patella. Details of the implant that was used have been described elsewhere [12,13]. A measured resection technique was used, followed by an adequate balance of the soft tissues. Pneumatic tourniquet was applied about the upper thigh, inflated during the bone cut and released after the cement had set, to allow haemostasis before wound closure. The tibial resection was performed using a standard extramedullary alignment guide, positioning the tibial component at 90°. The femoral valgus cut angle was determined using an intramedullary guide and correct external rotation of the femoral component was assessed using the posterior condylar axis as a guideline combined with bony landmarks. In all cases, patellar retention was applied according to the exclusion criteria. To ensure fixation, all components were cemented using high-viscosity Palacos cement (Biomet, Warsaw, IN). Cefazoline was administered as pre-operative prophylactic antibiotic therapy and discontinued after 48 h. All patients were subjected to the same rehabilitation protocol from the first day.

2.2. Evaluation of patients

Each patient was evaluated clinically and radiographically pre-operatively and postoperatively at six weeks, three months, six months and one year, and thereafter at yearly intervals ([Table 2](#)).

Table 1
Demographic and radiographic data.

Parameter	Cobalt–chromium	Oxidized zirconium
Number of patients	44	39
Male:female, n	13:31	17:22
Mean age, years	64.3	63.4
Mean body mass index, kg/m ²	28.7	29.6
Mean pre-operative alignment, °	3.7	4.7
Mean postoperative alignment, °	1.2	1.4
Mean CT tibial rotation, °	1.2	1.05
Mean CT femoral rotation, °	3.5	3.1

CT, computed tomography.

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