## Platelet-rich Plasma (PRP)

- Recent advances in cellular and molecular biology have shed new light on the processes of wound repair. Most importantly is the increased understanding of the complex signaling mechanisms involving numerous growth factors, cytokines and chemokines which direct normal tissue repair. Removing or adding these bioactive molecules can have dramatic effects in enhancing or retarding wound repair.
- The α granules of platelets are a store house for many of these bioactive molecules including growth factors, enzymes, cytokines, enzyme inhibitors, etc. The idea is to concentrate platelets in a small volume of plasma to deliver increased levels of these substances to injured tissue to enhance healing and decrease inflammation.
- PRP has been used for a number of soft tissue and orthopedic injuries such as tendinopathies, augmenting tendon repairs (ACL reconstructions), muscle injuries and joint cartilage repairs in humans and animals.
- However the clinical benefits of using PRP have not been universally realized. One reason for this problem is the wide variance in the final PRP product. There are several companies which market the equipment, biochemical reagents and protocols, to produce a variety of PRP products. There currently is no regulatory agency overseeing the production, quality, strength and purity of PRP products.
- The definition of PRP is "a volume of plasma that has a platelet count above the baseline of whole blood." Lately, this definition has been expanded to include some portion of red blood cells and white blood cells in the final preparation.
- The basic principle used in the creation of any PRP product is the selective separation of the liquid and solid components through a technique called **plasmapheresis**. This occurs because of Stoke's Law whereby the settling velocity of particles in a liquid in response to gravity will be approximately proportional to their diameter. Thus, platelets remain suspended in the liquid component (plasma) of blood, whereas the larger particles, RBCs and WBCs, settle more rapidly and become separated from the platelets by gravity. Anticoagulated blood is used – best to use anticoagulant citrate dextrose-A or citrate phosphate dextrose. The use of an anticoagulant is not necessary in creating PRP, but in its absence the clotting cascade will start fairly quickly (in a few minutes).
- The blood is subjected to 1 or 2 centrifugation depending on the composition of the final product. The initial centrifugation is called a "soft spin" and separates the plasma/platelets from the red and white blood cells. The fluid portion of this spin contains the platelets and a variable portion of the white blood cells. A second centrifugation step called a "hard spin" further concentrates the platelets into PRP and platelet-poor plasma.

- Depending on the technique or system used to create PRP a wide variety of end products can be produced. These products can vary in (1) the volume of whole blood needed, (2) the inclusion/exclusion of WBCs, (3) the exogenous activation of platelets, and (4) the formation of a fibrin matrix.
- Four categories of platelet concentration preparation are recognized: Leukocyte-poor or pure PRP, Leukocyte PRP, Pure platelet-rich fibrin clot, and Leukocyte platelet-rich fibrin clot.
- The volume of whole blood harvested relates directly to the amount of platelets available. The normal platelet count in a dog is 150,000 – 350,000.
- The final platelet concentration of any PRP product is based on (1) the initial volume of whole blood taken, (2) the platelet recovery efficiency of the technique used, and (3) the final volume of plasma utilized to suspend the concentrated platelets.
- There is a concern that WBCs in PRP may actually inhibit healing. PRP with WBCs may induce more local pain.
- The need for platelet activation before injection is not clear at this time
- PRP and platelet-rich fibrin constructs allow for local delivery of bioactive factors in the healing response of connective tissues.
- Increased levels of some bioactive factors increase cell migration, proliferation and matrix synthesis. This dose response is not always linear and can be both cell type and cytokine dependent.
- All PRP products are not the same!
- Although increased growth factor concentration secondary to increased platelet concentration has been proposed as the potential benefit of PRP, the precise mechanism of this action has yet to be fully determined.
- Further studies are definitely needed.