Nine 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 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[1] has the following features:

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

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

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.

First a Few Basics about PRP Preparation:

Understanding a few basics of PRP preparation will help understand how to differentiate between various systems. The illustration[2] on the left shows a sample of blood after it

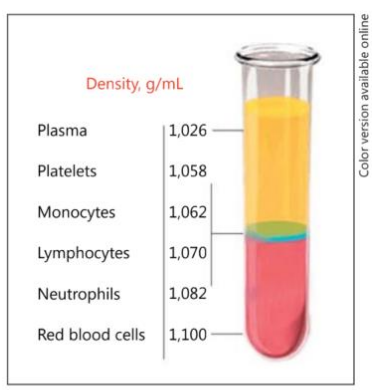

Fig. 1. After centrifugation, the blood components (red blood cells, leukocytes, and platelets) are separated from the plasma due to their different densities. The platelets have the lowest density. Adapted from Dohan Ehrenfest et al. [38].

2.(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#)

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).

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 cause a pro-inflammatory and catabolic effect on the target area. Buffy coat PRP systems require collection of the entire buffy coat in order to get a high concentration of platelets; during aspiration of the buffy coat contents, numerous RBCs inevitably end up in the sample. 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. An effective way to separate RBCs from platelets is the gel-barrier method. The gel forms a physical barrier that traps the RBCs underneath.

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 cause an anabolic effect.

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. For two decades experts have opined that the cellular response requires a minimum platelet dose. This dose has not been specifically defined because there are inhibitors (RBCs and neutrophils) and enhancers (monocytes and lymphocytes) that can influence the recruitment signal. Historically, the dose of platelets was the biggest factor in measuring PRP's effectiveness, but recent guidelines suggest that once a minimum threshold is met, more is not necessarily better[3]. Studies have suggested that this minimum threshold is defined as 1 billion platelets[4].

3.(Harmon K, Hanson R, Bowen J, Greenberg S, Magaziner E, Vandenbosch J, et al: Guidelines for the use of platelet rich plasma.

4.(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).

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. For example, most PRP systems use anticoagulant citrate dextrose solution A (ACD-A) as their anticoagulant. ACD-A is acidic (pH = 4.7) and will make the PRP sample acidic. An acidic environment may cause premature clumping and activation of platelets, decreasing platelet yield and platelet function. Some PRP systems offer a buffered anticoagulant to keep the pH at a more physiologic level (pH=7.4). Additionally, some manufacturers apply a special coating on the inside of the collection tubes to prevent premature clumping and activation.

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 #5: 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 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 #6: Follow the blood.

How many transfers into how many containers? Some PRP systems are 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 (as some are lost in each transfer), increases the risk of bacterial contamination, and increases the risk of needle stick injury.

Tip #7: Spin times differ between PRP systems.

Recommended spin times vary from 4 minutes to 21 minutes. Some systems require two separate spins, which increases overall preparation time.

Tip #8: 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 #9: 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? Make sure you are comparing apples to apples when making your decision.

Summary

These criteria are simple ways to compare various PRP systems. Hopefully this article has helped you identify what is most important in your situation. With these tips you should feel more ready to select a PRP system that is right for your clinic. For more information on PRP systems, please feel free to contact the author at DrRiggs@TheActiveJointInstitute.com.