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Short Term Outcomes of a Hydroxyapatite Coated Metal Backed Patella

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ABSTRACT

We retrospectively evaluated the records and radiographs of 101 knees with a hydroxyapatite coated metal backed patella (HAP) and 50 knees with a cemented polyethylene patella (CP) with minimum two year clinical follow up. There were no patellar revisions during the study period. Patients in both the HAP and CP groups had similar clinical outcomes at final follow-up. Forty-five percent of patients in the HAP group had 1–2 mm areas of decreased trabecular bone density around the pegs, which were not observed in the CP group, and may represent stress shielding. This uncemented HAP component has satisfactory early clinical outcomes, but long-term follow up is necessary to determine the durability of this implant.

The demand for total knee arthroplasty (TKA) is dramatically increasing, and in the next two decades primary TKA is expected to increase by 673% [1]. Cemented TKA continues to be the gold standard for end stage arthritis of the knee with excellent long-term survivorship [2,3]. However, issues with aseptic loosening of cemented components, and the advent of components with modern porous metal backed surfaces have resulted in an increased use of uncemented TKA [4–6]. Uncemented metal backed implants have the potential to decrease operative time, and improve biologic fixation to the components making them an attractive alternative to traditional cemented components.

Excellent short and long-term outcomes have been reported with both posterior stabilized and cruciate retaining cementless TKA [7–12]. A recent meta-analysis showed the mean 10 year survivorship of cementless TKA to be 95.6% as compared to 95.3% for cemented TKA, with a twenty year survivorship of 76% and 71% respectively [13]. Kim et al prospectively evaluated bilateral TKAs using cemented and cementless TKA in the same patient and showed nearly 100% survivorship in both groups at a mean 16 year follow-up [14]. Newer TKA implant surfaces and designs have been developed to improve long-term survivorship, and highly porous surfaces have been shown to enhance bone ingrowth in hopes of improving implant fixation [15,16]. These modern highly porous TKA implant surfaces have been successful with over a 95% survivorship at short-term follow-up, and have even been effectively used in the obese patient population [8,9,17].

Although early uncemented metal backed tibial and pegged femoral implants had satisfactory outcomes, initial metal backed patellae (MBP) designs were fraught with early failures and poor outcomes secondary to polyethylene fracture, osteolysis, and debonding of the polyethylene from the metal backed surface [11,18–24]. Due to the high complication rate of the MBP, some authors recommended avoidance of its use [25,26]. Technologic advances in the implant surface, modification of patellar peg placement, and design changes at the metal–polyethylene interface have focused on improving the outcomes and survivorship of these earlier designs [27–29]. Despite the increasing number of studies reporting excellent intermediate survivorship of modern uncemented TKA components, the patellofemoral joint has often been unevaluated preventing objective analysis of this portion of the uncemented TKA [5,6,30,31].

The Stryker (Mahwah, New Jersey) Triathalon Peri-Apatite® nonmodular metal backed patella has a three pegged porous hydroxyapatite ongrowth surface for biologic fixation with a highly cross linked polyethylene which has been available in the United States since 2007, but very little clinical data exist evaluating the durability of this implant [8]. Due to the early failures of previous metal backed patellar designs, we evaluated the short to midterm clinical outcomes and radiographic stability of a consecutive series of patients with this metal backed

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patellar implant, and compared those results to a consecutive series of patients with a cemented all polyethylene component.

Methods

Prior to the start of the study approval was obtained from our institutional review board. We retrospectively evaluated a consecutive series of the first 118 knees in 91 patients who received the three-pegged Peri-Apatite® hydroxyapatite nonmodular metal backed patella (HAP), and a similar cohort of the first 60 consecutive knees in 60 patients who received a three pegged cemented conventional polyethylene patellae (CP) implanted between June 2007 and March 2011 by the senior author in conjunction with the cruciate retaining Stryker (Mahwah, New Jersey) Triathalon TKA implant. The selection criteria for the use of either the uncemented or cemented patellar component were at the discretion of the senior author. Patients younger than 70 years of age with satisfactory patellar bone stock were considered candidates for the uncemented HAP component while patients older than 70, or patients with poor bone quality (as determined at the time of surgery) received a CP component. All patellae in all TKAs were resurfaced during this period by the senior author (MP).

The following data were extracted from patient medical records: demographics, diagnosis, range of motion (ROM), and mechanical axis alignment. In total there were 39 males (53 knees) and 112 females (125 knees) evaluated in the two groups. All patients who were evaluated had a minimum two-year clinical follow up. Patients were only excluded if they had less than two-year follow up.

Lateral and merchant radiographs were taken with a digital radiograph system in a standardized fashion, and were evaluated by two orthopedic surgeons at final follow up for radiolucent lines or areas of cystic changes in seven separate zones as previously described by the Knee Society for a two-pegged component [32], which was modified for a three-pegged component used in this study (Fig. 1). A radiolucent line was defined as an area of 2 mm or more in any region where no trabecular bone was touching the implant. Patellar tilt was measured at final follow up on the merchant view (Fig. 2) using the angle created by a tangential line at the base of the trochlea and another line parallel to the base of the patellar implant [33]. Mechanical axis measurements were obtained from three foot standing radiographs with the patella facing forward using a digital picture archiving and communication system.

Clinical and radiographic follow up was performed postoperatively at two weeks, three months, one year, two years, and five years. The validated Forgotten Joint Score-12 (FJS-12) [34], and Lower Extremity Activity Score (LEAS) [35] were used to evaluate patient subjective outcomes at final follow up. The FJS-12 score is a 12 question validated patient reported outcome tool that evaluates the ability of the patient to forget about their total joint in everyday activity [34], while the LEAS is a validated patient reported outcome tool used to evaluate the activity level in a limb with knee arthritis or TKA [35]. Patients were contacted by telephone if their outcome scores were not available or missing in the chart. Knee range of motion (ROM) was evaluated in the office setting by the senior author or his physician assistant using a goniometer at maximum active knee extension and flexion.

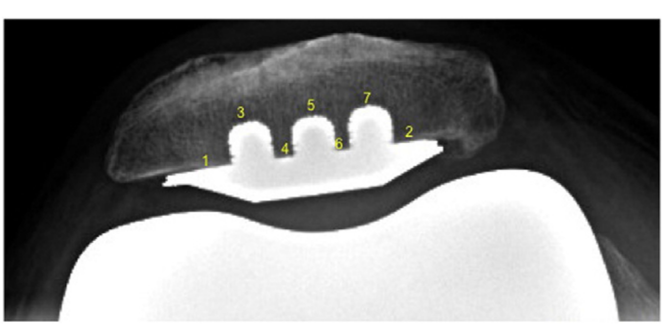

Fig. 1. The seven zones evaluated for radiolucent lines and cystic changes for the cemented and cementless patellar implants.

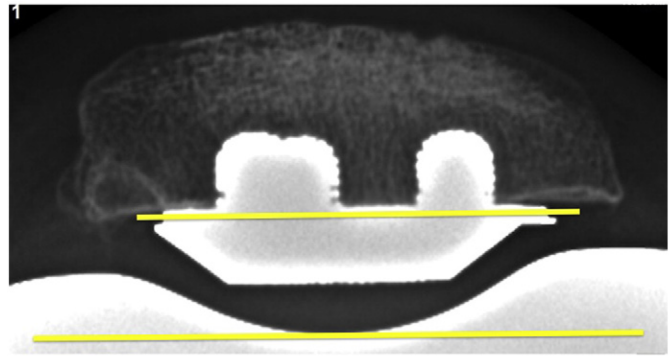

Fig. 2. Patellar tilt was measured using the angle created by a tangential line at the base of the trochlea and another line parallel to the base of the patellar implant.

Descriptive statistics were used to analyze patient's demographic data. Survivorship at final follow up was assessed by determining the need for revision of the patellar implant for any reason. Subjective patient outcome data and continuous variables were evaluated using Student t-tests. Additionally, multivariate linear regression was used to examine the difference between LEAS and FJS-12 sores between two TKA surgical methods (HAP vs. CP), in the crude and age adjusted model. A *P* value of less than .05 was considered statistically significant.

Results

There were 101 knees in the HAP group and 50 knees in the CP group, with a minimum two year clinical follow up. Mean age was greater in the CP group (65 ± 9) compared to the HAP (54 ± 6) group ($P < 0.0001$) (Table 1). On average, patients were classified as obese with a mean BMI of 32.9 ± 7.4 in the HAP and 32.3 ± 8 in the CP group ($P = 0.68$) (Table 1). Osteoarthritis (OA) was the preoperative diagnosis in 130 patients followed by post-traumatic OA in 15 and rheumatoid arthritis (RA) in 6 (Table 1).

All knees at final follow up were functioning well. The mean follow up for ROM evaluation and completion of the subjective LEAS and FJS-12 outcome scores was 59 ± 11 months in the HAP group and 73 ± 4 months in the CP group ($P < .0001$). We did not observe a statistically significant difference in FJS-12 scores between HAP and CP groups at final follow up (77.3 ± 23.2 vs. 72.3 ± 12.9, respectively, $P = 0.20$). However, we did observe a significantly higher LEAS score in the HAP group compared to the CP group (12.2 ± 2.6 vs. 9.2 ± 2.4, respectively, $P < 0.0001$).

Table 1
Patient Demographics and Mean Radiographic Follow Up with Associated Standard Deviations for the Cementless Hydroxyapatite and Cemented Polyethylene Patellar Cohorts.

	Patient Demographics		
	HAP (SD)	CP (SD)	*P* Value
Age	54 (6)	65 (9)	<.0001
Gender			
Male	36	7	
Female	65	43	
BMI	32.7 (7.4)	32.4 (8)	0.78
Clinical Follow Up	59 (11)	73 (4)	<.0001
Diagnosis			
OA	86	44	
Post Traumatic OA	11	4	
RA	4	2	