Patellofemoral Joint Arthroplasty: Our Experience in Isolated Patellofemoral and Bicompartmental Arthritic Knees

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ABSTRACT

INTRODUCTION: Isolated patellofemoral (PF) arthritis is rare, and there is no complete agreement about the best surgical treatment. The operative treatments are total knee arthroplasty and patellofemoral replacement (PFR). The incidence of many early complications of PF arthroplasty has decreased with the introduction of newer designs. Nowadays, the main cause of revision surgery is the progression of tibiofemoral osteoarthritis. In the past, PF arthroplasty was contraindicated in patients with evidence of osteoarthritis or pain in medial or lateral tibiofemoral compartments. The improvement in implant designs and surgical techniques has allowed the addition of a monocompartmental arthroplasty for the medial or lateral tibiofemoral compartment. In this work, we evaluate our first experience with PF arthroplasty and its combination with unicompartmental knee arthroplasty.

MATERIALS AND METHODS: From May 2014 to March 2016, we treated 14 patients. An isolated PF arthroplasty was performed in six knees (five patients), and a combined PF and unicompartmental knee arthroplasty was performed in nine cases. We observed a significant improvement in the clinical and functional Knee Society Scores (KSSs) after surgery in our patients.

RESULTS: We obtained good results in our cases both for clinical and functional KSSs. Patellar clunk was recorded in one case.

DISCUSSION AND CONCLUSION: We are going toward a new attitude in which partial osteoarthritic changes could be treated with partial resurfacing prosthetic solutions such as unicompartmental, bi–unicompartmental or PFR alone, or unicompartmental combined, which respects the cruciates and achieves maximal bone preservation, which is vital, particularly, for young patients.

KEYWORDS: patellofemoral arthritis, patellofemoral joint arthroplasty, total knee arthroplasty, bicompartmental knee arthroplasty

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Introduction

Osteoarthritic changes of the knee, whether primary or post-traumatic, do not always involve all three compartments (tibiofemoral medial and lateral and the patellofemoral (PF) ones).

Isolated PF arthritis is relatively rare. Some authors in fact reported that in patients older than 55 years with symptomatic knee osteoarthritis, it has an incidence of 2% in males and 8% in females.[1,2] Moreover, there is no complete agreement about the best surgical treatment. The risk factors for a future PF osteoarthrosis are a history of adolescent anterior knee pain, trochlear dysplasia, traumas, obesity, patella alta, or a history of recurrent PF instability.[3] The treatment options can be divided into non-operative and operative treatments. Among the former ones, there are physiotherapy, taping and intra-articular injections, or viscosupplementation. These types of interventions do not ensure long-term results, and the evidence in their support is poor.[4]

The operative treatments are total knee arthroplasty (TKA) and patellofemoral replacement (PFR). TKA has been used in treating isolated PF osteoarthritis with a reasonable success; however, anterior knee pain continues upward in 19% of patients.[5,6]

The correct patient selection is very important in order to succeed and avoid complications. The indications are primary or post-traumatic PF osteoarthritis or PF arthritis associated with trochlear dysplasia and patellar subluxation. The contraindications are chondrocalcinosis, tibiofemoral alignment defect, and inflammatory joint disease. Obesity with a body mass index (BMI) >30 kg/m^2 leads to a poor prognosis.

Traditionally, PF arthroplasty was contraindicated in patients with evidence of osteoarthritis or pain in medial or lateral tibiofemoral compartments. Nowadays, thanks to the development in implant designs and surgical techniques, several authors have suggested to add a unicompartmental knee

replacement (UKR) for the medial or lateral tibiofemoral compartment, which gives better results. This surgical procedure, in selected patients, enables to spare the central ligament complex and its proprioceptive function. The youngest and more active patients may be eligible for this type of resurfacing surgery. It is a minimally invasive technique because of the tissue sparing; this element leads to multiple goals such as avoiding complications (fat embolism, blood loss, infections, venous thromboembolism), using smaller incisions, and diminishing hospitalization. Moreover, it allows a faster rehabilitation and return to daily activity, resulting finally in a highly functional implant and easier revision surgery, if required.[7]

The indications for UKR are unicompartmental disease (medial or lateral) with mild degeneration of one or both of the other compartments, anatomical axis deformities caused by narrowing of the joint lines during the degenerative bone progression, minimal PF joint arthritis, age >60 years, weight <90 kg, and low to moderate activity level.

The improvement in the outcomes of these procedures leads to an enlargement of the indications. Hence, the relative contraindications are age <60 years, a BMI between 30 and 32, an anterior cruciate ligament (ACL)-deficient knee, a tibial slope <7°, and the presence of PF osteoarthrosis.

Absolute contraindications instead are inflammmatory osteoarthritis, fixed flexion deformity >10°, fixed valgus/varus deformity >10°, ACL deficiency in young active patients, and tibial lateral thrust.

Another advantage of better PF prosthetic designs has been the reduction in revision surgery needs,[8,9] and at present, the main cause of revision surgery is the progression of tibiofemoral osteoarthritis.

Ackroyd et al.[10], in a study with 306 AvonTM implants, found that progression of tibiofemoral osteoarthritis was the most common late complication.

Nicol et al.[11] reported that progression of tibiofemoral osteoarthritis is more common in patients operated for primary PF osteoarthritis.

According to the authors, PFR is considered in isolated idiopathic or secondary PF arthrosis in patients without medial or lateral femorotibial compartment osteoarthritis, without axis deformity, and with a competent ACL.

Axis deformity >5° in varus or valgus can simply lead to femorotibial arthritis.

In these cases, we consider association of a unicompartmental to a PF implant. Medial compartment is the region most affected.

Nowadays, the general opinion is that these procedures can be performed in young patients and in elderly people with several comorbidities, for the good results and the less-invasive surgery if compared with TKA. In our study, we evaluated our first experience with PFR arthroplasty and its combination with unicompartmental knee arthroplasty.

Materials and Methods

From May 2014 to March 2016, we treated 15 knees in 14 patients (Table 1). An isolated PF arthroplasty was performed in six knees (five patients with osteoarthritis), and a combined PF arthroplasty and unicompartmental knee arthroplasty was performed in nine cases.

The diagnosis was primary PF osteoarthritis in two cases, secondary PF arthritis in four cases (one case of post-traumatic arthritis and three cases secondary to PF instability), and bicompartmental arthritis of the knee in nine cases (the UKA implant was medial in seven cases and lateral in two cases).

In the "isolated PFR" group, we selected patients with osteoarthritis grades 3–4 Iwano, while in the "combined PFR and UKR" group, we included patients with osteoarthritis grades 2–4 Iwano for the PF joint and grades 3–4 Kellgren–Lawrence for the tibiofemoral joint.

Each patient was subjected to a clinical examination and radiographic investigations before and after surgery.

We used Sigma Partial knee System with Trochlea and Uni (DePuy) as PF and unicompartmental implants.

The clinical data were analyzed using the Knee Society Score (KSS). Radiological analysis included standard anterior–posterior view, lateral view, and axial view of the patella at 1 and 12 months postoperatively and yearly thereafter. In order to evaluate the stability and the cartilage degeneration, we performed a preoperative magnetic resonance imaging of the knee. The research protocol of this observational, retrospective study was approved via an internal audit by the director of the Department of Orthopaedics and Traumatology, San Luigi Hospital of Orbassano. Patients gave their written, informed consent to participate in the research.

Results

No patients were lost during the follow-up. The mean age of our patients was 62.4 years (standard deviation (SD) 8.7, range 48–77 years). The mean follow-up was 18.6 months (SD 7, range 7–28 months). The mean preoperative clinical KSS was 49.1 (SD 7.9, range 39–65), and the functional KSS was 65.3 (SD 10.4, range 50–80). The postoperative clinical KSS was 84.5 (SD 18.2, range 50–100), and the functional KSS was 95 (SD 10.2, range 60–100).

Regarding the group division, in "isolated PFR" group, the mean age was 53.3 years (SD 3.4, range 48–58 years). The mean follow-up was 20.3 months (SD 6.6, range 7–24 months). The mean preoperative clinical KSS was 50.2 (SD 5.7, range 45–60) and the functional KSS was 60 (SD 13.8, range 50–80). The postoperative clinical KSS was 96 (SD 6.2, range 88–100) and the functional KSS was 98.3 (SD 2.6, range 95–100).

On the other side, in "combined PFR and UKA" group, the mean age was 68.3 years (SD 5, range 61–77 years). The mean follow-up was 17.1 months (SD 7.4, range 9–28 months). The mean preoperative clinical KSS was 48.4 (SD 9.4, range 39–65) and the functional KSS was 68.9

Table 1.

N	DIAGNOSIS	SURGERY	AGE	FOLLOW UP	SEX	SIDE	PREOP. CLINICAL KSS	POSTOP. CLINICAL KSS	PREOP. FUNCTIONAL KSS	POSTOP. FUNCTIONAL KSS
1	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	77	28	M	dx	39	50	75	100
2	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	63	27	F	dx	39	88	70	100
3	Post traumatic artrhtis	PFR (Toclea DePuy)	58	24	F	sn	60	88	80	100
4	Secondary Patellofemural Arthritis (PF instability)	PFR (Toclea DePuy)	53	23	F	dx	45	100	50	100
5	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	65	20	F	dx	65	95	70	100
6	Lateral Compartment Arthrtis + Patellofemural Arthritis	Lateral UKR + PFR (Uni and Troclea De Puy)	67	11	F	sn	55	94	70	100
7	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	61	9	F	sn	44	57	60	60
8	Secondary Patellofemural Arthritis (PF instability)	PFR (Toclea DePuy)	55	7	F	sn	45	100	50	100
9	Primary Patellofemural Arthritis	PFR (Toclea DePuy)	55	21	M	sn	53	100	75	100
10	Primary Patellofemural Arthritis	PFR (Toclea DePuy)	52	24	M	sn	50	100	55	95
11	Secondary Patellofemural Arthritis (PF instability)	PFR (Toclea DePuy)	48	23	F	sn	48	88	50	95
12	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	70	20	F	dx	55	95	75	95
13	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	73	11	F	dx	55	94	75	95
14	Medial Compartment Arthrtis + Patellofemural Arthritis	Medial UKR + PFR (Uni and Troclea De Puy)	68	9	F	sn	45	58	65	95
15	Lateral Compartment Arthrtis + Patellofemural Arthritis	Lateral UKR + PFR (Uni and Troclea De Puy)	71	19	F	sn	39	60	60	90

Figure 1. PF arthroplasty.

(SD 6, range 60–75). The mean postoperative clinical KSS was 76.8 (SD 19.8, range 50–95) and the functional KSS was 92.8 (SD 12.8, range 60–100).

For all the patients, the differences between the clinical KSS before and after surgery ($P = 0.008$) and between the functional KSS before and after surgery ($P = 0.02$) were significant using the Wilcoxon matched pairs test.

In the "isolated PFR" group and in the "combined PFR and UKA" one, the differences between clinical and functional KSS, before and after surgery, were not statistically significant using the Wilcoxon matched pairs test ($P > 0.05$).

The improvement in the clinical KSS was 35.3 and that in the functional KSS was 29.7 for all the patients. In the isolated PFR group, the improvement in the clinical KSS was 45.8 and it was 38.3 for the functional KSS. In the combined PFR and UKA group, the improvement in the clinical KSS was 28.3 and that in the functional KSS was 23.9.

At the clinical examination during follow-up, we observed a complication in only one case, who suffered from pes anserinus tendinitis and experienced a painless patellar clunk.

Discussion

The results of the Wilcoxon matched pair test have shown a significant improvement in clinical and functional KSS scores, and there has been only one complicated case. As a result, our

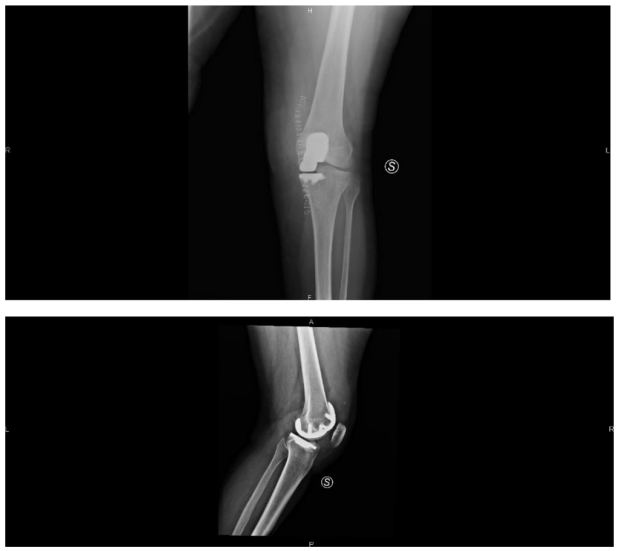

Figure 2. Medial unicompartmental + PF arthroplasty.

procedures gain a better function and restore a free range of movement with less pain.

Although there was an increasing trend in the clinical and functional KSSs, in both groups, the difference between clinical and functional KSSs, before and after surgery, was not significant using the Wilcoxon matched pairs test ($P > 0.05$). In our opinion, the small number of patients could explain these results.

As treatment of the osteoarthritic knee, our surgical philosophy prefers the partial resurfacing to TKA.

UKR and PFR are well-accepted surgical procedures for the treatment of knee arthritis. Furthermore, few surgeons in the world experienced association of different small implants following a philosophy of real less-invasive procedures. Unfortunately, despite the clear advantages of these "small implants" in terms of less-invasive surgery, even in 60-year-old non-obese patients with unicompartmental knee arthritis, some authors still feel TKA as the most reliable procedure.[12]

It is reported that the rate of early postoperative complications is higher for PF arthroplasty than for TKA.[13] Early postoperative complications include persistent anterior knee pain, patellar catching or snapping, and extensor mechanism rupture. The correct positioning of the components may avoid many of these complications. For example, a wrong positioning of the femoral component can be complicated by patellar maltracking or even patellar instability.[10] If the implant used is thicker than the amount of bone and cartilage resected, peripatellar pain may be an early consequence of "overstuffing" the PF joint. A recent study found that patients with the worst functional results had greater increase in patellar thickness following surgery.[14]

Many authors reported excellent results after TKA for the treatment of isolated PF arthritis in elderly patients.

However, in TKA, healthy portions of the knee are sacrificed, including one or both cruciate ligaments, thereby

eliminating normal knee kinematics and proprioception. For both young, active patients and elderly patients with standard functional demand, proprioception is essential for good knee function. TKA, therefore, could be considered overkilled. UKR and PFR are not new concepts and, nowadays, offer alternative surgical solutions to TKA. The new design prostheses improve the results of already used, old-fashioned implants.[1–4]

The association of unicompartmental with a PF implant is one of the hottest topics today. Leaving intact the ACL and treating at the same time the worn PF joint and one of the tibiofemoral compartments may be an attractive option for the modern knee surgeon. The objective of this association is to extend indications for Unis in knees with an intact ACL to preserve the normal knee biomechanics. No reports are present in the literature even if different authors have been using this association since many years.

Our experience is limited to 15 cases (six isolated PFR replacement and nine combined PF arthroplasty and unicompartmental knee arthroplasty), all performed in the last 2 years.

Treatments specifically addressed at the pathologic compartments without loss of normal bone and ligaments result in rapid recovery to normal activity, increased stability, and decreased pain.

We have used one type of PFR implants, and we have used fixed bearing implants in all bicompartmental cases. The choice of design depended upon our knowledge with measured resection implants for unicompartmental replacement and resurfacing with PF implants (Uni and Trochlea DePuy).

Data in literature describe promising results of combined PFR. Two studies involving UKR and PFR procedures have been published.[15,16] The study by Cartier involved a small series of nine patients and reported 100% survival at 12 years, with very good functional outcomes. The 71 patients study published by Parratte and Argenson, however, reported a much lower survival rate (54%) at 17 years and a good level of satisfaction. The authors of this second study underlined the issues related to implant design, the need for accurate patient selection and the problem of crude or absent instrumentation at the time of investigation, and the consequent risk of component malalignment. The authors of both studies concluded that this intervention is technically demanding and requires experience in both UKR and PFR. Currently, as confirmed by our experience, problems of implant design and instrumentation are becoming less commonplace, thanks to the progress made in this field. Much more importance must be given to the selection of patients and to the precision of the surgical procedure in terms of technique and correct knee balance.

Conclusions

The shifting demography of patients with localized knee arthritis, including younger, more active patients, is a major impetus for growing interest in conservative surgical alternatives to TKA such as UKR and PFR.

Small implants and a preserved joint biomechanics could represent a new development in reconstructive surgery.

UKR and PFR are not new concepts, and surgical alternatives to TKA should be considered. New materials, designs, and instruments have improved the clinical outcome and make these options accessible to more patients with a wider range of age. We are going toward a new attitude in which partial osteoarthritic changes could be treated with partial resurfacing prosthetic solutions. Unicompartmental, bi–unicompartmental, PFR alone, or unicompartmental combined respects the cruciate ligaments and achieves maximal bone preservation, which is vital particularly for young patients.

Author Contributions

Conceived and designed the experiments: LS, MS, FA, GF, AM. Analyzed the data: LS, MS, FA, GF, AM. Wrote the first draft of the manuscript: LS, MS, FA, GF, AM. Contributed to the writing of the manuscript: LS, MS, FA, GF, AM. Agree with manuscript results and conclusions: LS, MS, FA, GF, AM. Jointly developed the structure and arguments for the paper: LS, MS, FA, GF, AM. Made critical revisions and approved final version: LS, MS, FA, GF, AM. All authors reviewed and approved of the final manuscript.

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