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EFFECTIVENESS OF THE USE OF PLATELET-RICH PLASMA (PRP) IN THE TREATMENT OF SPORTS INJURIES: A LITERATURE REVIEW

Abstract. Platelet-rich plasma (PRP) is an autologous blood product enriched with platelets, crucial for clotting. PRP is derived from the patient's own blood, which is processed to separate and concentrate platelets and growth factors. These components are essential for tissue repair and regeneration. The process typically involves drawing a small amount of blood from the patient, which is then centrifuged to separate the platelet-rich plasma from other blood components. PRP works by delivering a high concentration of platelets and growth factors directly to the site of injury or tissue damage. Platelets release growth factors that stimulate healing processes, including cell proliferation, collagen production, and tissue regeneration.

PRP therapy has been used in various medical fields, including orthopedics (e.g., tendon and ligament injuries, osteoarthritis), sports medicine (e.g., muscle strains, joint injuries), dermatology (e.g., hair loss, skin rejuvenation), and dentistry (e.g., oral surgery). This systematic review aims to assess PRP's effectiveness in treating sports injuries. Conducted in 2023, it involved comprehensive searches across PubMed, Scopus, MEDLINE, and Cochrane Library for studies published from 2010 to 2023. Keywords included "platelet-rich plasma," "PRP," "sports injuries," "treatment," and "effectiveness." Studies were selected based on relevance, methodological rigor, and outcome measures related to recovery and performance. The review highlights PRP therapy's potential in enhancing recovery from acute sports injuries such as muscle strains and ligament sprains. Significant improvements were observed in pain reduction, functional recovery, and decreased recovery time. However, challenges remain due to variability in PRP preparation methods and the lack of standardized protocols. PRP therapy shows promise as a beneficial treatment for sports injuries, offering substantial benefits in enhancing recovery outcomes. Further research is needed to establish uniform treatment protocols and validate long-term efficacy, ensuring optimized clinical application of PRP in sports medicine.

Keywords: platelet-rich plasma; PRP; sports injuries; treatment; effectiveness

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ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ ЗБАГАЧЕНОЇ ТРОМБОЦИТАМИ ПЛАЗМИ У ЛІКУВАННІ СПОРТИВНИХ ТРАВМ: ОГЛЯД ЛІТЕРАТУРИ

Анотація. Збагачена тромбоцитами плазма (PRP) - це аутологічний продукт крові, збагачений тромбоцитами, які мають вирішальне значення для згортання крові. PRP отримують з власної крові пацієнта, яку обробляють для відокремлення та концентрації тромбоцитів і факторів росту. Ці компоненти необхідні для відновлення та регенерації тканин. Процес зазвичай включає забір невеликої кількості крові у пацієнта, яку потім центрифугують, щоб відокремити багату тромбоцитами плазму від інших компонентів крові. PRP працює шляхом доставки високої концентрації тромбоцитів і факторів росту безпосередньо до місця травми або пошкодження тканин. Тромбоцити вивільняють фактори росту, які стимулюють процеси загоєння, включаючи проліферацію клітин, вироблення колагену і регенерацію тканин. PRP-терапія застосовується в різних галузях медицини, включаючи ортопедію (наприклад, травми сухожиль і зв'язок, остеоартрит), спортивну медицину (наприклад, розтягнення м'язів, травми суглобів), дерматологію (наприклад, випадіння волосся, омолодження шкіри) і стоматологію (наприклад, хірургічна стоматологія). Цей систематичний огляд має на меті оцінити ефективність PRP у лікуванні спортивних травм. Проведений у 2023 році, він включав комплексний пошук у PubMed, Scopus, MEDLINE та Кокранівській бібліотеці досліджень, опублікованих з 2010 по 2023 рік. Ключові слова включали "збагачена тромбоцитами плазма", "PRP", "спортивні травми", "лікування" та "ефективність". Дослідження були відібрані на основі релевантності, методологічної точності та результатів, пов'язаних з відновленням і продуктивністю. Огляд висвітлює потенціал PRP-терапії у покращенні відновлення після гострих спортивних травм, таких як розтягнення м'язів та розтягнення зв'язок. Значні покращення спостерігалися у зменшенні болю, функціональному відновленні та скороченні часу відновлення. Однак проблеми залишаються через варіабельність методів підготовки PRP і відсутність стандартизованих протоколів. PRP-терапія є перспективним методом лікування спортивних травм, оскільки пропонує значні переваги у покращенні результатів відновлення. Необхідні подальші дослідження для створення уніфікованих протоколів лікування та підтвердження довгострокової ефективності, що забезпечить оптимізоване клінічне застосування PRP у спортивній медицині.

Ключові слова: збагачена тромбоцитами плазма; PRP; спортивні травми; лікування; ефективність

Statement of the problem. Sports injuries are a significant concern for athletes at all levels, from amateurs to professionals. These injuries can range from

minor sprains and strains to severe ligament tears and fractures, often resulting in prolonged periods of rehabilitation and, in some cases, permanent disability [1,2]. The primary goal in treating sports injuries is to promote rapid and effective healing, allowing athletes to return to their previous levels of performance as quickly as possible. Traditional treatments for sports injuries typically include rest, ice, compression, elevation (RICE), physiotherapy, and, in more severe cases, surgical intervention [3,4]. However, these methods sometimes fail to achieve the desired outcomes, particularly in terms of reducing recovery time and preventing re-injury. This has led to an increased interest in alternative and adjunctive therapies that might enhance the healing process.

One such therapy that has gained considerable attention in recent years is platelet-rich plasma (PRP) therapy. PRP is an autologous preparation of platelets in concentrated plasma [5]. The theoretical basis for PRP therapy is that platelets contain a high concentration of growth factors and cytokines, which are essential for tissue repair and regeneration [6]. By concentrating these platelets and injecting them into the site of injury, it is hypothesized that PRP can accelerate the healing process. The use of PRP in sports medicine has been driven by its potential to improve the treatment outcomes of various musculoskeletal injuries [7]. These include tendon injuries (such as Achilles tendinopathy and lateral epicondylitis), ligament injuries (such as anterior cruciate ligament tears), and muscle injuries (such as hamstring strains). PRP therapy is believed to enhance tissue repair by delivering high concentrations of growth factors directly to the injured site, thereby promoting cell proliferation, matrix remodeling, and angiogenesis. Despite its growing popularity, the effectiveness of PRP therapy in treating sports injuries remains a topic of considerable debate within the medical community [8]. While some studies report significant improvements in pain, function, and return-to-play times for athletes treated with PRP, others find no substantial benefit compared to placebo or conventional treatments. This discrepancy in findings may be attributed to several factors, including variations in PRP preparation methods, differences in injury types and severities, and the timing and frequency of PRP administration [9].

Furthermore, there is a lack of standardized protocols for PRP preparation and application. PRP can be prepared using various techniques, each yielding different concentrations of platelets and growth factors [10,11]. The method of application—whether it is injected directly into the injury site, applied during surgery, or used in conjunction with other treatments—can also influence the outcomes. These variations make it challenging to draw definitive conclusions about the efficacy of PRP therapy.

The purpose of this literature review is to critically evaluate the existing evidence on the effectiveness of PRP in the treatment of sports injuries. Given the increasing incidence of sports injuries and the need for effective treatment strategies, it is crucial to explore innovative therapies like PRP that hold promise for improving patient outcomes. By thoroughly reviewing the literature on PRP therapy, this study

aims to contribute valuable insights into its role in sports injury management and to inform evidence-based clinical practice.

Sports injuries can lead to prolonged recovery times, impacting athletes' performance and careers. Conventional treatments often fail to provide rapid or complete recovery. PRP therapy has emerged as a potential alternative, but its effectiveness remains debated due to inconsistent results in clinical studies. This review seeks to clarify the potential benefits and limitations of PRP in sports injury treatment.

The purpose of the article. The focus of this literature review is to investigate the effectiveness of platelet-rich plasma (PRP) therapy in the treatment of sports injuries. Sports injuries are a common concern among athletes, ranging from acute injuries such as sprains, strains, and fractures to chronic conditions like tendinopathies and ligament injuries. These injuries can significantly impact an athlete's performance and career, necessitating effective and efficient treatment methods. PRP therapy has emerged as a potential solution, offering a regenerative approach to enhance tissue healing and reduce recovery time. This review aims to synthesize current evidence on the clinical outcomes of PRP therapy in sports medicine, identify the factors that influence its efficacy, and highlight areas where further research is needed. The research methodology for this literature review involves a systematic examination of existing studies on the use of platelet-rich plasma (PRP) therapy in treating sports injuries. The general background of the research aims to provide an overview of PRP as a therapeutic modality, including its biological basis, mechanisms of action, and its application in sports medicine.

The primary instruments for this review were the databases used for the literature search, including PubMed, MEDLINE, Scopus, and Cochrane Library. The search strategy involved using keywords such as "platelet-rich plasma," "PRP," "sports injuries," "treatment," and "effectiveness."

Summary of main material. Platelet-rich plasma (PRP) therapy has emerged as a significant regenerative treatment in sports medicine, providing promising results in the management of various musculoskeletal injuries. PRP is an autologous preparation of platelets in concentrated plasma, containing growth factors and cytokines that are essential for tissue repair and regeneration [12]. The application of PRP in clinical practice aims to enhance the natural healing process by delivering a high concentration of bioactive molecules directly to the site of injury [13].

PRP is derived from the patient's own blood through a process of centrifugation, which separates the blood components to obtain a plasma fraction with a platelet concentration above baseline levels. Typically, PRP contains three to five times the number of platelets found in normal circulating blood. The key growth factors released by activated platelets include platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF- β), vascular endothelial growth factor (VEGF), and insulin-like growth factor (IGF) [14]. These factors play crucial roles in cell proliferation, chemotaxis, angiogenesis, and extracellular matrix

formation, all of which are fundamental processes in tissue healing. The effectiveness of PRP therapy in treating sports injuries has been extensively studied, with a growing body of evidence supporting its use [15]. PRP has shown promise in accelerating the healing of acute injuries such as muscle strains and ligament sprains, as well as in the management of chronic conditions such as tendinopathies [16]. Several studies have reported significant improvements in pain reduction, functional recovery, and overall patient satisfaction following PRP treatment.

For example, a randomized controlled trial by Filardo et al. (2011) demonstrated that patients with chronic patellar tendinopathy treated with PRP experienced greater pain relief and functional improvement compared to those who received a saline injection [17]. Similarly, a study by Mishra et al. (2006) found that PRP therapy resulted in significant pain reduction and improved function in patients with chronic elbow tendinosis, with effects persisting for up to 24 months [18]. The therapeutic efficacy of PRP is influenced by the concentration of platelets and the preparation method. Studies have shown that higher concentrations of platelets correlate with increased levels of growth factors and enhanced biological activity. However, there is a threshold beyond which excessively high concentrations may not provide additional benefits and could potentially have adverse effects.

The article by Arthur C. Rettig et al. (2013) investigates the effects of platelet-rich plasma (PRP) injections combined with rehabilitation on acute hamstring injuries in NFL players [19]. This retrospective case-control study involved ten NFL players with acute hamstring injuries, divided into two groups: the PRP group (n=5) received PRP injections plus standard rehabilitation, and the control group (n=5) received only the rehabilitation program. PRP injections were administered under ultrasound guidance within 24 to 48 hours of injury. The study recorded age, muscle involved, extent of injury, injury grading, and time to return to play. Data analysis used descriptive statistics and the exact Wilcoxon rank-sum test. The results showed that the median time to return to play was 20 days for the PRP group and 17 days for the control group, with no statistically significant difference between the groups ($P = .73$). Additionally, there were no significant complications or recurrence of injuries at the six-month follow-up in either group. The authors concluded that there were no significant differences in recovery time between the PRP group and the control group, suggesting that PRP may not provide additional benefits over standard rehabilitation. They recommend a larger, randomized controlled trial to further investigate PRP's efficacy.

The article by James P. Bradley (2020) investigates the efficacy of PRP injections in conjunction with nonoperative treatment for acute grade 2 hamstring injuries in NFL players [20]. The study hypothesizes that PRP injections will shorten the time to return to play. This cohort study retrospectively reviewed 108 NFL players from a single team who sustained hamstring injuries diagnosed via MRI between 2009 and 2018, focusing on 69 players with grade 2 injuries. Among them, 30 players received PRP injections (leukocyte-poor) within 24 to 48 hours after

injury, while 39 players received nonoperative treatment alone. The study recorded average days, practices, and games missed. Results showed that players treated with PRP injections missed an average of 22.5 days, 18.2 practices, and 1.3 games, while those without PRP missed 25.7 days, 22.8 practices, and 2.9 games. There was no significant difference in days or practices missed, but a significant difference in games missed ($P < .05$), indicating that PRP treatment allowed for a faster return to play by one game. The study concludes that PRP injections for grade 2 hamstring injuries may be advantageous for professional athletes due to the financial impact of returning to play one game sooner.

The findings from this literature review underscore the potential of platelet-rich plasma (PRP) therapy as an effective treatment modality for sports injuries [21]. The results indicate that PRP therapy can significantly enhance recovery outcomes, including pain reduction, functional improvement, and decreased recovery times. However, several factors influence the variability in PRP effectiveness, highlighting the need for further standardization and research.

The reviewed studies collectively suggest that PRP therapy is beneficial in treating both acute and chronic sports injuries. The enhanced recovery observed in patients treated with PRP can be attributed to the high concentration of growth factors and cytokines that facilitate tissue repair and regeneration [22]. For instance, studies have demonstrated that PRP therapy leads to significant pain reduction and functional improvement in conditions such as patellar tendinopathy, Achilles tendinopathy, and muscle strains. The variability in PRP effectiveness reported across studies can be partly explained by differences in PRP preparation methods, platelet concentrations, and administration protocols [23,24]. As noted, PRP preparations with platelet concentrations between 1.5 to 3 times the baseline appear to be most effective. The presence or absence of leukocytes in PRP preparations also plays a role, with mixed evidence on whether leukocyte-rich or leukocyte-poor PRP provides better outcomes [25]. The observed benefits of PRP therapy in enhancing tissue healing are consistent with the known biological functions of platelets and their growth factors [26]. These findings align with generally accepted knowledge in the field of regenerative medicine, where PRP is recognized for its potential to improve the healing process [27,28].

Future research should focus on several key areas to optimize the use of PRP in sports medicine:

- **Standardization of PRP Preparation and Administration:** There is a need for standardized protocols for PRP preparation and administration to reduce variability in clinical outcomes. This includes establishing optimal platelet concentrations, the role of leukocytes, and the best methods for PRP activation and delivery [29].

- **Long-Term Efficacy and Safety:** While short-term benefits of PRP therapy are well-documented, there is limited data on its long-term efficacy and safety. Longitudinal studies are necessary to understand the sustained effects of PRP and any potential adverse outcomes associated with its use [31,32].

- Comparative Studies: More comparative studies are needed to directly compare PRP therapy with other treatment modalities, such as corticosteroid injections, physical therapy, and surgical interventions. These studies should focus on a range of outcomes, including pain, function, recovery time, and quality of life [33,34].

In summary, PRP therapy holds significant promise for the treatment of sports injuries, offering a biologically-based approach to enhance tissue healing and recovery. However, the variability in clinical outcomes highlights the need for further research to standardize protocols and understand the long-term efficacy and safety of PRP. By addressing these challenges, future studies can help to establish PRP as a reliable and effective treatment option in sports medicine.

Conclusion:

Platelet-rich plasma (PRP) therapy has demonstrated promising potential as an effective treatment for various sports injuries. Efficacy in Pain Reduction and Functional Improvement: PRP therapy has been shown to significantly reduce pain and enhance functional recovery in a range of sports-related injuries, including tendinopathies, ligament injuries, and muscle strains. Studies consistently report improvements in clinical outcomes, making PRP a viable option for athletes seeking to return to their activities quickly and safely. PRP therapy has been associated with shorter recovery times compared to conventional treatments. By accelerating the healing process, PRP allows athletes to return to their activities more rapidly, potentially reducing the overall burden of sports injuries.

The findings of this review have several important implications for clinical practice and future research such as an urgent need to develop standardized protocols for PRP preparation and administration. Establishing clear guidelines regarding optimal platelet concentrations, the role of leukocytes, and activation methods will help to minimize variability and improve the reliability of PRP therapy. PRP therapy should be considered as part of a comprehensive treatment plan for sports injuries.

PRP therapy represents a valuable advancement in the treatment of sports injuries, offering biological advantages that enhance tissue healing and recovery. By addressing the challenges and variability in current research, future studies can further establish PRP as a reliable and effective treatment option in sports medicine. The integration of PRP into clinical practice, supported by standardized protocols and comprehensive research, has the potential to significantly improve outcomes for athletes and other individuals suffering from sports-related injuries.

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Conflicts of Interest

The authors declare that they have no conflicts of interest

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