

# Ten Tips for Selecting a Platelet-Rich Plasma Preparation System

By Ryan Riggs, M.D.

Choosing a platelet-rich plasma (PRP) preparation system can be overwhelming for a clinic. Over 50 different systems are mentioned in the literature and each system seems to trumpet its own unique features. But which factors are really important in comparing PRP systems?

I faced this dilemma five years ago when I decided to add PRP therapy to my practice. As a novice, my focus was primarily on the preparation process. As I got more comfortable, my concerns shifted to other aspects of PRP treatment: patient outcomes, effectiveness, profitability, customization, and streamlining.

When I was facing the ominous task of choosing a PRP system, it would have been nice to have some sort of guide to help me sort through the information and help me understand what is (or is not) important. This article will provide some tips on how to go about determining which PRP systems will be the most effective, easy to use, and affordable.

## How to Measure Effectiveness

Platelet-rich plasma (PRP) is an effective treatment for many orthopedic conditions. However, experts<sup>1</sup> explain that “not all PRP is created equal” and have recently identified four factors that bolster the effectiveness of PRP. (For more details on this refer to AAOE’s article on 4/22/19 [HERE](#).) The optimum PRP formulation as defined by experts<sup>1</sup> has the following features:

1. Minimal red blood cells (RBCs)
2. Minimal neutrophils
3. Maximum monocytes
4. Maximum lymphocytes

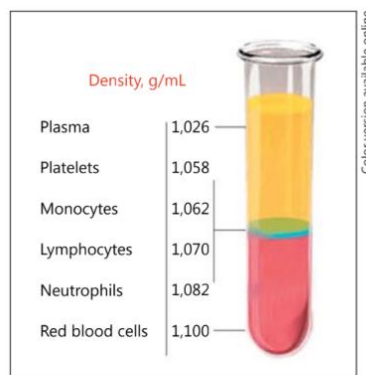
Though this is the most effective formulation of PRP, many PRP preparation systems fall short of these requirements. Knowing how a PRP preparation system works can help us decipher which system provides the most effective product.

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<sup>1</sup> Expert panel discussion. PRP Formulation: What Is In and What Is Out? The Orthobiologic Institute Symposium. June 2018; Las Vegas NV.

## First a Few Basics about PRP Preparation:

Understanding a few basics of PRP preparation will help you understand how to differentiate between various systems. The illustration<sup>2</sup> on the right shows a sample of blood after it has spun in a centrifuge. Because RBCs have the highest density, they end up at the bottom of the sample. On top of the RBCs is a concentrated collection of platelets, monocytes, lymphocytes, and neutrophils, all of which comprise the buffy coat (represented as the blue layer in the diagram).



**Fig. 1.** After centrifugation, the blood components (red blood cells, leukocytes, and platelets) are separated from the plasma due to their different densities. The platelets have the lowest density. Adapted from Dohan Ehrenfest et al. [38].

The greatest challenge of PRP systems is to separate the ideal components from the undesirable ones. How well a PRP system accomplishes this task is the best measure of effectiveness.

### Tip #1: Look for systems with the lowest RBC count.

Ideally the number of RBCs in your final PRP product should be zero. RBCs inhibit healing on multiple levels, so should be avoided in any PRP treatment. Many methods have been tried to overcome this difficulty—an hourglass configuration, flow cytometry, or removing most of the undesirable components and performing a second centrifugation. Even with these tools, many systems produce PRP so full of RBCs that the final product is red instead of amber. One effective way to separate RBCs from platelets is the gel-barrier method. A gel in the collection tube forms a physical barrier that traps the RBCs underneath during the centrifugation process.

### Tip #2: Look at the number of neutrophils compared to the number of monocytes and lymphocytes.

Neutrophils cause a pro-inflammatory and catabolic effect on the target area. Conversely, monocytes and lymphocytes work synergistically with platelets and enhance the healing effect. A PRP system that can minimize neutrophils while maximizing monocytes and lymphocytes is ideal.

### Tip #3: Pass the platelet dose threshold.

Experts believe that a crucial step in the healing process is the recruitment of progenitor cells to migrate to the target area and begin proliferating. If a PRP sample fails to create this cellular response, it is deemed ineffective. Historically, the dose of platelets was the biggest factor in measuring PRP's effectiveness, but recent guidelines suggest that once a minimum threshold is

<sup>2</sup>Alves R, Grimalt R: A Review of Platelet-Rich Plasma: History, Biology, Mechanism of Action, and Classification. *Skin Appendage Disord* 2018;4:18-24. doi: 10.1159/000477353, <https://www.karger.com/Article/FullText/477353#>

met, more is not necessarily better<sup>3</sup>. Studies have suggested that this minimum threshold is defined as one billion platelets<sup>4</sup>.

#### Tip #4: Have a high platelet yield.

A good measure of the efficiency of PRP systems is to see how many platelets from the original blood draw make it into the PRP sample. Platelet yield ranges from 13% to 79%. (Note: I have seen websites claim a platelet yield up to 94%, but no independent lab has ever yielded higher than 79%). In general, high efficiency is associated with high quality—some manufacturers pay attention to minute details to preserve the precious platelets, whereas others simply make you draw more blood out of the patient to make up for it.

#### Tip #5: Make sure it's a closed system.

We cannot discuss the quality and purity of PRP without considering possible exposure to contaminants around the office. Some PRP systems require pulling the top off of a container to draw up the buffy coat. Unless this step is done under a venting hood (which most clinics do not have) the PRP may be exposed to infectious agents like bacteria or viruses.

### How to Determine Ease of Use

Though many PRP systems are relatively easy to use, the fact is that each system requires some training and practice. Blood needs to be drawn, the blood needs to be handled to prepare for centrifugation, and the PRP needs to be collected after the spin. That being said, if you do your homework you will discover that many systems have a very user-friendly preparation process compared to others. You can identify those by applying the following tips.

#### Tip #6: Automated systems are not always automatic.

For the novice PRP user, this phrase sounds alluring. I was tempted to look into a PRP system that claimed to be fully automated. In theory, once I set up the machine, I could press one button and be done. Then I watched a processing video. Their setup required me to strap the syringe into a holder, engage the spring mechanism, feed about two feet of IV tubing through a complex maze of corners and bends, install a self-balancing disposable canister in the spinning

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<sup>3</sup>Harmon K, Hanson R, Bowen J, Greenberg S, Magaziner E, Vandenbosch J, et al: Guidelines for the use of platelet rich plasma. <https://www.scribd.com/document/159334949/206-ICMS-Guidelines-for-the-Use-of-Platelet-Rich-Plasma-Draftbook-on-as-bon-as-d-and-bow-n-dow-w>

<sup>4</sup>Dhillon, R.S., Schwarz, E.M., and Maloney, M.D. Platelet-rich plasma therapy—Future or trend?. *Arthritis Res Ther.* 2012; 14: 219, Marx, R.E. Platelet-rich plasma (PRP): What is PRP and what is not PRP?. *Implant Dent.* 2001; 10: 225–228, Rughetti, A., Giusti, I., D'Ascenzo, S. et al. Platelet gel-released supernatant modulates the angiogenic capability of human endothelial cells. *Blood Transfus.* 2008; 6: 12–17, *Editorial Commentary: Platelet-Rich Plasma for Knee Osteoarthritis: A "Novel" and Effective Symptomatic Approach* Chahla, Jorge et al. *Arthroscopy*, Volume 35, Issue 1, 118 – 120

mechanism, and preload a collection syringe in the same manner. The representative showed me how “easy” it was to set up the automated process, but the setup took over ten minutes.

#### Tip #7: Follow the blood.

How many transfers into how many containers? The process of some PRP systems is as simple as drawing the blood, spinning it, and withdrawing the PRP from the original container. Other systems require up to ten transfers from one container to another before the PRP is ready. This not only takes up more time (even after you get familiar with it), but it also decreases the platelet count (platelets tend to adhere to the inside of the container), increases the risk of bacterial contamination, and increases the risk of needle stick injury.

#### Tip #8: Spin times differ between PRP systems.

Recommended spin times vary from four minutes to 21 minutes. Some systems require two separate spins, which increases overall preparation time.

#### Tip #9: Go with a vacutainer.

Vacutainers are generally the primary method for blood collection. Because of this, many phlebotomists would naturally prefer a kit that uses a vacutainer during the blood collection instead of a syringe. After our clinic switched to a PRP system that used vacutainers, my phlebotomist loved it so much that she threatened to quit (jokingly, I hope) if I made her switch back to phlebotomy with a syringe.

### How to Determine Cost

#### Tip #10: Compare “apples to apples”.

Cost is an easy way to compare systems. Keep in mind both the initial **up-front cost** (usually the centrifuge) and the **per-treatment cost** of the disposable kit. Is the kit complete? What supplies are needed outside of the kit? And don't forget opportunity cost. A kit with a smaller price tag may in fact be more expensive in the long run if it is cumbersome and complicated or if it requires a lot more physician time. To include opportunity cost in your formula, measure how much profit per hour a PRP treatment can generate. This formula will allow you to compare apples to apples as you make a decision.

### Summary

Implementing PRP into your practice at first glance appears overwhelming. However, if you choose a system that is clinically effective, cost effective, and easy to use, your task becomes quite simple. These tips will help you compare PRP systems and find one that fits well with your specific practice. For more information on PRP systems, please feel free to contact the author at [DrRiggs@TheActiveJointInstitute.com](mailto:DrRiggs@TheActiveJointInstitute.com).