# Platelet-Rich Plasma for Skin Rejuvenation and Tissue Fill

Jiahui Lin, MD, Anthony P. Sclafani, MD*

**KEYWORDS**

• Platelet-rich plasma • Platelet-rich fibrin matrix • Skin rejuvenation • Tissue fill • Autologous fat graft • Laser resurfacing

**KEY POINTS**

- Platelet preparations, including platelet-rich plasma (PRP) and platelet-rich fibrin matrix (PRFM), contain high concentrations of growth factors that facilitate wound healing.
- Platelet preparations are generally safe to use, as they are derived from patients' own blood and, thus, are typically inexpensive to obtain.
- Platelet preparations have been used alone for small-volume tissue fill, such as for treatment of facial wrinkles, to help maintain contour when performing autologous fat grafts and to improve cosmetic outcomes and decrease recovery time after laser resurfacing.
- PRFM may be a better option compared with PRP, because of its slower release of growth factors and its greater similarity to the natural clotting and wound healing process.
- More robust studies are necessary to definitively characterize the benefits of platelet preparations for facial rejuvenation and tissue fill.

## INTRODUCTION

Platelet-rich plasma (PRP) has been one of various platelet preparations that have been used for wound healing, facial rejuvenation, and recovery after surgery. Although platelet preparations use is well documented in orthopedic and dental surgery, they have not yet been widely adopted in facial plastic surgery. Platelet preparations contain growth factors that enhance the production of collagen and fibronectin, promote angiogenesis, and improve wound healing.[1] Although studies abound, there are few robust randomized controlled trials. Most published literature consists of case reports or small case series. The preparation and specific type of platelet preparation used are also not always specified, making comparisons and further studies difficult. Additionally, objective outcomes are difficult to measure and not always reported, thereby limiting the results of many published studies. This article focuses specifically on the available data on the use of platelet preparations in facial skin rejuvenation and tissue fill.

## WHAT IS PLATELET-RICH PLASMA?

All platelet preparations start with autologous whole blood, from which platelets and other cells and proteins can be harvested (**Table 1**). Various types of platelet preparations exist and are classified based on their concentrations of leukocytes and fibrin polymerization as a result of the preparation technique.[2] All techniques involve blood collection immediately before use and one or more centrifugation steps. At a minimum, centrifugation separates a red blood cell (RBC) layer from a supernatant platelet-poor plasma (PPP) layer

Department of Otolaryngology–Head and Neck Surgery, Weill Cornell Medicine, New York, NY, USA
* Corresponding author. Department of Otolaryngology, Weill Greenberg Center, Weill Cornell Medical Center, 1305 York Avenue, Fifth Floor, New York, NY, 10021.
*E-mail address:* ans9243@med.cornell.edu

Facial Plast Surg Clin N Am ■ (2018) ■–■
https://doi.org/10.1016/j.fsc.2018.06.005

**Table 1**
**Types of platelet preparations and their properties**

| | Leukocyte Poor | Leukocyte Rich |
|---|---|---|
| PRP | P-PRP *(small volume, weak/minimal fibrin polymerization)* | L-PRP *(significant WBCs, small volume, weak/minimal fibrin polymerization)* |
| PRF | P-PRF/PRFM *(larger volume, strong/dense fibrin polymerization)* | L-PRF *(significant WBCs, larger volume, strong/dense fibrin polymerization)* |

*Abbreviations:* L-PRF, leukocyte-poor platelet-rich fibrin; L-PRP, leukocyte-rich PRP; P-PRF, leukocyte-poor platelet-rich fibrin; PRF, platelet-rich fibrin; PRFM, platelet-rich fibrin matrix; P-PRP, leukocyte-poor PRF; WBCs, white blood cells.

*Adapted from* Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). Trends Biotechnol 2009;27:158–67; with permission.

and a buffy coat layer in between that is rich in platelets and leukocytes. Additional centrifugation of the supernatant and buffy coat layers can yield 2 types of PRP: leukocyte-poor (or pure) PRP (P-PRP; leukocytes are separated from the platelets, which are subsequently concentrated in a small volume of plasma) and leukocyte-rich PRP (L-PRP; platelets and leukocytes together are concentrated in a small volume of plasma).

Both types of PRP typically require an activation step to release the growth factors with calcium chloride and/or thrombin. P-PRP was the first form of platelet concentrate developed for topical use. However, it required the support of a transfusion laboratory or cell separator in order to process out the leukocytes. Protocols that did not rely on such systems were often inconsistent and would yield L-PRP instead. Thus, L-PRP was developed, initially as a means to create PRP without a cell separator and later to purposefully include leukocytes for their anti-infectious and immune regulatory effects. Furthermore, leukocytes are known to produce large amounts of vascular endothelial growth factor (VEGF), which could further promote angiogenesis.[3,4]

Platelet-rich fibrin matrix (PRFM) differs from PRP, as it is larger in volume, has a lower platelet concentration, and includes fibrin that develops into a 3-dimensional matrix to bind growth factors and cells.[5] The most common commercially available form is leukocyte-poor platelet-rich fibrin (PRF) (sometimes referred to PRFM or P-PRF), in which collected blood is centrifuged at a low speed without anticoagulants in the presence of a thixotropic separator gel to produce 3 layers: a layer below the gel containing the RBCs and most white blood cells (WBCs), a buffy coat of platelets on the upper surface of the gel, and a supernatant PPP layer, which has a fibrinogen content equivalent to that of normal plasma. The plasma and buffy coat are then removed and used together. Activation with calcium, thrombin, or even through direct contact with tissue leads to conversion of fibrinogen to a polymerized fibrin, platelet degranulation, and release of growth factors from alpha granules. The fibrin network formed provides sites for binding and localization of growth factors and is also theorized to provide a scaffold for cellular migration and collagen deposition. It is thought that this preparation mimics natural clot formation and the wound response more closely.

A leukocyte-rich PRF (L-PRF) preparation also exists, but it has not widely been used for facial plastic surgical applications. The technique is similar to PRP methods with a few exceptions. After the first centrifugation, the buffy coat and PPP are transferred into a calcium chloride tube. A P-PRF clot can be formed after the second centrifugation and subsequently applied.

PRP is the most common commercially available platelet preparation. It classically contains 4 to 7 times the amount of platelets compared with the patients' baseline.[6] Its clinical benefits are largely attributed to the growth factors that are contained within alpha granules, including platelet-derived growth factor, epithelial growth factor, and VEGF.[7,8] These granules also contain other factors that may modulate inflammation and increase membrane permeability, including serotonin, histamine, dopamine, and adenosine.[9] Once the platelet preparation is activated, typically by calcium chloride or thrombin, these growth factors and bioactive factors are released from the alpha granules to act locally where the PRP is applied. When applied, PRP has been postulated to increase dermal fibroblast proliferation, increase the expression of matrix metalloproteinases (from leukocytes) to remove photodamaged extracellular matrix, augment the production of collagen, and promote wound healing via increased expression of G1 cell cycle regulators.[10,11]

It is important to distinguish between these different types of platelet preparations and reported preparation techniques. Although they are clearly delineated here, it is not always obvious in published reports, as most preparations are commonly referred to simply as *PRP*. In the review