Patellofemoral joint arthroplasty

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Abstract

Isolated patellofemoral osteoarthritis (PFOA) is symptomatic in around 10% of people aged over 55 years. This article presents a review of the treatment of PFOA with isolated patellofemoral arthroplasty (PFA). PFA has evolved in patient selection, surgical technique and implant design since its inception in the 1950s. Despite good clinical outcomes and survivorship being reported in the literature from a number of implants, PFA still remains a controversial subject due to high revision rates reported from large registries such as the National Joint Registry (NJR). Whilst patient selection and intra-operative techniques to optimize extensor mechanism function and avoid dynamic 'overstuffing' of the patellofemoral joint are key to the success of PFA, they are often overlooked. More recently, concomitant procedures to address patellar instability, tibiofemoral malalignment and patellofemoral malalignment have been performed to optimize PFA outcomes. With attention to detail in patient selection and surgical technique, using appropriate implants, PFA can lead to improved clinical outcomes and high survivorship for the treatment of isolated severe PFOA.

Keywords clinical outcome; patellofemoral arthroplasty; patellofemoral osteoarthritis; surgical technique

Introduction

Isolated patellofemoral osteoarthritis (PFOA) has been reported to be symptomatic in 8% of women and 2% of men over 55 years,[1] with radiological changes in 14% of women and 15% of men older than 60 years (Figure 1).[2] The clinical profile of radiologically confirmed severe isolated PFOA is distinct from tibiofemoral OA and is indicated by a history of patellar instability, chronic mistrust of the patella and anterior knee pain on inclines and stairs, particularly during descent. In addition, there are often episodes of considerable effusion, which may be associated with posterior pain, valgus malalignment, markedly reduced quadriceps strength and pain on patellofemoral joint (PFJ) compression.[3] The aetiology of PFOA is complex and multifactorial, with biomechanics and the morphology of the joint thought to contribute to disease severity. Women have increased patellofemoral contact pressures, which may contribute to the increased incidence of PFJ disorders in women.[4] Anterior knee pain in adolescence has traditionally been thought of as a benign condition that is often dismissed in orthopaedic clinics. Recent work has shown that a history of adolescent knee pain makes an individual 7.5 times more likely to develop PFOA, and experiencing a patellar dislocation increases the likelihood of severe PFOA by over three times.[5] This suggests that the prerequisites for future PFOA are displayed in patients presenting to the orthopaedic department at an age when we may be able to intervene; but as yet we are reliant on treating by first principles and basic biomechanics evidence. Patella alta and trochlea internal rotation have also been associated with the structural features of isolated PFOA,[6] and an increased risk of worsening PFOA over time.[7] Trochlear dysplasia, both in classic reduction of the coronal groove and the more recently acknowledged reduction in trochlea length in the sagittal plane, changes the forces transmitted within the PFJ and may well predispose to future PFOA.

Similar to tibiofemoral OA, conservative management is the essence of the initial treatment of PFOA. The majority of patients with isolated PFOA can be managed conservatively, with weight loss and quadriceps strengthening exercises being the mainstay of treatment,[8] whilst patellar taping and patellar bracing also have the potential to also alleviate symptoms.[9] Understanding the recruitment of core muscles and the role of hamstring-quadriceps balance is vital in the non-operative management of PFOA. Imagine a single-leg stance with poor core and gluteal muscle recruitment, such that the pelvis tilts. The subsequent dipping on single leg stance will create an apparent increased knee valgus, which is a detrimental factor for the exacerbation of PFOA. Similarly, an overtight hamstring, often coupled with reduced quadriceps strength, biomechanically increases PFJ forces, which may tip the balance in a failing PFJ. Gait re-education can play a vital part, particularly looking at the relative contributions of the hip and knee joint to the combined flexion of the lower limb; knee dominant patients over-flex their knees and spare their hips, whereas hip dominant patients keep their knees straight and bend at the hip. Consequently, by training patients to use their 'redundant' hip joint, knee dominant patients can reduce the forces in their overloaded PFJ.

Once conservative management options have failed, a decision needs to be made regarding surgical management. In early PFOA in young patients with appropriate trochlear morphology there is an option to perform biological treatments such as trochleoplasty, tibial tubercle osteotomy and chondral regenerative techniques. However, once severe PFOA is established, the aim should be to balance benefit *versus* risk and to target surgical treatment to the patients' symptoms, ideally starting at the least invasive end of the surgical ladder. Surgical treatments include arthroscopic lateral facetectomy, tibial tubercle osteotomy (distalization +/− usually medialization and anteriorization), patellectomy (historic), patellofemoral joint arthroplasty (PFA) and ultimately total knee arthroplasty (TKA). These procedures all have potential negative connotations, and replacement of the patellofemoral joint, properly done on a well-aligned extensor mechanism, is most attractive when both the patellar and trochlear cartilage are deficient (Figure 2).[10] The implant used for arthroplasty is subject to debate, with poor outcomes from

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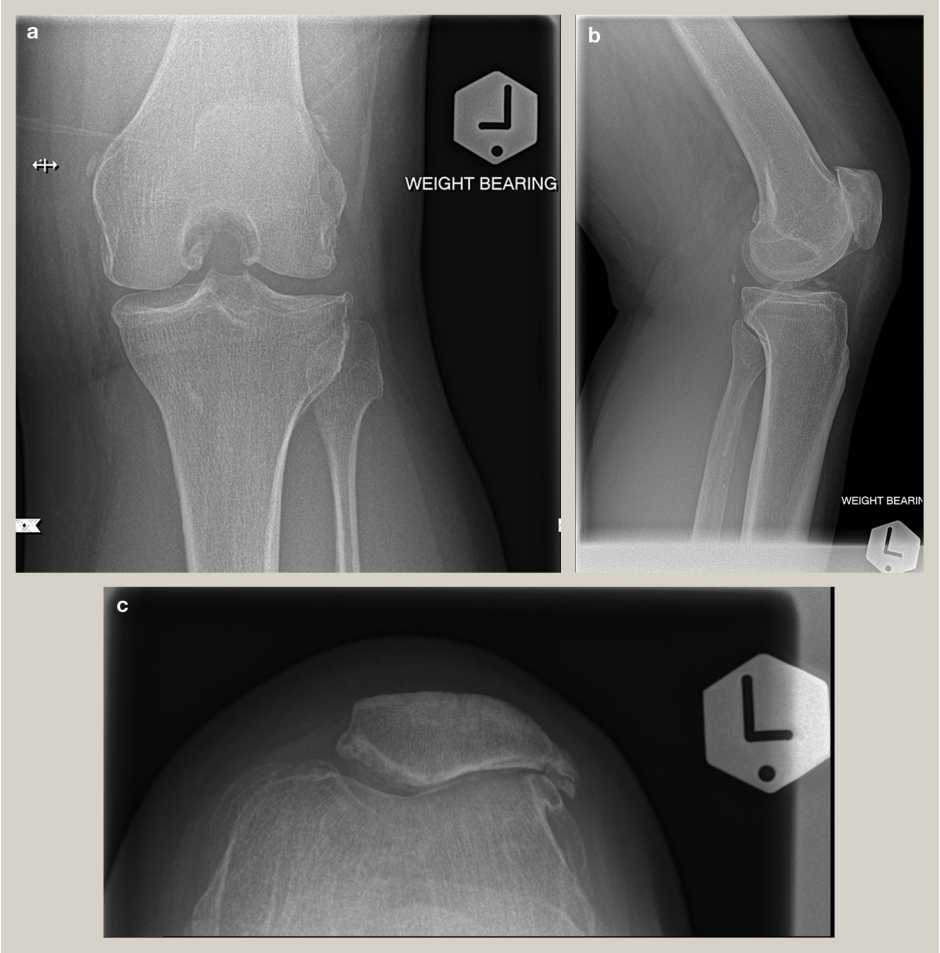

Figure 1 (**a**) Weight-bearing Rosenberg, (**b**) Lateral and (**c**) Merchant radiographs, demonstrating lateral facet patellofemoral osteoarthritis with a well-preserved tibiofemoral articulation.

traditional PFA making it a controversial procedure. A dichotomy of opinion has therefore evolved, with some surgeons choosing to use a familiar TKA and others a less invasive PFA.[11] The option of performing TKA is often preferred, due to lower revision rates compared with PFA,[12,13] but the ability to perform PFA has many potential benefits, particularly in younger patients. Following PFA, the patient should have kinematics and a range of motion that resemble the natural knee.[14] Patients treated with PFA show improved function and return to activity, with less blood loss, fewer complications and shorter hospital stays following surgery, compared to TKA.[15] Recently, the differing rates of patient mortality between unicompartmental knee arthroplasty (UKA) and TKA have been documented.[16,17] It would be reasonable to extrapolate the reduction in mortality demonstrated in these studies to PFA also, although this is as yet unproven. It is for these reasons that PFA was developed and has evolved as a treatment option for extensive severe isolated PFOA.

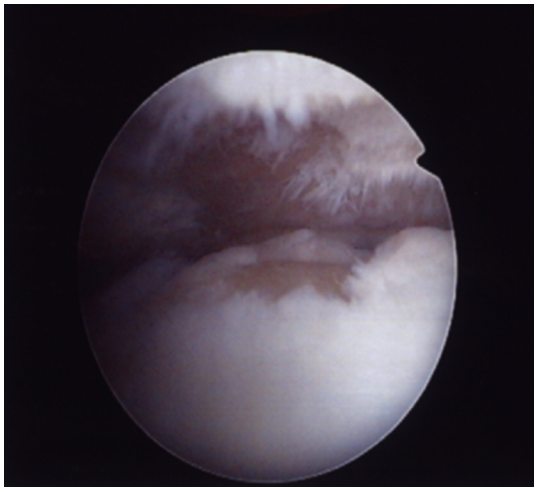

Figure 2 Arthroscopic view of severe patellofemoral osteoarthritis.

History of PFA

The development of PFA commenced in the 1950s, as McKeever reported on his series of 39 patients treated with patella resurfacing using a Vitallium prosthesis.[18] The prosthesis was developed as an alternative to patellectomy, which was the common treatment for fracture or isolated degenerative change of the patella at the time. The patella cap prosthesis was designed to mimic the native patellar articular cartilage, with three facets present, but it did not address trochlea disease (Figure 3). A minimum 4-year follow-up case series reported a good or

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