


Regenerative Medicine Cell Based Therapies:

PRP

Scott M Evans PA
New Hampshire Orthopedic Center

The Problem


- An estimated 126.6 million Americans are affected by a musculoskeletal condition showing as pain in the knees, hips or back.
- Back fusion average cost is \$91,000 with a success rate of 30%.
- Discectomy's average cost is \$45,000 and with a success rate of 70%.
- Knee replacement averages \$52,500 and is 85% successful.
- Hip replacement averages \$39,300 and is 90% successful.
- Opioids are prescribed to treat pain without finding the source of pain even though roughly 21 to 29 percent of patients will misuse them. Every day, more than 115 people in the United States die after overdosing on opioids.
- Regenerative therapies are available for these issues with a 80-85% success rate at 30% of the cost of traditional surgeries.
- Over 50% of the candidates for surgery could receive regenerative treatments saving money, time and pain with quicker recovery time and no chance of complications.
- Regenerative therapy is just beginning to be approved as an option by insurance companies.



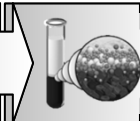
Hypothesis for Autologous Therapies

- The human body has built in repair mechanisms (**Platelets and Nucleated cells**) to recover from tissue injury. Concentrating those cells **at the bedside** and delivering to an injury site may accelerate tissue healing and regeneration in an effort to:


Reduce or Eliminate Pain
Postpone or Avoid Surgical Intervention



ASPIRATE



CONCENTRATE

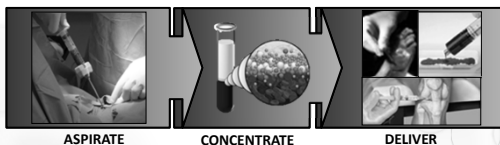


DELIVER

Hypothesis for Autologous Therapies

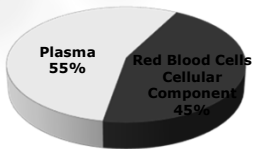
The human body has built in repair mechanisms (*Platelets and Nucleated cells*) to recover from tissue injury. Concentrating those cells at the bedside and delivering to an injury site may:

- Accelerate the repair process
- Improve tissue function and quality

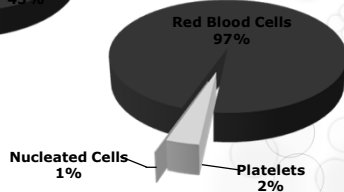


Cellular Content of Whole Blood

Composition of Whole Blood



Breakdown of Cellular Component



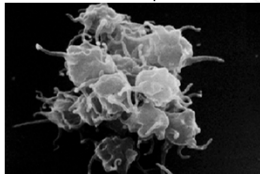
What is a Platelet?

- Platelets or Thrombocytes are small disc-like, colorless, anuclear cells that play a major role in the coagulation and healing process.
- Activated platelets will releases key growth factors involved in healing and tissue regeneration.

Resting platelet



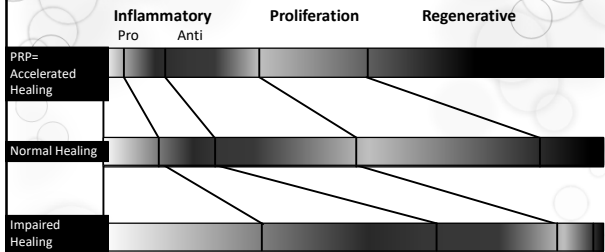
Activated platelet



Important Considerations for PRP

- PRP at 4-6 times baseline has more anti-inflammatory mediators and effects
- PRP contains concentrated nucleated cells critical for healing/tissue regeneration including neutrophils, macrophages, lymphocytes and fibroblasts
- Platelet activation should occur at the tissue level directly at the site of injury or just prior to injection d/t growth factor half life


Therapeutic Goal of Regenerative Medicine




Applications

Specialty	Applications	Benefits	References
Non-Operative Sports Medicine	Epicondylitis	Accelerated healing of soft tissue, avoidance of surgery, and reduced pain.	Mishra & Peerbooms
	Plantar Fasciitis		Ragab & Grambart
	Partial Rotator Cuff Tears		Kajikawa, Samson, Hamid
	Partial Muscle, Tendon, Ligament Tears		
	Partial Meniscal Tears		
	Intra-articular, Knee, Hip, Wrist, DDD		Kon, Filardo, Sampson, Pettine


6 Degrees of Separation



1. Filling of Whole Blood (1000 rpm)
System detects when filling has stopped and moves into soft spin



2. Early Softspin (2800 rpm)




3. Late Softspin (2800 rpm)


The system measures the fill volume and makes adjustments to subsequent process steps.

ARTERIOCYTE
CELLULAR THERAPIES
MEDICAL SYSTEMS


6 Degrees of Separation



4. Early Hardspin (3800 rpm)




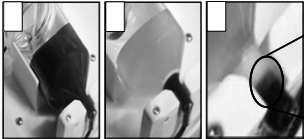
5. Mid Hardspin (3800 rpm)



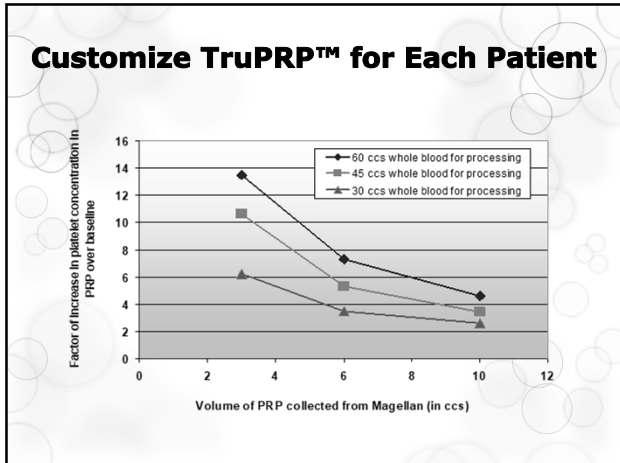
6. Completion of Hardspin

ARTERIOCYTE
CELLULAR THERAPIES
MEDICAL SYSTEMS

Cell Separation and Concentration in Magellan-Red PRP



- Platelets
- White Blood Cells
- Progenitor Cells
- Red Blood Cells









Requirements for Regeneration

Seeds <i>Genic</i>	Stem Cells: MSCs, HSCs	
Fertilizer <i>Inductive</i>	Growth Factors Signaling Proteins	
Ground/Soil <i>Conductive</i>	The Injected Tissue	





PRP Applications Supported by Literature

	DDD Stenosis Spondylosis Spondylolisthesis Scoliosis Facet Arthropathy		Labral Injury Rotator Cuff Tear Osteoarthritis
	Osteoarthritis Avascular Necrosis Ligament Injury Labral Injury Augment to THA		Osteoarthritis Fractures Achilles Injury Plantar Fasciitis Charcot Foot
	Osteoarthritis Ligament Injury Meniscal Tear Tendon Injury Augment to TKA		Ligament Injury Tendon Injury Osteoarthritis Carpal Tunnel

PRP & cBMA Potential Applications					
Knee Pain	Elbow/Arm/Wrist Pain	Lower Extremity Pain	Hip Pain	Back and Other Pain	Shoulder Pain
Tendon Injuries (i.e. Patellar)					
	Medial and Lateral Epicondylitis	Peroneal Tendinopathy & Achilles Tendinopathy or partial tears	Sacroiliac Joint Pain	Facet Pain	Labral Injuries
Bursitis					
	Ulnar Collateral Ligament Pain	Heel Spur Syndrome & Bursitis of the Heel	Osteoarthritis and Labral Tears	Adductor Longus Strain/Tendinopathy	Bursitis
Muscle Injuries					



Processing for PRP

Dual Centrifugation and starting volume are very important!

- **Single spin centrifuges** → Final "PRP" with a 1.7-2.3 X baseline platelet concentration
- **Dual spin centrifuges** → Final PRP with platelet concentrations in the therapeutic range, 4X baseline and above

Starting blood or marrow volume at least 30 ml-60 ml → we aren't creating platelets, stem cells or other healing factors, but simply concentrating from a larger volume to a smaller volume by removing the background noise/competition (RBC's)
