Soft tissue injuries are common conditions afflicting sporting, performance and active dogs due to the repetitive forces placed on tendons and ligaments during activities. It is reported that tendon and ligament injuries account for nearly 45% of all musculoskeletal injuries in humans yearly in the U.S. Tendons and ligaments are susceptible to major stress during sports, and if injured through repetitive microtrauma, heal slowly due to poor vascularity compared with other connective tissues. While tendon ruptures or avulsions are typically treated through primary surgical repair, this is not typically an option for core lesions (intratendinous disruptions). Core lesions typically heal by secondary intention or fibrosis rather than regeneration. Because of the loss of organized matrix these tissues have lost their elasticity and are predisposed to reinjury.

Regenerative medicine therapy has been shown in the equine literature to allow for healing and regeneration of tendon core lesions following injury. A similar response has been noted in dogs with tendon injury. Regenerative medicine technology gives new hope for extending the careers and improving the quality of life of the canine athlete.

**Stem Cell Therapy:**

Almost all veterinary research has focused on adult stem cells, specifically mesenchymal stem cells, derived from bone marrow (BM-MSC) or adipose tissue (AD-MSC). In dogs, the stem cells may be obtained from bone marrow or subcutaneous adipose tissues. To date, there is no definitive evidence in dogs that supports one tissue source over the other for regenerative treatments. Adipose tissue may be a preferred source in dogs for several reasons including ease of access, low morbidity and pain associated with collection, and high yielding mesenchymal stem cell count (especially falciform). The cells isolated from the adipose tissue not only include the mesenchymal stem cells but endothelial progenitor cells, pericytes, immune cells, fibroblasts and other growth factor-secreting bioactive cells. This is known as stromal vascular fraction therapy. The stem cells along with this mix of other regenerative cells can be injected directly into the injured tissue, joint and/or intravenously. Alternatively, the stem cells can be isolated from adipose tissue, cultured and expanded. This yields a more homogenous population with a larger quantity of cells for injection. This is known as adipose derived progenitor cell therapy. Because these cells are always obtained from the intended recipient, the risk of rejection and disease transmission is eliminated.

The mechanisms by which these regenerative cells initiate change within the body are complex. MSCs decrease pro-inflammatory and increase anti-inflammatory mediators. MSCs are activated to become immunosuppressive by soluble factors and in turn secrete soluble factors that inhibit T-lymphocyte activation and proliferation. MSCs secrete bioactive levels of cytokines and growth factors that support angiogenesis, tissue remodeling, differentiation, and antiapoptotic events. The cytokines and growth factors secreted by the MSCs can also assist in neovascularization. MSCs demonstrate a diverse plasticity and are able to migrate to sites where needed.
Platelet Rich Plasma:

Platelet rich plasma (PRP) is a regenerative medicine therapy that is thought to hasten healing of tissues when applied directly to the site of injury. Since its original debut in 1987 where it was used to seal incisions in open-heart surgery, a plethora of case studies have been published within the human literature documenting the safe use of PRP in oral surgery, periodontal surgery, neurosurgery, ophthalmology, wound healing, bone healing, joint replacements, and more recently, sports medicine injuries. The use of PRP for athletic injuries is an area of intense research and clinical applications.

It is the growth factors contained within the platelets that are of significance for use in tissue injuries. The two factors that are thought to have the most influential role in tissue healing are transforming growth factor-beta (TGF-β) and platelet-derived growth factor (PDGF). Normal platelet concentration in dogs is 200,000-500,000 platelets per microliter (μL or 0.000001 liter). To obtain platelet-rich plasma, the patient’s blood is mixed with an anticoagulant and processed either manually by spinning it in a centrifuge to separate its components (centrifugation) or through an automated system. This processed fraction of the blood is termed “platelet-rich plasma.” This fraction is then mixed with thrombin and calcium-chloride to activate the platelets before injection for therapeutic use.

The PRP used by the Veterinary Orthopedic & Sports Medicine Group (VOSM) is processed by the Regenerative Medicine Laboratory at the Leesburg, Virginia, campus of Virginia Tech, which uses a manual centrifugation method. This laboratory is able to yield platelet counts 7 to 10 times above normal, with few white blood cells present in the product.

Combination Therapy:

By combining cultured adipose derived progenitor cells (ADPC) with PRP it is possible to achieve the positive effects of both regenerative therapies. Combination ADPC-PRP therapy provides cells for regeneration, growth factors, as well as a scaffold to provide a template for cell attachment.

For the past 4 years the Veterinary Orthopedic & Sports Medicine Group (VOSM) has been utilizing combination ADPC-PRP therapy for the treatment of tendinopathies, specifically core lesions in dogs. VOSM has been collaborating with the Regenerative Medicine Laboratory at the Marion DuPont Equine Medical Center at Virginia Tech for the processing of the combination therapies.

Tendons included in our study are the supraspinatus, biceps, subscapularis, flexor carpi ulnaris, iliopsoas, and Achilles. The tendon injuries are confirmed via MRI and/or diagnostic musculoskeletal ultrasound. Tissues (adipose tissues from the falciform) and blood (for PRP) are collected and submitted for processing. Cultured ADPC and PRP are returned to VOSM in 10-14 days and injected under ultrasound guidance into the core lesion. Long-term objective follow-up includes diagnostic ultrasound and objective gait analysis.

This talk will discuss case selection, diagnostics, tissue processing, treatments and objective follow-up and assessments.