



## Treatment of Post-Traumatic Chondropathy of The Knee Joint Platelet-Rich Plasma

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**Abstract:** The study showed that, after 6 months, patients who underwent intraarticular administration of platelet-rich plasma were characterized by significantly higher values of the subscales "Symptoms"; "Daily activity" ( $p < 0.01$ ); "Sports, active recreation" ( $p < 0.01$ ); "Quality of life" ( $p < 0.01$ ) and the final value on the KOOS scale ( $p < 0.01$ ) compared to patients of the control group. We have not detected any side effects and complications when using this method of treatment.

**Keywords:** knee joint, post-traumatic chondropathy, platelet-rich plasma

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The knee joint is the largest joint in the human body. Since it experiences a significant static and dynamic mechanical load, and has a complex anatomical structure, various injuries of the knee joint are extremely common. According to various authors, they account for 50-70% of all injuries of the musculoskeletal system [1].

Post-traumatic chondropathy (chondromalacia) is characterized by the presence of various hyaline cartilage defects in depth, localization and area in patients who have suffered a knee joint injury. The frequency of occurrence of this pathology varies from 51 to 66% according to arthroscopy data [2].

Surgical methods occupy a special place in the complex treatment of cartilage defects [7]. Among them, surgical techniques aimed at stimulating reparative processes at the expense of bone marrow cells of the subchondral layer are widely used. They provide for antegrade and retrograde tunneling of the subchondral bone, micro-fracturing, "debridement". Various types of osteochondral autotransplantation and autogenetic chondrocyte transplantation are also used to replace articular cartilage defects. However, in most cases, the newly formed tissue has the character of fibrocartilage or fibrous tissue, which is significantly different from normal cartilage and is able to fully perform its functions [8]. Conservative methods of treatment of hyaline cartilage damage (the use of physiotherapy techniques, non-steroidal anti-inflammatory drugs, hyaluronic acid preparations, etc.) have a short-term clinical effect. Many medications have a symptomatic effect and do not slow down the processes of further cartilage degeneration [9]. Taking into account the above, improving the effectiveness of treatment of patients with post-traumatic chondropathy of the knee joint is an important and urgent task for orthopedic traumatologists.

### Introduction

In recent decades, tissue engineering and cell therapy have taken an increasingly strong position in clinical medicine. In this regard, the possibility of using platelet-rich plasma (PRP) in the treatment of patients with injuries of the musculoskeletal system and their consequences is currently of great interest [10]. The presence of plasma clot formation products and platelet growth factors in PRP,

which ensure the processes of regeneration and hemostasis, are the basis for its use. OTP contains not only growth factors (PDGF — platelet growth factor, TGF- $\beta$  — transforming growth factor, EGF — epithelial growth factor, VEGF - vascular endothelial growth factor), but also adhesive molecules (fibrin, fibronectin and vitronectin) necessary for cell migration, cell adhesion and stimulation of collagen synthesis. OTP also contains cytokines. having an anti-inflammatory effect, stimulating repair and anabolic processes in damaged tissues [11].

Since OTP is a derivative of the patient's own blood, the use of ns is associated with the risk of parenteral transmission of infections, such as HIV or hepatitis. The use of OTP does not cause hyperplastic processes, carcinogenesis or tumor growth. Growth factors are not mutagens and do not block the feedback mechanisms of tissue repair and regeneration processes [12].

Good results were obtained when using OTP in the field of maxillofacial surgery. OTP is used in the treatment of long-term non-healing, infected skin wounds, trophic ulcers, diabetic foot. OTP is also widely used in traumatology, orthopedics and sports medicine in the treatment of enthesopathies, injuries to the rotator cuff of the shoulder, atrophic false joints, large bone cysts and associated pathological fractures, injuries to the fingers of the hand with skin and soft tissue defects [13].

In recent years, researchers have obtained good results when using OTP in the treatment of osteoarthritis and related cartilage defects of articular surfaces [14, 15]. The results of these studies suggest that OTP has chondroprotective properties, improves regeneration processes in cartilage tissue.

The aim of the study is to improve the results of complex treatment of patients with post-traumatic chondropathy of the knee joint by intraarticular administration of platelet-rich plasma.

### **Material and methods**

The results of the examination of 55 patients of both sexes who were treated in the traumatology department of the Bukhara Regional Multidisciplinary Medical Center, who were diagnosed with post-traumatic chondropathy of the knee joint, were analyzed at the Clinic of Traumatology and Orthopedics of the Bukhara State Medical Institute.

After a standard clinical and X-ray examination, all patients underwent arthroscopy of the knee joint according to the generally accepted protocol with an assessment of the localization and depth of the articular cartilage lesion according to the Outerbridge classification[16]. During arthroscopy, concomitant injuries of the internal structures of the knee joint (menisci, cruciate ligaments), if any, were eliminated. All patients underwent debridement of the cartilage defect zone (cervical chondroplasty), microfracturing or tunneling of the subchondral bone as indicated. In the postoperative period, all patients received medication (NSAIDs, chondroprotectors), physiotherapy (PMP on the joint area) and physical therapy.

In addition to complex treatment, 31 patients of both sexes (the study group) underwent a course of intraarticular administration of OTP in the postoperative period. The patients of the control group (24 people) were not administered OTP in the postoperative period.

The exclusion criteria from the study and control groups were as follows: the age of patients less than 18 or more than 50 years; the presence of radiological or arthroscopic signs of gonarthrosis; the presence of systemic connective tissue diseases in patients.

OTP was obtained from the patient's venous blood immediately before use. 20 ml of blood was taken from the cubital vein with a sterile solution of sodium citrate in a ratio of 9 to 1. The resulting mixture was centrifuged at a separation factor of 450g for 15 minutes in compliance with the rules of asepsis. After centrifugation, 1.4-1.6 ml of OTP was taken from the platelet-rich plasma layer using a syringe and an injection needle. The number of platelets was counted in each OTP sample.

The procedure of intraarticular administration of OTP was performed in the conditions of a dressing room. The knee joint area was treated with an antiseptic solution for external use ("Septocid-Synergy"). The skin and the underlying soft tissues in the area of the planned joint puncture were infiltrated with a local anesthetic solution (2% lidocaine solution — 2 ml). The puncture was performed in the position of bending the knee joint at an angle of 90° at a point located 1 cm below the level of the lower pole of the patella and at a distance of 0.5 cm medial or lateral of the patellar ligament proper. Immediately before the introduction of OTP, platelet activation was performed by mixing OTP with 0.2 ml of a 10% calcium chloride solution. After the procedure, an aseptic bandage was applied to the knee joint. The course of treatment consisted of 3 injections, which were carried out at intervals of 7 days.

To determine the effectiveness of treatment, in addition to clinical research methods, a scale for assessing the outcomes of injuries and diseases of the knee joint — KOOS (Knee injury and osteoarthritis outcome score) was used before arthroscopy, 2 and 6 months after the course of treatment.

The normality of the distribution of the data obtained as a result of the study was checked using the Shapiro-Wilk criterion. The data having a distribution different from the normal one were presented in the form of medians and percentiles. The data were compared before and after treatment using the Wilcoxon test. The Mann-Whitney U-test was used to assess the differences between the groups according to the level of quantitative characteristics. The qualitative characteristics were compared with the use of  $\chi^2$  (if necessary, with the Yates correction).  $P < 0.05$  was taken as the level of statistical significance. The statistical analysis was performed using the STATISTICA 6.0 program.

## Results

The age of the patients in the study group was 27 (25; 34) years. The age of patients in the control group was 30 (24; 37) years. 71% of the patients in the study group were male, 29% female. In the control group, 79.2% were men, 20.8% were women. There were no significant differences in the sexual and age structure in the patients of the study and control groups ( $p > 0.05$ ). In 58.3% of the patients of the control group (35.5% of the study group), full-layer defects of the knee joint cartilage were detected during arthroscopy (chondromalacia 3-4 art.). Isolated cartilage defects of the medial condyle of the femur and patella prevailed in both groups. There were no significant differences between the groups in the structure of post-traumatic chondropathy, the structure of internal injuries of the knee joint and the time elapsed from the moment of injury to arthrotopia of the knee joint ( $p > 0.05$ ). The basic level of values of subscale indicators and the final score on the KOOS scale also significantly differed in patients of the study and control groups (Table No. 1).

The number of platelets in the OTP samples was 1030000/ml (1017000; 1105000), which confirms the proper quality of the product obtained by us in the process of centrifugation of the patient's blood.

As a result of treatment, both in the study and in the control group, there was a significant improvement in the subscale indicators and the final value on the KOOS scale ( $p < 0.01$ ). However, 2 months after treatment, the patients of the study group were characterized by significantly higher values of the subscales "Symptoms" ( $p < 0.01$ ); "Sports, active recreation" ( $p < 0.01$ ); "Quality of life" ( $p < 0.01$ ) and the final value on the KOOS scale ( $p < 0.01$ ) compared to the patients of the control group. 6 months after the course of treatment, significant differences between the groups remain, although there is a tendency to increase the values of the indicators of the functional state of the knee joint in patients of both groups (table). There are also statistically significant differences in the values of the indicators of the "Daily Activity" subscale (the study group is characterized by higher indicators). We did not detect any adverse reactions and complications in patients during the course of intraarticular administration of OTP.

### Conclusion

The problem of post-traumatic chondropathy of the knee joint is relevant all over the world. The presence of even an isolated cartilage defect in the patient (the absence of concomitant damage to the meniscus and cruciate ligaments) leads to the development and progression of gonarthrosis after 5-6 years [5]. The frequency of unsatisfactory outcomes of both conservative and surgical methods of treatment of this pathology remains quite high.

However, given the relatively small number of patients studied and the duration of follow-up, it is necessary to further study the effectiveness of intraarticular administration of OTP in the treatment of patients with post-traumatic chondropathy of the knee joint.

1. The use of OTP in the treatment of post-traumatic chondropathy is an effective and safe method that can significantly improve the indicators of the functional state of the knee joint and the quality of life of patients.
2. For a comprehensive assessment of the effectiveness of intraarticular administration of OTP in the treatment of post-traumatic chondropathy of the knee joint, further clinical and experimental studies are advisable.

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