

## PRP White Paper – J. Corey Orava, DVM

Platelet Rich Plasma (PRP) has received an unusual and growing amount of attention in the past few years. Despite nearly 10,000 articles on PubMed, many medical professionals still do not fully understand some fundamental facts about PRP – namely: What constitutes PRP? How is it produced? Are all PRP products the same? How is it being used in clinical practice? Are there scientific studies to support said use? When would certain variations (e.g. high WBC count) be indicated/contraindicated? What should a health professional look for in a PRP system?

By definition, PRP is simply platelets suspended in plasma at a concentration greater than whole blood. Thus, samples of plasma with 12X and 1.2X platelet counts relative to whole blood would both be considered PRP, whereas a sample with 0.9X would be considered platelet poor plasma (PPP).

Many systems are available to produce PRP, virtually all of them use centrifugation to concentrate the platelets. One system (footnote a.) uses filtration rather than centrifugation, but since this product does not contain plasma it should not be considered PRP, but rather a platelet/leukocyte concentrate. Given that plasma contains growth factors implicated in wound healing, such as insulin-like growth factor-1 (IGF-1), true PRP has some clear advantages.

PRP contains three basic cell types: platelets, erythrocytes and leukocytes. Much debate exists in the literature over the ideal concentration of these products.

Regarding platelets, there is a large body of evidence that PRP is better than PPP. Thus, it is important to use the correct centrifuge settings for your target species. For example, centrifuges that do not have adjustable speed typically spin at maximum speeds and will therefore push virtually all the platelets down into the buffy coat. Less well known, but equally important, are the studies showing that very high platelet concentrations may actually do harm.

Hemoglobins are some of the most abundant proteins within RBCs. Heme released from erythrocytes can create chronic oxidative stress within the joint microenvironment which, in turn, leads to the generation of reactive oxygen species that contribute to the destruction of cartilage and bone. Thus, RBCs should be avoided in most, if not all, PRP formulations.

Another contentious issue regarding PRP is the concentration of white blood cells (WBCs). In vitro evidence has suggested that leukocyte-reduced products may be preferred. However, in vivo papers support the use of both leukocyte-reduced as well as leukocyte-rich products. These seemingly conflicting results may reflect the inherent variability between PRP formulations or the variability of different wounds.

Available PRP systems not only concentrate their products differently, but platelet levels also vary between individuals and even within the same individual at different times. Additionally, and possibly more important, not all wounds are equal. Namely, an acute wound is not the same as a chronic wound and a clean wound is not the same as a contaminated wound. Does it then make sense that a single PRP formulation should work best for all applications? Intuitively the PRP should be selected for the particular injury and thus, the ideal PRP system should be adaptable.

Given the above, for optimal results, PRP should be formulated for a specific wound. For example, within an acute injury inflammation is typically abundant. Thus, using a PRP product with additional WBCs is likely not necessary and may even be contraindicated in acute wounds. Chronic musculoskeletal wounds on the other hand are typically characterized by an absence of inflammatory cells. In these wounds, addition of WBCs may help to reboot the healing process. And to make matters more complicated, wounds can have both acute and chronic components.

Along the same lines, one would presume that when treating a contaminated/infected wound, PRP with WBCs could be indicated. Yet, hemoglobin can inhibit local tissue defenses thus RBCs should be removed from any PRP formulation intended to be used in a contaminated or infected wound.

A recent systematic review by Milants, Bruyère and Kaux, investigated the use of PRP for osteoarthritis (OA) with the goal of determining if there is an optimal PRP formulation. Their publication, which reviewed 19 randomized controlled trials, found that the following PRP worked best for OA: single centrifuge spin, moderate (<5X) concentration of platelets, minimal amount of both WBCs and RBCs and using fresh not frozen PRP.

PRP is being used in veterinary clinics for a variety of conditions. Peer-reviewed literature supports that PRP is safe and has demonstrated efficacy for conditions ranging from cutaneous wounds to tendon/ligament injuries and osteoarthritis. Further research is on-going at numerous universities - undoubtedly many new questions will be raised and hopefully many answers realized. In the interim, veterinarians that are considering incorporating PRP into their practices should ask themselves the following questions:

- Has the system been validated in the intended species?
- Is the system designed to minimize risk of contamination?
- Is the system adaptable (i.e. able to make variable levels of WBCs, RBCs, platelets and plasma)?
- Is the system easy to use?
- Is the system affordable?
- Will I have to buy an expensive dedicated centrifuge or is it likely to fit a common/affordable centrifuge?
- Is the system portable?

#### Rebound PRP by Enso Discoveries:

- ✓ Developed by veterinarians for veterinarians
- ✓ Validated at Kansas State University, College of Veterinary Medicine
- ✓ Validated in horses, dogs, cats and cattle
- ✓ No need for expensive capital equipment
- ✓ Complete kit - includes syringes, needles, anticoagulant and PRP tubes
- ✓ Very affordable
- ✓ Adaptable: low WBCs (99+% depleted); moderate to high platelets (2x to 8x)

“The healing benefits of platelet-rich preparations along with the low risk and availability of simple preparation procedures should encourage more clinicians to incorporate platelet-rich products in their practice to accelerate healing, reduce adverse events, and improve patient outcomes.” Davis, VL et al (2014) *J Oral Implantology*, 40(4): 511-521

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Footnote:

a. Pall Medical - <https://medical.pall.com/en/veterinary-platelet-enhancement-therapy---innovative-treatment-f.html>

