

### Potential Orthobiologics Use in Sports Medicine

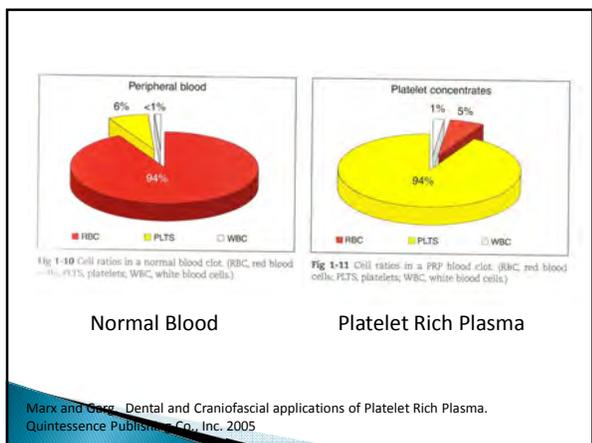
- AC joint separation
- Achilles tendonitis
- Achilles tendon rupture
- ACL repair – BTJ healing
- Ankle sprain (high)
- Bone-Tendon junction (BTJ) healing diseases
- Concussion
- Chronic traumatic encephalopathy (CTE)
- Chronic bursitis
- Dislocations (shoulder)
- Epicondylitis
- Fractures
- Hamstring injury
- Low back strain
- Meniscus injury (knee)
- MCL injuries
- Muscle injuries
- Nerve injuries
- Osteoarthritis
- Plantar fasciitis
- Rotator cuff tears
- Side stitch
- Shin splints
- Spinal cord injury
- Stress Fractures
- Tendinitis
- Tennis elbow
- Turf toe

## PLATELET RICH PLASMA (PRP) INJECTION

The “modern” version of dextrose prolotherapy: Injections of autologous centrifuged blood with platelets concentrated is used as the injectate.

## What is PRP?

- ▶ Type of **injection therapy** used for various chronic sports injuries to promote healing.
- ▶ PRP = abbreviation for Platelet-Rich Plasma.
- ▶ Over 6,000 PRP journal articles have been published between 2013–15 (between 2012–13 was about 400).



## History of PRP

- ▶ First human application was described in mandibular reconstruction in oromaxillary surgery in 1998 (Robert Marx, Prof. of Surgery and Chief of Oromaxillary Surgery Division at Univ. of Miami).
- ▶ Since then, PRP has experienced a surge in clinical uses and research.
- ▶ Endorsement from athletes.
  - Tiger Woods
  - Alex Rodriguez (NY Yankees)
  - Masahiro Tanaka (NY Yankees)
  - Kobe Bryant (LA Lakers)
  - Troy Polamalu (Pitts Steelers)
  - Hines Ward (Pitts Steelers, 2009)

### How Is PRP Prepared?

Various systems but basics are:

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From web, Chattanooga Orthopedic Center PLC

### "STEM CELL INJECTION"

- ▶ Think of:
- ▶ PRP as "Fertilizer"
- ▶ Stem Cells as "Seeds"

### Cell Sources

**ADIPOSE TISSUE**  
(Zuk et al. 2001)  
and

**BONE MARROW**  
(Caplan et al. 1999)

### Mesenchymal Stem Cells

- ▶ First identified in **bone marrow** by Caplan in 1991 and, subsequently, in **adipose tissues** by Zuk et al at UCLA in 2001, *Mesenchymal Adult Stem Cells* can differentiate into:

- Ligament
- Tendon
- Cartilage
- Muscle
- Bone
- Adipose tissue

Courtesy of Donna Alderman, D.O.

### How Does MSCs Help Arthritis?

- ▶ Not entirely understood.
- ▶ 1) Regeneration of cartilage has been demonstrated in vitro and in animal models.

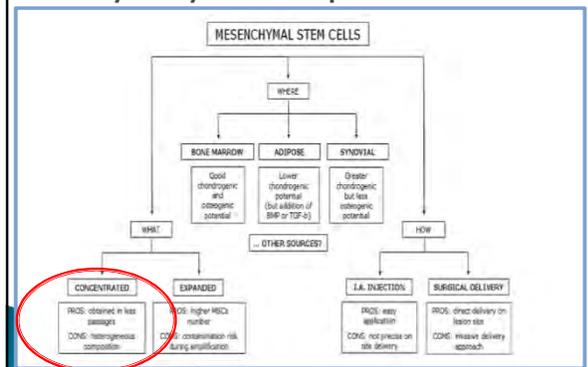
(Anusua et al. Knee Surg, 2006)

### How Does MSCs Help Arthritis?

- ▶ 2) Paracrine mechanism (cell-to-cell talk) via cytokines and growth factors.

(Bunnell et al. Cell Res and Therapy 2010)

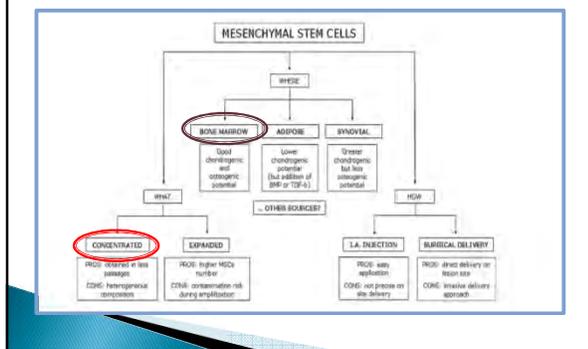
### Many Ways to Prepare MSCs...



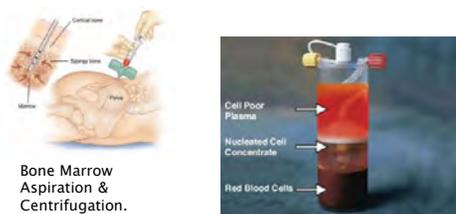
### Issue with “Expanded” MSCs

- ▶ In US, however, **FDA does not allow culturing of the stem cells** in clinics. (FDA does not allow these cells to be “more than minimally manipulated” or be outside of the patient for over 24 hrs.)
- ▶ Clinicians have used centrifuge to concentrate MSCs from **bone marrow** (Bone Marrow Aspirate Concentrate) or **adipose tissues** (Adipose Derived Stromal Vascular Fraction)

### So what we do instead:



### Obtaining BMAC:

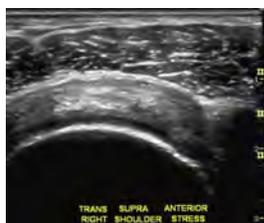


Bone Marrow Aspiration & Centrifugation.

### Why Musculoskeletal Ultrasound?

Ideal for diagnosis & monitoring musculoskeletal injuries – especially sprains & strains

- Dynamic Real time patient interaction
- Soft tissue
- Better spatial resolution
- No radiation
- No contraindications
- Low cost



### Applications of MSK U/S?

- ▶ Therapeutic Interventions
  - aspiration cyst/ bursal / hematoma / soft calcification
  - Difficult joint injections
    - Small joints, hip injections
  - Tendon sheath injections
    - Biceps, paratenon of achilles, deQuervain's
  - Regenerative tendon injections
    - Prolotherapy
    - PRP injections
    - Stem cell injections
  - Nerve entrapments associated with soft tissue injury
    - hydrodissection
  - Releases/ Tenotomy with Tenex FAST procedure
    - Lateral elbow
    - Plantar fascia
    - Trigger digit



### Therapeutics/Ultrasound guided injections

- ▶ Small or large peripheral joints
- ▶ Insures precision
- ▶ No “fishing around”
- ▶ Ability to document procedures



Does Ultrasound Guidance improve safety and efficacy

Sibbitt et al, J Rheumatol '09  
 “Does sonographic needle guidance affect the clinical outcome of intraarticular injections?”

148 painful joints IA triamcinolone acetonide injection by palpation-guided injection or US guided injection

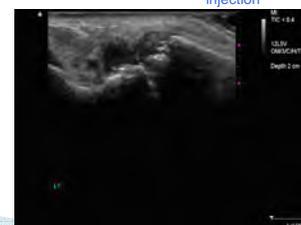
CMC Joint injection

**Results**  
**43%** reduced procedural pain

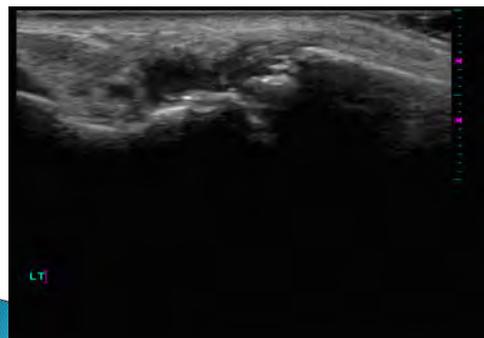
**58.5%** reduction in absolute pain scores (p < 0.001)

**75%** reduction in significant pain (VAS p < 0.001)

US also increased detection of effusion by **200%**, volume of aspirated fluid by **33.7%**

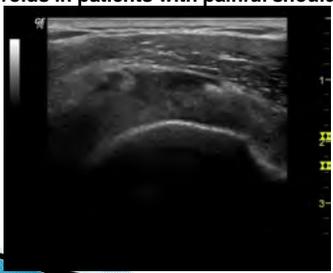


### CMC Osteoarthritis thumb



Naredo et al J Rheumatol '04

A randomized comparative study of short term response to blind injection versus sonographic-guided injection of local corticosteroids in patients with painful shoulder.



25

Naredo et al J Rheumatol '04

41 patients with painful shoulder

Group 1 blind subacromial injection of 20 mg triamcinolone (n = 20)

Group 2 US guided injection of 20 mg triamcinolone (n = 21)



assessed within 5 days before injection & 6 weeks after injection

Six weeks after injection, the VAS and the SFA score showed a significantly greater improvement in Group 2 compared with Group 1 (mean VAS score change 34.9 for Group 2 vs 7.1 for Group 1,  $p < 0.001$ )

26

Subacromial Subdeltoid Bursa Injection



27

Glenohumeral arthritis



28

Glenohumeral Joint Injection

- Joint space is often collapsed and indistinguishable
- Arthroscopy: The Journal of Arthroscopic & Related Surgery, El Attrache '05 (41 live awake patients injected anteriorly)

Only 26.8% (11 of 41) of injections placed anteriorly were actually intra-articular

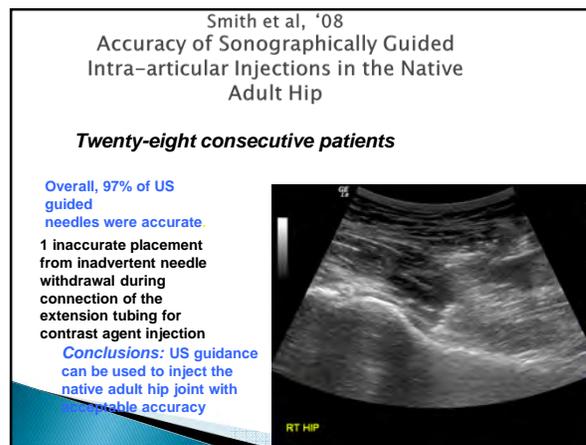
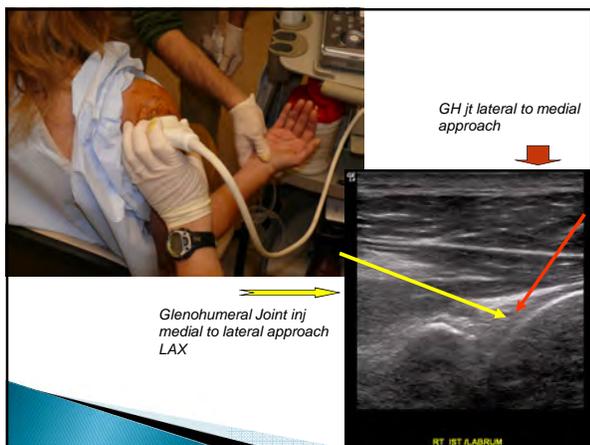
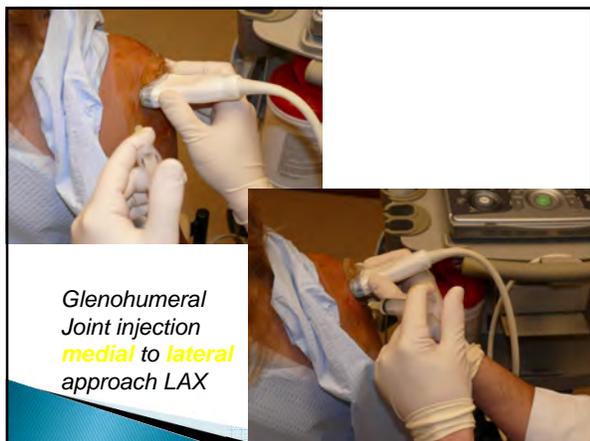


29

ORTHOPEDICS El Attrache '06

- 40 cadaver shoulders injected, 20 anteriorly and 20 posteriorly, to assess the accuracy of injections placed in the glenohumeral joint
- 1 mL gadolinium injected into the joint to determine accuracy of position
- The anterior approach had an 80% accuracy rate and .75 positive predictive value
- The posterior approach had a 50% accuracy rate and a .67 positive predictive value.
- Anterior injections produced higher rate of accuracy than posterior injections.

30



**Steroid injection for hip osteoarthritis: efficacy under ultrasound guidance**

Micu et al, Rheumatology 2010

- ▶ 40 patients with hip OA and synovitis detected by US
- ▶ 40 IA steroid injection under US guidance compared to age matched controls
- ▶ Walking pain VAS reduced vs baseline  $P < 0.001$  at 1 & 3 months
- ▶ Synovial hypertrophy reduced in 75% at 1 & 3 months vs baseline
- ▶ Conclusion: efficacious, safe therapeutic approach for pain control and reducing synovial hypertrophy avoiding use of X-ray guidance

**Finnoff et al PM&R '10**

Accuracy of ultrasound-guided versus unguided pes anserinus bursa injections

- ▶ 12 US-guided and 12 unguided pes anserinus bursa injections
- ▶ 92% (11 of 12 specimens) in the US-guided
- ▶ 17% (2 of 12 specimens) in the unguided
- ▶ US-guided injection technique was significantly more accurate than the unguided technique (Williams-corrected  $\chi^2 = 12.528, P < .01$ ).

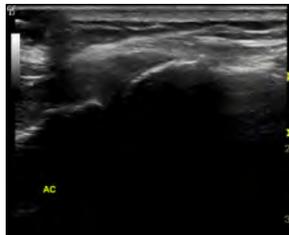
## Peck et al, PM&R '10

### Accuracy of ultrasound-guided versus palpation-guided acromioclavicular joint injections: a cadaveric study

All 10 US guided (100%) injected into ACJ

10 US guided and 10 palpation-guided ACJ injections

4 of 10 (40%) palpation-guided injections within the ACJ (P = .0054)



37

## Conclusion

- ▶ Regenerative Medicine for MSK application is still in its infancy as a therapeutic agent with limited available evidences.
- ▶ But it appears promising and safe, offering an exciting alternative to recurrent, chronic injuries unresponsive to conventional treatments.

## Conclusions

- ▶ U/S is a useful tool in guiding minimally invasive orthobiologic procedures
- ▶ New and exciting modality that will assist in better diagnosing and treating sports medicine conditions in the training room, sideline, or in your clinic
- ▶ The field is still emerging and expertise takes time and practice
- ▶ Formal certification now available for Physicians and ultrasonographers –Not just radiologists

39

## Thank You!



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41

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