Patellofemoral Arthroplasty Versus Total Knee Arthroplasty in Patients With Isolated Patellofemoral Osteoarthritis

Diane L. Dahm, MD, Walid Al-Rayashi, MD, Khaled Dajani, MD, Jay P. Shah, MD, Bruce A. Levy, MD, and Michael J. Stuart, MD

Abstract
We identified all patients at our institution who underwent patellofemoral arthroplasty (PFA) or total knee arthroplasty (TKA) as treatment for isolated patellofemoral arthritis (PA) between January 2003 and December 2005. Twenty-three PFA and 22 TKA patients met inclusion criteria. Mean age was 60 years and 69 years, respectively ($P = 0.01$). Mean follow-up was 29 months (range, 24 to 49 months) in the PFA group and 27 months (range, 24 to 33 months) in the TKA group. Mean postoperative Knee Society Clinical Rating System scores were 89 and 90 in the PFA and TKA cohorts, respectively. Mean UCLA scores were 6.6 and 4.2, respectively ($P < 0.0001$). Mean blood loss ($P = 0.03$) and hospital stay ($P = 0.01$) were significantly lower among PFA patients. Linear regression analysis showed that blood loss, hospital stay, and functional outcomes were not affected by age as an independent variable. No significant complications occurred in the PFA group. There was one deep vein thrombosis in the TKA group. We conclude that PFA yields clinical outcomes comparable to that of TKA as treatment for isolated PA and may be a less invasive option for this select subgroup of patients.

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There has been a renewed interest in treatment options for patients with isolated patellofemoral arthritis (PA) of the knee. In patients over age 55 years presenting with knee pain, isolated PA has been reported in 8% of women and 2% of men, and has been associated with a relatively high rate of disability. Davies and colleagues reported that 9% of the 209 patients in their study who had arthritis of the knee were diagnosed with isolated PA.2

Conservative treatment of PA includes strengthening exercises, bracing or taping, nonsteroidal anti-inflammatory drugs, injections of hyaluronic acid and/or corticosteroids, and activity modification.3,4 Reported surgical options for early stage disease and/or patellar malalignment include arthroscopic debridement with or without lateral retinacular release, tibial tubercle elevation or anteromedialization, cartilage stimulation techniques (such as microfracture or abrasion arthroplasty), and cartilage replacement procedures.5-7 For more advanced disease, patellectomy and patellar resurfacing have been described but have fallen out of favor as a result of overall unsatisfactory results.6,9

Total knee arthroplasty (TKA) has been reported to be an accepted method of treatment for advanced isolated PA.10-13 Although TKA has been reported to provide pain relief and functional improvement in this population, its indications and benefits relative to patellofemoral arthroplasty (PFA) remain controversial.14

There are few studies in the literature that report outcomes of PFA using newer PFA designs15,16 and no prior study comparing the results of TKA with the results of PFA using modern implants. In this comparative retrospective study, we hypothesized that patients who underwent PFA as treatment for isolated PA would have similar outcomes as patients treated with TKA.

All patients provided verbal and/or written consent for participation in this study.

Materials and Methods
We reviewed all patients who underwent knee arthroplasty at our institution between January 2003 and December 2005. From this registry, we first selected only those patients diagnosed with PA. Patients were screened further for isolated disease using the following criteria: a Kellgren and Lawrence17 score ≤ 2 at the tibiofemoral...
Table I. Incidence and Severity of Trochlear Dysplasia by Group

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<th>TKA Group</th>
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<td>B</td>
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Abbreviations: PFA, patellofemoral arthroplasty; TKA, total knee arthroplasty.

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Documented. Postoperative patellar symmetry, tilt, and subluxation also were documented.\textsuperscript{21,22}

Paired comparisons between the PFA and TKA groups were performed using Wilcoxon signed-rank tests. Multivariate regression was used to analyze the outcome effects of any independent variable showing a significant difference between the groups. All regression models were analyzed for power and fit, with significance set at .05. The statistical analysis was performed using JMP 6 statistical discovery software (SAS, Inc., Cary, North Carolina).

RESULTS

Between January 2003 and December 2005, 3500 patients underwent a knee arthroplasty procedure at our institution. We identified 205 knees (5.8%) coded in our database for PA. After detailed radiographic review, 45 knees (1.3%) with isolated PA were identified. There were 23 knees (0.7%) that underwent PFA and 22 knees (0.6%) that underwent TKA.

Mean follow-up was 29 months (range, 24 to 49 months) and 27 months (range, 24 to 33 months) in the PFA and TKA groups, respectively. There were no statistically significant differences between the groups in regard to gender (P = .65), race (P = .34), body mass index (30 vs 30; P = .82), average number of prior knee surgeries (1 vs 1; P = .19), smoking status (P = .57), or employment status (defined as employed, retired, or work disabled, P = .56). Mean age at time of surgery was 60 years (range, 39 to 81 years) in the TKA group and 69 years (range, 44 to 83 years) in the TKA group. This difference in age was statistically significant (P = .01).

There were no statistically significant differences between the PFA and TKA groups in relation to mean preoperative Kellgren and Lawrence score (1 vs 1, P = .88), mean preoperative Iwano score (4 vs 4; P = .30), or the presence/absence of trochlear dysplasia (P = .74). Complete data on trochlear dysplasia can be found in Table I. Nineteen knees in the PFA group (83%) and 15 knees in the TKA group (68%) had preoperative patella alta per the Insall-Salvati index (P = .27). There were no statistically significant differences between the PFA and TKA groups in regard to the following.

...
Preoperative pain was rated by the PFA group as mild in 1 knee (4%), moderate in 15 knees (74%), and severe in 5 knees (22%). The TKA group rated their preoperative pain as mild in 1 knee (5%), moderate in 15 knees (68%), and severe in 6 knees (27%). Preoperative pain was not significantly different between the groups (P = .33). All patients localized their pain to the anterior part of the knee preoperatively. There were no statistically significant differences between the 2 groups in regard to preoperative psychiatric diagnoses (P = .32) or preoperative narcotic use (P = .12). Thirteen patients (34%) had 1 or more pre-existing psychiatric diagnoses at the time of surgery: 8 patients in the PFA group (42%) and 5 patients in the TKA group (26%).

Six patients (25%) in the PFA group and 4 patients (18%) in the TKA group had undergone previous knee surgery; of those, there was a mean of 2.2 prior procedures in the PFA group and 2.3 procedures in the TKA group.

Mean operating time was 112 minutes (range, 48 to 155 minutes) for the PFA group and 98 minutes (range, 48 to 164 minutes) for the TKA groups (P = .31). Nineteen of the 23 PFA patients (83%) had a lateral release performed, compared with 1 (5%) of the TKA patients (P < .05).

Mean blood loss was 117 mL (range, 25 to 250 mL) and 197 mL (range, 25 to 500 mL) among the PFA and TKA patients, respectively (P = .03). One patient in the PFA group and 6 patients in the TKA group required blood transfusion (P = .008). Mean postoperative inpatient stay was 3.3 days (range, 2 to 5 days) and 4.4 days (range, 3 to 6 days) among the PFA and TKA patients, respectively (P = .001).

Postoperative Merchant view radiographs were available for 18 knees (78%) in the PFA group and all 22 knees (100%) in the TKA group; of these, 14 knees (78%) in the PFA group and 17 knees (77%) in the TKA group were symmetrically resurfaced (P = .65). The average patellar tilt was 4.1° (range, 1° to 8.5°) in the PFA group and 3.7° (range, 0.7° to 27°) in the TKA group (P = .41). The average subluxation was 2.7 mm laterally (range, 0 to 7 mm) and 1.1 mm medially (range, 0 to 8 mm) in the PFA and TKA groups, respectively (P = .25).

There was a slight but nonsignificant trend toward improved postoperative range of motion in the PFA group compared with the TKA group. Mean postoperative flexion was 122° vs 119° (P = .09) and mean postoperative extension was 0° vs 1° (P = .08) in the PFA and TKA groups, respectively.

Mean postoperative KSS scores were 89 (range, 69 to 100) and 90 (range, 47 to 100) for the PFA and TKA patients, respectively (P = .85). Mean postoperative KSS function scores were 84 (range, 51 to 100) in the PFA group and 73 (range, 59 to 94) in the TKA group (P = .05). Mean postoperative Tegner scores were 4.3 (range, 3 to 6) in the PFA group and 2.6 (range, 2 to 3) in the TKA group (P < .0001). Mean postoperative UCLA scores were 6.6 (range, 5 to 9) and 4.2 (range, 3 to 6) for the PFA and TKA patients, respectively (P < .0001). The most commonly reported postoperative sporting activities in both groups were walking, cycling, and swimming. Two patients in the PFA group reported running postoperatively. A complete list of sporting activities is included in Table II.
Pain at final follow-up was rated by the PFA group as none in 8 knees (35%), mild in 10 knees (43%), and moderate in 5 knees (22%). The TKA group rated their pain at final follow-up as none in 13 knees (59%), mild in 6 knees (27%), and moderate in 3 knees (14%). Pain at final follow-up was not significantly different between groups (P = .26). Ten patients (26%) exhibited narcotic use at the time of latest follow-up: 6 PFA patients (32%) and 4 TKA patients (21%) (P = .48).

Among the PFA group, 17 patients (74%) reported they were much better at final follow-up compared with their preoperative condition, 5 patients (22%) were somewhat better, and 1 patient (4%) reported being worse. Among the TKA patients, 18 (82%) were much better, and 4 (18%) were somewhat better. There was no statistically significant difference in satisfaction at final follow-up between groups (P = .66).

Multivariate regression was used to analyze the effects of age; presence/absence of trochlear dysplasia; and patellar asymmetry, tilt, or subluxation on postoperative scores between the 2 groups (Table III). A well-powered (> 90%) regression analysis demonstrated that age and presence/absence of trochlear dysplasia had no statistically significant effect on postoperative KSS score, KSS function score, Tegner score, UCLA score, or satisfaction at final follow-up. With the numbers available, postoperative patellar asymmetry, tilt, and subluxation had no significant effect on outcome measures.

No patients in the PFA group required revision or further surgery. Among the TKA group, 1 patient (4%) required manipulation for stiffness and 1 patient (4%) developed deep vein thrombosis in the early postoperative period.

**DISCUSSION**

The surgical treatment of advanced symptomatic PA remains somewhat controversial. Satisfactory results have been reported for both PFA and TKA in this setting. How then, should the decision to proceed with TKA or PFA be made?

In the present study, we retrospectively compared the clinical and functional outcomes of patients who underwent either PFA or TKA for treatment of isolated PA. Demographically, the 2 cohorts were remarkably similar. Radiographs were reviewed carefully to ensure that only patients treated for isolated PA were included. Although the TKA patients were significantly older than the PFA patients (mean, 69 vs 60 years, respectively), a well-powered regression analysis demonstrated that age as an independent variable had no effect on postoperative KSS score, KSS function score, Tegner score, UCLA score, or satisfaction at final follow-up.

It has been reported that a common cause of failure of modern PFA prostheses is progression of tibiofemoral arthritis (TA). Ackroyd and colleagues noted a 20% progression of TA on radiographs with a revision rate of 4% at 5-year follow-up. Patient selection is, therefore, thought to be of paramount importance. It has been suggested that patients presenting with idiopathic PA may be more prone to progression to generalized TA, and thus caution should be used when considering these patients for PFA. Delanois and colleagues suggest that those with trochlear dysplasia or patellar fracture may be more ideal candidates for PFA, with less chance for progression of TA. Leadbetter has advocated more widespread utilization of PFA in younger patients with isolated PA to extend function and reduce pain while avoiding a more complex TKA procedure.

In our study, the majority of patients in each group exhibited radiographic evidence of trochlear dysplasia and patella alta preoperatively; both of these conditions are commonly seen in patients presenting with patellar instability—which has been hypothesized to increase the risk of PA. Interestingly, the presence or absence of dysplasia did not affect the postoperative knee scores of patients in either group. It should be emphasized that strict radiographic criteria were utilized in our study in order to include only patients with isolated PA. Although it is possible that with longer follow-up we will see deterioration of results in the group treated with PFA, the early benefits of improved function, return to higher activity, and less morbidity seem to outweigh the risk of revision for TA progression.

Despite a high overall satisfaction rate in both groups, with over two-thirds of patients in each group reporting they were "much better" when compared with their preoperative status, it should be noted that 22% of PFA patients and 14% of TKA patients still stated they had "moderate" pain. Furthermore, 32% of PFA patients and 21% of TKA patients used narcotic pain medication at the time of latest follow-up. The etiology of such pain is not entirely clear. Also of note, 42% of PFA patients were diagnosed with a preoperative psychiatric condition (most commonly, anxiety or depression), which is somewhat higher than that seen in the general popula-
tion (26%) and the general osteoarthritis population (21%). This underscores the complexity of the diagnosis and treatment of patellofemoral pain syndrome, and the need for a comprehensive approach to management of such patients.

The strengths of this study include complete follow-up with no patients lost, a comprehensive analysis with use of standardized radiographic measures, and validated clinical outcome and activity scores. Weaknesses include the retrospective nature of the study, which is subject to selection bias, as well as the relatively small numbers in each cohort. Longer follow-up is necessary to determine the longevity of the patellofemoral prosthesis.

CONCLUSION
In our study, patients who underwent modern PFA for treatment of isolated PA were compared with a cohort who underwent TKA for the same diagnosis during the same time period. Patients treated with PFA demonstrated similar results with respect to pain relief, but showed improved function and return to activity when compared with the patients treated with TKA. Patellofemoral arthroplasty patients also experienced less blood loss, fewer complications, and shorter hospital stay following surgery. Our results indicate that PFA is a less invasive treatment option for patients with isolated PA, yielding early outcomes that compare favorably with TKA.

AUTHOR’S DISCLOSURE STATEMENT
The authors report no actual or potential conflict of interest in relation to this article.

REFERENCES