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Four-Year Follow Up Outcome Study of Patellofemoral Arthroplasty at a Single Institution

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ABSTRACT

Patellofemoral arthroplasty (PFA) is an option for younger patients with isolated patellofemoral arthritis. Older PFAs had high failure rates due to poor design. This retrospective study reports the outcomes of PFA at a single institution using a second-generation implant. Fifty-one patients (51 knees) with isolated patellofemoral arthritis underwent PFA. Mean follow-up was 4.1 years (range, 2.2–6.1). Mean Knee Society objective and function scores, Oxford Knee score, Melbourne Knee score and Physical Component Score improved significantly. 76% had their expectations fulfilled and 76% experienced good satisfaction. Mean Insall–Salvati and Caton–Deschamps ratios increased significantly. Two wound infections (3.92%) were encountered. Survivorship was 92.2% with four revisions, two due to progression of arthritis, one due to patella maltracking, and one due to anterior knee pain.

Patellofemoral arthritis occurs in isolation in approximately 10% of patients with arthritis of the knee. These patients tend to be younger, with a preponderance of females [1]. Risk factors for patellofemoral arthritis include a history of adolescent anterior knee pain, trochlear dysplasia, trauma, obesity, patella alta, or a history of recurrent patellofemoral instability [2–4]. Isolated lesions in specific locations in the patellofemoral articulation may be amenable to re-alignment procedures, chondrocyte implantation, microfracture or partial lateral facetectomy. However, once the disease process becomes more extensive, the results of such procedures are less predictable [2,5] and joint arthroplasty may be indicated. Younger patients with isolated end-stage patellofemoral arthritis pose a difficult clinical problem to an orthopaedic surgeon as a Total Knee Arthroplasty (TKA) would invariably lead to revision surgery. The myriad of surgical options available for the treatment of patellofemoral arthritis indicates the difficulty in treating this challenging problem, with no "gold standard" treatment being defined currently [2,3].

The challenges to Patellofemoral Arthroplasty (PFA) lie in its complex anatomy and kinematics, both of which have to be respected in order to obtain optimal results [2,3,6,7]. PFA has existed since the 1950s when McKeever reported a series of 40 patients with patellar resurfacing using a Vitallium prosthesis screwed onto the patella [8]. In the 1970s, Blazina et al [9] and Lubinus [10] introduced femoral components combined with the resurfaced patella. One early prosthesis had a successful survivorship of 90% at 4 year follow-up [11]. However, most reports showed sub-optimal results, with high rates of failure attributed to poor design features such as sharp, constraining trochlear grooves that were prone to complications such as maltracking and catching of the patella [8,12,13]. TKA has been utilized in treating isolated patellofemoral osteoarthritis with reasonable success, however, anterior knee pain continues in 19% of patients with no prospective randomized clinical trials available to date [14,15].

Second generation PFAs have existed since the 1990s with an evolved design rationale [16]. The femoral component has a broad, symmetrical trochlear flange that narrows distally, ensuring that the patella engages during flexion but is relatively unconstrained in extension. These more anatomical implant designs have led to a renewed interest in PFA in recent years [17,18]. Some studies have shown good mid-term results and clinical survivorships ranging from 80% to 100% [6,17–23]. We report the clinical and radiological outcomes, complication rates and survivorship data of a single PFA implant at our center from 2008 to 2012.

Patients and Methods

Patient Selection

Between 2008 and 2012, 51 consecutive patients presented with isolated patellofemoral arthritis and were treated with PFA. The study was approved by our institutional review board. All surgeries were performed by three experienced arthroplasty surgeons using a single PFA prosthesis (SIGMA HP Partial Knee, DePuy, Warsaw, IN) at a single

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Table 1
Preoperative Characteristics of Cohort (N = 51).

Mean follow-up period in years (range)	4.1 (2.2 to 6.1)
Mean age in years ± SD (range)	52.7 ± 7.5 (39 to 72)
Gender (%)	44 Female (86%), 7 Male (14%)
Side (%)	19 Left (37%), 32 Right (63%)
Body Mass Index in kg/m^2 ± SD (range)	28.7 ± 5.5 (20 to 43)
Mean length of hospital stay in days (range)	3.7 (2 to 8)

institution. The 51 patients (44 females, 7 males) had a mean age of 52.7 ± 7.5 years. Preoperative clinical data of patients are summarized in the table below (Table 1). All patients were followed up for a mean of 4.1 years (range, 2.2–6.1 years). Data were prospectively collected pre-operatively, at six months, one year and two years post-operatively.

All patients had isolated patellofemoral disease. One patient had a previous distal femur fracture with screw fixation that may have contributed to the development of post-traumatic patellofemoral arthritis. The remaining patients had no identifiable risk factors for disease etiology.

Inclusion criteria that have been previously described [7,16] were used in this study, including degenerative osteoarthritis confined to the patellofemoral joint, post-traumatic osteoarthritis, symptoms referable to patellofemoral joint degeneration that were unresponsive to non-operative intervention, patellofemoral malalignment or dysplasia, failed conservative procedures such as arthroscopic debridement, or extensor unloading procedures. Patients were questioned to determine if there was a familial history of early onset knee arthritis, as this might contribute to early progression of tibiofemoral osteoarthritis. Any patient with suspected tibiofemoral osteoarthritis, advanced chondromalacia or chondrocalcinosis, systemic inflammatory arthritis, complex regional pain syndrome, infection or who had a previous history of severe arthrofibrotic healing were excluded from receiving a PFA. Females with "Q" angle >20° and >15° in males were also excluded.

Surgical Technique

The procedure was standardized utilizing an abbreviated medial parapatellar approach under tourniquet. Meticulous surgical technique was attempted for all knees. The femoral component was positioned in the most lateralized position on the anterior femur to maximize anterior coverage without medial or lateral overhang after referencing rotation parallel to the transepicondylar axis and perpendicular to the anteroposterior axis (Whiteside's line). The patella was prepared similarly to the principles of TKA utilizing a measured resection approach. A parallel resection at the patellar equator was made to avoid maltracking. Careful measurement of patella thickness in all quadrants confirmed an equal resection. Coverage was maximized with the patella button in a medialized position. The patella was then reconstituted to a normal thickness. Any sources of catching or snapping were addressed prior to implantation of the final prosthesis. Lateral releases were performed as needed for tracking purposes after the tourniquet was let down. Excess cement was removed to prevent third-body wear and formation of a destructive loose body when migrated into the tibiofemoral compartments. Drains were inserted at the end of the procedure as the discretion of the attending surgeon. All of the surgical implants were cemented.

Post-operatively, pain was managed in the inpatient setting with intramuscular pethidine and intravenous ondansetron as needed, and in the outpatient setting with oral analgesics such as paracetamol, gabapentin and arcoxia or naproxen with a proton pump inhibitor.

Outcome Measures

Two experienced independent physiotherapists performed the pre-operative and post-operative assessment of all patients. They were blind to the measurements of their colleagues. All the patients had pre-operative Range of Motion, Melbourne Knee score [24], Knee Society scores, Oxford Knee scores, Short-Form 36 (SF-36) scores. The eight domains (Physical functioning, Social functioning, Role-Physical, Bodily Pain, Mental Health, Role-Emotional, Vitality, and General Health) of SF-36 were transformed into two summary scores: the Physical Component Summary (PCS) and Mental Component Summary (MCS). The advantages of PCS and MCS are a smaller confidence interval and elimination of both floor and ceiling effect [25]. All scores were evaluated again at six months, one year, and two years post-operatively, together with an assessment of the patient's fulfilment of expectations and satisfaction rates with surgery. Expectation and satisfaction scores were rated out of a maximum of seven or six respectively, with higher scores indicating poorer results. We stratified expectation scores into: excellent, good, fair and poor (Table 2).

Post-operative X-rays were reviewed to assess alignment and check for radiological loosening. Radiological outcomes were measured using the Insall–Salvati (Patella Alta > 1.5) and Caton–Deschamps (Patella Alta > 1.3, Patella Baja < 0.6) ratios to assess for outliers. Data with regard to any further intervention were obtained from the hospital records. Complication rate and revision to TKA as an endpoint were reviewed.

Statistical Analysis

All continuous data are expressed in terms of mean and standard deviation of the mean. Repeated measures ANOVA and post hoc tests using the Bonferroni correction were used to determine any significant differences between the scores obtained at set time intervals before and after PFA. Student's t test was used to compare pre-operative and post-operative radiographic ratios. Survivorship analysis was based on the Kaplan–Meier method. We defined statistical significance at the 5% ($P \leq 0.05$) level. Statistical analysis was carried out with SPSS software version 20.0 (SPSS Inc, Chicago, IL).

Results

For analysis, 51 patients followed through all evaluations and no patients were lost to follow-up. An isolated PFA implantation with a single implant was performed in all patients. Ten patients had been treated with a prior procedure (four arthroscopic debridements, one microfracture, one debridement and microfracture, three debridement and lateral release, one debridement, microfracture and lateral release). Lateral release was performed intra-operatively in seven patients. No intra-operative complications such as intra-articular fracture, nerve or vessel damage were encountered.

Table 2
Evaluation of Patient Expectation and Satisfaction.

Score	Patient Expectation[a]	Stratification
1	Yes, totally	Excellent
2	Yes, almost totally	Good
3	Yes, quite a bit	
4	More or less	Fair
5	No, not quite	Poor
6	No, far from it	
7	No, not at all	
Score	Patient Satisfaction[b]	Stratification
1	Excellent	Excellent
2	Very good	Good
3	Good	
4	Fair	Fair
5	Poor	Poor
6	Terrible	

[a] Question Adapted from Q48 North American Spine Society Low Back Pain Instrument.
[b] Question Adapted from Q53 North American Spine Society Low Back Pain Instrument.