

## ***Integrated approach to the election of surgical method of treatment patients with patellofemoral arthritis (PFA)***

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**Introduction** Patellofemoral arthritis (PFA) began to be studied relatively recently. At present, there are no common approaches to the terminology, etiology and pathogenesis, as well as to the tactics of treating this disease. However, orthopedic researchers started to closely investigate the PFA, since its incidence is high in various populations (up to 36 and possibly higher). The main groups of patients are young and middle-aged people. The pathology is an obligatory predictor for development of classical knee osteoarthritis. Particular attention should be paid to the development of an approach to choosing a method of treating the disease. **Material and methods** A prospective cohort study was conducted, the type of study design was one group study of 88 subjects (48 women and 40 men aged 18–45 years, mean age:  $31.5 \pm 4$  years). The method of surgical treatment was chosen with the help of a computer program developed by the authors, taking into account a number of indicators: 1) relevant clinical manifestations and data of quality of life questionnaires; 2) findings of radiation diagnostic methods and MRI. Postoperative follow-up was 3–6–12 months. **Results** The integral evaluation of the results obtained was analyzed using clinical cases. **Discussion** We developed a program for assessing the condition of the knee joint for abnormalities in the patellofemoral articulation. It demonstrated good evaluation results, which were instrumentally confirmed by such precise diagnostic methods as MRI / CT and arthroscopy. The program contains integral information of important criteria, specific for normal biomechanics of the patellofemoral joint: quadriceps angle (Q-angle), patellar type, trochlear dysplasia, Insall-Salvatti index and TT-TG distance. In addition, it uses modern scale system assessment, containing not only subjective, but also objective parameters for evaluating the function of the knee joint.

**Keywords:** arthroscopy, patella, patellofemoral arthritis, trochleoplasty

### INTRODUCTION

Currently, orthopedic traumatologists adhere to the concept of ensuring the optimal quality of life for a patient after surgery [1, 2]. The results of its assessment in the process of pre-operative examination as well as its monitoring during the provision of therapeutic measures serve as the end point of the general characteristics of the adequacy of the operation, in particular, in patients with PFA [3].

Such an emphasis on maintaining an optimum functioning in PFA is associated with a number of relevant issues of this disease: 1) approximate incidence rate reaches 6.9–36.1 % in different populations,

but no precise information has been reported [3, 4]; 2) incidence is high among people of young and middle age (up to 50 years) and so affects the quality of life of the population which is most able to work [5]; 3) patellofemoral syndrome and arthrosis is an early predictor of tibiofemoral arthrosis [5, 6]; 4) lack of a unified approach to the treatment of this disease [6].

The foregoing issues prompted us to create an integral approach to the choice of the method of surgical treatment of PFA, taking into account the multifactorial nature of the disease [7], as well as clinical and anatomical features.

### MATERIAL AND METHODS

A prospective cohort study was conducted on the basis of orthopedic department No. 2 of the Republican State Healthcare Institution “Republican Clinical Hospital of the Ministry of Health of the Republic of Tatarstan”. The study model type was a case series (study of one group) involving 88

individuals (48 women and 40 men aged 18–45 years, average age  $31.5 \pm 4$  years).

The choice of a surgical treatment method was carried out using computer software developed by the authors (registration certificate of software No. 2018615675), which takes into account a number of

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indicators: 1) relevant clinical signs and data from quality of life questionnaires; 2) findings of imaging diagnostic methods and MRI (**Fig. 1**). Postoperative follow-up was three, six and 12 months.

Postoperative results were evaluated using a visual analogue scale (VAS), Oxford KneeScore scale (OKS) (biomechanical and functional status), and KneeSocietyScore (RRS) for range of movements in the knee joints [8, 9].

### Case reports

*Case report No. 1* Patient A., 34 years old, was hospitalized in the orthopedic department No. 2 of the Republican Clinical Hospital of the Ministry of Health of the Republic of Tatarstan with patellofemoral pain syndrome. Chronic somatic pathology was not revealed.

The patient complained of persistent pain in the left knee that was increased at physical activity (walking over 800 m, active movements) during the last 6 months as well as of restriction of movements in the joints

and gait disorders. The patient's gait was disturbed due to the fear of pain. Conservative treatment for patellofemoral pain had been administered for one year (NSAIDs, chondroprotectors) and physical functional therapy which brought a temporary effect. The patellofemoral joint was assessed before the operation (**Fig. 2**).

Thus, it was found that patient A., 34 years old, had PFA with minor anatomical and functional anomalies. The method of treatment was arthroscopy of the knee joint, followed by modification of physical activity. In 2016, she underwent a surgery of arthroscopic debridement of the left knee joint, resection chondroplasty of the chondromalacia zones, lateral release of the retinaculum. During the operation, chondromalacia of the patella in stage 2–3 (damage to the lateral facet) was detected. The results obtained in the study periods are presented in Table 1 which are stable at the present moment.

**Program of patellofemoral joint assessment in adults and choice of the treatment method**

Clinical manifestations and quality of life		Findings of imaging methods of diagnosis and MRI	
Generalized hypermobility	none	Wiberg patella type	Type I
Q-angle value	8-10° for men, 15±5° for female	Femoral condyle dysplasia (Delour)	Type A
Pain on VAS scale, mm	none	Patella alta (Insall-Salvatti index)	0.8-1.2
OKS scale for functions, points	40-48 points	TT-TG distance (patella dislocation)	less than 15 mm
KSS scale, knee joint range of motion	70-79 points	Cartilage defects	none

[Display the diagnosis and treatment tactics](#)

**Fig. 1** Interface of the software developed for assessing the state of the patellofemoral joint for choosing treatment tactics

**Program of patellofemoral joint assessment in adults and choice of the treatment method**

Clinical manifestations and quality of life		Findings of imaging methods of diagnosis and MRI	
Generalized hypermobility	none	Wiberg patella type	Type I
Q-angle value	13	Femoral condyle dysplasia (Delour)	Type A
Pain on VAS scale, cm	up to 5 cm	Patella alta (Insall-Salvatti index)	0.8-1.2
OKS scale for functions, points	40-48 points	TT-TG distance (patella dislocation)	less than 15 mm
KSS scale, knee joint range of motion	70-79 points	Cartilage defects	focal

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**Diagnosis**

PFA accompanied by minor anatomical and functional anomalies

**Surgical intervention tactics**

Modification of physical loads, medication therapy, knee joint arthroscopy

**Fig. 2** Assessment of the joint condition in patient A., 34 years old

Table 1

Results of surgical treatment in PFA with minor anatomical and functional anomalies

Observation periods	VAS, cm	KSS, points	OKS, points
Norm	0	100-79	40-48
Before surgery	5	71	31
After 3 months	3	76	41
After 6 months	2	84	45
After 12 months	0	91	47

*Case report No. 2* Patient A., 31 years old, was hospitalized in the orthopedic department No. 2 of the Republican Clinical Hospital of the Ministry of Health of the Republic of Tatarstan with chronic pain in the left knee joint. Chronic somatic pathology was not revealed.

The patient complained of persistent pain in the left knee at daily physical activity for the last 7 years, as well as restriction of movement in the joints and impaired gait. The patient's gait was disturbed due to fear of pain. Conservative treatment for patellofemoral pain was administered by courses throughout the year (NSAIDs, chondroprotectors) and physical functional therapy, which yielded a temporary effect that continued about 3 months. The patellofemoral joint was assessed before the operation (**Fig. 3**).

This patient was diagnosed with PFA and moderate anatomical and functional anomalies. The method of treatment was a mandatory reconstruction of the knee joint extensor apparatus. An important guideline for the choice of operation was the distance TT-TG (projection distance between the perpendicular from the middle of the tibial tuberosity and the intercondylar sulcus), which characterizes the instability of the patella. It was 22 mm. In 2017, she was surgically treated with arthroscopic debridement of the left knee

joint and extension apparatus plasty of the right knee joint according to Fulkerson. Chondromalacia of the patella was of stage 3-4 with lateral subluxation of the patella. The resection chondroplasty of the chondromalacia zones, a lateral release of the retinaculum and the FULKERSON ventralization of the tuberosity of the tibia (**Fig. 4**) were performed. The left lower extremity was immobilized with a plaster cast for 3 weeks. A course of physiotherapy to restore the function of the knee joint followed.

The results obtained in the periods of study are presented in Table 2. The effect is preserved at the moment.

Table 2

Results of surgical treatment in PFA with moderate anatomical and functional abnormalities

Observation periods	VAS, cm	KSS, points	OKS, points
Norm	0	100-79	40-48
Before surgery	8	56	20
After 3 months	4	72	28
After 6 months	2	86	38
After 12 months	1	100	41

*Case report No. 3* Patient B., 33 years old, was hospitalized in the orthopedic department No. 2 of the Republican Clinical Hospital of the Ministry of Health of the Republic of Tatarstan for chronic arthralgia in the right knee joint. Chronic somatic pathology was not revealed.

The patient complained of persistent pain in the right knee for the last 3 years by daily physical activity, as well as restriction of movement in the joints, impaired gait. She received conservative treatment for patellofemoral pain, but it was ineffective. The patellofemoral joint was assessed before the intervention (**Fig. 5**).

**Program of patellofemoral joint assessment in adults and choice of the treatment method**

**Clinical manifestations and quality of life**

Generalized hypermobility Up to 3 criteria for Beighton

Q-angle value Deviation within 5 degrees

Pain on VAS scale, cm upward of 5 cm

OKS scale for functions, points 20-29 points

KSS scale, knee joint range of motion less than 60 points

**Findings of imaging methods of diagnosis and MRI**

Wiberg patella type Type I

Femoral condyle dysplasia (Delour) Type A

Patella alta (Insall-Salvatti index) 0.8-1.2

TT-TG distance (patella dislocation) upward of 20 mm

Cartilage defects focal

Display the diagnosis and treatment tactics

**Diagnosis**

PFA accompanied by moderate anatomical and functional anomalies

**Surgical intervention tactics**

Reconstruction in the proximal tibia (ventralization of the tibial tuberosity)

Fig. 3 Assessment of the joint condition in patient D., 31 years old



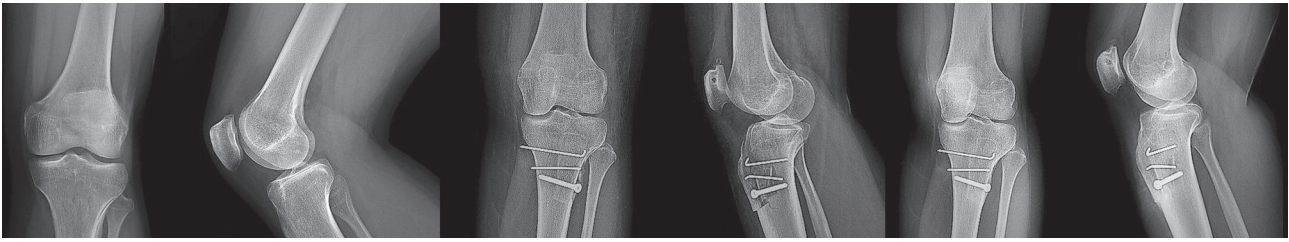


Fig. 4 Radiographic findings of the knee joint of the patient D., 31 years old, before and after surgery and 1-year follow-up

**Program of patellofemoral joint assessment in adults and choice of the treatment method**

**Clinical manifestations and quality of life**

Generalized hypermobility ≥ 4 criteria for Beighton

Q-angle value 11

Pain on VAS scale, cm upward of 5 cm

OKS scale for functions, points 20-29 points

KSS scale, knee joint range of motion less than 60 points

**Findings of imaging methods of diagnosis and MRI**

Wiberg patella type Type III

Femoral condyle dysplasia (Delour) Type C/D

Patella alta (Insall-Salvatti index) 0.8-1.2

TT-TG distance (patella dislocation) 15-20 mm

Cartilage defects generalized

Display the diagnosis and treatment tactics

**Diagnosis**

PFA accompanied by pronounced anatomical and functional anomalies

**Surgical intervention tactics**

Trochleoplasty

Fig. 5 Assessment of the joint condition in patient B., 33 years old

The patient was diagnosed with PFA accompanied by pronounced anatomical and functional anomalies. Dysplasia of the femoral condyles of DeJour type C, generalized chondromalacia and instability (Fig. 5) were among the basic criteria of the severity that was verified by diagnostic arthroscopy in combination with therapeutic debridement. In 2017, the patient underwent trochleoplasty of the right knee joint in combination with the release of the lateral retinaculum of the patella. The postoperative period was uneventful. The results obtained in the study

period are presented in Table 3; negative dynamics during the follow-up was not observed.

Table 3

Results of surgical treatment in PFA with moderate anatomical and functional abnormalities

Observation periods	VAS, cm	KSS, points	OKS, points
Norm	0	100-79	40-48
Before surgery	6	49	23
After 3 months	4	77	31
After 6 months	1	86	38
After 12 months	0	89	41

## DISCUSSION AND CONCLUSION

The program for assessing the condition of the knee joint developed by us in disorders of the patellofemoral articulation demonstrated good evaluation results, which were instrumentally confirmed by such accurate diagnostic methods as MRI /CT and arthroscopy. The program contains integral information of important modern criteria specific to the normal biomechanics of the patellofemoral joint: the quadriceps angle (Q-angle), the patella type, trochlear dysplasia, the Insall-Salvatti index and the TT-TG distance. In addition, it uses modern evaluation scales that contain not only subjective, but also objective parameters for evaluating the function of the knee joint. The surgeons managed to maximally correct the tactics of surgical intervention in the patients under the study thanks to the analysis

performed according to the program. It resulted in good clinical and functional outcomes of treatment (Fig. 6).

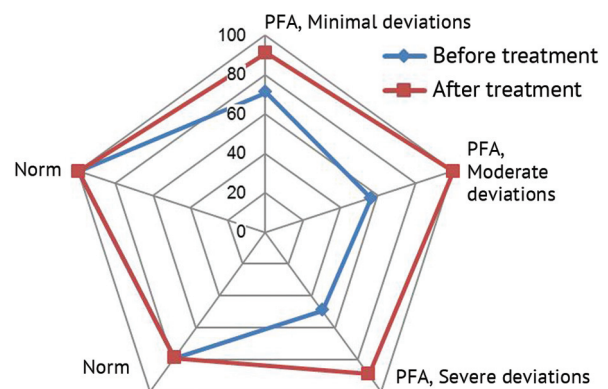


Fig. 6 Anatomical and functional results after surgical treatment on the example of the KSS scale (results before surgery and a year follow-up)

Thus, this program can be recommended for use in the therapeutic and diagnostic process in order to determine the optimal treatment tactics for patellofemoral arthrosis in different age groups.

**Conflict of interest** None

**Source of financing** The study was conducted without sponsorship.

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