

Patello-Femoral Joint Endoprosthesis

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Abstract

The Patello-Femoral Joint (PFJ) plays an important role in the functioning and stability of the knee joint, which is associated with the anatomical features of its structure. Any deviations in the functioning of the PFJ of dysplastic or traumatic origin leads to the formation of Patello-Femoral osteoarthritis (PFOA) in it. [1-4]. Treatment for PFOA includes both non-operative and surgical methods. Conservative technologies with severe degrees of PFOA provide a short-term effect or are ineffective [5]. A large number of surgical methods for the treatment of PFOA are known, which comprise two large groups: extra-articular and intra-articular interventions. Among the latter, arthroscopic technologies are currently leading [6], which are effective mainly for dysplastic arthrosis and patellar chondromalacia in young people [7]. In case of gross violations of the articulating surfaces of the PFJ due to malunited fractures of the patella or distal epimetaphysis of the femur, arthroplastic interventions are used. The latter are aimed at restoring normal relationships in the joint and improving the conditions of sliding in it [8-10]. However, the effect of classical arthroplasty in severe degrees of PFOA is most often short-lived: pain in the anterior part of the knee joint recurs, and the patient's quality of life still suffers significantly [1,11].

Endoprosthesis is one of the radical ways to restore the Palliative Performance Scale (PPS) occupational or function disability in severe osteoarthritis. In 1955, MacKeever installed the first Press Fit Condylar (PFC) endoprosthesis, but it had to be removed early due to design imperfections [12]. In subsequent years, new instrument technologies were established: various companies created new designs of endoprostheses, improved the surgical technique of their implantation, worked out the issues of indications and contraindications for PPS arthroplasty, analysed the survival rate of various types of prostheses, complications, and treatment outcomes [13-16]. In Russia, publications on PPS endoprosthesis are rare [17,18].

Despite more than 60 years of experience in clinical observations and studies associated with PPC arthroplasty, various aspects of this problem are currently being actively discussed. For example, the economic advantages and complications of this method, the possibility of combining PFJ arthroplasty with uni-compartmental knee replacement, the frequency of PFJ endoprosthesis conversions to a total prosthesis, and others. The authors pay special attention to long-term treatment outcomes, the effectiveness of PFJ arthroplasty and its prospects [19-23].

Objective: To study the long-term outcomes of Patello-Femoral Joint (PFJ) arthroplasty in osteoarthritis stage 2-4.

Materials and methods: The authors performed surgical treatment of 56 patients with arthrosis of the PFJ(PFOA) stages 2 - 4. The patients were examined by clinical and complex radiation methods using CT and MRI. The age of the patients ranged from 25 to 67 years, the average age was 46, the duration of the disease was 1-4 years. All patients presented with severe pain in the anterior part of the knee joint and dysfunction it. Conservative therapy in all patients was ineffective and short-term, despite the systematic course of treatment. Comprehensive preoperative examination of the knee joint revealed the causes of PFOA: impaired congruence of articulated surfaces, localization and degree of cartilage damage, narrowing of the joint gap, the presence of osteophytes and subchondral sclerosis. Thirty-eight (38) patients with PFOA 2 stage. the ventralization of the tibial tuberosity were performed with the formation of a distractional regenerate by Ilizarov apparatus according to the author's method [24]. The pain relief was achieved with a good pain score and the function of the knee joint was significantly improved. In subsequent years, none of the patients in this group not required surgical treatment.

Keywords: Patello-Femoral; Endoprosthesis

Introduction

Eighteen (18) patients with PFOA stage 3 and 4. endoprosthesis of the PFC was performed. In this group of patients, the main reason for the formation of arthrosis was a history of trauma. Incorrectly healed fractures of the patella were noted in eight (8) patients, the distal epimetaphysis of the femur in 1. Closed injury of the knee joint was found in four (4) patients, in five (5) patients it was not possible to establish the cause of isolated PFOA. All patients of this group were diagnosed with hypotrophy of the thigh muscles by 2-3 cm, limitation of movements in the knee joint in 10 patients, and in eight (8) patients with PFOA, extension contracture of the knee joint was diagnosed, which caused a serious disruption of limb function, lameness. The need to use a cane or crutches was noted in 10 patients.

For the treatment of PFOA, PPS endoprosthesis was performed in 18 patients with an autostable prosthesis developed by LARS (France). The prosthesis consists of a trochlear part made of a cobalt-chromium alloy, which repeats the shape of the articular platform for the patella in the area of the femoral epimetaphysis. This part of the prosthesis is fixed without cement due to 2 anchors at the bottom and a bicortical screw fixing the upper part of the prosthesis to the femur. The patellar part of the prosthesis ("medallion") is made of high molecular weight polyethylene, has a "leg", which is cemented to the patella. The LARS endoprosthesis is available in three sizes (small, medium, large) for the left and right knee joints. In some patients, PFC arthroplasty was supplemented with revision and debridement of the anterior part of knee joint. In two (2) patients with severe knee extensor contractures, prosthetics were combined with mobilization of the heads of the quadriceps muscle. The limb was not fixed after the operation. The restoration of the function of the operated joint began on days 2 - 3 using the CPM principle. Partial load with crutches was allowed from the first week after the operation. Complex rehabilitation treatment allowed to normalize the function of the knee joint after 2-2.5 months since the operation with the return of patients to work.

There were no complications in the postoperative period. In one (1) patient, three (3) years after the operation, as a result of a fall from a height onto a bent knee, a polyethylene "medallion" was fractured. This man underwent a revision of the joint, removed fragments of the broken "medallion" and installed a new one on cement. The knee joint function in this patient was completely restored after 1 month.

Results and Discussion

The results of PFC prosthetics were studied 8-15 years after surgery and were assessed using the Bristol scale for the knee joint. All patients had good and excellent results. X-ray examinations of the patients showed that in the long-term follow-up, all endoprotheses were stable, there were no signs of bone tissue resorption, and osteoarthritis in the tibiofemoral joint had no tendency to progress.

Clinical observation

Patient R. 61 years old, suffered pain in the anterior part of the right knee joint for 6 years. She regularly received conservative and sanatorium treatment, but for the last one and a half years, any therapy was ineffective. The patient took high doses of analgesics, was severely limping and used a walking stick. During the examination, the diagnosis of osteoarthritis of the knee joint was established and chondromalacia of the patella, subchondral cyst of the inner condyle of the tibia. The patient refused total arthroplasty, insisting on the need to eliminate pain in the anterior part of the knee joint.



Figure 1a: X-ray photograph of knee joint. Osteoarthritis of stage 2

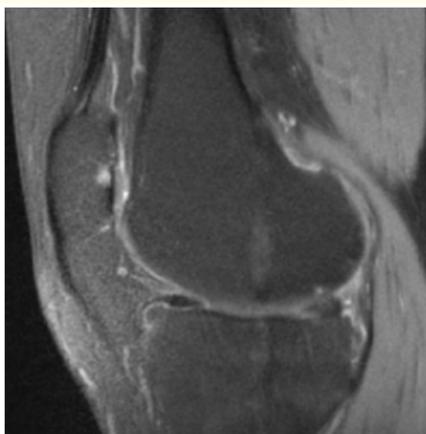


Figure 1b: MRI, T2W FS, chondromalacia patella



Figure 1c: MRI, N2W FS, subchondral cyst of internal part of tibia proximal epiphysis

Figure 1: Patient R: A 61-year-old woman with osteoarthritis

In 2008, patient R. was performed endoprosthesis of the right PFJ with the LARS system.



Figure 2: X-ray of knee joint of patient R after surgery

Patient R., 71-year-old woman was examined 10 years after the operation: pain does not bother, knee function is full. She continues to work and considers herself healthy. She regularly swims in the pool, does exercise therapy and walks 2-2.5 km every day. She receives sanatorium treatment annually. She does not take chondroprotectors and other medications.



Figure 3a: X-ray of knee-joint of patient R, 10 years after surgery



Figure 3b: CT showing subchondral cyst of internal part of tibia epiphysis

To assess the degree of progression of osteoarthritis in the operated joint, patient R. underwent comparative CT with multiplanar reconstruction (determination of the joint space height).

Tables 1 and 2 show the data on the height of the operated knee joint in dynamics in different zones of its inner and outer sections.

Study Area	2008 г.	2018 г.
Outdoor	3.5	3.6 (+ 0.1)
Central	2.3	1.9 (-0.4)
Internal	4.6	4.1 (- 0.5)

Table 1: The Height of the Knee Joint Gap (mm) in Different Zones of its Internal Section in Dynamics.

Study area	2008 г.	2018 г.
Outdoor	3.4	3.3 (- 0.1)
Central	4.7	4.0 (- 0.7)
Internal	3.7	2.9 (- 0.8)

Table 2:The Height of the Knee Joint Gap (mm) in Different Zones of its Outer Section in Dynamics.

Comparative dynamics of the gap height of the operated knee joint before and after the operation showed that the decrease in the gap height in it was < 1 mm in all parts of the joint. This indicates that the original 2 tbsp. osteoarthritis in patient R. practically did not progress for 10 years. According to S. Strickland., et al., [23] in a few years after surgery, approximately 1/3 of patients with PFJ prostheses require conversion to a total prosthesis due to the progression of osteoarthritis in the knee joint. Other authors, on the contrary, argue that arthroplasty of the PPS delays total prosthetics by approximately 10-15 years in 80% of patients [19, 25-27]. The longterm results of PFJ prosthetics obtained by us convincingly indicate the advisability of using this technology, which not only restores the normal function of the knee joint, but also prevents the progression of osteoarthritis in the tibiofemoral joint.

Currently, orthopedists are actively looking for various methods of treating osteoarthritis of large joints in order to prolong their active functioning and maximize the delay of total arthroplasty [6]. The latter is associated with a large number of serious complications of this method: deep infection, aseptic instability and loosening of implants, the frequent need for re-endoproshetics [28, 29]. One of the fast-growing modern trends in orthopedics is limited arthroplasty for osteoarthritis, a typical example of which is uni-compartmental arthroplasty. The advantages of this operation are obvious: minor trauma to soft tissues, minimal bone resection, low blood loss, preservation of the biomechanics of the knee joint functioning, and a short rehabilitation period. From this point of view, PPS arthroplasty with isolated PFOA, which is "bone-conserving arthroplasty", should be considered as a modern trend in orthopedics, providing a sufficiently high efficiency and safety of treatment of the above pathology.

Conclusions

- In isolated osteoarthritis of PFJ of stage 3 and 4 of any genesis with intractable pain syndrome and dysfunction of the knee joint, arthroplasty of the PFJ provides a stable restoration of limb function and patients' ability to work.
- PFJ arthroplasty is an effective and low-traumatic technology, which is indicated primarily in case of incorrectly fused fractures of the patella and distal epimetaphysis of the femur, especially in young and middle-aged patients.
- PFC endoproshetics prevents the progression of degenerative-dystrophic changes in the tibiofemoral joint and ensures the active functioning of the affected limb in subsequent years.

Conflict of Interests

The authors declare no conflicts of interest.

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