How to Incorporate Platelet Rich Plasma (PRP) in your Practice

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Diplomate, American College of Veterinary Sports Medicine & Rehabilitation
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  - May Jacobson, PhD
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  - Jennifer Barrett, DVM, PhD, DACVS
  - Victor Ibrahim, MD
  - May Jacobson, PhD
Disclosures

- Received regenerative medicine products and systems from the companies below for system validation and clinical testing:
  - Arthrex
  - EmCyte
  - Harvest
  - MediVet
  - PulseVet
  - CRT

- Consultant for Harvest, Scil, EVROST, ReCellerate, CRT, Vetra
Objectives

• Platelet Rich Plasma medicine as a treatment for orthopedic – sports medicine conditions in the canine

• Overview of the technology

• Indications & applications

• Current canine literature & studies

• Prospective multicenter PRP canine system analysis
Regenerative Medicine
“Soap-box”

- Must have a definitive diagnosis and treat the underlying condition to get the best response
- Not a “Silver bullet”
- Combination therapy is the key
  - Medical Management
  - Surgical treatment
  - Stem cell therapy / Platelet Rich Plasma
  - Rehabilitation therapy
Regenerative Medicine
PRP Terminology

• **Platelet rich plasma (PRP)**
  • Autologous blood plasma enriched with platelets (contains and releases through degranulation) numerous growth factors and anti-inflammatory cytokines

• **Autologous protein solution (APS)**
  • High concentration growth factors (TGF-B; EGF; PDGF)

• **Autologous conditioned serum (ACS)**
  • High concentration growth factors and anti-inflammatory cytokines (IL-1 receptor antagonist, IGF-1, etc).

• **Autologous conditioned plasma (ACP)**
  • Plasma with a high concentration of platelets
Regenerative Medicine
Platelet Rich Plasma (PRP)

• Blood plasma with concentrated platelets

• Concentrated platelets found in PRP contain huge reservoirs of bioactive proteins / growth factors

• These bioactive proteins:
  • Initiate and accelerate tendon, ligament and cartilage repair and regeneration
  • Decrease inflammatory mediators in osteoarthritis
  • Reduce pain and improve articular function in osteoarthritis

Regenerative Medicine
Platelet Rich Plasma (PRP)

- The growth factors contained in the platelets alpha granules include:
  - transforming growth factor β (TGF-β),
  - platelet derived growth factor (PDGF- AB and BB),
  - insulin-like growth factor (IGF-1),
  - vascular endothelial growth factor (VEGF),
  - epidermal growth factor (EGF),
  - fibroblast growth factor.

- Promote angiogenesis into the lesion: (VEGF and FGF),
- Enhance cellular proliferation (PDGF, FGF, and TGF-β),
- Promote extracellular matrix formation (TGF-β and IGF-1)
Platelet Rich Plasma (PRP)
Roles & Functions

• Enhances the recruitment, proliferation, and differentiation of cells involved in tissue regeneration

• Fibrin for matrix / scaffold

MechanoBiology Laboratory
Univ. of Pittsburgh School of Medicine
Regenerative Medicine
Platelet Rich Plasma (PRP)

Protocol:

• Blood collection (10-30 mls)

• Blood is centrifuged or filtrated and PRP produced

• Increases the concentration of platelets and growth factors up to 2-10%

• For OA PRP is injected
  • Blind IA
  • Fluoroscopic guided
  • Digital radiography guided

• For soft tissue injury PRP is injected under ultrasound guidance

Regenerative Medicine
Platelet Rich Plasma (PRP)

- Platelet concentration increase 3-7 fold
- No neutrophils
- No RBCs
- Gravity or spin separation
- Good price point
- Validated for dogs
PRP

Platelet Concentration

Prefer increased concentration post-spin:

- Increased granules that release growth factors

PRP

RBC Concentration

Prefer decreased concentration post spin:

• RBCs:

• damage cartilage and synovium directly via iron-catalyzed formation of ROS

• increase concentrations of unwanted inflammatory mediators (IL-1 and TGF-α)

• cause significantly more synoviocyte death when compared with LR-PRP, LP-PRP, and PBS.

PRP
Neutrophil Concentration

Prefer decreased concentration post spin:

• Multiple studies show that neutrophils increase concentrations of unwanted inflammatory mediators (IL-1β, TNF-α, IL-6, IL-8)

• Increased concentrations of neutrophils in PRP is positively correlated with an increased MMP-9 concentration which degrades collagen and other extracellular matrix molecules

Monocyte Concentration

 Prefer increased concentration post-spin:

• Monocytes are associated with an increase in cellular metabolism and collagen production in fibroblasts

• Decreased release of anti-angiogenic cytokines interferon-γ and IL-12

Unsure of preferred concentration post spin:

- Significance of lymphocyte concentration in PRP still unknown

- Platelets have been shown to activate peripheral blood mononuclear cells (lymphocytes, monocytes, and macrophages) to help stimulate collagen production
  - Mediated by an increase in IL-6 expression

Regenerative Medicine
Platelet Rich Plasma (PRP)

Clinically:

• Currently being used in humans and horses
  • Hines Ward and Troy Polamalu, Pittsburg Steelers
  • Takashi Saito, LA Dodgers
  • Jose Reyes, Mets
  • 20 professional soccer players
Platelet Rich Plasma Therapy
Evidence Based Medicine

“The first rigorous study asking whether the platelet injections actually work finds they are no more effective than saltwater.”
Platelet Rich Plasma Therapy
Evidence Based Medicine

Tendon Injuries:


Platelet Rich Plasma Therapy  
Evidence Based Medicine

Osteoarthritis:


• A biological therapy to osteoarthritis treatment using platelet-rich plasma. Anitua E, et al., Expert Opin Biol Ther. 2013

• Platelet-rich plasma versus hyaluronic Acid. Ahadi T, Abtahi M. Arthroscopy. 2012

PRP Therapy
Evidence Based Medicine

Canine:

Ligament

Xie X¹, Wu H, Zhao S, Xie G, Huangfu X, Zhao J.

CONCLUSIONS: During the graft remodeling process, we observed a time-dependent change of gene expression following ACL reconstruction surgery. Furthermore, our results demonstrate that PRP alters the expression of some target genes at certain time points, especially during the early stages of graft remodeling, which might explain the enhancing effect of PRP on the ACL graft maturation process.
PRP Therapy
Evidence Based Medicine

Canine:

Tendon
ACP Therapy – Canine Tendon

Iliopsoas Tendinopathy
Cook J, et al.

• 9 treated with ACP with > 2 yr follow-up
  • 1-2 injections
  • 12-week rehab protocol

• 8 of 9 improved
  • Exam + Ultrasound

• 7 of 9 returned to sport
  • 1 dog retired to pet
  • 1 case ultimately had surgery
    • Severe mineralization
PRP Therapy
Evidence Based Medicine

Canine:

Osteoarthritis
Prospective trial of autologous conditioned plasma versus hyaluronan plus corticosteroid for elbow osteoarthritis in dogs.

Franklin SP¹, Cook JL.
Prospective trial of autologous conditioned plasma versus hyaluronan plus corticosteroid for elbow osteoarthritis in dogs.

Franklin SP¹, Cook JL.
“Patients are seeing elite athletes, like Tiger Woods and Raphael Nadal, being treated with some form of PRP and are asking their orthopaedic surgeons to give them ‘what Tiger got.’ The problem is that we don’t know ‘what Tiger got,’ what happened to him before or afterwards, or what was used, and no one is publishing that data,” noted Dr. Mishra.
According to Steven P. Arnoczky, DVM, “Unlike pharmaceuticals regulated by the United States Pharmacopeia, in which the precise contents, concentrations, and potency are clearly known, PRP preparations have no such guarantee.”
Concentration of platelets and growth factors in canine autologous conditioned plasma.

Stief M¹, Gottschalk J, Ionita JC, Einspanier A, Oechtering G, Böttcher P.

<table>
<thead>
<tr>
<th></th>
<th>Whole blood</th>
<th>Autologous conditioned plasma*</th>
<th>Standard plasma#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PLT (G/l)</td>
<td>WBC (G/l)</td>
<td>RBC (T/l)</td>
</tr>
<tr>
<td>Group 1</td>
<td>271.50⁸</td>
<td>9.35</td>
<td>6.78</td>
</tr>
<tr>
<td></td>
<td>(244.75-338.75)</td>
<td>(8.45-9.95)</td>
<td>(6.65-7.17)</td>
</tr>
<tr>
<td>Group 2</td>
<td>255.50⁸</td>
<td>10.25</td>
<td>6.08</td>
</tr>
<tr>
<td></td>
<td>(205.50-273.50)</td>
<td>(8.70-11.50)</td>
<td>(5.91-6.54)</td>
</tr>
</tbody>
</table>

Clinical significance: Canine ACP prepared according to the manufacturer’s recommendations, or by using a softer spin does not show the same specifications as human ACP, which shows a doubling in platelet count compared to WB. Even though canine ACP has compared to SP (p = 0.001, p = 0.0028). Regarding IGF-1 content, there was not any significant difference between ACP and SP.

<table>
<thead>
<tr>
<th></th>
<th>Autologous conditioned plasma*</th>
<th>Standard plasma#</th>
<th>Factor of enrichment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin-like growth factor-1 (ng/ml)</td>
<td>68.5 ± 35.6</td>
<td>67.9 ± 32.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Epidermal growth factor</td>
<td>No signal</td>
<td>No signal</td>
<td>-</td>
</tr>
<tr>
<td>Vascular endothelial growth factor - canine</td>
<td>No signal</td>
<td>No signal</td>
<td>-</td>
</tr>
<tr>
<td>Platelet-derived growth factor-AA</td>
<td>No signal</td>
<td>No signal</td>
<td>-</td>
</tr>
<tr>
<td>Platelet-derived growth factor-AB</td>
<td>No signal</td>
<td>No signal</td>
<td>-</td>
</tr>
<tr>
<td>Platelet-derived growth factor-BB (pg/ml)</td>
<td>251.0 ± 132.8</td>
<td>1540.8 ± 553.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Transforming growth factor-β1 (pg/ml)</td>
<td>1239.9 ± 590.8</td>
<td>&gt;2000.0 (not available)</td>
<td>&gt;1.6</td>
</tr>
<tr>
<td>Transforming growth factor-β2</td>
<td>No signal</td>
<td>No signal</td>
<td>-</td>
</tr>
</tbody>
</table>
Canine Platelet Rich Plasma Systems: A Multicenter, Prospective Analysis

Brittany Jean Carr, DVM, Sherman Canapp, DVM, MS, DACVS, DACVSMR, David Mason, BVetMed, MRCVS, DACVS, DECVS2, Katie Cox, MS

1Veterinary Orthopedic and Sports Medicine, Annapolis Junction, MD, USA
2Las Vegas Veterinary Specialty Center, Las Vegas, NV, USA
PRP Multicenter Analysis

The purpose of this multicenter study was to prospectively analyze and compare key parameters of the PRP product from five commercial canine PRP systems in healthy, adult canines.
Materials and Methods

The following five commercial systems were prospectively analyzed:

- SmartPReP®2 ACP+ (Harvest Technologies, Corp)
- Arthrex ACP (Arthrex Orthobiologics)
- CRT Pure PRP (Canine Regenerative Therapies, LLC)
- ProTec PRP (Pulse Veterinary Technologies, LLC)
- C-PET Canine Platelet Enhancement Therapy (Pall Corporation)
Material & Methods

- 10 healthy dogs were used for each PRP system
- Blood was obtained from each dog according to the manufacture’s protocol
- A baseline WBC differential, platelet count, and hematocrit value were obtained on all dogs
- The mean baseline platelet, RBC, WBC, neutrophil and monocyte concentrations were determined for each PRP system
- All blood samples were processed according to the manufacturer’s protocols
- The platelet, RBC, WBC, neutrophil and monocyte concentrations were obtained for all processed samples
- The mean PRP product concentrations were determined for each PRP system
- These values were then compared to the baseline values.
- Two-way ANOVA with post-hoc Tukey’s multiple comparisons test was performed
- P<0.05 was considered significant; results are expressed as mean +/- SD
Lymphocyte Comparison

**Lymphocytes (K/uL)**

- **Pre**
- **Post**

<table>
<thead>
<tr>
<th>PRP System</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvest</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Arthrex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Vet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-Pet</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

The asterisks (*) indicate statistically significant differences.
Monocyte Comparison

Monocytes (K/µL)

PRP System

- CRT
- Harvest
- Arthrex
- Pulse Vet
- C-Pet

Pre vs Post

* denotes statistical significance.
Conclusion

• The systems with the highest platelet yield were the SmartPRep®2 ACP+ and CRT Pure PRP systems.

• However, while the SmartPRep®2 ACP+ yielded a 219% mean increase in platelets from baseline, this system failed to reduce WBC concentration and Neutrophil concentrations.

• The CRT Pure PRP system yields a 550% mean increase of platelets while removing greater than 95% of the RBC, 19% of WBC, and 85% of neutrophils.
Conclusions

• No claims regarding the efficacy of PRP therapy in canines or the efficacy of the PRP formulations evaluated can be deduced from this study.

• Further study is indicated to assess the efficacy of PRP therapy in canines, the efficacy of canine PRP systems, and the clinical applications for PRP therapy in dogs.
Pure Platelet-Rich Plasma (Pure PRP) Protocol

High concentration of platelet and growth factors in a pure plasma suspension with no red blood cells or neutrophils
Step 1

Fill and prime the 60 mL syringe to be used for blood draw with 10 mL of anticoagulant citrate dextrose solution formula A (ACD-A)
Step 2

Draw 50 mL of blood from the jugular vein filling the syringe to 60 mL using a butterfly needle, inverting several times to mix.
Step 3

Fill the concentrating device with 60 mL of blood
Step 4

Use the scale to counterbalance the concentrating devices
Step 5

Place the concentrating devices in the centrifuge

First spin: 1 minute 3600 RPM brake off
Step 6

Remove the concentrating device from the centrifuge

Platelets & Plasma

RBC
Step 7

Remove any red blood cells remaining in the line
Step 8

Aspirate the platelet plasma suspension until the aspirating disc touches the RBC interface or RBC are seen in the line.
Step 9
Transfer the platelet plasma suspension into the final concentrating device
Step 10

Use the scale to counterbalance the concentrating devices
Step 11

Place the concentrating devices in the centrifuge

Second spin:
5 minutes
3800 RPM
brake off
Step 12

Remove the concentrating device from the centrifuge

Concentrated Platelets
Step 13

Using the aspiration accessory, aspirate plasma into the 60 mL syringe until the aspirating disc reaches the bottom of the tube.
Step 14

Using the 12 mL syringe, inject 10 mL of air into the concentrating device
Step 15

Swirl the concentrating device to re-suspend the platelets back into the plasma.
Step 16

Invert the concentrating device and aspirate the Pure PRP into the 12 mL syringe.
Step 17

6 mL Pure PRP ready to be injected!
Stem Cell & PRP Combination for the Treatment of Supraspinatus Tendinopathy in Dogs

Sherman Canapp, DVM, MS, CCRT, DACVS, DACVSMR
Jennifer Barrett, DVM, PhD, DACVS, DACVSMR
Debra Canapp, DVM, CVA, CCRT, DACVSMR
Victor Ibrahim, MD
Adipose Progenitor Cell Therapy & Platelet Rich Plasma Combination

• Supraspinatus Tendinopathy

• Retrospective Data:
  • 327 supraspinatus tendinopathy cases
  • 116 were treated with ADPC – PRP combination therapy
  • 66 unilateral; 50 bilateral
  • 55 unilateral cases without concurrent elbow or shoulder pathology with follow-up msk ultrasound
  • 25 unilateral cases without concurrent elbow or shoulder pathology with follow-up objective gait analysis

Jennifer Barrett, DVM, PhD, DACVS, DACVSMR
Debra Canapp, DVM, CCRT, CVA, DACVSMR
Victor Ibrahim, MD
**Signalment**

**Age Range:** 1 to 14 years

**Average Age:** 6.4 years (median – 6 years)

**Population**

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Altered</td>
<td>2</td>
<td>28</td>
</tr>
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</table>

n=55
### Signalment

<table>
<thead>
<tr>
<th>Breed</th>
<th>Population</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basenji</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>Bernese Mountain Dog</td>
<td>2</td>
<td>3.7%</td>
</tr>
<tr>
<td>Border Collie</td>
<td>13</td>
<td>23.6%</td>
</tr>
<tr>
<td>Boxer</td>
<td>3</td>
<td>5.5%</td>
</tr>
<tr>
<td>Corgi</td>
<td>3</td>
<td>5.5%</td>
</tr>
<tr>
<td>German Shepherd Dog</td>
<td>7</td>
<td>12.7%</td>
</tr>
<tr>
<td>Golden Retriever</td>
<td>3</td>
<td>5.5%</td>
</tr>
<tr>
<td>Greater Swiss Mountain Dog</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>Labrador Retriever</td>
<td>13</td>
<td>23.6%</td>
</tr>
<tr>
<td>Mixed</td>
<td>5</td>
<td>9.1%</td>
</tr>
<tr>
<td>Poodle – Standard</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>Rhodesian Ridgeback</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>Rottweiler</td>
<td>1</td>
<td>1.8%</td>
</tr>
<tr>
<td>Wheaten Terrier</td>
<td>1</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

*n=55*
Occupation

Sport/Performance 49.1%
Companion 50.9%
n=55

Agility – 37.0%
Field Trial – 7.4%
Flyball – 7.4%
Herding – 7.4%
Hunting – 3.7%
Obedience – 18.5%
Rally – 7.4%
Show – 11.1%
History

- > 52 weeks: 40%
- 25 - 52 weeks: 9%
- 13 - 24 weeks: 16.4%
- 5 - 12 weeks: 23.6%
- 4 weeks & <: 10.9%

Population: n=55

Duration of Lameness
History

Previous Treatment

Population

NSAIDs

n=55

61.8%

45.5%
ADPC / PRP Combo
Supraspinatus Tendinopathy

- Definitive Diagnosis:
  - Radiographs (shoulder and elbow)
  - Musculoskeletal ultrasound
  - +/-MRI
  - +/-Arthroscopy (elbow and shoulder)
- Pre Treatment Objective Measures:
  - Objective gait analysis (GAIT4)
  - Goniometric measurements and limb circumference
  - Pre-treatment ultrasound measurements (objective scoring system)
- Tissue Collection:
  - Adipose collection (8-12 grams) from falciform and culture expanded
  - Blood collections from jugular for PRP

- Treatment:
  - Ultrasound guided injections (fenestration technique)
  - Standardized post treatment rehabilitation therapy

- Objective Follow Up:
  - Ultrasound every 30 days
  - Objective gait analysis every 30 days
  - Goniometric measurements and limb circumference every 30 days
Supraspinatus Tendinopathy
Diagnostics - Radiographs

Mineralization 12.4%
Supraspinatus Tendinopathy Diagnostics - Ultrasound

- **Greater tubercle of humerus**
- **Mixed Echogenicity representing tendinopathy**
- **Supraspinatus tendon**
- **Joint Capsule**
- **Biceps tendon**
Supraspinatus Tendinopathy
Pre-treatment Ultrasound

Mixed echogenicity

R SUPRA = 0.50CM2

L supra enlarged
Musculoskeletal Ultrasound Objective Grading Scale

- Quantitative Ultrasound Shoulder Pathology Rating Scale (USPRS)
- Modified (USPRS)
- ST Cross-Sectional Area at a Standardized Level
  Canapp D, Barrett J, Ibrahim V

0 = Normal fibrillar pattern and echogenicity
1 = Mild loss of fibrillar pattern and/or echogenicity
2 = Moderate loss of fibrillar pattern and/or echogenicity
3 = Calcified area of tendon
4 = Clear tear partial thickness
5 = Clear tear full thickness
Temporal-spatial gait analysis
Light V, et al. AJVR. 2010
Regenerative Medicine
Adipose Progenitor Cell Therapy

- Procedure: Cultured expanded cells

  - 8-12g adipose tissue (falciform) suspended in adipose cell media

  - Shipped FedEx in premade packaging on ice

  - Mesenchymal cells are isolated, cultured and returned in 10-14 days

  - Residual cells are banked for future use
Regenerative Medicine Tissue Processing

• VA Tech Regenerative Medicine Services Proprietary Techniques

• ADPC Processing:
  • 8 -12g of adipose suspended in adipose cell media
  • Adipose was mechanically and enzymatically separated to release ADPCs
  • Nucleated cells counted and cultured in stem cell media
  • Daily monitoring for adherence, growth and phenotype
  • Once 70% confluent cells detached, washed and suspended in autologous PRP

• PRP Processing:
  • 30 mls of blood (>30 lb dog) in CPDA
  • Prepared from anti-coagulated blood
  • Centrifugation to obtain a four-fold increase in platelets
  • 80% reduction in white blood cells
  • Platelet and WBC counts performed to verify concentrations
Regenerative Medicine

Adipose & Blood Collection

Culture & Expansion of Adipose Progenitor Cells

Rehabilitation Program

Ultrasound-guided Injection into Lesion

Resuspension for Injection in PRP or ACS
Ultrasound Guided Injection

Post-injection Standardized Rehab Program

- Manual therapy
- Modalities
- Therapeutic home exercise program
- Hydrotherapy
- Strengthening techniques
  - Isometric exercises
- End stage eccentric exercises
  - Trotting and walking down hills

Phys Ther, 2004
J Orthop Sports Phys Ther, 1994
Lasers Surg Med, 2005
Statistical Analysis

• Dogs returned at ~30, 60, and 90 days for objective follow-up
  • musculoskeletal ultrasound (n=55)
  • objective gait analysis (n=25)

• Ultrasound: Cross-sectional area of the treated (ADPC-PRP injected) tendon was compared to the contralateral (non-affected) tendon at baseline and at each follow-up evaluation

• Objective gait analysis: Total pressure index (TPI) of treated forelimb was compared to the contra-lateral (non-affected) forelimb at baseline and at each follow-up evaluation

• Repeated measures ANOVA (significance p<0.05)
APDC – PRP Combination Results - Ultrasound

• Of the 55 unilateral supraspinatus cases treated with ADPC – PRP combination therapy:
  • Reduction in SST size was noted in all cases
  • 82% reached the contralateral “normal” size
  • All cases showed improvement in fiber pattern
Response to Regenerative Medicine:
Musculoskeletal Ultrasound

Cross-sectional Measurement (cm²)

n=55

Individual Results of Unaffected and Affected Supraspinatus Measurements
Response to Regenerative Medicine
Musculoskeletal Ultrasound

Unilateral Supraspinatus Tendinopathy

Cross Sectional Area (cm²)

Initial Exam  4-6 weeks  6-12 weeks  >12 weeks

Injured  Contralateral

Response to Regenerative Medicine Musculoskeletal Ultrasound

Unilateral Supraspinatus Tendinopathy

Cross Sectional Area (cm²)

Initial Exam  4-6 weeks  6-12 weeks  >12 weeks

Injured  Contralateral

Response to Regenerative Medicine Musculoskeletal Ultrasound

Unilateral Supraspinatus Tendinopathy

Cross Sectional Area (cm²)

Initial Exam  4-6 weeks  6-12 weeks  >12 weeks

Injured  Contralateral
Response to Regenerative Medicine
Musculoskeletal Ultrasound

Supraspinatus Tendinopathy Over Time

Cross Sectional Area (cm²)

- Initial
- 4-6 weeks
- 6-12 weeks

Stars indicate statistically significant differences.
APDC – PRP Combination
Objective Gait Analysis

• Of 55 unilateral supraspinatus cases treated with ADPC – PRP, we had follow-up gait analysis on 25 cases at 90 days post-treatment:

• 88% (22 cases) were sound on G4D compared to baseline

• 12% (3 cases) improved but not sound
Response to Regenerative Medicine
Objective Gait Analysis

Day 0
Day 90

TPI %
n=25

Individual Results of Affected Forelimb
Response to Regenerative Medicine

Objective Gait Analysis

Unilateral Supraspinatus Tendinopathy

<table>
<thead>
<tr>
<th>Total Pressure Index</th>
<th>Pre-Tx</th>
<th>Post-Tx</th>
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<tbody>
<tr>
<td></td>
<td>Injured</td>
<td>Contralateral</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>33</td>
</tr>
</tbody>
</table>

Star indicates significant improvement post treatment.
Clinical Impressions

• Results of combination ADPC-PRP treatments are promising for dogs with supraspinatus tendinopathies

• Appears to offer an option for cases that have failed to respond to conservative management and rehab therapy

• Treatment option for tendons with disrupted fiber patterns and core lesions

• Treatment requires proficiency in diagnostic musculoskeletal ultrasound
Clinical Impressions.....

• Unexpected findings:
  • mineralization “resorption”
  • nodule/bulge reduction

• In addition to favorable follow-up US findings and gait analysis, ability for return to sport is encouraging

• Sporting and performance dogs that are > 4 months post-tx have returned to competition (96.4% dogs returned to sport)
Unexpected Findings
Unexpected Findings

• Similar results in gait analysis and ultrasound with BMAC and PRP combination therapy for the past 12 months
  
  • 17 cases

• Used as an alternative to culture expanded ADPC due to client convenience

• ~65% of caseload is from out-of-state or international
Limitations

- Nature of retrospective studies
- Loss of follow-up
- Missing data points
- No randomization

- No placebo group
- Although 45.5% of cases had failed previous rehabilitation therapy
Conclusions

• ADPC-PRP combination may be considered as a treatment option for SST in the canine

• Not a “silver bullet”
  • Rehabilitation therapy

• Increased need for training/proficiency in canine musculoskeletal ultrasound

• More questions than answers:
  • Bone marrow vs adipose derived
  • Cultured vs non-cultured
  • Optimal cell counts
  • Combination therapy (APC & PRP)
  • Placebo controlled???
Conclusions
Future Directions

• Randomized, blinded, placebo controlled

• Phase I Study
  • SVF/PRP combination
  • -vs-
  • Cultured ADPC/PRP combination
  • -VS-
  • Plasma control/Rehab

• Phase II Study
  • Adipose –vs- bone marrow

AKC CHF Prospective Supraspinatus Study
2014-2016; Currently enrolling cases…..please send!!!
Conclusions

- PRP may be considered as a treatment option for dogs with osteoarthritis or soft tissue injury
- Not a “silver bullet”
  - Rehabilitation therapy
- Increased need for training/proficiency in canine musculoskeletal ultrasound
- Increased need for proficiency in intra-articular injections
- Requires a definitive diagnosis
- Requires a validated canine PRP system with appropriate cellular concentrations
Thank you!!!
Questions?