

Update on Patellofemoral Arthroplasty



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Patellofemoral arthroplasty (PFA) has been used for the treatment of isolated patellofemoral arthritis for more than 30 years. Changes in implant design, patient selection, and technical considerations have led to improved short-term and midterm outcomes over the past decade. These outcomes suggest that PFA is a valuable tool for patients with isolated anterior compartment degenerative arthritis, especially in the setting of trochlear dysplasia. PFA may provide benefits over total knee arthroplasty (TKA) for isolated patellofemoral arthritis owing to its preservation of tibiofemoral mechanics, less-invasive nature, and the possibility of conversion to TKA using primary TKA components. This review discusses the indications for implant design considerations, proper patient selection, and technical considerations made during surgery which have resulted in PFA becoming a more reliable and useful tool in the treatment of anterior knee pain because of degenerative arthritis.

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Introduction

Isolated patellofemoral arthritis remains a relatively uncommon but challenging condition to treat. It is estimated that only approximately 9% of patients older than 40 years presenting with knee pain have radiographic evidence of isolated patellofemoral arthritis.¹ Owing to the relatively small prevalence of disease and high revision rates with early prostheses,²⁻⁴ patellofemoral arthroplasty (PFA) has remained a controversial option. More recent advances in patient selection, implant design, and attention to implant positioning have led to significantly improved midterm results.⁵⁻⁷ With an increasingly younger and more demanding population seeking treatment, it is anticipated that PFA will provide more predictable and durable results than cartilage restoration options do in middle-aged patients while preserving more of the joint than total knee arthroplasty (TKA) does for the patients of all ages with isolated patellofemoral arthritis.

Prosthetic Design Considerations

A number of articles have reviewed the differences between early (first generation) and newer (second generation) PFA

implants.⁸⁻¹¹ First-generation implants were introduced in 1979 and followed the poorly performing Vitallium McKeever patellar button. These used an inlay design where the medial and lateral edges of the prosthesis were designed to blend with the native edges of the trochlea. With this type of design, native anatomy influenced implant positioning. Given the high prevalence of trochlear dysplasia in this population,⁵ reproducibility was challenging and a tendency to flex the component existed; leading to a high rate of snapping and clunking as the patella transitioned onto and off of the prosthesis in extension.¹¹ Furthermore, these prostheses were more highly constrained with a deeper trochlear groove, theoretically leading to less natural kinematics and higher wear. Outcomes with such implants varied, but studies demonstrated revision or TKA conversion rates as high as 15%-35% in short-term to midterm follow-up.⁸ Recently, some interest has returned to inlay designs with newer patient-specific implants. These include the Arthrosurface prosthesis that is used for small lesions and the custom, computed tomography (CT)-based Kinamed prosthesis used for complete resurfacing. Both of these designs may be at risk of failure in trochlear dysplasia given their inability to change patellofemoral joint mechanics.

Second-generation implants that use an anterior femoral cut similar to that used for TKA have come to the market from multiple manufacturers over the past 2 decades. This onlay design allows for resurfacing of the entire anterior compartment and allows for more correction of a dysplastic trochlea. Many newer designs extend more proximally than older

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designs or native trochlea does, which promotes uniform engagement of the patella at the proximal edge of the prosthesis to reduce clunk and subluxation in extension even with mild patella alta.⁹ More recent designs are also less constrained and are therefore more forgiving regarding subtle patellofemoral malalignment.^{7,8} Results with a second-generation implant at our institution at a mean of 4 years showed statistically significant improvements in Knee Society function, pain, and stair-climbing scores as well as Tegner and University of California, Los Angeles activity scores. The revision rate was 2 of 59 (3.4%) at final follow-up, with these patients requiring conversion to TKA for tibiofemoral progression at 50 and 63 months. Multiple other studies have found similar short-term and midterm results with second-generation implants.^{6,12} We continue to favor use of an onlay-type prosthesis, as the high incidence of trochlear dysplasia makes even newer-style inlay prostheses less predictable.

Clinical Evaluation

Similar to tibiofemoral unicompartmental arthroplasty, results improve when strict patient selection criteria are used. PFA is indicated only for isolated, end-stage, unicompartmental patellofemoral arthritis. This is in contrast to all other anterior knee pain for which conservative management has failed. Isolated patellofemoral arthritis is often multifactorial, consisting of genetic, posttraumatic, and dysplastic causes. It is important to rule out tibiofemoral arthritis as well as any possibility of inflammatory arthritis. It is critical to inquire about remote patellar instability, as hypertrophic changes or diminished activity may improve previous instability that could be unmasked with the low-friction bearing surface of a PFA. An ideal patient has complaints of pain and crepitus with stair climbing, long periods of sitting, and walking on uneven surfaces, with less or no difficulty walking on flat surfaces.

The physical examination requires a complete evaluation of the lower extremities. Assessing hip to ankle standing alignment is important, as PFA is not indicated in patients with significant varus or valgus deformity. Caution should be exercised in patients with greater than 8° valgus or 5° varus deformities.¹³ A hip examination in the prone position may demonstrate femoral malrotation or hip osteoarthritis. A complete knee examination with attention to the presence of tibiofemoral pathology should be performed, as pain referable to the tibiofemoral joint is unlikely to be relieved following PFA. Despite this, no study has found meniscal injury or anterior cruciate deficiency to be a contraindication to PFA.⁸ Patellar laxity, apprehension, tilt, grind, Q angle, and the presence of a J sign should be compared with the contralateral side. Examination signs indicative of instability require a careful evaluation of the underlying cause. Lateral patellar subluxation due to lateral patellofemoral wear in the presence of trochlear dysplasia may be appropriately treated with PFA, whereas angular deformities may require antecedent or combined procedures.¹⁴ Regarding body mass index, studies have failed to show increased revision rates at short-term and midterm follow-up⁵; however, with follow-up of 13.3 years, van

Jonbergen et al⁴ found a significantly increased rate of revision for patients with a body mass index more than 30 kg/m².

The radiographic examination is an extension of the physical examination and history. Full-length standing hip-knee-ankle, standing anteroposterior, posteroanterior flexion, lateral, and Merchant views should be obtained. Films are assessed for evidence of hip arthritis, tibiofemoral arthritis, coronal malalignment at the knee, and ankle or hindfoot valgus. Lateral radiographs are examined for evidence of trochlear dysplasia, as described by DeJour, including the crossover sign, supratrochlear spur, and double contour.¹⁵ Multiple studies using second-generation implants show the progression of tibiofemoral arthritis to be less likely in patients with trochlear dysplasia, suggesting that these patients may have the most durable results.^{5,15,16} Patients without dysplasia are counseled that they are at a higher risk of progression of tibiofemoral arthritis, but that in some cases, PFA may be an appropriate bridging procedure, particularly in physiologically younger patients. Assessment of patellar height is important, as patella baja is generally felt to be a contraindication unless corrected.³ A posteroanterior flexion can be helpful to further evaluate tibiofemoral articulation. Currently, advanced imaging is not a prerequisite for surgical consideration; however, CT can be helpful, particularly in patients with instability, to assess for dysplasia, determine tibial tuberosity trochlear groove (TT-TG) distance, and assess whether tibial tubercle realignment is indicated. Magnetic resonance imaging may be useful to determine the presence of tibiofemoral chondromalacia and TT-posterior cruciate ligament distance in place of TT-TG in those with trochlear dysplasia where a TG is not present. It is noteworthy that caution should be exercised in younger patients with CT or magnetic resonance imaging evidence of patellofemoral chondromalacia, but without frank radiographic joint space narrowing or osteophyte formation, as these patients may have nonarthritic sources of pain and less predictable pain relief following PFA.

TKA vs PFA for Isolated Patellofemoral Arthritis

Owing to the somewhat unpredictable results reported for early PFA designs, multiple studies have looked to TKA as a possible superior option for patients with isolated patellofemoral arthritis. Multiple studies of TKA for isolated patellofemoral disease show high midterm survivorship, significant improvements in Knee Society functional and objective scores, and a relatively low incidence of anterior knee pain and instability with or without patellar resurfacing.^{3,6,17,18} No prospective randomized trial has been performed; however, we retrospectively analyzed and compared all patients over a 3-year period who underwent arthroplasty for isolated patellofemoral arthritis. At a mean follow-up of 27-29 months, the groups had similar Knee Society Scores of 89 and 90 for PFA and TKA, respectively; however, PFA patients had significantly higher University of California, Los Angeles scores, lower blood loss, and shorter hospital stays. None of these outcomes were affected by age as an independent variable.¹⁹ To date,

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