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Increased bone mineral density in the non-resurfaced patella after total knee arthroplasty: A clinical and densitometric study

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ABSTRACT

We report the results of a longitudinal study of 40 patients with osteoarthritis who had primary prosthetic replacement without patellar resurfacing, and were followed at 6 months postoperatively with a densitometric study and clinically at a minimum follow-up of 2 years. Densitometric analysis showed a mean preoperative density at the affected knee of 0.69 g/cm^2 (CI: 0.62–0.76), compared to 0.86 g/cm^2 (CI: 0.79–0.93) for the opposite knee ($p = 0.002$). In our study population, the return to load and motion to the retained patella led to a significant increase in patellar bone density as measured by densitometry studies. This observation correlated with significant improvement in knee functional score.

Introduction

In primary TKA (Total Knee Arthroplasty), management of patella is debated.[1] Many authors always resurface the patella to improve postoperative outcomes and to reduce anterior knee pain.[2–8] Others report that the non-resurfaced patella leads to similar results to those obtained with patellar resurfacing (PR) in primary TKA, avoiding the complications accompanying PR (including avascular necrosis, patellar fracture, patellar tendon injury, aseptic loosening, and polyethylene wear of the patella component).[1,9–16]

Complications following patellar resurfacing are difficult to manage.[17] Adequate patellar tracking is determined by the restoration of knee alignment and by proper rotation of both tibial and femoral component that permit central patellar tracking.[14,18–22] Shear stress stimulates bone remodelling and apposition in response to application of physiological loads despite surgical denervation.[23]

We wished to test the null hypothesis that there was no short term change in bone mineral density (BMD) of non-resurfaced patella using Dual Energy X-ray Absorptiometry (DEXA) in a homogenous group of patients managed with primary TKA for knee osteoarthritis when knee alignment was correctly restored.

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Materials and methods

Between January 2001 and December 2002, all patients scheduled to undergo a primary TKA were evaluated for possible inclusion in the study. Patients with inflammatory arthritis, or in whom knee arthroplasty was being performed for treatment of patellofemoral symptoms (a history of patellar fracture, patellectomy, patellofemoral instability), or patients who had a prior unicondylar knee replacement, severe malalignment, previous patellar realignment or other major knee surgery such as high tibial osteotomy were excluded.

A total of 40 patients (20 males and 20 females) were recruited into the study. Institutional review board approval was granted, and written informed consent was obtained from each patient enrolled in this study. The mean age of the cohort was 70 ± 3.5 years (95%CI: 68.9 to 71.1; Range: 60 to 76), with a mean preoperative body mass index (BMI) of 27.6 ± 2.5 (95%CI: 26.8 to 28.4).

Surgery

All patients received routine antibiotic prophylaxis (2 gr. of intravenous injection of cefazolin) from 30 min before of anaesthesia until 5th day postoperatively. Prophylaxis against deep-vein thrombosis (subcutaneous low molecular weight heparin) was continued for 30 postoperative days.

All the patients were operated by a board certified Orthopaedic Surgeon with a special interest in this surgery.

First step: *knee prosthesis implantation*
The paramedian approach was used, with the patella being reflected laterally with preservation of the infrapatellar fat pad in all patients. The femoral and tibial cuts were made using the cuttings jigs designed for primary posterior-stabilised knee prosthesis, and both cruciate ligaments and menisci were excised.

Equidistant holes were performed by drilling into the cut surfaces of the bone. The cement was inserted with finger-packing in both tibial and femoral components surfaces. Subsequently, the components were articulated, and the knee was slowly moved to full extension to allow cement polymerisation.

Second step: patelloplasty
None of the patients had patellar resurfacing, but all received a patelloplasty: including excision of osteophytes, if any, and circumferential denervation of the patella. The knee was slowly moved from full extension to 90° of flexion to assess patellofemoral tracking for alignment. Patellar tracking was ensured by soft-tissue balancing, performing a lateral release in 8 patients (20%).

Rehabilitation programme

Ambulation
Patients were allowed to touch weight bearing only with crutches for 6 weeks. Crutch walking with progressive weight bearing was allowed for the next 6 weeks.

ROM
Continuous passive motion (CPM) (0°–40°) (Kinetec, Smith and Nephew, Memphis, TN) was initiated the first day after surgery for 3 days. CPM progressed 5°–10° a day as tolerated. Muscle strength exercises, CPM and active-assisted knee ROM were progressed allowing a ROM of 0°–90° by 2 weeks postoperatively. The ROM increased to 115° at 6 weeks. After 6 weeks, ROM was increased as able, to a functional range for the patient.

Clinical and radiographical assessment

An author not involved in the surgery (ADM) performed all the preoperative and outcome assessments at 6 months and a minimum of 24 months follow-up.

The preoperative and postoperative clinical evaluation was performed according to the Knee Society Clinical Rating System[24] score (ranging from 0 to 100), including knee objective and functional assessment, grading patients as excellent (80–100), good (70–79), fair (60–69) and poor (below 60).

At 6 months after the procedure, lateral, anteroposterior, and sky-line radiographs evidenced correct femoro-tibial alignment in all patients. Concerning patellofemoral alignment, axial sky-line radiographs assessed the patellar position as centred, tilted, subluxed, or dislocated.[25]

Densitometric analysis

Each patient underwent a bone densitometry study BMD preoperatively and at 6 months. Densitometry scores for both the affected and unaffected knees were obtained.

BMD (g/cm^2) measurements were made by DEXA scanning (Hologic QDR 4500W, Inc, Waltham, MA). All scans were acquired and analysed using Hologic standard software. The bone mineral density of the patella was obtained from a lateral projection with the patient in lateral decubitus and the knees flexed to 30°.[26,27] A preliminary scan was performed of a global Region of Interest (ROI) comprising the patella, the distal femur and the proximal tibia. Then, all the bony regions were coloured, and focused scanning of the patella performed (Fig. 1).

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences Software (SPSS 10.0 for Windows, SPSS Inc., Chicago, IL, USA). Data are shown as mean, standard deviation and/or confidence interval. Parametric (Student's *t*-test) and non-parametric tests (Wilcoxon for paired data and Mann–Whitney *U* for non-paired data) were used to compare different values. Two tailed p-values < 0.05 were considered statistically significant.

Results

All the patients included in this study underwent unilateral total knee arthroplasty: 23 on the right side and 17 on the left. The mean hospital stay was five days (range, five to seven days).