PLATELET RICH PLASMA UPDATE

Financial Disclosure
Dr. Annette Zaharoff has no relevant financial relationships with commercial interests to disclose.

Regenerative Medicine
- Replacing or regenerating human cells, tissues, organs to restore or establish normal function
- MSK medicine
  - Repair injuries, facilitate healing
  - Cartilage cells, stem cells, collagen, platelets

This presentation is the intellectual property of the author. Contact them at amzsportsmd@msn.com for permission to reprint and/or distribute.
Blood

- Whole Blood
  - Plasma, 93% RBC, 1% WBC
  - 6% Platelets
- PRP
  - 94% Platelets (4-6 fold increase)
  - 5% RBC, <1% WBC, Plasma
  - Increase stimulus for connective tissue healing

Connective Tissue Healing

- Sequential cascade, systematic process in acute injuries
- Regulation by various cells in different phases
- Phases
  - Inflammation
  - Proliferation
  - Remodeling

Inflammatory Phase

- Hemostasis
- Platelet aggregation
- Platelet degranulation
  - GF’s, cytokines, adhesion molecules, > 30 bioactive factors
  - Cell proliferation, chemotaxis, cell differentiation, angiogenesis
Growth Factors

- Increase platelet concentration
  - 4-6 fold increase (1,000,000 / µL)
- Increase hMSC's
- Increase proliferative activity of cells (fibroblasts, chondrocytes, osteoid, collagen, matrix)
- No mutagenic activity

Platelet Rich Plasma
Healing Cascade

PRP in Clinical Setting

- History
  - Ferrari (1987), autologous transfusion
- Other specialties
  - Maxillofacial, cosmetic, dentistry, spine, neurosurgery, wound healing, podiatry, orthopedics, urology, ENT, Cardiology

Seeing is Believing

Human bone graft histology at 6 months without platelet rich plasma. There is a 50% trabecular bone density, active resorption remodeling, and a preponderance of immature bone.
Human bone graft histology at 4 months with platelet-rich plasma enhancement. There is an 80% trabecular bone density, the bone is mature, and there is no evidence of active resorption remodeling.

Seeing is Believing

Split thickness skin graft 6 days.

45 days
MSK Medicine

• MSK injuries
  – Long term pain, disability
  – 45% soft tissue

• Standard treatment
  – NSAID
  – Corticosteroids
  – Pharmaceuticals most commonly prescribed
  – Surgery

PRP in MSK Medicine

• Chronic degenerative tendinopathies
• Acute injury
  – Muscle, ligament, tendon
• Articular cartilage, intra-articular damage
• Bone and periosteum healing
• Kon et al (2011)
  – Pre-clinical effects of PRP on MSK tissue and injuries
PRP Literature

• Basic Science
  – In vitro and animal studies
• Low evidence
  – Controlled trials, Cohort and case studies
  – Level 3, 4
• High evidence
  – Systematic reviews, met-analysis of RCT’s,
  – Level 1, 2

PRP Literature

• J Bone Joint Surg Am. 2012; literature search
  – 895 relevant citations. 33 studies-23 randomized controlled trials and 10 prospective cohort studies, 32 proved eligible for inclusion
• Conclusions: The current literature is complicated by a lack of standardization of study protocols, platelet-separation techniques, and outcome measures. As a result, there is uncertainty about the evidence to support the increasing clinical use of platelet-rich plasma and autologous blood concentrates as a treatment modality for orthopedic bone and soft-tissue injuries.
• Level of Evidence: Therapeutic Level 2 evidence

PRP in Sports Medicine

• Increasing prevalence of regenerative injections
• >86,000 athletes use in U.S.
• WADA approved (2011)
• Pro sports
“Spinning Blood Isn’t Just for Athletes Anymore”

• Wall Street Journal - March 2010

PRP Literature

• Review articles
    • + outcomes = 21
    • - or no effect = 7 (small sample size, platelet processing compromised)
    • Level 1-4 evidence
    • + outcomes = 13
Muscle and Tendon Healing

- Mishra (2006)
  - Prospective study, lateral epicondylosis
  - PRP vs bupivacaine
  - 98% improved at 2 yrs.
- Peerbooms (2010)
  - Level 1, lateral epicondylosis
  - PRP vs corticosteroid injection
  - Increased function, decreased pain

- Sanchez (2007)
  - Earlier return to function and impact activities post-op Achilles repair
  - N = 12
- De Vos (2010)
  - Eccentric exercise with PRP or saline injection of Achilles tendinopathy
  - Similar improvement
Muscle and Tendon Healing

• Barrett (2004)
  – Retrospective study, N = 9
  – + U/S changes of plantar fascia at 1 year
  – 7 of 9 patients with 100% relief

• Kon (2009)
  – Prospective, cohort study, chronic patellar tendinosis, failed treatment
  – Decrease pain, increase function with PRP 3x, administered q15 days

Muscle and Tendon Healing

• Randelli (2008)
  – Level 1
  – PRP augmentation of RC repair vs standard
  – Earlier decrease of post-op pain and increase function
  – No MRI differences at 2 yrs, sustained improvement

Muscle and Tendon Healing

• Sanchez
  – 20 professional athletes with hamstring injuries
  – Full recovery in half the expected time **without any fibrosis** or re-injury

• Ligaments
  – MCL, ACL have mixed reviews
Articular Cartilage

- Van Buul
  - Human OA chondrocytes inflammatory factors (interleukin-1ß) inhibited by PRP
- Sampson (2010)
  - PRP 3x q4 weeks, reduced pain, increased function compared to baseline at 1 year

Articular Cartilage

- Kon (2009)
  - 115 patients
  - Moderate-severe knee OA, failed conservative care
  - Majority with statistically significant objective, subjective improvement

Articular Cartilage

- Kon (2010)
  - PRP vs low and high molecular weight HA viscosupplementation
    - ≤50 y.o.-all improved at 6 mos; PRP most effective to ↓ pain, ↑ function
    - >50 y.o.-PRP and low molecular weight similar improvement, high m.wt. worst
- PRP safe, effective alternative to HA
State of the Research Art

- Basic science
  - Animal and in vitro studies
- Clinical science
  - Larger sample sizes
  - Randomized controlled studies
  - Standardized protocols, preparations and techniques

Achilles tear
Post PRP – 2 months

PRP-Before and After
Pre-procedure
Post-procedure

This presentation is the intellectual property of the author. Contact them at amzsportsmd@msn.com for permission to reprint and/or distribute.
PRP Preparation

• Venous blood draw
  – Anticoagulated, 30-60ml
• Graft preparation centrifuges

PRP Preparation

• Platelet concentrates
  (4-6 fold) into small
  amount of plasma with
  leucocytes
PRP Process

- Injection
  - Activation of platelets
  - Image-guided

Risks

- Allergic reactions (medication only)
- Percutaneous needle technique
  - Image guidance
- Infection (no transmissible factors)
  - 1:50,000 risk
- Pain
  - Temporary, short duration
Contraindications

Table 1. Absolute and relative contraindications to PRP use

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet dysfunction syndrome</td>
<td>Consistent use of NSAIDs within 48 hours of procedure</td>
</tr>
<tr>
<td>Critical thromboembolism</td>
<td>Corticosteroid injection at treatment site within 1 month</td>
</tr>
<tr>
<td>Septicemia</td>
<td>Septicemia within 2 weeks</td>
</tr>
<tr>
<td>Local infection at procedure site</td>
<td>Thrombosis</td>
</tr>
<tr>
<td>Patient not willing to accept risks</td>
<td>Recent fever or illness</td>
</tr>
<tr>
<td></td>
<td>Cancer, especially hematopoietic or bone</td>
</tr>
<tr>
<td></td>
<td>Hemoglobin levels &lt; 10 g/dL</td>
</tr>
<tr>
<td></td>
<td>Platelet count &lt; 150,000</td>
</tr>
</tbody>
</table>

PRP: platelet-rich plasma

Treatment Course

- Average 2-4 injections
- Frequency: q2-6 weeks
- Post injection
  - No NSAID’s or corticosteroids
  - Tylenol or Rx pain medications prn
- ADL’s as comfortable, braces and crutches prn
- No heavy resistive exercise or excessive motion at injection area for 2 weeks
- Light exercise as tolerated
- >2-4 weeks: transition into exercise/activity guided by exam and functional status

This presentation is the intellectual property of the author. Contact them at amzsportsmd@msn.com for permission to reprint and/or distribute.
Conclusions

• Important to understand the body's healing process to make rational decisions for treating MSK injuries
• When indicated, seek non-surgical treatment options with emphasis on long term repair

Conclusions

• PRP may be an effective long term, non-surgical treatment option for MSK injuries, when indicated
• Safe, simple, cost effective procedure vs. surgery
• Ability to demonstrate objective healing
• Great potential in MSK medicine

Thank you

amzsportsmd@msn.com