Treating Patellofemoral Arthritis with Patellofemoral Arthroplasty

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Background

Epidemiological studies estimate the prevalence of isolated patellofemoral osteoarthritis (PF OA) in the range of 13–24% in women and 11–15% in men [1, 2]. A recent meta-analysis reported rates of isolated radiographic patellofemoral OA in a population-based cohort and symptom-based cohort to be 10% and 8%, respectively [3]. Women constitute the majority of patients presenting with patellofemoral OA, which may be related to higher incidence of dysplasia and malalignment in that group [4]. Other potential etiologies of isolated patellofemoral OA may be related to increased BMI or a history of trauma (patella fracture, chronic patellar dislocation/subluxation) [4, 5]. Overall, it appears that while isolated patellofemoral OA is a relatively uncommon problem when compared to tibiofemoral OA, it remains a source of pain and functional limitation [6].

Clinical Evaluation

Patients with isolated patellofemoral OA present differently than patients with tricompartmental or tibiofemoral OA. Perhaps, the most important distinguishing characteristic is the location of pain or discomfort, as these patients should present with pain localized to the peri- or retropatellar aspects of the knee joint. Localization of pain to these regions of the knee is crucial in the accurate diagnosis of symptomatic patellofemoral OA prior to PFA. Symptoms may be exacerbated by activities that preferentially load the patellofemoral joint, including stair or hill ambulation, rising from a seated position, squatting, or prolonged sitting with the knee in a flexed position. Conversely, prolonged ambulation on level surfaces (which is often difficult or painful in advanced tibiofemoral OA) should be relatively asymptomatic in patients with *isolated* patellofemoral OA. In addition, a history of anterior knee crepitus is common.

Other key elements of a patient's history include previous trauma to the knee, which may include patella fracture, patellar subluxation or dislocation, or blunt injury to the patella. A history of recurrent patellar dislocations may indicate the presence of malalignment or generalized ligamentous laxity. After the location and quality of pain have been established, the surgeon should ascertain whether previous interventions such as physical therapy, weight reduction, bracing, medications, injections, or nonarthroplasty surgery were undertaken. Last, a history of inflammatory or crystalline arthritis should be specifically addressed, as this would preclude the patient from consideration of PFA.

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Physical examination begins with observation of standing alignment and gait, which may provide clues regarding rotational or axial malalignment, coronal alignment, presence of more advanced arthritis or alternative sources of anterior knee pain, and/or muscular balance. Motion should not be particularly limited, and there should not be a flexion contracture, which would suggest more advanced disease. Check active patellar tracking with the limb dangling over the edge of the examination table. Typically, patellofemoral crepitus is felt and/or heard. Patellar maltracking may be observed with lateral deviation of the patella as the knee approaches full extension (J sign), indicating muscular imbalance or rotational deformity. For patients who have high Q angles, a tibial tubercle realignment procedure (antero-medialization) may be considered before or at the same time as PFA.

Provocative testing should identify the presence of tenderness with palpation around the patella, apprehension with attempted lateral subluxation, pain and crepitus with patellar compression, and recreation of patellofemoral crepitus and retropatellar knee pain with range of motion and squatting. Any associated medial or lateral tibiofemoral joint line tenderness should alert the surgeon to the possibility of meniscal pathology or tibiofemoral OA, even if radiographs are relatively normal. Other potential sources of anterior knee pain, such as pes anserine bursitis, patellar tendinitis, prepatellar bursitis, instability, or pain referred from the ipsilateral hip or back, must be ruled out. Cruciate and collateral ligament integrity should be carefully assessed, as tibiofemoral instability may predispose to early progressive tibiofemoral OA.

Imaging of the knee should include a standard plain film series, including standing anteroposterior (AP), standing midflexion posteroanterior (PA, Rosenberg), lateral, and axial (sunrise) views (Fig. 10.1a–d). AP and Rosenberg views should be notable for an absence of tibiofemoral joint degeneration, although small osteophytes and mild squaring of the femoral condyles may be acceptable in the context of normal tibiofemoral (TF) joint spaces and lack of clinical symptoms. The lateral view may demonstrate patellar osteophytes and patellofemoral joint space narrowing but is perhaps more helpful in the assessment of patellar height and exclusion of patella alta or baja deformity. The axial view is the best assessment for patellofemoral joint space and may also demonstrate other pertinent findings such as patellar tilt, subluxation, trochlear dysplasia, or osteophytes. If significant lower limb angular deformity is suspected, full-length standing plain films should be obtained.

Magnetic resonance imaging (MRI) is primarily used to confirm the findings of patellofemoral joint degeneration (chondral thinning, bony edema) and, perhaps as importantly, exclude the presence of substantial tibiofemoral compartment pathology such as meniscal injury, chondromalacia/arthritis or subchondral edema. The presence of more substantial tibiofemoral chondral disease or edema would exclude isolated PFA, although consideration may be given to BiKA, combined PFA and chondral grafting, or TKA. Previous arthroscopy photographs or video, if available, may be especially valuable in documenting the extent of patellofemoral joint disease as well as the absence of disease elsewhere.

Patient Selection/Indications

Proper patient selection is crucial for successful postoperative outcomes following PFA [5, 7, 8]. The ideal candidate for PFA has isolated, noninflammatory arthritis of the patellofemoral joint, leading to pain and significant functional limitations. Patients with primary or post-traumatic osteoarthritis or other concurrent patellofemoral disorders such as trochlear dysplasia or mild patellar subluxation that have resulted in PF OA are also indicated for PFA. Our data on patients with less radiographic severity, but who nonetheless have appropriately painful and symptomatic Grade IV chondromalacia of the lateral patellar facet and/or lateral trochlea, show that they too

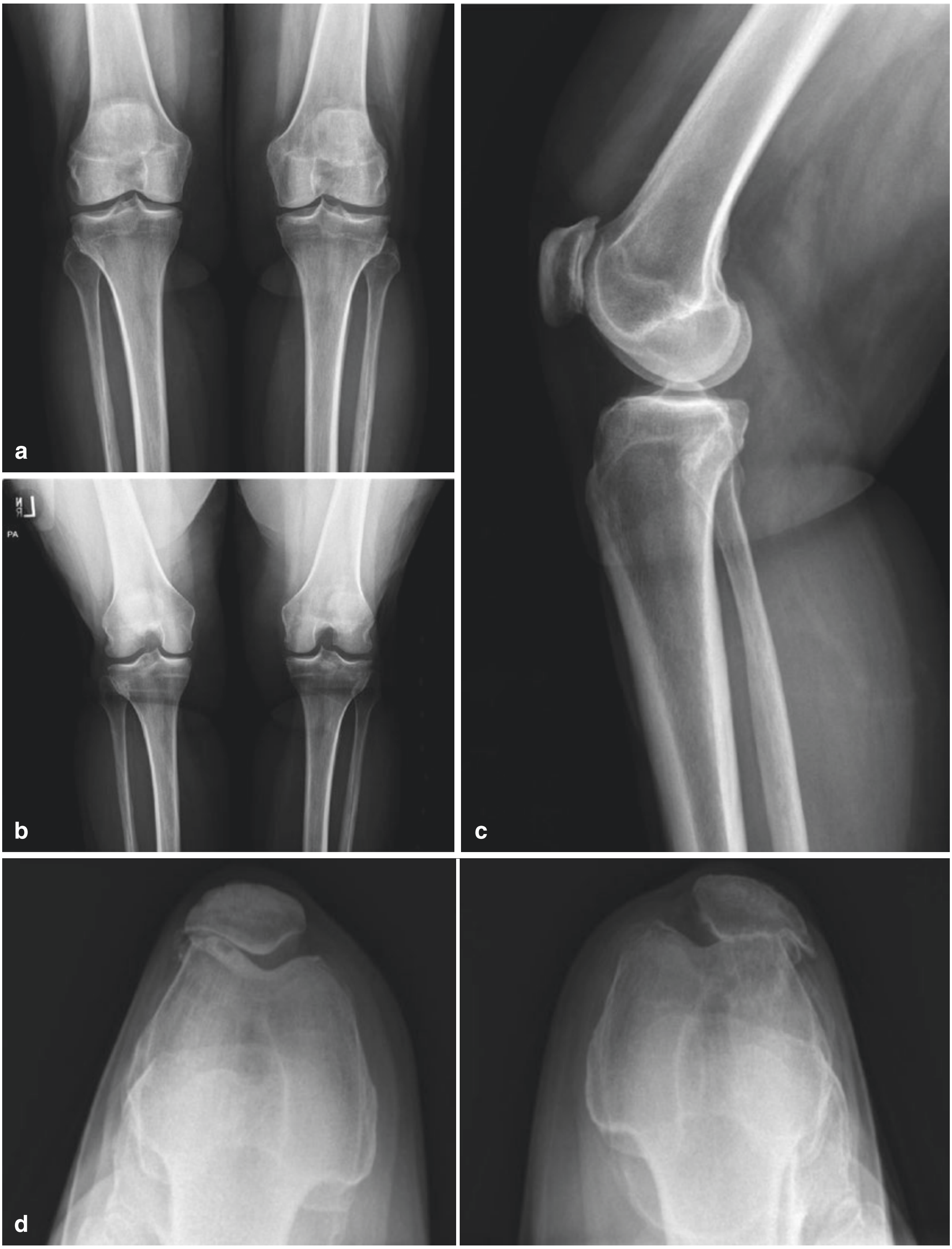

Fig. 10.1 (**a**–**d**) Standing anteroposterior (AP), midflexion posteroanterior (PA, Rosenberg), lateral and sunrise radiographs show arthritis localized to the patellofemoral compartment

may have substantial pain relief and symptomatic improvement with PFA. As mentioned above, patients should report localized retro-patellar or peripatellar pain, worsened with activities that load the patellofemoral joint. Conversely, they should have notable absence of signs and symptoms of tibiofemoral arthritis including limited pain with ambulation on level ground. Patients should also reasonably attempt some extent of nonoperative treatment prior to PFA, including physical therapy, weight loss, nonsteroidal anti-inflammatory medication, activity modification, injections, or bracing, which may or may not have much impact on symptoms.

There are a number of contraindications to PFA. PFA should not be considered in the presence of tibiofemoral cartilage loss (Grade III or more chondromalacia) or if the patient has tibiofemoral joint pain and tenderness that do not appear to be referred from the PF compartment. Similarly, PFA should not be performed in patients who have inflammatory arthritis or diffuse chondrocalcinosis, as they would be at a higher risk of ongoing pain, arthritis progression, and failure. While PFA is useful for some patients with Grade IV chondromalacia of the lateral patellar facet and/or lateral trochlea, we would not typically advise PFA in patients with isolated Grade IV chondromalacia of the medial patellar facet and/or medial trochlea, since medial-sided patellofemoral chondral wear should not typically be very painful; when it is, other sources of anterior pain should be sorted out and nonsurgical options pursued. Isolated PFA is contraindicated in the presence of flexion contractures, tibiofemoral malalignment, or uncorrectable patellar tracking.

Mild-to-moderate patellar maltracking or patellar tilt, on the other hand, is easily addressed at the time of PFA with lateral retinacular release or recession and appropriate positioning of the trochlear and patellar components. Alternatively, severe patellofemoral malalignment or rotational deformity, noted on clinical exam and confirmed with imaging, is a relative contraindication if not correctable prior to, or simultaneous with, PFA. Typically, the tibiofemoral alignment should be "neutral"; tibiofemoral malalignment suggests greater disease and would be a contraindication to isolated PFA [9].

Intuitively, due to the increased patellofemoral stresses associated with increased weight, obese patients are thought to be at increased risk of failure after PFA, but more of an issue is that obese patients are more likely to have subtle or overt TF disease, which can compromise the results of PFA. Indeed, this has been confirmed by previous studies demonstrating that obese patients (BMI >30 kg/m^2) are at a higher risk for revision for a variety of reasons [10, 11]. This mirrors the available data for TKA [12]. However, to date, there is no accepted BMI cutoff for PFA. Similarly, there is currently no consensus regarding optimal age for patients undergoing PFA, although authors have generally advocated for a younger patient population (30–60 years old) compared to that undergoing total knee arthroplasty (TKA). [13, 14] In one series, 50% of patients undergoing PFA were age 50 years or younger. Nonetheless, excellent outcomes are achievable even in octogenarians with isolated PF arthritis [15]. We would not typically recommend PFA in patients in their twenties.

Patients should also be evaluated for preoperative opioid use or dependence. Patients who require opioid medications for patellofemoral OA are generally considered poor candidates for PFA, and all attempts should be made to wean them from these medications prior to pursuing surgery. Last, previous studies have shown that coexisting psychological distress or psychiatric disease may be associated with poorer outcomes and/or poorer satisfaction postoperatively [15]. This has also been demonstrated repeatedly in the TKA literature. Accordingly, it is important for the practitioner to determine the mental status of patients prior to proceeding with PFA and set appropriate and realistic expectations for patients. Indications and contraindications are further summarized in Table 10.1.

History and Design Considerations

The first PFA design was introduced in 1955 by McKeever and comprised an isolated patellar resurfacing with a screw-on Vitallium shell. In the absence of trochlear resurfacing, this design was associated with early failure, particularly related to wear of the trochlear cartilage, and it was abandoned [16, 17].

Table 10.1 Indications and contraindications for PFA

Indications	Contraindications	Relative contraindications
Advanced primary isolated patellofemoral OA	Tibiofemoral OA or ≥ grade III TF chondromalacia	BMI > 40 kg/m^2
Post-traumatic patellofemoral OA	Inflammatory arthritis or chondrocalcinosis	Isolated grade IV chondromalacia of medial patellar facet and/or medial trochlea
PF OA secondary to patellar maltracking +/−trochlear dysplasia	Knee instability	Preoperative opioid dependence
Mild patellar subluxation or tilt	Limb malalignment (valgus >8°, varus >5°)	Disproportionate pain
Grade IV chondromalacia of lateral patellar facet and/or lateral trochlea	Flexion contracture	Equivalent anterior pain walking on level ground as descending stairs, kneeling, or squatting
Retropatellar/peripatellar pain worsened by descending stairs, kneeling, or squatting	Uncorrectable patellar malalignment	Age < 30 years
		Tibiofemoral tenderness

Subsequent PFA prostheses resurfaced both the patella and trochlea. “First-generation,” or “inlay,” design trochlear components were developed to position the prosthesis flush with the surrounding trochlear cartilage, with its rotation determined by native trochlear orientation [7, 18]. The design characteristics of inlay PFA trochlear components have proven to be problematic, when coupled with inherent anatomic variations of the native trochlea [18]. A previous MRI study demonstrated that trochlear inclination is nearly ~10° internally rotated relative to anatomic landmarks such as the transepicondylar axis (TEA) [19]. As a result, internal rotation of the trochlear component is common in inlay PFA, leading to higher rates of patellar tracking problems (Fig. 10.2a–d). Further, most inlay prostheses have narrow medial-lateral widths and do not extend proximal to the native trochlear surface; these design characteristics lead to an increased potential for patellar maltracking and catching/subluxation against the proximal trochlear flange with knee flexion, [7, 18, 19] and relatively high failure rates requiring re-operation for patellar instability as high as 29% at short- and mid-term follow-up [20–27].

“Second-generation,” or “onlay,” PFA trochlear components were developed to address the shortcomings of earlier designs, particularly the issues of geometric mismatch with the native trochlea and component positioning, which resulted in a relatively high incidence of secondary patellar maltracking and subluxation. Onlay-style trochlear prostheses replace the entire anterior trochlear surface, positioning the component flush with the anterior femoral cortical surface proximal to the trochlea, obviating some of the issues related to maintenance of the native anatomic rotation in earlier designs [7, 18]. The trochlear surface extends proximal to the native trochlea, which decreases the risk of catching/subluxation during the initial 10–20 degrees of knee flexion, and maintains the patella engaged in the trochlea in full extension. In addition, by routinely rotating the trochlear component perpendicular to the AP axis or parallel to the transepicondylar axis of the femur, the risk of maltracking and subluxation is reduced. In general, onlay-style prostheses have yielded better short- and medium-term results than inlay-style trochlear components owing to the elimination of patellar maltracking problems, which increase the need for secondary surgery or revision. Unlike inlay-style designs, which are more commonly revised early, onlay components are more durable and most likely revised late for progression of tibiofemoral arthritis, rather than early component failure [13, 18, 28, 29].

Surgical Technique

A standard para-median skin incision is utilized, extending just proximal to the proximal edge of the patella (in flexion) to the proximal medial aspect of the tibial tubercle (Fig. 10.3a).

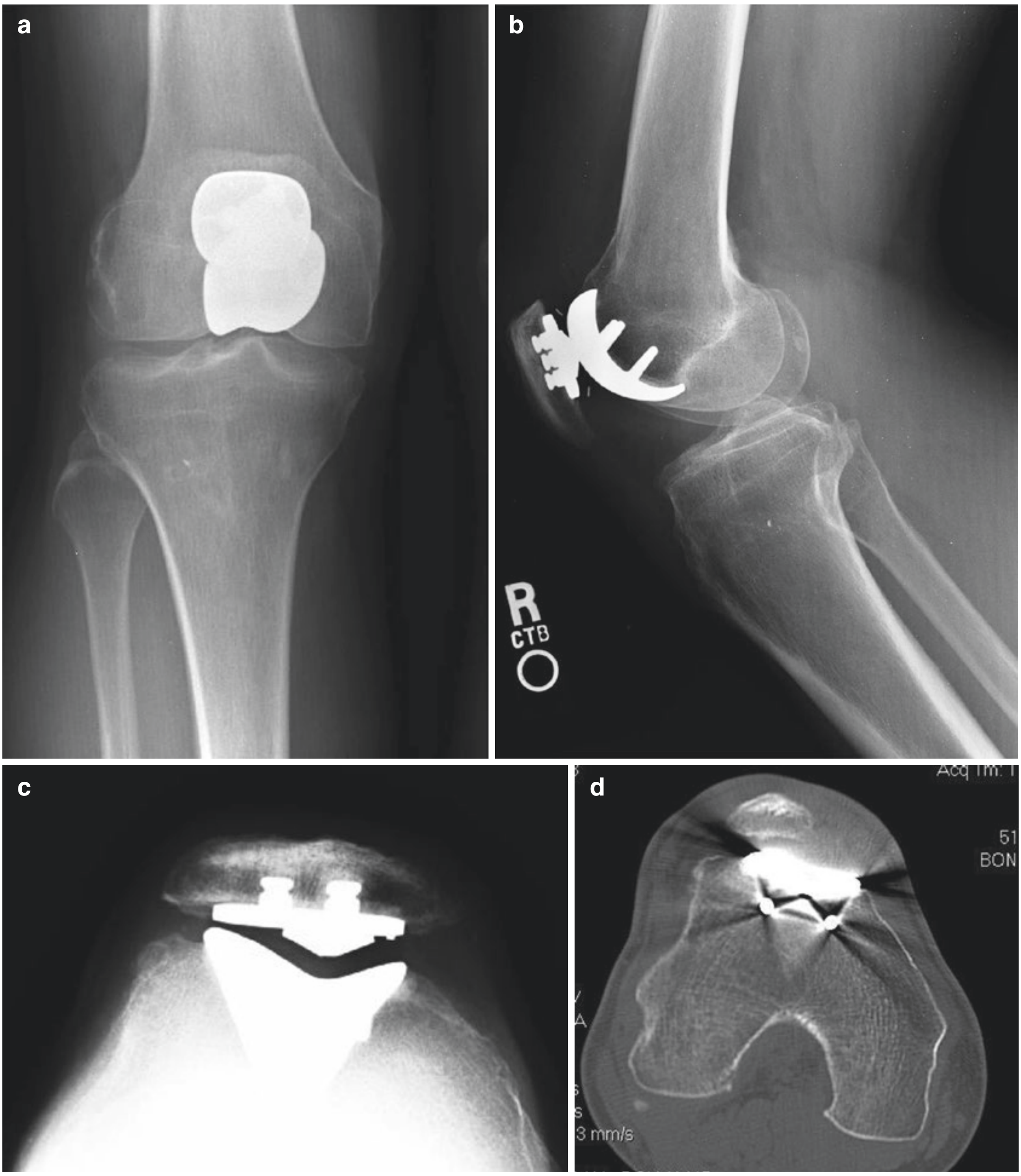

Fig. 10.2 (**a**–**d**) Postoperative AP, lateral, and sunrise radiographs and computed tomography scan after PFA with an inlay-style trochlear component show that it is internally rotated, causing lateral patellar subluxation and catching

The arthrotomy can be performed according to the surgeon's preference, as medial parapatellar, midvastus, and subvastus approaches will all provide adequate visualization of the patellofemoral joint space. In the author's experience, a medial parapatellar or midvastus approach is utilized in most cases. The surgeon should be cautious to avoid iatrogenic injury to the menisci, intermeniscal ligament, or articular cartilage of the femoral condyle or tibial plateau during the arthrotomy (Fig. 10.3b). Most often, the arthrotomy is thus made in limited flexion or full extension to slacken the capsule and keep it away from the medial femoral condyle. Before proceeding

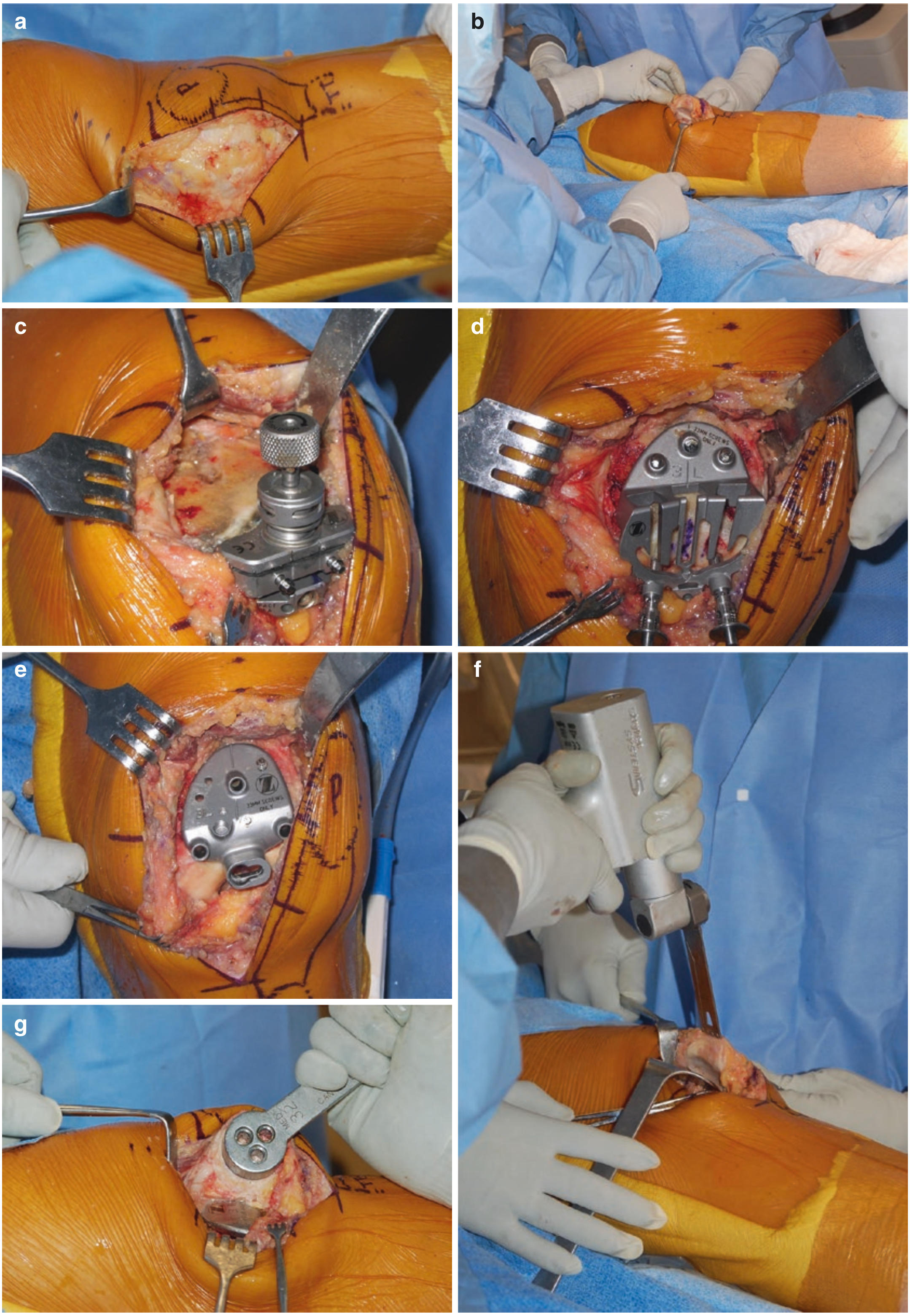

Fig. 10.3 (**a**–**j**) Intraoperative photographs demonstrate surgical technique of onlay-style PFA

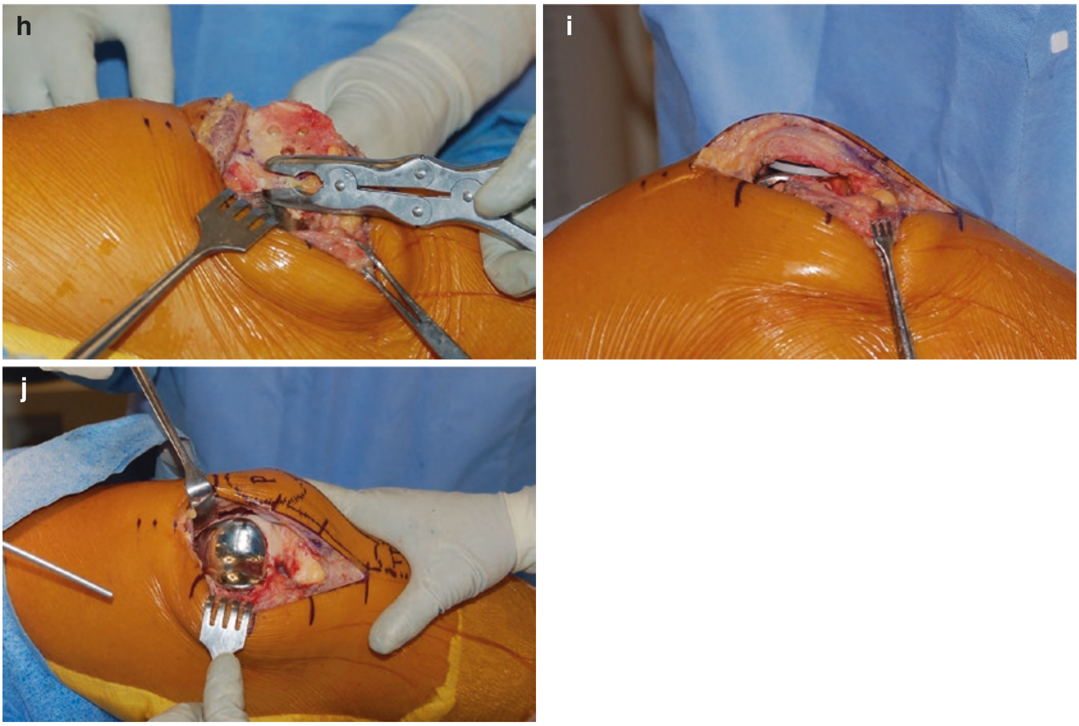

Fig. 10.3 (continued)

with the case, careful inspection of the entire joint is critical to ensure and confirm proper patient selection for PFA; the surgeon should inspect the tibiofemoral compartments for any sign of significant cartilage degeneration and be prepared to add a chondral resurfacing, BiKA, or proceed with a TKA if otherwise [30].

Although surgical techniques vary between systems, most protocols for onlay designs are centered on defining the anteroposterior axis of the knee joint (Whiteside's line). This is the landmark around which trochlear component rotation is set. The AP axis (Whiteside's line) is drawn with a marking pen. An intramedullary guide is utilized and the femoral canal accessed through a starting point anterior to the center of the intercondylar notch. The intramedullary guide is externally rotated so that its cutting slot is perpendicular to the anteroposterior axis of the femur (or parallel to the transepicondylar axis) and its vertical position secured to make a transverse resection flush with the anterior femoral cortex. An outrigger boom is applied to the cutting guide to determine the depth of the anterior resection. The guide is adjusted up or down to achieve an anterior resection that is flush with the anterior femoral cortex, leaving the classic "baby grand piano" sign (Fig. 10.3c). Anteriorization of the cut will result in overstuffing of the patellofemoral compartment; overly aggressive resection will cause notching of the anterior femur.

The next step involves sizing of the trochlear component and preparation of the intercondylar surface. We prefer to use a milling system, which can accurately prepare this area (Fig. 10.3d, e). The appropriately sized guide, corresponding to the implant size, is selected to maximize coverage of the resected anterior trochlear surface but leaving 1–3 mm of bone exposed on either side of the anterior surface of the trochlear component. This optimizes the surface for patellar tracking while also reducing the risk of mediolateral trochlear component overhang or synovial irritation. It is also important to check that the templated trochlear component does not encroach on the weight-bearing surfaces of the tibiofemoral articulations or overhang into the intercondylar notch. The varus-valgus alignment of the trochlear component (and milling guide) is determined by the orientation of the femoral condylar surfaces, since in the region of transition onto the intercondylar, surfaces, the component edges must be flush with, or 1 mm recessed relative to the adjacent condylar articular cartilage. The trial trochlear component is then impacted into place.

Next, attention is turned to the preparation of the patella. The patella is resurfaced by the same principles followed in total knee arthroplasty. The resection should parallel the anterior patellar cortex, removing 8–10 mm, depending on the thickness of the patellar component selected and how much resection the native patella can accommodate (Fig. 10.3f). The remaining patella bone should be no thinner than 12–13 mm. The patellar component size is selected using a guide applied medially. The guide should rest on the medial edge of the patella and not overhang beyond the margins of the bone. Three lug holes are drilled, and the lateral edge of the guide or patellar prosthesis is traced with a methylene blue marker (Fig. 10.3g, h). The portion of the lateral patellar facet that is not covered by the patellar component should be removed to avoid a potential source of painful bone impingement that could occur if it were to articulate against either the trochlear implant or articular cartilage. Assessment of patellar tracking is performed with the trial components in place. If patellar tilt, subluxation, or catching of the components is noted, carefully ensure that component position and bone preparation are accurate and make corrections if necessary. Otherwise, patellar tilt and mild subluxation can usually be addressed successfully by a lateral retinacular recession or release. As stated earlier, more severe extensor mechanism malalignment would require a tibial tubercle realignment if there is an excessive Q angle, or a proximal realignment if the Q angle is normal.

After satisfactory trialing, the prepared recipient sites are irrigated with pulsatile lavage and dried. Methylmethacrylate is mixed and applied directly to the prepared bone surfaces in a doughy state. The cement is pressurized into the trabeculae and components implanted. Manual pressure is applied to the trochlear component, and a patellar clamp is used for the patellar component until the cement cures. Extruded cement is removed. Once again, patellar tracking is reassessed and the need for a lateral release or recession is determined (Fig. 10.3i, j). The wound is irrigated and sutured in layers. Postoperative radiographs are obtained (Fig. 10.4a–c).

Clinical Results of PFA

While inlay-style components have demonstrated high rates of secondary surgeries and early revisions to TKA due primarily to patellar maltracking problems, [11, 25] recent evidence shows routinely good clinical results and marked reduction of patellar maltracking when utilizing onlay-style trochlear components and surgical techniques that position the trochlear component perpendicular to the AP axis of the femur [28, 29, 31–33]. In fact, by revising inlay-style trochlear components that are experiencing patellar tracking and instability problems to an onlay device, patellar tracking and functional outcomes can be improved [34]. With those improvements in implant design and an understanding of the impact of trochlear component positioning, outcomes of PFA rival those of TKA [35]. Additionally, the majority of recent studies have demonstrated that the primary mode of failure after PFA is related to later progression of tibiofemoral arthritis, rather than early implant-related patellofemoral complications that have plagued inlay designs [28, 29, 31, 32].

The dichotomy in outcomes between inlay and onlay designs is highlighted in the Australian National Joint Registry, which shows that the 5-year cumulative revision rate was over 20% for inlay prostheses and under 10% for onlay designs. The most likely explanation for this has to do with trochlear component morphology and positioning relative to the femoral AP axis [36]. A single-surgeon series found that patients undergoing PFA with a first-generation inlay PFA had a 17% incidence of patellar maltracking, resulting in a relatively high need for second-

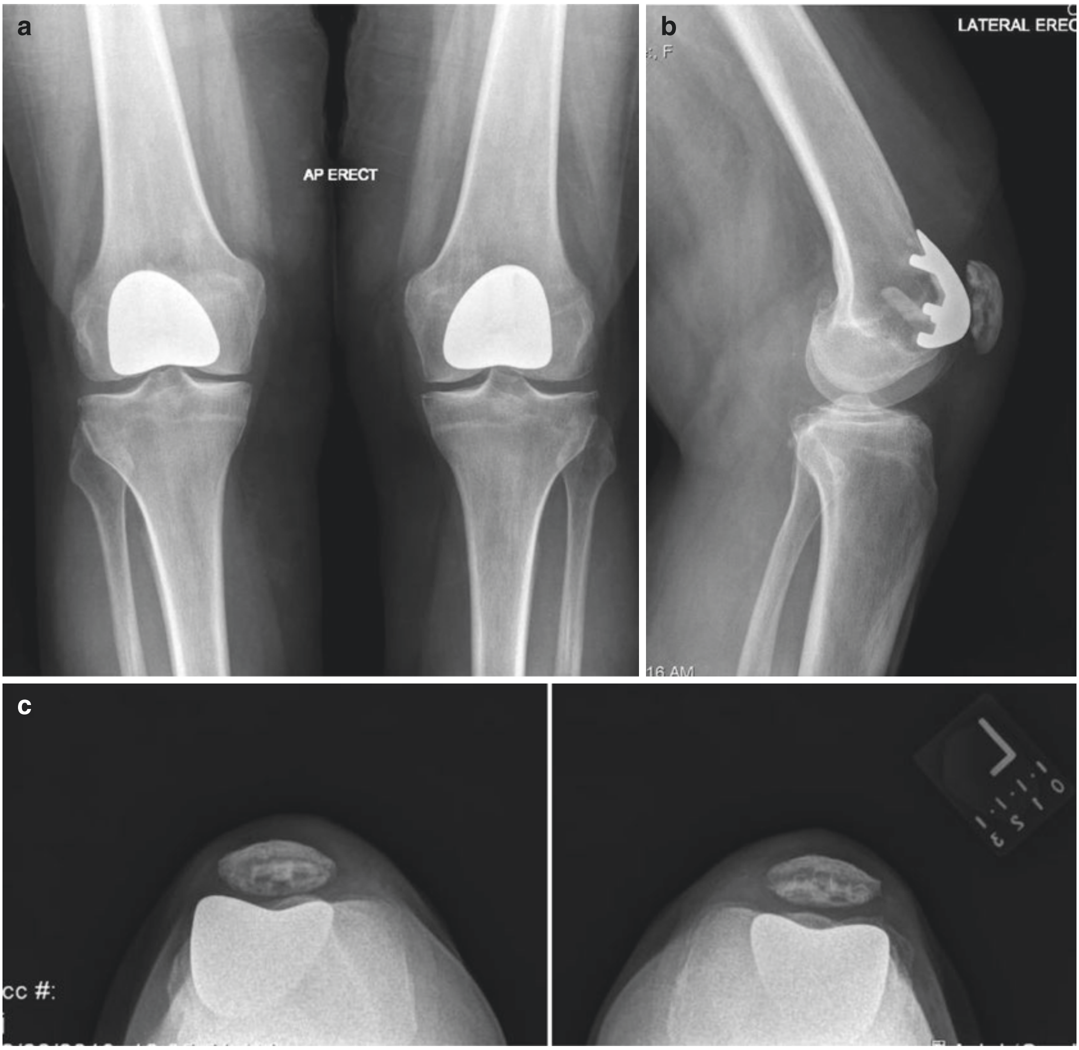

Fig. 10.4 (**a**–**c**) Postoperative AP, lateral, and sunrise radiographs after PFA with an onlay-style trochlear component positioned perpendicular to the AP axis of the femur, with good patellar tracking

ary surgery or revision, whereas those who had a second-generation implant, using an "onlay design," had an incidence of patellar maltracking of less than 1% [37]. Metcalfe et al., in the largest series to date, examined a total of 558 cases of PFA with an onlay-style prosthesis, using the United Kingdom National Joint Registry (NJR). The authors collected data from PFA performed over nearly two decades (1996–2014) and correspondingly had 2- to 18-year follow-up. They reported good functional outcomes by Oxford Knee Score and WOMAC. Their reported revision rate was 21.7% (105/483), of which the majority (58%) were for progression of tibiofemoral OA. The authors found that survivorship improved through the course of the study period, with 9-year survivorship of 91.8% for cases performed in the latter 9 years. They hypothesized that some of the observed effect may have been related to advances in instrumentation, surgeon experience, and refinement to surgical indications. Interestingly, the individual surgeon was found to have the most significant impact on revision rate. Again, this argues that technique and/or surgical indications may play a large role in improved survivorship in their registry data. Recent evidence regarding the outcomes of PFA is summarized in Table 10.2.

In the analysis of treatment strategies for PF OA, it is useful to consider the results of PFA compared to TKA. One retrospective study compared outcomes in 45 patients undergoing PFA or TKA at mean 2.5-year follow-up. They found similar Knee Society and pain scores, but the PFA group had significantly higher activity scores [38]. A recent meta-analysis of 28 studies compared complications with PFA and TKA performed for isolated patellofemoral arthritis. The authors found an eightfold higher likelihood of re-operation and revision for all PFA compared to TKA. However, when comparing second-generation onlay prostheses only, no significant differences in re-operation, revision, pain, or mechanical complications were found, indicating a significant effect of implant design and rotational positioning of the trochlear component.

Table 10.2 Results of patellofemoral arthroplasty (PFA)

Series	Implant utilized	Study size (No. of knees)	Average age (years)	Average follow-up (years)	Clinical outcome	Revision
Nicol et al. [28]	Avon (Stryker)	103	68 (46–84)	7.1 (5.5–8.5)	N/A	14% (14/103)
Ackroyd et al. [41]	Avon (Stryker)	109	68 (46–86)	5.2 (5–8)	Median Bristol pain score improved from 15 to 35 points at 2 years; mean Oxford score improved from 19 to 38 at 2 years and 40 at 5 years. 14 (4%) had residual anterior knee pain	3.6% (11/109), 5 patients required MUA
Mont et al. [29]	Avon (Stryker)	43	49 (27–67)	7 (4–8)	Significant improvement KSOS score from 64 to 87; KSFS score from 48 to 82	11.6% (5/43); all were revised to TKA for tibiofemoral progression
Dahm et al. [33]	Avon (Stryker)	59	56 ± 10.4	4 (2–6)	Significant improvement in KSFS from 56 to 78; KSPS 51–90. Significant improvement to Tegner activity level from 2 to 4; and UCLA activity score from 3.4 to 5.8	3% (2 of 59); both revised to TKA for tibiofemoral progression; re-operation with arthroscopic procedures in 2 additional patients
Liow et al. [10]	High-performance partial knee (DePuy)	51	52.7 ± 7.5	41. (2.2–6.1)	Significant improvement in Melbourne knee score, KSOS, KSFS, and PCS at 2 years. Overall, 76% excellent/good function at 2 years	7.3% (4/51); 3 for OA progression, 1 for patella maltracking
Kazarian et al. [15]	Gender solutions PJR (Zimmer)	70	50 (36–80)	4.9 (2.3–7.4)	57% satisfied or very satisfied by KSS Significantly improved original KSS knee (55–88) and function (39–85) scores	4% (2/70); 1 converted to TKA, 1 underwent additional UKA
Metcalfe et al. [31]	Avon (Stryker)	483	58.8 (25–92)	Minimum 2 years (2–18 years)	Median postoperative Oxford knee score was 35, WOMAC was 35 at 2 years	21.7% (105/483); 4 to revision PFA, 90 to TKA, 11 to unknown implant

Abbreviations: *KSOS* Knee Society Objective Score, *KSFS* Knee Society Functional Score, *KSPS* Knee Society Pain Score, *PCS* Physical Component Score, *KSS* Knee Society Score, *WOMAC* Western Ontario McMaster Universities Osteoarthritis Index

On subgroup analysis, first-generation inlay-style prostheses had over four times higher rates of significant complications than second-generation onlay prostheses, likely biasing the overall results. These data indicate that modern onlay-style PFA and TKA likely have similar rates of complications in this patient population [39].

To date, there are very little prospective data comparing PFA with TKA in patients with isolated patellofemoral OA. Recently, Odgaard et al. reported their results from a randomized controlled trial examining this issue. Patients with isolated patellofemoral OA were identified by clinical and radiographic assessment and randomized to receive either an onlay PFA or a TKA. The patients and clinical evaluators were blinded (for the first year), and various patient outcome measures were collected at regular follow-up visits up to 2 years postoperatively. The authors found significantly improved clinical outcomes (SF-36 body pain, KOOS symptoms, and Oxford Knee Score) in the PFA patients at 2 years. No patient-reported outcome (PRO) favored conventional TKA at 2 years, but KOOS scores and knee ROM were significantly more improved in the PFA group compared to the TKA group. Overall, there was no statistically significant difference between PFA and TKA in regard to risk of revision, although the authors reported that one patient had PFA revision and one patient had conversion to TKA [35].

Beyond implant design features, several studies have highlighted features that may lead to more durable results, on the one hand, or lead to failures or dissatisfaction, on the other hand. Several studies found that patients who undergo PFA for treatment of patellofemoral arthritis secondary to patellar malalignment, trochlear dysplasia, or prior patellar fracture have a diminished likelihood of failing due to progressive tibiofemoral arthritis compared to those with primary PF arthritis, as long as patella tracking is optimized prior to or during PFA surgery [40]. Nicol et al., for instance, reported a 14% revision rate, largely related to progressive tibiofemoral OA, in a consecutive series of 103 patients followed up for a mean of 7.1 years. They noted that the revision rate was significantly higher in patients with patellofemoral OA in the absence of trochlear dysplasia [28].

Obesity and elevated BMI have also been shown to be risk factors for poorer functional outcomes and increased risk of revision [10, 11]. These studies justify the inclusion of isolated trochlear dysplasia as an indication for PFA and obesity as a relative contraindication. Finally, patients with low mental health scores have now been shown to have suboptimal outcomes after PFA. Using the strict selection criteria and surgical technique outlined above, Kazarian et al. found significant improvements in the mean knee range of motion and Knee Society Knee and Function scores at an average 4.9 years of follow-up after PFA with a modern onlay-style design. Less than 4% of patients required revision arthroplasty, all for progressive tibiofemoral arthritis, and none for patellar maltracking. No components were loose or worn at most recent follow-up. Despite these improvements, while patients with high mental health scores were satisfied and had their expectations met, those with poor mental health scores tended to be dissatisfied with their outcomes and their expectations were not met, suggesting that patient mental health may be a valid selection criteria for PFA [15].

Summary

Patellofemoral arthroplasty (PFA) has been shown to be a durable and effective treatment in patients with isolated patellofemoral osteoarthritis (PF OA), with or without trochlear dysplasia. Historically, design limitations were associated with early failure related to patellar maltracking and subluxation. The development of onlay-style implants has significantly improved clinical outcomes and survivorship of PFA. As a result, with onlay-style implants, the most common etiology for failure after PFA is progression of tibiofemoral OA. In patients with medial or lateral tibiofemoral chondromalacia in addition to PF OA, performance of cartilage grafting or bicompartmental knee arthroplasty (BiKA) may be considered. Notably, with the use of modern implants, clinical performance and survivorship

now compares favorably to total knee arthroplasty (TKA) and may demonstrate superiority in certain clinical measures and patient-reported outcomes (PROs). As always, diligent patient selection is paramount to ensure successful outcomes after PFA; careful consideration should be given when discussing PFA with patients with elevated BMI, chronic opioid use, and comorbid mood disorders. With careful patient selection, meticulous technique, and modern onlay-style trochlear implants, excellent outcomes should be anticipated after PFA.

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