

# BASICS OF PRP THERAPY

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R3 Medical Training



# OUTLINE

What it is.

What's in it.

Single vs. Double Spin.

Controversy

Indications/Research



# DEFINITION

Autologous blood sample that has a platelet concentration above that contained in normal baseline blood plasma.

Platelets contain over 30 bioactive proteins, many of which have a fundamental role in tissue healing.



# WHAT DEFINES CLINICAL PRP

Normal

200,000/microliter



For Bone/Soft Tissue  
Enhancement

- 1,000,000 platelets/microliter
- Equals 1 billion platelets per milliliter
- So typical 5 ml treatment = 5 billion platelets.

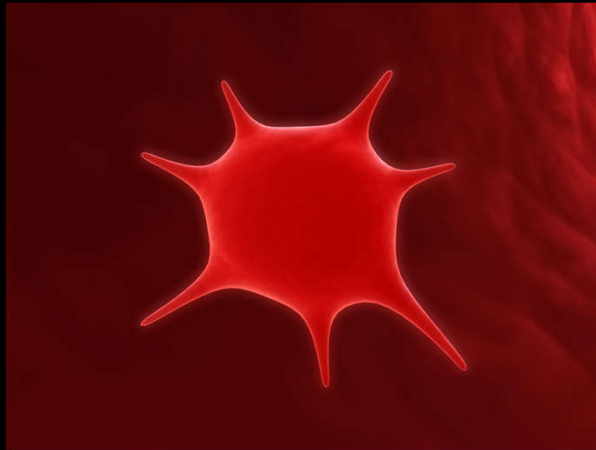


# GROWTH FACTORS IN PR

Platelet Growth Factor Type	Growth factor Source	Biological Actions
Platelet derived growth factor (a-b)	Platelets, osteoblasts, endothelial cells, macrophages, monocytes, smooth muscle cells	Mitogenic for mesenchymal cells and osteoblasts, stimulates chemotaxis and mitogenesis in fibroblast/glia/smooth muscle, regulates collagenase secretion and collagen synthesis, stimulates macrophage and neutrophil chemotaxis
Transforming growth factor GF(alpha -beta)	Platelets, extracellular matrix of bone, cartilage matrix, activated TH1 cells and natural killer cells, macrophages/monocytes and neutrophils	Stimulates undifferentiated mesenchymal cell proliferation; regulates endothelial, fibroblastic and osteoblastic mitogenesis; regulates collagen synthesis and collagenase secretion, regulates mitogenic effects of growth factors, stimulates endothelial chemotaxis and angiogenesis, inhibits macrophage and lymphocyte proliferation
Vascular endothelial growth factor, VEGF	Platelets, endothelial cells	Increases angiogenesis and vessel permeability, stimulates mitogenesis for endothelial cells
Epidermal growth factor, EGF	Platelets, macrophages, monocytes	Stimulates endothelial chemotaxis / angiogenesis, regulates collagenase secretion, stimulates epithelial /mesenchymal mitogenesis
Fibroblast growth factor, FGF	Platelets, macrophages, mesenchymal cells, chondrocytes, osteoblasts	Promotes growth and differentiation of chondrocytes and osteoblasts, mitogenic for mesenchymal cells, chondrocytes and osteoblasts
Connective tissue growth factor CTGF	Platelets through endocytosis from extracellular environment in bone marrow	Promotes angiogenesis, cartilage regeneration, fibrosis and platelet adhesion
Insulin like growth factor - IGF -1	Plasma, epithelial cells, endothelial cells, fibroblasts, smooth muscle cells, osteoblasts, bone matrix	Chemotaxis for fibroblasts and stimulates protein synthesis, enhances bone formation by proliferation and differentiation of osteoblasts

# PRP ACTIVATION

Activation causes granules to fuse to cell membrane (degranulation)



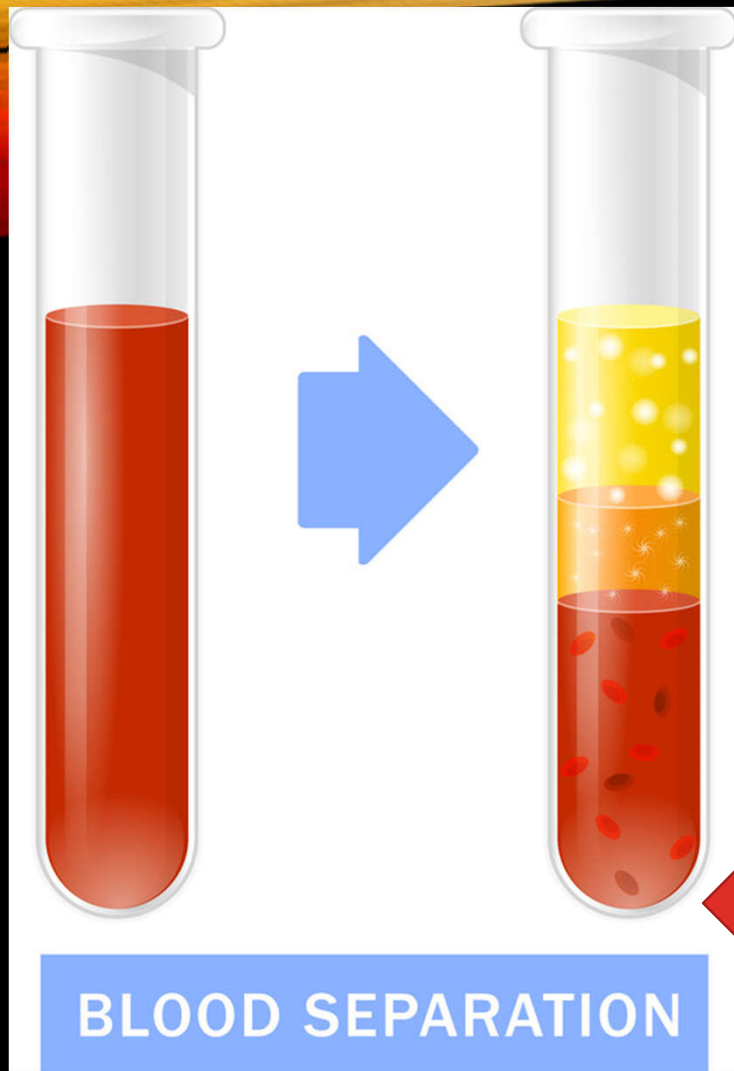
y bind to  
et cells, like  
C's,  
oblasts,  
oblasts, etc

Proteins/Growth Factors become bioactive (PDGF, TGF-B, et) and secreted. Over 95% are secreted within ONE hour.

This leads to intracellular activation creating gene sequencing to direct cellular proliferation, collagen synthesis, etc to provoke tissue repair and tissue regeneration.

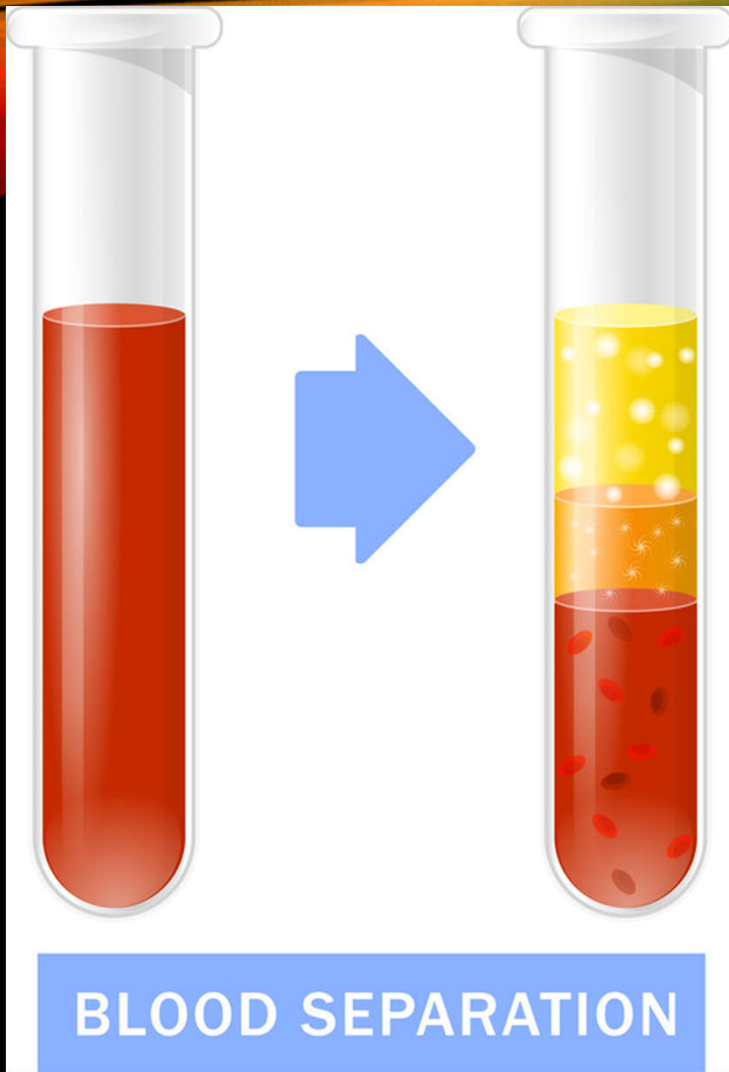
# PRP PREPARATION

- Blood collection with anticoagulant
- 1<sup>st</sup> spin separates whole blood into layers.



RBC's at bottom – we don't want these. Studies show blood in joints can lead to degenerative changes. Synovial fluid treated with RBC's results in cell death.

# PRP PREPARATION



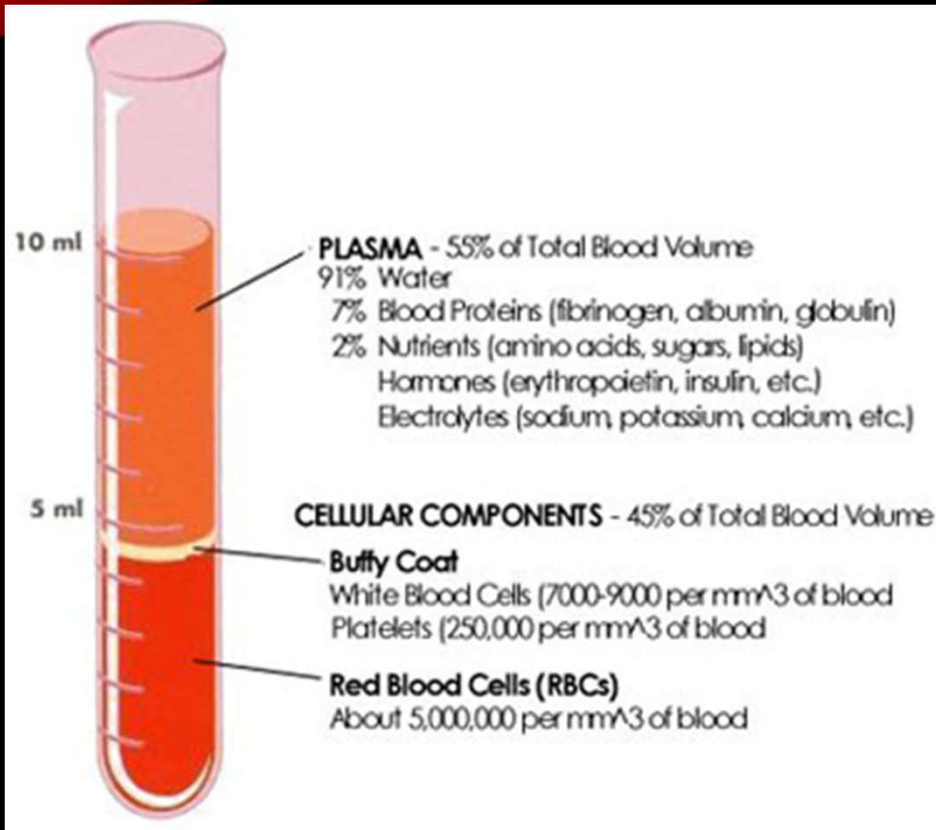
Buffy coat is rich in WBC's and platelets.

**There are five major types of white blood cells:**

- neutrophils.
- lymphocytes.
- eosinophils.
- monocytes.
- basophils.

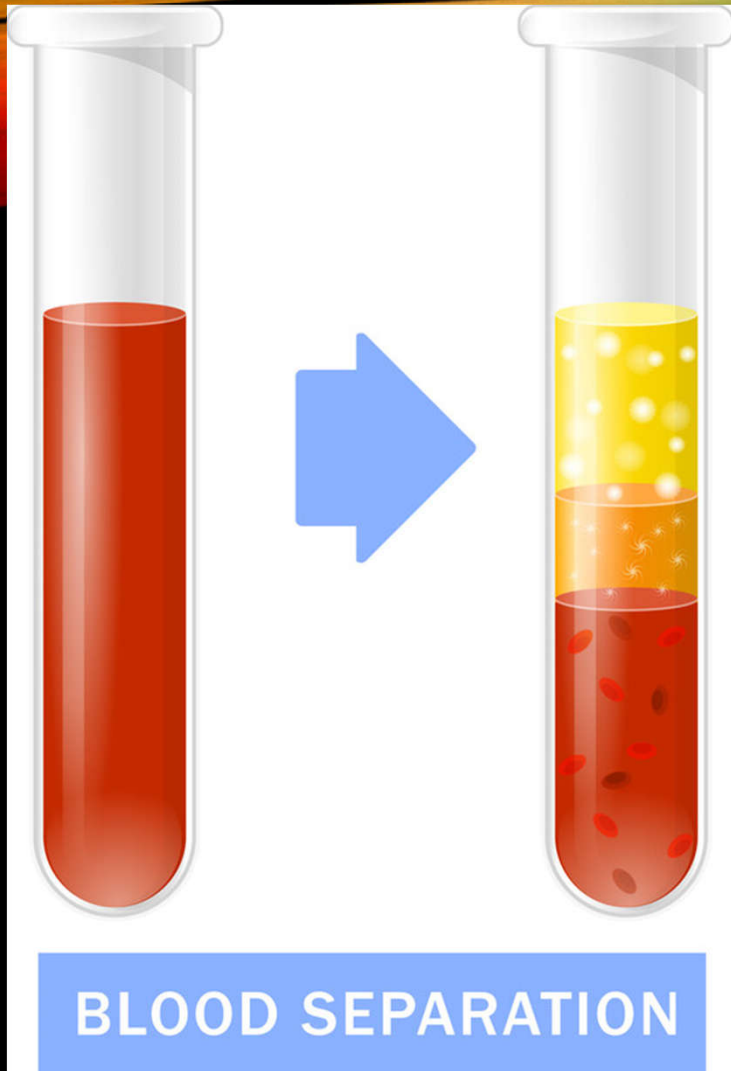


# PRP PREPARATION



Top layer has plasma – water, proteins, electrolytes

# PRP PREPARATION



If you're just going to do a single spin, you would use the middle layer – buffy coat.

This has a LOT of leucocytes and platelets. So it will be a leucocyte rich (LR) PRP.

## PROCESS OF PRP THERAPY

1



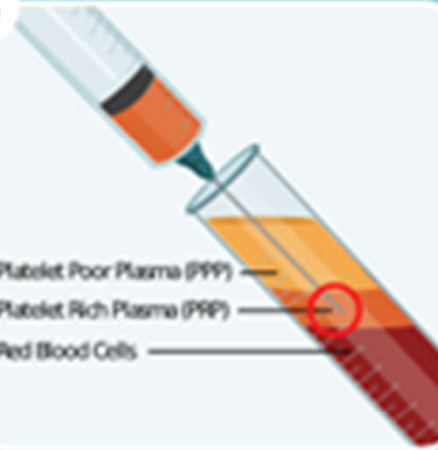
Collect blood

2



Spin down the blood

3



Extract platelet-rich plasma

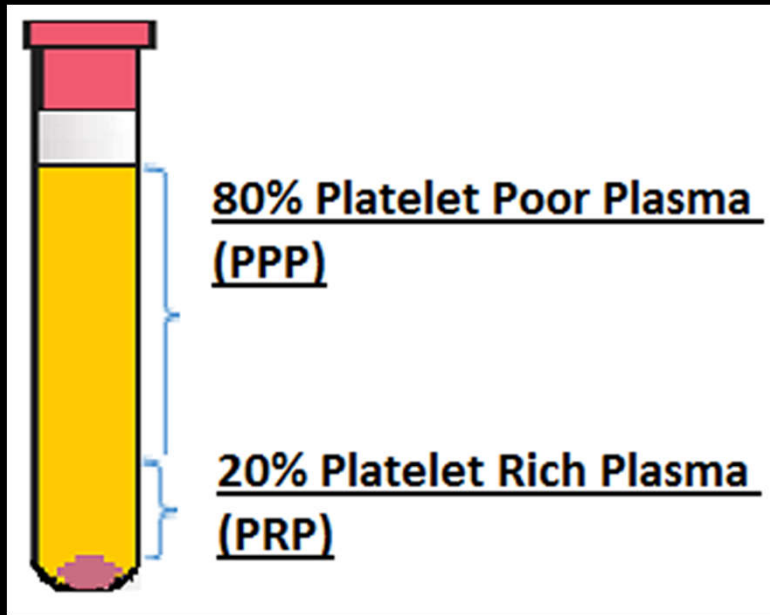
4



Inject injured area with PRP

Copyright Complete Med Car

# SECOND SPIN



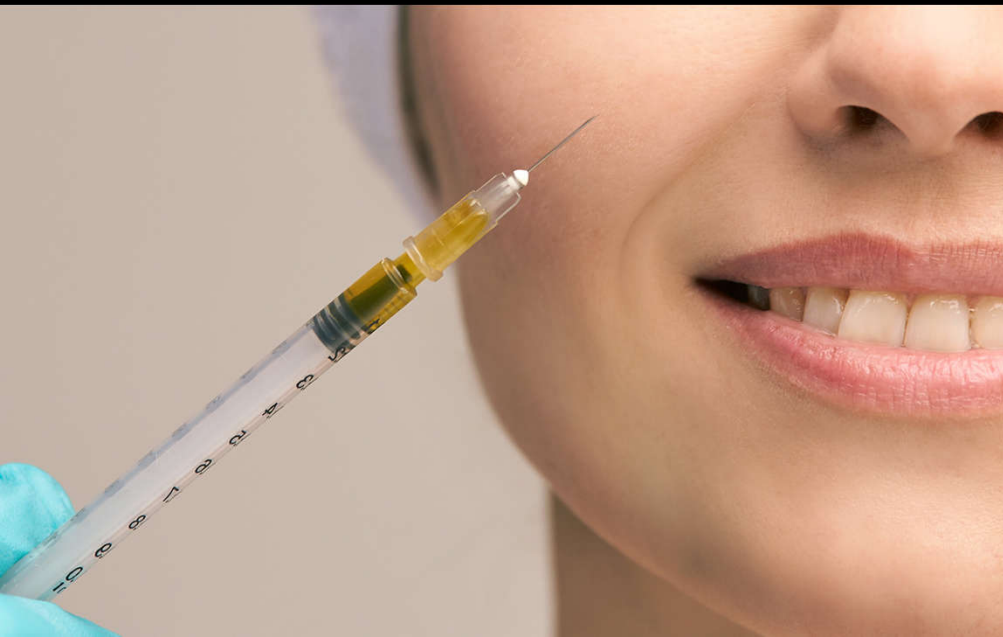
- The top and middle layers get transferred out.
- Don't want RBC's.
- This creates an upper portion of platelet poor plasma and a bottom layer of platelets with a few RBC's.





**YOU WANT MONOCYTES, NOT GRANULOCYTES**

# UNANSWERED QUESTION



- To activate or not?
- Optimal type of PRP to use?
- PRP alone or with stem cells/exosomes?

# Commercially available PRP systems and their PRP preparations

	Company	Blood volume required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced?	Increase in [platelets] (times baseline)
Platelet-rich PRP						
ArthroPrep	Arthrex	52 [6]	1–20 <sup>a</sup>	17 [6]	+	10 <sup>a</sup>
ArthroPrep CS	EmCyte	54 [6]	6 [6]	10 [6]	+	4–7 [6]
ArthroPrep III	Biomet	54 [6]	6 [6]	15 [6]	+	3–10 [6]
ArthroPrep II	Isto Biologics/Arteriocyte	52 [6]	3.5–7 [6]	17 [6]	+	3–15 [6]
ArthroPrep 2	Harvest	54 [6]	7 [6]	14 [6]	+	5–9 [6]
Platelet-poor PRP						
ArthroPrep ACP (ACP)	Arthrex	11 [7]	4 [7]	5 [7]	–	1.3 [7]
ArthroPrep ACP (ACP)	Harvest	54 <sup>a</sup>	6.5 <sup>a</sup>	18 <sup>a</sup>	+	3–6
ArthroPrep ACP (ACP)	EmCyte	50 <sup>a</sup>	6.5 <sup>a</sup>	8.5 <sup>a</sup>	+	4–7 <sup>a</sup>

# WHY WE OFFER EMCYTE AND PUREPRP

Offers upwards of 9 billion platelets in a 7ml sample.

Great control of neutrophils – they are the most abundant leukocyte and show up quickly at injury site. Normally they are cleared quickly by macrophages. If not, they die and release ALL their proinflammatory contents.

Monocytes – largest of leukocytes and are non-inflammatory. The PurePRP system enhances the immune response with monocytes in higher concentrations, while allowing providers to control the neutrophil counts.





# DOES AGE AFFECT PRP QUALITY



- NO!
- A study by Weibrich et al (2004) showed no significant changes in platelet concentration or growth factors in relation to age or gender

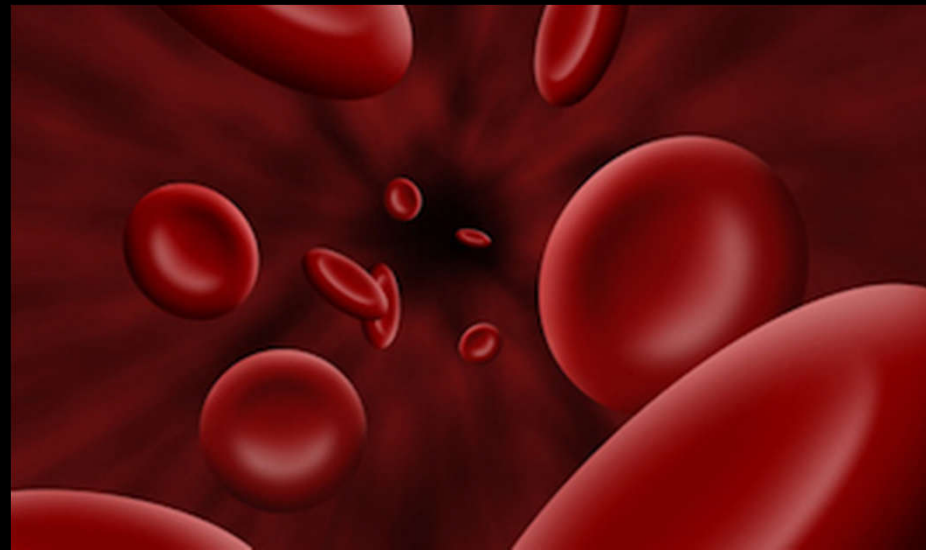
# INDICATIONS

## Soft Tissue

- Achilles
- Plantar Fasciitis
- Rotator Cuff
- Elbow
- Greater Trochanter

## • Joints

- Knee
- Hip
- Spine
- TMJ



# ACHILLE

Platelet-Rich Plasma Injection for  
Chronic Achilles Tendinopathy A  
Randomized Controlled Trial

JAMA study. 54 randomized pts age  
18-70

Conclusion Among patients with  
chronic mid portion Achilles  
tendinopathy who were treated  
with eccentric exercises, a PRP  
injection compared with a saline  
injection **did not result** in greater  
improvement in pain and activity.



# PLANTAR FASCIITIS

Is Platelet-rich Plasma Injection more Effective than Steroid Injection in the Treatment of Chronic Plantar Fasciitis in Achieving Long-term Relief?

Malaysian Orthopedic Journal 2019

60 patients, randomized, blinded



Table II: Mean VAS score in both groups

VAS	Group A (PRP)	Group B (Steroid)	P value (at end of 6 months follow-up)
Pre-Treatment	7.137	7.214	
6 Weeks	2.62	1.928	
3 Months	1.931	2.89	
6 Months	1.413	3.785	<0.001



# ROTATOR CUFF

Nonoperative Treatment of Rotator Cuff Disease With Platelet-Rich Plasma: A Systematic Review of Randomized Controlled Trials

May 2019 Journal of Arthroscopy

Looked at 5 studies, over 200 patients.

The currently limited available evidence on PRP for nonoperative treatment of chronic rotator cuff disease suggests that in the short term, PRP injections **may not be beneficial**. When directly compared with exercisetherapy, PRP **does not result** in superior functional outcomes, pain scores, or range of motion.



# PATELLAR TENDINOPATHY (JUMPER'S KNEE)

Little et al – 81% of patients returned to pre-symptom levels of activity.

Zayni et al showed better pain relief and function with 2 injections versus one.

PRP appears to be a viable treatment option for chronic refractory patellar tendinopathy, and leukocyte-rich preparation is recommended. (ONE SPIN)



# LATERAL EPICONDYLITIS (TENNIS ELBOW)

Meta- analysis showed PRP was better at reducing pain in short and long term versus steroid. Effects lasted up to 2 years. No subcutaneous atrophy.

One of the best studies (Mishra et al) showed leucocyte rich yielded better long term results than lidocaine or dry needling.





# ELBOW LIGAMENT PARTIAL TEAR

Podesta et al. followed the progress of 34 throwing athletes being treated for partial thickness tears of the UCL with a single PRP injection [56].

They found that 30 of the 34 athletes were able to return to the same level of play or higher at an average of 12 weeks





# HOHEI OHTANI

While UCL injuries can lead to Tommy John surgery, several pitchers -- including New York Yankees right-hander Masahiro Tanaka and Boston Red Sox left-hander Chris Sale -- have had PRP injection therapy as a more conservative treatment and continued to pitch without further issues.

For Ohtani – he still ended up needing the surgery.



# GREATER TROCHANTERIC BURSITIS

Platelet-Rich Plasma Versus Surgery  
for the Management of Recalcitrant  
Greater Trochanteric Pain  
Syndrome: A Systematic Review

March 2020 Journal of Arthroscopy  
Santiago et al.

10 studies evaluated. 210 patients.  
F/U over 2 years plus.

PRP outcome was equivalent to  
surgery (awesome), but quite a few  
complications with surgery (re-tears,  
DVT, wound issues, snapping hip).



# Study design characteristics for PRP versus control injection for osteoarthritis

Study	Year of publication	Level of evidence	Sample size		Type of PRP	Number of injections	Intervention/injection volume and contents		Follow-up (months)
			PRP	Control			PRP	Control	
Battaglia et al. [72]	2013	I	50	50	LR-PRP	3	5 mL PRP	30 mg HA	12
Dallari et al. [73]	2016	I	44, +HA: 31	36	NR	3	7 mL PRP + HA	30 mg HA	12
Doria et al. [74]	2017	II	40	40	NR	3	5 mL PRP	15 mg HA	12
Sante et al. [75]	2016	I	21	22	NR	3	3 mL PRP	30 mg HA	4
Cole et al. [76]	2017	I	49	50	LP-PRP	3	4 mL PRP	16 mg HA injection	12
Duymus et al. [77]	2017	I	41	HA: 40, ozone: 39	NR	2	5 mL PRP	40 mg HA, 15 mL ozone	12
Gormeli et al. [78]	2017	I	PRP (3×): 46, PRP (1×): 45	HA: 46, placebo: 45	NR	3 versus 1	5 mL PRP	30 mg HA, NR saline	6
Lana et al. [79]	2016	I	36, +HA: 33	36	NR	3	5 mL PRP + 20 mg HA	20 mg HA	12
Montanez et al. [80]	2016	I	28	27	NR	3	NR	NR HA	6
Paterson et al. [81]	2016	I	12	11	NR	3	3 mL PRP	3 mL HA	3
Simental et al. [82]	2016	I	33	32	LP-PRP	3	3 mL PRP	Tylenol 500 mg q8h	4
Smith et al. [83•]	2016	I	15	15	LP-PRP	3	3–8 mL PRP	3–8 mL saline	12

NR, not reported; LP-PRP leukocyte-poor PRP, LR-PRP leukocyte-rich PRP, PRGF plasma rich in growth factors, HA hyaluronic acid

Hand = 2/4 positive. Knee = 7/8 positive





## KNEE OA

The temporal effect of platelet-rich plasma on pain and physical function in the treatment of knee osteoarthritis: systematic review and meta-analysis of randomized controlled trials

Journal of Ortho Surgery & Research  
2017

Reviewed 14 studies and 1400 patients.

- Intra-articular PRP injections probably are **more efficacious** in the treatment of knee OA in terms of pain relief and self-reported function improvement at 3, 6 and 12 months follow-up, compared with other injections, including saline placebo, HA, ozone, and corticosteroids.



# ONE INJECTION OR MULTIPLE

**Single- and double-dose of platelet-rich plasma versus hyaluronic acid for treatment of knee osteoarthritis: A randomized controlled trial.**

World J Orthop. 2019

95 patients for 4 months.

Found that the efficacy of PRP increases after multiple injections (3 wks apart).

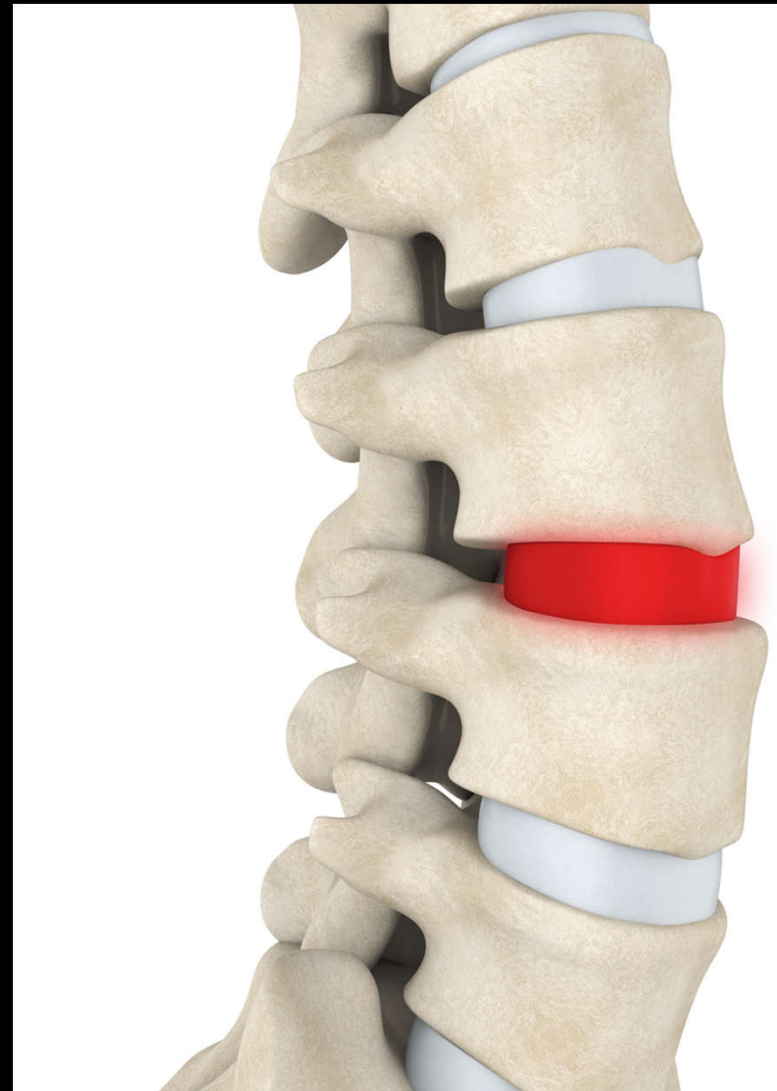


# DEGENERATIVE DISC DISEASE

**Treatment of  
symptomatic degenerative intervertebral  
discs with autologous platelet-  
rich plasma: follow-up at 5-9 years.**

Regen Med. 2019

This subset of patients demonstrated  
statistically and clinically significant  
improvements in pain and function  
at 5-9 years postinjection.

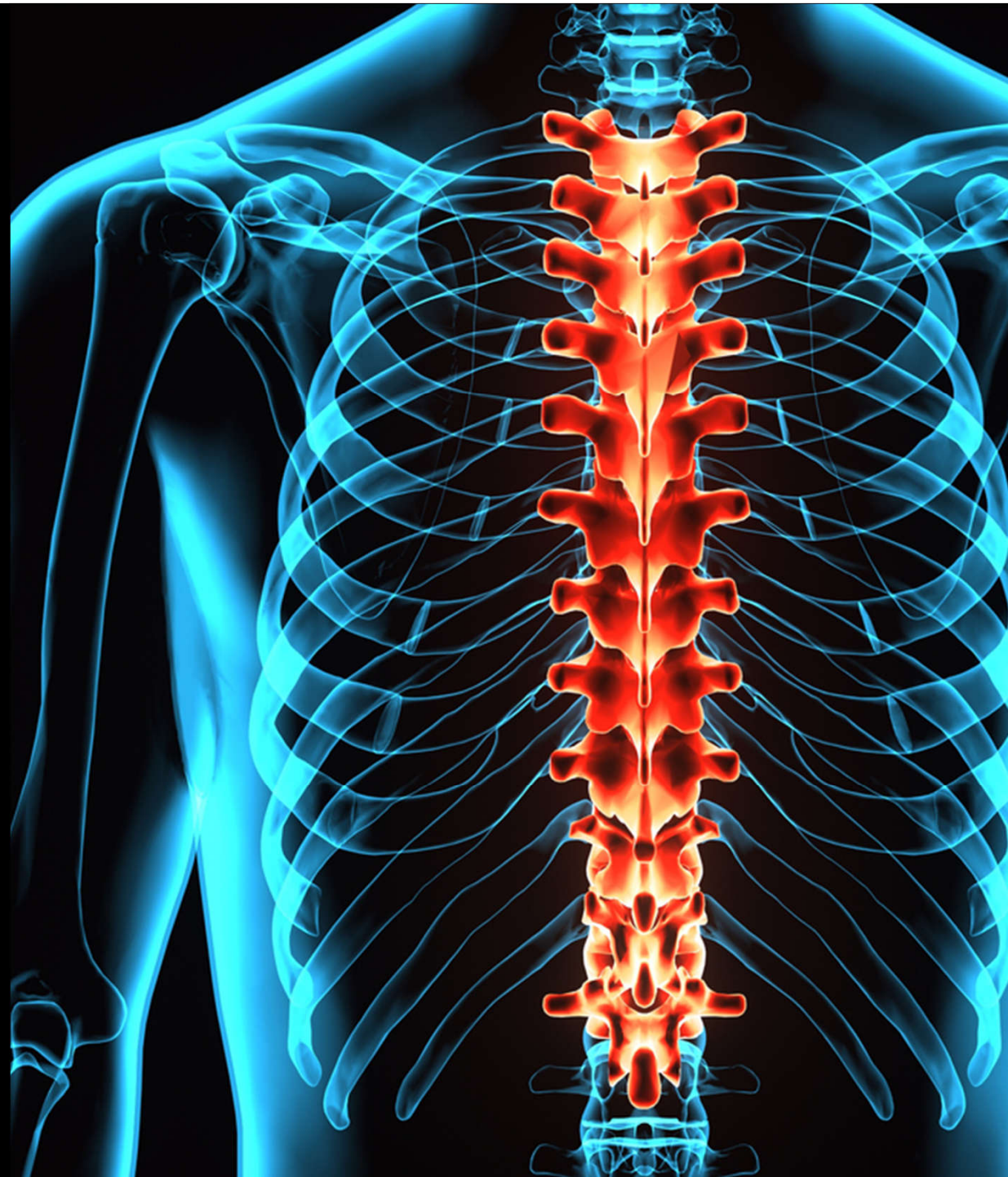


# LUMBAR FACET SYNDROME

Analysis of the clinical efficacy of platelet-rich plasma therapy in the treatment of patients with isolated facet-syndrome of the lumbar spine

Russian study – 49 pts followed 18 months.

Clinical efficacy is confirmed by the persistent significant reduction of pain symptoms and restoration of functional status in the early and late postoperative periods with low risks of adverse outcomes.





J

platelet-rich plasma for the  
therapeutic management of  
temporomandibular joint  
disorders: a systematic review.

looked at 6 studies, published  
2018 in J Oral Maxillofac Surg.

four of the studies  
found PRP injections to be  
superior in terms of  
improvements in mandibular  
range of motion and pain  
intensity up to 12 months after  
treatment, while the  
remaining two studies found  
similar results for the different  
treatments.





# CONCLUSION

PRP – Very Low Risk and relatively inexpensive.

Lots of unanswered questions

- Dosing – we have an idea.
- Activation
- LR or LP

No gold standard.

Many positive studies despite this!

Great option, anecdotally great with stem cells/exosomes.

