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Regenerative Biological Effects of Platelet-Rich Plasma (PRP) Therapy in Orthopaedic Sports Medicine

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Abstract Sports injuries may lead to severe consequences for athletes. Many athletes suffer from injuries of skeletal muscle. While these injuries may be minor, they may be quite serious [1]. An athlete needs to train on a regular basis. An injury causes her/his time to be wasted. Similarly, if the athlete is a member of a certain team, the injury affects multiple people. Platelet-rich plasma (PRP) is a quite promising technique with significant potentials. PRP is an autologous blood product used in terms of sports medicine to treat acute and chronic tendon, ligament, and muscle injuries in over 86,000 athletes in the United States on annual basis [2]. PRP is a quite promising technique with significant potentials. It is expected to accelerate the healing process of tendon and ligament related injuries. This is particularly advantageous for athletes [3].

Keywords: *plasma, therapy, sports medicine, orthopaedic*

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1. Introduction

There are methods of treatment for sports injuries. Yet, sometimes these methods fail to fully rehabilitate the injury. There are cases that the athlete does not fully regain his previous performance after the injury. %55 of sports injuries are related to skeletal muscle. Aside from their physical effects, these injuries may result in pain of long duration. Furthermore, the injury may conclude the athlete's sports life because of its reversible consequences [1,4]. The reason why Platelet-Rich Plasma injection is such a promising treatment is because of the inadequacy of conventional methods [1].

The study of Platelet-Rich Plasma dates back to the 1970s. However, the 1990s were a turning point for PRP because it's strong potential for the treatment of sports injuries was understood [5]. In the past few years, PRP has caught great attention and it has started to be used commonly on people [2]. Recent data states that there are nearly 90,000 athletes in the U.S that benefit from PRP. It is also commonly used in Europe [5,6,7].

1.1. Platelet-Rich Plasma (PRP)

With the ability to heal injuries and regeneration, Platelet-Rich Plasma is a widespread breakthrough in the world of sports [8]. Platelet-Rich Plasma (PRP) consists of platelets and growth factors that are concentrated. It may be mistaken for a regular blood clot, but there is a major distinction [9]. While a regular blood clot consists of %94 red blood cells and %6 platelets, Platelet-Rich Plasma consists of %5 red blood cells and %94 platelets. Platelets are cells that play a key role in the healing process. Regarding the platelet ratio in PRP, its potential healing effect may be understood [8].

For the preparation of PRP, first, a blood sample has to be drawn. Then, to distinguish the components inside, it must be centrifuged. Centrifugation can be completed in two stages. This is a very common procedure to obtain PRP. For the final stage, the platelets are activated. Afterward, Platelet-Rich Plasma (PRP) is ready to be applied to the injured area. An important point to pay regard to is that PRP is very likely to turn into a clog. Therefore, it is crucial to arrange time correctly to obtain an accurate result [3].

PRP is considered as a very promising method in terms of healing injuries that are related to tendons and connective tissue. Thus, it is a major discovery for athletes who suffer commonly from these injuries [9]. The key point of Platelet-Rich Plasma is that it allows platelets to reach the injury before other components. When the platelets reach the target, they can start the healing process by setting the growth factors free [10].

1.1.1. Growth Factors

In the past decade, studies that focused on injury treatment showed the importance of growth factors. PRP is known to include some of these growth factors [8].

Thegrowth factors in PRP assist the regeneration process. These growth factors are mainly Platelet-Derived Growth Factor (PDGF), Transforming Growth Factor (TGF), Vascular Endothelial Growth Factor (VEGF) and Epithelial Growth Factor (EGF) [8]. However, there are several other biological substances in PRP such as fibrin, fibronectin, and vitronectin [11,12]. When PRP reaches the target injured area, it triggers the mitogenesis and angiogenesis. Thus, rising the number of cells that are responsible for the healing [13].

The inadequate amount of studies on PRP brings along the issue of safety. Since the source of PRP is the patient's blood, It is possible to say PRP is incapable of transferring diseases. Therefore, the concern of HIV or hepatitis is invalid [13].

1.1.2. Growth Factors and Cancer Risk

The risk of cancer is one of the concerns of Platelet-Rich Plasma. The idea behind this concern is the possibility of growth factors to trigger cell reproduction. Thus, PRP is rich in growth factors is regarded as a possible risk factor. However, there is no evidence that growth factors directly cause cancer. The target zone of growth factors is the membrane of the cell. Growth factors are not abnormal substances [13].

1.1.3. World Anti-Doping Agency and PRP

Until 2010, the World Anti-Doping Agency strictly prohibited the use of platelet related components. Platelet-Rich Plasma was also in the list of prohibited substances. The reason for that was the growth factors in PRP. High levels of growth factors in an athlete's body were considered to be unjust. Yet, the regulation of PRP usage was lifted in 2011. The claim that PRP was a performance-enhancer was not proved [5].

2. Discussion

Tennis Elbow is one of the disorders that can be cured with the help of a PRP application [14,15]. Also, several studies suggest the use of PRP for jumper's knee, rotator cuff, and Achilles tendon disorders. However, these assertions need further studying and need to be clinically researched. A study on Achilles tendon disorder demonstrated that when PRP is applied to patients with a chronic disorder, the treatment was unsuccessful [16]. However, some studies suggest otherwise, claiming that PRP did lead to some improvements in the disease [17].

Anterior Cruciate Ligament reconstruction is one of the treatments that may benefit from PRP. Several studies questioned if PRP may help the healing process by curing tendons. The 6 months of post-operation was observed. However, no significant improvement was found [18,19].

A Research that studied the effect of PRP on elbow tendinopathy was conducted on 100 people. It was observed that patients that were treated with PRP demonstrated substantial improvements in terms of pain and movement compared to the non-treated group [15].

A clinical trial studied the PRP effect specifically on chronic Achilles Tendinopathy. The study examined two control groups: the first group including a treatment method of PRP and eccentric training and the second group with saline injection and eccentric training. At the end of the study, the two groups showed no difference in terms of pain and function status [16]. However, some studies argue the beneficial effect of PRP on Achilles Tendinopathy. For instance, in one research, surgery with PRP treatment resulted in improvements [17].

3. Conclusion

With PRP treatment, the sports injuries may be cured in a shorter period, meaning the athlete may continue her/his exercises shortly. The treatment is expected to reduce the risk of performance decrease after the injury. Also, the athlete may avoid the risk of recurrence of injury. Still, the detailed future effects of PRP are yet to be studied [3].

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