

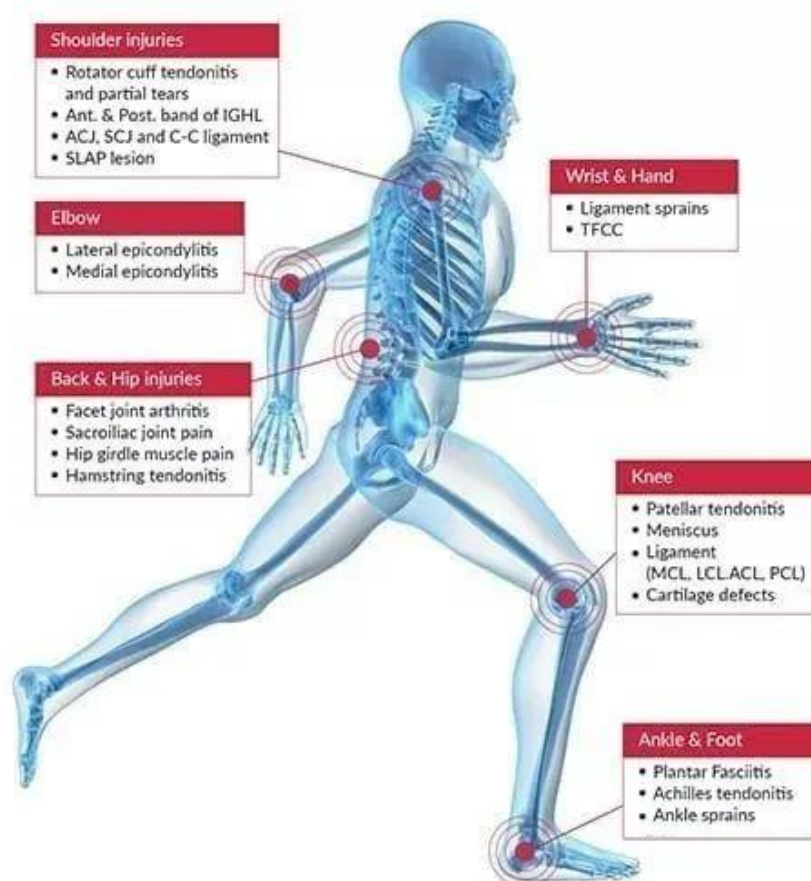
What are the different types of platelet-rich plasma PRP in the world?

Platelet-rich plasma (PRP) is currently widely used in various medical fields. In recent years, the application of PRP in orthopedics has attracted more and more attention, and its application in different fields such as tissue regeneration, wound healing, scar repair, plastic surgery and beauty has become more and more extensive. In today's issue, we'll analyze the biology of PRP, its mechanism of action, and the classification of PRP to better understand what can and shouldn't be done with PRP.

The History of PRP

PRP is also known as platelet-rich plasma (PRP), platelet-rich growth factor (GFS) and platelet-rich fibrin (PRF) matrix. The concept and description of PRP began in the field of hematology. Hematologists coined the term PRP in the 1970s, mainly to treat patients with thrombocytopenia by extracting platelets and adding transfusions.

Ten years later, PRP began to be used in maxillofacial surgery as PRF. Fibrin has adhesive and homeostatic properties, and PRP has anti-inflammatory properties that stimulate cell proliferation. Subsequently, PRP began to be widely used in the musculoskeletal field of sports injuries and achieved good therapeutic effects. Because the treatment targets are mainly professional athletes, it has attracted extensive attention in the media and has been widely used in the field of sports medicine. Subsequently, PRP was gradually promoted in orthopedics, surgery, pediatric surgery, gynecology, urology, plastic and cosmetic surgery and ophthalmology.



Platelet Biology

Peripheral blood cells include red blood cells, white blood cells and platelets, all derived from a common pluripotent stem cell that can differentiate into different cell lineages. These cell lines contain precursor cells that can divide and mature. Platelets are derived from bone marrow and are nucleated disc-shaped cells of different sizes, with an average diameter of about 2 μm , and are the least dense blood cells. Platelet counts in normal circulating blood range from 150,000 to 400,000 per microliter. Platelets contain several crucial secretory granules, of which there are three main ones: dense granules, α -granules, and lysosomes. Each platelet has about 50-80 particles.

The Definition of PRP

In conclusion, PRP is a biological product, which is a concentrated plasma with a significantly higher platelet concentration than that in peripheral blood. PRP not only contains high levels of platelets, but also contains all coagulation factors, including a series of growth factors, chemokines, cytokines and plasma proteins.

PRP is extracted from peripheral blood drawn by various laboratory preparation methods. After preparation, according to different density gradients, red blood cells, PRP, and PPP in the blood components are separated in sequence. In PRP, in addition to the high concentration of platelets, it is also necessary to consider whether it contains leukocytes and whether it is activated. Based on these aspects, different PRP types suitable for different pathological conditions are determined.

Several commercial devices are currently available that can simplify the preparation of PRP. These PRP devices typically produce 2-5 fold higher PRP platelet concentrations. Although one might think that the higher the platelet concentration and the higher the amount of growth factor, the better the therapeutic effect should be, this has not been established, and 3-5 times the concentration is generally considered appropriate.

Commercial devices have the advantage of being standardized and simpler, but have limitations of their respective devices. Some can not remove specific impurities well, and some PRP preparations are not high in concentration. Basically, all commercial equipment cannot be individually and accurately prepared. This is the biggest problem with standardized equipment. At present, only precise individualized laboratory preparation technology can cover all patient needs, which has high requirements on laboratory technology.

The Classification of PRP

In 2006, Everts et al proposed the concept of leukocyte-rich PRP. Therefore, PRP can be roughly divided into two types according to the number of leukocytes contained: PRP with poor leukocytes and PRP with rich leukocytes.

1) Platelet-rich plasma containing high concentration of leukocytes, referred to as L-PRP (Leukocyte Platelet-Rich Plasma, containing a small amount of red blood cells), is mainly used for refractory wounds, diabetic foot, gout with non-healing wounds, bone repair, nonunion, bone marrow inflammation and other clinical treatment.

2) Platelet-rich plasma without or with low concentrations of leukocytes is referred to as P-PRP (Pure Platelet-Rich Plasma, without red blood cells), mainly used for sports injuries and degenerative diseases, including meniscus injuries, ligament and tendon injuries, tennis elbow, knee Arthritis, cartilage degeneration, lumbar disc herniation and other diseases.

3) After the liquid PRP is activated by thrombin or calcium, a gel-like PRP or PRF can be formed. (First prepared by Dohan et al. in France)

In 2009, Dohan Ehrenfest et al. proposed 4 classifications based on the presence or absence of cellular components (such as leukocytes) and fibrin structure:

- 1) Pure PRP or leukocyte-poor PRP: The prepared PRP has no leukocytes, and the content of fibrin after activation is low.
- 2) White blood cells and PRP: contain white blood cells, and the content of fibrin after activation is low.
- 3) Pure PRF or leukocyte-poor PRF: the preparation does not contain leukocytes and has high-density fibrin. These products come in the form of activated gels and cannot be used for injection.
- 4) Leukocyte-rich fibrin and PRF: containing leukocytes and high-density fibrin.

In 2016, Magalon et al. proposed the DEPA classification (dose, efficiency, purity, activation), focusing on PRP platelet count, product purity, and platelet activation.

1. Platelet injection dose: Calculate by multiplying platelet concentration by platelet volume. According to the injected dose (in billions or millions of platelets), it can be divided into (a) very high dose: >5 billion; (b) high dose: from 3 billion to 5 billion; (c) medium dose: from 1 billion to 3 billion; (d) low dose: less than 1 billion.
2. Preparation efficiency: the percentage of platelets collected from blood. (a) High device efficiency: platelet recovery rate >90%; (b) medium device efficiency: platelet recovery rate between 70-90%; (c) low device efficiency: recovery rate between 30-70%; (d) The equipment efficiency is extremely low: the recovery rate is less than 30%.
3. PRP purity: It is related to the relative composition of platelets, white blood cells and red blood cells in PRP. We describe it as (a) very pure PRP: >90% platelets relative to erythrocytes and leukocytes in PRP; (b) pure PRP: 70-90% platelets; (c) heterogeneous PRP: % platelets Between 30-70%; (d) Whole blood PRP: the percentage of platelets in PRP is less than 30%.
4. Activation process: whether to activate platelets with exogenous coagulation factors, such as autologous thrombin or calcium chloride.

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