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Pattern Recognition in Sports Medicine: Achilles Tendinopathy, Plantar Fasciopathy and other foot conditions that drive us crazy!



Prof Wayne Derman
MBChB, BSc (Med)(Hons) PhD, FFIMS



- Achilles is thickest and strongest
- Combined gastroc and soleus
- No synovial sheath but posterior paratenon
- Continuous with perimyseum of muscle and
- Periosteum of calcaneus
- Anterior: Fat pad
- Bursae

Important for normal foot biomech, windlass effect
 3 segments: lateral & medial aponeurosis
 Central- post medial calcaneal tuberosity to toes
 Longitudinal arch of foot and shock absorber

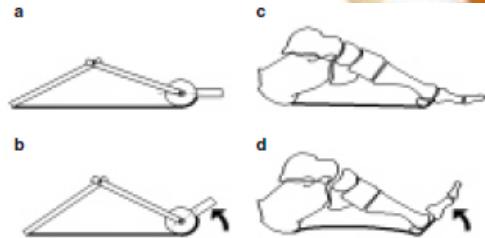
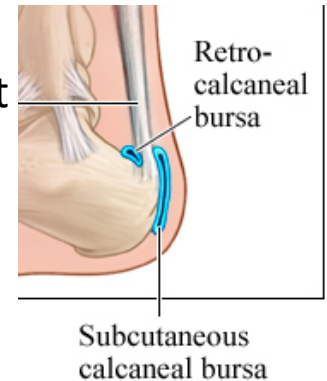


Fig. 7. Hick's windlass effect in the foot. (a) Mechanical windlass in

Mechanobiological Response of Tendon Stem Cells: Implications of Tendon Homeostasis and Pathogenesis of Tendinopathy



Jianying Zhang, James H-C. Wang

- Stem cells present in tendons
- Mechanical stretching increased TSC proliferation in a dose dependent manner
- Low-moderate stretching 4% promoted TSC into tenocytes (Col 1)
- Large stretching of 8% induced TSC into fat cells, cartilage cells and bone cells.
- Low stretching beneficial, large mechanical loading adverse resulting in lipid accumulation, mucoid formation and tissue calcification
- Rat running studies

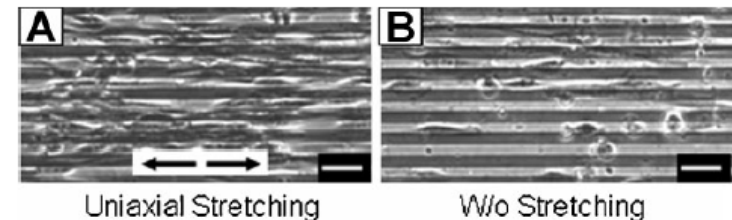


Figure 1. The application of cyclic uniaxial mechanical stretching to rabbit TSCs. (A) Morphology of stretched cells on the microgrooved surface (double arrow indicates stretching direction). (B) Morphology of TSCs on the nonstretched microgrooved surface. It is seen that more cells were present after stretching (A) compared to nonstretching control (B). (Bars = 30 μm .)

Tendinosis: a failed healing response

Epidemiology of Achilles tendinopathy



- Common in runners and jumpers
- 9% of recreational runners
- 5% of athletes have careers ended through this injury
- 5.6% of non-athletic population
- Older athletes – higher
- 66% midportion
- 20% insertional
- 14% retrocalcaneal bursa + insertion

Risk factors for Achilles tendinopathy



Predisposing & Susceptibility

- excessive foot pronation or supination
- calf weakness
- altered femoral or tibial mechanics
- genetic predisposition
- male sex
- central obesity
- Menopause
- Type 2 DM
- Years of running
- Poor muscle (gastroc) flexibility
- Decreased joint ROM (dorsiflexion)

Inciting

- Change in load (km, m/s, min)
- Decrease in recovery time
- Change of footwear
- Poor footwear



Causes of pain in the Achilles region

- Midportion Achilles tendinopathy
- Posterior impingement syndrome
- Insertional Achilles tendinopathy
- Retrocalcaneal bursitis + Haglunds
- Sever's disease
- Referred pain
- Tendon rupture
- Achilles tendinopathy 2^o to:
 - Lipid accumulation
 - Inflammatory (Rheuma)
 - Quinalone Antibiotics
 - Statin Rx
- Accessory soleus muscle
- Ingrowing palantaris tendon



Tendon injuries



- 2002 – Flouoroquinolones most commonly prescribed class of antibiotic in US adult population.
- Increasing association with Achilles tendon
- 2008 – black box warning of Achilles tendinopathy and rupture
- 3-6x increased risk of tendon problems or rupture
- Absolute risk of 7.74 per 100.000 days at risk and 3.2 /1000 patient years
- Mechanism free radical & toxin damage to watershed area of the tendon, remodeling of tendon and matrix disorder
- Association with increased age and corticosteroid use
- Discuss risk, alternate drugs.



Ciprofloxacin	500 750
Garenoxacin	400 600
Gatifloxacin	400
Gemifloxacin	320 640
Levofloxacin	500 750
Moxifloxacin	200 400

Fluoroquinolones and Tendinopathy: A Guide for Athletes and Sports Clinicians and a Systematic Review of the Literature

Trevor Lewis, MSc, MCSP*; Jill Cook, PhD†

- Tendinopathy can be a complication of treatment with fluoroquinolone antibiotics and usually is linked with 1 or more synergistic factors.
- Symptoms of fluoroquinolone-related tendinopathy can present within hours of starting treatment or up to 6 months after ceasing treatment, and recovery can be slower and require a less aggressive approach early in rehabilitation than for other types of tendinopathy.
- Treatment with fluoroquinolones should be discontinued and treatment with a nonquinolone antibiotic should be considered in patients who present with tendinopathy.
- Clinicians, athletes, athletic trainers, and medical support teams should be aware of and alert to the potential adverse effects of fluoroquinolones.

Persistent pain following ankle sprain: Bilateral accessory soleus muscles

M Neethling-du Toit, R V P de Villiers, E W Derman

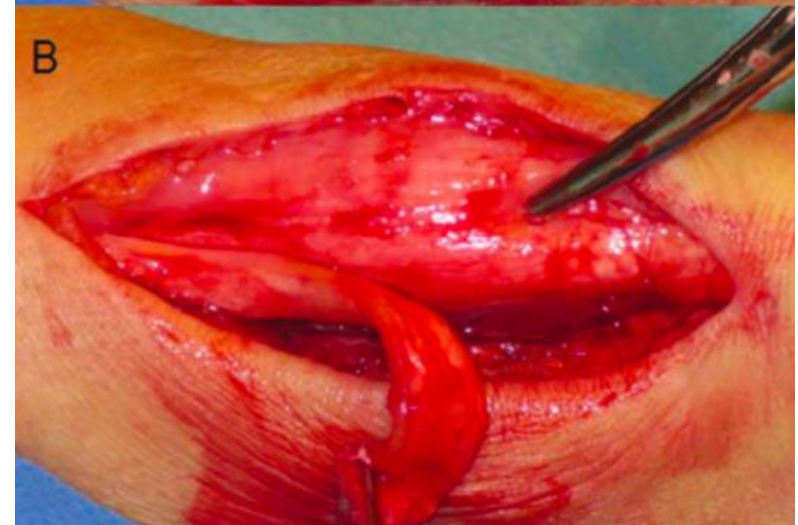
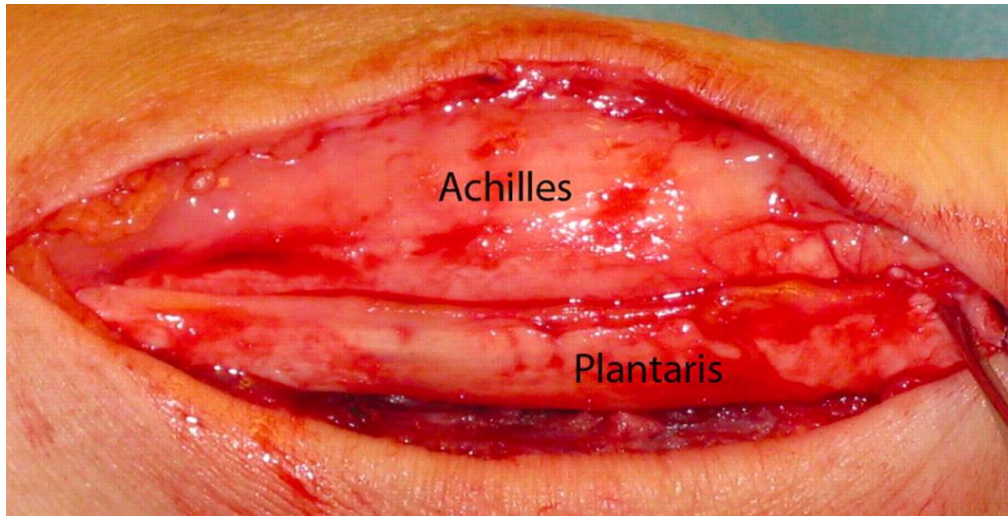


Fig. 1. Ultrasound of left accessory soleus muscle: same echogenicity and appearance as the underlying flexor hallucis longus muscle.



Fig. 2. Left ankle MRI: posteromedial insertion (arrow) of the accessory soleus muscle onto the calcaneus via a thin tendon.

Plantaris tendinopathy/invagination



The VISA A questionnaire



IN THIS QUESTIONNAIRE, THE TERM PAIN REFERS SPECIFICALLY TO PAIN IN THE ACHILLES TENDON REGION.

1. For how many minutes do you have stiffness in the Achilles region on first getting up?
 100 mins 0 mins Points:

2. Once you are warmed up for the day, do you have pain when stretching the Achilles tendon fully over the edge of a step? (keeping knee straight)
 strong severe pain no pain Points:

3. After walking on flat ground for 30 minutes, do you have pain within the next 2 hours? (If unable to walk on flat ground for 30 minutes because of pain, score 0 for this question).
 strong severe pain no pain Points:

4. Do you have pain walking downstairs with a normal gait cycle?
 strong severe pain no pain Points:

5. Do you have pain during or immediately after doing 10 (single leg) heel raises from a flat surface?
 strong severe pain no pain Points:

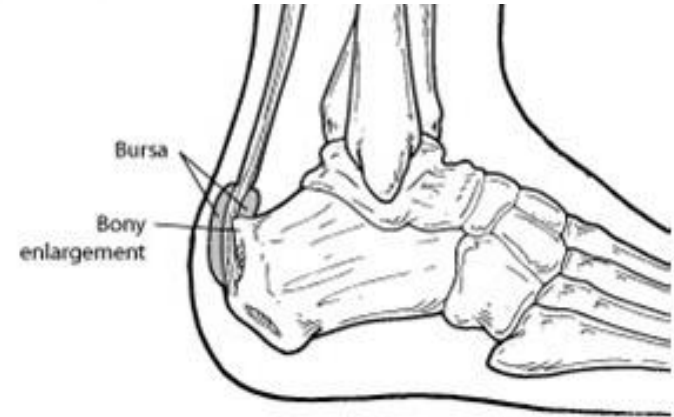
6. How many single leg hops can you do without pain?
 strong severe pain/unable no pain Points:

7. Are you currently undertaking sports or other physical activity?
 0 = Not at all
 4 = Modified training ± modified competition
 7 = Full training ± competition but not at same level as when symptoms began
 10 = Competing at the same or higher level as when symptoms began Points:

8. Please complete **EITHER A, B or C** in this question.
 - If you have no pain while undertaking Achilles tendon loading sports, please complete **Q8A only**.
 - If you have pain while undertaking Achilles tendon loading sports but it does not stop you from completing the activity, please complete **Q8B only**.
 - If you have pain which stops you from completing Achilles tendon loading sports, please complete **Q8C only**.
 A. If you have no pain while undertaking Achilles tendon loading sports, for how long can you train/practice?
 0 = Nil 1-10 mins = 7 11-20 mins = 14 21-30 mins = 21 >30 mins = 30 Points:
 OR
 B. If you have some pain while undertaking Achilles tendon loading sports, but it does not stop you from completing your training/practice, for how long can you train/practice?
 0 = Nil 1-10 mins = 4 11-20 mins = 10 21-30 mins = 14 >30 mins = 20 Points:
 OR
 C. If you have pain that stops you from completing your training/practice in Achilles tendon loading sports, for how long can you train/practice?
 0 = Nil 1-10 mins = 2 11-20 mins = 5 21-30 mins = 7 >30 mins = 10 Points:

TOTAL SCORE (/100):

Clinical examination: Haglund's



Clinical examination



Forced plantar flexion test

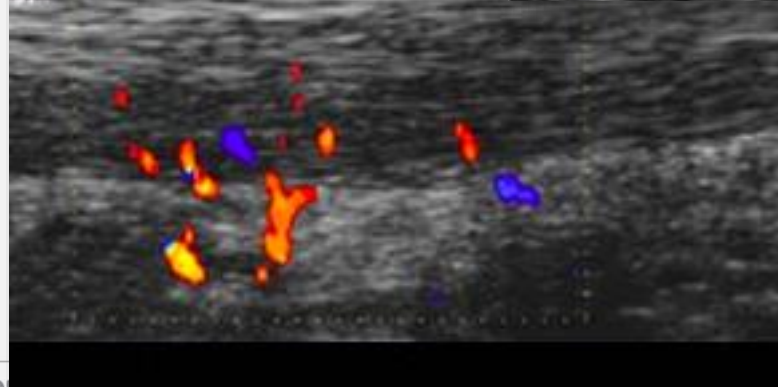
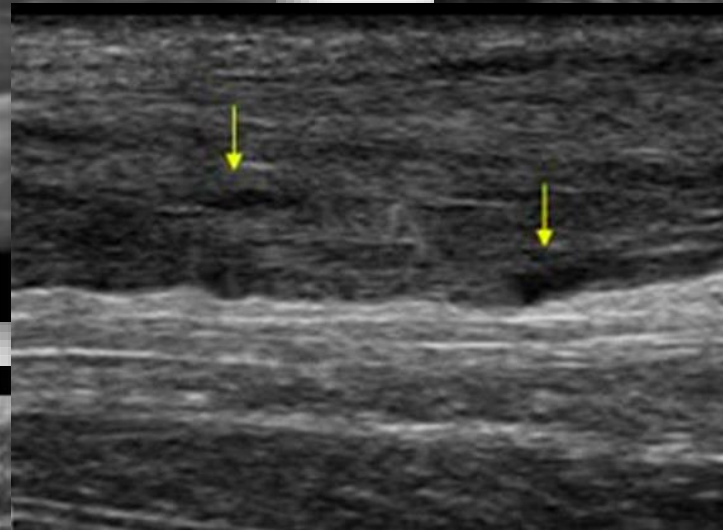
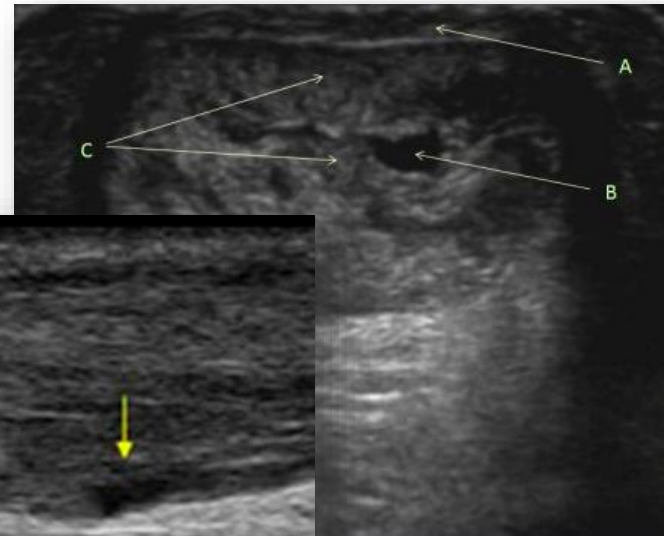
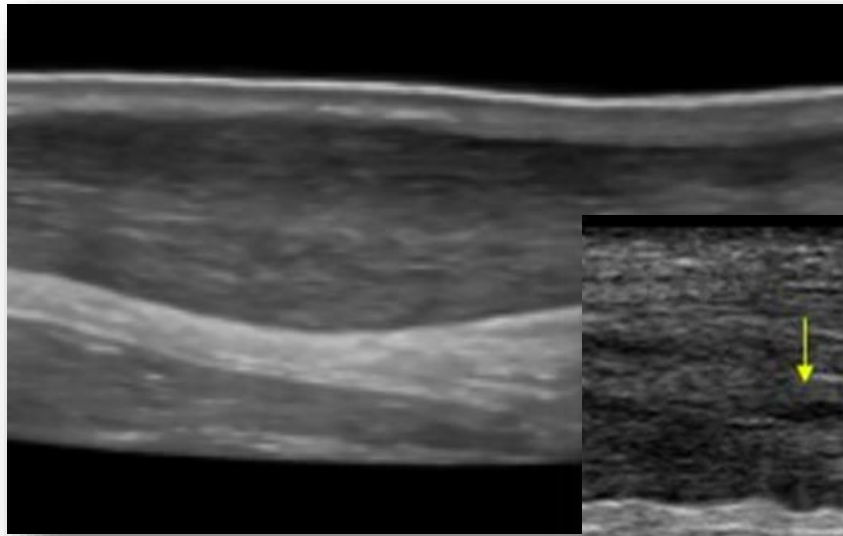
- This test is to be used in assessment of the patient with Achilles tendon discomfort. The patient assumes the prone position on the plinth and the knee of the affected limb is then flexed.
- The investigator places her hands on the heel and the dorsum of the foot and forcible plantar flexes the foot.
- This maneuver is painful if posterior impingement is present.

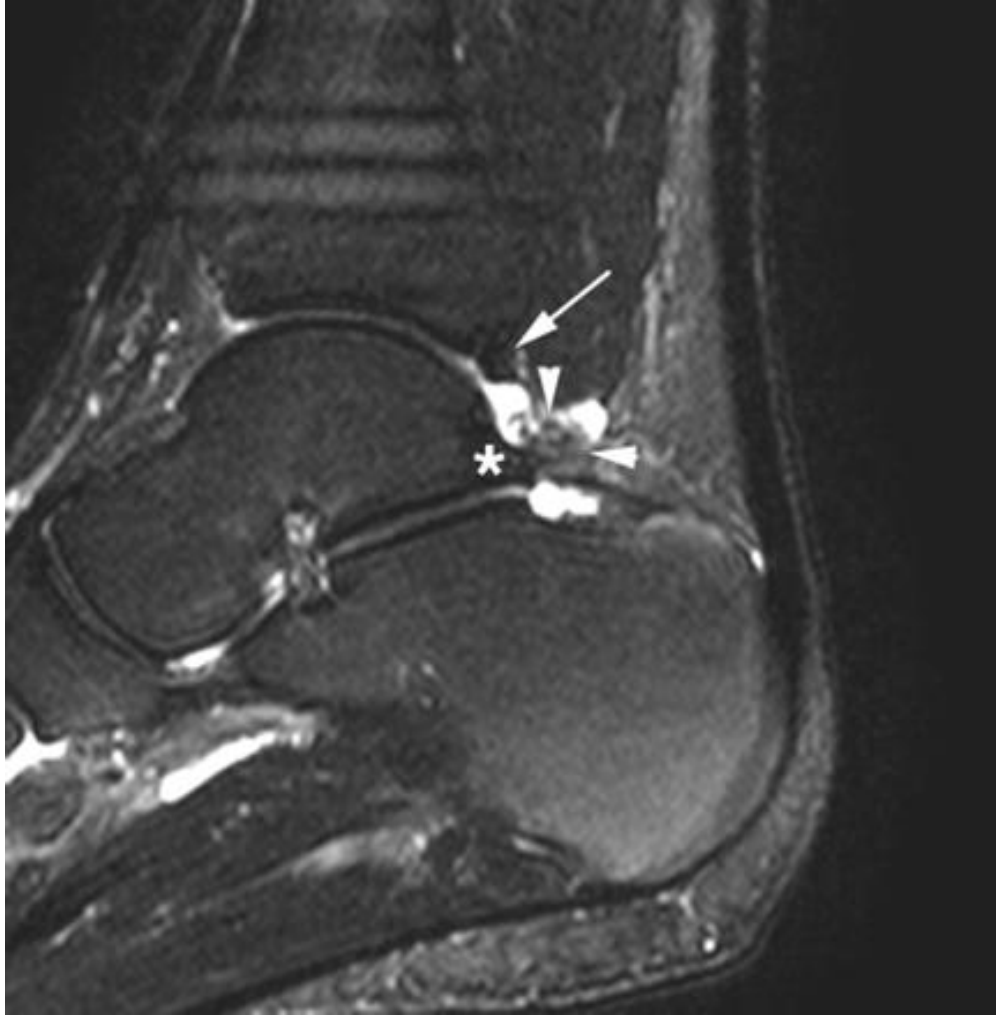


Clinical tests for possible Achilles rupture



Imaging in Achilles tendinopathy





Management strategy for Chronic AT



- Address risk factors (Step 1)
 - Load mx
 - Footwear
 - Weightloss
- Pain management (Step 2)
 - Heel raise
 - Night splint
 - NSAID (hyper-reactive tendon only)
 - Corticosteroid (paratenon or bursal involvement only)
 - Nitrate patches
- Loading strategies and foot core (Step 3)
- Pro-inflammatory Interventions (Step 4)
 - ECSWT
 - PRP
- IF No Response (Step 5)
 - HVTI
 - Tenex or other



Heavy-Load Eccentric Calf Muscle Training For the Treatment of Chronic Achilles Tendinosis

Håkan Alfredson, MD, Tom Pietilä, RPT, Per Jonsson, RPT, and
Ronny Lorentzon,* MD, PhD

362 Alfredson et al.

American Journal of Sports Medicine

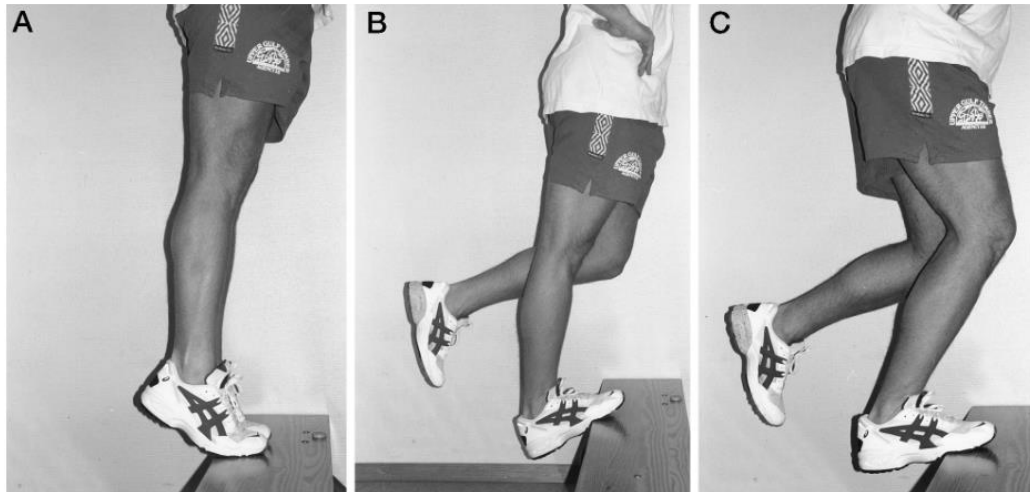


Figure 1. From an upright body position and standing with all body weight on the forefoot and the ankle joint in plantar flexion lifted by the noninjured leg (A), the calf muscle was loaded eccentrically by having the patient lower the heel with the knee straight (B) and with the knee bent (C).

3 x 15
2 x day
Insertional – not past neg

Heavy Slow Resistance Versus Eccentric Training as Treatment for Achilles Tendinopathy

A Randomized Controlled Trial

Rikke Beyer,^{*†} PT, MSc, Mads Kongsgaard,[†] PhD, Birgitte Hougs Kjær,^{*} PT, MSc, Tommy Øhlenschläger,[†] MD, Michael Kjær,[†] MD, DMSci, and S. Peter Magnusson,^{*†‡} PT, DMSci

Investigation performed at Bispebjerg Hospital, Copenhagen and Medical Sciences, University of Copenhagen, Copenhagen

THE LATEST: ISOMETRIC HOLDS!

Individualized Rx



Figure 1. Depiction of applied heavy slow resistance exercises: (A) heel rises with bended knee in the seated calf raise machine, (B) heel rises with straight knee standing on a disc weight with the forefoot with the barbell on shoulders, (C) heel rises with straight knee in the leg press machine. All exercises are performed bilateral with equal weight on both legs.

Management strategy for Chronic AT



- Address risk factors (Step 1)
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 - PRP
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 - Tenex or other



Platelet Rich Plasma



Review of literature

Acta Orthop Belg. 2013 Feb;79(1):10-5.

Platelet-rich plasma application in the management of chronic tendonitis

Kaux JF, Crielaard JM.

Department of Motricity Sciences, Service of Physical Medicine and Sports Traumatology, University of Liege, Belgium. j.kaux@chu.ulg.ac.be

Abstract

Platelet-rich plasma (PRP) may represent a new therapeutic approach for the management of chronic tendonitis, which promote angiogenesis, tissue remodeling and collagen synthesis. This review of the use of PRP in chronic tendonitis, including epicondylitis, rotator cuff tendinopathies, and Achilles tendinopathy, was conducted (until July 31, 2012). Clinical studies included. Articles with a high level of evidence were selected. Despite the proven efficacy of PRP on tissue regeneration in experimental studies, the few studies that have been performed in chronic tendonitis with appropriate placebo groups are needed to determine the real effectiveness of PRP in chronic tendonitis.

“Despite the proven efficacy of PRP on tissue regeneration in experimental studies – scanty tangible clinical evidence with respect to its efficacy in chronic tendon disorders”

High volume stripping injection

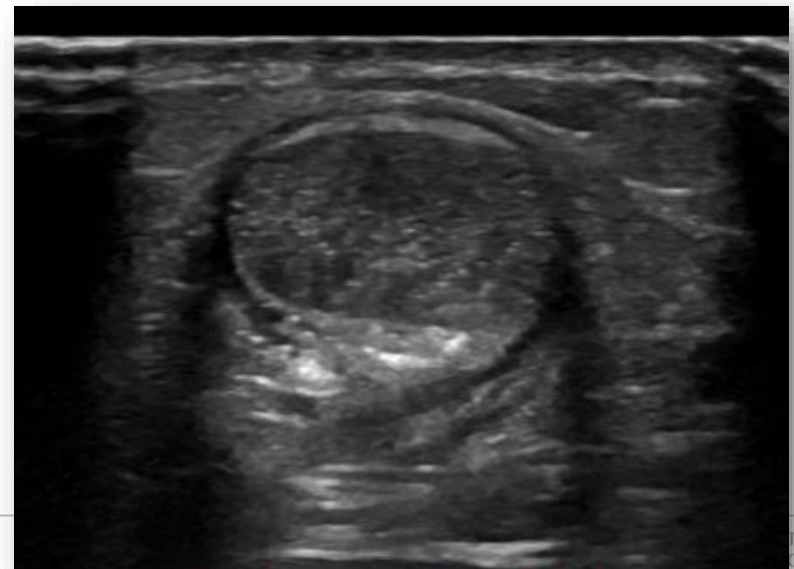


What do I use?

40 ml Saline

10 ml Marcaine

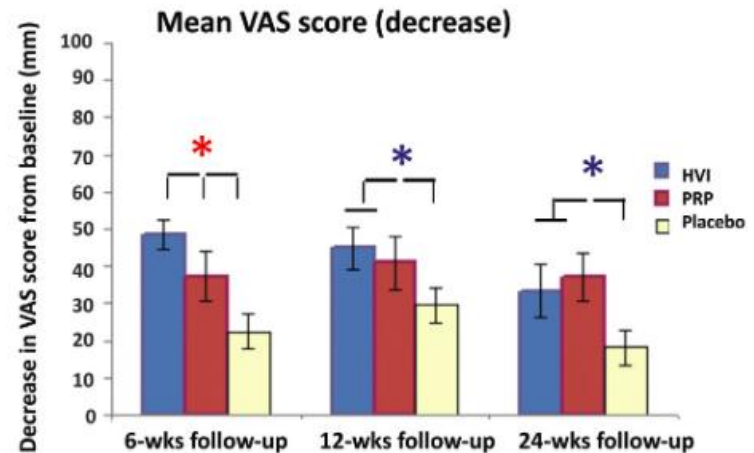
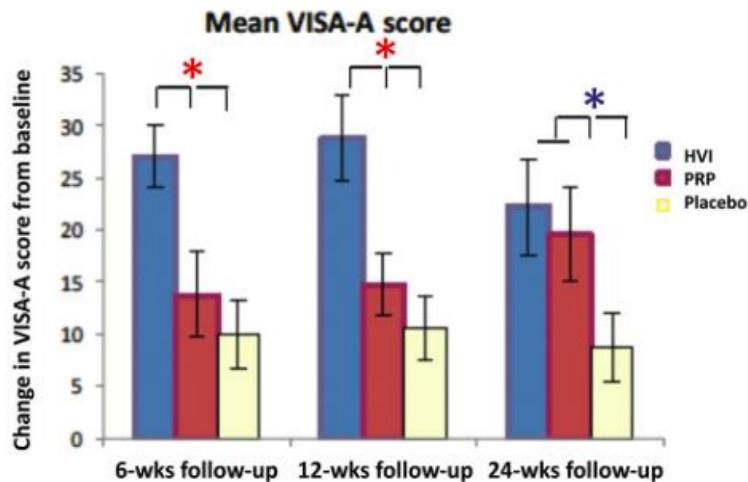
2 ml Celestone Sol



Effect of High-Volume Injection, Platelet-Rich Plasma, and Sham Treatment in Chronic Midportion Achilles Tendinopathy

A Randomized Double-Blinded Prospective Study

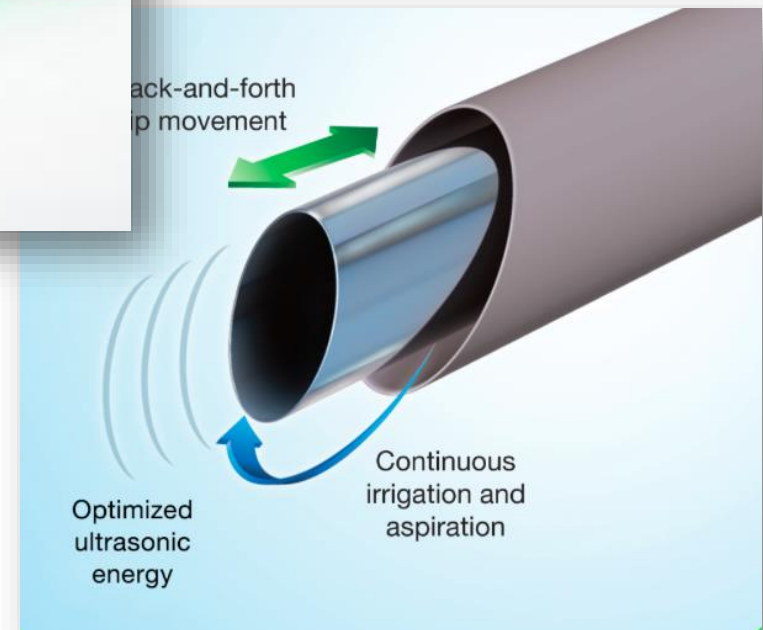
Anders Ploug Boesen,^{*†‡} MD, PhD, Rudi Hansen,[†] PT, MSc, Morten Ilum Boesen,[§] MD, PhD, Peter Malliaras,^{||} BPhysio (Hons), PhD, and Henning Langberg,[¶] DrMed, PhD, DMSc
Investigation performed at the Institute of Sports Medicine, Bispebjerg Hospital, Copenhagen, Denmark



Treatment with HVI or PRP in combination with eccentric training in chronic AT seems more effective in reducing pain, improving activity level, and reducing tendon thickness and intratendinous vascularity than eccentric training alone.

HVI may be more effective in improving outcomes of chronic AT than PRP in the short term.

Percutaneous tenotomy



Epidemiology of Plantar fasciopathy



- Point prevalence 3.6-7%
- 1 million visits to med professionals a year in USA
- Significant health burden
- 8% of running injuries
- Younger – lower prevalence
- Older athletes – higher
- Sex – conflicting
- Self limiting (24 mths)
- Painful & disabling affecting QOL



Plantar fasciopathy: Revisiting the risk factors

P. Beeson BSc, MSc, PhD, FFPM RCSP (Glasg)*

Senior Lecturer School of Health, The University of Northampton, United Kingdom

Intrinsic

- Increased age
- Obesity
- Decreased ankle dorsiflexion due to tight Achilles
- Tight posterior lower limb muscles esp hamstrings
- Rheumatological disease
- Diabetes
- Chemotherapy

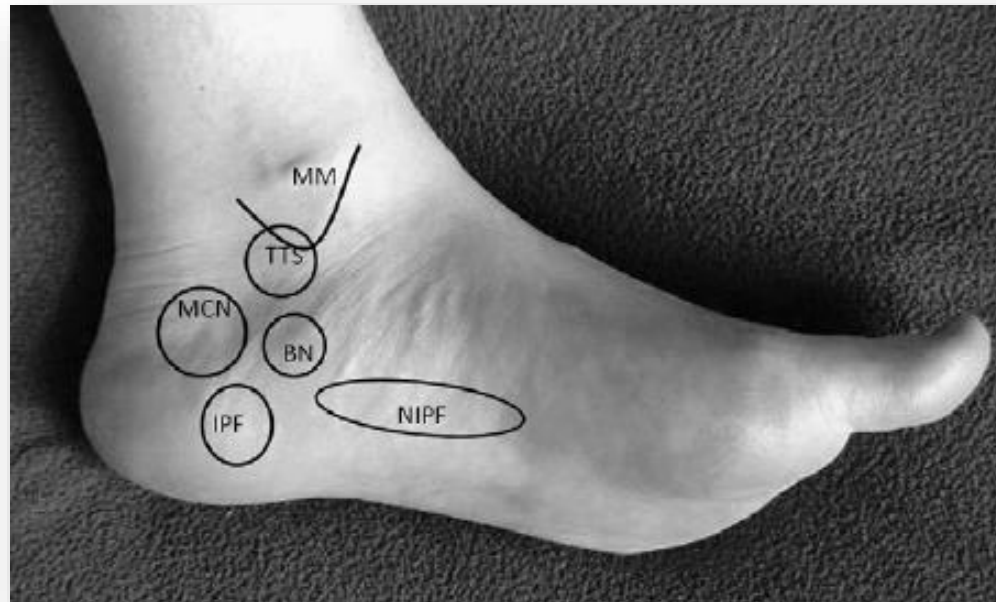
Extrinsic

- Occupation
 - Prolonged weight bearing
 - Change in surface (hard)
- Physical load
 - Excessive foot pronation
 - Rearfoot eversion
 - Arch height collapse
- Inappropriate footwear
- Sleeping posture
- Sport and load issues

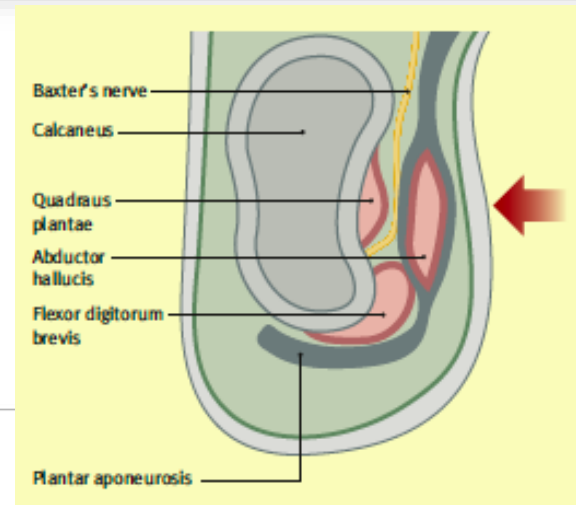
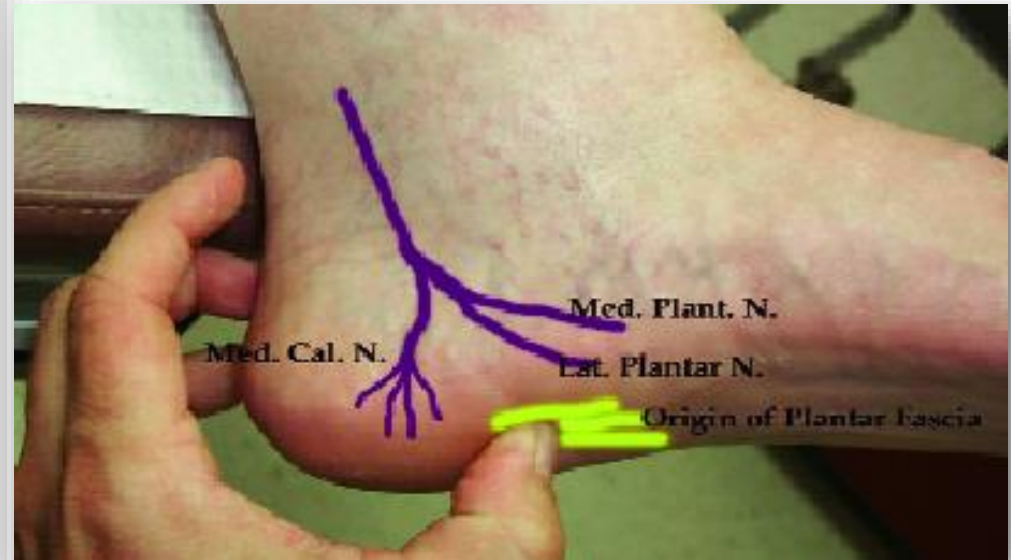
Differential diagnosis of plantar fasciopathy



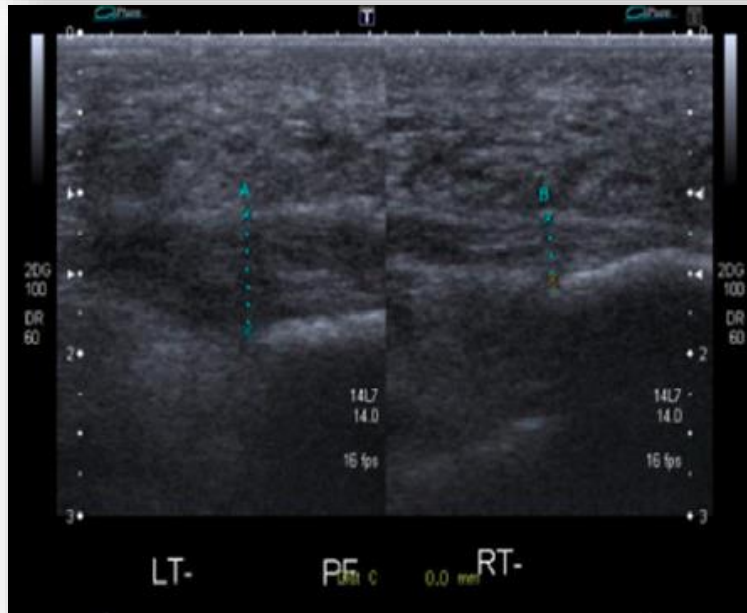
- Fat pad contusion
- Calcaneal bone stress injury
- Medial calcaneal nerve entrapment
- FHL tendinitis
- Lateral plantar nerve entrapment
- Tarsal tunnel syndrome
- Talar dome stress injury
- Retro-calcaneal bursitis
- Osteoid osteoma
- Rheumatological conditions
- Referred pain
- RSD
- ?Multiple structure pathology



Clinical tests for plantar heel pain



Imaging of plantar heel pain (PF)

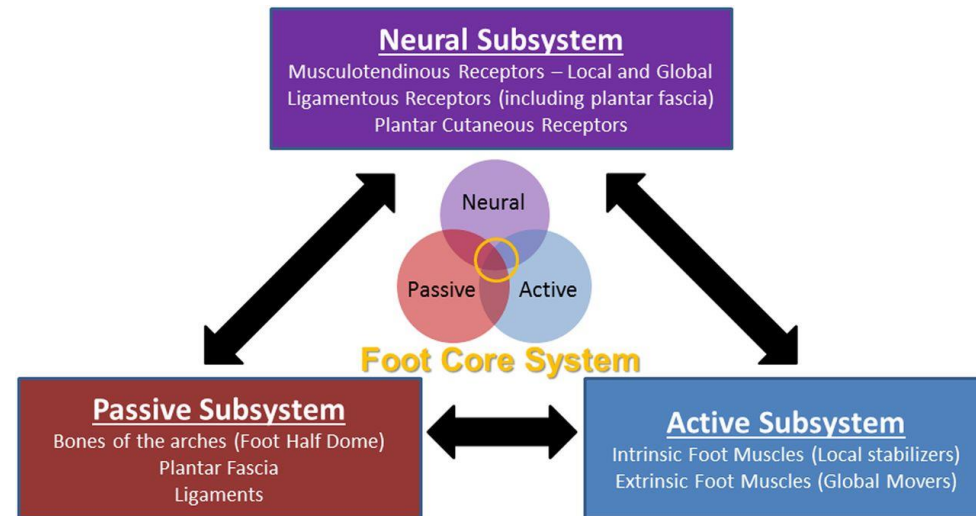


The foot core system: a new paradigm for understanding intrinsic foot muscle function



Patrick O McKeon,¹ Jay Hertel,² Dennis Bramble,³ Irene Davis⁴

- The foot core system is comprised of interacting subsystems that provide relevant sensory input and functional stability for accommodating to changing demands during both static and dynamic activities. The interaction of these subsystems is very similar to the lumbopelvic core system.
- The plantar intrinsic foot muscles within the active and neural subsystems play a critical role in the foot core system as local stabilisers and direct sensors of foot deformation.
- Assessment of the foot core system can provide clinical insight into the ability of the foot to cope with changing functional demands.
- Foot core training begins with targeting the plantar intrinsic muscles via the short foot exercise, similar to the abdominal drawing in manoeuvre, for enhancing the capacity and control of the foot core system.



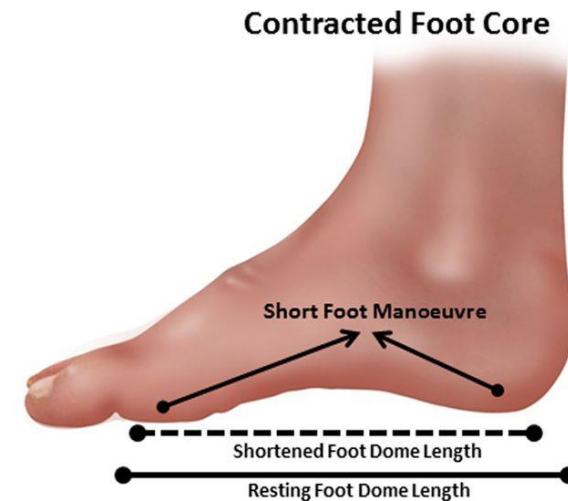
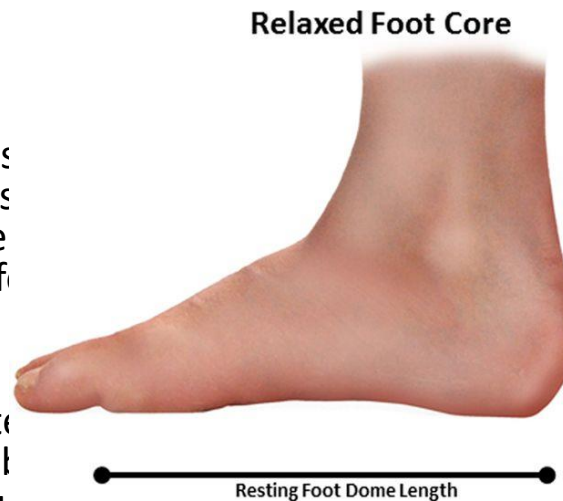
The foot core system: a new paradigm for understanding intrinsic foot muscle function



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- Assessment of the foot core system provides clinical insight into the ability of the foot to cope with changing functional demands.
- Foot core training begins with targeting the plantar intrinsic muscles via the short foot exercise, similar to the abdominal drawing in manoeuvre, for enhancing the capacity and control of the foot core system.



Update on Evidence-Based Treatments for Plantar Fasciopathy



David Berbrayer, MD, Michael Fredericson, MD

Table 1. Levels of evidence of effectiveness for the management of plantar fasciopathy*

Acute Plantar Fasciopathy <4wk	Subacute Plantar Fasciopathy 4-12wk	Chronic Plantar Fasciopathy >12w
Plantar fascial and Achilles tendon stretching (high evidence)	Ultrasonographically guided dexamethasone injection (high evidence)	Extracorporeal shock wave/sound therapy (high evidence)
Over-the-counter arch supports/heel cushions (medium evidence)		Foot orthotics (medium evidence)
		Botulinum toxin A (medium evidence)
		Night splints (medium evidence)
Iontophoresis (medium evidence)	Acupuncture (low evidence)	
Low-dye taping (medium evidence)	Manual therapy (low evidence)	
Oral nonsteroidal anti-inflammatory drugs (low evidence)		
Manual therapy (low evidence)		

*The formulation and grading of the recommendations in Table 1 were based on a review of the literature and on the 5 components of the FORM framework for evidence-based clinical guidelines: evidence based, consistency, clinical impact, generalizability, and applicability (Hillier S, Grimmer-Somers K, Merlin T, et al. FORM: An Australian method for formulating and grading recommendations in evidence-based clinical guidelines. BMC Med Res Method 2011;11:23).



What is my current practice?

- All patients in early stage get mild stretching and self rolling exercises followed by foot core exercise
- All patients get risk factor correction
- For stubborn morning pain – exoform night splint/boot/ Strasbourg sock
- Appropriate footwear
- One pro-inflammatory intervent
– ECSWT, Needling, PRP



Corticosteroid injections for PF





Some take home messages!

- Up to 80% of patients with AT or PF will be healed with conservative approach.
- Have a patient centered graded approach to your management.
- Limited use of corticosteroids.
- Restrict use of quinalone Antibiotics
- Weight loss is NB in both conditions
- Pro – inflammatory Mx/HVSI are promising.

Thank you for your attention!

