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Platelet-Rich Plasma

Fact or Fantasy?

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KEYWORDS

• Platelet-rich plasma • PRP • Platelet-rich fibrin • Growth factors • Autologous platelets
• Autologous injectables

KEY POINTS

- Platelet-rich plasma (PRP) is an autologous solution drawn from one's blood that has been centrifuged and filtered to contain a high concentration of platelets and their bioactive growth factors.
- PRP has been applied in numerous ways in multiple medical and surgical fields, particularly in cosmetic medicine and surgery because of its potential rejuvenating effects.
- In cosmetic medicine and surgery, PRP has been described to improve wound healing, reduce hypertrophic scars, enhance fat grafting, promote hair growth, rejuvenate the skin, and serve as an adjunct for other cosmetic procedures, but the evidence in support of the true efficacy of PRP is limited.
- The reported PRP isolation protocols vary significantly, and until an optimal and standardized isolation protocol is agreed on, it will be difficult to appropriately evaluate the efficacy of PRP in cosmetic medicine and surgery.

INTRODUCTION

Platelet-rich plasma (PRP) is an autologous solution of highly concentrated platelets and their associated bioactive factors. The use of PRP has become a controversial topic in medicine since its introduction in the 1970s. Multiple fields, including orthopedics, rheumatology, cardiology, gynecology, ophthalmology, physical medicine and rehabilitation, and oral maxillofacial surgery, have sought to understand the mechanism of PRP activity, optimize its efficacy, and apply it in different clinical scenarios. Because PRP contains growth factors that are integral to inflammatory processes and wound healing, its application is also of significant interest in cosmetic plastic surgery and dermatology.

During the past 2 decades, multiple studies, case series, and case reports have been published describing the potential applications of PRP in cosmetic surgery and medicine. Physicians are searching to determine how PRP may be applied in minimally invasive rejuvenation, making PRP a popular topic at national and international cosmetic conferences. As with many products and procedures in cosmetic surgery, PRP has found its way into popular media, and celebrities are now advocating for procedures like the "Vampire Lift and Vampire Facial." As such, increasingly more patients are now coming to physicians requesting PRP-based therapies.

Although the attention surrounding PRP is intriguing, it is important for physicians and other practitioners to step back and critically evaluate the evidence on the

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effectiveness of PRP therapies. Because PRP is being touted as having numerous applications in cosmetic surgery, it is the duty of the treating physician to understand the data, on both a basic science level and a clinical level, for each proposed indication, before use of PRP in patient care.

This article informs the reader on the following: (1) the history of PRP; (2) the current definition of PRP and its functional components; (3) how PRP is currently isolated and classified; (4) current PRP applications in the field of cosmetic surgery and the scientific evidence on these indications; (5) potential adverse effects; and (6) the future of PRP therapies.

THE HISTORY OF PLATELET-RICH PLASMA

It is difficult to set a date on the exact origin of PRP given that there are so many forms of "platelet-rich plasma" formulations. In 1970, Matras described the allogeneic fibrin glue formed by polymerizing fibrinogen with thrombin and calcium [1]. In 1990, Gibble and Ness described an autologous fibrin gel with hemostatic properties [2]. In 1998, Marx and colleagues [3] first described PRP's potential regenerative properties when they described its ability to enhance bone grafts in oral surgery. Eventually, the more modern conception of PRP was described, which shifted the focus away from recombinant growth factors. The allure of an autologous source of platelets containing active growth factors was, in part, because of the avoidance of recombinant growth factors that were limited by high cost, suboptimal delivery to target tissues and cells, and short half-lives. As a result, over the past 2 decades, the use of autologous PRP, without exogenous factors, has grown in many medical and surgical specialties.

DEFINITION AND FUNCTIONAL COMPONENTS OF PLATELET-RICH PLASMA

PRP is an autologous solution isolated from one's blood that has been centrifuged and filtered to contain a high concentration of platelets, often 3 to 4 times higher than physiologic concentrations [4]. The functional component of PRP is the platelet (thrombocyte), a membrane-bound cellular fragment, and the bioactive molecules stored in its alpha and dense granules. The principle behind the medical application of PRP is the ability to deliver high concentrations of activated physiologic growth factors to specific cells and tissues. Although there are more than 30 bioactive molecules contained in platelets, the most important ones are cell adhesion molecules, namely, fibrin, fibronectin, and vitronectin, that aid in hemostasis, as well as 7 key growth factors: connective tissue growth factor, epidermal growth factor (EGF), fibroblast growth factor (FGF), insulin-like growth factor 1 (IGF-1), platelet-derived growth factor (PDGF), transforming growth factor (TGF), and vascular endothelial growth factor [4]. Each of these growth factors has specific functions, but all play a role in inflammation and wound healing (Table 1).

TABLE 1
The 7 Most Important Growth Factors in Platelet-rich Plasma and Their Physiologic Effects

Growth Factor	Physiologic Effect
Connective tissue growth factor	Promotes fibrosis Stimulates white blood cell and platelet adhesion, migration, and proliferation Promotes angiogenesis
EGF	Activates keratinocytes Promotes reepithelialization Maintains skin integrity Stimulates epithelial, mesenchymal, and endothelial mitogenesis
FGF	Promotes endothelial proliferation and organization Promotes angiogenesis Mitogenic Promotes proliferation of fibroblasts Stimulates epithelial proliferation, migration, and differentiation Regulates tissue remodeling
IGF	Regulates epithelial growth and development
PDGF	Promotes fibroblast, smooth muscle, and glial mitogenesis Regulates tissue remodeling Regulates cellular differentiation Promotes angiogenesis Regulates cellular division of fibroblasts Maintains proliferation of oligodendrocyte progenitor cells
TGF	Promotes synthesis of extracellular matrix Stimulates fibroblast and keratinocyte proliferation Promotes angiogenesis
Vascular endothelial growth factor	Promotes angiogenesis Promotes lymphangiogenesis