

## Outcome of Patellofemoral Arthroplasty

AHMED KASHWAA, M.Sc.; ROSHDY EL SALLAB, M.D.; ADHAM ELGEIDI, M.D. and NASER SELIM, M.D.

The Department of Orthopaedic Surgery, Faculty of Medicine, Mansoura University, Egypt

### Abstract

**Background:** Isolated patellofemoral arthritis remains a relatively uncommon but challenging condition to be treated. Patellofemoral arthroplasty (PFA) is an alternative to Total Knee Arthroplasty (TKA) for patients with recalcitrant isolated patellofemoral arthritis.

**Aim of Study:** Prospective comparative study.

**Patients and Methods:** Fifty eight (n=58) knees of 48 patients with isolated patellofemoral osteoarthritis, and divided into 2 groups group A with conservative management, Group B with surgical management. Perioperative circumstances of perioperative complications, operating room time, blood transfusion requirements and length of hospital stay were reported.

Post-operative evaluation was done via WOMAC Score, Oxford Knee Score, and global ROM.

**Results:** The average Oxford score showed that the surgical management had better Oxford score than that of conservative management during the early follow-up up to one year. The surgical management had better ROM than that of conservative management. The surgical management had better WOMAC score than that of conservative management during the entire follow-up.

**Conclusion:** Patellofemoral arthroplasty in treatment of patellofemoral arthritis has a good clinical and radiological outcome. It is associated with few or minor post-operative complications.

**Key Words:** Patellofemoral arthritis – Patellofemoral arthroplasty – Knee pain.

### Introduction

**PATELLOFEMORAL** Arthritis remains a relatively uncommon but challenging condition to be treated. 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].

The causes of isolated patellofemoral arthritis are generally divided into primary and secondary arthritis, the later including trochlear dysplasia, malalignment and post traumatic arthrosis [2].

Non operative forms of treatment of patellofemoral arthritis tend to be ineffective or only provide temporary relief, and many forms of operative treatment have disappointing outcomes. Total knee arthroplasty has been shown to provide effective and lasting pain relief for isolated patellofemoral arthritis [1].

Patellofemoral arthroplasty (PFA) is an alternative to Total Knee Arthroplasty (TKA) for patients with recalcitrant isolated patellofemoral arthritis [3]. Compared with TKA, PFA allows for more normal knee kinematics, proprioception, and range of motion by preserving the tibiofemoral condylar surfaces, menisci, and cruciate ligaments [3]. Given the young age of many patients, improved functionality and activity levels after PFA compared to TKA, and the incidence of persistent anterior knee pain in as many as 19% of patients who undergo TKA for isolated patellofemoral arthritis, PFA has particular relevance [4].

In 1955, Patellofemoral Arthroplasty (PFA) was first described by MacKeever who proposed a vitallium results confirmed by the series of Levitt and Vermeulen et al., was quickly abandoned due to excessive wear of the trochlea [5].

PFA had a rebirth in the 1970, when the Richards prosthesis (Smith-Nephew-Richards) was introduced [6].

The two main types of PF implants are based on the trochlea preparation method: Resurfacing implants and anterior cut implants:

- Resurfacing (first generation) implants simply resurface worn cartilage without significantly

**Correspondence to:** Dr. Ahmed Kashwaa, The Department of Orthopaedic Surgery, Faculty of Medicine, Mansoura University, Egypt

changing the shape of the subchondral bone (inlay technique).

- Anterior cut (second-generation) implants use the same anterior femoral cuts as total knee arthroplasty. (Onlay technique) [6].

Although the clinical results of patellofemoral arthroplasty depend primarily on implant design and surgical technique, careful patient selection with strict inclusion and exclusion criteria, is necessary for good outcomes and long-term survivorship [7].

This study aims was to compare the results of conservative treatment (home exercise program) versus patellofemoral arthroplasty.

### Patients and Methods

#### Study design:

This prospective study was conducted at Knee Surgery, Arthroscopy and Sport Injuries Clinic Unit, Mansoura University Hospitals in the period from 2014 to 2020.

#### Patient sample:

Fifty eight knees (n=58) of 48 patients with isolated patellofemoral osteoarthritis. Cases were divided into two groups;

*Group A:* 29 cases (34 knees) receive conservative management.

*Group B:* 19 cases (24 knees) receive surgical management.

#### Inclusion criteria:

- 1- Anterior knee pain interfering with daily activities:
  - Referred to patellofemoral joint.
  - Unresponsive to non-operative treatment for at least months.
  - Failed prior conservative procedures (arthroscopic debridement, cartilage transplantation).
- 2- Post traumatic patellofemoral osteoarthritis.
- 3- Intact ligaments and menisci.
- 4- Good range of motion 5°->90° of extension, flexion respectively.
- 5- Patellofemoral arthritis stage 3 or 4 according to Iwano classification.
- 6- Tibiofemoral arthritis grade I or II according to Kellgren-Lawrence.
- 7- Normal limb alignment.

#### Exclusion criteria:

- 1- Uncorrected patellofemoral instability or malalignment.
- 2- Uncorrected tibiofemoral mechanical malalignment.
- 3- Stiff knee.
- 4- Systemic inflammatory arthropathy (rheumatoid arthritis ... etc.).
- 5- Chronic regional pain syndrome.
- 6- Active infection.
- 7- Associated tibiofemoral arthritis Grade 3 or 4 according to Kellgren-Lawrence classification.
- 8- Patellofemoral arthritis stage 1 or 2.
- 9- BMI >40.
- 10- HB A1C >8.
- 11- Psychogenic pain.

#### Patient consent:

A written formal consent was obtained from all cases after explaining the details of the surgical procedure as well as any possible complications.

#### Patient preparation:

Clinical, lab and radiological evaluation as WOMAC, Oxford Knee Score, and global ROM. Lab to assess general condition and infection and CT: To obtain measures of anatomical shape and alignment of the patella and trochlea.

#### Procedure:

Under control aseptic measure, patellar and anterior femoral resection were done. The trochlear implant was implanted first. Applied bone cement to the backside of the component and the prepared femoral bone. Placed the trochlear component onto the femur and impact with the femoral impactor until seated. Coat the prepared patella and the patellar component with a thin layer of cement and place the component onto the prepared patella. Pressurize the implant for fixation to the patella using the Cement Clamp.

Perioperative complications, operating room time, blood transfusion requirements and length of hospital stay were documented for all patients.

#### Outcome measures:

Length of hospital stay, WOMAC Score, Oxford Knee Score, Global ROM were used as patient outcome measures at Patient Reported Outcome Measures (PROMs) at different time points (6 weeks, 3 months, 6 months, 1y post-operatively).

*Statistical analysis:*

IBM's SPSS statistics (Statistical Package for the Social Sciences) for windows (version 25, 2017) was used for statistical analysis of the collected data. Shapiro-Wilk test was used to check the normality of the data distribution.

All tests were conducted with 95% confidence interval. *p* (probability) value <0.05 was considered statistically significant. Quantitative variables were expressed as mean and standard deviation, median, inter-quartile range, minimum and maximum as appropriate while categorical variables were expressed as frequency and percentage. Independent sample T and Mann Whitney tests were used for inter-group (between subjects) comparison of parametric and non-parametric continuous data with no follow-up readings respectively. Fisher exact and Chi square tests were used for inter-group comparison of nominal data using the crosstabs function.

**Results**

Regarding demographics, there was no significant difference between the two study groups when it comes to age, BMI, sex, smoking or occupation (*p*>0.05). These data are illustrated in (Table 1).

Concerning the etiology of the disease did not have any statistically effect on the results of the type of the management (*p*>0.05). It shows also the affected side did not have any statistically effect on the results of the type of the management (*p*>0.05). It also shows the average duration of the symptoms did not have any statistically effect on the results of the type of the management (*p*>0.05) these data are shown in (Table 2).

Descriptive data of operative and post-operative details in the surgical group shows that the average hospital stay was 5.08 days ±SD 1.248 and the average blood loss was 86.25ml ±SD 22.806. These data are illustrated in (Table 3).

Regarding WOMAC score, there was no statistically significant difference among the both groups before treatment (*p*>0.05). The average WOMAC score the results of the management and showed that the surgical management had better WOMAC score than that of conservative management during the entire follow-up (*p*<0.05). These data are illustrated in (Table 4).

AS regard basal Oxford score pre management, there was no statistically significant difference among the both groups (*p*>0.05) among Oxford score.

The average Oxford score showed that the surgical management had better Oxford score than that of conservative management during the early follow-up up to one year (*p*<0.05).

The average Oxford score 24 months post management showed there were no significant different effects of the both types of the management on the Oxford score in the final follow-up (*p*>0.05). These data are illustrated in (Table 5).

Concerning ROM of the pre and post management there was no statistically significant differences among the both groups (*p*>0.05).

The average ROM 6 weeks post management showed no statistically significant different results among the types of the management according to ROM (*p*>0.05).

The average ROM 12 months post management showed statistically significant difference of the results of the management and showed that the surgical management had better ROM than that of conservative management after 12 and 24 months follow-up (*p*<0.05). These data are illustrated in (Table 6).

Table (1): Demographic data.

	Conservative management (CM) (n=29 patients 34 knees)	Surgical management (SM) (n=19 patients 24 knees)	95% CI	<i>p</i>
Age	54.72±2.103	52.65±6.030	-0.35, 4.54	0.091
BMI	32.51±3.867	30.41±3.222	-0.06, 4.25	0.056
<i>Gender:</i>				
Male	27.6% (8)	31.6% (6)		0.766
Female	72.4% (21)	68.4% (13)		
Smoking	20.7% (6)	10.5% (2)		0.451
<i>Occupation:</i>				
Manual worker	27.6% (8)	5.3% (1)	-	0.118
Housewife	55.2% (16)	63.2% (12)		
Employee	17.2% (5)	31.6% (6)		

Table (2): Disease etiology, affected side, duration of symptoms of the participants in the study.

	Conservative management (n=34 knees)	Surgical management (n=24 knees)	95% CI	<i>p</i>
<i>Etiology:</i>				
Primary	41.2% (14)	20.8% (5)	-	0.170
Trochlear dysplasia	41.2% (14)	66.7% (16)		
Post-traumatic	17.6% (6)	12.5% (3)		
<i>Side:</i>				
Right	35.3% (12)	33.3% (8)	-	0.574
Left	35.3% (12)	25.0% (6)		
Bilateral	29.4% (10)	41.7% (10)		
Duration (months)	31.12±3.444	32.67±4.931	-3.75, 0.65	0.164

Table (3): Descriptive data of operative and post-operative details in the surgical group.

	Surgical management (n=24)
Hospital stay (day)	5.08±1.248
Blood loss (ml)	86.25±22.806

Table (4): WOMAC score basal and follow-up values in the studied groups.

WOMAC	Conservative management (n=34)	Surgical management (n=24)	95% CI	p
<i>Pre:</i>				
Basal	60.65±14.441	59.13±14.296	-6.16, 9.20	0.693
<i>Post-operative:</i>				
6 weeks	45.18±16.654	35.33±10.785	2.08, 17.61	0.014
3 months	43.12±16.279	31.04±7.986	4.86, 19.29	0.001
6 months	44.79±17.998	31.00±10.562	5.58, 22.01	0.001
12 months	45.71±17.903	32.33±9.458	5.35, 21.39	0.001
24 months	45.68±17.927	33.13±9.470	4.52, 20.58	0.003
Last follow-up	45.65±17.936	33.08±9.722	4.49, 20.63	0.003

Table (5): Oxford score basal and follow-up values in the studied groups.

	Conservative (n=34)	Surgical management (n=24)	95% CI	p
<i>Pre:</i>				
Basal	23.24±7.770	23.04±7.232	-3.84, 4.23	0.924
<i>Post-operative:</i>				
6 weeks	18.62±8.128	13.00±5.794	1.74, 9.50	0.005
3 months	16.59±7.556	11.13±5.136	1.90, 9.03	0.003
6 months	16.91±9.229	11.46±6.192	1.12, 9.79	0.015
12 months	17.00±9.585	12.25±6.340	0.26, 9.24	0.038
24 months	16.53±9.504	12.21±6.481	-0.16, 8.80	0.059
Last follow-up	16.29±9.858	12.04±6.196	-0.31, 8.82	0.067

Table (6): ROM basal & follow-up values in the studied groups.

	Conservative (n=34)	Surgical management (n=24)	95% CI	p
<i>Pre:</i>				
Basal	126.59±12.688	128.13±12.794	-8.34, 5.26	0.652
<i>Post-operative:</i>				
6 weeks	126.38±12.990	127.85±13.147	-7.95, 5.91	0.769
6 months	126.38±12.990	133.33±13.147	-10.12, 3.76	0.362
12 months	126.38±12.990	125.91±13.147	-13.92, 0.02	0.051
Last follow-up	125.71±13.197	133.75±13.205	-14.81, -0.95	0.027
			-14.79, -0.90	0.028
			-15.09, -0.99	0.026

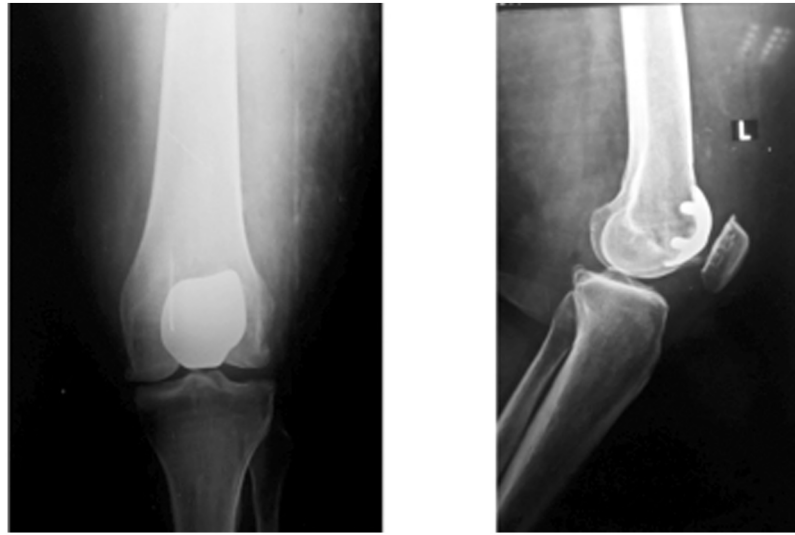
Cases:

- Female patients.
- 42y.
- Housewife.
- Bilateral anterior knee pain.
- Lt > Rt.

- Pain increase with downstairs.
- Female patient.
- 50y.
- Anterior knee pain on Rt knee.
- No Hx of trauma.



Fig. (1): Pre-operative X-ray.



Trochlear component size 2, Patella 30 \* 8

Fig. (2): Post-operative X-ray.



Crossing sign

Fig. (3): Pre-operative X-ray.



Troclea size 2, Patella 34 \* 9

Fig. (4): Post-operative X-ray.



Fig. (5): Two years follow-up.

## Discussion

Treatment of patellofemoral arthritis has been challenging to clinicians. This is partly due to its variety of causes as well as growing but an inadequate understanding of cartilage regeneration. In most cases, management is non-operative, and conservative treatment is indicated [1].

Physical therapy is a mainstay for treatment and can alleviate patellofemoral pain by strengthening the quadriceps femoris complex, most often the vastus medialis, as well as stretching the lateral patellar retinaculum. This can help with maltracking and range of motion of the joint. In patients. Weight loss can decrease force loads on the anterior knee and alleviate pain. Activity modification may be helpful, including decreasing the frequency of squats, jumps, and other activities with prolonged flexion and increasing other activities that place less stress on the anterior knee [1].

Surgical management is indicated in selected patients. Generally, surgical candidates have not received any benefit from non-operative management. Patellofemoral Arthroplasty (PFA) is an alternative to Total Knee Arthroplasty (TKA) for patients with recalcitrant isolated patellofemoral arthritis [8]. Compared with TKA, PFA allows for more normal knee kinematics, proprioception, and range of motion by preserving the tibiofemoral condylar surfaces, menisci, and cruciate ligaments [3].

The current study was conducted on 48 cases (58 knees) who were subdivided into 29 patients (34 knees) undergone conservative treatment and 19 patients (24 knees) undergone surgical treatment.

In this study, a significant statistical difference was detected when comparing the surgical treatment

with the conservative treatment. The surgical is being superior over the two-year follow-up period in terms of ROM, Oxford score and WOMAC score. No complications were reported either intra or post-operatively in the studied patients. The average hospital stay was 5.08 days  $\pm$  SD 1.248 and the average blood loss was 86.25ml  $\pm$ SD 22.806.

As regards the demographic data, there were no statistically significant differences among both studied groups as regards age, BMI, gender, smoking and occupation ( $p > 0.05$ ). In addition, disease etiology, affected side and duration of symptoms seemed to be comparable among both studied groups with no significant difference ( $p > 0.05$ ). Such similarity indicated that demographic characteristics, disease etiology, affected side and duration of symptoms were not interfering with the net results of outcomes and modality of therapy was the only factor that affects the outcomes.

As regards, disease etiology, we found, the majority of the studied cases were trochlear dysplasia followed by primary and post-traumatic osteoarthritis, with comparable affection on both sides (right and left) and similar duration. For further assessment of the results, patients in the surgical group were subdivided into two subgroups based on the etiology of the disease; trochlear dysplasia and non-Trochlear dysplasia group. There was no statistically significant difference regarding the post-operative results over the two-years follow-up period between two groups.

In the same line with Liow, [9] who conducted their study on fifty-one patients (51 knees) with isolated patellofemoral arthritis underwent PFA with second generation implant. They demonstrated that, there was no significant difference in outcomes

between the Trochlear dysplasia and non-Trochlear dysplasia groups at two years ( $p>0.05$ ).

Regarding Range of Motion (ROM), there were no statistically significant differences among both groups till 6 months, while at 12 months, 24 months and last follow-up, there were statistically significant differences ( $p<0.05$ ).

Crossley, [10] evaluated, in a series of ninety people with lateral PFJ OA, whether a physiotherapy treatment, targeted to the PFJ, resulted in greater improvements in pain and physical function than a physiotherapy education intervention in people with symptomatic and radiographic PFJ OA. They concluded that “the project's outcome will influence PFJ OA rehabilitation, with the potential to reduce the personal and societal burden of this increasing public health problem”.

In harmony with the current study, Farahini, Hossein [11] revealed that, PFA give better ROM unless the surgery was conducted in the proper time. Better ROM before the surgery with a lower tibiofemoral varus/valgus angle were more likely to result in a better range of motion after the surgery, suggesting that an appropriate timing for the surgery when the knee joint is still in a better function can lead to a better outcome.

As regards, Oxford score, there was significant difference among both groups early up to last follow-up ( $p<0.05$ ). while, regarding WOMAC score, there were statistically significant differences among both groups after 6 weeks till the last follow-up ( $p<0.05$ ).

Similarly, Goh, [12] conducted a retrospective study about the outcomes of PFA at a single institution using a second-generation implant on fifty-one patients (51 knees) with isolated patellofemoral arthritis. They demonstrated that, Oxford Knee score and Melbourne Knee score improved significantly. In addition, 76% of which had their expectations fulfilled and 76% experienced good satisfaction.

As regards, descriptive data of operative and post-operative details in the surgical group and it showed that the average hospital stay was 5.08 days  $\pm$  SD 1.248 and the average blood loss was 86.25ml  $\pm$  SD 22.806.

While, Prasad, Narayana [13] conducted a study on cases who were undergone TKA and demon

strated that, the mean intra-operative blood loss was 220ml ( $\pm 115.6$ ), the average post-operative drainage was 443ml ( $\pm 160.9$ ) and median hospital stay was 7 days (6-14).

#### Conclusion:

Patellofemoral arthroplasty in treatment of patellofemoral arthritis has a good clinical and radiological outcome. It is associated with few or minor post-operative complications.

#### References

- 1- KIEL J. and K. KAISER: Patellofemoral Arthritis, in StatPearls [Internet], StatPearls Publishing, 2019.
- 2- WALLS R.J., J.D. ELDRIDGE , and K.J. MULHALL: Patellofemoral arthroplasty: Evolving indications, technique, and application in younger patients. In Seminars in Arthroplasty. Elsevier, 2007.
- 3- KAZARIAN G.S., et al.: Significant functional improvement at 2 years after isolated patellofemoral arthroplasty with an onlay trochlear implant, but low mental health scores predispose to dissatisfaction. The Journal of Arthroplasty, 31 (2): p. 389-94, 2016.
- 4- LEADBETTER W.B., et al.: Patellofemoral arthroplasty: A multi-centre study with minimum 2-year follow-up. International Orthopaedics, 33 (6): p. 1597, 2009.
- 5- ROSSI R., et al.: Patellofemoral Arthroplasty: Current Concepts and Review of the Literature, 2017.
- 6- LUSTIG S.: Patellofemoral arthroplasty. Orthopaedics & Traumatology: Surgery & Research, 100 (1): p. S35-S43, 2014.
- 7- WALKER T., B. PERKINSON and W.M. MIHALKO: Patellofemoral arthroplasty: The other unicompartmental knee replacement. JBJS, 94 (18): p. 1712-20, 2012.
- 8- PISANO G., et al.: Patellofemoral arthroplasty: Current concepts and review of the literature. Joints, 5 (4): p. 237, 2017.
- 9- LIOW, et al.: Obesity and the absence of trochlear dysplasia increase the risk of revision in patellofemoral arthroplasty. The Knee, 23 (2): p. 331-7, 2016.
- 10- CROSSLEY, et al.: Physical therapy for patellofemoral pain: A randomized, double-blinded, placebo-controlled trial. The American Journal of Sports Medicine, 30 (6): p. 857-65, 2002.
- 11- FARAHINI, et al.: Factors influencing range of motion after total knee arthroplasty. Iranian Red Crescent Medical Journal, 14 (7): p. 417, 2012.
- 12- GOH, et al.: Four-year follow-up outcome study of patellofemoral arthroplasty at a single institution. The Journal of Arthroplasty, 30 (6): p. 959-63, 2015.
- 13- PRASAD, et al.: Blood loss in total knee arthroplasty: An analysis of risk factors. International Orthopaedics, 31 (1): p. 39-44, 2007.

## دراسة مقارنة لنتائج إستبدال مفصل رضة الفخذ

يعد علاج خشونة مفصل رضة الفخذ أحد التحديات بالرغم من قلة إنتشار المرض. حيث تبلغ نسبة الأشخاص فوق سن الأربعين الذين يعانون من آلام فى مقدمة مفصل الركبة حوالى ٩٪ وترجع أسباب خشونة مفصل رضة الفخذ إلى أسباب أولية وأسباب ثانوية.

يعتبر الإستبدال الجزئى لمفصل الركبة عن طريق إستبدال مفصل رضة الركبة فقط وسيلة بديلة للإستبدال الكامل لمفصل الركبة فى علاج خشونة مفصل رضة الفخذ لما يمنحه للمريض من قدرة أفضل على الحركة وإحساس أقل بالألم عن طريق المحافظة على مكونات سطح مفصل الركبة بما يحتويه من أربطة وغضاريف.

الهدف من هذه الدراسة: سوف تقوم هذه الدراسة بمقارنة العلاج الجراحى بالعلاج التحفظى فى حالات من إلتهاب المفاصل الرضفى.

المرضى: إشمتمت الدراسة على ٤٨ حالة تعاني من إلتهاب المفاصل الرضفى وشملت المجموعة (١) المرضى الذين خضعوا للعلاج التحفظى وعددهم ٣٤ والمجموعة (٢) شملت المرضى الذين خضعوا للتدخل الجراحى وعددهم ٢٤.

النتائج: لم يكن هناك فروق ذات دلالة إحصائية فيما يتعلق بالتغيرات الديموغرافية بينما كان هناك إختلافاً ذو دلالة إحصائية فيما يتعلق بمثاييس إكسفورد مؤشر WOMAC ومدى الحركة.

الإستنتاج: إستبدال مفصل رضة الفخذ أفضل من العلاج التحفظى فى علاج حالات إلتهاب المفاصل الرضفى.

محلولة: عدد الحالات ٤٨ حالة منهم ١٠ حالات تعاني من خشونة فى مفصلى الركبتين وبذلك يكون العدد ٥٨ ركبة تخضع للدراسة.