Central Asian Journal of Medicine

THE RESULTS OF A CLINICAL EVALUATION OF THE USE OF STROMAL VASCULAR FRACTION, BONE MARROW CONCENTRATE FOR THE TREATMENT OF OSTEOARTHRITIS OF THE KNEE JOINT IN THE EARLY STAGES

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ABSTRACT

The aim of the study is to investigate the combined use of high-potency fatty tissue stem cells with platelet-rich plasma in patients to reduce the development of knee osteoarthritis. The results were evaluated using clinical methods. The views of modern scholars on this matter are presented. The results have been presented, discussed, and recommended for use in knee osteoarthritis.

Key words: stromal vascular fraction, bone marrow aspirate concentrate, platelet-rich plasma, cell therapy, osteoarthritis.

INTRODUCTION

There are a large number of causes that cause the development of osteoarthritis, from mechanical damage to systemic diseases. The generally accepted division of osteoarthritis into primary (idiopathic) and secondary is rather arbitrary, since it is hardly possible to imagine a real person's evolutionary process in its "pure form", without additional factors accompanying during life (injuries, hypothermia, hormonal changes, etc.). A large number of risk factors, both those that can be affected (modifiable): overweight, chronic overloads, injuries, and non–modifiable (gender, age, congenital orthopedic deformities, genetic predisposition, systemic diseases, etc.), have led to the widespread occurrence of osteoarthritis in general, osteoarthritis of the lower extremities, in particular, and specifically osteoarthritis of the knee joint [1].

It has been noted that the prevalence of osteoarthritis increases exponentially with age, and after 70-80 years it approaches 100% [2]. Women are more susceptible to OA than men. In addition, women tend to have more severe manifestations of OA than men, especially after menopause [4].

One of the leading and, unfortunately, increasingly common modifiable risk factors for osteochondrosis is overweight. In obese patients, not only increased stress on the joints of the lower extremities and spine is important, but also hormonal imbalance [5].

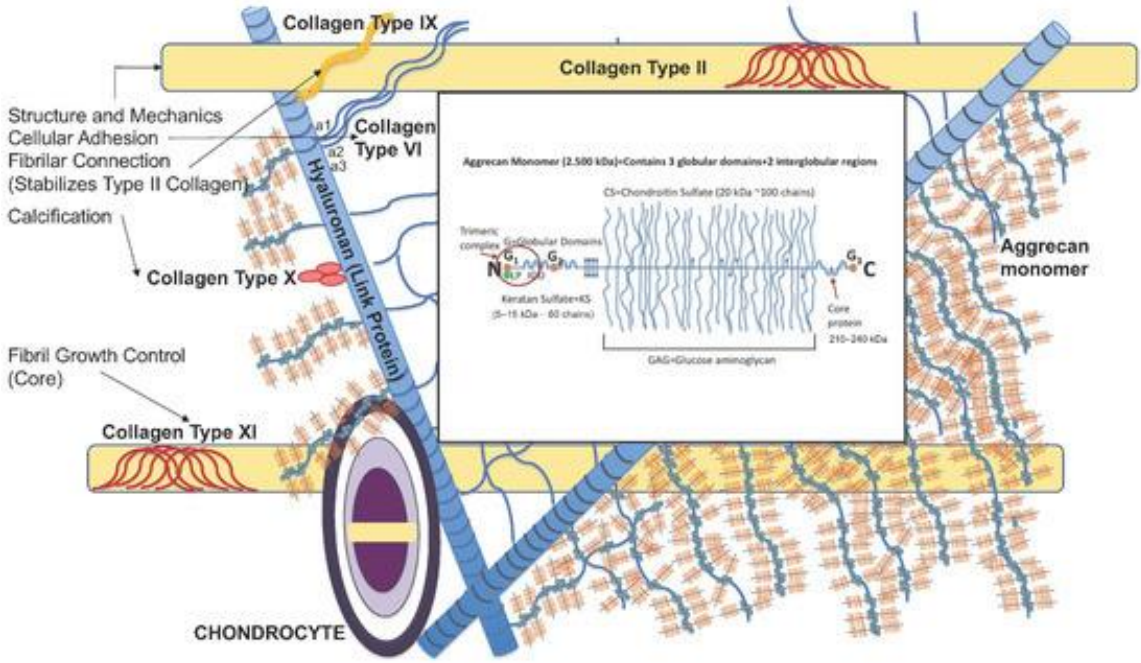
The leading change in joints during the development of osteoarthritis is the pathology of articular cartilage and subchondral bone [6]. Articular cartilage is devoid of feeding vessels, its trophism is carried out due to diffusion from both the underlying subchondral bone and synovial fluid. When cartilage is affected, it largely loses its properties, including shock absorption, and cracks. The nature and localization of these changes may vary slightly depending on the type of adverse effects. For example, post-traumatic changes can be localized in the area of calcified cartilage and subchondral bone (with intense simultaneous impact) or in the surface layers of cartilage in the form of oblique cracks with the formation of flaps and small cartilage fragments (with chronic injury) [3].

With damage to the articular cartilage associated with direct injury, chronic overload, age-related involutive changes, and systemic disorders, the cartilage is unable to fully exercise its cushioning and load-redistributing functions, which increases the load on the subchondral bone, which gradually scleroses and as a result turns into a kind of "plug" delimiting the articular cartilage is separated from the underlying bone tissue, which leads to trophic disruption and further destruction of articular cartilage. The cartilage matrix loses its hydrophilicity, and the cartilage cracks. Osteosclerosis processes worsen, intraosseous pressure increases, being

another cause of persistent pain. Active substances released from decaying cartilage tissue, including lytic enzymes, as well as a progressive inflammatory reaction turn synovial fluid into an aggressive environment that not only loses its positive properties, but also contributes to the aggravation of joint pathology and increased pain [9]. In this condition, articular cartilage is unable to withstand even relatively small workloads, which have a destructive effect on it [6]. The processes of cartilage destruction are progressing, and bone remodulation is developing. Osteophytes form, the articular surface becomes uneven, cystic degeneration in the periarticular zone is noted, bone components are impressed with deformity of the limb axis and pronounced violations of the biomechanics of movements [8].

In advanced cases, the surface of the cartilage defect is represented by sclerosed subchondral bone, which excludes the possibility of any regenerative processes [7].

FIGURE 1



Purpose of research

Optimization of minimally invasive surgical treatment of knee osteoarthritis using stem cells.

Materials and methods. The research procedure.

In our clinical prospective study, 81 patients were monitored from 2020 to 2023 at the Department of Traumatology-Orthopedics, HCV and Neurosurgery in the Department of Traumatology No. 1,2 at the private clinic Akfa medline on the basis of the MCC MCMC TMA. The patients were divided into 4 groups: the first group included 51 patients with SVF+PRP therapy (stromal vascular fraction); the second group included 30 patients with BMAC+PRP therapy (bone marrow concentrate).

For the clinical assessment of the patients' results in the study, such methods as the KOOS scale and VAS were used.

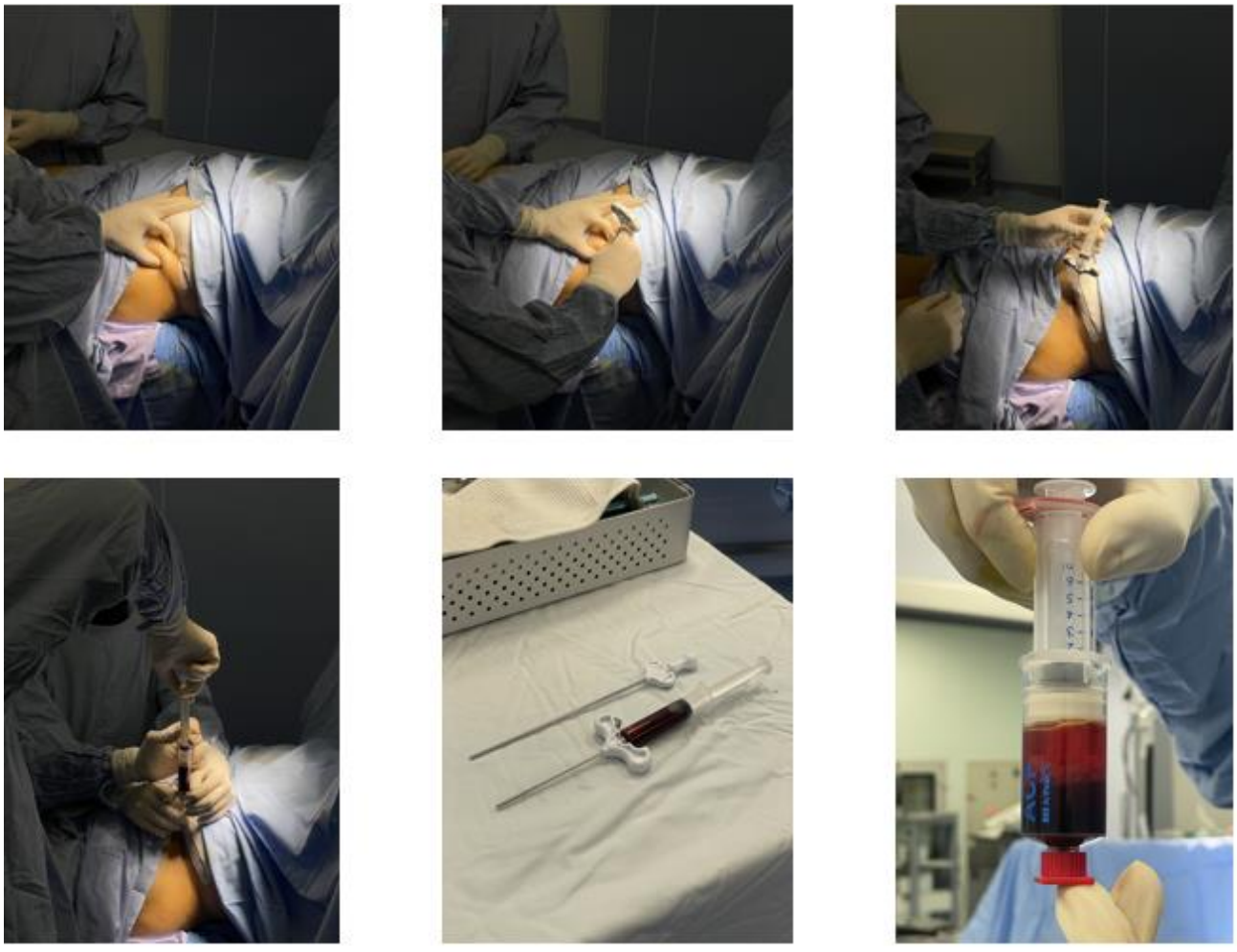
The method of isolation of the stromal vascular fraction. Under local anesthesia, 2.0 ml of 0.5% novocaine, in the operating room, a group of surgeons simultaneously draw venous blood to obtain platelet-rich autogenous plasma (PRP), the resulting venous blood in a volume of 15 ml is treated with platelet release in a volume of about 5 ml by single centrifugation at 3200 rpm for 5 minutes in 20 ml in a test tube with the addition of 1 ml of 5% sodium citrate. When taking adipose tissue into the subcutaneous fat, a Klein solution and 1 ml of dexamethasone are injected through an infusion cannula, and fiber infiltration is performed. 30 minutes after the injection of the specified solution, about 40 ml of adipose tissue is taken using a special cannula for injection into the knee joint. By double centrifugation for 4 minutes at 2400 rpm and filtration in specialized Artex syringes, about 5 ml of the stromal vascular fraction (SVF) is obtained. The resulting stromal vascular fraction (SVF) is mixed with pre-prepared platelet-rich plasma (PRP) from the patient's blood. The finished mass in a volume of 10 ml is transplanted into the affected joints (5 ml each) under local anesthesia with 2.0 ml of 0.5% novocaine. The place of adipose tissue intake and the injection area are sealed with alcohol aseptic dressings. The operation is performed within 40-45 minutes.

FIGURE 2

A method for extracting bone marrow concentrate. Under local anesthesia, 2.0 ml of 0.5% novocaine were taken from the graft sites, venous blood was taken in the

operating room, bone marrow was taken by puncturing the medial surface with a trocar in the area of the tibial epimetaphysis and adipose tissue was taken by puncturing the skin with a 2.5 mm needle in the area of the patient's anterior abdominal wall. Bone marrow sampling in a volume of 50 ml was carried out with a special 50 ml vacuum syringe with a threaded thread for a trocar. The bone marrow aspirate was processed by single centrifugation for 15 minutes at 2800 rpm in three 20 ml tubes with 2 ml of 5% sodium citrate added to each, and an average portion of concentrated bone marrow aspirate (BMAC) was isolated in a volume of 5 ml. Venous blood in a volume of 15 ml was treated with the release of platelets in a volume of about 5 ml (PRP) by single centrifugation at 3200 rpm for 5 minutes in a 20 ml tube with the addition of 1 ml of 5% sodium citrate. The resulting concentrated bone marrow aspirate (BMAC) in a volume of 5 ml is mixed with pre-prepared platelet-rich plasma (PRP) from the patient's blood in a volume of 5 ml. The finished mass in a volume of 10 ml is transplanted into the affected joints (5 ml each) under local anesthesia with 2.0 ml of 0.5% novocaine. The place of collection of adipose tissue, bone marrow and the injection area are sealed with alcohol aseptic dressings. The operation is performed within 45-50 minutes.

FIGURE 3



Results

Evaluation of treatment results in patients with stromal vascular fraction.

The results of treatment of patients when assessed using the VAS scale.

The diagram shows that, when evaluated in group 1 of patients on the VAS scale before surgery, the average values were 6.8 points, after surgery after 24 months. the indicators became 3.39 points.

TABLE 1

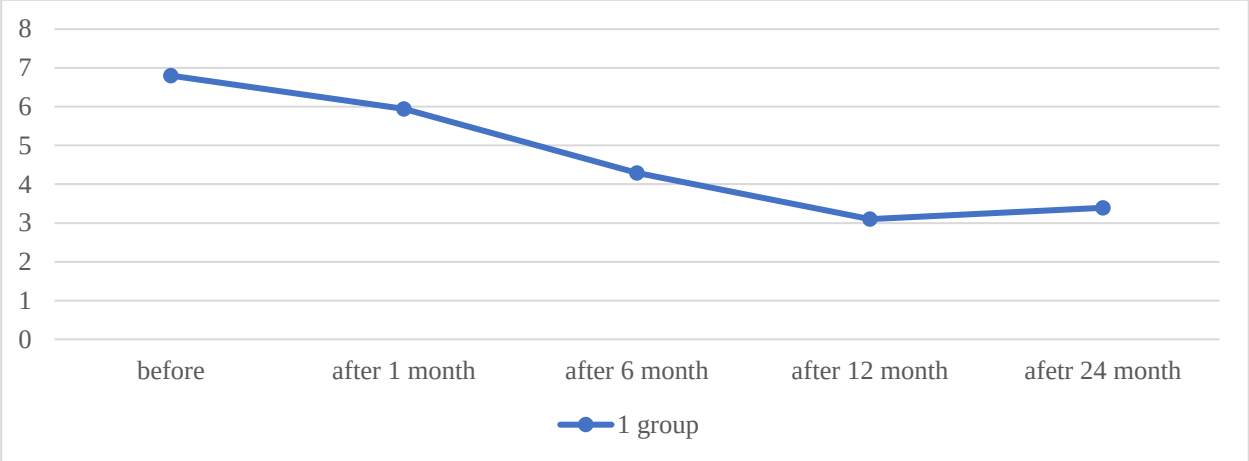
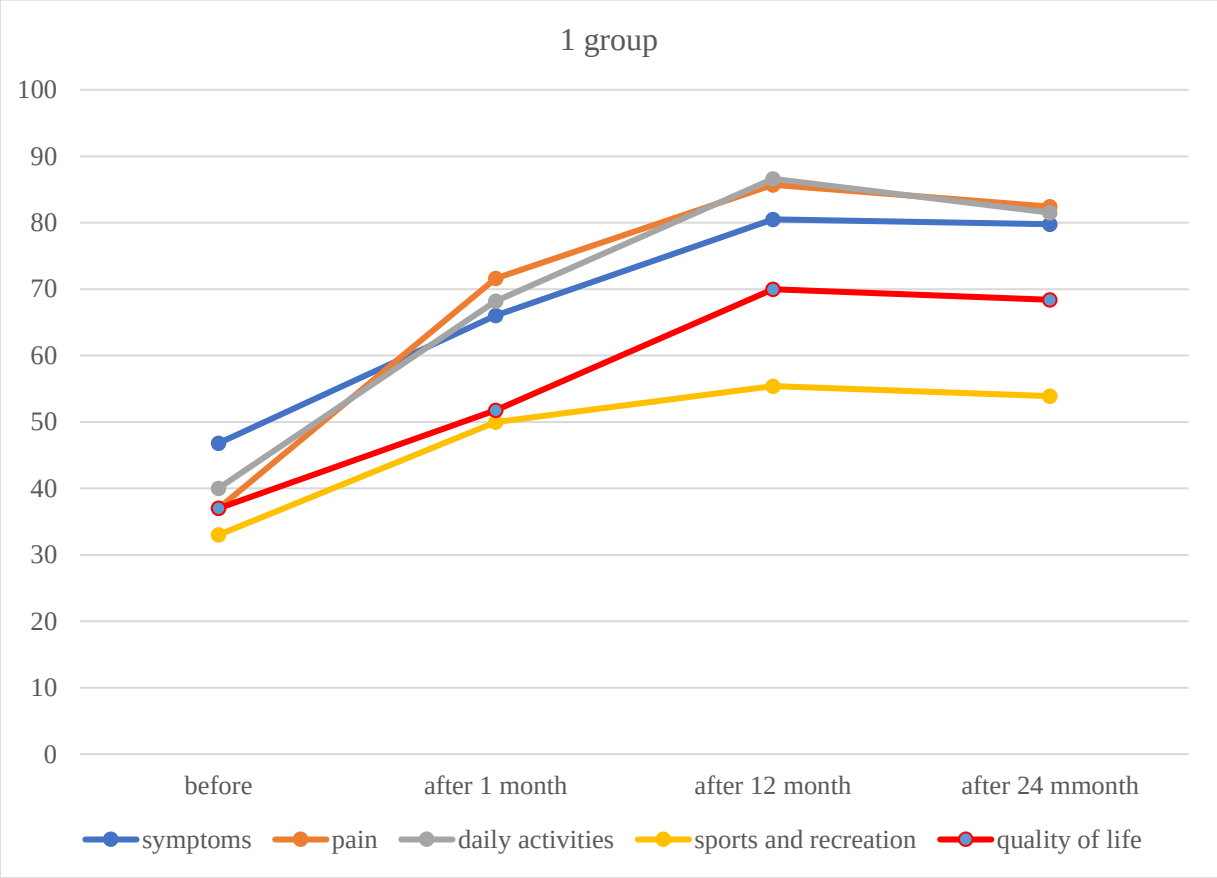


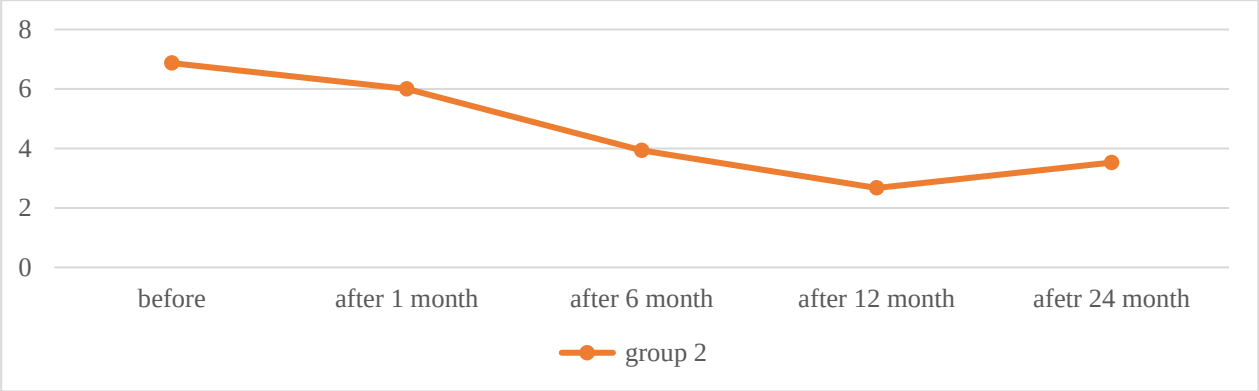
TABLE 2



The diagram shows that before surgery, the KOOS indicators were: symptoms before surgery 46.8 points after surgery after 24 months 79.8 points; pain before surgery 37 points after surgery after 24 months 82.4 points; daily activity before

surgery 40 points after surgery after 24 months 81.5 points; sports and recreation before surgery 33 scores after surgery after 24 months. 53.9 points; quality of life before surgery 37 points after surgery after 24 months. 68.4 points.

TABLE 3



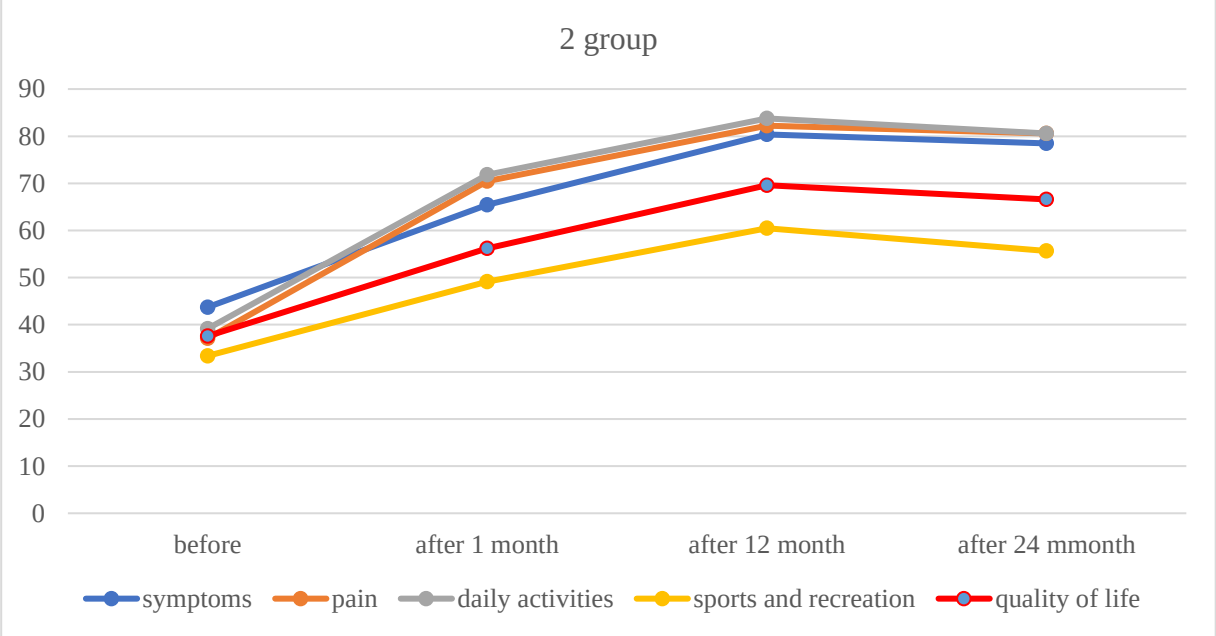
Evaluation of treatment results in patients using bone marrow concentrate.

The results of treatment of patients when assessed using the VAS scale.

The diagram shows that when evaluated using the VAS scale before surgery, the average score in the second group of patients was 6.87 points, and after surgery, 24 months later, the score reached 3.53 points.

The diagram shows that before surgery, KOOS scores were: symptoms before surgery - 43.7 points after surgery - 24 months. 78.5 points; pain before surgery 37.1 points after surgery 24 months. 80.6 points; daily activity before surgery 39.2 points after surgery 24 months. 80.6 points; sports and rest before surgery 33.4 points after surgery 24 months. 55.7 points; quality of life before surgery 37.6 points after surgery 24 months. 65.6 points;

TABLE 4



Discussion

After clinical studies, it can be noted that the use of stem cells in osteoarthritis of the knee joint is effective from a clinical point of view. The studies of many modern authors indicate the positive results of using stem cells even with defects in the cartilage of articular surfaces. It is advisable to include modern methods for assessing the cartilage of articular surfaces in studies aimed at treating osteoarthritis with stem cells. Comparatively evaluate which methods help the body to restore the cartilage layer the most. It is necessary to evaluate the number of viable stem cells when we introduce them into SWF, BMAC. It can be observed how effectively growth factors in platelet-rich plasma help stem cells survive.

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