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Replacement for patellofemoral arthritis

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ABSTRACT

Background: Patellofemoral osteoarthritis (PFOA) is relatively common, affecting 24% females and 11% males over the age of 55 years. Most patients can be treated conservatively. Arthroplasty remains the ultimate procedure for end stage PFOA. Debate continues as to whether total knee replacement (TKR) or patellofemoral replacement (PFR) is better for this group of patients. The aim of this article is to review the current evidence for use of these two procedures in this condition.
Methods: Recent meta-analyses, systematic reviews and appropriate cohort publications concerning surgical management of PFOA were sourced. A cohort of patients from the authors' own institution was also reviewed. An instructional lecture was then created and delivered at the British Association for Surgery of the Knee 2019 annual conference, on behalf of the British Patellofemoral Society. This article has been written based on this lecture.
Results: It is clear that PFOA is a different disease process than tibiofemoral osteoarthritis (TFOA). There is no doubt that PFR has a higher failure rate than TKR, but evidence suggests that outcomes and recovery may be better in the PFR group. This is complicated by subsets of those with PFOA faring better than others, the reasons for which are likely to be multifactorial.
Conclusions: Both PFR and TKR may be used appropriately for PFOA. In keeping with a shared decision-making process, patients should be counselled appropriately preoperatively when deciding between these procedures. Further research is required to understand the differences in outcome between procedures and in subsets of patients with PFOA.

1. Introduction

Patellofemoral osteoarthritis is relatively common, affecting 24% females and 11% males over the age of 55 years [1]. There is a distinct relationship with the presence of patellofemoral dysplasia and a history of instability. Most patients will manage with conservative treatment and they are less likely to progress to arthroplasty than those with tibiofemoral wear; as activities are easier to modify, which offload the patellofemoral compartment, without significant loss of function.

Surgical treatment consists of both arthroplasty and non-arthroplasty options. Options for the latter are limited and this review will restrict itself to discussion concerning arthroplasty only. The indications for arthroplasty in patellofemoral arthritis are signif-

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icant symptomatic pain and/or instability due to dysplasia, where there is bone on bone contact within the compartment. Surgery should only be undertaken when all conservative treatment options have been exhausted and the patient wishes to undergo surgery having understood the risks and benefits. They should also be fit for surgery and be able to comply with post-operative rehabilitation [1,2].

Options for arthroplasty include a total knee replacement or a patellofemoral replacement. Compared with total knee replacement (TKR), a patellofemoral replacement (PFR) is said to be safer with regard to mortality and risk of complications, has a faster recovery rate leaving better function and conserves bone leading to an easier revision procedure if required [1]. Patellofemoral replacement is contraindicated in inflammatory joint disease and in the presence of tibiofemoral wear. It is also not recommended in the presence of a fixed flexion deformity or where the patella is unstable in flexion. The patella may or may not be resurfaced, but certainly should not be if there is insufficient bone stock or, clearly, where a patellectomy has been performed previously. There is debate as to whether a TKR or PFR is the best procedure for patellofemoral osteoarthritis, as PFR is often quoted as having a higher failure rate than TKR [3]. What is not clear is whether the reason for a higher failure is dependent on the implant itself or the ability of the implanting surgeon, which relates to their surgical skills and clinical judgement in patient selection. Rarely assessed in these discussions are the functional outcomes of these patients, along with outcome across their lifetime especially regarding revision surgery. Perhaps the commonest reason a surgeon undertakes a TKR rather than PFR is that they have never learned to undertake the latter procedure.

This review will assess the evidence comparing TKR versus PFR for patellofemoral arthritis. It will look at both survivorship and patient related outcome measure (PROM) data within the literature and compare this to the authors unit's results. The references used are those that compare TKR with PFR or those that assess subsets of patients undergoing PFR. Review articles have been quoted from which the original papers may be sourced by the reader if desired. This paper is based upon an instructional lecture delivered at the British Association for Surgery of the Knee (BASK) 2019 annual conference on behalf of the British Patellofemoral Society.

2. Survivorship after arthroplasty for patellofemoral arthritis

Patellofemoral replacement is much less commonly performed compared with total knee replacement or unicompartmental knee replacement (UKR) within the UK. In 2018 the number of knee replacements performed in England and Wales was 99,093 with 86% cemented TKRs, 11% UKRs and one percent PFRs [4]. There is a difference in demographics with those undergoing a PFR being much younger (median age 58), compared with TKR (median age 70), with a higher proportion of females (78%). It is clear that the overall failure rate of PFR at 10 years is much higher (18.9%) than that for UKR (11.1%) or TKR (3.4%). Some of this may be explained by the demographics, with those under 65 have a much higher failure rate than those over 75, an effect much more pronounced in males. Of interest is that Metcalfe's study demonstrated a gradual reduction in age at replacement over the 15 years of study, indicating that survivorship may not be the only factor at play in deciding to offer a PFR [5]. Most of the disparity in failure rates will, however, be due to either the implant or underlying disease process. Unfortunately the National Joint Registry (NJR) does not record the affected compartment within the indications for surgery, so for the most part comparison can only be made for results between PFR for patellofemoral osteoarthritis (PFOA) and UKR/TKR for tibiofemoral osteoarthritis (TFOA). It is however possible to make inferences from subsets of patients analysed within the NJR, before reviewing other areas of the literature.

A stark difference is evident for the rates of re-revision after PFR which is dependent on the time to first revision. Failure rates at 10 years of the revision procedure range from approximately 25% for those first revised within one year of the primary procedure, which falls to about six percent for those first revised after five years [4]. Strickland reviewed the reasons for failure in these time periods and identified that those failing early were due to infection, pain and mechanical reasons, whereas those failing late were predominantly due to tibiofemoral joint disease progression, with implant failure being rare in PFR [1]. It is clear from this that the early failures are mostly technical in nature and will relate to patient selection and/or technical ability of the surgeon. This may be mirrored in the finding also by Strickland that the results of cohort studies are almost universally better than registry data, where these studies are often undertaken based within the units of designing or early adopting interested surgeons [1].

The NJR also indicates that only around five percent of surgeons undertake more than 10 PFRs per annum [6]. Therefore one must question, with such low volumes of procedures being undertaken, whether the high failure rate of PFRs is due to poor performance of the low volume surgeon. However, review of the NJR funnel plot for revision rate by surgeon for the whole of the dataset since 2003 reveals not only several low volume surgeons with a high revision rate but also two high volume surgeons that are outlying at the 95% confidence interval [7]. Metcalfe reviewed their own unit's data and identified that the strongest effect on revision was the operating surgeon, although did not state if this was dependent on volume or not [5]. They also found that survivorship improved over the period of the study which was independent of the age, sex or diagnosis for each patient. Clearly the variation in failure rate is multifactorial especially where NJR data is concerned. What is evident is that for the low-volume surgeon a high revision rate will be masked within their overall knee revision figures, and for the high-volume surgeon they may become an overall outlier even if not an outlier within each subgroup. The only way for surgeons to improve their practice is to ensure that they monitor their results regularly, using the tools provided by the appropriate registry used in their country of practice.

One confounding factor concerning aggregated data within the NJR, which started collecting data in 2003, is the use of multiple implants. The first-generation PFRs (1975–2008) were of in-lay design, with the position determined by an often dysplastic trochlea, they were narrow and had little proximal extension. These were abandoned due to a high failure rate due to mal-

tracking, patella instability and patella catching. The second-generation designs (1990s onwards) are of on-lay type, replacing the trochlea in a position chosen by the surgeon with a much flatter profile [1]. The NJR clearly demonstrates that there is a difference in survivorship between even the second-generation designs, whether this is due to the implant or the surgeon choosing each implant is not clear [4].

Ideally a good quality randomised controlled trial (RCT) should answer many of the questions raised. However only one such trial exists of 100 quasi blinded patients to TKR vs PFR with published follow-up at two years [8]. The number of patients and follow-up period prevented a comparison of survivorship. They did however find, up to two years, the PROMs better in the PFR group along with a faster recovery, but equal complication rates. Clement undertook a propensity matched study of 108 patients and found for PFR a shorter length of stay (1.8 days), higher satisfaction but a lower 10-year survival which was not significant [9]. Bunyoz et al. [3] undertook a systematic review of TKR vs second generation PFR that included the use of a variety of outcome measures all of which yielded similar results for each measure for each procedure. They confirmed a higher failure rate for PFR raising the difficulties in patient selection. In Strickland's review [1], PFR compared with TKR was found to have a higher revision rate (especially for first generation implants), similar complication rates, but faster recovery. They also found that conversion of a PFR to TKR was superior to revision of a primary TKR performed for PFOA. Overall PFR was more expensive than TKR but more effective, however a 24.5% reduction in revision rate would also tip the cost benefit towards PFR.

3. Patient related outcomes after arthroplasty for patellofemoral arthritis

On this evidence it is clear that PFR has a higher revision rate but appears may confer better symptomatic relief and functional outcome. The work presented so far only reviews the procedure without taking into account the underlying pathology. Broadly speaking patellofemoral arthritis may occur in patients ranging from normal anatomy to severe dysplasia, with problems occurring both within (e.g. trochlear dysplasia/lateral femoral condylar hypoplasia) and out with (e.g. limb rotational abnormalities) the joint. Patients may also have a varying degree of joint hypermobility, especially those who have experienced dislocations in the past. For those with normal anatomy the pattern of wear tends to be more generalised and can be related to other pathologies, such as previous fractures and chondrocalcinosis.

Two studies have made efforts to identify patients who fare better with PFR. Metcalfe et al. [5] reviewed 558 implants over an 18 year period and identified that the younger patient (<50 years) had the lowest improvement in Oxford Knee Score (OKS). Also those with a diagnosis of anterior knee pain, previous trauma and medial facet disease fared worse. Middleton et al. [10] reviewed 103 implants and found that the lowest revision rates were in those with dysplasia (with or without previous dislocation). Those with normal anatomy or previous dislocation had better OKS at their most recent review compared with those with only dysplasia. Little other work has been undertaken to date to compare outcomes between these groups.

4. Authors unit's results after arthroplasty for patellofemoral arthritis

The Knee unit at Stepping Hill Hospital, Stockport was an early independent adopter of the Avon PFR, starting procedures in 1999. All patients listed for a PFR were followed up in keeping with the Trust's policy on introduction of new procedures at that time. This group has been reviewed and comprises of 286 implants in 227 patients, with 220 receiving a PFR and 66 a TKR, of whom 83% were converted due to tibiofemoral disease identified leading up to or at surgery. Although not an RCT this cohort permits comparison of PFR with TKR for PFOA and at the very least gives an indication of how patients perform if conversion is required. These groups have also been compared with those receiving a TKR (210 patients) or UKR (75 patients) for tibiofemoral disease performed at the same centre [11] and a normal reference group of those without knee arthritis (349 individuals) [12].

Patients receiving a PFR were slightly younger than those with a TKR for PFOA (61 years vs 67 years). However, the female to male ratio was similar between the groups at 6:1, a ratio much greater than recorded within the NJR [4]. The length of stay was much shorter for PFR in the first decade (4.9 vs 6.4 days), which was reduced in the second decade with the inception of an enhanced recovery programme (3.4 vs 5.4 days). Nearly 50% fewer patients were listed for PFR in the second decade with no difference in the age/sex profile or ratio of procedures ultimately performed, the reasons for this are not clear.

Table 1
Topics to cover counselling patients when making a shared decision between a TKR and PFR.

Surgery should be avoided until unable to cope despite conservative treatment
The outcome of PFOA is worse than TFOA irrespective of procedure
The aim of surgery is to improve pain and if present instability
Improvement in function is variable
There is a 25% conversion rate to TKR and this must be accepted preoperatively
PFR yields slightly better outcomes (PROMs/kneeling ability) than TKR for PFOA
PFR is better with respect to recovery and LoS
The failure rate of a PFR is greater than a TKR
It is easier to convert a PFR to TKR than revise a TKR and the results are satisfactory
Patients should be encouraged to review a surgeon's own data

All patients were invited to complete a questionnaire preoperatively, then at one, five, 10 and 15 years post-operatively. Scores included the OKS, Kujala score, University of California Los Angeles (UCLA) activity score, Tegner activity score and Visual Analogue Scale scores. It has been identified that the one year OKS is representative of the patterns of the other scores measured, unless otherwise stated. The one year OKS in the Stockport group matched those for Clement [9] and Metcalfe [5]. The PFR scores were similar to TKR for PFOA, however neither scores improved as much as they did for either a UKR or TKR for TFOA [11]. Those with a UKR for TFOA were most likely to approach a normal knee score followed by a TKR for TFOA, then those receiving any replacement for PFOA [11,12]. In those patients with PFOA older than 70 there was a trend for better scores; also in this group improvement in UCLA activity scores was better than the younger patient irrespective of the type of replacement. Patients with a PFR were 50% more likely, than a TKR, to report being able to kneel with moderate difficulty or better. Those receiving a PFR with previous dislocation were much younger (45 years) compared with dysplasia (57 years) and normal anatomy (61 years). The pattern of improvement in OKS of these groups was similar to that reported by Middleton [10].

The patella was not resurfaced in eight patients; where in three it was too thin, two had previously had a patellectomy and in three the surfaces appeared pristine at surgery. Irrespective of procedure those with patella resurfacing had a greater improvement in OKS than those who did not.

Of the 220 PFRs performed 25 have been revised at a mean of 6.2 years following primary procedure. The initial OKS improvement for these patients was not as good as PFRs that remain unrevised. In the revised group the OKS fell to a similar level prior to PFR, but one year following revision their scores matched that of the overall one year post-PFR group.

5. Conclusions

From the limited literature and work at Stockport it is clear that PFOA is a different disease process than TFOA, with worse outcomes irrespective of the procedure performed. Patellofemoral replacement has a shorter length of stay, quicker recovery with better kneeling ability and appears to yield better PROMs and activity levels, certainly in the older patient. Those with abnormal anatomy seem to have slightly worse outcomes which may be age related, however results seem better when symptoms include instability. Clearly the patella is not always replaceable but perhaps all those that are replaceable should be replaced. Registries show that revision rates following PFR are higher than TKR, however conversion of a PFR to TKR appears to yield satisfactory results. Based on the current evidence there are clear differences between the available procedures. In keeping with a shared decision-making process, patients should be counselled appropriately preoperatively when deciding between these procedures, along with the usual pros and cons of joint replacement surgery, Table 1.

Further research is required to compare conservative versus operative treatment for PFOA, and between a PFR and TKR for the surgical group. There needs to be a greater understanding of the effect of the underlying pathology, along with exploration as to why there is wide variation in results between surgeons.

It is very likely that with the right surgeon the results of PFR for PFOA will be better than TKR, because they will not only perform the procedure well and at the right time, but they will also make the right implant choice. In addition, they are likely to be working in an appropriate environment with good governance procedures in place. Finally, it is also likely that for the average surgeon patients with PFOA will fare better with a TKR.

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Ethical committee approval was not required for the production of this review article.

Declaration of competing interest

There are no conflicts of interest with respect to the publication of this article.

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