



2021 Napa Primary Care Conference

Diagnosing and Managing Overuse Injuries in 2021

Too Much, Too Soon, Too Fast!



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DISCLOSURE

- I have no relevant financial disclosures in reference to this lecture.



My opinions and assertions contained herein are private views and are not to be construed as official or as reflecting the views of the U.S. Army Medical Department or the U.S. Army Service at large.

Objectives

- Review the terminology, epidemiology and etiology of overuse injuries.
- Introduce a paradigm for diagnosing and managing overuse injuries in 2021.
- Discuss New and Emerging Adjunctive Therapies





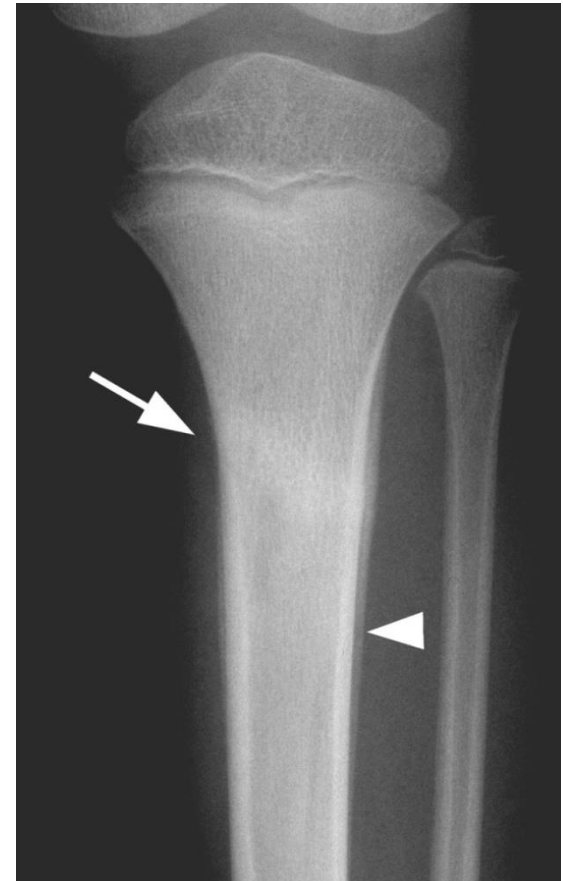
Terminology



Athletic Injury

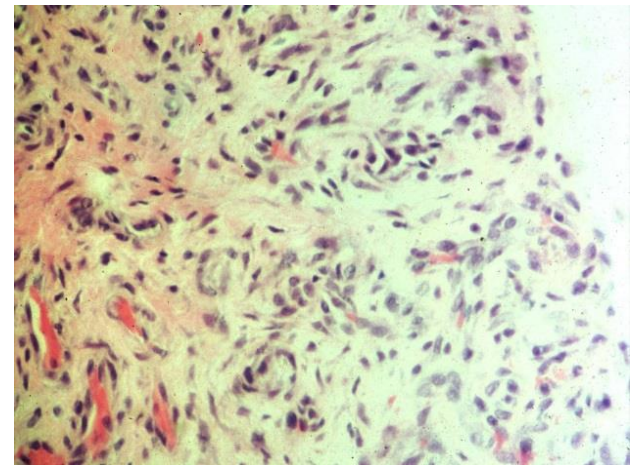
Macrotrauma: a specific episode of trauma with acute tissue disruption.

Microtrauma: anatomic structure exposed to repetitive, subthreshold, cumulative force where the body's reparative process is exceeded.



Microtraumatic Injury

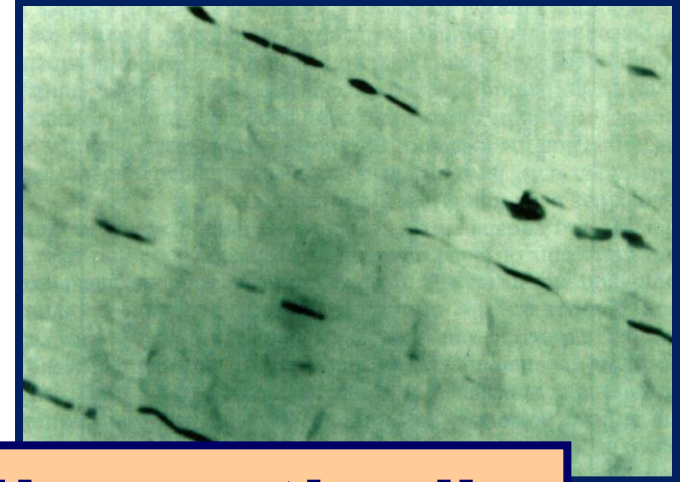
- **Sub-clinical injury precedes the moment of perceived injury** by the patient.
- The normal reparative process is aborted for a **degenerative cascade**.
- Soft tissue degeneration is noteworthy for a **paucity of inflammatory cell lines**.



Kaeding CC, Best TM: Tendinosis: pathophysiology and nonoperative treatment.
Sports Health 2009; 1(4): 284-292.

Tendon Nomenclature

- **Tendinitis:** symptomatic degeneration with vascular disruption and inflammatory repair.
- **Tendinopathy:** umbrella term for all tendon disorders.
- **Tendinosis:** intratendinous noninflammatory degeneration from repetitive microtrauma.



“Just call it a “tendinopathy.”

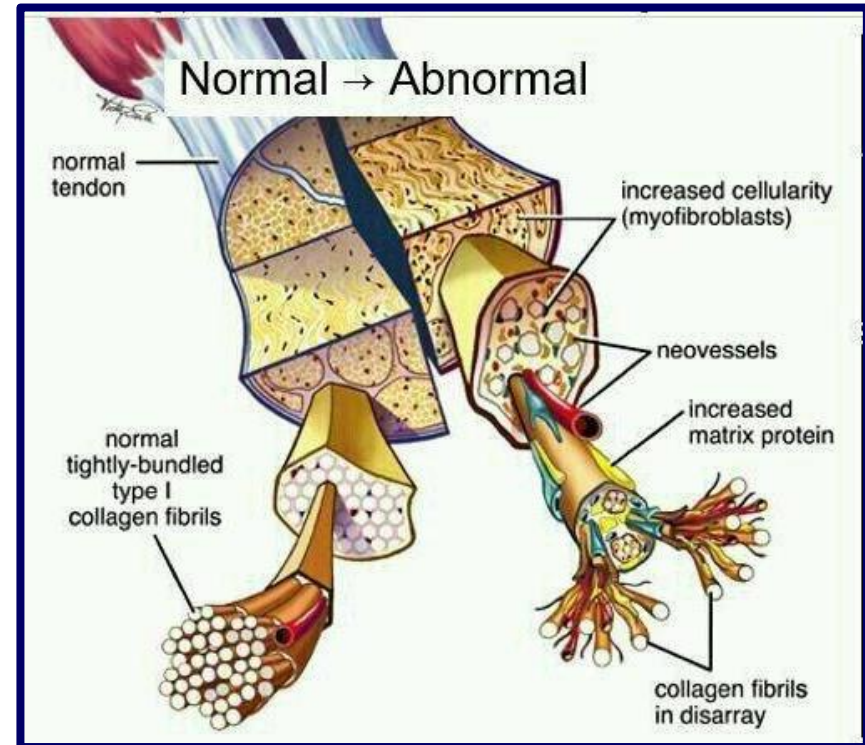


Kaeding CC, Best TM: Tendinosis: pathophysiology and nonoperative treatment. Sports Health 2009; 1(4): 284-292.

Updated Terminology

Box 1 ICON 2019: international scientific tendinopathy symposium consensus: clinical terminology

- ▶ Tendinopathy is the preferred term for persistent tendon pain and loss of function related to mechanical loading.
- ▶ Tendon tear (partial or complete) refers to a macroscopic* discontinuity of a load-bearing tendon.
- ▶ Imaging is not always necessary for a diagnosis of tendinopathy.
- ▶ Patellar tendinopathy is the preferred term for persistent patellar tendon pain and loss of function related to mechanical loading.
- ▶ Achilles tendinopathy is the preferred term for persistent Achilles tendon pain and loss of function related to mechanical loading.
- ▶ Peroneal (fibularis) tendinopathy is the preferred term for persistent peroneal (fibularis) tendon pain and loss of function related to mechanical loading.
- ▶ Persistent tendon pain and loss of function related to mechanical loading of the medial or lateral elbow tendons should be referred to as medial or lateral elbow tendinopathy.



Scott A, et al: ICON 2019: International Scientific Tendinopathy Symposium Consensus: Clinical Terminology. Br J Sports Med. 2019 Aug 9.



Epidemiology and Etiology of Overuse Injuries



Epidemiology of Overuse Injuries

- The aggregate total expenditure for musculoskeletal (MSK) diseases had **more than doubled** from 1996-1998 to 2009-2011.
 - 367.1 billion to 796.3 billion USD.
- **Overuse injuries** account for **7% of all office visits** in the United States.
- In USA, tendinopathy (16.5 million cases/year):
 - **30% of MSK injury visits to primary care physicians.**
 - 50% of sporting injuries.



Skjong CC et al: Tendinopathy Treatment: Where is the evidence? Clinics in Sports Medicine 2012: 31; 329-350.

Weinstein S, King T: The burden of musculoskeletal diseases in the United States. Yelin E, Semin Arthritis Rheum. 2016 Dec; 46(3):259-260

What Family Doc's See in the Office

- 1857 patient visits were analyzed.
- Majority of patient visits were for orthopedic injuries (95.4%); most



Subacromial Impingement and Patellofemoral Pain are the Most Common Referrals!

were: tendinitis (21.1%), anterior knee pain (10.6%), and ligament sprains (9.9%).



Butcher JD, Zukowski CW, Brannen SJ, Fieseler C, O'Connor FG, Farrish S, Lillegard WA: Patient profile, referral sources, and consultant utilization in a primary care sports medicine clinic. J Fam Pract. 1996 Dec;43(6):556-60.

Etiology of Tendinopathy

- “Despite recent advances, the pathophysiologic trigger and process resulting in clinically significant tendinosis are **poorly understood.**”

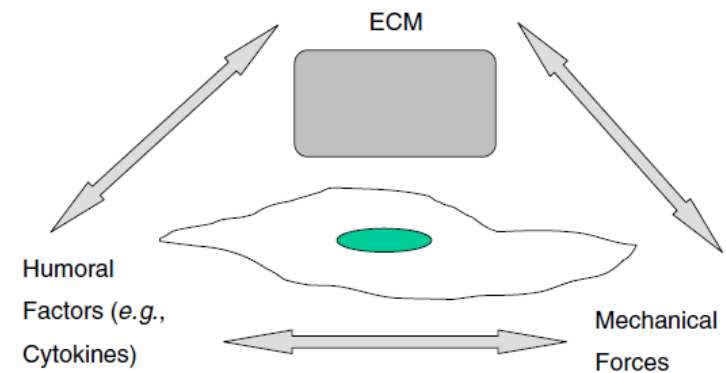
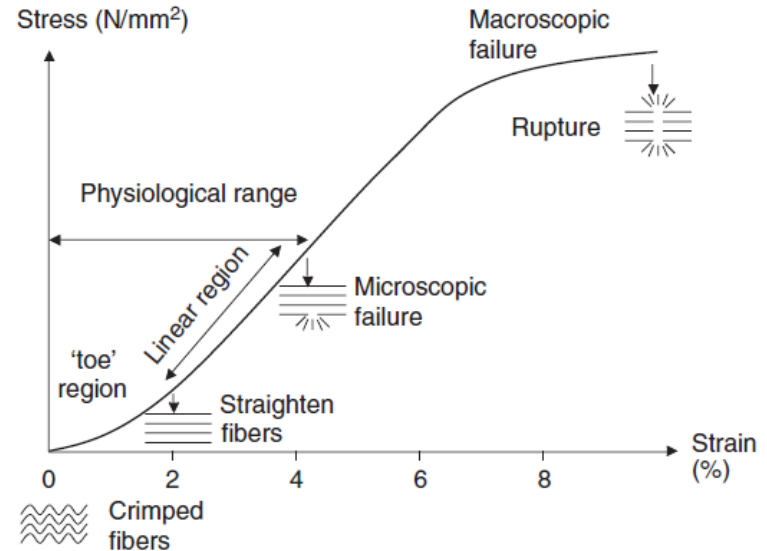
Kaeding CC, Best TM: Tendinosis: pathophysiology and nonoperative treatment. Sports Health 2009; 1(4): 284-292.

- The pathogenesis of tendon pathology is **not fully understood.**
- “The prevailing model...tendon pathology occurs from a primary **response of the tendon cells to overload**, which results in tendon cell activation and proliferation, increases in proteoglycans that in turn results in **collagen matrix disruption and increased vascularization.**”

Cardoso TB, Pizzari T, Kinsella R, Hope D, COOK JL. Current trends in tendinopathy management. Best Pract Res Clin Rheumatol. 2019 Feb;33(1):122-140.

Overuse Injury and the Role of “Mechanotransduction”

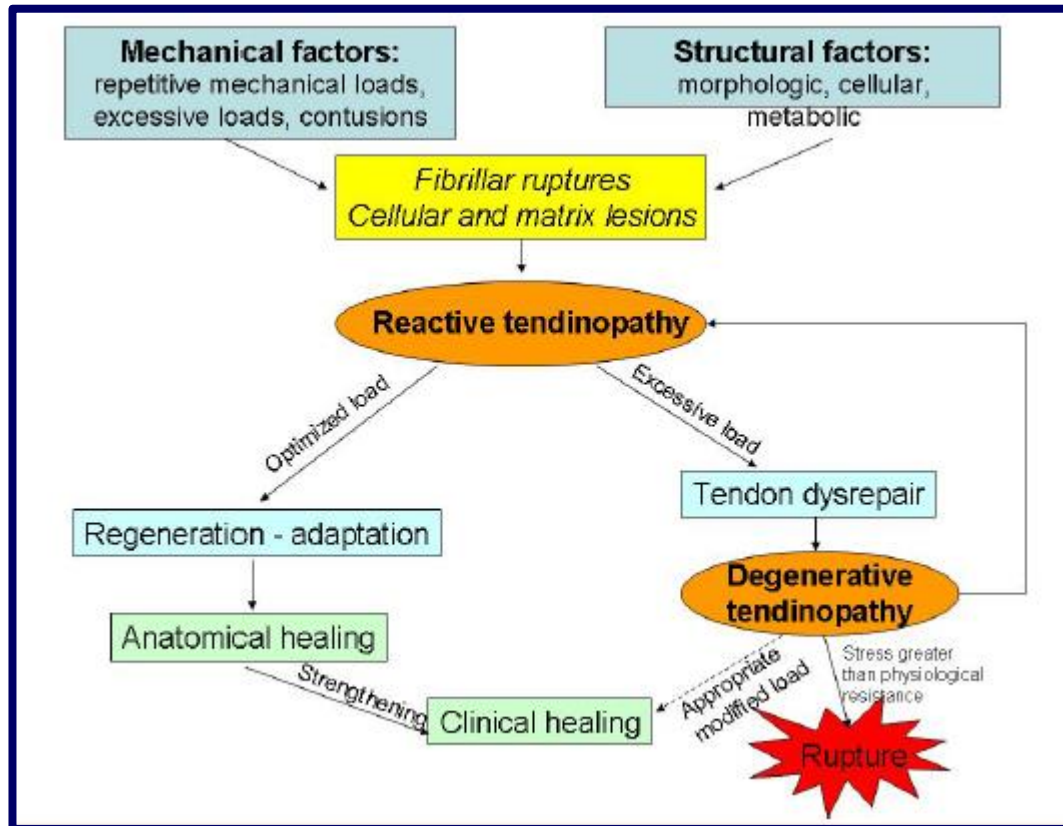
- **Tendons change structure in response to the loads** placed upon them.
- Mechanical loading **induces gene expression and protein synthesis.**
- Overuse injuries may be the result of an **uncoupling** of normal **mechanotransduction** between the tenocyte and the extracellular matrix (ECM).



Wang JH: Mechanobiology of tendon: A Review. Journal of Biomechanics 39 (2006) 1563–1582.

Dr. Jill Cook

The Tendon Continuum



Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. BJSM 2009;43:409-416

Etiology – Risk Factors

■ Intrinsic Abnormalities

- Malalignment
- Flexibility deficits
- Muscle imbalance
- Instability

■ Extrinsic Abnormalities

- Training errors
- Equipment
- Technique

**Most of the time...
too much, too soon, too fast!**



What Causes the Pain in Tendinopathy?

- **Currently unknown**
- **Microdialysis, Ultrasound, & Doppler**
- **Microdialysis 4 dz Achilles; 4 normal:**
 - **No difference in prostaglandin E2**
 - Significant increase in glutamate & substance P
 - **Vasculo-neural growth appears to be related to the origin of the pain in tendinopathy.**
 - Similar results in lateral epicondylitis/patellar tendon



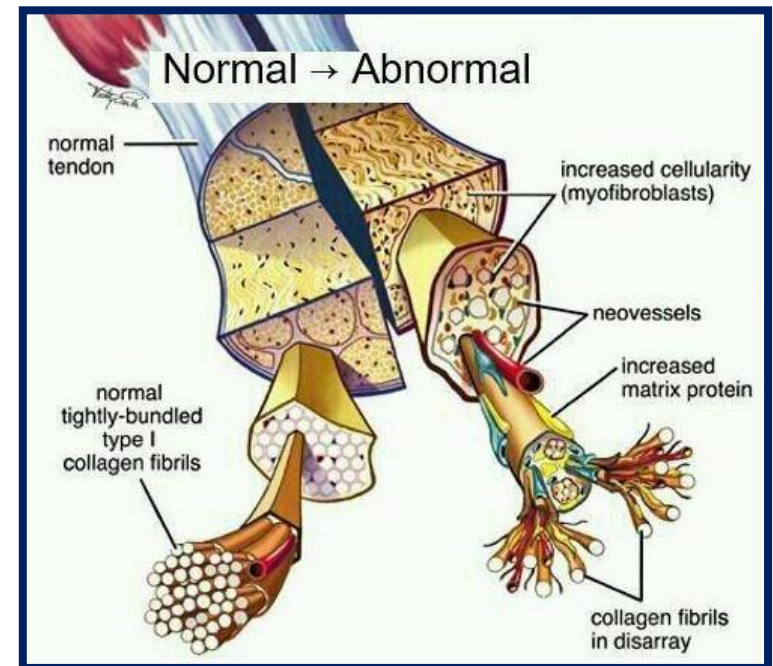
Dr. Hakan Alfredson



**Knee Surg Sports Traumatol Arthrosc. 1999;7(6):378-81 &
Br J Sports Med. 2004 Feb;38(1)**

What Causes the Pain in Tendinopathy?

- Pain is the key feature of tendinopathy, and clinically, it is initiated by **excess tendon load**.
- It occurs in the presence of tendon pathology, but the converse is not true; **tendon pathology can exist without pain**.
- Hence, **tendon pathology itself cannot be the sole source of pain**.
- The **local nociceptive driver within the tendon pathology is unknown**



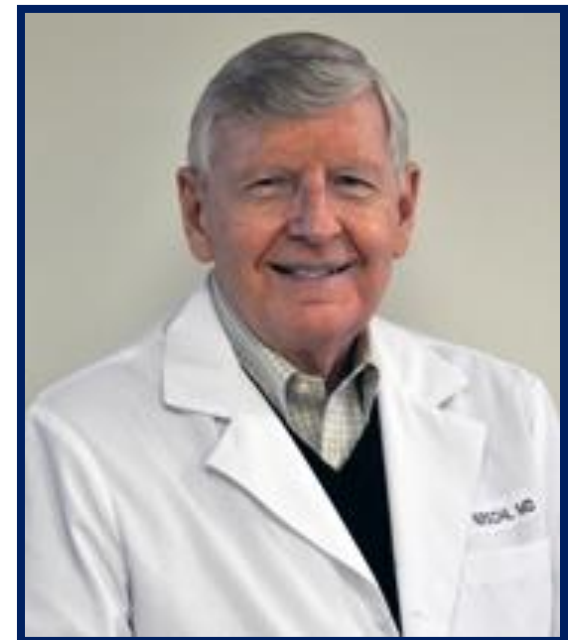
Cardoso TB, Pizzari T, Kinsella R, Hope D, Cook JL. Current trends in tendinopathy management. Best Pract Res Clin Rheumatol. 2019 Feb;33(1):122-140.



Diagnosis and Management of Overuse Injuries



Pathoanatomical Diagnosis



O'Connor FG, Nirschl RP, Sobel JA: Five-Step Treatment for Overuse Injuries. The Physician and Sports Medicine 1992; 20(10):128-142.

Pathoanatomical Diagnosis: The Physician as a Risk Factor

**“You find what you look for,
and diagnose what you know!”**



**Jack Hughston MD
Founder, Hughston Clinic**

Pathoanatomical Diagnosis: Guiding Principles

- History and Physical Examination
 - “**The Principle of Transition**”
 - “Too much, too soon, too fast!”
 - Concept of “**Victims and Culprits**”



Presenting injury is the **victim**, while the primary dysfunction is the **culprit**!

Pathoanatomical Diagnosis: The Critical Historical Element

- **The most important aspect of diagnosis is current “function.”**

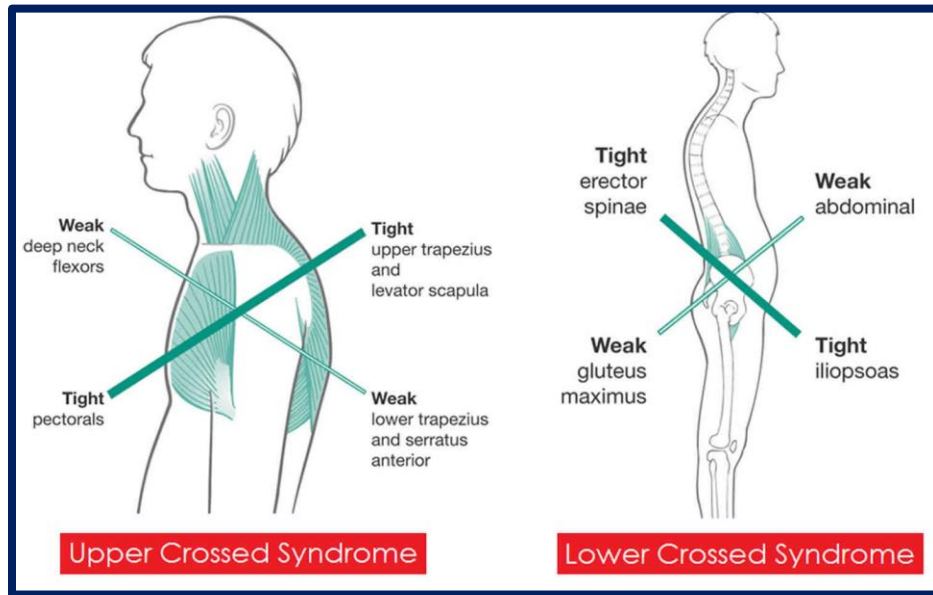
**Critically Important, the Goal is
not ‘tissue healing:**

- **Reduce pain**
- **Improve function/load capacity**

Puffer JC, Zachaewski JE: Management of Overuse Injuries. American Family Physician 1988.

Physical Examination: What's Causing the Problem?

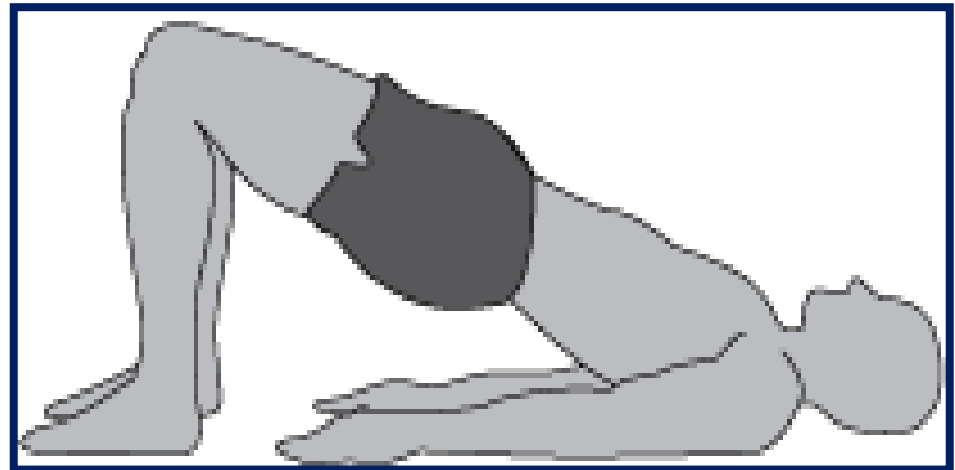
■ Structural versus Functional?



Cardoso TB, Pizzari T, Kinsella R, Hope D, Cook JL. Current trends in tendinopathy management. Best Pract Res Clin Rheumatol. 2019 Feb;33(1):122-140.

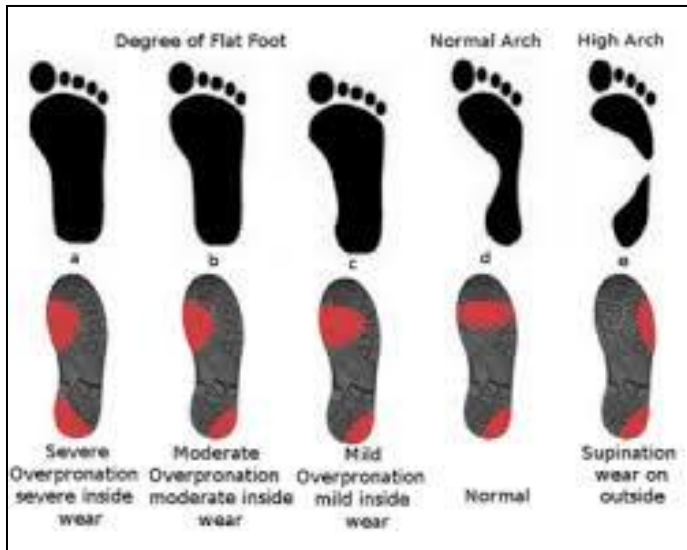
Functional Assessment

- **Assessment of the entire lower extremity kinetic chain:**
 - Spine
 - Hip flexors
 - Quadriceps
 - Iliotibial band
 - Patellofemoral joint
 - Gastrocnemius
 - Core stability

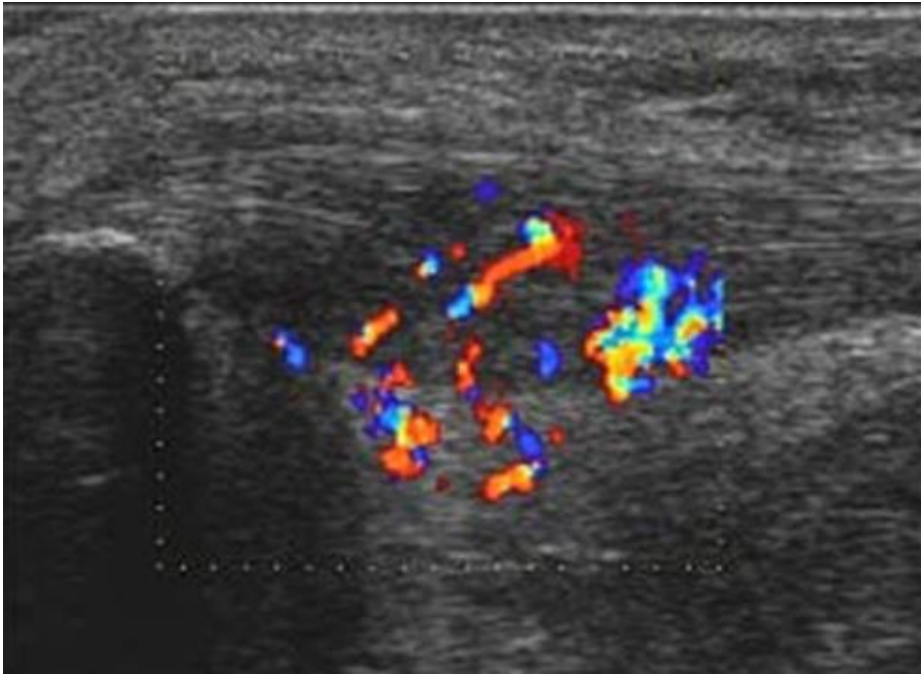


Pathoanatomical Diagnosis

- **Biomechanical evaluation**
 - Dynamic physical assessment
 - **Equipment assessment**
 - Professional assessment
- **Selected diagnostic tests**
 - advanced testing only as indicated



The Role of Imaging



- As there is **poor correlation between abnormal tendon structure and pain**, imaging has almost **no role in diagnosis and prognosis in tendinopathy** and cannot be used as an outcome measure.

Control of Inflammation



Virginia Sportsmedicine Institute Overuse Injury Management Pyramid



Control of Inflammation

■ PRICEMM

- Protection
- Rest
- Ice
- Compression
- Elevation
- Medications
- Modalities

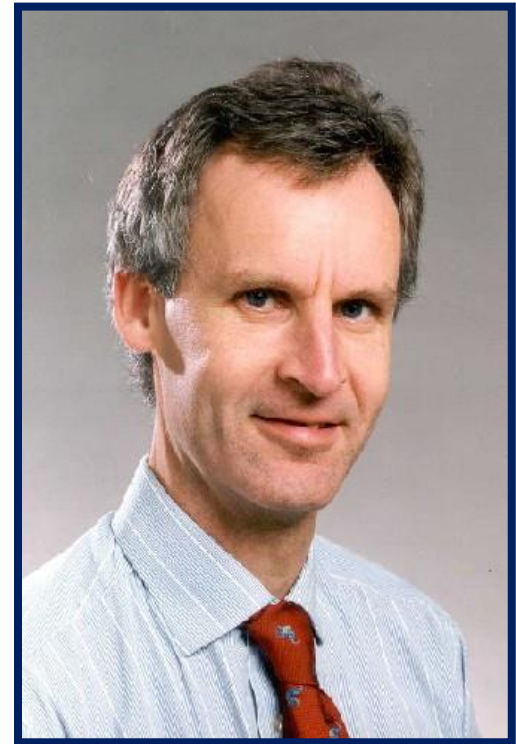


O'Connor FG, Nirschl RP, Sobel JA: Five-Step Treatment for Overuse Injuries. The Physician and Sports Medicine 1992; 20(10):128-142.

What do we mean by the term “Inflammation”?

A contemporary Basic Science Update for Sports Medicine

“As surprising as it may seem, THERE HAS NOT BEEN AN ABUNDANCE OF HIGH QUALITY, adequately powered randomized studies to provide the clinician with strong evidence about the role of (NSAIDs and corticosteroids) in common conditions.”



Scott A, Khan KM, Cook JL, Durino v: British Journal of Sports Medicine 2004;38:372-380.

A Humbling Read!



**Tendinopathy Treatment:
Where is the Evidence?**

The variability in both quantity and quality of research into tendinopathy treatments makes it difficult to make definitive treatment recommendations.

Clinics in Sports Medicine

respectively.⁸ Interestingly, tendinopathy is not only an affliction of the physically active. Although Achilles tendinopathy is traditionally seen in association with running and jumping activities, a significant percentage of cases have been found in those leading a sedentary lifestyle.⁹⁻¹¹

Given the widespread prevalence and incidence of tendinopathy in the general public, much effort has been placed in determining the most beneficial and

Dr Skjong and Dr Meisinger have no disclosures.

**Skjong CC et al: Tendinopathy Treatment: Where is the evidence?
Clinics in Sports Medicine 2012: 31; 329-350.**

NSAIDs and Tendinopathy

■ Purpose/hypothesis:

- To investigate **whether an initial short-term NSAID treatment added to a physical rehabilitation program in the early phase of Achilles tendinopathy would have an additive effect.**

■ Methods:

- A total of 69 patients with early phase Achilles tendinopathy (lasting <3 months) were randomly assigned to either a naproxen group (7 days of treatment; 500 mg twice daily; $n = 34$) or a placebo group (7 days of placebo treatment; $n = 35$).
- Both groups received an identical 12-week physical rehabilitation program.

■ Results:

- **No significant differences were found between the 2 treatment groups for any of the outcome measures at any time point ($P > .05$).**
- At baseline, ultrasonography showed increased thickness (0.12 ± 0.03 cm; $P < .0001$) and vascularity (0.3 ± 0.1 cm²; $P < .005$) on the tendinopathic side compared with the contralateral side, but no changes over time were observed for ultrasonography, MRI, or UTE T2* MRI results.

■ Conclusion:

- Clinical symptoms in early tendinopathy improved with physical rehabilitation, but **this improvement was not augmented with the addition of NSAID treatment.**
- Furthermore, this clinical recovery occurred in **the absence of any measurable structural alterations.**

Malmgaard-Clausen NM, Jørgensen OH, Høffner R, Andersen PEB, Svensson RB, Hansen P, Nybing JD, Magnusson SP, Kjær M. No Additive Clinical or Physiological Effects of Short-term Anti-inflammatory Treatment to Physical Rehabilitation in the Early Phase of Human Achilles Tendinopathy: A Randomized Controlled Trial. Am J Sports Med. 2021 Jun;49(7):1711-1720.

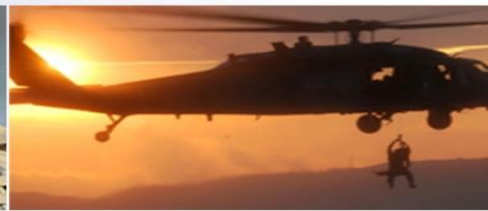
The Role of Corticosteroid Injections

- Few evidence-based treatment guidelines for tendinopathy exist.
- 3824 trials were identified ;41 met inclusion criteria, providing data for 2672 participants.
- Consistent findings between many high-quality randomized controlled trials that corticosteroid injections **reduced pain in the short term** compared with other interventions, **but this effect was reversed at intermediate and long terms.**



Coombes BK et al: Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomized controlled trials Lancet. 2010 Nov 20;376(9754):1751-67.

Promotion of Healing



Virginia Sportsmedicine Institute Overuse Injury Management Pyramid



Promotion of Healing

■ THERAPEUTIC EXERCISE

- Normal ROM
- Strength,
- Force-Couple
- Proprioception

■ Central aerobics

- neurologic stimulus
- increasing regional perfusion

■ Surgical intervention

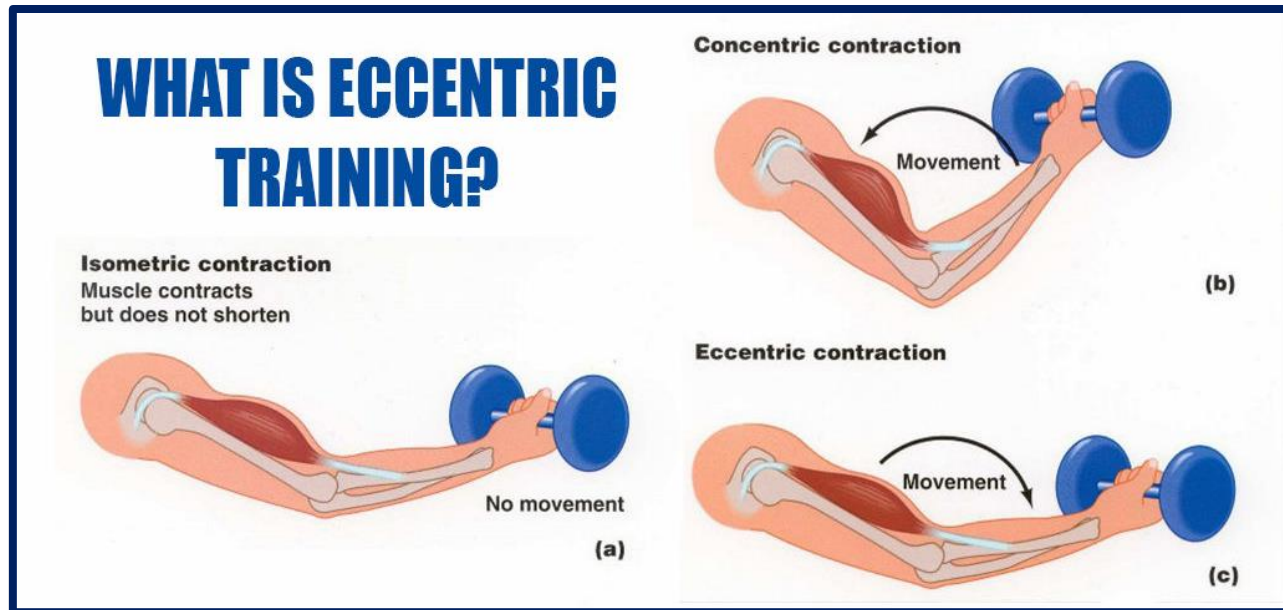
- failed quality rehabilitation



Promotion of Healing

■ Eccentric Exercise:

- as many overuse injuries are postulated to have their etiology in eccentric overload, thought to be core to the rehabilitative effort.



Curwin SL, Stanish WD: Tendinitis: Its etiology and treatment.
Toronto, Collamore Press, 1984.

Eccentric Exercise for Achilles Tendinopathy

- Prospective uncontrolled study of 15 patients with chronic Achilles tendonitis.
- 12 week program of graduated heavy loaded eccentric exercise.
- Two year follow-up only 1 of the 15 required surgery.



Alfredson H, Lorentzon R. Chronic Achilles tendinosis: recommendations for treatment and prevention. Sports Med. 2000 Feb;29(2):135-46.

Tendinopathy Rehabilitation Stages

■ Stage 1 Isometric Exercise

- Isometric exercise relieves tendon pain and can be used before provocative activities.

■ Stage 2 Isotonic and Heavy Slow Resistance Exercises

■ Stage 3 Speed and Energy Storage Exercises

- A gradual increase in faster functional movements 2 to 3 times a week should be commenced whilst maintaining a base of isometrics and strength and endurance exercises on alternate days.
- Monitoring of load response is a key at this stage as speed adds significant load on the tendon. The response of the tendon to a load (e.g. hopping) or a hallmark sign (morning pain and stiffness) the day after faster loads will clearly demonstrate if the tendon is tolerating the load.

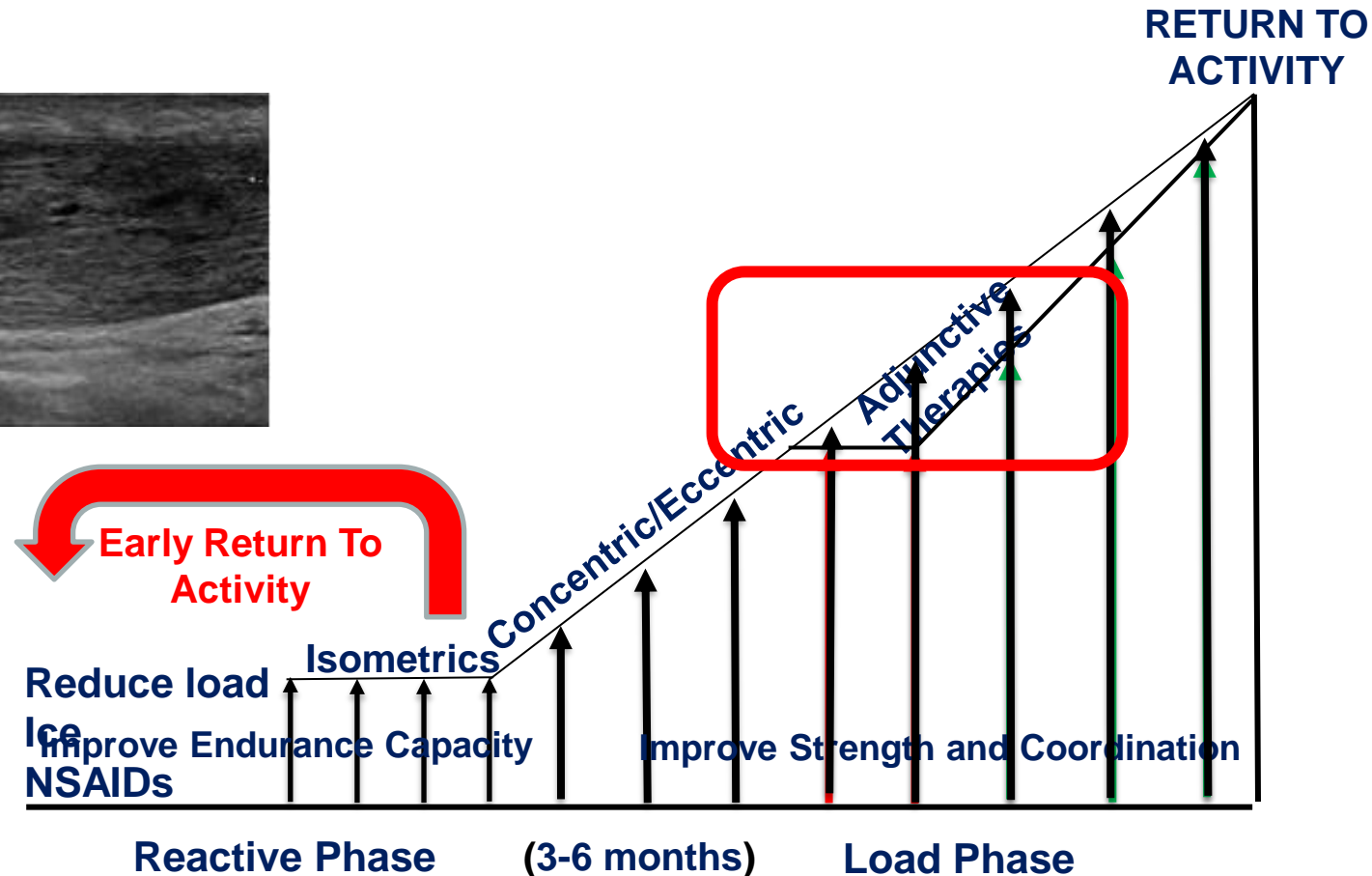
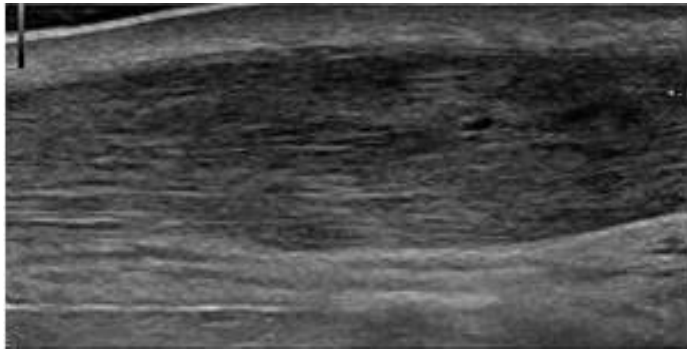
■ Stage 4 Sport Specific Exercises

- Restoring the elastic properties of the kinetic chain is dependent on the functional and sporting needs of the person.
- Sports specific drills should be slowly introduced and progressed until return to sport specific activities are achieved.
- Energy storage and release or sport specific exercises can replace stage 3 exercise, but stage 1 and 2 exercises should be maintained twice a week.



Cardoso TB, Pizzari T, Kinsella R, Hope D, Cook JL. Current trends in tendinopathy management. Best Pract Res Clin Rheumatol. 2019 Feb;33(1):122-140.

Tendinopathy Rehabilitative Paradigm: Putting it All Together



Tendinopathy TX Rules:

1. Every tendon is different
2. Individualize program
3. Intervene w/ lack of progress

Loading Rules:

1. Progressive Loading
2. No severe pain > 5/10
3. No pain into next day
4. 3 Sets of 15 twice daily



ADJUNCTIVE Strategies for Sports Inflammation and Pain

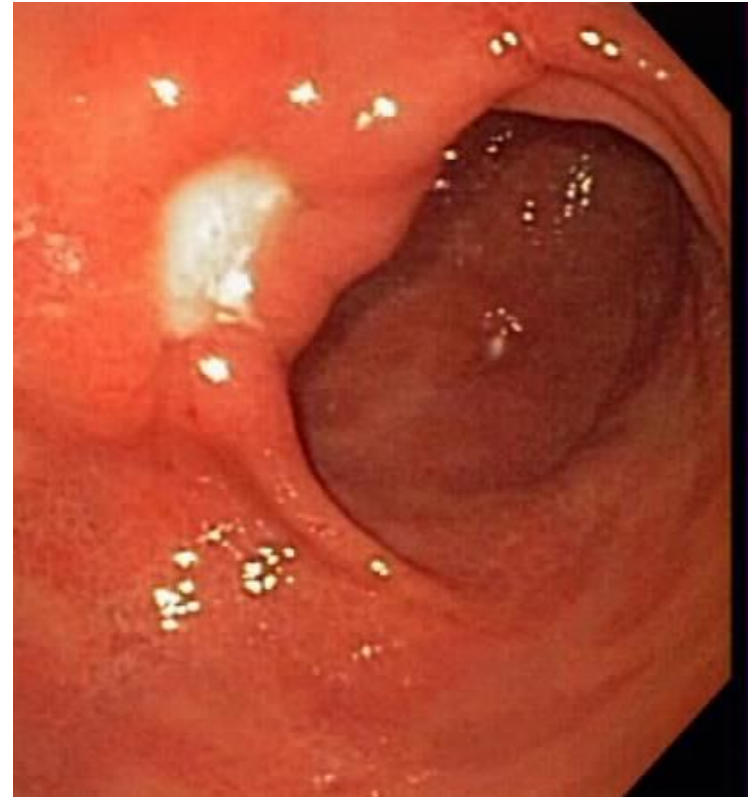


Why the Need for New and Emerging Therapies?



Patients don't Necessarily like Medications!

- A total of 24,081 patients were randomly assigned to the celecoxib group (mean [\pm SD] daily dose, 209 ± 37 mg), the naproxen group (852 ± 103 mg), or the ibuprofen group (2045 ± 246 mg) for a mean treatment duration of 20.3 ± 16.0 months and a mean follow-up period of 34.1 ± 13.4 months.
- During the trial, **68.8% of the patients stopped taking the study drug**, and 27.4% of the patients discontinued follow-up.



Nissen SE, PRECISION Trial Investigators. Cardiovascular Safety of Celecoxib, Naproxen, or Ibuprofen for Arthritis.
N Engl J Med. 2016 Dec 29;375(26):2519-29

Are Steroid Injections Counterproductive?

- **OBJECTIVE:** determine the effects of IA injection of 40 mg of triamcinolone acetonide (IA-TAC) every 3 months on progression of cartilage loss and knee pain.
- **DESIGN, SETTING, AND PARTICIPANTS:** Two-year, randomized, placebo-controlled, double-blind trial IA-TAC vs saline for symptomatic knee osteoarthritis with synovitis in 140 patients.
- **INTERVENTIONS:** IA-TAC (n = 70) or saline (n = 70) every 12 weeks for 2 years.
- **MAIN OUTCOMES AND MEASURES:** Annual knee magnetic resonance imaging for quantitative evaluation of cartilage volume and Western Ontario and McMaster Universities Osteoarthritis index collected every 3 months
- **RESULTS:** Among 140 randomized patients (mean age, 58) IA-TAC resulted in significantly greater cartilage volume loss than did saline for a mean change in index compartment cartilage thickness of -0.21 mm vs -0.10 mm; and no significant difference in pain (-1.2 vs -1.9).
- **CONCLUSIONS AND RELEVANCE:** 2 years of IA-TAC, c/w saline, resulted in greater cartilage volume loss and no significant difference in knee pain.

McAlindon TE: Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis: A Randomized Clinical Trial. JAMA. 2017 May 16;317(19):1967-1975

Surgical Intervention is Coming Under Question

■ Methods

- A double-blind, sham-controlled trial was conducted with 118 surgical candidates (mean age 40 years), with patient history, clinical symptoms and MRI arthrography indicating an isolated type II SLAP lesion. Patients were randomly assigned to either labral repair (n=40), biceps tenodesis (n=39) or sham surgery (n=39) if arthroscopy revealed an isolated SLAP II lesion.

■ Results

- There were no significant between-group differences at any follow-up in any outcome.. Postoperative stiffness occurred in five patients after labral repair and in four patients after tenodesis.

■ Conclusion

- **Neither labral repair nor biceps tenodesis had any significant benefit over sham surgery for patients with SLAP II lesions in the population studied.**



Schröder CP, Skare Ø, Reikerås O, Mowinckel P, Brox JI. Sham surgery versus labral repair or biceps tenodesis for type II SLAP lesions of the shoulder: a three-armed randomised clinical trial. *British Journal of Sports Medicine*. 2017;51(24):1759-1766.

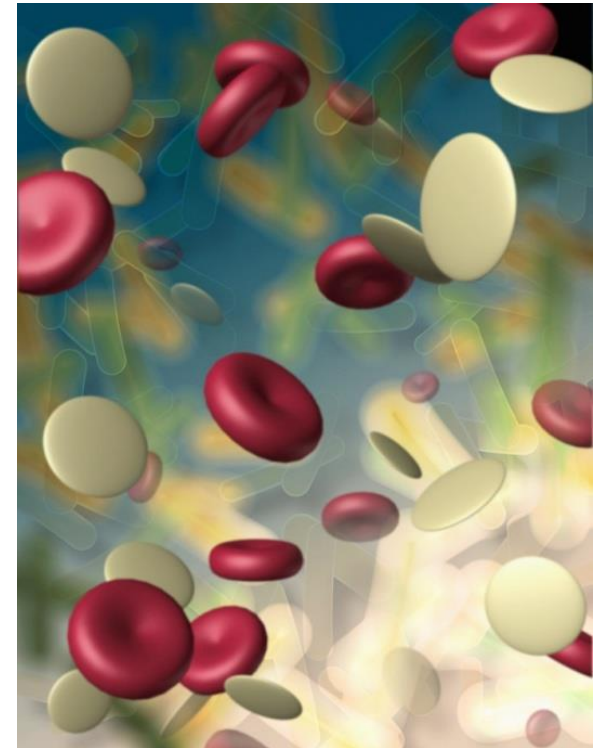


Platelet Rich Plasma (PRP) and Stem Cells Have Arrived!



What is Platelet Rich Plasma (PRP)?

- PRP is defined as a sample of autologous blood with concentrations of platelets above baseline values.
- Clinically active PRP typically contains over **1 million platelets** per microliter.
- A part of the medical frontier know as “**orthobiologics**.”



Marx R. Platelet Rich Plasma: what is it and what is not PRP? Implant Dent 2001;10:225-8.

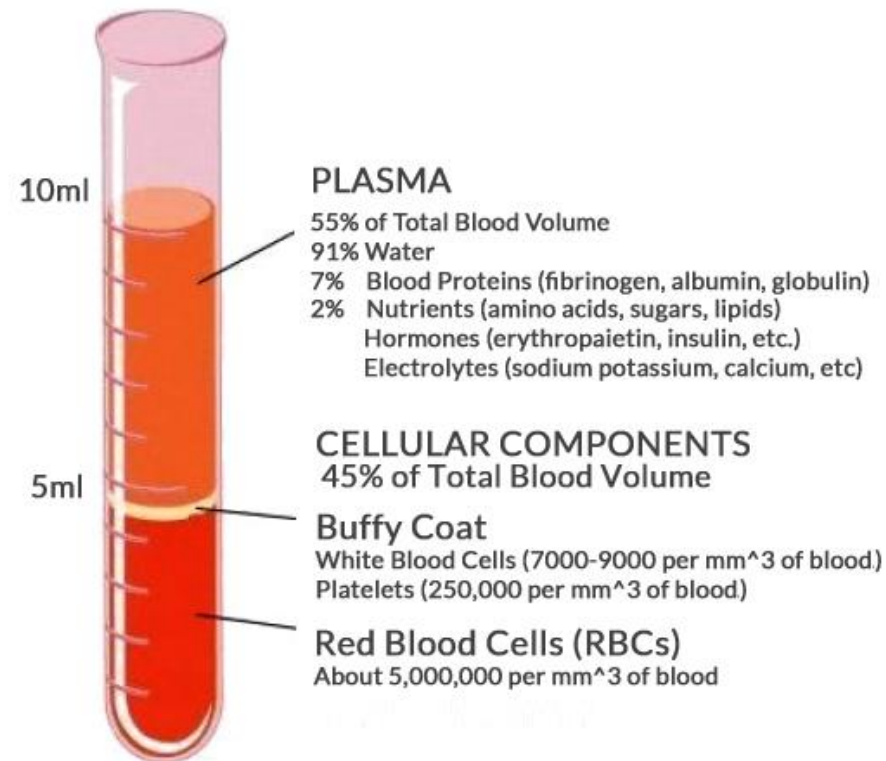
How is PRP Made

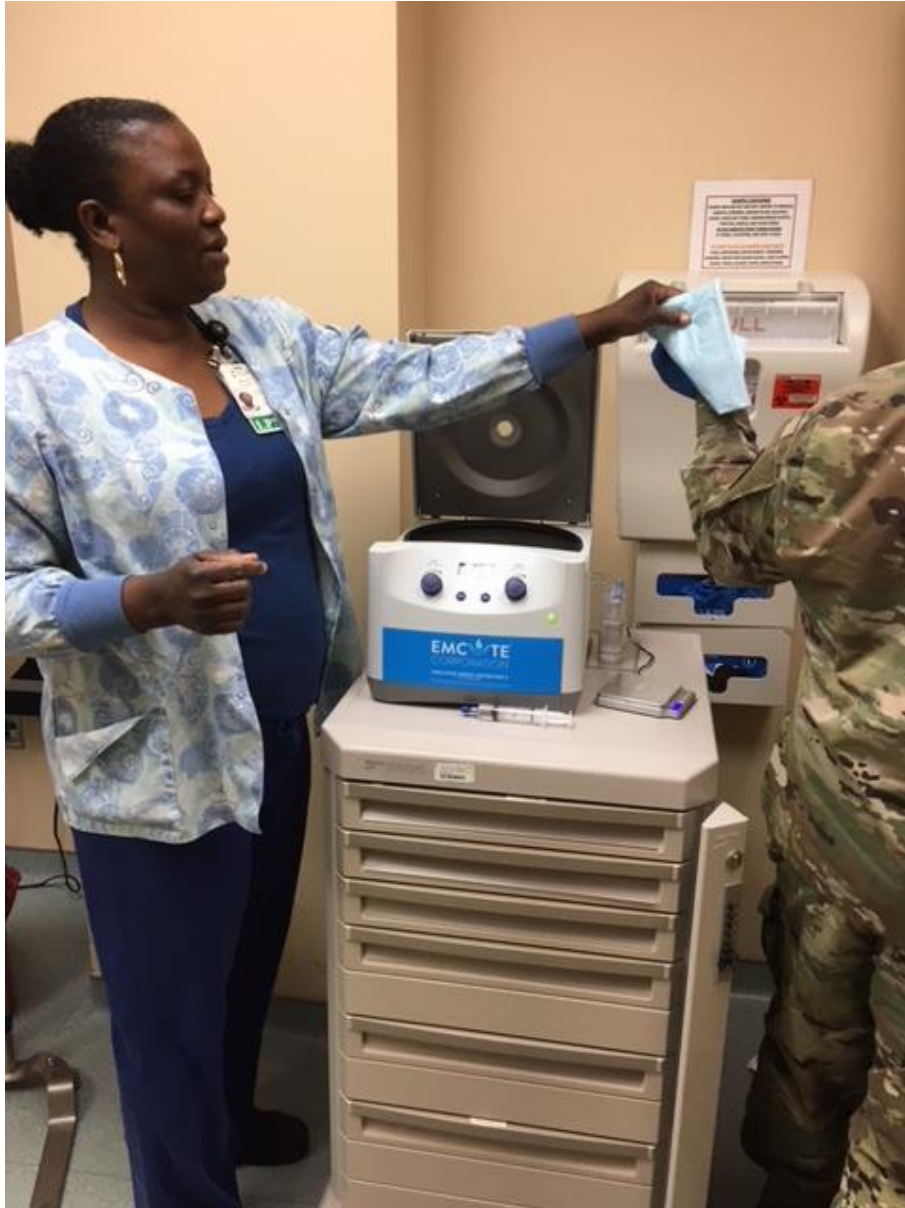
■ First centrifugation

- Acellular plasma (top layer) = platelet poor plasma (PPP)
- Buffy coat = platelet concentrate and WBCs
- RBCs (bottom layer) = red blood cells

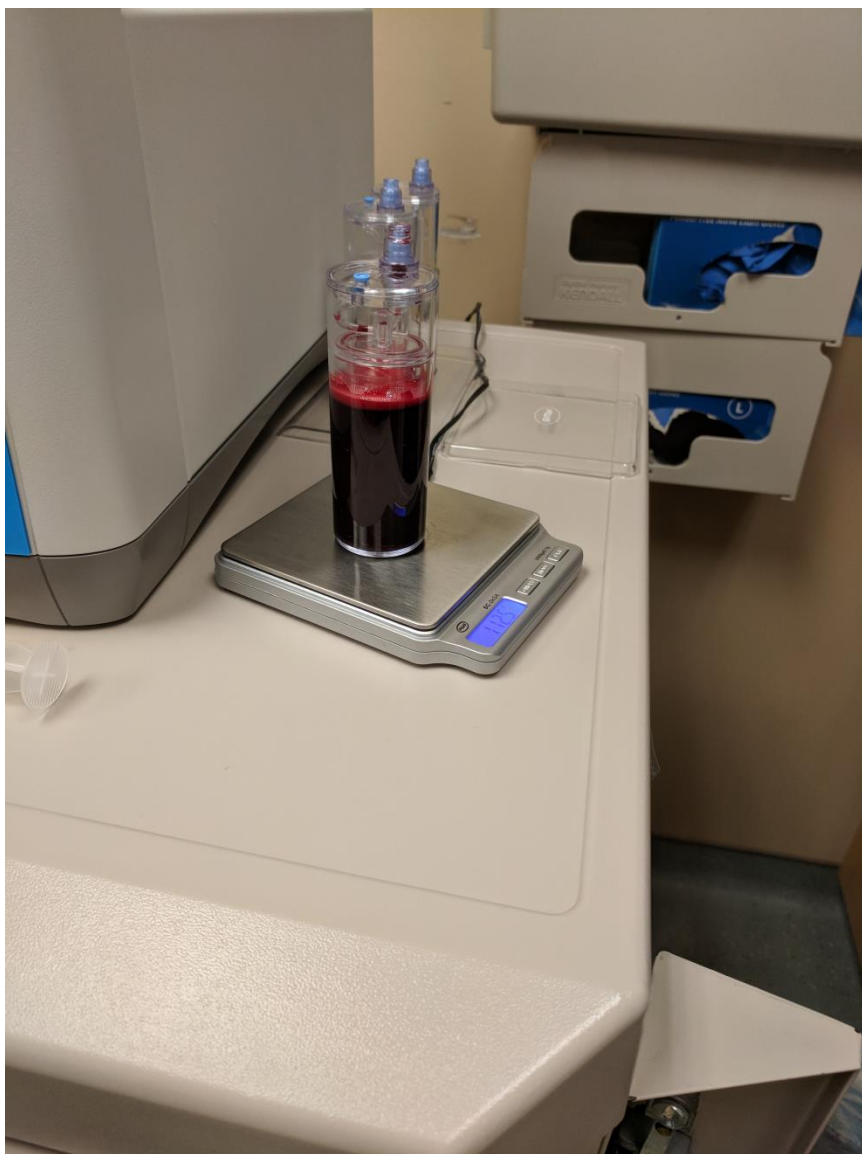
■ Second centrifugation

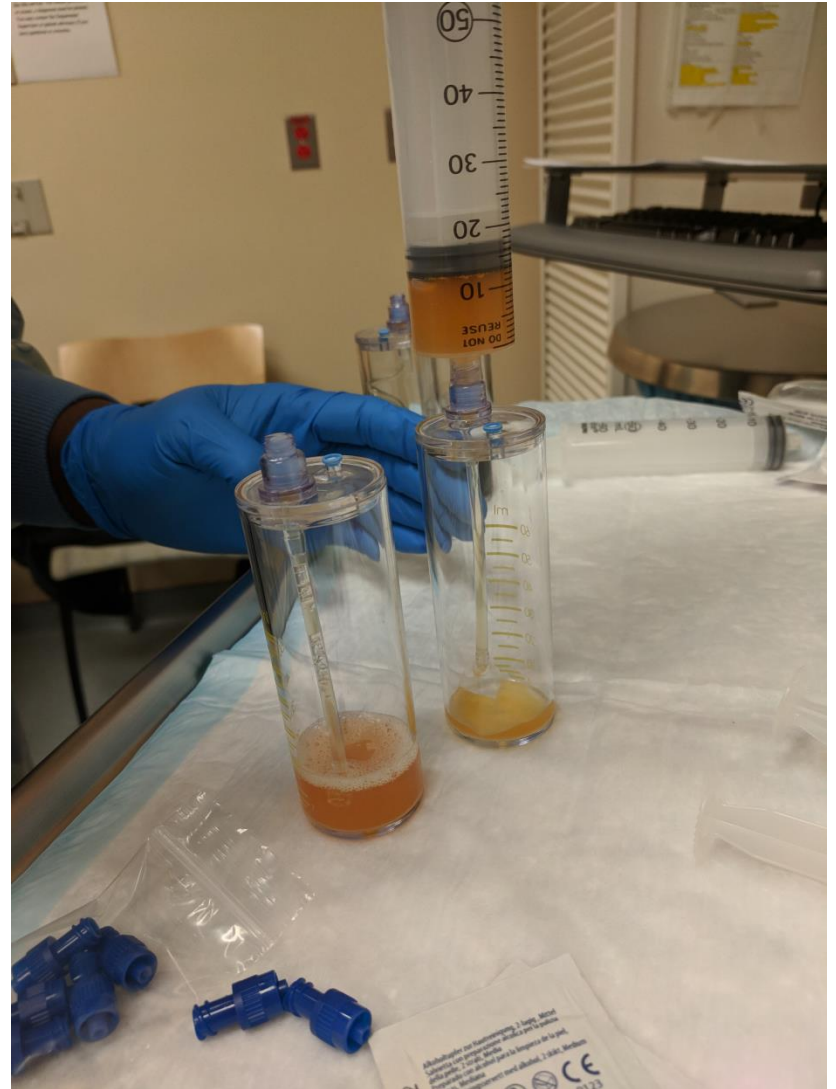
- Only involves PPP and buffy coat
- Increases platelet concentration
- +/- elimination of WBCs

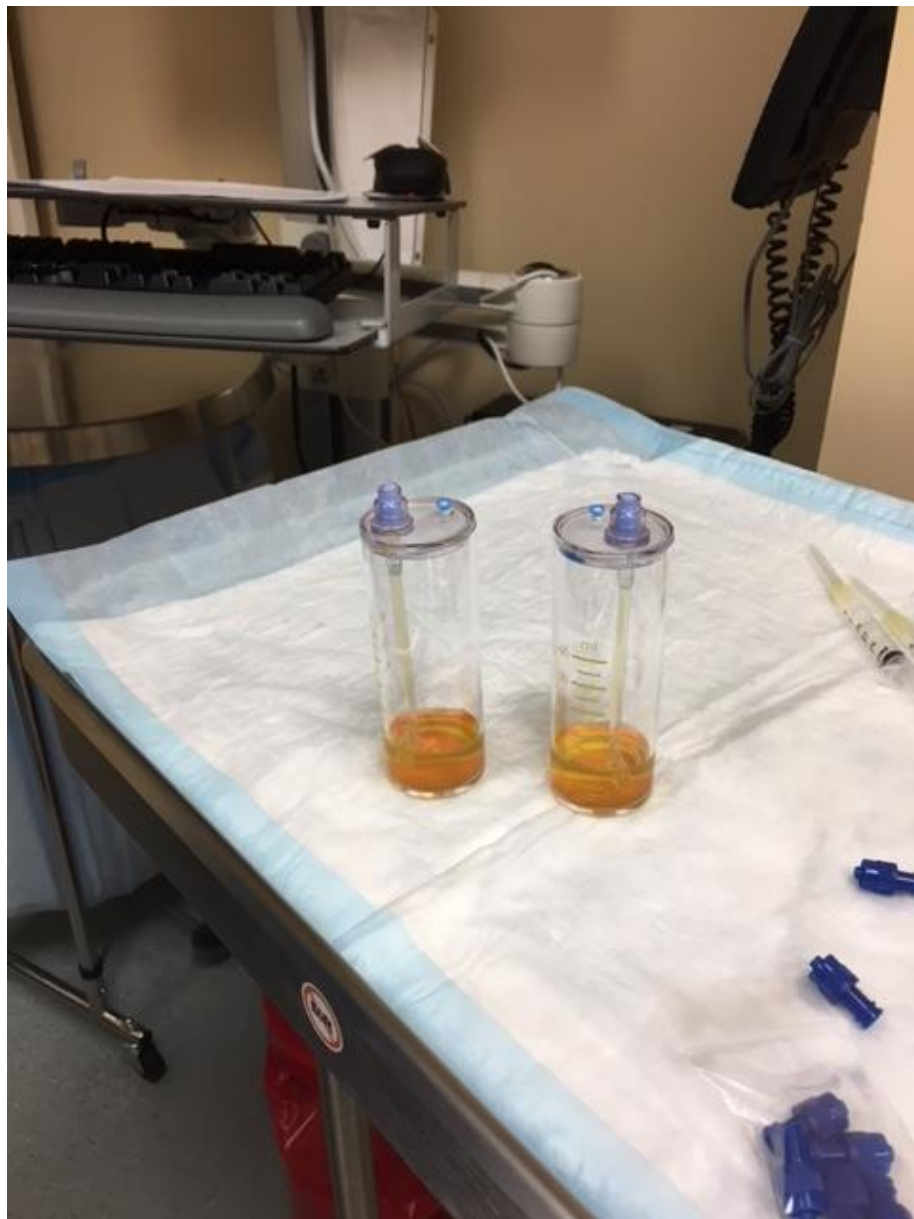


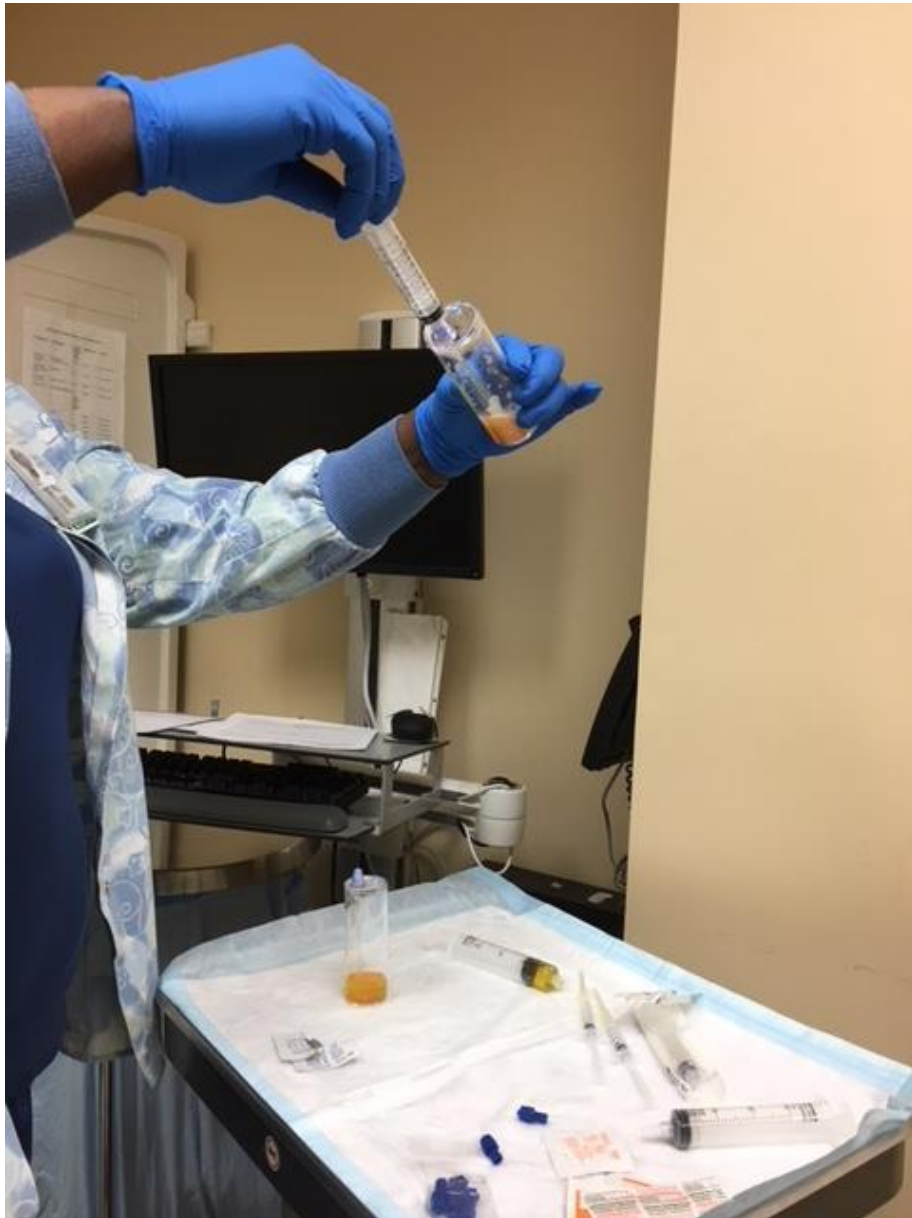












Current Thinking on PRP

■ AUTHORS' CONCLUSIONS:

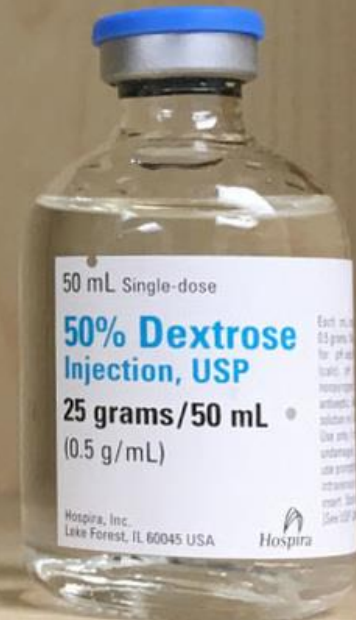
- Overall, and for the individual clinical conditions, **there is currently insufficient evidence to support the use of PRP for treating musculoskeletal soft tissue injuries.**
- Researchers contemplating RCTs should consider the coverage of currently ongoing trials when assessing the need for future RCTs on specific conditions.
- **There is need for standardisation of PRP preparation methods.**



Moraes VY et al: Platelet-rich therapies for musculoskeletal soft tissue injuries. Cochrane Database Syst Rev. 2013 Dec 23;12:CD010071.

PROLOTHERAPY

The power of SUGAR+INFLAMMATION



Hauser RA, Lackner JB, Steilen-Matias D, Harris DK. A Systematic Review of Dextrose Prolotherapy for Chronic Musculoskeletal Pain. *Clinical Medicine Insights Arthritis and Musculoskeletal Disorders*. 2016;9:139-159.

Prolotherapy Deserves A Look!

- Fourteen RCTs, 1 case–control study, and 18 case series studies met the inclusion criteria and were evaluated.
- The RCTs were high-quality Level 1 evidence and found dextrose injection superior to controls in **Osgood–Schlatter disease, lateral epicondylitis of the elbow, traumatic rotator cuff injury, knee OA, finger OA, and myofascial pain;**
- in biomechanical but not subjective measures in temporal mandibular joint; and comparable in a short-term RCT but superior in a long-term RCT in low back pain.



Hauser RA, Lackner JB, Steilen-Matias D, Harris DK.

A Systematic Review of Dextrose Prolotherapy for Chronic Musculoskeletal Pain.
Clinical Medicine Insights Arthritis and Musculoskeletal Disorders. 2016;9:139-159.

Topical Nitric Oxide

- **Inhibition of nitric oxide has been shown to reduce collagen content, contraction, and synthesis by wound fibroblasts in vitro.**
- **In animal studies, nitric oxide synthase inhibition resulted in a reduction in the cross sectional area and load to failure of healing tendons.**
- Topical glyceryl trinitrate has been used for over 100 years as a therapy for angina pectoris; a pro-drug of nitrous oxide.





AUTHORS' CONCLUSIONS: There is some evidence from one study at high risk of bias that topical glyceryl trinitrate is **more effective than placebo for rotator cuff disease among patients with acute symptoms (< seven-days duration)**, but there is insufficient evidence to be certain about their longer-term effects.



**Cumpston M:Topical glyceryl trinitrate for rotator cuff disease.
Cochrane Database Syst Rev. 2009 Jul 8;(3).**



Shock Wave Therapy is not Dead Yet!



Shock Wave Therapy

- **METHODS:** 25 patients were allocated to receive eccentric loading (Group 1), 25 were allocated to treatment with repetitive low-energy shock wave therapy (Group 2).
- **RESULTS:** The group that received shock wave therapy showed significantly more favorable results ($p = 0.002$ through $p = 0.04$).
- **CONCLUSIONS:** Eccentric loading showed inferior results to low-energy shock wave therapy in patients with **chronic recalcitrant tendinopathy of the insertion of the Achilles tendon** at four months of follow-up.



Rompe JD et al: Eccentric loading compared with shock wave treatment for chronic insertional Achilles tendinopathy. A randomized, controlled trial. J Bone Joint Surg Am. 2008 Jan;90(1):52-61.

Fitness Exercise



Virginia Sportsmedicine Institute Overuse Injury Management Pyramid



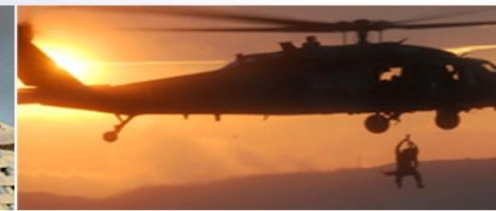
Fitness Exercise

- Transition exercises
- Sports-specific exercise
- Central aerobics



Prehabilitate for the abuse of the
Sport Activity!

Control Abuse



Virginia Sportsmedicine Institute Overuse Injury Management Pyramid



Control Abuse

- **Modify extrinsic overload:**
 - technique
 - **training**
- Bracing and taping
- Proper equipment
- Monitor for Overtraining



Sports Participation

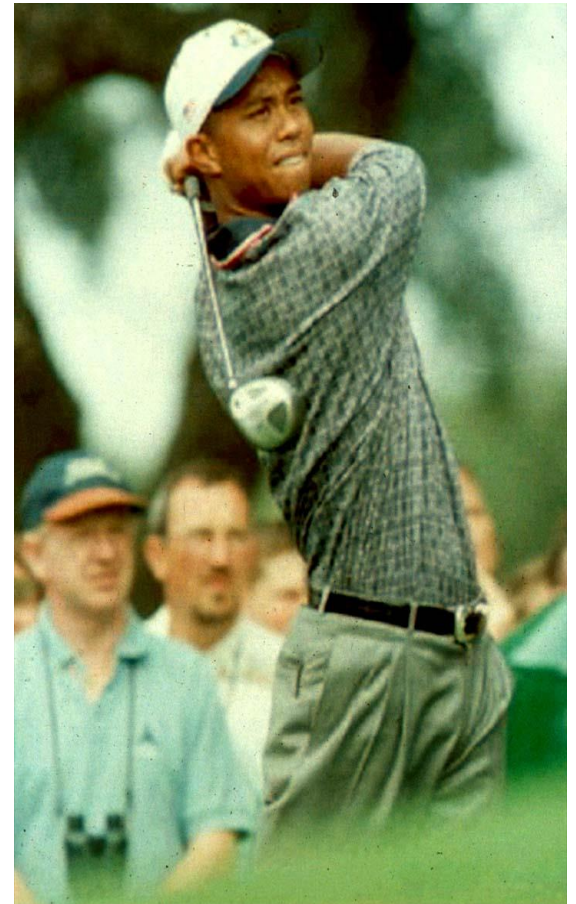
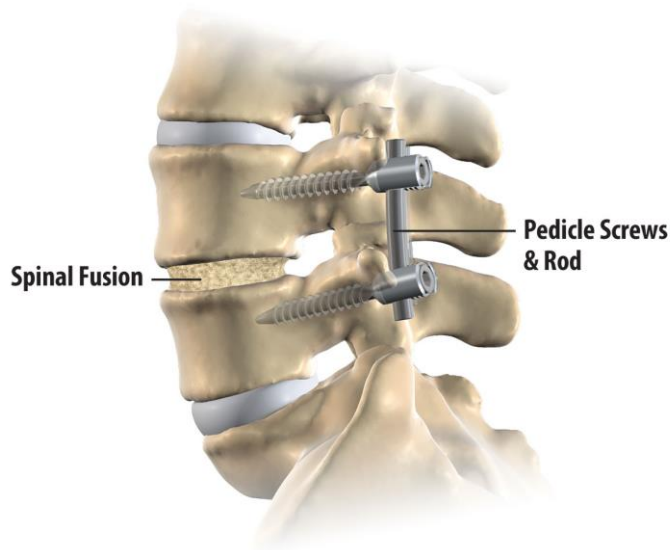


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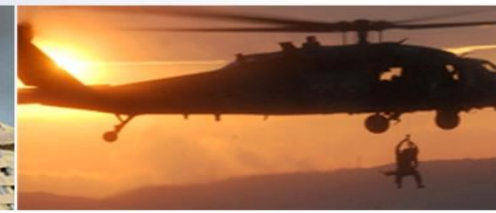


Sports Participation

- **Sports specific function**
- **Psychologic readiness**
- **Ongoing rehabilitation or prehabilitation program**



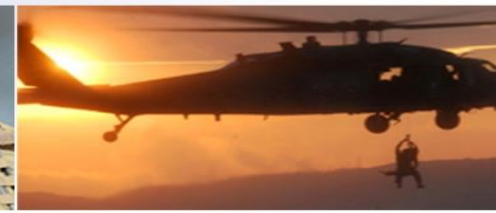
Summary



- An analysis of the current state of knowledge indicates that there are **more questions than answers** in overuse injuries.
- **Overuse injury** frequently begins well before the injury becomes painful.
- **Eccentric** exercise is a principal culprit that can lead to **overuse** injury.
- **Degenerative** tendinopathy is the most common overuse tendon injury encountered by clinicians.
- The **triggers** and **therapies** for tendinopathy remain poorly understood in 2021.



Summary



- Any good therapy begins with a good **pathoanatomic** diagnosis.
- Look for the **Transition**...Find the **Culprit**!
- **NSAIDs and Corticosteroids** principally work in overuse injuries by providing short term **analgesia**.
- Exercise, in particular **eccentric exercise**, is the cornerstone of recovery.
- **Promising new adjunctive therapies** that promote tissue regeneration and healing are emerging!



Management of Chronic Tendon Injuries

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Chronic tendon injuries are common athletic and occupational injuries that account for many physician visits. Tendons have a complex biology that provides a unique combination of strength, flexibility, and elasticity but also predisposes them to injury. The term tendinopathy is preferred to tendinitis because of the presence of a disordered and degenerative healing process—not inflammation—in the pathologic tendon. Insidious onset of pain and dysfunction is a common presentation for most tendinopathies, and patients typically report that a change in activity affected the use of the tendon. Diagnosis is typically based on history and physical examination findings, but radiography is an acceptable initial imaging modality. Ultrasonography and magnetic resonance imaging may be useful when the diagnosis is unclear. The mainstays of treatment are activity modification, relative rest, pain control, and protection. Early initiation of rehabilitative exercises that emphasize eccentric loading is also beneficial. Despite a lack of high-quality evidence, cryotherapy has a role in controlling pain. Nonsteroidal anti-inflammatory drugs and corticosteroids have a role in treatment despite the lack of histologic evidence of inflammation. Short-term use of these drugs reduces pain and increases range of motion, which can assist patients in completing rehabilitative exercises. Care should be taken when injecting corticosteroids into and near major load-bearing tendons because of the risk of rupture. Topical nitroglycerin, extracorporeal shock wave therapy, and platelet-rich plasma injections have varying levels of evidence in certain tendinopathies and are additional nonsurgical treatment options. (*Am Fam Physician*. 2019;100(3):147-157. Copyright © 2019 American Academy of Family Physicians.)



Illustration by Catherine Delphia



Kane SF, Olewinski LH, Tamminga KS. Management of Chronic Tendon Injuries. *Am Fam Physician*. 2019 Aug 1;100(3):147-157.

Summary of Treatments for Chronic Tendon Injuries

Treatment	Mechanism	Effectiveness	Risks
Rest	Reduces strain on painful tissue	First-line treatment; used as control in some studies	Few risks; time required may not be acceptable (e.g., missed work or competition)
Bracing	Reduces strain on surrounding muscle groups; can also be a form of rest	Evidence varies for location and type of brace ²¹⁻²⁴	Prolonged immobilization can lead to stiffness and atrophy; should be used in combination with physical therapy
Corticosteroid injections	Anti-inflammatory effects	Better than rest alone and equal to NSAIDs for short-term treatment of chronic tendinopathy ²⁵ ; similar to physical therapy and NSAIDs for rotator cuff tendinopathy without impingement ²⁶ ; short-term benefit (less than six months) for lateral epicondylitis ²⁷	Local pain and atrophy, skin depigmentation, rare risk of tendon rupture; repeated injection are more harmful than a single injection ²⁷
Cryotherapy/icing	Anti-inflammatory effects; direct application over tendon or ice cup massage	Few studies for chronic tendinopathy ²⁸⁻³⁰	Few risks
Eccentric exercises	Loading tendon to promote structural remodeling and repair	Good evidence of benefit for midsubstance Achilles tendinopathy, rotator cuff tendinopathy, lateral epicondylitis, and patellar tendinopathy ^{14,15,25,30,31}	Few risks; if guided by a physical therapist, barriers may include cost, transportation, and time off work
Extracorporeal shock wave therapy	Microsecond pressure pulses of energy directed at 2- to 8-mm areas; electrohydraulic, electromagnetic, or piezoelectric source; therapeutic mechanism unknown	Good evidence for high-dose energy-focused therapy for plantar fasciitis, greater trochanteric pain syndrome, and calcific rotator cuff tendinopathy, but not noncalcific rotator cuff tendinopathy or lateral epicondylitis ^{25,32}	Noninvasive; adverse effects are rare but include pain and risk of tendon injury; equipment is expensive
NSAIDs	Anti-inflammatory and analgesic effects; unclear why NSAIDs are effective because chronic tendinopathy is a degenerative and noninflammatory process	Some benefit for short-term treatment of chronic tendinopathy, but evidence wanes as treatment duration increases, which may represent more refractory cases; inexpensive and patient controlled ^{34,13,25}	Gastrointestinal, renal, and cardiovascular risk with long-term use
Platelet-rich plasma injections	Platelets produce growth factors that are beneficial to tissue repair and regrowth; activity is limited after the procedure with physical therapy-driven protocol	Cochrane review showed no functional benefits compared with placebo, dry needling, whole blood, or no intervention, but a subgroup of studies showed short-term benefit for pain ³³ ; a meta-analysis showed no benefits, but protocol was not standardized ³⁴ ; a meta-analysis found benefit when leukocyte-rich platelet-rich plasma was used with ultrasound guidance ³⁵ ; two randomized controlled trials showed no benefit for Achilles tendinopathy ^{36,37} ; some experts think benefit might be derived from dry needling/fenestration alone ³⁸	Often not covered by insurance; can be expensive and painful
Therapeutic ultrasound	High-frequency, low-power ultrasound; similar to imaging ultrasonography, but beams are focused on a small area rather than spread for visualization ³⁹ ; causes cavitation (creation of small gas bubbles) and acoustic streaming (eddy of fluids near vibrating structures), which affect energy across cell membranes; thought to stimulate metabolic processes that accelerate growth factor and collagen synthesis and repair (mediates inflammatory process) ⁴⁰	Some benefit for lateral epicondylitis and calcific rotator cuff tendinopathy; systematic review showed no benefit for noncalcific rotator cuff tendinopathy ^{39,41}	Discomfort, mild pain
Topical nitroglycerin	Enhances collagen synthesis and other relevant healing factors; many studies used one-fourth of a 5-mg patch	Improves pain with activity; conflicting evidence for pain at rest; no effect on pain duration for chronic tendinopathies ^{25,42}	Contact dermatitis, headaches; takes time to be effective
Ultrasound-guided debridement	Debridement with irrigation and suction removes diseased tendon; ultrasonography is used to identify areas of disease; similar to surgical debridement but is performed in the office with a small incision	Case series showed benefit for lateral epicondylitis ^{43,44} ; chart review showed benefit for insertional Achilles tendinopathy ⁴⁵	Limited case studies show adverse effects (e.g. tendon rupture) or evidence of tendon injury due to the procedure ⁴⁶

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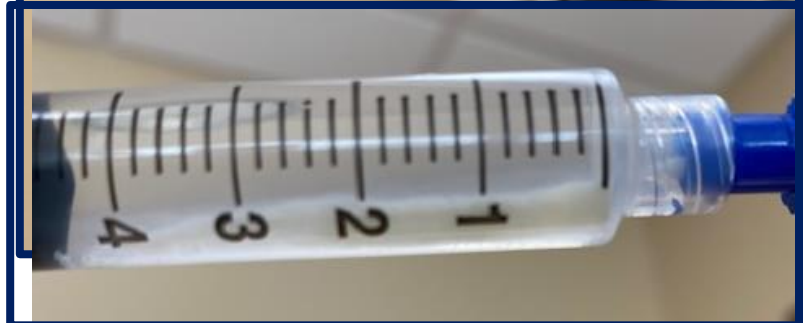
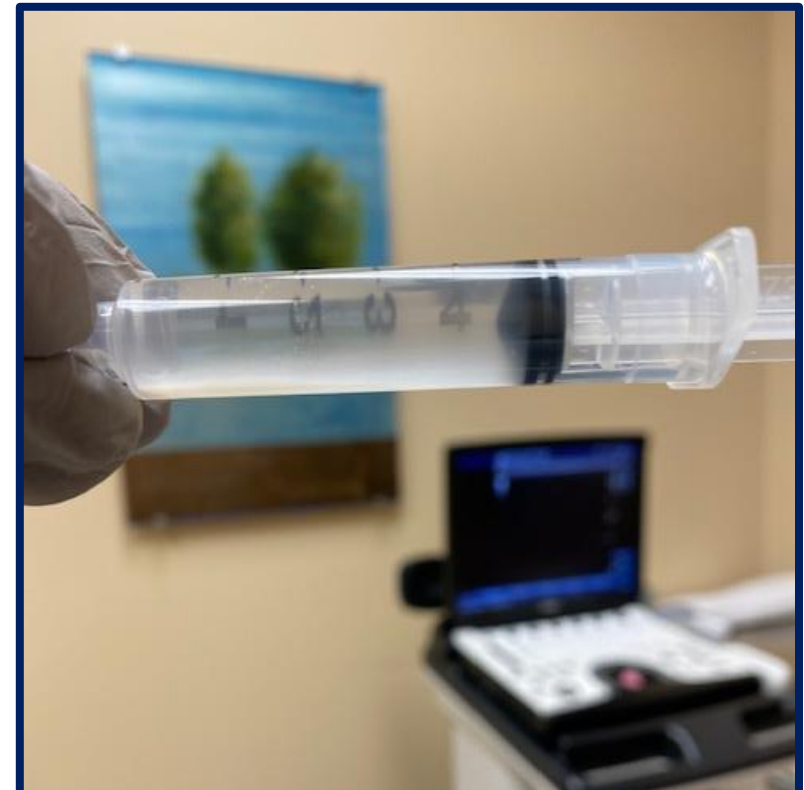
SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	Evidence rating	Comments
Corticosteroid injections near areas of tendinopathy are helpful for short-term but not long-term treatment. However, they have a small risk of tendon rupture. ^{13,25-27,29,31,49,61}	A	Based on clinical review articles and systematic reviews of randomized controlled trials
With consistent use, topical nitroglycerin can reduce tendon pain associated with activity. ^{25,42}	A	Based on a systematic review and meta-analysis
Extracorporeal shock wave therapy may be beneficial for plantar fasciitis, greater trochanteric pain syndrome, and calcific rotator cuff tendinopathy that are resistant to initial treatment. It has no clear benefit for noncalcific rotator cuff tendinopathy or lateral epicondylitis. ^{25,32,50,51}	B	Based on clinical review articles and systematic reviews of lower-quality studies
Eccentric exercises are effective for treating rotator cuff tendinopathy, lateral epicondylitis, patellar tendinopathy, and midsubstance Achilles tendinopathy. ^{13-15,25,31,55,64,67,68,73,79}	B	Based on clinical review articles, systematic reviews of lower-quality studies, and lower-quality randomized controlled trials

A = consistent, good-quality patient-oriented evidence; **B** = inconsistent or limited-quality patient-oriented evidence; **C** = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <https://www.aafp.org/afpsort>.

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Barbotage



Questions?

