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Abstract

The use of platelet-rich plasma (PRP) in sports medicine is a recently developed technique in which concentrated autologous blood is used to increase the healing rate of various tissues. PRP has been most extensively used in the treatment of different musculoskeletal disorders, particularly in athletic injuries. Owing to its apparent safety and ease of preparation and administration, there has been an increased interest in the efficacy of PRP in a large number of different clinical settings. PRP has been used to treat conditions such as lateral epicondylitis, ligamentous strains, muscular strains, and fracture nonunion in athletes. PRP can be injected to the site of the pathology, either during surgery or in the physician's office. The benefits of PRP in the clinical field appear to be promising, and many investigators are still exploring new ways to use this therapy effectively. However, the clinical evidence for the benefits of PRP in the field of sports medicine is unclear. The purpose of this article was to review the current evidence on PRP therapy in this field.

Keywords
Platelet-rich plasma– sports medicine– growth factor– PRP

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Thrombozytenreiches Plasma: seine Anwendung in der Sportmedizin

Zusammenfassung

Die Anwendung von thrombozytenreichem Plasma (plättchenreiches Plasma oder PRP) in der Sportmedizin ist eine erst kürzlich entwickelte Technik, bei der konzentriertes autologes Blut eingesetzt wird, um die Heilungsgeschwindigkeit verschiedener Gewebearten zu erhöhen. PRP kommt häufig bei verschiedensten Erkrankungen des Bewegungsapparates, vor allem aber bei Sportverletzungen zum Einsatz. Die einfache Herstellung und die scheinbar sichere Anwendung sowie die unkomplizierte Verabreichung haben zu einem

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Platelet-rich Plasma: Applications in Sports Medicine

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Introduction

As a relatively new autologous source, platelet-rich plasma (PRP) has come into the spotlight in the field of orthopedic surgery. PRP, a so-called buffy coat product, is prepared from freshly drawn autologous blood. It is a mixture of platelet- and leukocyte-rich plasma, activated with thrombin to produce a viscous gel cloth [11]. It contains a high concentration of platelets along with at least 6 abundant platelet growth factors such as platelet-derived growth factor (PDGF) and transforming growth factor (TGF), within α-granules, each of which has a specific function during wound repair [1,32]. PRP has been applied in many fields. Since the first use by Ferrari in 1987 during an open heart operation as an autologous transfusion component to avoid homologous blood product transfusion, there have been over 5200 medical research publications related to PRP recorded in the National Center for Biotechnology Information database (NCBI) in various specialties, including sports medicine, neurosurgery, ophthalmology, dentistry, wound healing, orthopedics, and cardiothoracic and maxillofacial surgery [32]. Particularly, there have been many basic and clinical published investigations concerned about therapeutic efficacy of PRP in sports-related injuries and disorders [3,15,21,24,31,38,44].

Athletes are known to be early adopters of novel treatment methods. They like to find less invasive methods for injury management, to enable a fast return to their sports. Additionally, they tend to choose treatments which have little or no published peer-reviewed evidence of efficacy, mostly due to the fact that it takes many years for new treatment modalities to be fully-validated by large, prospective, randomized controlled trials [25]. Because of these demands, PRP be an attractive option for novel use by clinicians in sports medicine.

As summarized by Smith et al. [42] "In surgical settings, PRP decreases the frequency of intraoperative and postoperative bleeding" at the surgical sites; "accelerates soft-tissue healing; supports the initial stability of grafted tissue at the recipient sites as a result of its cohesive and adhesive nature; promotes rapid vascularization of healing tissue by delivering growth factors and, when used in combination with bone replacement materials, induces regeneration".

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verstärkten Interesse an der Wirksamkeit der PRP-Anwendung in unterschiedlichen klinischen Einsatzbereichen geführt. PRP wird bei Erkrankungen wie Epicondylitis humeri radialis, Bandverletzungen, Muskelverletzungen und der Fraktur- und Pseudarthrosenbehandlung bei Sportlern eingesetzt. PRP kann entweder während der Operation oder im Sprechzimmer des Arztes direkt an die gewünschte Stelle injiziert werden. Die Vorteile von PRP in der klinischen Anwendung scheinen vielversprechend zu sein und viele Forscher suchen noch immer neue Wege, diese Therapie effektiv zu nutzen und weiter zu entwickeln. Jedoch konnten die klinischen Nachweise für die vorteilhafte Anwendung von PRP im Bereich der Sportmedizin bisher nicht eindeutig erbracht werden. Dieser Artikel beleuchtet die aktuellen Erkenntnisse der PRP-Therapie in der Sportmedizin und prüft diese kritisch.

Schlüsselwörter
Thrombozytenreiches Plasma– Plättchenreiches Plasma– Sportmedizin– Wachstumsfaktor– PRP

Nevertheless, few clinical studies have quantified the actual components that are used in treatment, and a standard formulation or dosage of PRP is not yet recorded. Therefore, guidelines for PRP therapy application must be developed in order to encourage and assist physicians to use it safely, and to develop robust clinical research to define the scope of use of PRP and its anticipated effects. This article will attempt to review the scientific basis and current state of applicable indications, and suggest a path forward for its use in sports medicine.

Basic concepts of PRP

To obtain PRP, a sample of the patient's blood was taken and centrifuged to concentrate autologous platelets (Fig. 1). The whole blood sample normally contain 93% red blood cells, 6% platelets, and 1% white blood cells. The average platelet concentration in a whole blood sample is about 200,000 per mL (normal range 150,000-350,000 per mL) [36]. In PRP, the ratio of red blood cells to platelets is found to be reversed; thereby, the concentration of platelet related factors becomes higher, which is thought to be more effective in healing. The exact ratio of red and white blood cells to platelets in PRP is variable depending on the way in which the PRP is prepared. From a quantitative perspective, PRP is broadly defined as a sample of autologous plasma with platelet concentrations above baseline. To develop more specific preparations, some research groups have adopted a more objective definition of 5 times the platelet concentration of whole blood, that is, 1,000,000 per mL platelet count.
Platelets have to be activated with thrombin and calcium upon application of the resultant gel to the surgical site [25,38]. This process leads to the formation of a blood clot, in which platelets predominate over red blood cells in a ratio reversed that of a natural clot. Surgical lesions or wounds enhanced with PRP heal at rates two to three times faster than untreated surgical sites [20,39].

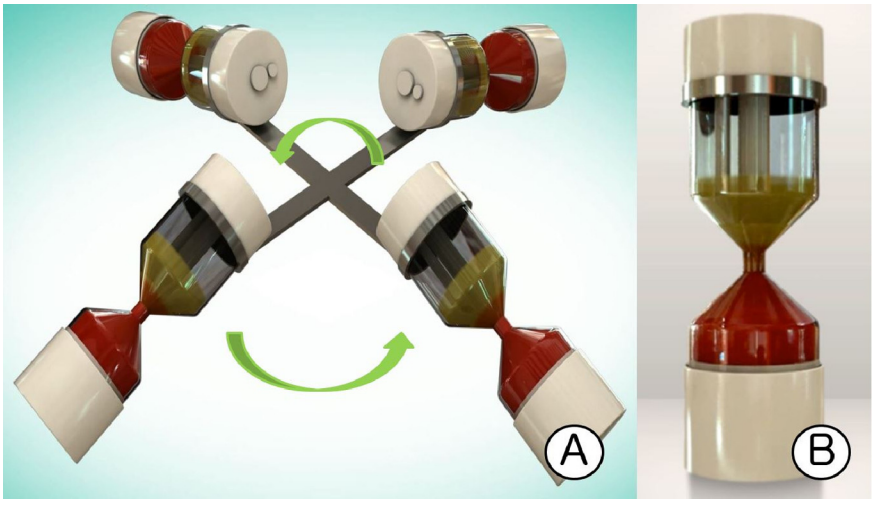

Figure 1
Schematic image of PRP preparation. A) Centrifugation of whole blood B) whole blood is divided into Packed RBC layer and buffy coat layer (PLT, WBC), PRP, and PPP layer.