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PLATELET-RICH PLASMA ENHANCES QUALITY OF LIFE IN ADOLESCENT ATHLETES WITH MAJOR JOINT INJURIES

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Introduction. The relevance of the study is substantiated by the ongoing state policy, the increasing number of children and adolescents engaged in physical education and sports, the high rate of injuries sustained during sports activities, and, consequently, the need to implement innovative treatment methods that minimize the duration of therapy and ensure the fastest possible return to the training process. Assessment of the subjects' quality of life during research is one of the indicators (components) of the comprehensive evaluation of the effectiveness of the implemented medical technologies.

Objective. To assess the quality of life of underage athletes (aged 10–17 years inclusive) from Russian national teams with injuries and damage to major joints after a course of platelet-rich plasma therapy (PRP).

Materials and methods. Single-center, prospective, controlled, open-label study involving 22 adolescent athletes: median age 16 [15.25; 17.0] years (girls — 17 [16.0; 17.0] years; boys — 16 [14.5; 16.0] years) with injuries and lesions of large joints. PRP therapy (three injections at one-week intervals) was performed according to a standardized closed protocol used in the medical institution, using a commercial Arthrex kit. The following were performed: objective examination, consultations with an orthopedic traumatologist, pain assessment using a visual analog scale, muscle strength assessment according to the six-grade Hislop and Montgomery classification, functional tests to assess the integrity of the anterior cruciate ligament — the Lachman test and the ligaments of the knee and ankle joints — the anterior drawer test, clinical and laboratory tests (complete blood count), instrumental examinations (MRI — magnetic resonance imaging). Quality of life of adolescent athletes was assessed using the PedsQL 4.0 questionnaire. Statistical data processing was performed using Excel and the JASP v.0.16 software package.

Results. After the cycle of PRP therapy, athletes demonstrated a statistically significant improvement in quality-of-life scores as assessed by the PedsQL 4.0. The greatest positive dynamics, an increase of 23.1% (73 [63; 87] points at initial examination vs. 83 [81; 94] points at follow-up assessment), was observed on the role functioning scale. Physical functioning scores improved by 13.7% compared to baseline, while emotional functioning showed moderate improvement (6.7%). Statistically significant positive dynamics ($p < 0.001$) before and after PRP therapy were identified for eight items across four scales, with the most pronounced changes reported by respondents on the physical and role functioning scales. A statistically significant positive dynamic in pain intensity was also recorded after PRP therapy, with the maximum effect observed after two injections. The reduction in pain intensity was not associated with improvement in quality-of-life scores; however, this aspect may be related to the specific stage of physiological maturation and requires further study of the influence of individual factors on quality-of-life assessment by adolescent athletes.

Conclusions. PRP therapy minimizes pain and also has a positive impact on the quality of life of juvenile athletes with musculoskeletal injuries, manifesting not only in improved physical condition but also in emotional, role, and social functioning. Quality of life assessment may serve as an additional criterion for evaluating the PRP therapy effectiveness for major joint injuries in juvenile athletes.

Keywords: sports medicine; quality of life assessment; PRP therapy; adolescent athletes; sports injuries; treatment efficacy; PedsQL 4.0

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Compliance with ethical principles. The study was approved by the Local Ethics Committee of the Federal Scientific and Clinical Center for Children and Adolescents of the FMBA of Russia (minutes No. 2 dated 15.05.2025). Voluntary informed consent to participate in the study was signed by all athletes, parents/guardians, or legal representatives of the juniors.

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ПРИМЕНЕНИЕ ОБОГАЩЕННОЙ ТРОМБОЦИТАМИ ПЛАЗМЫ ПОЗВОЛЯЕТ ПОВЫСИТЬ КАЧЕСТВО ЖИЗНИ НЕСОВЕРШЕННОЛЕТНИХ СПОРТСМЕНОВ С ТРАВМАМИ КРУПНЫХ СУСТАВОВ

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Введение. Актуальность исследования обоснована проводимой государственной политикой, ростом количества детей и подростков, занимающихся физической культурой и спортом, высоким процентом травм, получаемых во время занятий спортом, и, как следствие, необходимостью внедрения инновационных методов терапии, минимизирующих срок лечения и обеспечивающих скорейшее возвращение к учебно-тренировочному процессу. Оценка качества жизни испытуемых при проведении исследований является одним из индикаторов (компонентов) комплексной оценки эффективности внедряемых медицинских технологий.

Цель. Оценка качества жизни несовершеннолетних спортсменов сборных команд Российской Федерации в возрасте 10–17 лет включительно с травмами и повреждениями крупных суставов после проведения курса терапии обогащенной тромбоцитами плазмой (PRP).

Материалы и методы. Проведено одноцентровое проспективное контролируемое открытое исследование с участием 22 несовершеннолетних спортсменов: медианный возраст — 16 [15,25; 17,0] лет (девочки — 17 [16,0; 17,0] лет; мальчики — 16 [14,5; 16,0] лет) с травмами и повреждениями крупных суставов. PRP-терапия (три инъекции с интервалом в одну неделю) применялась в соответствии со стандартизированной в медицинской организации закрытой методикой с использованием коммерческого набора Arthrex. Проведены: объективный осмотр, консультации врача травматолога-ортопеда, оценка болевого синдрома по визуально-аналоговой шкале, мышечной силы по шести степеням по стандартной классификации Hislop и Montgomery, функциональных тестов оценки целостности передней крестообразной связки — теста Лахмана и связок коленного и голеностопного суставов — теста переднего выдвижного ящика, клинико-лабораторные исследования (общий анализ крови), инструментальные исследования (магнитно-резонансная томография — МРТ). Оценка качества жизни несовершеннолетних спортсменов проведена по опроснику PedsQL 4.0. Статистическая обработка данных выполнена с применением Excel и пакета прикладных программ JASP v.0.16.

Результаты. После курса PRP-терапии у спортсменов статистически значимо повысились показатели качества жизни, оцененные по PedsQL 4.0. Наибольшая положительная динамика на 23,1% (73 [63; 87] балла при первичном осмотре против 83 [81; 94] баллов при динамической оценке) отмечена по шкале ролевого функционирования. По шкале физического функционирования показатели были повышены на 13,7% по сравнению с первичными данными, зарегистрирована умеренная динамика эмоционального функционирования (6,7%). Установлено 8 вопросов в разрезе 4 шкал, по которым определена статистически значимая ($p < 0,001$) положительная динамика до и после проведения PRP-терапии, наиболее выраженные изменения отмечены респондентами в показателе физического и ролевого функционирования. Зафиксирована статистически значимая положительная динамика болевого синдрома при применении PRP, с максимальным эффектом после двух инъекций. Снижение интенсивности болевого синдрома не ассоциировано с улучшением показателей качества жизни, однако данный аспект может быть связан с особенностями этапа физического созревания и требует продолжения изучения влияния отдельных факторов на оценку качества жизни несовершеннолетними спортсменами.

Выводы. Проведение курса PRP-терапии минимизирует болевой синдром, а также оказывает положительное влияние на качество жизни несовершеннолетних спортсменов с травмами опорно-двигательного аппарата, что проявляется не только в улучшении физического состояния, но и эмоционального, ролевого и социального. Оценка качества жизни может служить дополнительным критерием эффективности применения обогащенной тромбоцитами плазмы при травмах крупных суставов у несовершеннолетних спортсменов.

Ключевые слова: спортивная медицина; оценка качества жизни; PRP-терапия; несовершеннолетние спортсмены; спортивные травмы; эффективность терапии; опросник PedsQL 4.0

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Финансирование. Работа выполнена в рамках государственного задания, рег. № 124022800121-3, тема НИР «PRP-терапия при травмах и заболеваниях крупных суставов у юниоров спортивных сборных команд Российской Федерации» (шифр «PRP-терапия при травмах»; код 83.002.24.800).

Соответствие принципам этики. Исследование одобрено локальным этическим комитетом ФГБУ «ФНКЦ детей и подростков ФМБА России» (протокол № 2 от 15.05.2025). Всеми спортсменами, родителями/опекунами или законными представителями юниоров подписано добровольное информированное согласие на участие в исследовании.

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INTRODUCTION

Forming a healthy sporting future for the country is a key task of the biomedical support for elite sports, a responsibility entrusted to the Federal Medical-Biological Agency. At the end of 2025, 93.4% of children and adolescents in Russia were engaged in physical education and sports, with sports injuries accounting for 35.8%¹. In this regard, to ensure the fastest possible return of young athletes to training and competitive activity and

to elite sports, the implementation of innovative treatment and rehabilitation methods is necessary. Among these is the use of PRP — platelet-rich plasma².

PRP belongs to the methods of regenerative medicine and exhibits pronounced anti-inflammatory, analgesic, regenerative, and anti-apoptotic properties. PRP has the potential to enhance stem cell recruitment, angiogenesis, and extracellular matrix production, as well as to promote osteogenesis and osteoinduction. Owing to these mechanisms of action, PRP

¹ NCAA Injury Surveillance 1997–1998. Overland Park, Kan: National Collegiate Athletic Association; 1998.

² Ryabov VP, Nurullin IF, Kurmaev ZF. Occupational injuries and diseases in athletes: a methodological guide. Kazan: Kazan University; 2017.

is widely used in the treatment of musculoskeletal injuries. Clinical studies confirm the high efficacy of PRP therapy in patellar tendinopathy, lateral epicondylitis, rotator cuff injury, as well as in tendon and muscle injuries at various sites [1, 2].

PRP belongs to the class of orthobiologic products and is an autologous biomaterial that stimulates regenerative processes in tissues with minimal risk of adverse reactions. The PRP injection procedure is minimally invasive and, when performed in strict accordance with the protocol, is associated with a very low complication rate. PRP has gained widespread use in sports traumatology, orthopedics, and in adults with osteoarthritis. However, studies on the use of PRP in adolescent athletes are insufficient [3].

At the same time, when evaluating the effectiveness or ineffectiveness of a method, it is necessary to take into account not only the dynamics of the pathological process but also its impact on the patient's social and daily activities and self-care capacity.

Currently, quality of life occupies a central place in healthcare as "an integral characteristic of the physical, mental, emotional, and social functioning of a healthy or ill person, based on his or her subjective perception"³. Some studies present quality of life assessments in cardiology and neurology patients, as well as in gerontology and transplantology. There are very few studies focused on the quality of life of athletes who sustain injuries and lesions. At the same time, according to literature data, injuries occurring in sports during adolescence can lead to emotional burnout and premature end of a sports career [4].

The study purpose was to assess the quality of life of adolescent athletes (aged 10–17 years inclusive) from Russian national teams with injuries and damage to major joints after a course of PRP therapy.

MATERIALS AND METHODS

A single-center, prospective, controlled, open-label study was conducted involving pediatric patients (aged 10–17 years inclusive) who are professional athletes with injuries and damage to major joints.

The study was conducted on a group of adolescent athletes with injuries and damage to major joints who received a PRP therapy cycle consisting of three injections at one-week intervals. The study included 22 adolescent professional athletes with injuries and damage to major joints; the number of girls and boys was equal (95% CI [29.11%; 70.89%]). The median age of the young athletes was 16 [15.25; 17.0] years (girls — 17 [16.0; 17.0] years; boys — 16 [14.5; 16.0] years). Athletes with knee joint injuries

accounted for 11 (50%), ankle joint — 5 (22.7%), shoulder joint — 3 (13.6%), elbow joint — 2 (9.1%), and hip joint — 1 (4.6%). Distribution by sport type: complex coordination sports — 45.4%, team sports — 36.4%, combat sports — 18.2%.

Inclusion criteria for athletes in the study: age 10–17 years inclusive; any sports specialization; by injury location — major joints (knee, ankle, elbow, shoulder, hip); by type of injured tissue — cartilage, tendon, muscle, condyle, ligament; no history of positive effect from conservative treatment (therapeutic exercise, physiotherapy, use of NSAIDs or other groups of medications); by nature of injury — acute or due to overuse; absence of osteotraumatic changes according to imaging data; compliance with indications for PRP therapy.

Exclusion criteria for the study were: age under 10 years; presence of an infectious process, traumatic and/or inflammatory skin lesions in the intended injection area; acute phase of the injury; autoimmune diseases; abnormalities in laboratory blood parameters: coagulopathies, hemoglobin concentration less than 90 g/L, platelet count less than $100 \times 10^3/\mu\text{L}$, elevated leukocyte (WBC) count (neutrophil-driven) $> 9 \times 10^6/\text{mL}$; a history of significant allergies (to PRP components); indications for surgical treatment.

PRP therapy was administered according to a standardized, closed protocol used at the medical institution, utilizing a commercial Arthrex kit⁴.

According to the approved study protocol, the following were performed in adolescent professional athletes: objective examination (collection of complaints and medical history), consultations with an orthopedic traumatologist, pain assessment using a visual analog scale [5], muscle strength assessment according to the six-grade Hislop and Montgomery (2000)⁵ classification, functional tests for evaluating anterior cruciate ligament integrity (Lachman test) [6] and for evaluating knee and ankle joint ligaments (anterior drawer test) [7], clinical laboratory tests (complete blood count), and instrumental examinations (MRI — magnetic resonance imaging).

The athletes were also informed about the specifics of participation in the study and completed the accompanying documentation. A total of six visits were conducted; during the first visit, overall health status was assessed and laboratory parameters were analyzed. On the same day or during the second visit (the following day), the young athletes received their first ultrasound-guided injection of PRP. The athletes' health status was assessed dynamically before the start of therapy, before each subsequent injection (to rule out contraindications to PRP), and after completion of treatment.

³ Novik AA, Ionova TI, Shevchenko YuL. *Manual on quality of life research in medicine*. 2nd ed. Moscow: OLMA Media Group; 2007.

⁴ Order No. 55 of the Federal State Budgetary Institution "Federal Scientific and Clinical Center for Children and Adolescents of the Federal Medical and Biological Agency" dated 10.02.2025, "On approval of the protocol for studying the effectiveness of PRP therapy in injuries and diseases of major joints in juniors of Russian national sports teams".

⁵ Valerius KP. *Muscles. Anatomy. Movements. Testing*. Transl. from English, ed. by Tsykunov MB. Moscow: Practical Medicine; 2015.

Quality of life of the adolescent athletes was assessed using the PedsQL 4.0 (Generic Core Scales for assessing children's quality of life), which is a universal instrument for obtaining data on quality-of-life parameters in children and adolescents aged 8–12 years and 13–17 years (inclusive)⁶. The questionnaire consists of 23 items, which are grouped into the following assessment scales:

- physical functioning scale — scores on this scale reflect the volume of daily physical activity that is not limited by health status; the higher the score, the greater the physical load the respondent can perform. Low scores on this scale indicate significant physical limitations. This scale contains 8 items;
- emotional functioning (EF) scale — assesses the extent to which the emotional state interferes with work performance and daily activities, including increased time required to complete tasks, reduced volume of work accomplished, and decreased quality of work; the higher the score, the less the emotional state limits the respondent's daily activity. This scale includes 5 items;
- social functioning (SF) scale — assesses satisfaction with the level of social activity (communication, spending time, leisure, relationships with others) and reflects the extent to which the respondent's physical or emotional state limits these activities; the higher the score, the higher the social activity. Low scores correspond to significant limitations in social contacts and reduced level of communication due to worsening health. This scale includes 5 items;
- school/role functioning (RF) scale — characterizes the extent to which the performance of work or daily duties is limited by health-related problems; the higher the score, the fewer health problems the respondent perceives. Low scores indicate limitations in daily activities due to poor physical health. This scale contains 5 items.

For each question, respondents were offered five answer options depending on the frequency of occurrence of the particular characteristic reflected in the assessment scales: “never”, “almost never”, “sometimes”, “often”, “almost always”. Each answer option was assigned standardized scores on a 100-point scale: “never” — 100 points; “almost never” — 75 points; “sometimes” — 50 points; “often” — 25 points; “almost always” — 0 points.

The total score for all modules was calculated on a 100-point scale after the scaling procedure: the higher the final value, the better the child's quality of life. To obtain results for each functioning scale, the arithmetic mean was calculated using the formula:

$$X = X_1 + X_2 + X_n / n, \quad (1)$$

where X — total score for each scale; $X_1, X_2, \dots, X_n$ — scores obtained after scaling for each item; n — number of items in each functioning scale.

Statistical data analysis was performed using Excel and the JASP v.0.16 software package. Qualitative characteristics are presented as proportions (%) with 95% confidence intervals. Since the studied parameters were not normally distributed, the data are presented as median (M_e) with interquartile range [Q_1 ; Q_3]. Intragroup comparison was performed using the non-parametric Wilcoxon test, with a critical significance level of $\alpha \leq 0.05$. To establish the relationship between quality-of-life scores and pain intensity before and after PRP therapy, correlation (Spearman's) analysis was performed.

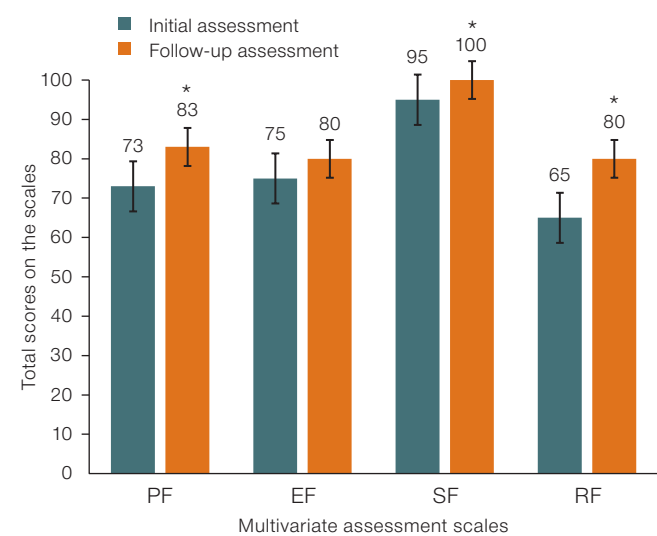
RESULTS

During the study, when assessing the quality of life in adolescent athletes with injuries and lesions of major joints, it was found that after a course of PRP therapy, the athletes showed a statistically significant ($p < 0.001$) improvement in quality-of-life indicators as assessed by the PedsQL 4.0. The greatest positive dynamics (23.1%) were observed in the domain of role functioning (median values were 73 [63; 87] points during the initial examination compared to 83 [81; 94] points during the follow-up assessment). Respondents reported a subjective improvement in physical condition: in the domain of physical functioning, during the follow-up assessment after the therapy, the indicators increased by 13.7% compared to the baseline data. Moderate dynamics of 6.7% were observed in emotional functioning; indicators of social functioning were initially high, and therefore, the increase during the follow-up assessment was minor — 5.3% (Fig. 1).

Additionally, the study examined the dynamics of each indicator across the studied scales in terms of subjective responses to the questions (Fig. 2). Statistically significant differences ($p < 0.001$) were identified in the responses during the repeated questionnaire administration. The most pronounced dynamics (an increase of 50%) were reported by respondents in the physical functioning indicator for the question “It is hard for me to run” (median value 50 [50; 100] at the initial visit, and after therapy — 75 [75; 100]) and “I feel pain” (50 [50; 75] at the initial visit and 75 [75; 75] after therapy); in the role functioning indicator — for the question “I missed school because I had to go to the doctor or the hospital” (50 [50; 75] at the initial visit, and after therapy — 75 [75; 75]).

Particular attention should be paid to the positive dynamics in questions reflecting social adaptation and emotional state. Statistically significant changes

⁶ Nikitina TP. Development and validation of the Russian version of the PedsQL questionnaire for assessing quality of life in children aged 8–18 years: author's abstract of diss. ... Cand. Sci. (Med.). St. Petersburg; 2004.



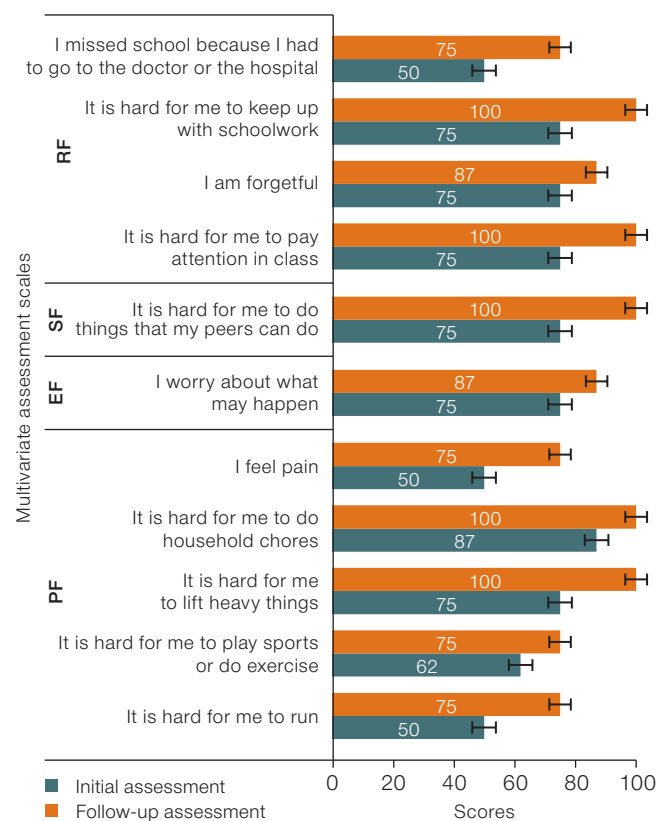
The figure prepared by the authors based on their own data

Fig. 1. Dynamics of quality of life of adolescent athletes (PedsQL 4.0) before and after a cycle of PRP therapy. PF — physical functioning, EF — emotional functioning, SF — social functioning, RF — role functioning; * — $p < 0.001$ — statistically significant difference compared to the indicator at the initial assessment; median values of the indicators are presented

($p < 0.001$) before and after the therapy cycle were observed for the question “I am not able to do things that my peers can do” (75 [75; 100] during the initial questionnaire, 100 [100; 100] during the follow-up) and “I worry about what may happen” (75 [75; 100] at the initial visit, 87 [75; 100] after the therapy cycle). Thus, following a cycle of PRP therapy, adolescent athletes feel themselves on a par with their peers and become more emotionally stable.

In this study, an analysis of the dynamics of pain syndrome was conducted, assessed using the visual analog scale (VAS) (Table).

When assessing pain, it was found that its intensity significantly decreased already after the first injection of platelet-rich plasma (4.9 ± 1.63 points before treatment versus 3.45 ± 1.1 points after the first injection; $p < 0.001$). The maximum effect was observed



The figure prepared by the authors based on their own data

Fig. 2. Analysis of quality-of-life changes in athletes, broken down by individual questionnaire items. RF — role functioning, SF — social functioning, EF — emotional functioning, PF — physical functioning; median values of the indicators presented are statistically significant ($p < 0.005$)

by the fourth visit, two weeks after the start of therapy (after two PRP injections): the pain level decreased to 2.04 ± 1.04 points, after which stabilization and further improvement in the athletes’ health status were observed — by the 12-week time point (visit 6), the mean pain level score was 0.2 ± 0.5 ($p < 0.001$).

During the study, no statistically significant ($p > 0.05$) correlation was found between the intensity of pain syndrome and quality-of-life indicators, either at baseline or after 12 weeks of follow-up.

Table. Dynamics of pain syndrome assessed by the visual analog scale during a cycle of PRP therapy

Parameter	Visit 1 (2)	Visit 3	Visit 4	Visit 5	Visit 6
Severity level of pain syndrome, points	4.9 ± 1.63	3.45 ± 1.1	2.04 ± 1.04	0.9 ± 0.97	0,2 ± 0,5
Statistical significance level, p	<0.001				
		<0.001			
			0.776		
				<0.001	

Table prepared by the authors based on their own data

Note. Data are presented as mean value and standard deviation ($M \pm SD$).

DISCUSSION

PRP therapy is an innovative treatment method that is actively used in various fields of medicine, particularly in orthopedics and sports medicine [8–11]. This method is based on the use of the patient's autologous (own) blood plasma enriched with platelets [8]. Platelets contain growth factors that stimulate tissue regeneration, accelerate healing, and promote recovery after injuries or surgeries [11]. One of the main advantages of PRP therapy is rapid recovery after the procedure [9, 10]. Patients may return to sports activities just a few days after undergoing it. Additionally, PRP may help improve blood circulation and metabolism in joint tissues, also contributing to their recovery. This method is safe, which is associated with a minimal risk of allergic reactions. Importantly, the composition of PRP can be tailored to the individual needs of the patient; this makes the method versatile for various types of injuries and diseases.

In the study by Kia et al., long-term follow-up results revealed significantly lower pain severity in the PRP group compared to the control group (weighted mean difference (WMD) -0.84; 95% CI: -1.23, -0.44; $p < 0.01$). In patients receiving PRP treatment for rotator cuff injuries of the shoulder (WMD, -0.53; 95% CI: -0.98, -0.09; $p = 0.02$) and lateral epicondylitis (WMD) -1.39; 95% CI: -2.49, -0.29; $p = 0.01$), a significant reduction in pain syndrome was observed in the long term [12, 13].

According to Simonov et al., the use of autologous platelet-rich plasma in comprehensive therapy for knee joint injuries in football players aged 13–18 years demonstrated statistically significant efficacy in reducing pain syndrome and improving the functional state of the joint [3].

Popescu demonstrated in his study the efficacy and safety of using platelet-rich plasma in 30 patients aged 12–17 years with meniscus injuries. A reduction in pain syndrome according to the VAS scale was shown, with overall “excellent” and “good” results of PRP therapy in 76.7% of patients [14].

In the study by Herdea et al., a reduction in pain syndrome and an improvement in the Lysholm score were noted in young amateur athletes with meniscus injury: 83.3% of athletes returned to sports and daily physical activity one month after PRP therapy [15].

Thus, PRP is considered a safe and effective method that promotes not only physical recovery [16, 17] but also psychological reintegration due to the rapid return to normal life, which is particularly important for adolescent athletes: 70–80% of 15-year-olds stop playing sports [18], and one of the main reasons, in addition to injuries, is emotional burnout in the child [19].

However, based on these studies, improvements in quality of life can only be inferred indirectly, as specialized questionnaires were not used in them.

In our study, the analysis of quality-of-life dynamics using the PedsQL 4.0 questionnaire demonstrated a statistically significant improvement ($p < 0.001$) across all multidimensional scales after a cycle of PRP therapy, but no correlation was found between quality of life and pain syndrome in athletes either before or after the course of treatment with platelet-rich plasma. In this regard, it seems worthwhile to study the influence of various factors on the assessment of quality of life in adolescent athletes with musculoskeletal injuries. This is related to the developmental stage, as adolescence is a time of both physical maturation and other age-related psychological or sociocultural changes, each of which is associated with risks and opportunities and may affect the psychoemotional state [20], which, in turn, will undoubtedly influence the subjective assessment of quality of life.

Conducting a study of quality of life in adolescent athletes with major joint injuries who have undergone a course of therapy with platelet-rich plasma is associated with a number of limitations. In our work, these limitations include the small sample size ($n = 22$) and the subjectivity of self-reported data in children and adolescents, since a questionnaire method was used, and respondents' answers may have been influenced by their current emotional state. At the same time, the PedsQL 4.0 questionnaire is a validated tool for assessing quality of life and has an age-specific modification; however, it does not account for the specifics of sports activity.

CONCLUSIONS

The conducted study has shown that a cycle of PRP therapy leads to a statistically significant improvement in quality of life in young athletes with injuries and lesions of major joints across all scales of the PedsQL 4.0 questionnaire; the most pronounced effect was observed in the domain of role functioning, indicating the restoration of the ability to fully participate in sports and academic activities.

The absence of a correlation between the level of pain syndrome and quality of life (both before and after therapy with platelet-rich plasma) suggests that, in adolescent athletes, quality of life is determined not only by the presence and intensity of pain but also by a number of other factors, including motivation, support from family and team, as well as the prospect of returning to the academic and training process.

The moderate dynamics of emotional functioning underscore the advisability of integrating psychological support into the comprehensive therapeutic program for young athletes with musculoskeletal injuries.

Thus, PRP therapy serves not only as an effective method for pain relief and accelerating regeneration in musculoskeletal injuries but also as an important component for preserving and restoring the quality of life of young athletes.

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