



Musculoskeletal Procedures & Injectables

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Nothing to disclose

UC San Diego
HEALTH SYSTEM
Sports Medicine



Introduction

Best Practices

Anesthetics

Corticosteroids

Ultrasound guidance

Viscosupplementation/Hyaluronic acid

Biologics/PRP

Tenotomy

UC San Diego
HEALTH SYSTEM
Sports Medicine

Supplies

- Consent-signed/in note
- Sterile techniques
 - Isopropyl wipes
 - Betadine- stain
 - Chlorhexidine swabs
- Local Anesthetics
 - Lidocaine 1% vs 2% > Bupivacaine, Ropivacaine
- Corticosteroids we stock
 - Betamethasone
 - Triamcinolone
 - Methylprednisolone
 - Dexamethasone
- Needles
 - Spinal 22g; 25g 2"; **25g 1 1/2**; TB syringe

Common Corticosteroid Injectables

TABLE
Common Injectable Corticosteroids

Solubility/ Generic Name	Trade Name	Equivalent Dose* (mg)	Recommended Dosage	
			Large Joints† (mg)	Small Joints (mg)
Most Soluble				
Betamethasone sodium phosphate	Celestone	0.6	12	6
Soluble				
Dexamethasone sodium phosphate	Decadron	0.75	2-4	0.8-1
Prednisolone sodium phosphate	Hydeltrasol	5	10-20	4-5
Slightly Soluble				
Triamcinolone diacetate	Aristospan Forte	4	10-40	5-10
Methylprednisolone acetate	Depo-Medrol	4	20-80	5-20
Prednisolone tebutate	Hydeltra-TBA	5	10-40	4-10
Relatively Insoluble				
Hydrocortisone acetate	Hydrocortone	20	25	10-25
Dexamethasone acetate	Decadron-LA	0.75	5-15	4-5
Prednisolone acetate	Predalone	5	10-25	5-10
Triamcinolone acetonide	Kenalog	4	5-40	2.5-5
Triamcinolone hexacetonide	Aristospan	4	10-20	2-6
Combination				
Betamethasone sodium phosphate- betamethasone acetate	Celestone Soluspan	0.6	6-12	1.5-3

*For example, 0.6 Celestone=0.75 Decadron=5 Predalone.

†Hip, knee, shoulder, or ankle.

Corticosteroid Benefits

Table 2 – Studies of potential benefits of corticosteroid injections versus placebo in various shoulder conditions

Shoulder condition/studies	Duration of beneficial effect	Type	Dose
Subacromial impingement: Blair 1996 ⁶	Up to 33 weeks	Kenalog	40 mg
Acromioclavicular arthritis: Jacob 1997 ⁸	20 days	Celestone/Soluspan	6 mg
Glenohumeral arthritis	—	—	—
Biceps tendinitis	—	—	—
Adhesive capsulitis:			
Ryans 2005 ⁵²	6 weeks	Kenalog	20 mg
Buchbinder 2004 ⁷	12 weeks	Depo-Medrol	40 mg
Carette 2003 ⁵³	Up to 3 months	Kenalog	40 mg
Laroche 1998 ⁵⁴	24/26 (92%) at 2.5 years	Haldrone*	40 mg
Myofascial pain (eg, trigger points)	—	—	—
Scapulothoracic bursitis	—	—	—
Rotator cuff tendinitis:			
Adebajo 1990 ⁵	4 weeks	Kenalog	80 mg
Petri 1987 ⁵⁵	4 weeks	Kenalog	40 mg

*Paramethasone acetate.

Corticosteroid Benefits

- Adhesive capsulitis: short/long term; reduced surgery
- CTS: short term; reduced surgery
- DeQuervain's tenosynovitis: short/long term
- "GT Bursitis": short term
- Lateral epicondylitis: short term; high risk symptom rebound, PT/eccentric better long term outcomes
- Trigger finger: cure rates 54-86%
- Hip OA: 5 RCTs improvements lasting weeks, NNT for benefits at 8 weeks = 2.4
- Knee OA: good short term, also some long term, NNT benefits at 24 weeks = 4.4 (New Zealand study)

Corticosteroid Side effects

Side effects - Local

- Post-injection flare: Marked pain at the site of injection/joint – needle puncture/chemical synovitis due to crystals – treated with analgesics, ice packs
- Facial flushing – common in women – onset within a few hrs of injection
- Skin/fat atrophy – common with less soluble agents
- Joint sepsis - rare

CSI in Diabetes Type 1 & 2

- rise glucose Day1 & 2 with return to baseline D3
- no change HbA1c

Infection?

- AMSSM largest study to date
- <<1/30,000

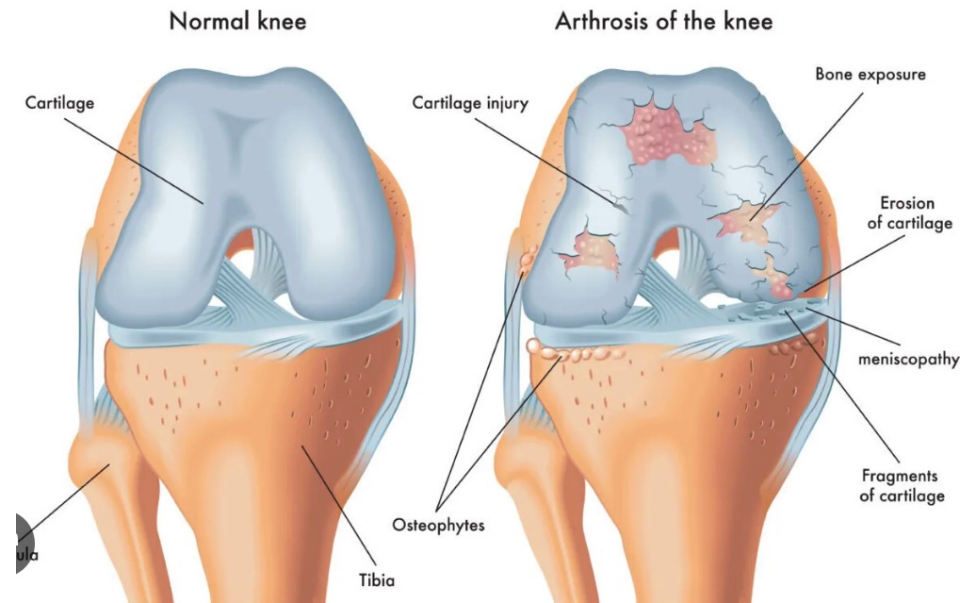
Corticosteroid Injections (CSI) and cartilage loss?

- >MRI cartilage volume/thickness (Canadian study)
 - more transient loss MMx/Med Cmpt but no other structural change throughout knee (no change overall volume)
 - WOMAC/pain scores no change at 1 year

Conclusion: safe, no long term structural changes, uncertain significance of transient loss thickness MMx

Corticosteroids and Joint Safety

- Intra-articular Triamcinolone is NOT harmful to Human OA Knee Cartilage
- Chemical analysis, cell analysis and cartilage structure unaffected and similar to placebo
- Supports usage for Knee OA and synovitis without significant concerns for harm
- NIH study, No funding from Pharma



Porter a, Nguyen J et al. Triamcinolone Acetonide is Not Harmful to Healthy And Osteoarthritic Human Knee Cartilage. *Am Jo of Sports Med*; DOI 10.1177; pg. 1-10, 2026

Landmark/Palpation vs Ultrasound Guided Injx

	Standard Technique	UltraSound Guidance
Shoulder:		
AC Joint	45%	100%
Glenohumeral Joint	79%	95%
Subacromial Joint	63%	100%
Knee:		
Superiolateral Approach	79%	99%

Hyaluronic Acid/Viscosupplementation

- Viscosupplementation: High Viscosity Hyaluronan
 - Mechanism of action
 - Shock absorption
 - Lubrication
 - Anti-inflammatory
 - Pain reduction

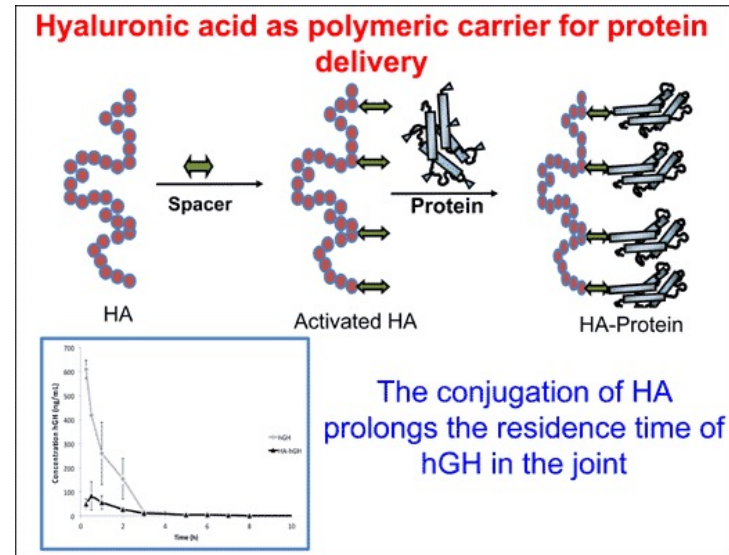


Table 1

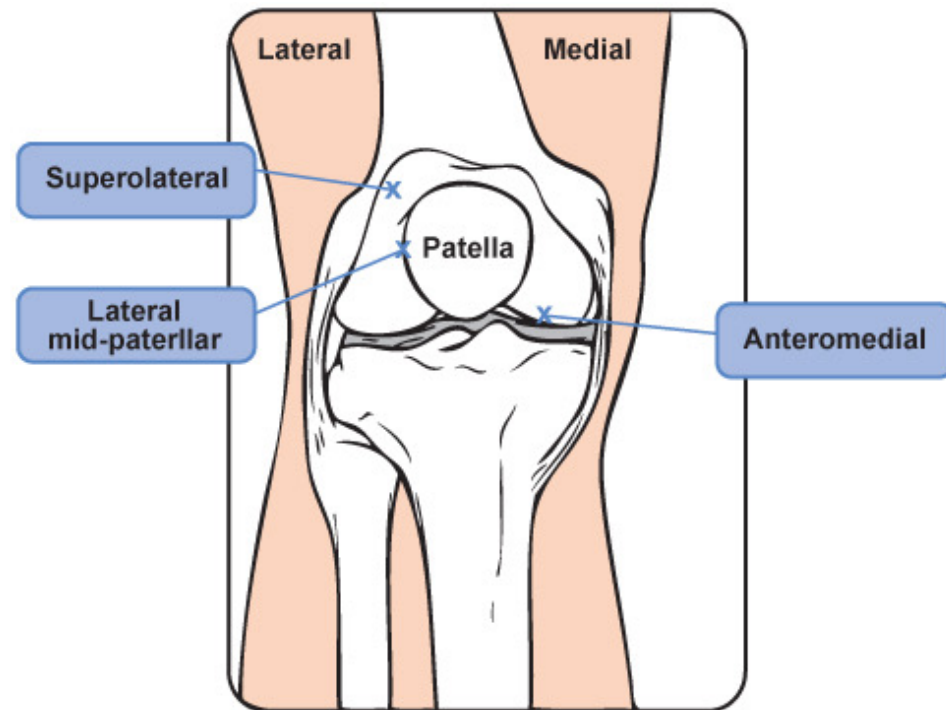
Current FDA-Approved Hyaluronan Preparations^{7,82}

NAME	ACTIVE INGREDIENT	HOW SUPPLIED
Synvisc	Synthetic hylan G-F 20; HMW cross-linked hyaluronan derived from chicken combs	Synvisc: 2.25 mL prefilled syringe containing one 2 mL (16 mg) dose of hylan G-F 20
Synvisc-One		Synvisc-One: 10-mL prefilled syringe containing 3 doses (total 48 mg hylan polymers)
Gel-One	Hydrogel of cross-linked sodium hyalurate derived from chicken combs	3-mL prefilled syringe (30 mg cross-linked hyaluronate)
Hyalgan	HMW natural sodium hyaluronate from chicken combs	Solution in 2-mL vials or 2-mL prefilled syringes (each containing 20 mg sodium hyaluronate)
Supartz	HMW natural sodium hyaluronate from chicken combs	2.5-mL prefilled syringe (25 mg sodium hyaluronate)
Orthovisc	HMW natural hyaluronan derived from bacterial cells	2-mL prefilled syringe (30 mg hyaluronan)
Euflexxa	HMW natural sodium hyaluronate derived from bacterial cells	2-mL prefilled syringe (20 mg sodium hyaluronate)

HMW = high molecular weight.

Hyaluronic Acid/Viscosupplementation

- Osteoarthritis
- Knee most studied, Hip, PFS
 - Safe
 - Supartz: multiple courses safer?
 - Pseudosepsis
 - Histamine reaction
 - Efficacy similar to NSAIDS
 - Duration benefit 3-6 months per injx series
 - Delayed time to joint arthroplasty
 - Age
 - Young (post-trauma OA) > Older
 - Severity
 - Mild/Mod > Severe
 - Older/Severe OA pts.
 - Better with 2nd series



Hyaluronic Acid/Viscosupplementation

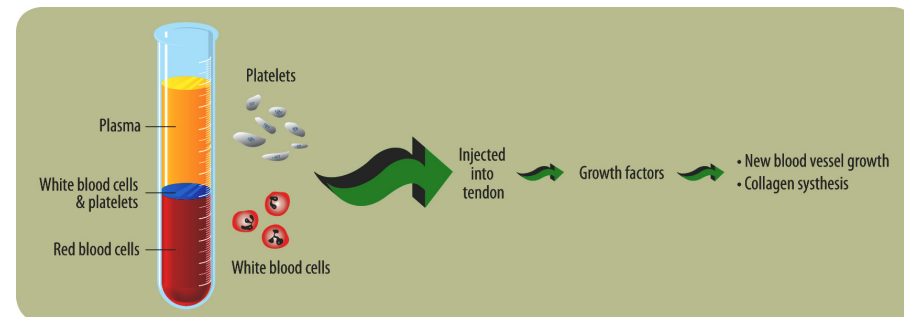
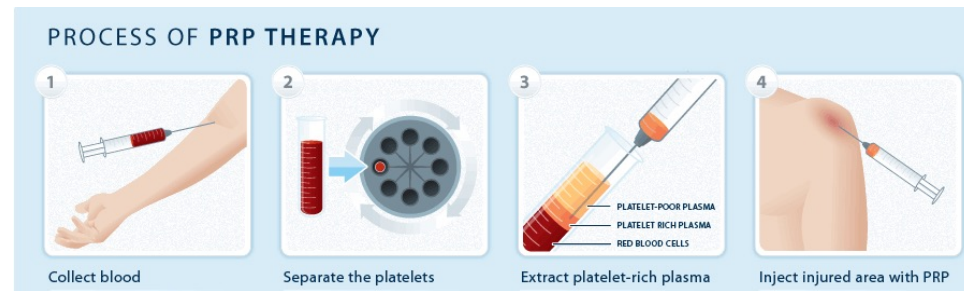
- 2015 systematic review of meta-analyses
 - Highest level of evidence as viable option for knee OA
 - 26 weeks benefit
 - Improved pain
 - Improved function
 - Safe
 - Better side effect profile than oral NSAIDs
 - CSI better short term 1-5 weeks
 - HA better than CSI 5-13 weeks
 - PRP best at 8 – 26+ weeks



KA Cambell et al. Is Local Viscosupplementation Injection Clinically Superior to Other Therapies in the Treatment of Osteoarthritis of the Knee: A Systematic Review of Overlapping Meta-analyses. *Arthroscopy* Vol 31, October 2015

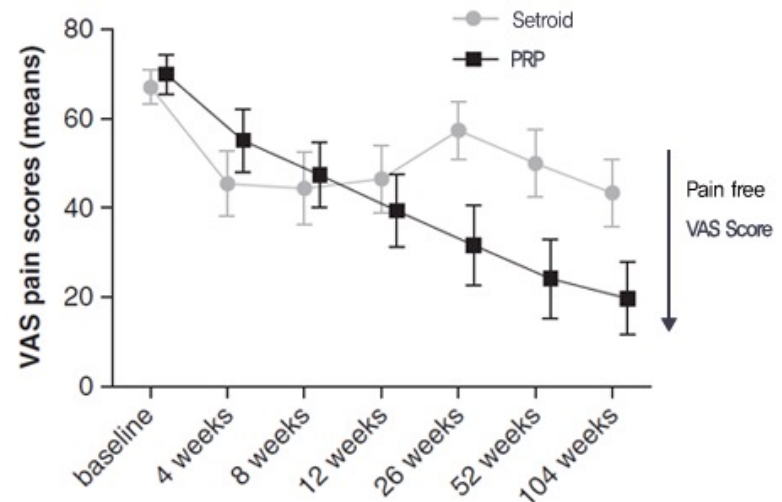
Platelet-Rich Plasma (PRP)

- Indications
 - Tendinopathy/Tears
 - Elbow Common Extensor
 - Patellar Tendon
 - Achilles Tendon
 - High Platelet & WBC concentration
 - Debatable success
 - PRP vs ABI vs Dry needling



Platelet-Rich Plasma (PRP)

- Indications
 - **Osteoarthritis**
 - knee
 - hip
 - single injx
 - high Platelet/low WBC
 - Minor increase pain few days
 - long term superiority over CSI/HA and some benefit 1-2 years
 - MRI: no deterioration at one year (4-6% cartilage loss per year no injx group)



Rotator Cuff Tendinopathy

- CSI-40mg TAC US guided Subacromial vs PRP (LP, 1.6Xconc.)
- Mean Age 27.7 years
 - 1 mo **CSI>PRP**
 - 3 mo CSI=PRP
 - 6 mo CSI=PRP
 - 12 mo CSI<**PRP**

Subacr Injx PRP better pain and fxnal outcomes...JoShoulderElbow2024; 1058-2746;

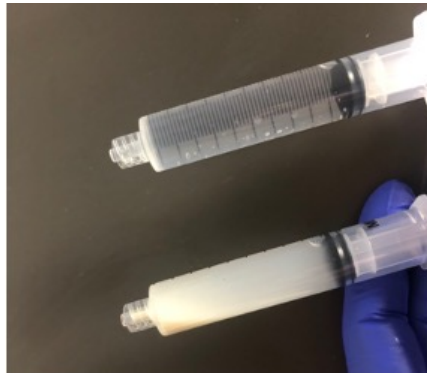
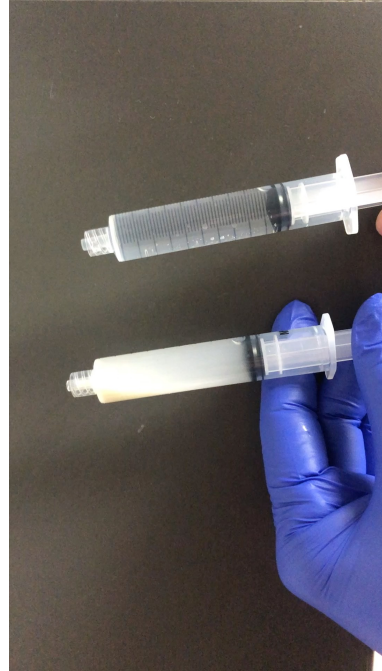
Lateral Epicondylitis Meta-analysis

- CSI vs PRP for pain and functional scores:
 - < 2mo **CSI**>PRP
 - 2-6mo CSI=PRP
 - >6mo CSI<**PRP**

PRP better results long-term fxnal and Pain, AmJoSM 2024
52(10):2646-2656

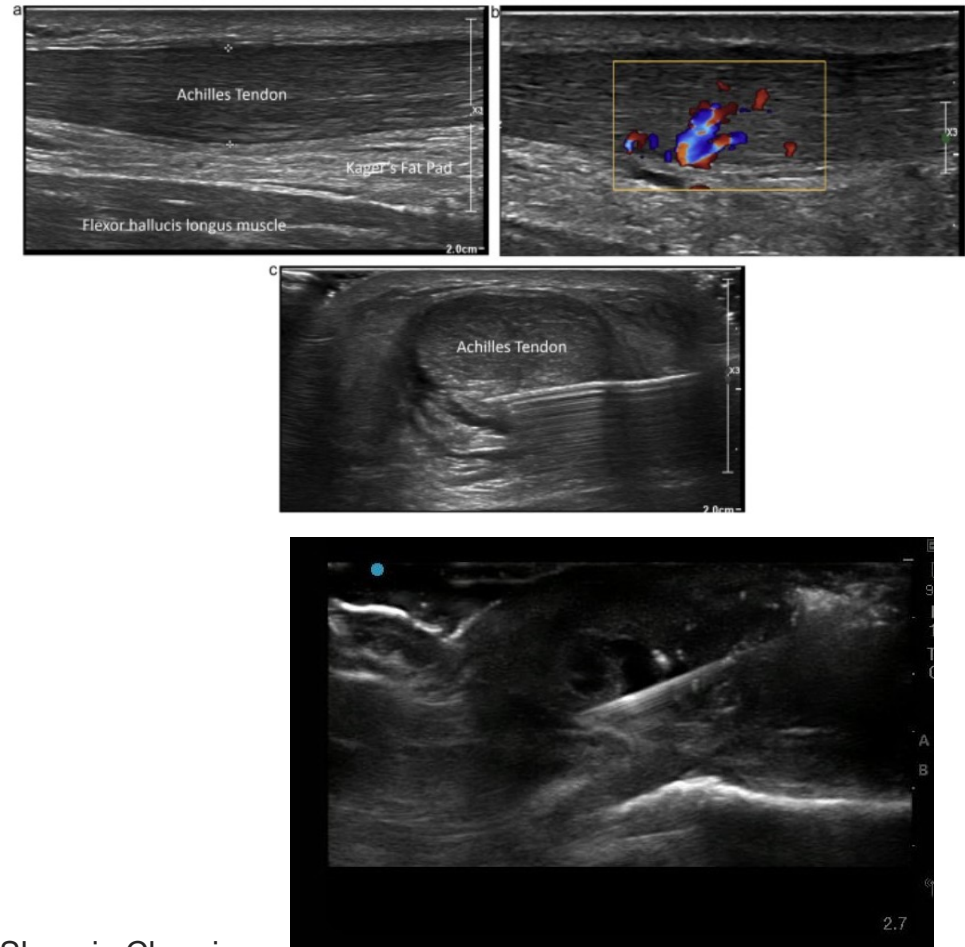
Calcific Tendinitis/HADD

- NSAIDS
- Colchicine
- PT
- CSI
- **Barbotage**



High Volume Saline injections, Nerve/Tendon Hydrodissection

- Chronic Midportion Achilles Tendinopathy
 - 40 mL saline
- Adhesive capsulitis
 - 10/20/30mL
- Nerve or Tendon Hydrodissection
 - RCT e/o benefit CTS, others
- Bursitis Sclerosis with Doxycycline injection



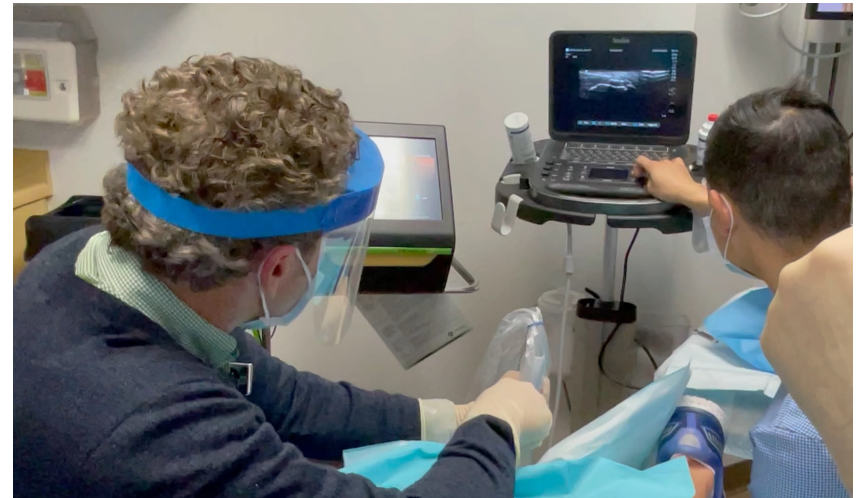
Boesen, AP et al. Effect of High-Volume Injection, PRP and Sham in Chronic Midportion Achilles Tendinopathy. Am Jo Sports Med 2017. 45;9:2034-2043

Humphrey, Joel et al. The short-term effects of high volume image guided injections in resistant non-insertional Achilles tendinopathy. Sports Med Australia 2009. 09.007;: 295-298

Needle Tenotomy/Tenex

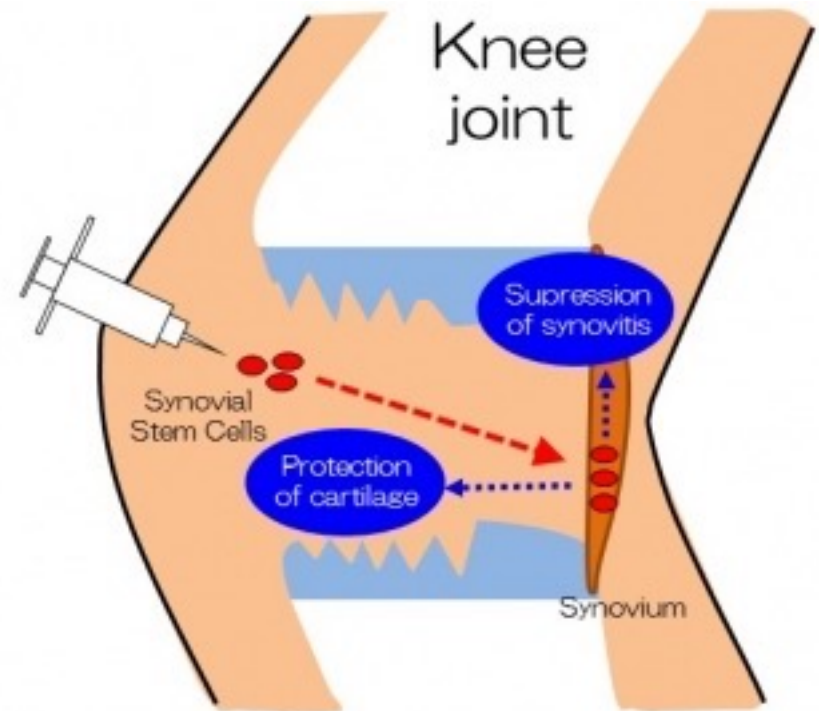
- Percutaneous Ultrasonic Tenotomy
 - Chronic Tendinopathy
 - Calcific Tendinopathy & extra-tendinous lesions
 - Bone spurs/Haglunds deformity
 - 40 procedures Insertional Achilles
 - chronic moderate to severe pain
 - 70% high satisfaction rate at median 1.7 year f/u
 - 1/40 complicate rate (minor superficial skin infection)
 - Small fraction cost of surgical debridement with far quicker recovery time

Tenex Ultrasound Device



Emerging Therapies

- Stem cells
 - Adipose
 - Bone Marrow
 - Amniotic
- Allogeneic Cell Therapy-phase 3
 - IA chondrocytes
- Sustained Release Corticosteroid: Zilretta- beaded TAC granules
 - >12 week efficacy
- Lorecivivint- Phase 3
 - DMARD injx 1x/year for mod/severe OA
 - improve pain/fxn/cartilage regen?
- Ozone
 - Prolozone



Important Considerations

- Sports US Guided Injections
 - HA/ABI/PRP/Needle Fenestration
 - Placement of solution with pinpoint accuracy
 - Gold standard for Hip and certain injectables
- Placebo
 - Psychobiological effects are profound
 - ‘The Sell’/Art of Medicine
 - Medical Hypnosis

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