

Bucharest 2-4 October
2025



Update on Protocols and Techniques for Intra-articular Orthobiologic Procedures

Luga Podesta, MD

Director, Regenerative Sports Medicine

Bluetail Medical Group-Naples

Podesta Orthopedic & Sports Medicine

Assistant Clinical Professor

Orlando College of Osteopathic Medicine

Western University School of Health Sciences



Disclosures

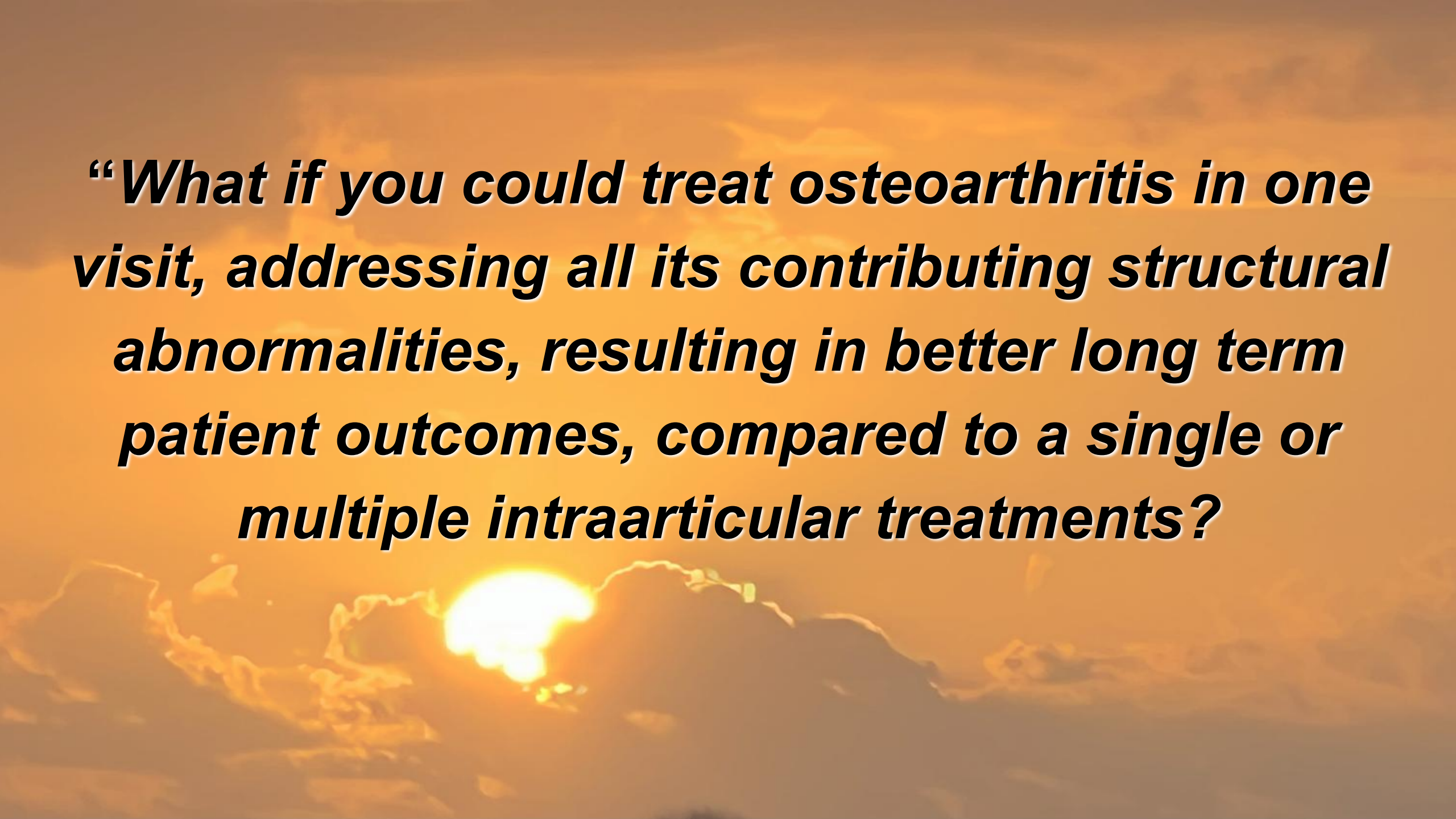
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“What if you could treat osteoarthritis in one visit, addressing all its contributing structural abnormalities, resulting in better long term patient outcomes, compared to a single or multiple intraarticular treatments?”

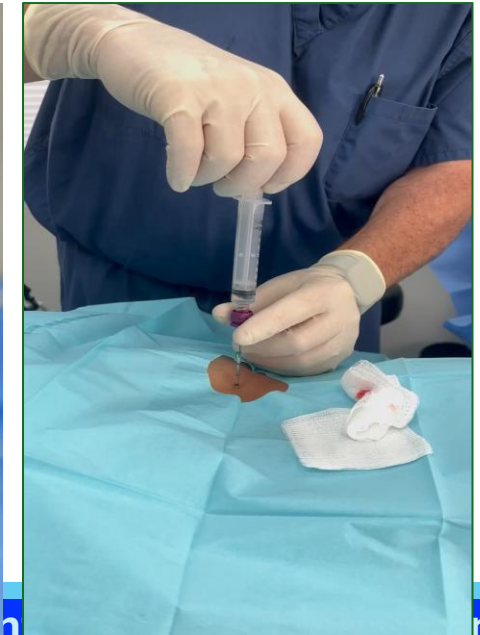
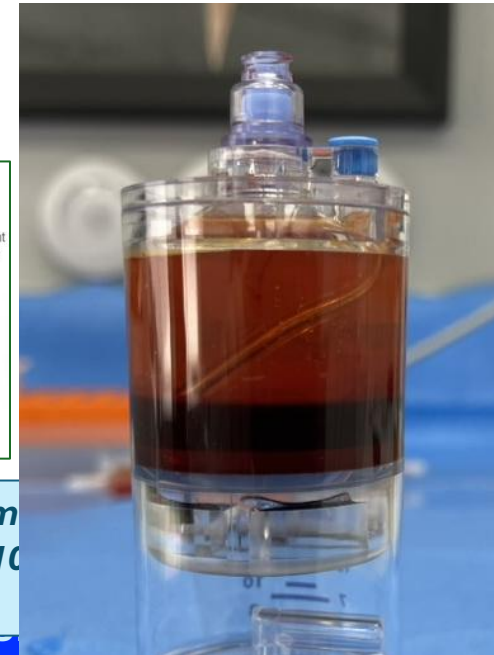
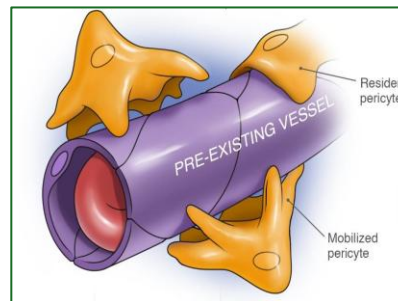
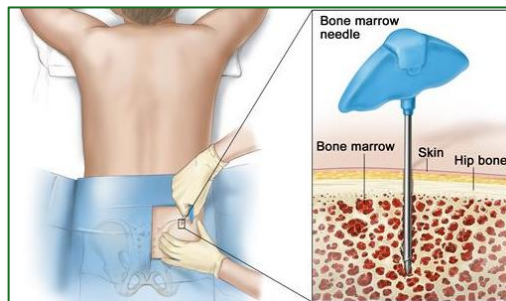
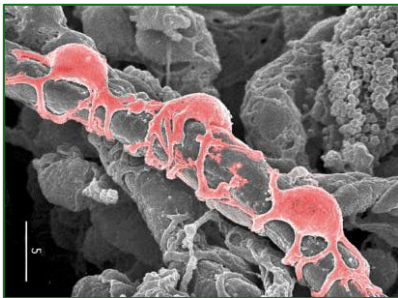
Biologic optimization

Blood draw

- Large bore #17g fenestrated needle
- Slow steady draw
- Minimizing turbulence and negative
- Optimize platelet capture rate



Bone Marrow Aspiration



It is important to apply sufficient “accelerative” force to engage the viscous bone marrow for its collection. This is achieved only by a very rapid pull-back on the plunger of the 10 mL syringe; Hernigou; International Orthop 2014

A microscopic image showing a dense network of white, fibrous strands (fibrin) forming a mesh that traps numerous red, biconcave disc-shaped cells (red blood cells).

Platelet Dosing

Why is it important?

CLINICAL OUTCOMES!

Optimal platelet dose - *intra-articular injections*

Platelet dosing - *Total deliverable platelets*

Acta Orthopaedica 2020; 91 (6): 743–749
743

Intra-articular injection with Autologous Conditioned Plasma does not lead to a clinically relevant improvement of knee osteoarthritis: a prospective case series of 140 patients with 1-year follow-up

Jasmijn V KORPERSHOEK¹, Lucienne A VONK¹, Tommy S DE WINDT¹, Jon ADMIRAAL¹, Esmee C KESTER¹, Nienke VAN EGMOND¹, Daniël B F SARIS^{1,2}, and Roel J H CUSTERS¹

¹ University Medical Center Utrecht, Utrecht, the Netherlands; ² Mayo Clinic, Rochester, USA
Correspondence: r.j.h.custers@umcutrecht.nl
Submitted 2020-06-02, Accepted 2020-06-28.



Platelet Dose: 2.2 billion

Their findings did not support the use of PRP for the management of knee OA!

JAMA | Original Investigation

Effect of Intra-articular Platelet-Rich Plasma vs Placebo Injection on Pain and Medial Tibial Cartilage Volume in Patients With Knee Osteoarthritis The RESTORE Randomized Clinical Trial

Kim L. Bennell, PhD; Kade L. Paterson, PhD; Ben R. Metcalf, BSc; Vicky Duong, DPT; Jillian Eyles, PhD; Jessica Kasza, PhD; Yuanyuan Wang, PhD; Flavia Cicuttini, PhD; Rachelle Buchbinder, PhD; Andrew Forbes, PhD; Anthony Harris, MSc; Shirley P. Yu, MPH; David Connell, MMed; James Linklater, MBBS; Bing Hui Wang, PhD; Win Min Oo, PhD; David J. Hunter, PhD



Platelet Dose: 1.6 billion

www.nature.com/scientificreports

scientific reports

OPEN

Platelet-rich plasma (PRP) in osteoarthritis (OA) knee: Correct dose critical for long term clinical efficacy

Himanshu Bansal^{1,2,3}, Jerry Leon², Jeremy L. Pont³, David A. Wilson³, Anupama Bansal¹, Diwaker Agarwal⁴ & Justin Preteasa³



Platelet Dose: 10.1 billion

Biologic Optimization

Combined therapies

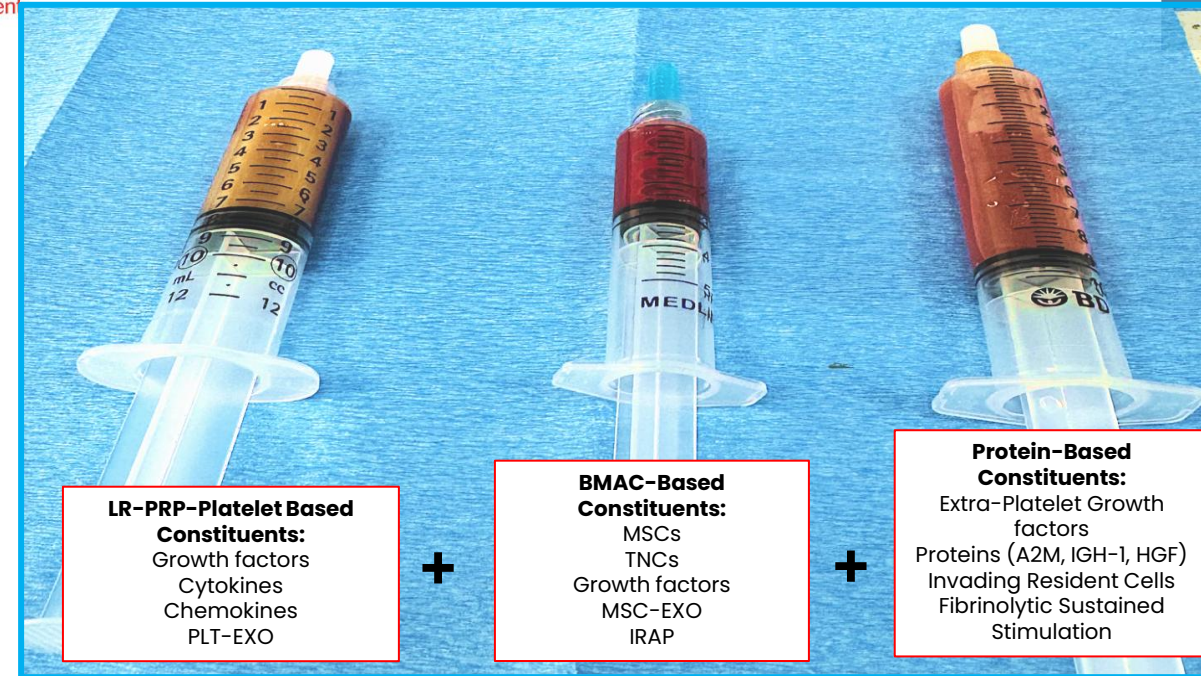
➤ LR-PRP + HA *Lana et al, J Stem Cells Regen Med, 2016; Yu et al, Exp Ther Med, 2018*

- PRP + HA > PRP > HA > Placebo

➤ LR-PRP + BMC (*Progenitor cells*)

- Suitable microenvironment, augment cell proliferation, differentiation, and neo angiogenesis
- Act as a scaffold

➤ LR-PRP + BMC + Fibrin Matrix
(*GFs, Progenitor Cells*) + (*PPP GFs, Fibrinogen, A2M*)

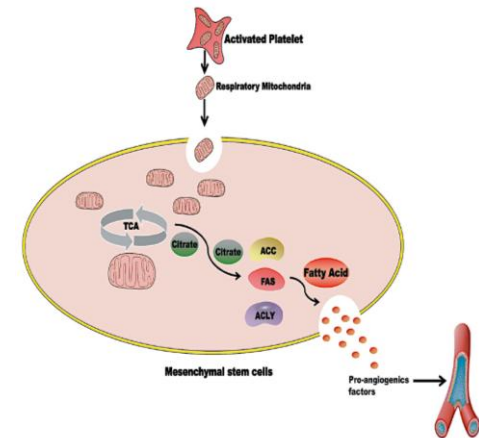
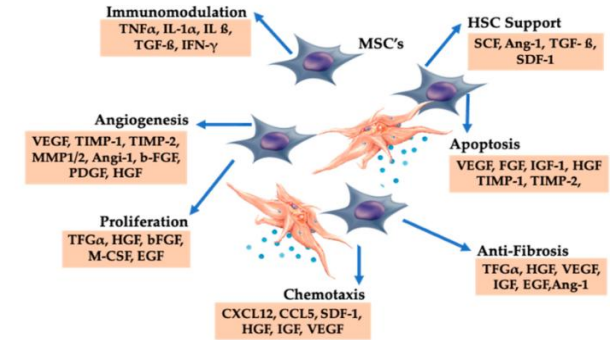


Based on the typical PRP, MSC, and protein characteristics, it is suggested that a potential synergistic effect occurs if PRP is combined with MSC preparations, and that PRP effects might be extended over a longer period of time, when mixed with a protein concentrate and consolidated as one Autologous Protein Product.

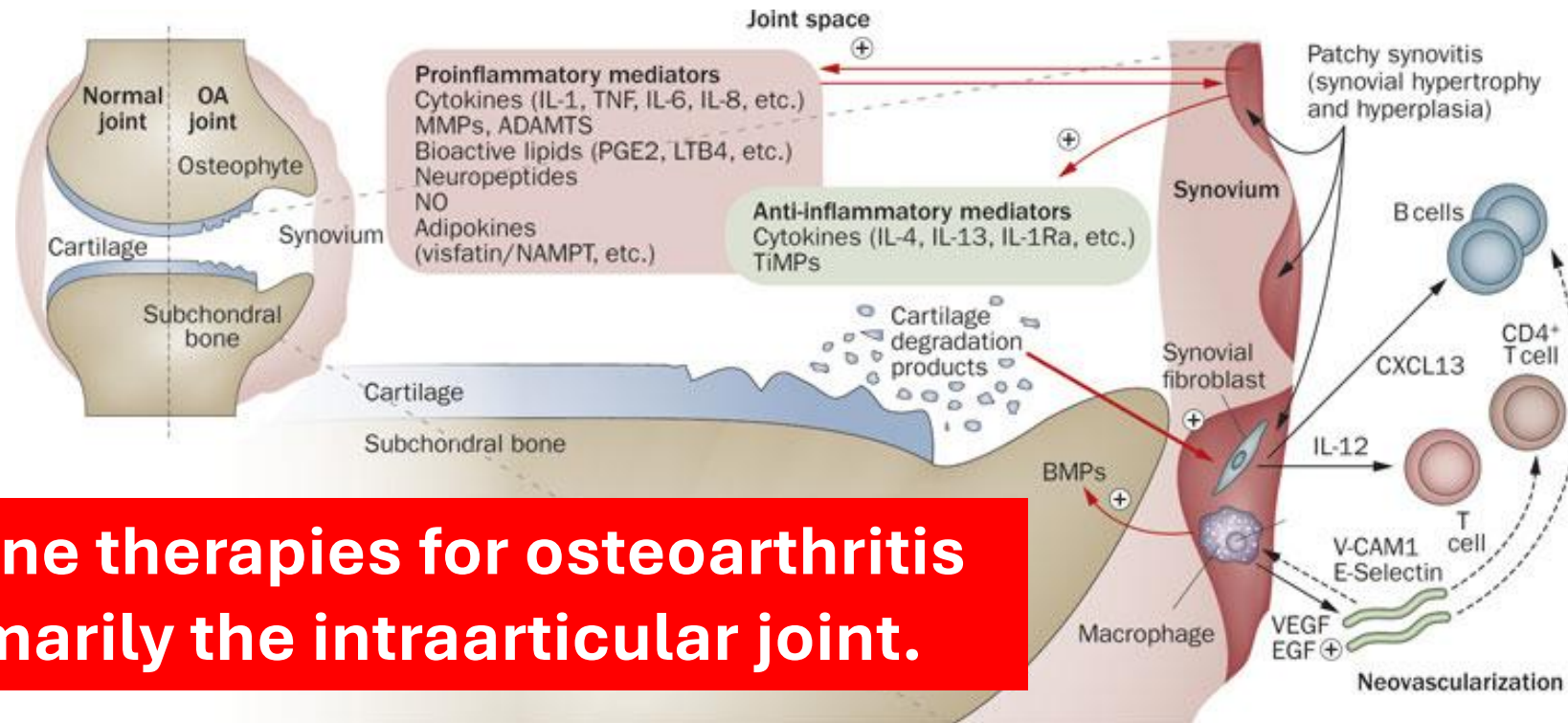
Rationale for combining PRP with BMC



- ✓ Multiple synergistic effects between platelets and MSCs have been demonstrated.
- ✓ The MSC regenerative capacity, including immunomodulatory and antifibrotic potential are increased by PRP-Platelets.
- ✓ Mitochondria, increase the energy production of host cells, also regulating fatty acid synthesis pathways.
(relevant in cell differentiation, angiogenesis).
- ✓ Evidence suggests that PRP-Platelets transfer mitochondria to MSCs, altering their biological activities in recipient cells.



Intra-articular Injections



Often first line therapies for osteoarthritis target primarily the intraarticular joint.

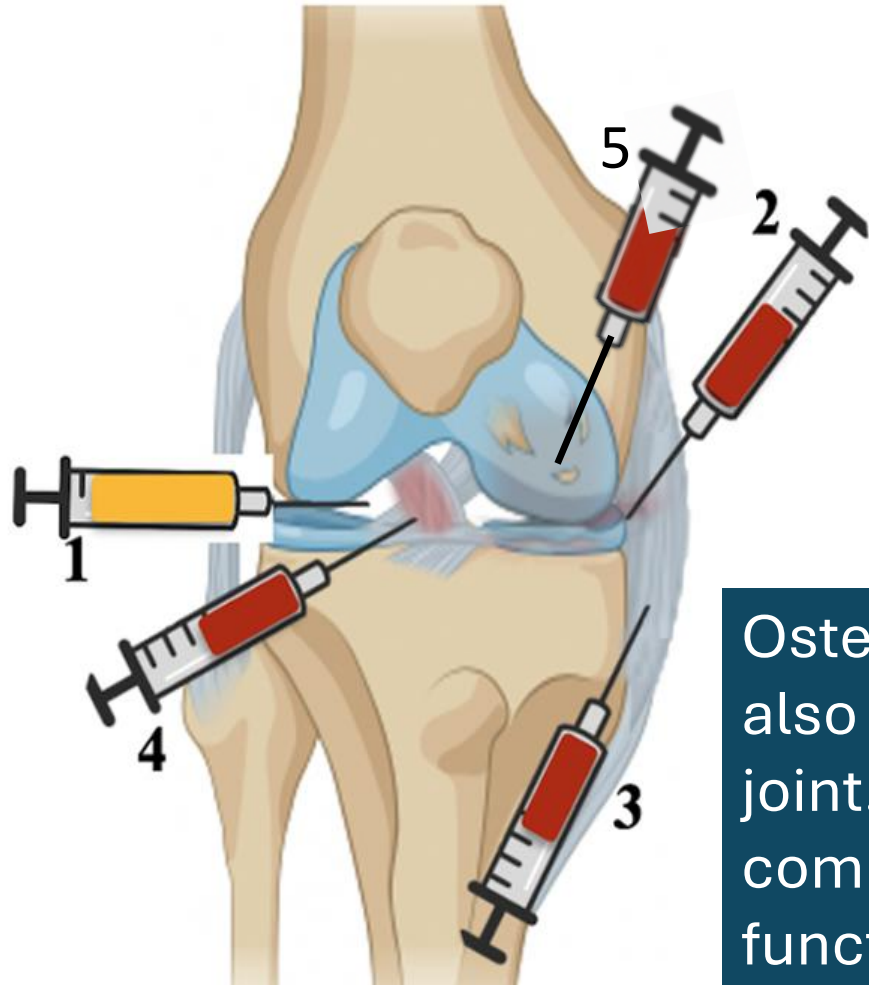
Joint environment is complex and dynamic
Must consider all cellular constituents when
evaluating intra-articular treatments

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Osteoarthritis - multiple pathologies



Joint

Synovium

Treat the Entire Joint!

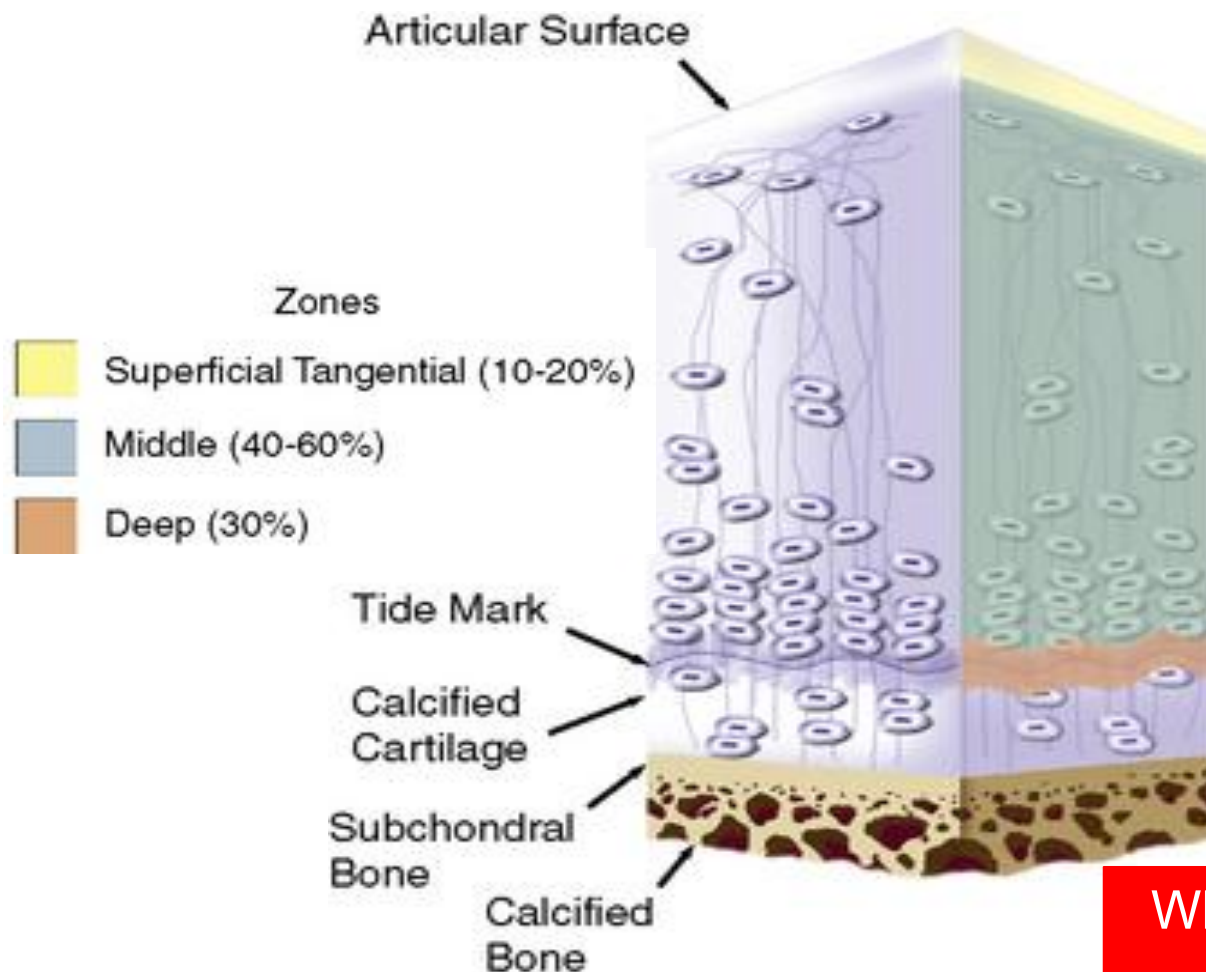
Ligaments

Alignment

SUBCHONDRAL BONE!

Osteoarthritis involves not only the articular cartilage, but also the soft tissue that cushion, stabilize and move the joint. We now have a better understanding of the complexities of the osteochondral unit and its integral function in joint homeostasis and in the development of joint pathologies when disrupted.

Osteochondral Unit



Relies on the interplay between...

- Articular cartilage
- Subchondral plate
- Trabecular bone

Functions to:

Absorb and distribute load across the joint

When we see failure of that osteochondral unit, we will begin to see failure of the joint as an organ and progressive breakdown of joint homeostasis

What is the bone pathology?

Should we treat them all the same?

ACL tear



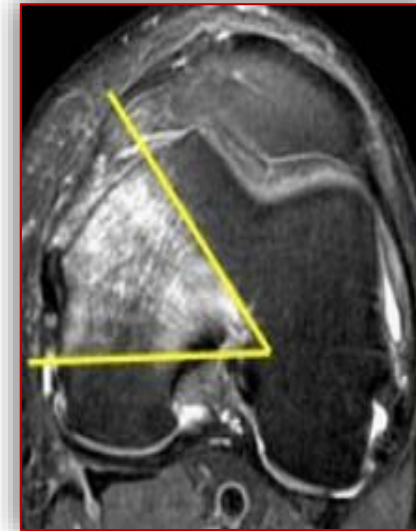
Insufficiency Fx



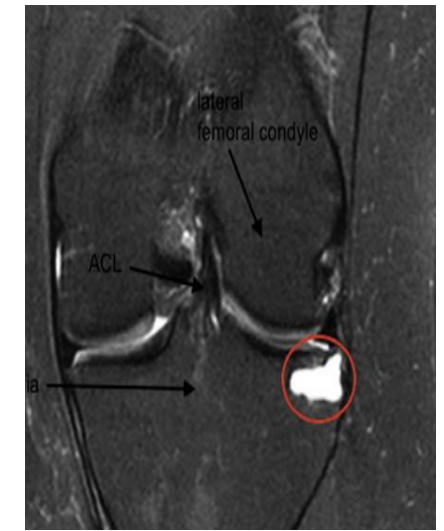
Osteoarthritis



Acute SONK/AVN



Bone cyst



- Size / Quality of lesion
- In office vs. Operating Room --- PAIN
- Volume of Decompression?
- Viscosity of Bone Graft
- Need for additional work / Scope?

Courtesy of Alberto Panero, DO

Why are BMLs important to treat? – *disease progression*

Bone Marrow Edema and Its Relation to Progression of Knee Osteoarthritis

David T. Felson, MD, MPH, Sara McLaughlin, MPH, Joyce Goggins, MPH, Michael P. LaValley, PhD, M. Elon Gale, MD, Saara Totterman, MD, Wei Li, MBA, Catherine Hill, MD, MSc, and Daniel Gale, MD
Annals of Internal Medicine, Volume 139, Number 5_Part_1, 2003
https://doi.org/10.7326/0003-4819-139-5_Part_1-200309020-00008

- Conclusion: BME is a potential risk for structural deterioration of the knee

Osteoarthritis

Magnetic Resonance Imaging of Subchondral Bone Marrow Lesions in Association with Osteoarthritis

Li Xu MD *, Daichi Hayashi MBBS, PhD *, Frank W. Roemer MD * †, David T. Felson MD, MPH ‡, Ali Guermazi MD, PhD *

- The subchondral bone cyst-like lesions were an independent factor for inducing pain in OA patients

A Case Report & Literature Review

Subchondral Bone Marrow Lesions Associated With Knee Osteoarthritis

Peter F. Sharkey, MD, Steven B. Cohen, MD, Charles F. Leinberry, MD, and Javad Parvizi, MD

Skeletal Radiol (2008) 37:609–617
DOI 10.1007/s00256-008-0504-x

SCIENTIFIC ARTICLE

Bone marrow edema in the knee in osteoarthrosis and association with total knee arthroplasty within a three-year follow-up

Courtney Scher • Joseph Craig • Fred Nelson

"Subjects who had BME of any pattern type were **8.95 x** as likely to progress rapidly to a TKA when compared to subjects with no BME (p=0.016)"

Treatment options? – *Intraarticular vs Intraarticular + Interosseous*

Treating Severe Knee Osteoarthritis with Combination of Intra-Osseous and Intra-Articular Infiltrations of Platelet-Rich Plasma: An Observational Study

Mikel Sánchez^{1,2}, Diego Delgado², Orlando Pompei¹, Juan Carlos Pérez¹, Pello Sánchez², Ane Garate², Ane Miren Bilbao¹, Nicolás Fiz¹ and Sabino Padilla³

Cartilage. 2019 Apr; 10(2): 245–253.

Comparison of hyaluronic acid and PRP intra-articular injection with combined intra-articular and intraosseous PRP injections to treat patients with knee osteoarthritis

Ke Su¹, Yuming Bai², Jun Wang², Haisen Zhang², Hao Liu³, Shiyun Ma²

Clin Rheumatol 2018 May;37(5):1341-1350.

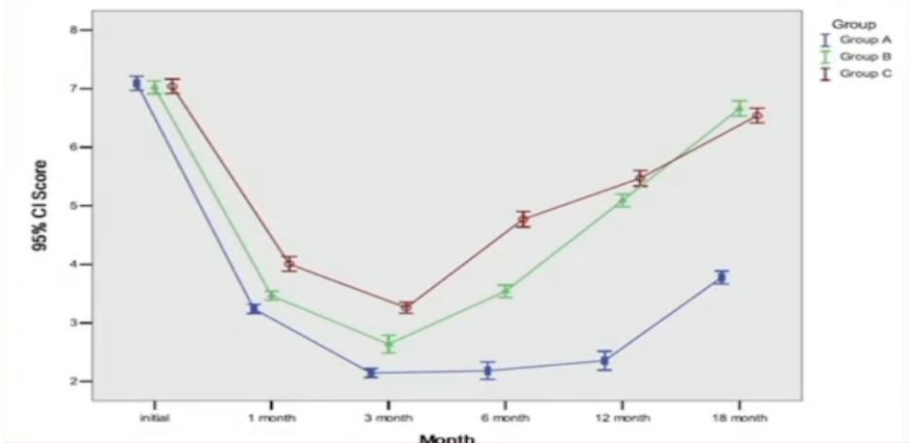
The combination of intraosseous with intra-articular injections of PRP resulted in a significantly superior clinical outcome, with sustained lower VAS and WOMAC scores and improvement in quality of life within 18 months.

60 patients

Intra-articular (IA) vs IA & intraosseous PR

➤ 2 month FU -> same effect

➤ 6/12-month FU -> intraosseous is superior to IA



86 patients grade 2/3 knee OA

Blue: Intra-articular (IA) & Intraosseous PRP

Green: IA PRP

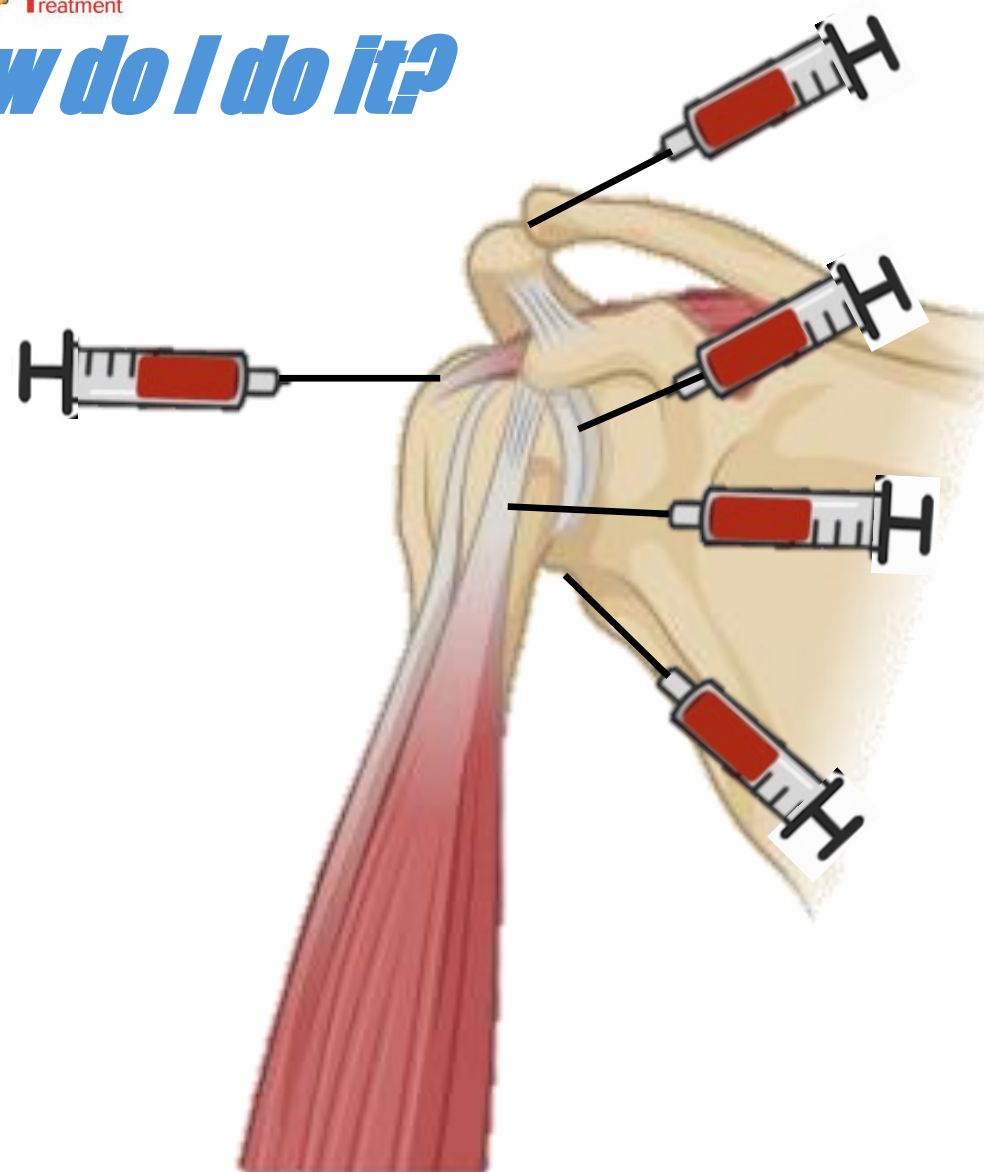
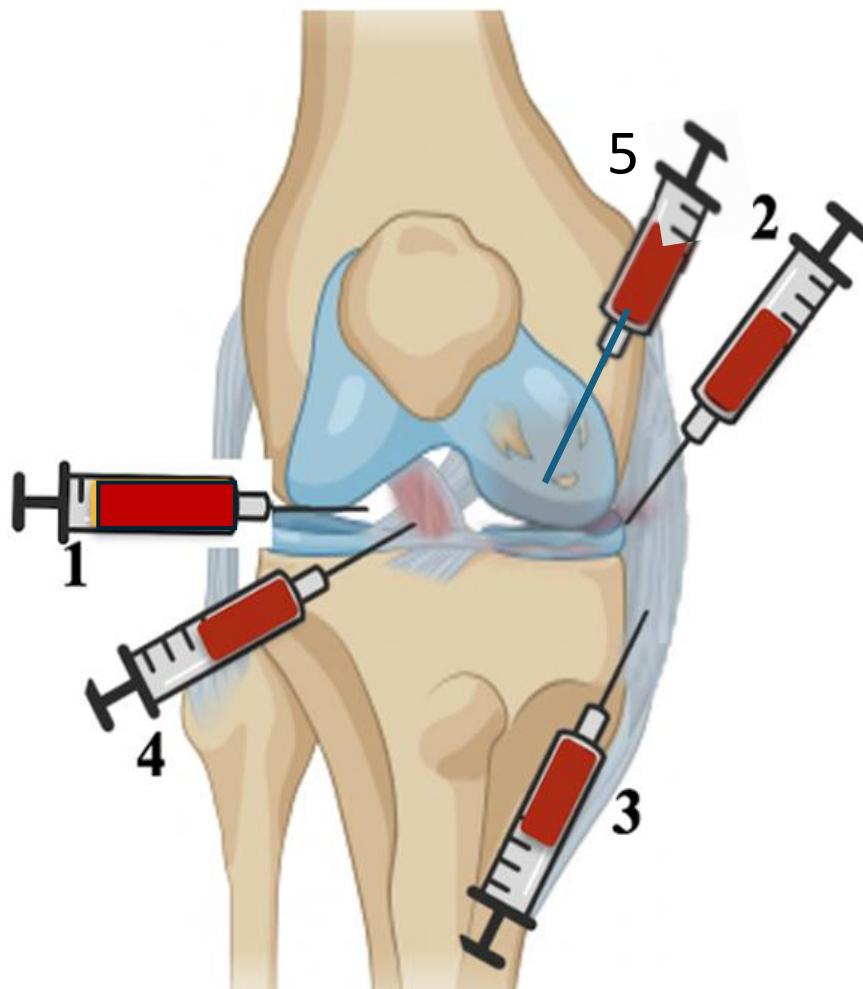
Red: IA hyaluronic acid

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What do I do and how do I do it?



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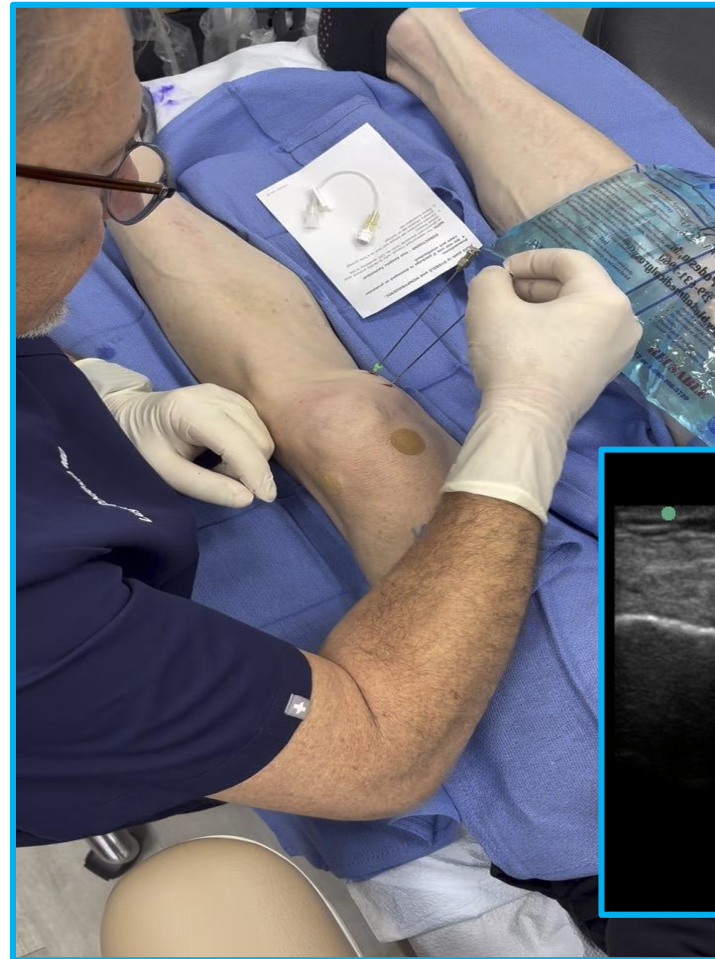
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Imaging options – *precision is key!!*

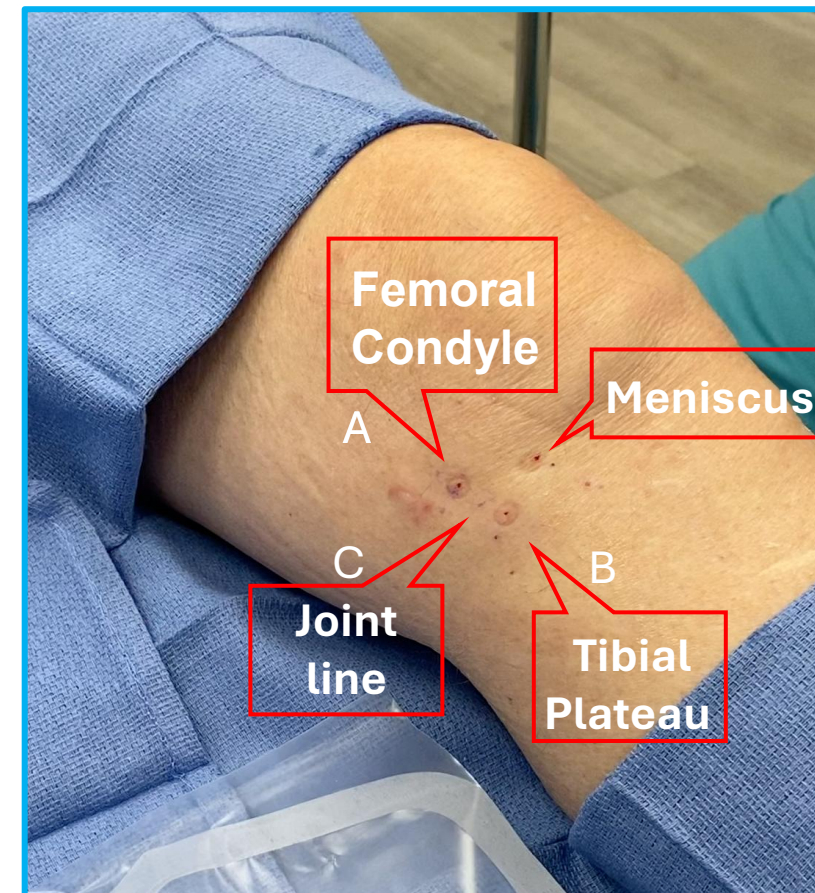
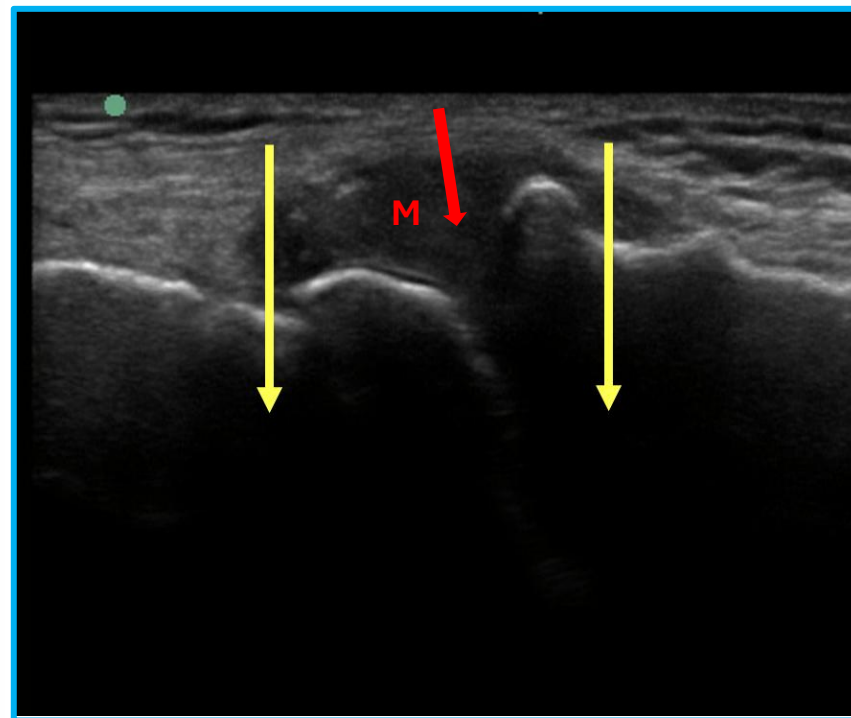
Fluoroscopic guidance



MSK ultrasound guidance



Interosseous injection - *preparation and planning*



MSK US Guided IO Subchondral Procedure

- Regional/local anesthesia, allow adequate time for it to work!
 - ❖ Adductor canal, periosteal, genicular n, ant fem cut N
- 18-gauge spinal needle / metal stylet / laser engraved cm markings
- Insert needle to cortex
- Advance needle to predetermined depth across BML, remaining parallel to joint line
- Slowly inject 2-3 ml's while withdrawing needle
- Leave needle in place to assure clot formation, Activate with CaCl to prevent run off
- Withdraw needle, apply sterile waterproof dressing
- Apply HEAT
- Off load compartment / protect healing



What do I do and how do I do it?

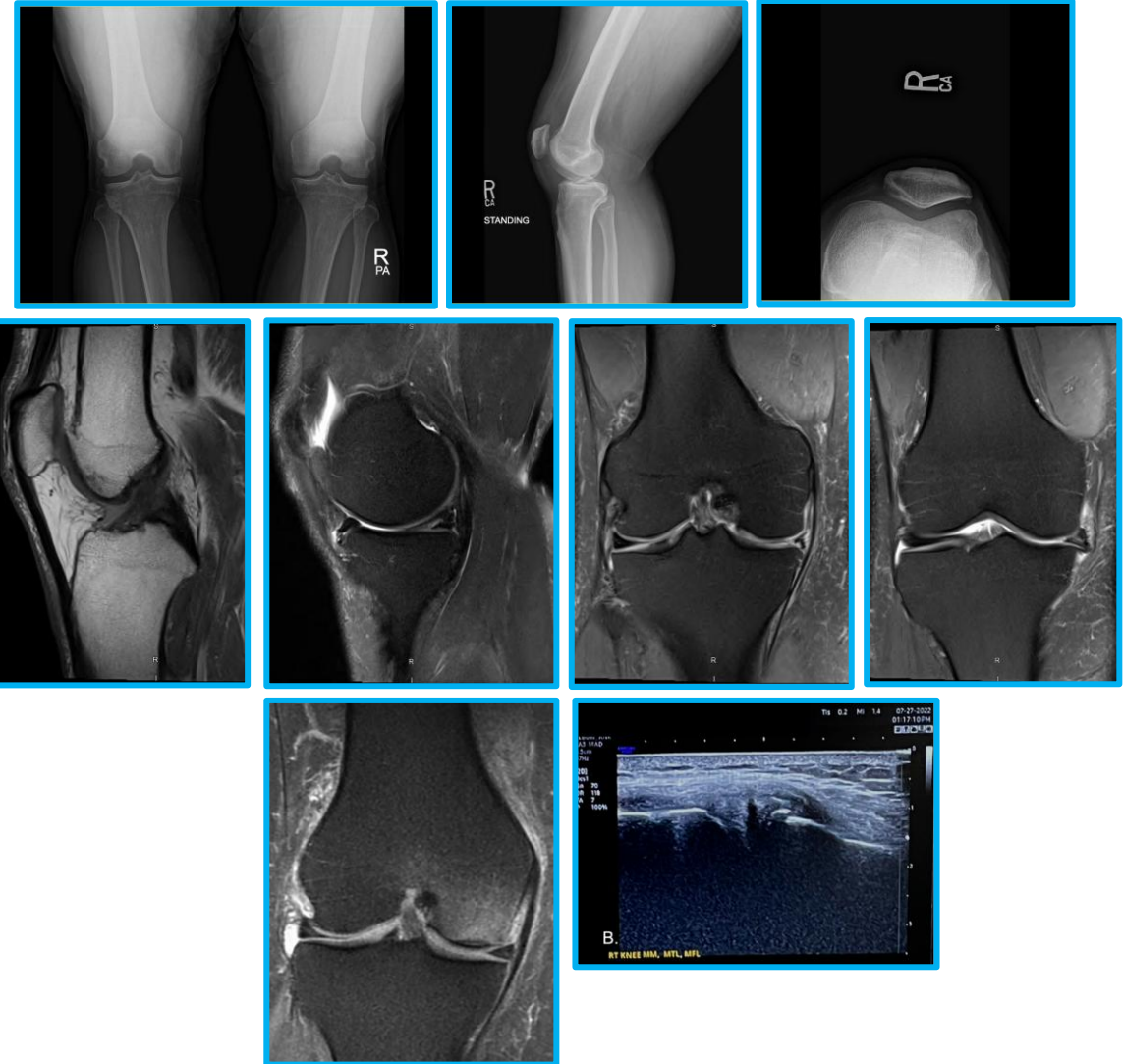
HISTORY

- 63-year-old male
- Former professional football player
- Initial knee injury at 24 yo
- Chronic right knee pain
- Medial joint line pain
- Difficulty stairs, sitting, stopping short / changing direction, squatting
- Intermittent knee swelling
- **Wants to remain active but can't**



IMAGING

- A complex posterior horn medial meniscus
- Medial collateral ligament (MCL), stripping of tibial insertion, diffusely thickened fibers
- Mild KL 2-3 osteoarthritis, medial compartment with joint space narrowing
- Moderate diffuse chondromalacia anterior medial femoral condyle
- Muroid degenerative, thickened, ACL
- Bone marrow edema, medial femoral condyle, medial tibial plateau



BEEKMAN BC DXH500 HEMATOLOGY ANALYSIS REPORT:

Platelet Rich Plasma NR-PRP; NP-PRP

Determine dosage & volume/treatment site

Mono	0.65 x10 ³ /μL
Neu	6.80 x10 ³ /μL

Lowest volume with highest cellular count!

PRP Analysis

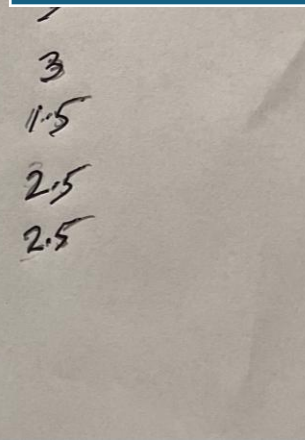
Total LR-PRP Volume (mls)	9.0 ml
WBC	80.97 x10 ³ /μL
Lymph	38.14 x10 ³ /μL
Mono	15.89 x10 ³ /μL
Neu	26.17 x10 ³ /μL
RBC	2.23 x10 ⁶ /μL
HCT	21.9 %
MPV	7.14 fL
Total # Plts WB (x10 ³ /μL)	196.6 x10 ³ /μL
Total # Plts PRP (x10 ³ /μL)	3886.5 x10 ³ /μL
Total Platelets Captured (%)	98.84 %
Platelet Concentration / baseline	19.77 X
Total Deliverable / Available PLTs (x10 ⁶)	34,978 x10 ⁶
Total # PLTs/ml (x10 ³ / ml)	3887 x10 ³ / ml

Bone Marrow Concentrate

Bone Marrow Aspirate Volume	40 mls
Anticoagulant:	Heparin (1ml/10ml)
Total BMC Volume (mls)	7.0 mls
Total Nuclear Cells (TLC)	142.67 x10 ³ /μL TNCs
Total BMC Plts (TBMC PLTS)	595.7 x10 ³ /μL

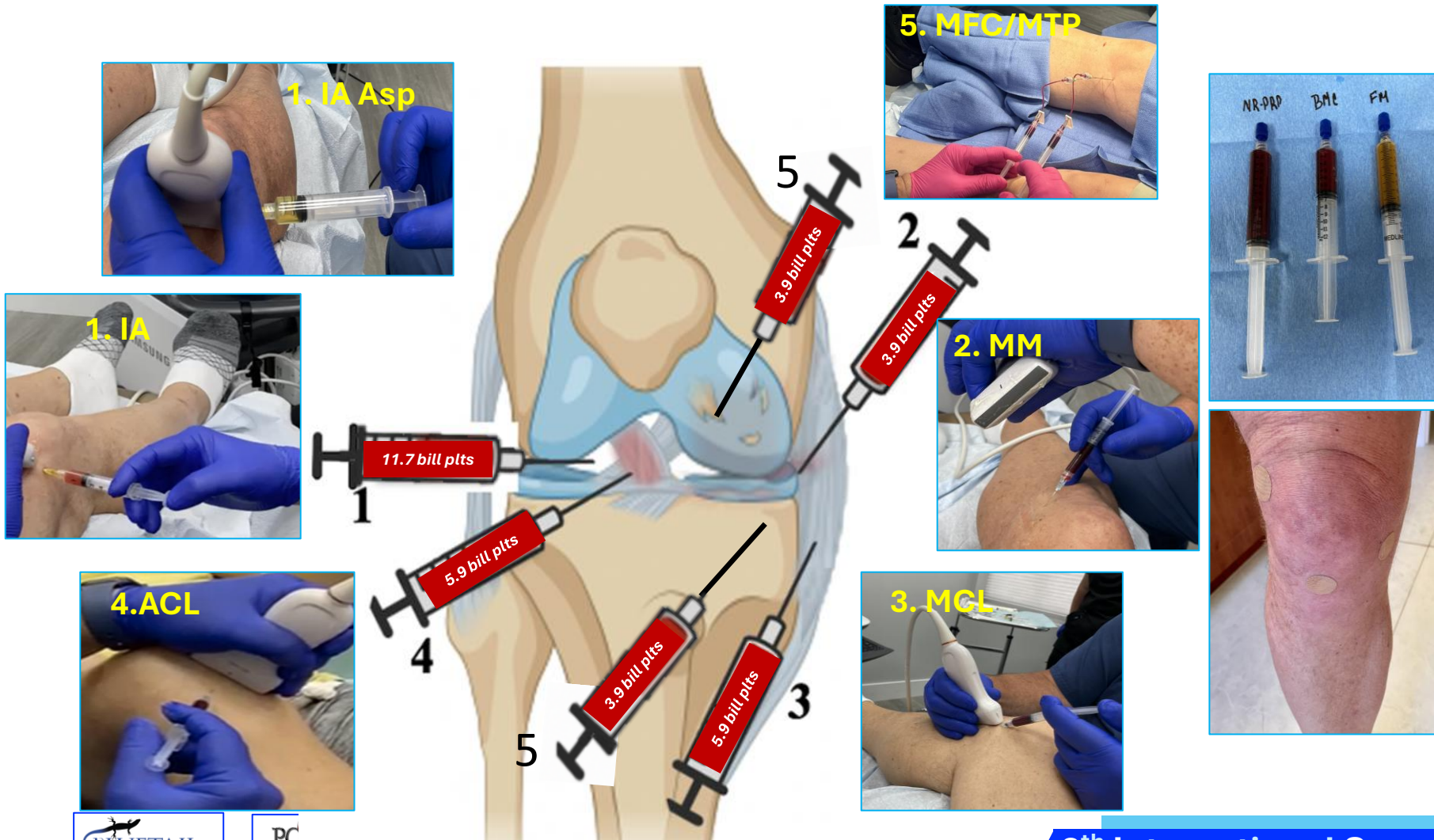
Protein Fibrin Matrix

1 st Autologous PPP Volume	60 ml
Protein Fibrin Matrix Volume	6.0 mls



u put in!!

Treatment Complex Knee - IA joint, ACL, MCL, MM, MCL MFC, MTP SC bone



LR-PRP (9.0 mls)

TDP 35 billion/9.0ml
3.9 billion Plts/ml

BMC (7 mls)

TNC 143 million/ml
BMC-PLTs 596 million/ml

PFM (6 mls)

A2M, IGH-1, HGF

IA Knee (LR-PRP, BMC, PFM, HA)

ACL (LR-PRP, BMC, PFM)

MCL (LR-PRP, BMC, PFM)

MM (LR-PRP, BMC)

MFC (LR-PRP, BMC)

MTP (LR-PRP, BMC)

RESULTS - multiple knee pathologies

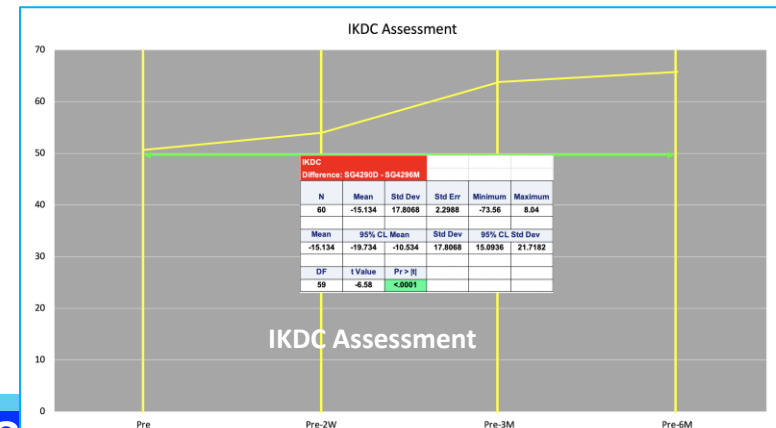
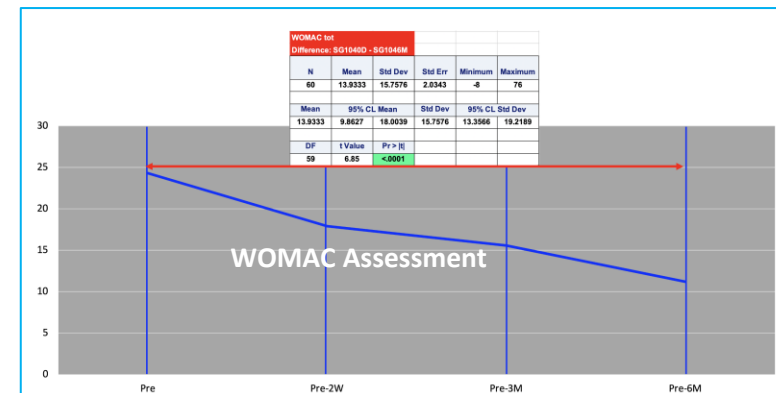
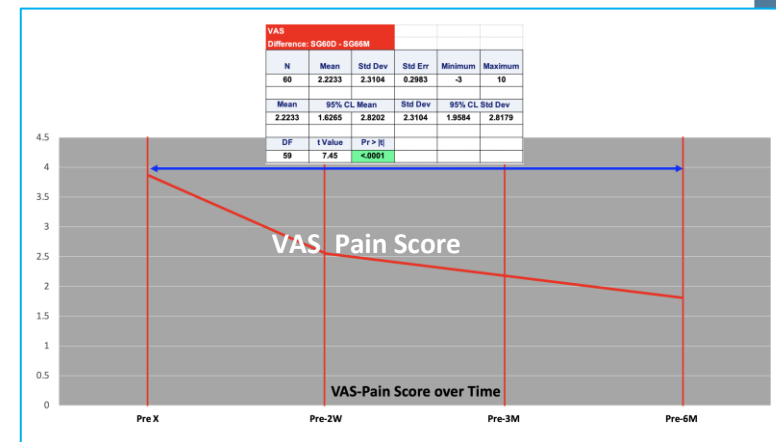
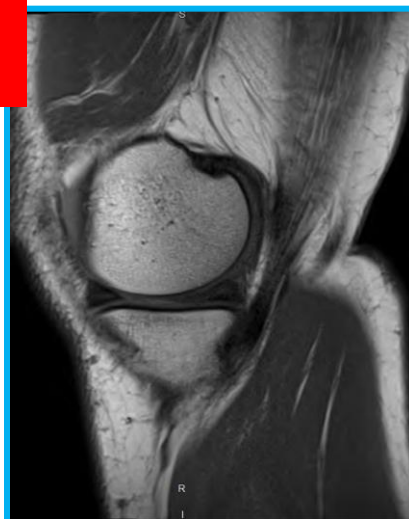
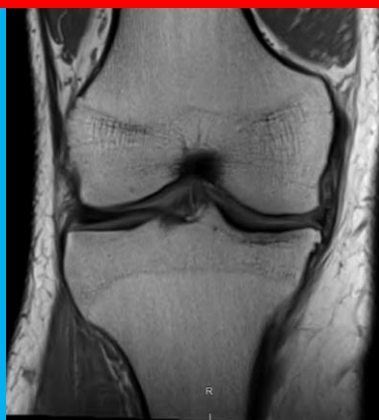


9 months

✓ Pain free

✓ Soft tissue / meniscal tear healed

✓ Back to full activity (with unloader brace)



Pearls

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- Treat the entire joint
- PRP and MSC DOSE matter!
- Analgesia is absolutely necessary!
- LR-PRP in joints and Soft tissue (> Plt Dosage)
- Activation (Ca^+Cl) to prevent runoff
- Protect-unload joint/compartments
- Post-treatment rehab & protected return to activity important (load management)
- You can't cheat mother nature - respect the biology!



A vibrant sunset scene over a vast ocean. The sun is a bright yellow orb on the left, partially obscured by orange and yellow clouds. The sky transitions from a deep orange near the horizon to a darker, greyish-blue at the top. The ocean is a deep blue-grey with white-capped waves breaking in the foreground. The overall mood is peaceful and serene.

Thank you!

www.LugaPodestaMD.com

lugamd@aol.com