The Kintec Group Presents

Current Concepts Review on Management of Recalcitrant Plantar Fasciitis

PRESENTERS

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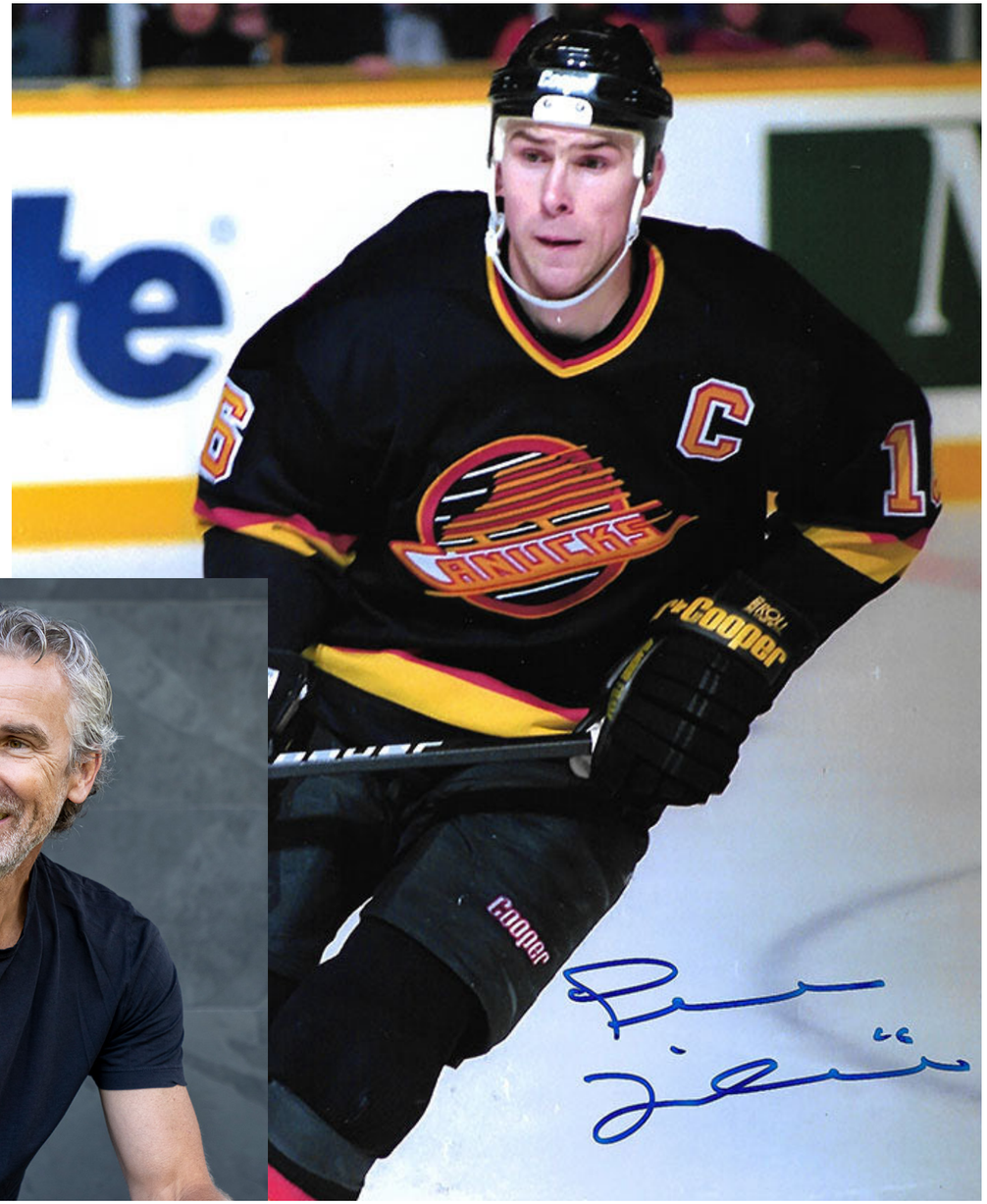
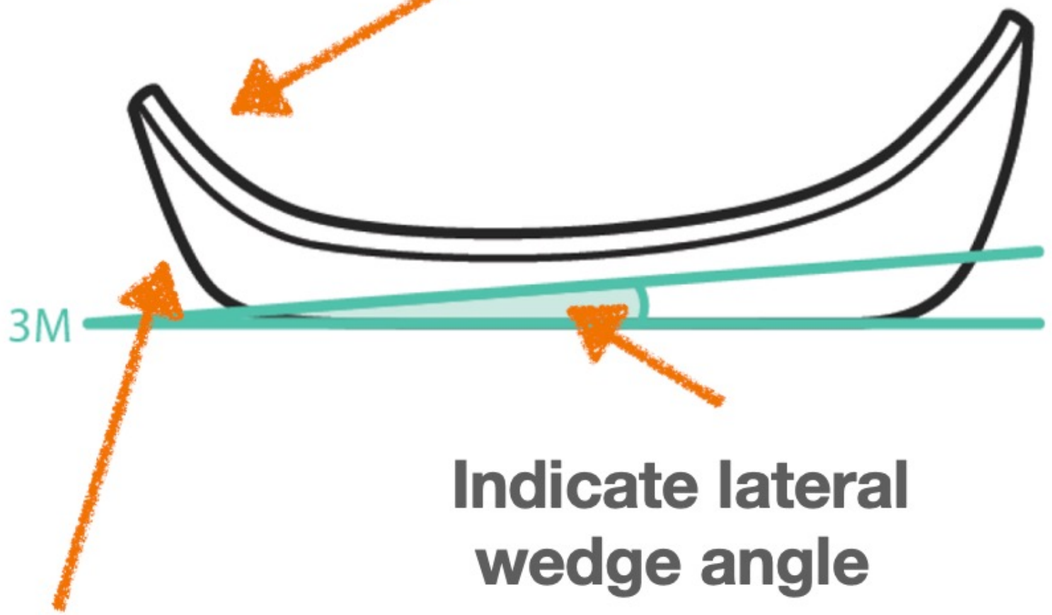


Metatarsalgia: Clinical Profile and Comfort from Foot Orthoses Treatment. Robb K & Ryan M. 2024 Accepted

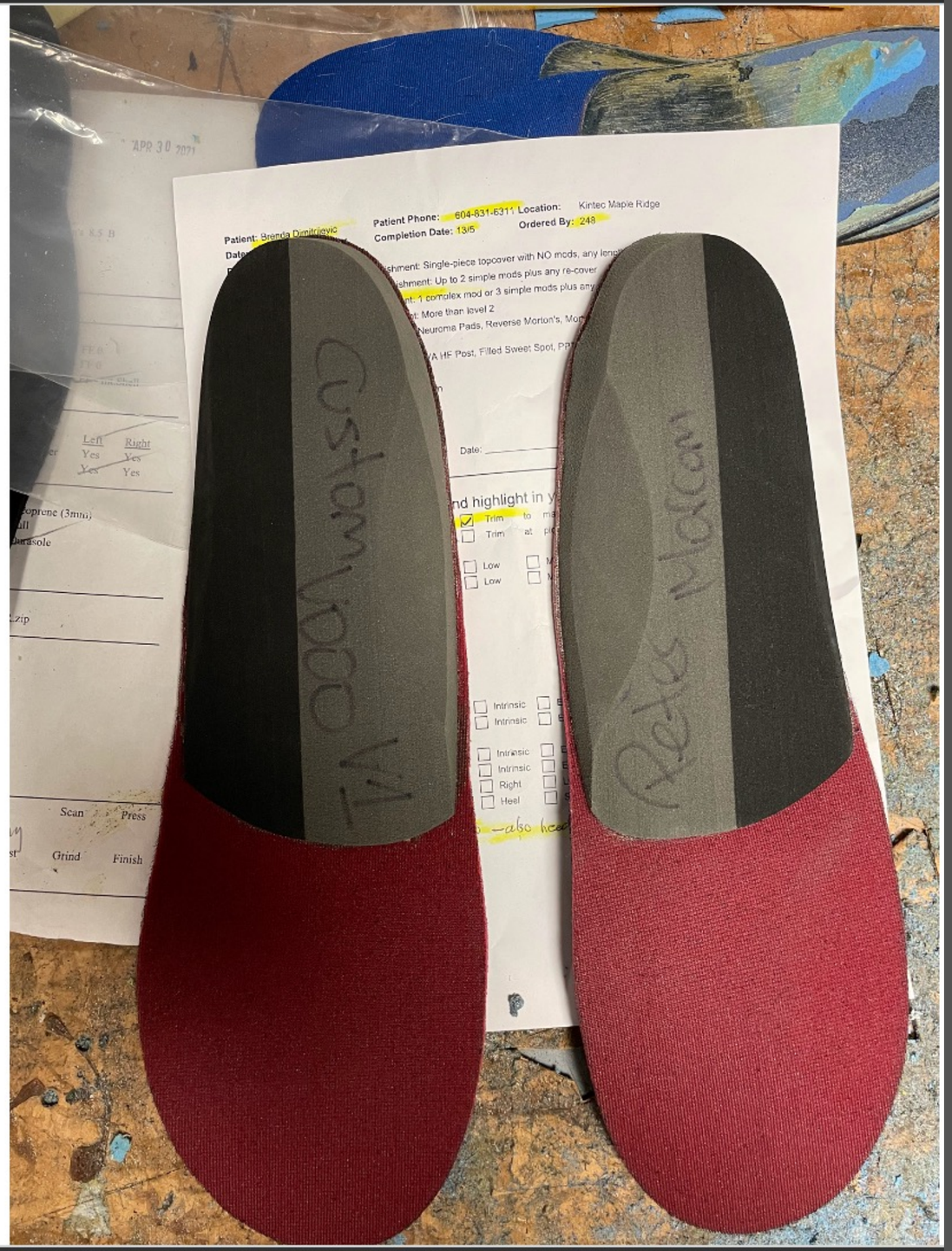
Custom VDOO

Customize arch contouring

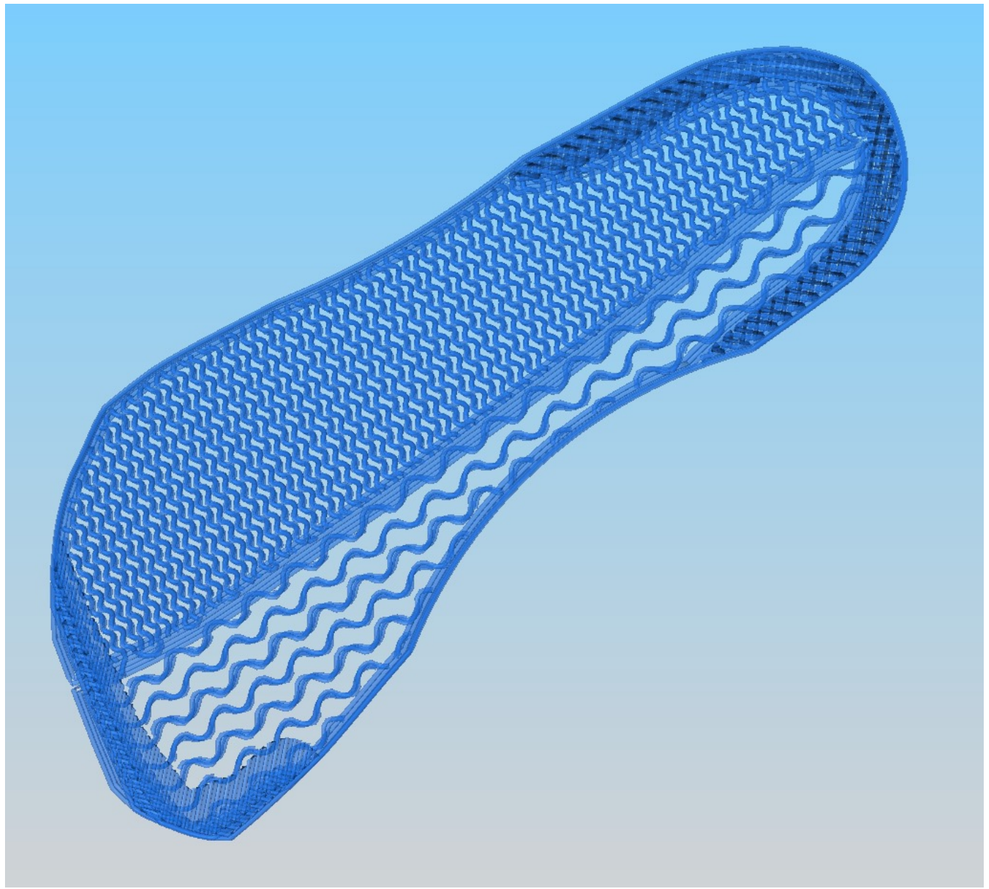


Indicate lateral wedge angle

Customize foot/ankle support

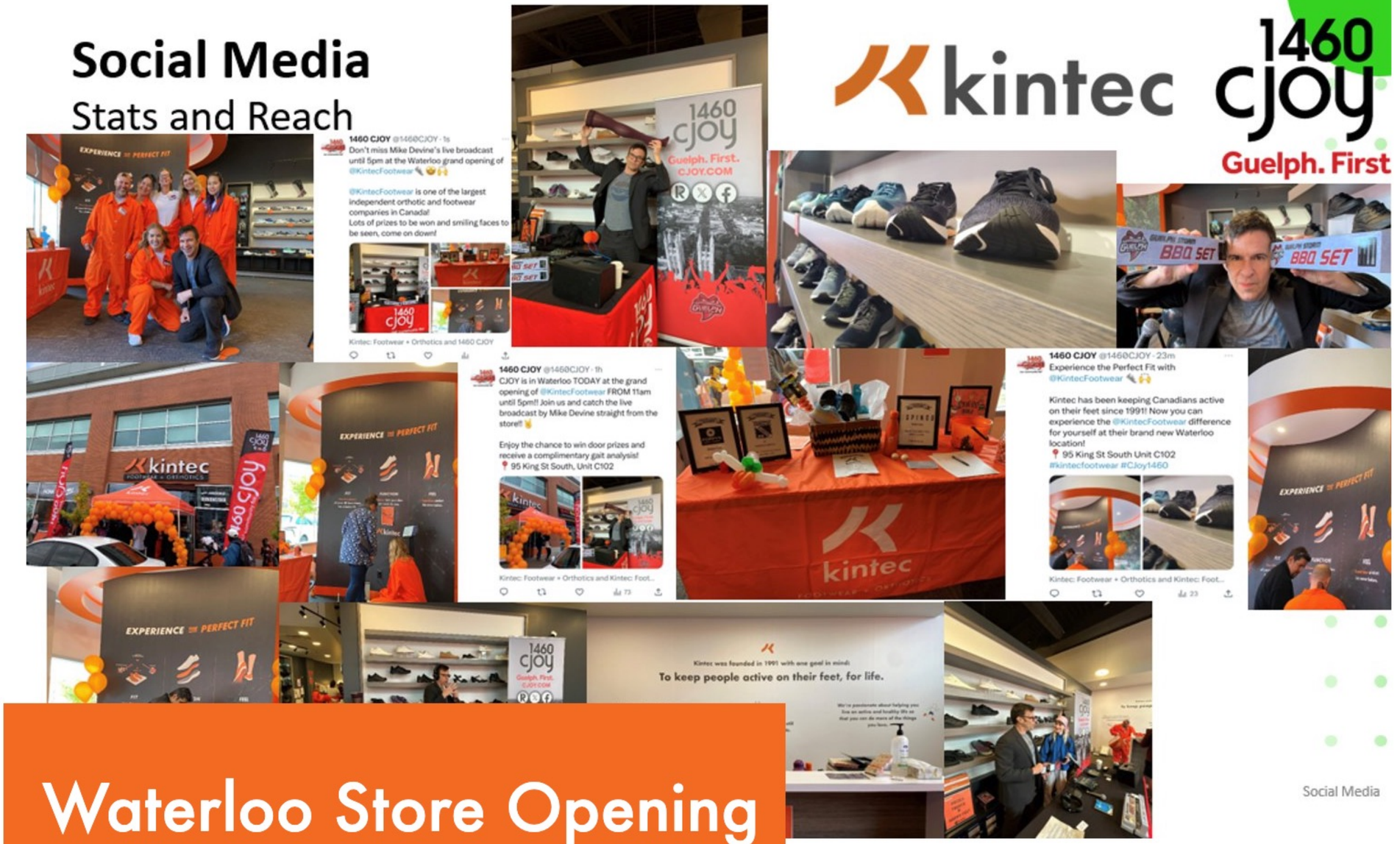


3D PRINTING



Social Media

Stats and Reach

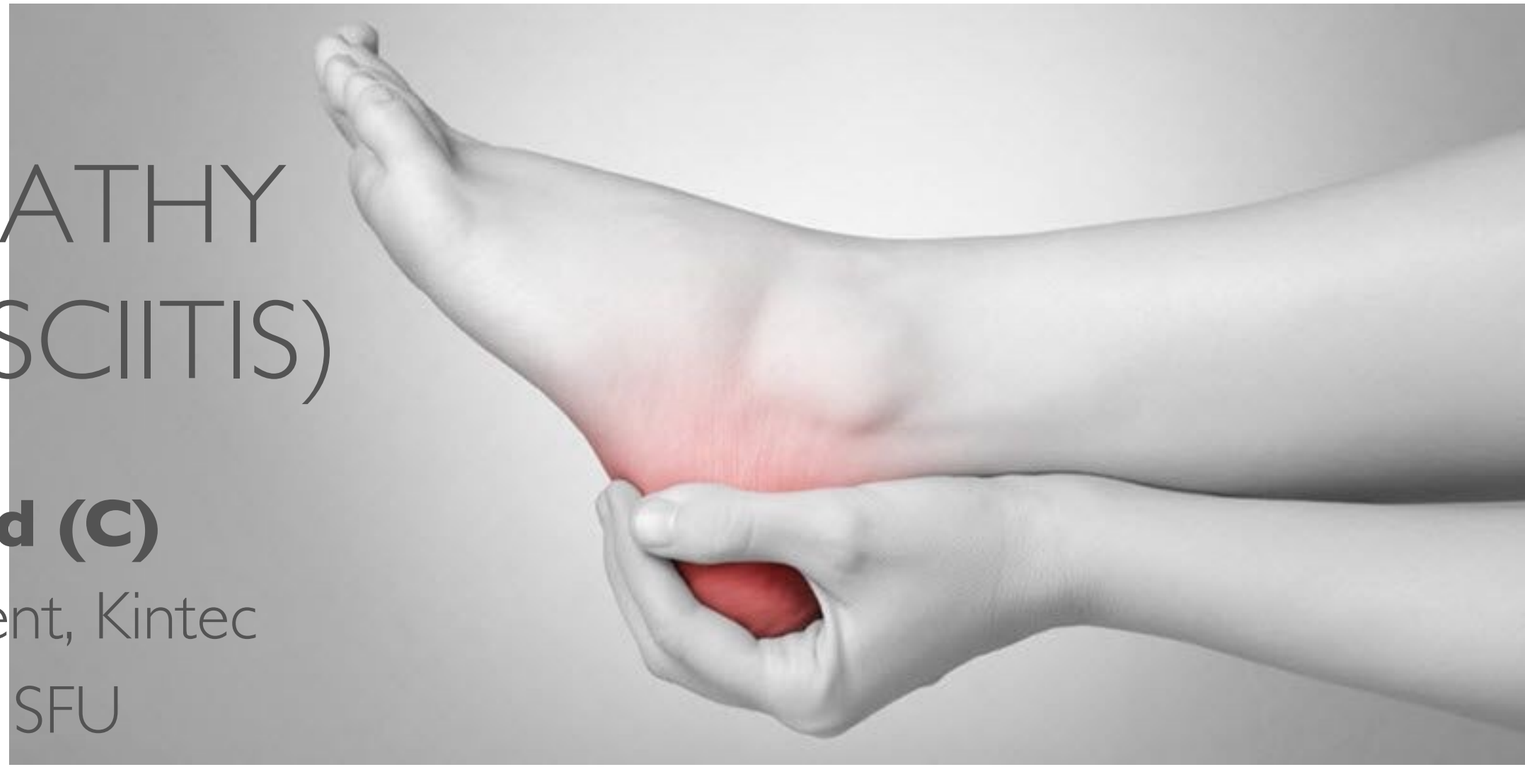


Waterloo Store Opening

Whitby Store Opening

Vernon Store Opening

PLANTAR FASCIOPATHY (A.K.A. PLANTAR FASCIITIS)



Michael Ryan PhD, C Ped (C)
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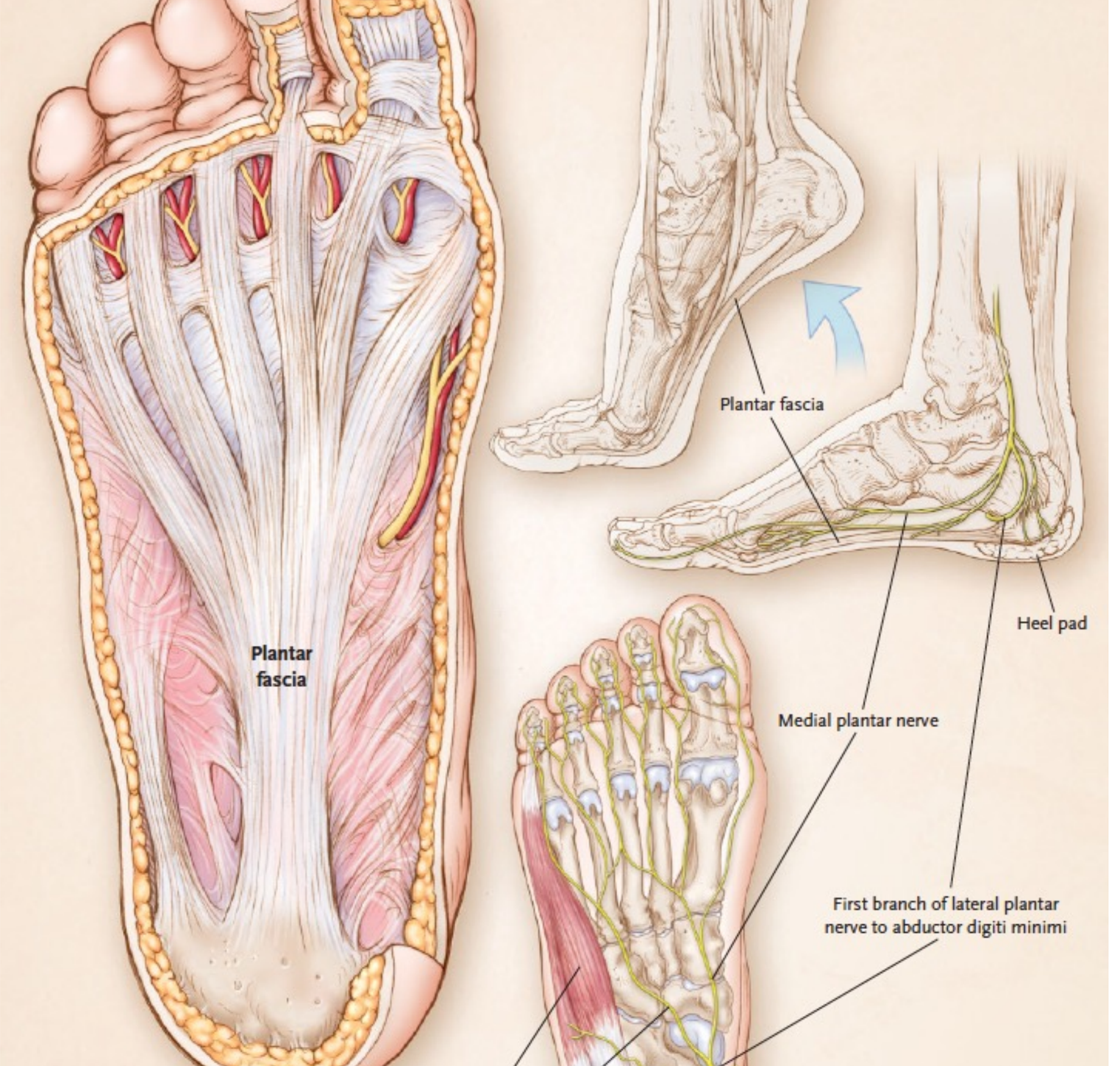
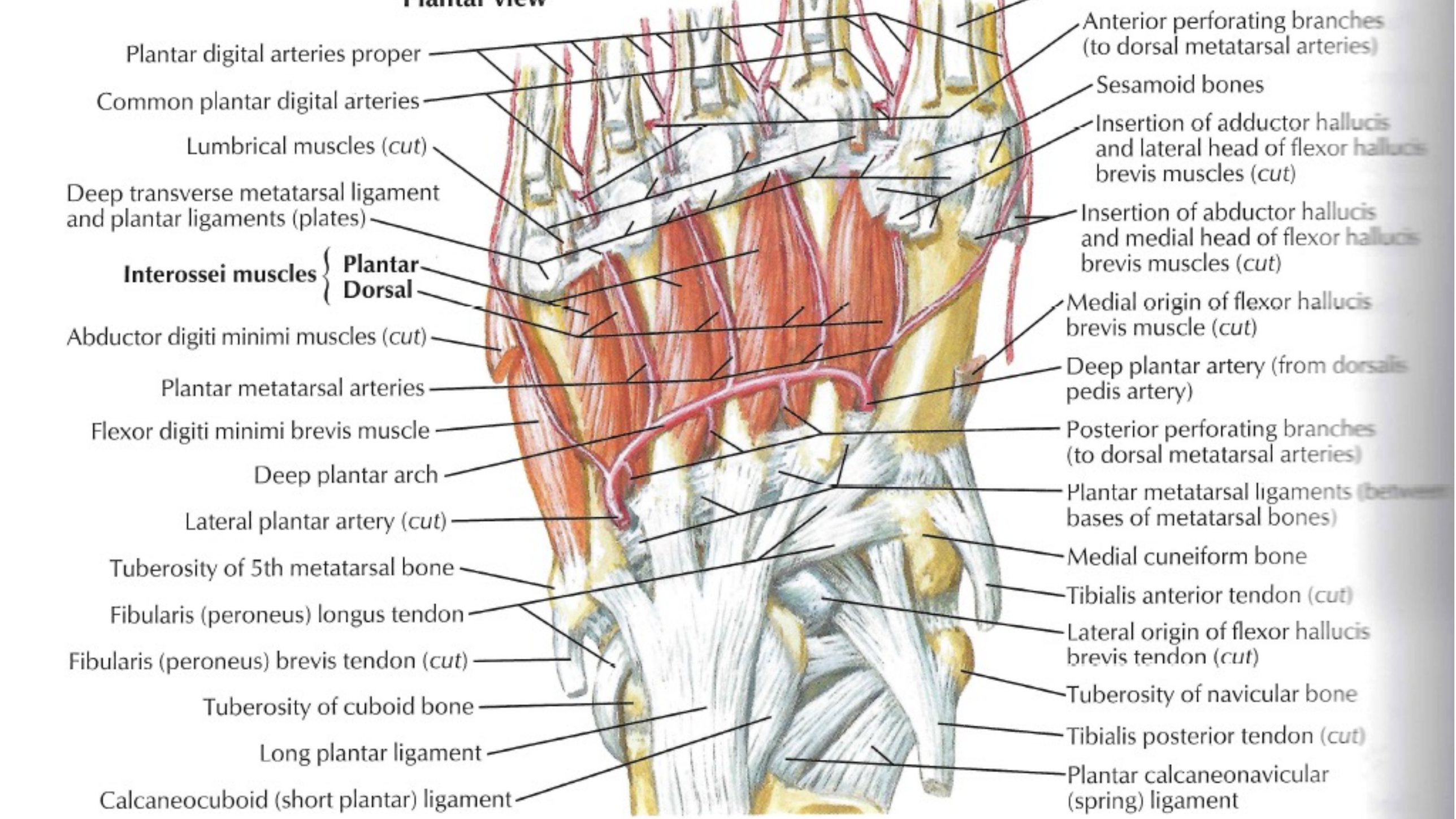
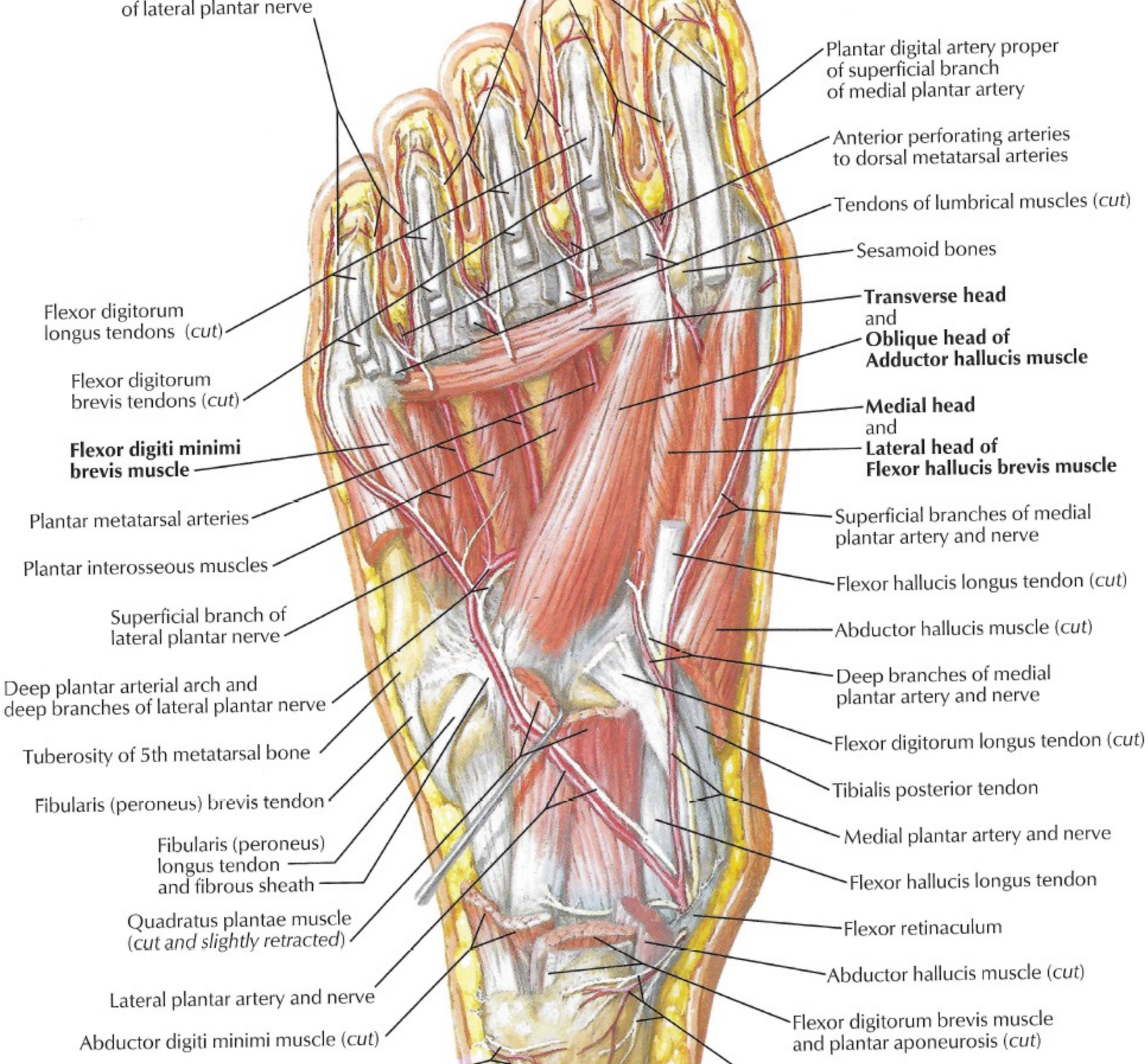
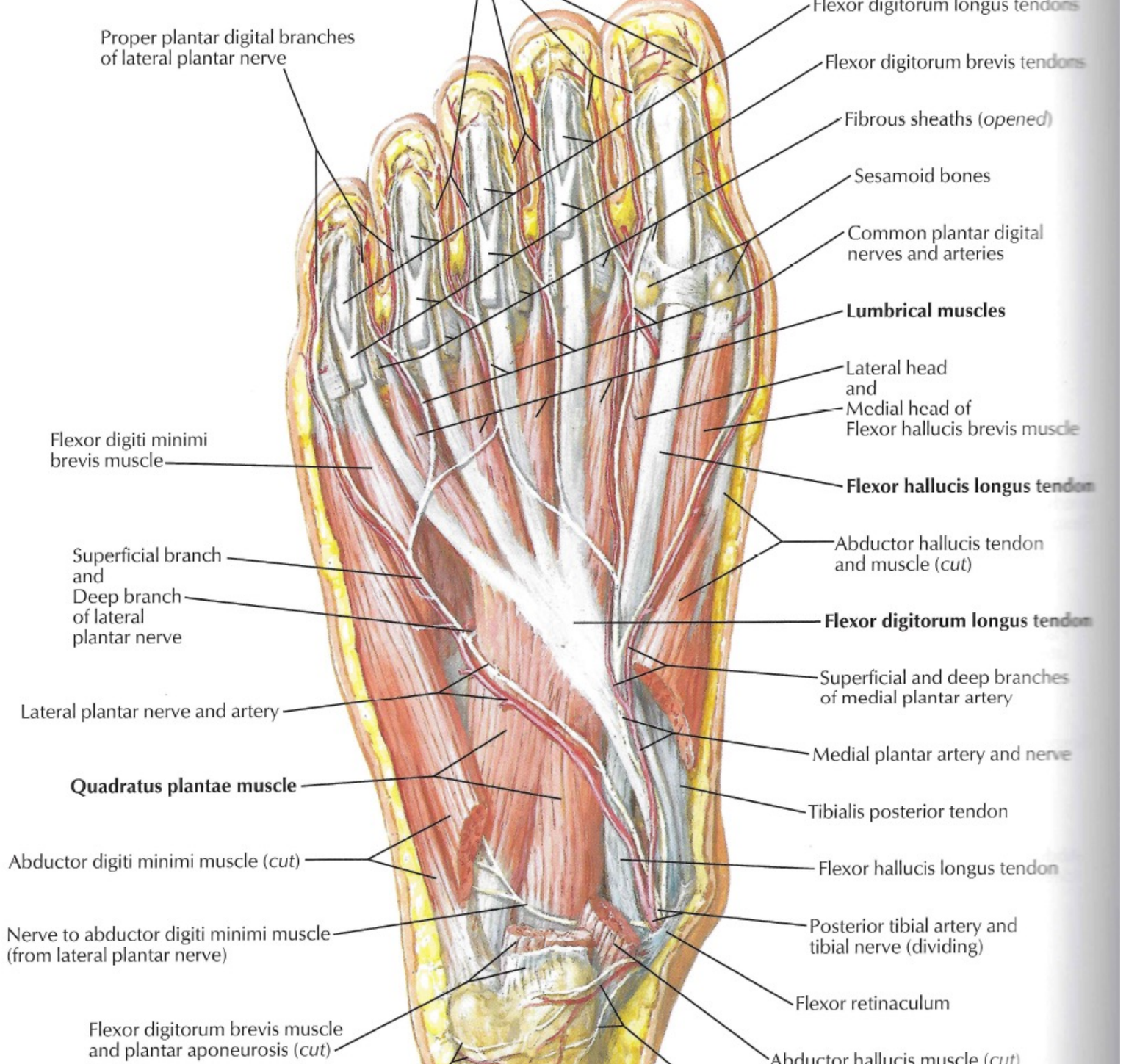
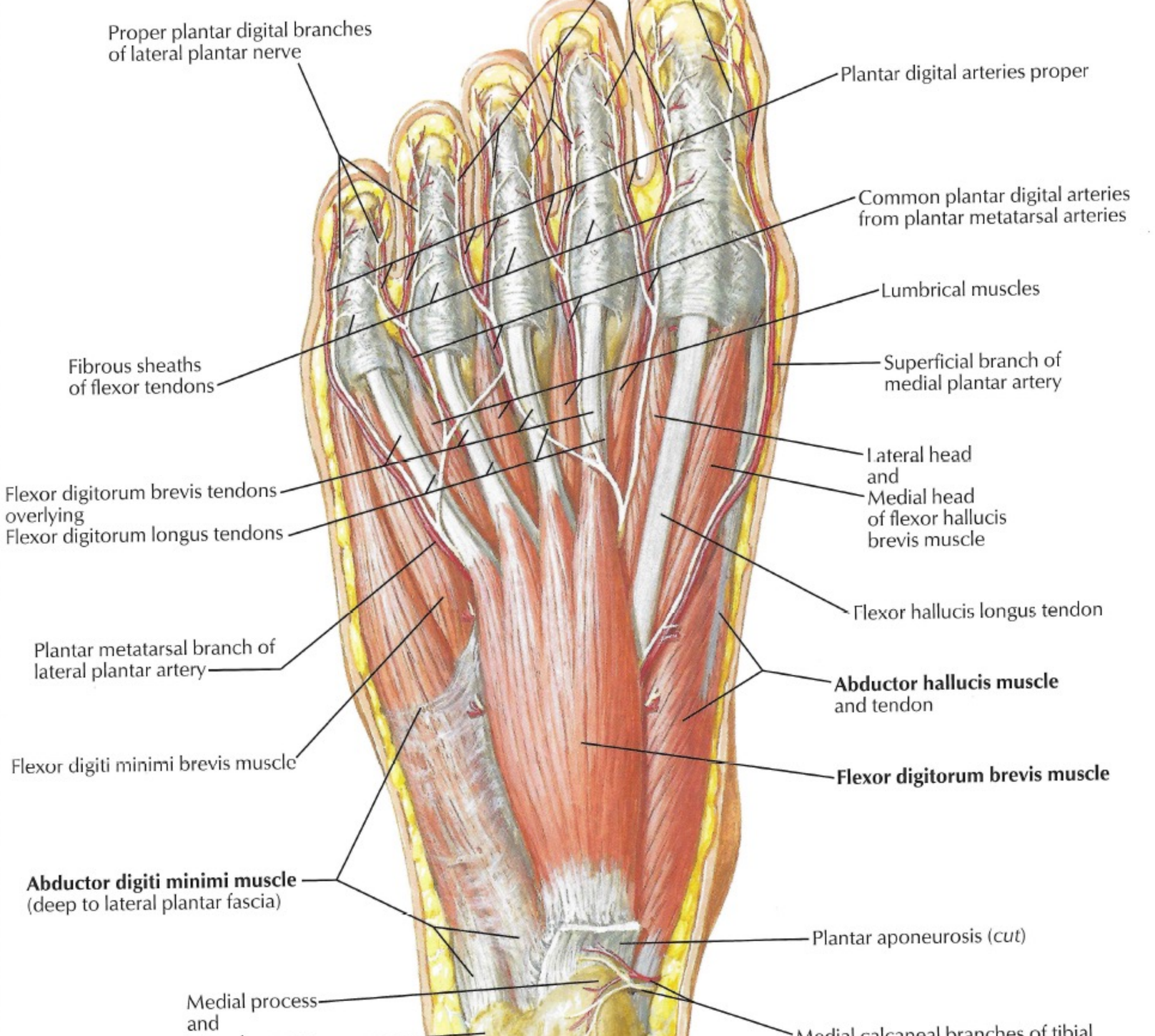
PREAMBLE

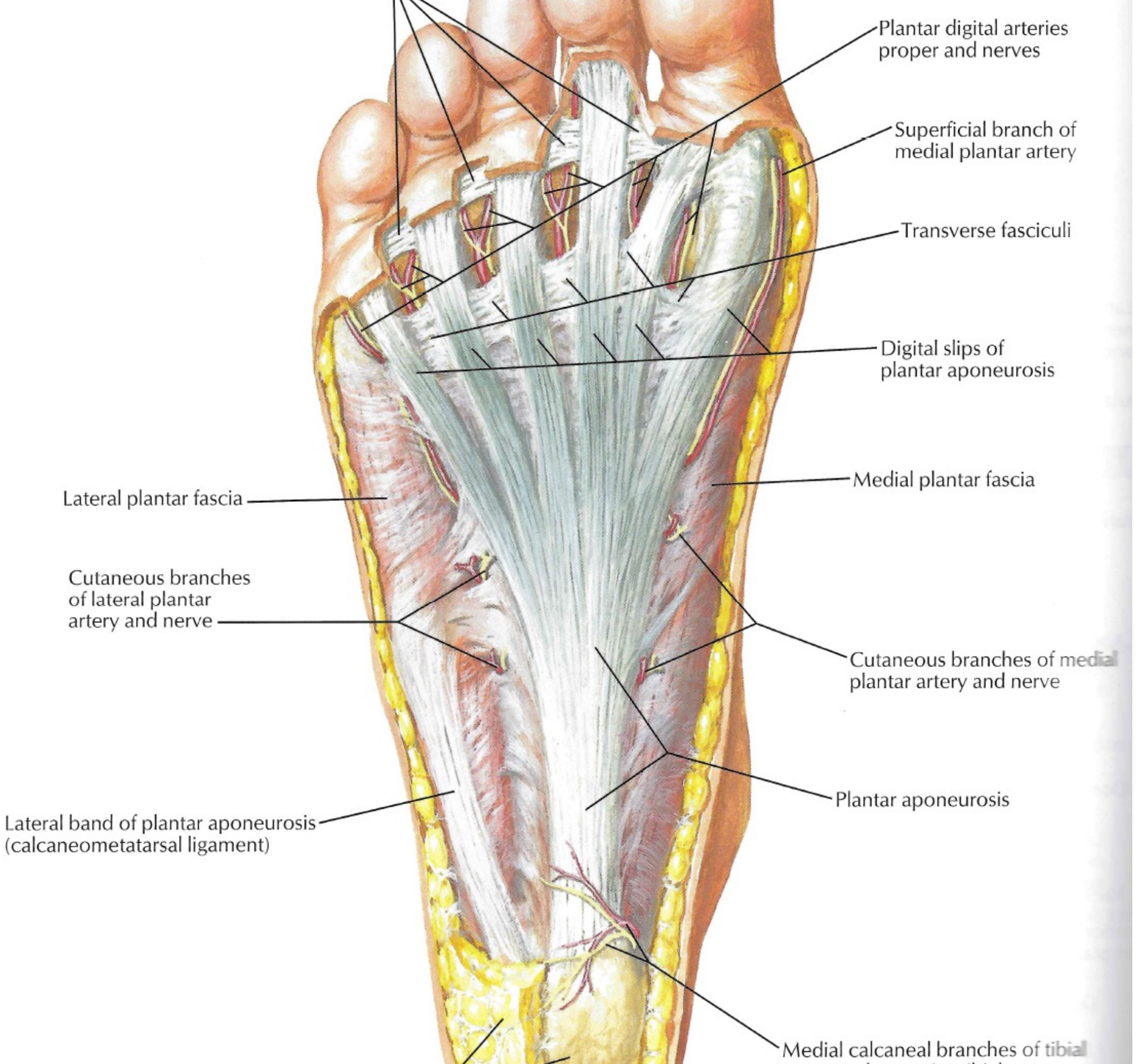

Plantar fascia
Plantar fascia
Heel pad
Medial plantar nerve
First branch of lateral plantar nerve to abductor digiti minimi


Plantar view
Plantar digital arteries proper
Common plantar digital arteries
Lumbrical muscles (cut)
Deep transverse metatarsal ligament and plantar ligaments (plates)
Interossei muscles
Plantar
Dorsal
Abductor digiti minimi muscles (cut)
Plantar metatarsal arteries
Flexor digiti minimi brevis muscle
Deep plantar arch
Lateral plantar artery (cut)
Tuberosity of 5th metatarsal bone
Fibularis (peroneus) longus tendon
Fibularis (peroneus) brevis tendon (cut)
Tuberosity of cuboid bone
Long plantar ligament
Calcaneocuboid (short plantar) ligament
Anterior perforating branches (to dorsal metatarsal arteries)
Sesamoid bones
Insertion of adductor hallucis and lateral head of flexor hallucis brevis muscles (cut)
Insertion of abductor hallucis and medial head of flexor hallucis brevis muscles (cut)
Medial origin of flexor hallucis brevis muscle (cut)
Deep plantar artery (from dorsalis pedis artery)
Posterior perforating branches (to dorsal metatarsal arteries)
Plantar metatarsal ligaments (between bases of metatarsal bones)
Medial cuneiform bone
Tibialis anterior tendon (cut)
Lateral origin of flexor hallucis brevis tendon (cut)
Tuberosity of navicular bone
Tibialis posterior tendon (cut)
Plantar calcaneonavicular (spring) ligament

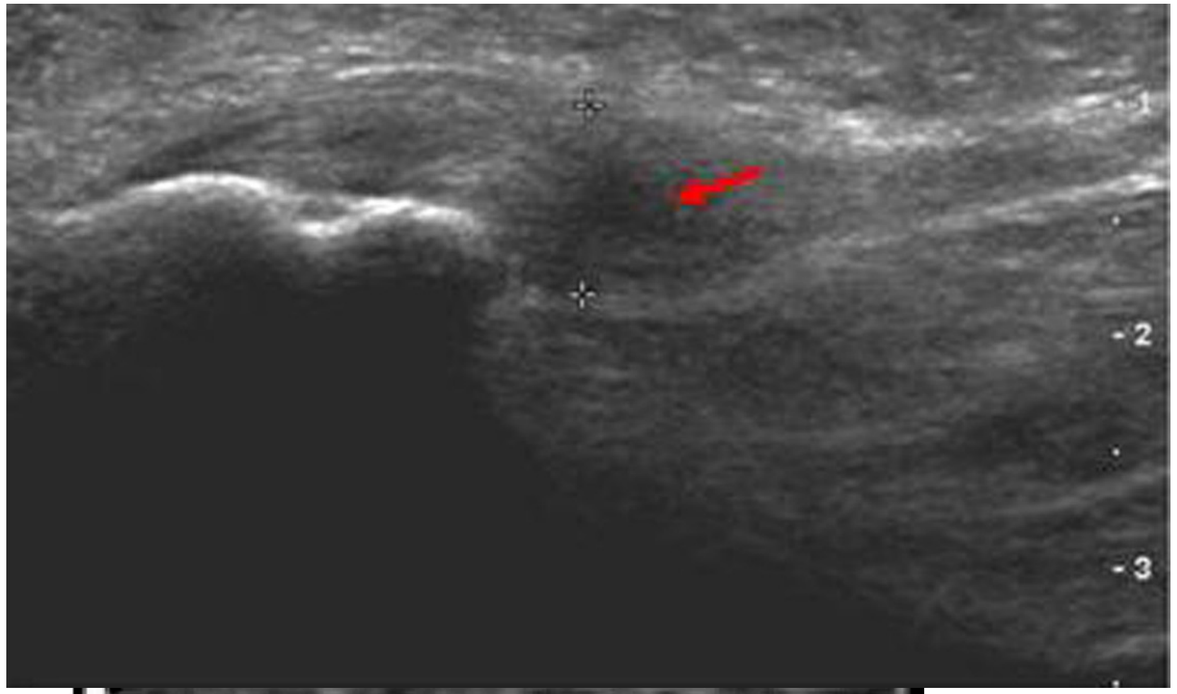

of lateral plantar nerve
Plantar digital artery proper of superficial branch of medial plantar artery
Anterior perforating arteries to dorsal metatarsal arteries
Tendons of lumbrical muscles (cut)
Sesamoid bones
Flexor digitorum longus tendons (cut)
Transverse head and Oblique head of Adductor hallucis muscle
Flexor digitorum brevis tendons (cut)
Medial head and Lateral head of Flexor hallucis brevis muscle
Flexor digiti minimi brevis muscle
Plantar metatarsal arteries
Superficial branches of medial plantar artery and nerve
Plantar interosseous muscles
Flexor hallucis longus tendon (cut)
Superficial branch of lateral plantar nerve
Abductor hallucis muscle (cut)
Deep plantar arterial arch and deep branches of lateral plantar nerve
Deep branches of medial plantar artery and nerve
Flexor digitorum longus tendon (cut)
Tuberosity of 5th metatarsal bone
Tibialis posterior tendon
Fibularis (peroneus) brevis tendon
Medial plantar artery and nerve
Fibularis (peroneus) longus tendon and fibrous sheath
Flexor hallucis longus tendon
Quadratus plantae muscle (cut and slightly retracted)
Flexor retinaculum
Abductor hallucis muscle (cut)
Lateral plantar artery and nerve
Flexor digitorum brevis muscle and plantar aponeurosis (cut)
Abductor digiti minimi muscle (cut)

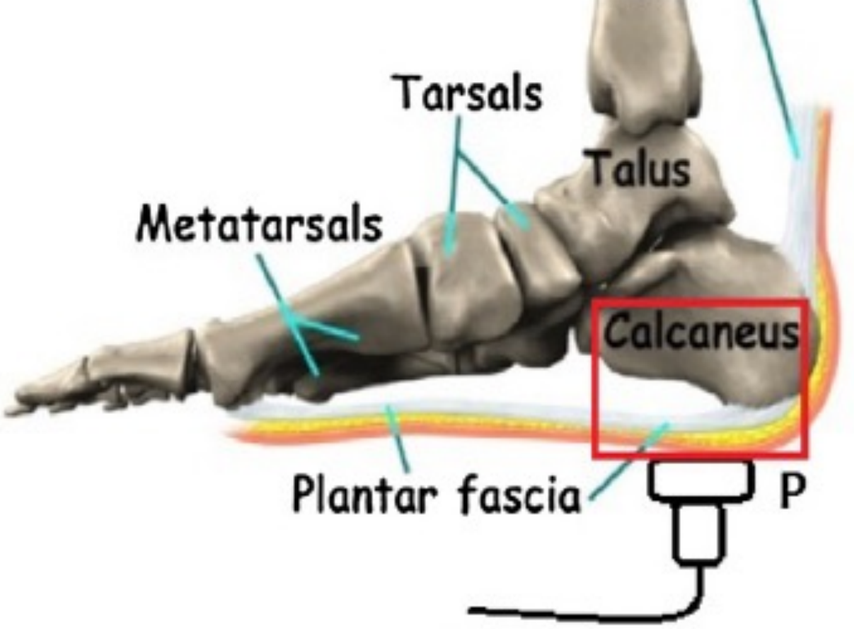

Proper plantar digital branches of lateral plantar nerve
Flexor digitorum longus tendons
Flexor digitorum brevis tendons
Fibrous sheaths (*opened*)
Sesamoid bones
Common plantar digital nerves and arteries
Lumbrical muscles
Lateral head and Medial head of Flexor hallucis brevis muscle
Flexor digiti minimi brevis muscle
Flexor hallucis longus tendon
Abductor hallucis tendon and muscle (*cut*)
Superficial branch and Deep branch of lateral plantar nerve
Flexor digitorum longus tendon
Superficial and deep branches of medial plantar artery
Lateral plantar nerve and artery
Medial plantar artery and nerve
Quadratus plantae muscle
Tibialis posterior tendon
Abductor digiti minimi muscle (*cut*)
Flexor hallucis longus tendon
Nerve to abductor digiti minimi muscle (from lateral plantar nerve)
Posterior tibial artery and tibial nerve (dividing)
Flexor retinaculum
Flexor digitorum brevis muscle and plantar aponeurosis (*cut*)
Abductor hallucis muscle (*cut*)


Proper plantar digital branches of lateral plantar nerve
Plantar digital arteries proper
Common plantar digital arteries from plantar metatarsal arteries
Lumbrical muscles
Fibrous sheaths of flexor tendons
Superficial branch of medial plantar artery
Flexor digitorum brevis tendons overlying Flexor digitorum longus tendons
Lateral head and Medial head of flexor hallucis brevis muscle
Flexor hallucis longus tendon
Plantar metatarsal branch of lateral plantar artery
Abductor hallucis muscle and tendon
Flexor digiti minimi brevis muscle
Flexor digitorum brevis muscle
Abductor digiti minimi muscle (deep to lateral plantar fascia)
Plantar aponeurosis (cut)
Medial process and
Medial calcaneal branches of tibial


Plantar digital arteries proper and nerves
Superficial branch of medial plantar artery
Transverse fasciculi
Digital slips of plantar aponeurosis
Lateral plantar fascia
Medial plantar fascia
Cutaneous branches of lateral plantar artery and nerve
Cutaneous branches of medial plantar artery and nerve
Plantar aponeurosis
Lateral band of plantar aponeurosis (calcaneometatarsal ligament)
Medial calcaneal branches of tibial

PLANTAR FASCIOPATHY



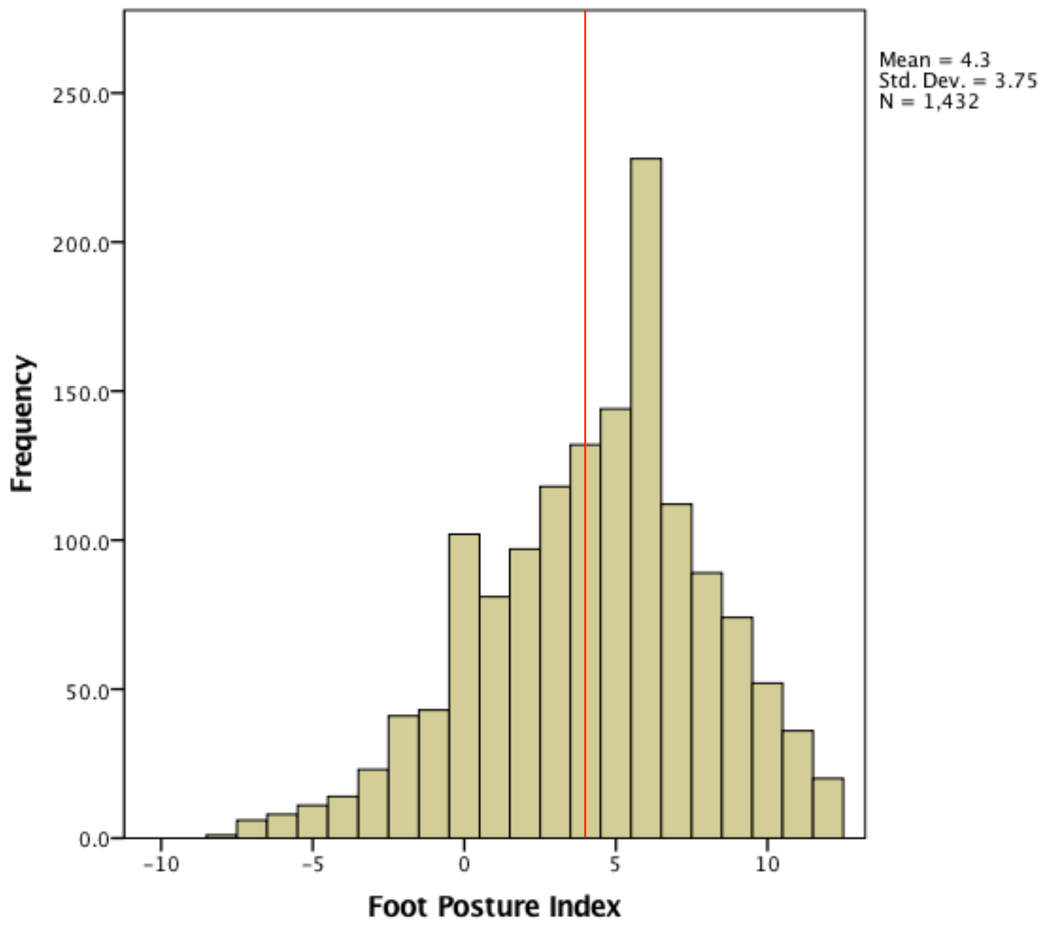


Original article

Sonographically guided intratendinous injections of hyperosmolar dextrose/lidocaine: a pilot study for the treatment of chronic plantar fasciitis

M B Ryan,[1] A D Wong,[2] J H Gillies,[3] J Wong,[4] J E Taunton[5]

Plantar fasciitis & Foot Posture



FPI = 12

FPI = -5

THERAPEUTIC APPROACHES

TREATMENT

- If **plantar fasciopathy**, need to address

1. Pain
2. Intrinsic muscle activation
3. Plantar fascia rehabilitation

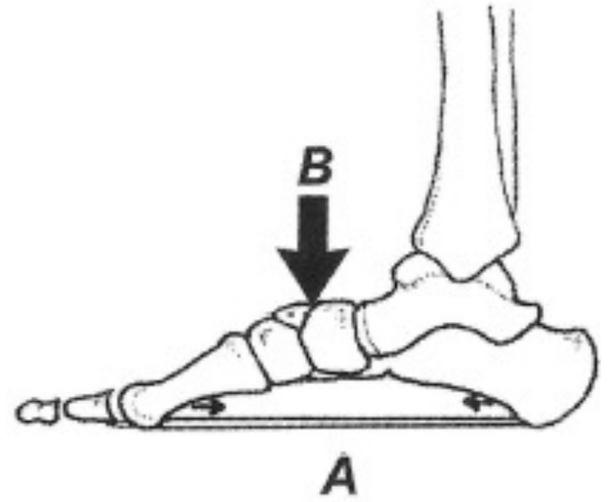
FOOT ORTHOSES

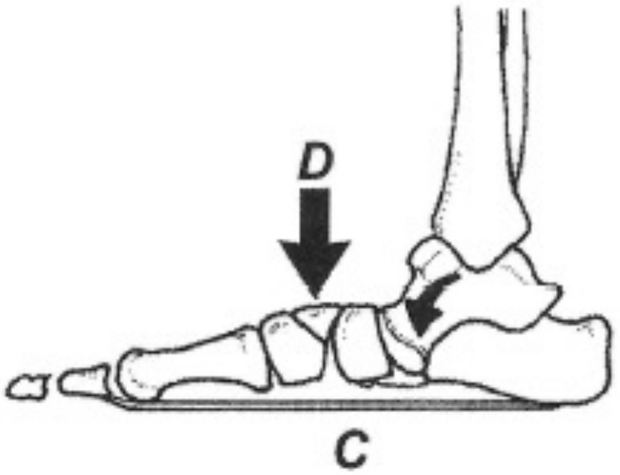
Review

Management of plantar heel pain: a best practice guide informed by a systematic review, expert clinical reasoning and patient values

Dylan Morrissey [1,2] Matthew Cotchett [3] Ahmed Said J'Bari,[1] Trevor Prior,[1] Ian B Griffiths [1] Michael Skovdal Rathleff,[4] Halime Gulle,[1] Bill Vicenzino [5] Christian J Barton [3,6]

Conclusions: Best practice from a mixed-methods study suggests....patients who do not optimally improve may be offered shockwave therapy, followed by orthoses.





ARE THESE THE SAME?

=

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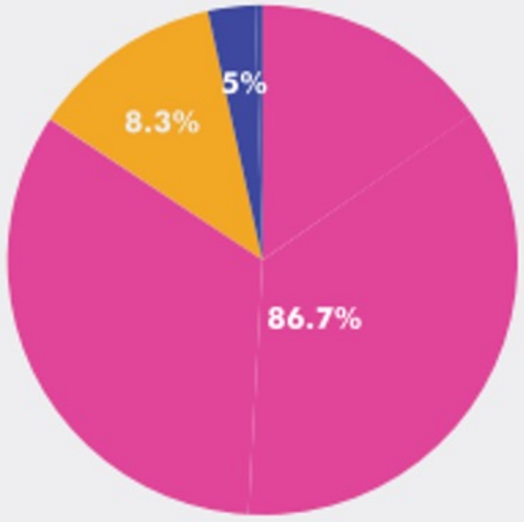
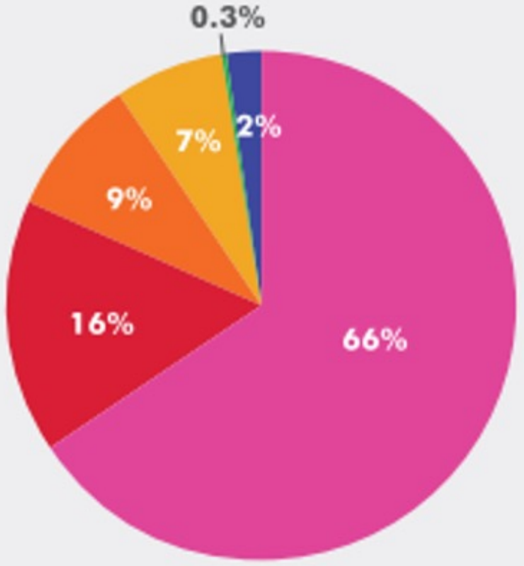
KIWI DATABASE

Sample size: 4,954
% change in pain from assessment: 58%

GLOBAL RATE OF CHANGE
Not including adjustments

- Improved
- No Change
- Worse

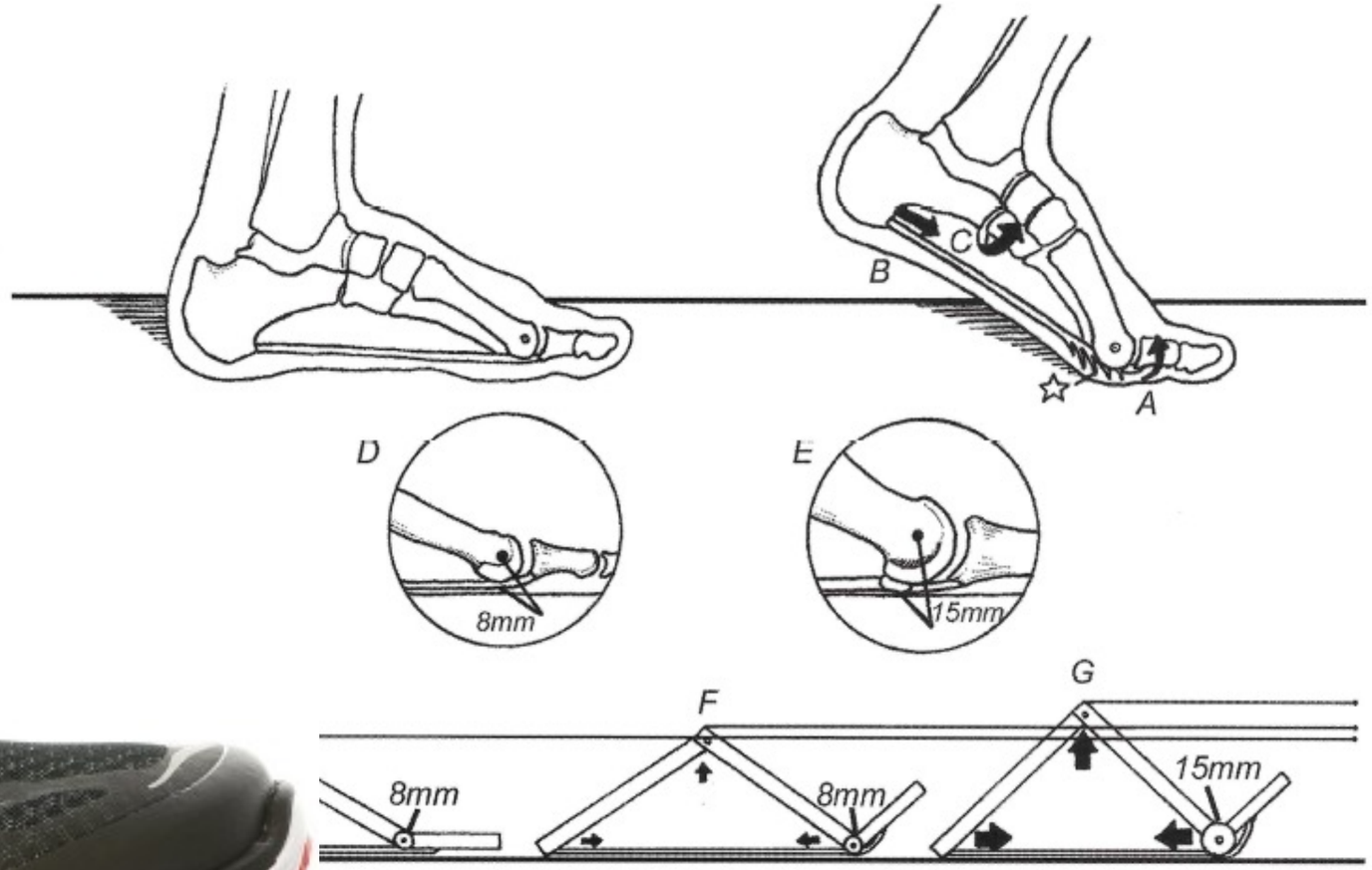




ORTHOTICS USAGE
Frequency of usage

- Greater than 6 hours per day
- 4-6 hours per day
- 1-3 hours per day
- Couple times per week
- Couple times per month
- Never wear the orthotics

ROCKER SHOES



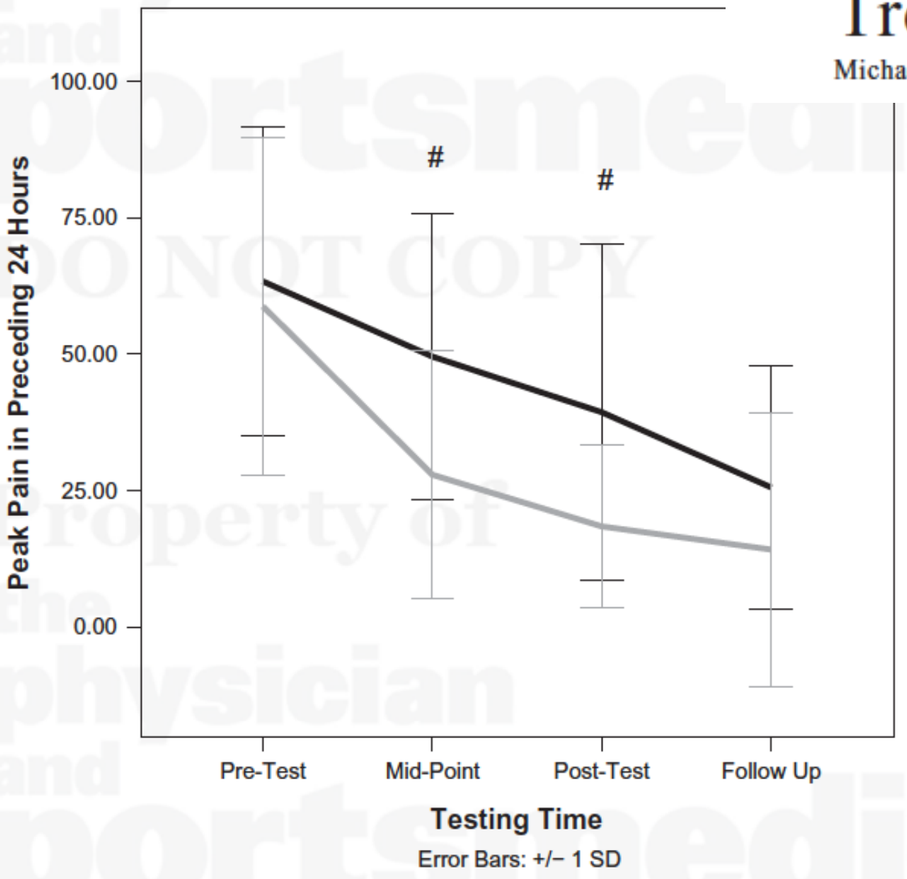
Plantar Fascia-Specific Stretching Exercise Improves Outcomes in Patients with Chronic Plantar Fasciitis

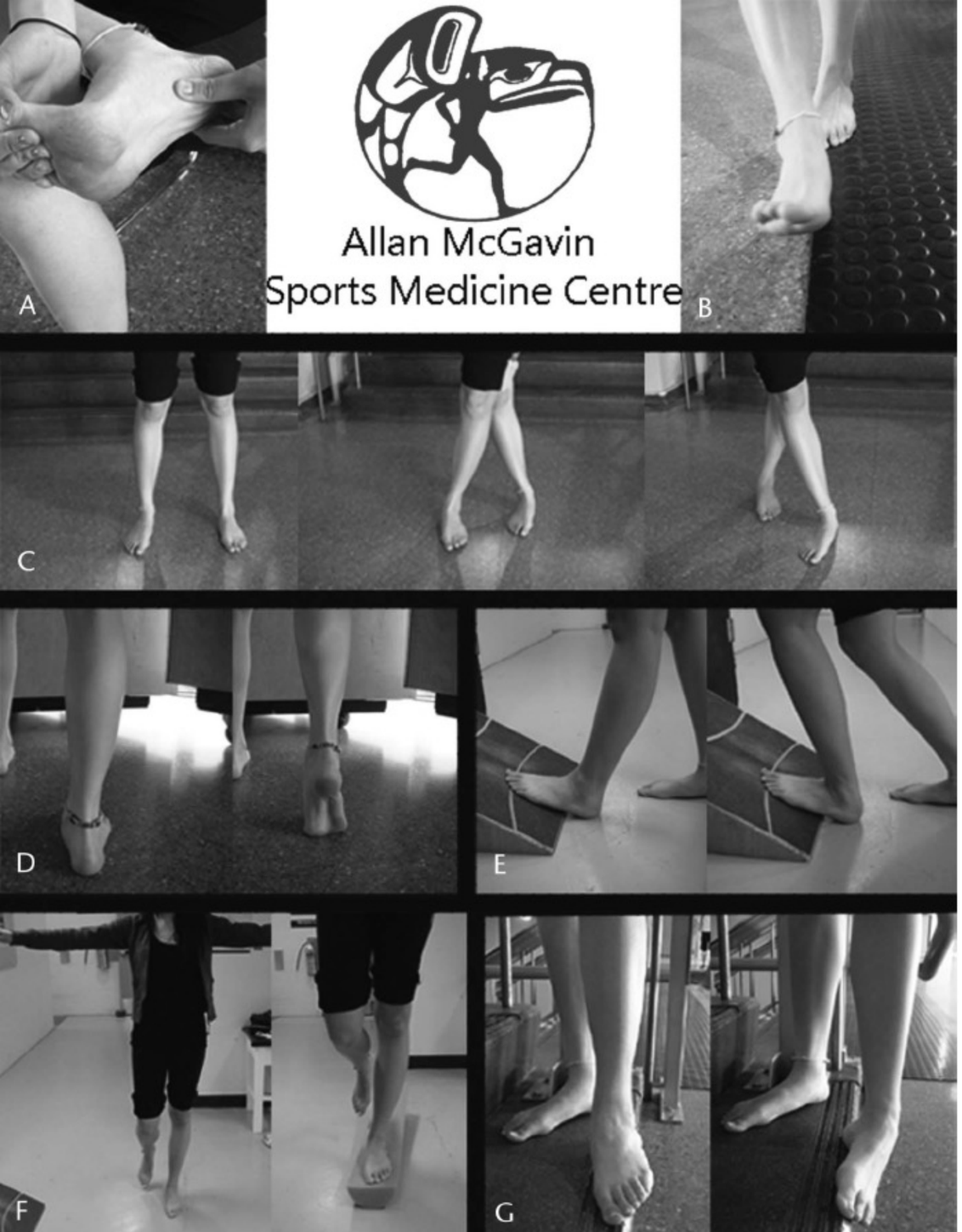
A Prospective Clinical Trial with Two-Year Follow-up

By Benedict F. DiGiovanni, MD, Deborah A. Nawoczenski, PhD, PT, Daniel P. Malay, MSPT, Petra A. Graci, DPT, Taryn T. Williams, MSPT, Gregory E. Wilding, PhD, and Judith F. Baumhauer, MD

Examining the Degree of Pain Reduction Using a Multielement Exercise Model with a Conventional Training Shoe Versus an Ultraflexible Training Shoe for Treating Plantar Fasciitis

Michael Ryan, PhD; Scott Fraser, BSc, PT; Kymberly McDonald, BSc; Jack Taunton, MD, MSc





Comparison of a Physiotherapy Program Versus Dexamethasone Injections for Plantar Fasciopathy in Prolonged Standing Workers: A Randomized Clinical Trial

Michael Ryan, PhD,† Jamie Hartwell, BKin,* Scott Fraser, PT,**
*Richard Newsham-West, MPhty, PhD,† and Jack Taunton, MD**

NIGHT SPLINTS

CURRENT CONCEPTS

Management of Recalcitrant Plantar Fasciitis

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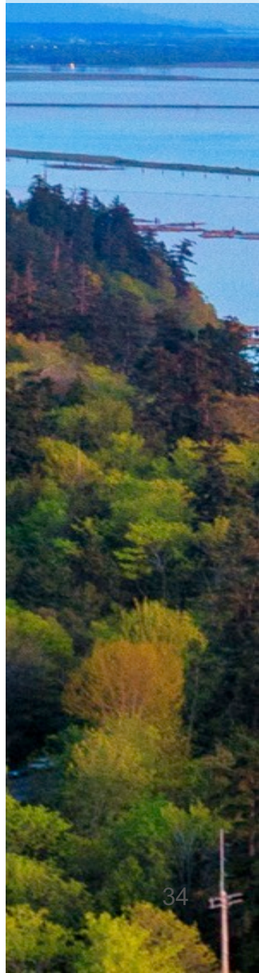
Clinical Assistant Professor, Dip Sports Med
Division of Physical Medicine and Rehabilitation
University of British Columbia Faculty of Medicine

Kintec Community Event
March 6, 2024

DISCLOSURES

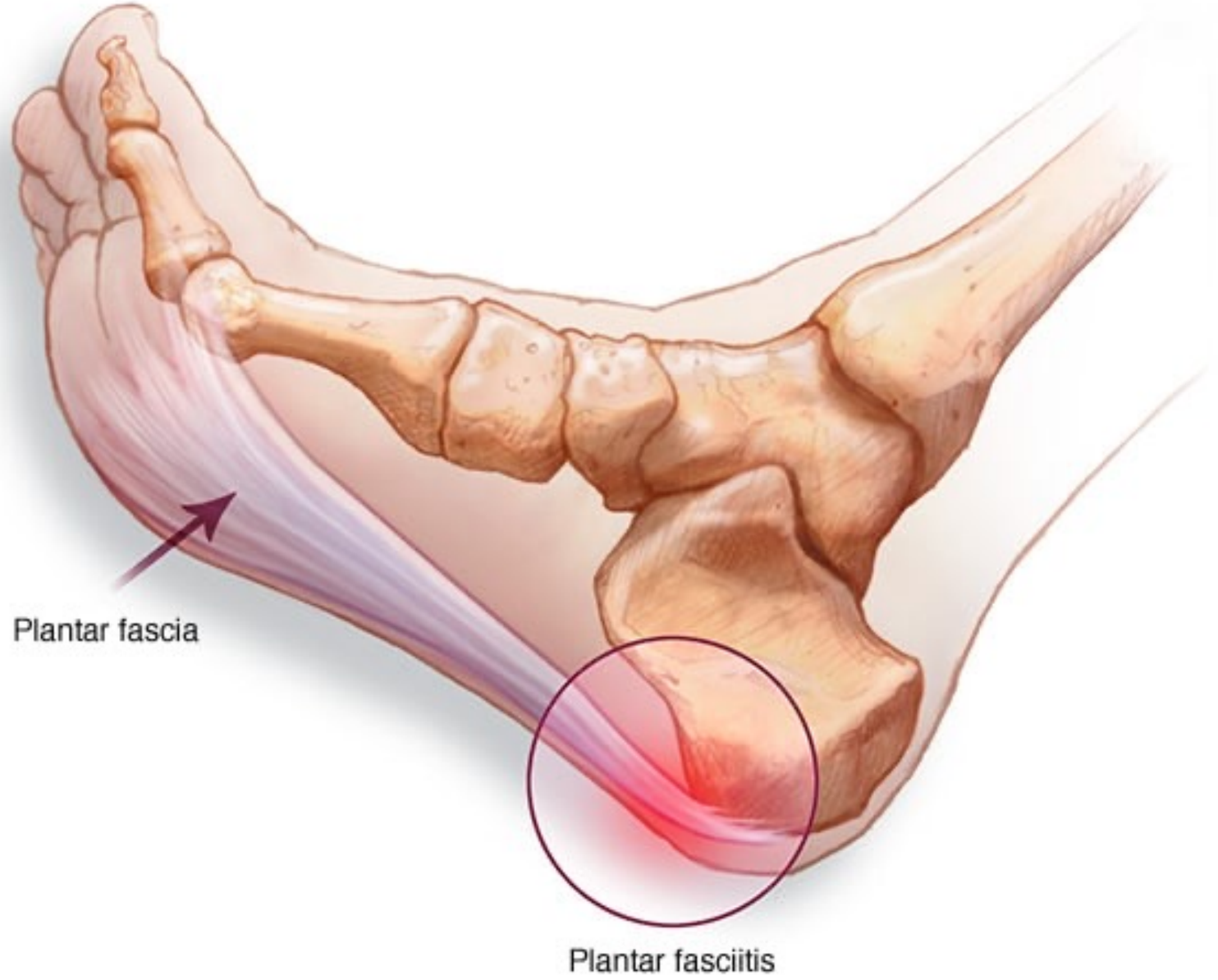
Neither I, Dr. Kaila A. Holtz, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.

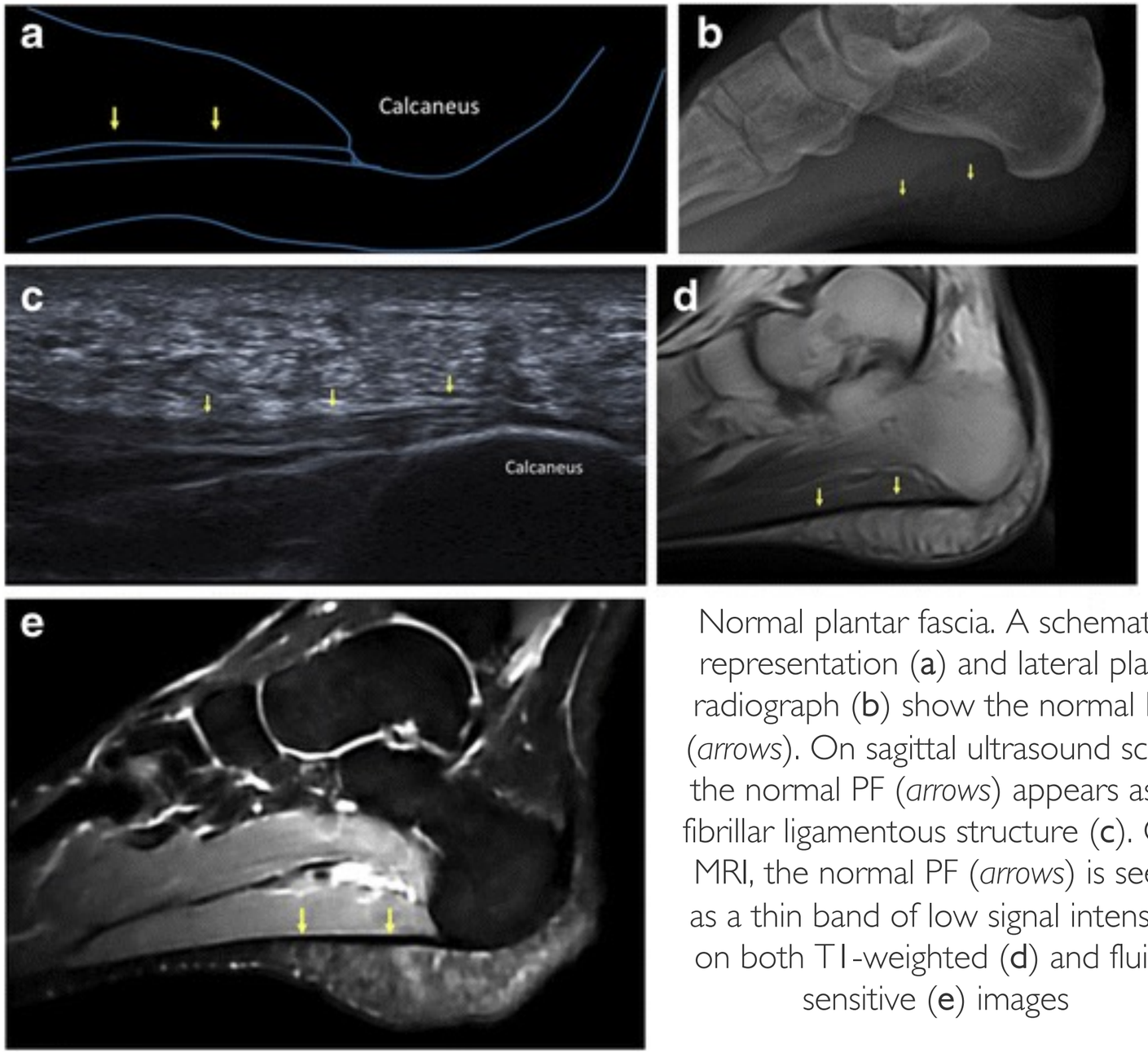


OBJECTIVES

By the end of the session, **you will be able to**:

1. Describe the pathophysiology of plantar fasciitis;
2. Describe the basic principles behind orthobiologic treatments (ESWT, dextrose microtenomy, PRP);
3. Counsel a patient regarding the pro's and con's of interventional treatment for plantar fasciitis;
4. Offer your patients some insights where orthobiologic injections might fit into their treatment plan.





Normal plantar fascia. A schematic representation (**a**) and lateral plain radiograph (**b**) show the normal PF (*arrows*). On sagittal ultrasound scan, the normal PF (*arrows*) appears as a fibrillar ligamentous structure (**c**). On MRI, the normal PF (*arrows*) is seen as a thin band of low signal intensity on both T1-weighted (**d**) and fluid-sensitive (**e**) images

Draghi, F., Gitto, S., Bortolotto, C. *et al.* Imaging of plantar fascia disorders: findings on plain radiography, ultrasound and magnetic resonance imaging. *Insights Imaging* **8**, 69–78 (2017)

INTRODUCTION – PLANTAR FASCIITIS

Single most common cause of heel pain.

Affects approx 10% of the population (lifetime risk).

Higher incidence among individuals ages 45 to 65 years.

Risk Factors:

- Standing occupations (e.g. military personnel)
- Long distance runners
- Obesity
- Tight gastrocnemius/soleus complex
- Pes planus

Hasegawa, M., Urits, I., Orhurhu, V. *et al.* Current Concepts of Minimally Invasive Treatment Options for Plantar Fasciitis: a Comprehensive Review. *Curr Pain Headache Rep* **24**, 55 (2020).

PATHOPHYSIOLOGY OF PLANTAR FASCIITIS

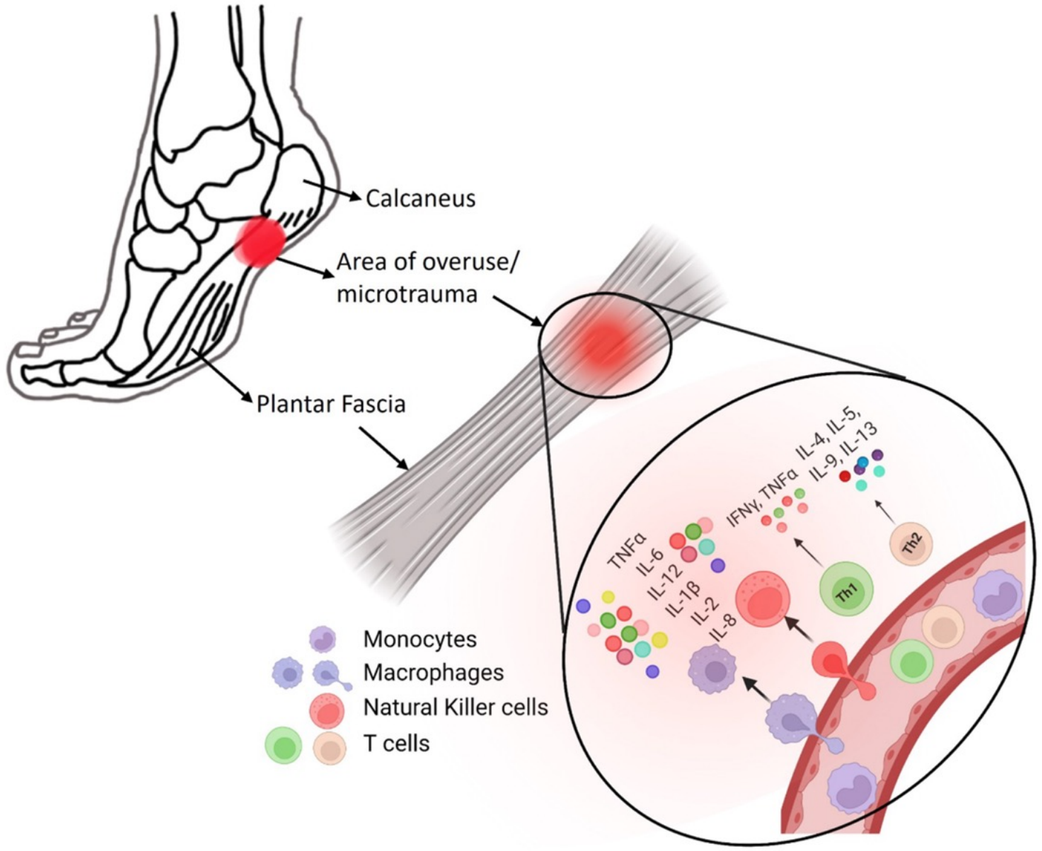
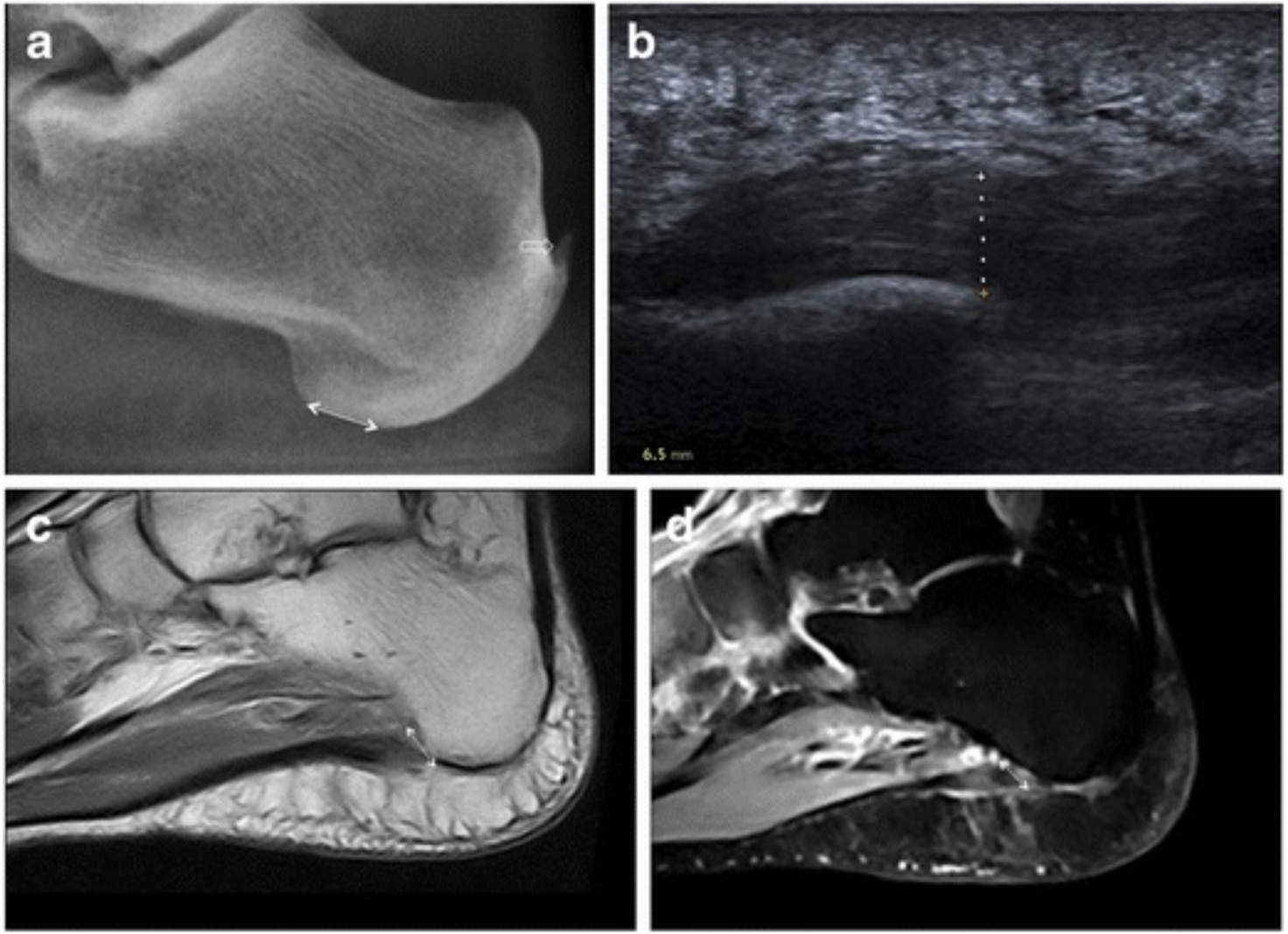


Fig. 6. Inflammation of plantar fascia. Microtrauma causes macrophages to release inflammatory cytokines which incite the inflammatory process. T-Cells and NK cells are signaled to the site of injury via chemotaxis; they migrate from the bloodstream into the tissue via diapedesis. The presence of T-cells and NK cells at the site of injury further propagates the inflammatory process.

Rabadi D, Seo S, Wong B, Chung D, Rai V, Agrawal DK. Immunopathogenesis, early Detection, current therapies and prevention of plantar Fasciitis: A concise review. Int Immunopharmacol. 2022 Sep;110:109023.

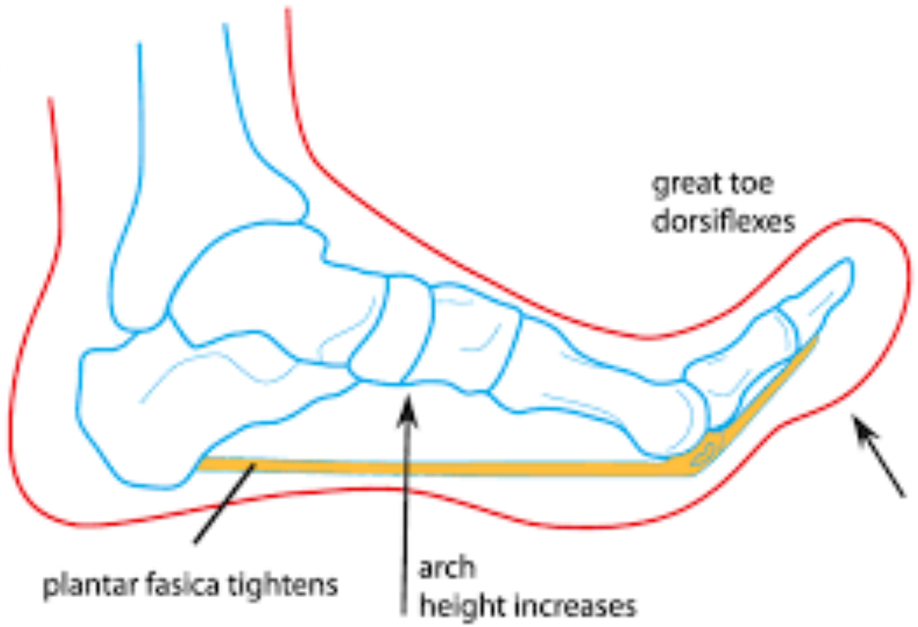


Plantar fasciitis. Lateral plain radiograph highlights an increase in the distance between subcutaneous fat and intrinsic muscles of the foot at the calcaneal insertion of the PF as an indirect sign of plantar fasciitis (*double-head arrow*); calcific enthesopathy of the Achilles tendon is also seen (*open arrow*) (**a**). On ultrasound, plantar fasciitis presents with PF thickening (*dashed line*, 6.5 mm), a hypoechoic appearance and loss of fibrillar pattern (**b**). MRI confirms thickening of the PF at its calcaneal origin (*double-head arrow*) with intrasubstance areas of intermediate and high signal intensity on T1-weighted (**c**) and fluid-sensitive (**d**) images, respectively

CLINICAL PRESENTATION

- Classic symptom is pain in the mornings when rising from bed.
- Pain that originates at the heel.
- Restricted ankle dorsiflexion (risk fac

Positive windlass test



EVIDENCE BASED NON-INVASIVE TREATMENT

Treatment	Mechanism	Evidence Level
NSAIDS	Reduced prostaglandins by inhibiting COX-1/COX-2	B
Custom Orthotics	Reduces shock through the plantar fascia	B
Rocker bottom shoes	Reduces stress through the arch	B
Achilles stretching Plantar stretching Night Splints	Reduces migration of inflammatory cells Reduces risk factors	B

CASE EXAMPLE

CASE EXAMPLE

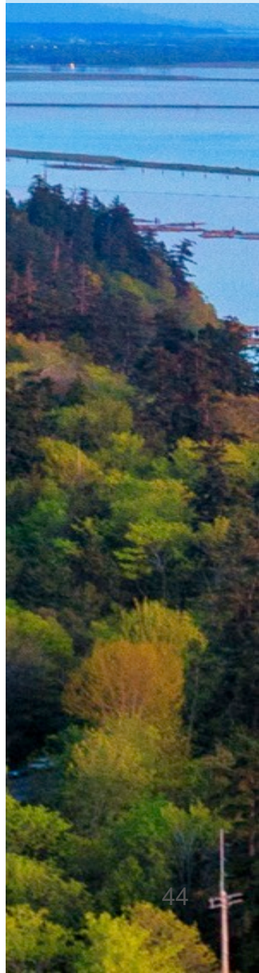
45-year-old man referred to me with plantar fasciitis referred for cortisone injection?

Risk Factors:

- Recreational runner
- Pes planus
- Walking at work (construction site)

Treatments tried:

- Achilles stretching
- Diclofenac 10%
- Physiotherapy – manual therapy, strengthening, taping



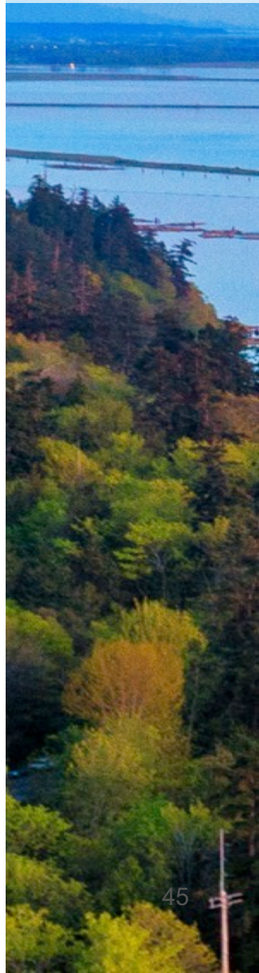
CASE EXAMPLE

On examination,

- Normal neurological examination.
- Pes planus.
- Normal gastrocnemius/soleus complex.
- Maximally tender to the medial tuberosity of the calcaneus.
- Non tender to other structures of the foot, particularly the tarsal tunnel, Achilles insertion, abductor hallucis (Baxter's nerve), etc.
- Positive Windlass maneuver.

Clinical diagnosis: Plantar fasciitis/fasciosis

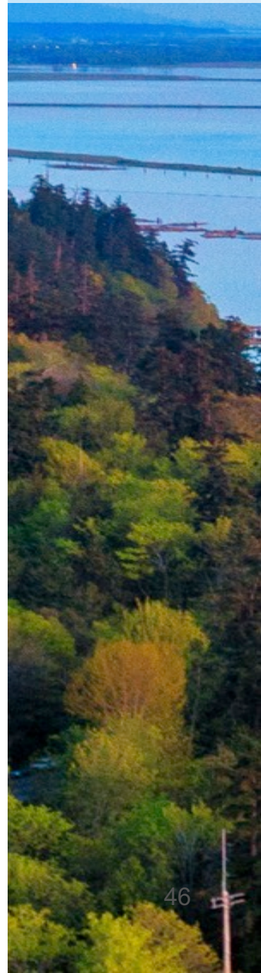
Goal #1: Identify gaps in treatment plan!



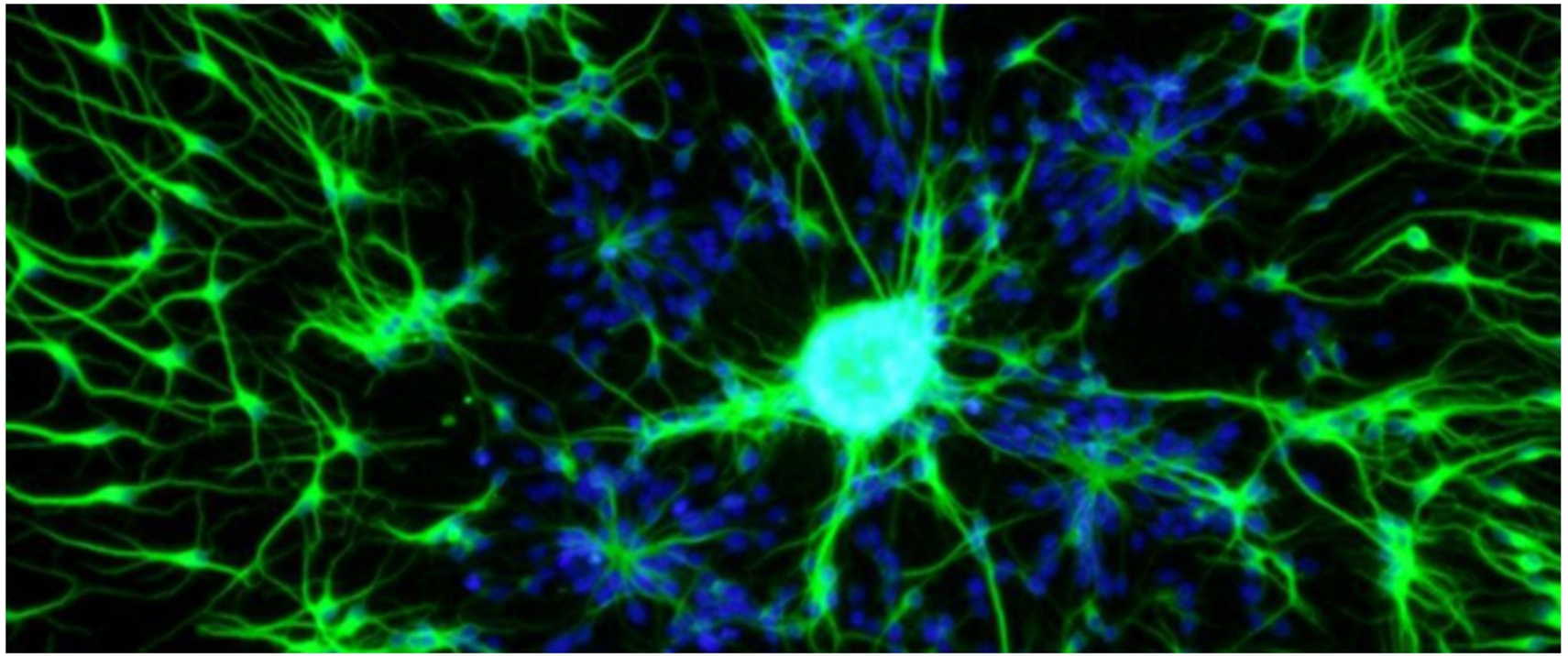
PLANTAR FASCIITIS MANAGEMENT

Treatment	Where/How?	Duration
NSAIDS	Topical diclofenac 10% twice daily to medial heel	14 days
Custom Orthotics Night Splints	Local pedorthotist clinic	2-3 months
Rocker bottom shoes	Local pedorthotist clinic/footwear store	2-3 months
Achilles stretching Plantar stretching	Physiotherapy	2-3 months

If after 6 months, second line measures



REGENERATIVE MEDICINE



Regenerative medicine focuses on developing and applying new treatments to heal tissues and organs to restore function lost due to aging, disease, damage or defects. (Mayo.edu)

RELEVANT TERMS

Musculoskeletal Regenerative Medicine
Joints – Tendons - Ligaments

Non-invasive Methods	Orthobiologic Injections	Surgical Techniques
• Shockwave therapy	• Dextrose Prolotherapy • Platelet Rich Plasma • Bone Marrow Aspirate* • Microfragmented Adipose Tissue*	• Autologous chrondrocyte implantation • Matrix-Associated chondrocyte implantation

*not approved by Health Canada

EXTRACORPOREAL SHOCKWAVE THERAPY (ESWT)

Non-invasive therapy that sends acoustic shockwaves to tissues that results in mechano-transduction within the tissue leading to the production of free radicals that induce growth factors in the tissue.

- Collagen synthesis
- Cellular proliferation
- Pain reduction

PROLOTHERAPY

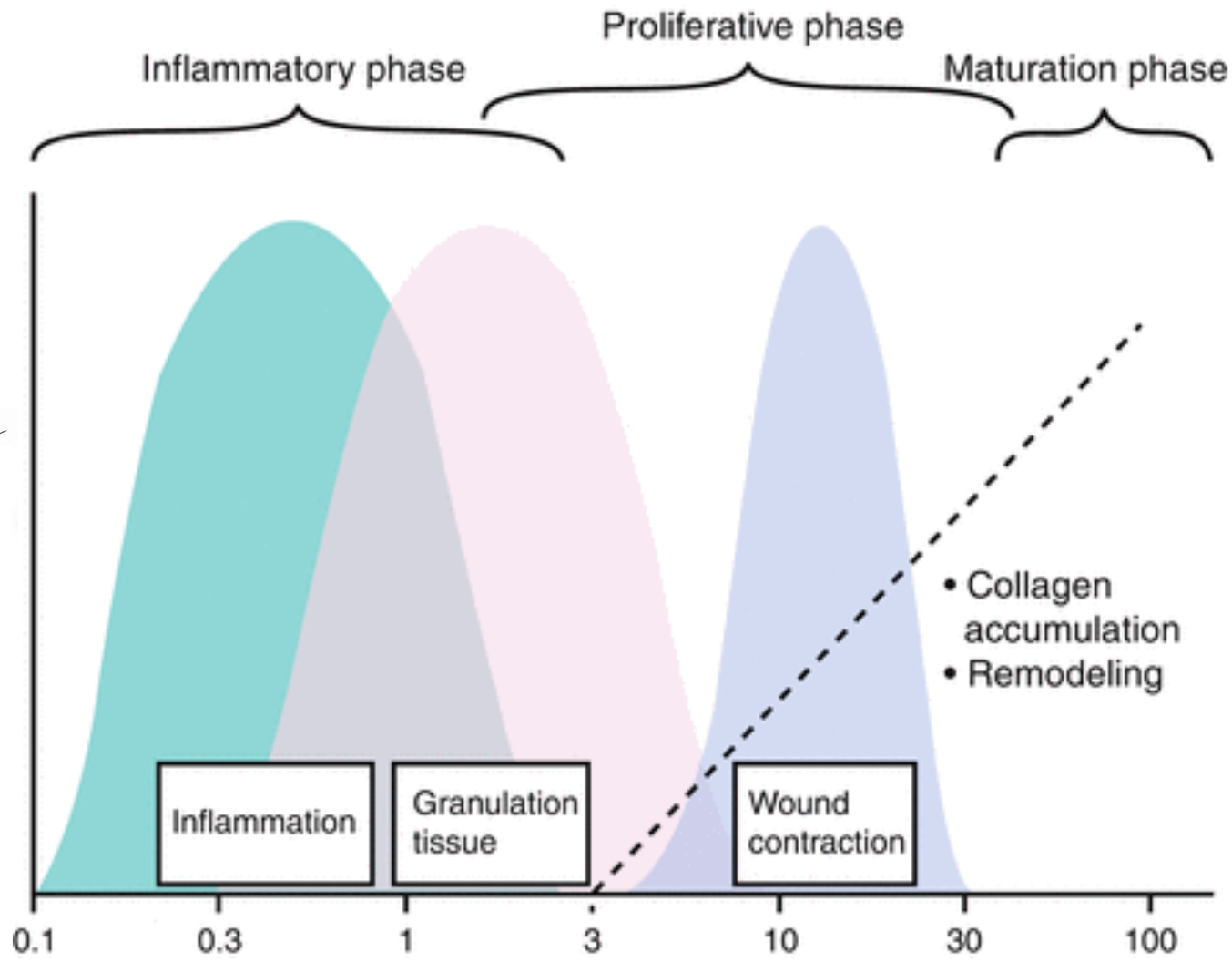
Solutions range from 12.5 – 25% Dextrose

Been **used safely for more than 80 years.** It was popularized by Dr. George Hackett, a general surgeon in the U.S, in the 1950's who was an expert in disability assessments.

Used as an **off-label substance**.

Goal of treatment: to augment the tensile strength of joint-stabilizing structures like ligaments and tendons.

BASIC PRINCIPLES OF PROLOTHERAPY



Wound Healing Cascade[2]

PLATELET RICH PLASMA - PRP

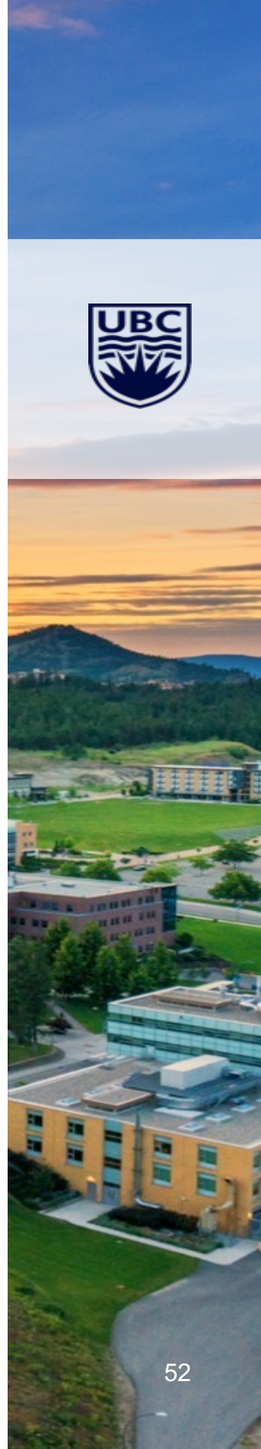
Solution of **autologous** human plasma with **increased platelet concentrations**.

Obtained by **centrifuging or separating** a large volume (usually 60 to 120mL) of blood and extracting specific layers.

Classified as **a drug** by Health Canada.

Does NOT contain "stem cells".

Goal of treatment: to augment the natural healing process with supraphysiologic amounts of growth factors by injecting platelets at/into an injury site.



COMPOSITION OF PLATELET RICH PLASMA

Plasma + Buffy Coat – Keep

Buffy Coat + Plasma
LR – PRP

Platelets only + Plasma
LP – PRP

Most kits report an increase in platelets of **2-10X baseline**.

Red Cells - Discard

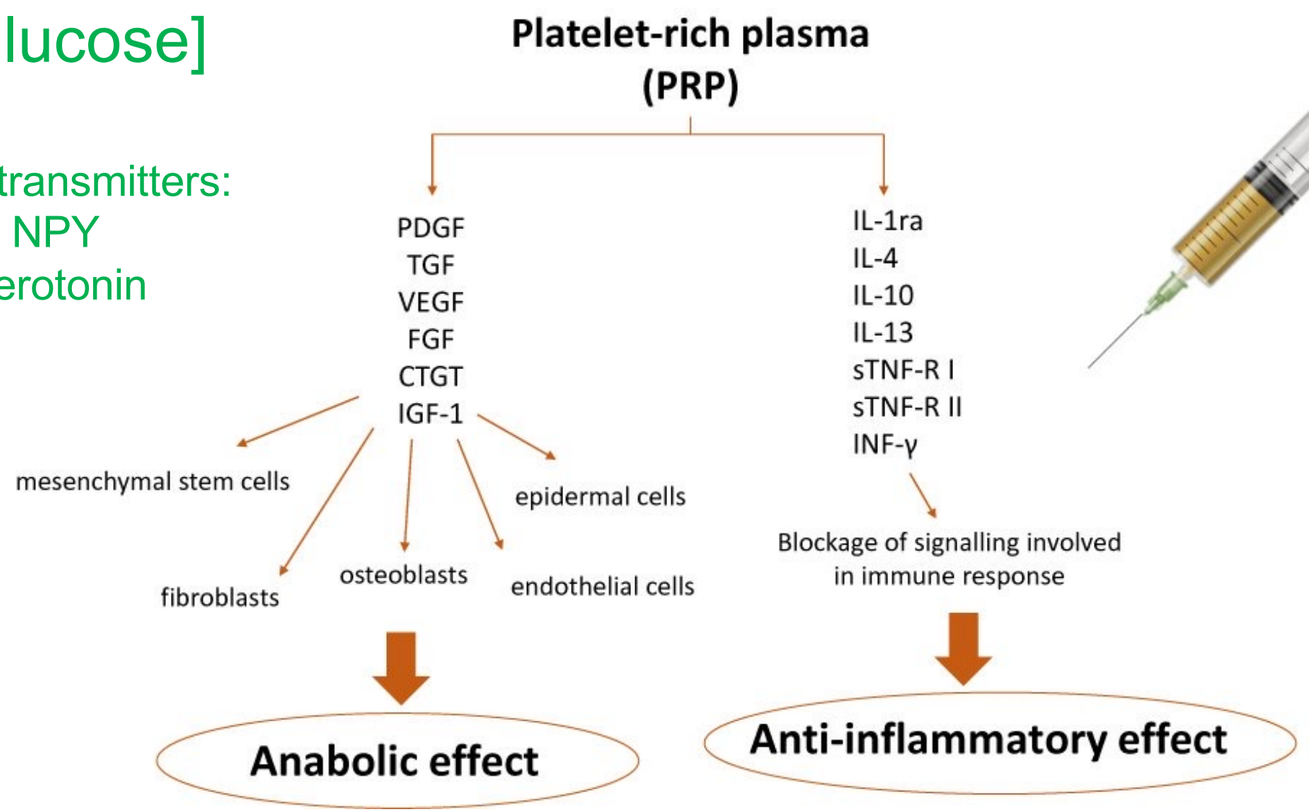
EXAMPLE OF COMMERCIAL PRP SYSTEM

WHAT ARE THE "ACTIVE" COMPONENTS OF PRP?

PRP is defined as a platelet rich concentrate with higher than baseline levels of platelets relative to whole blood.

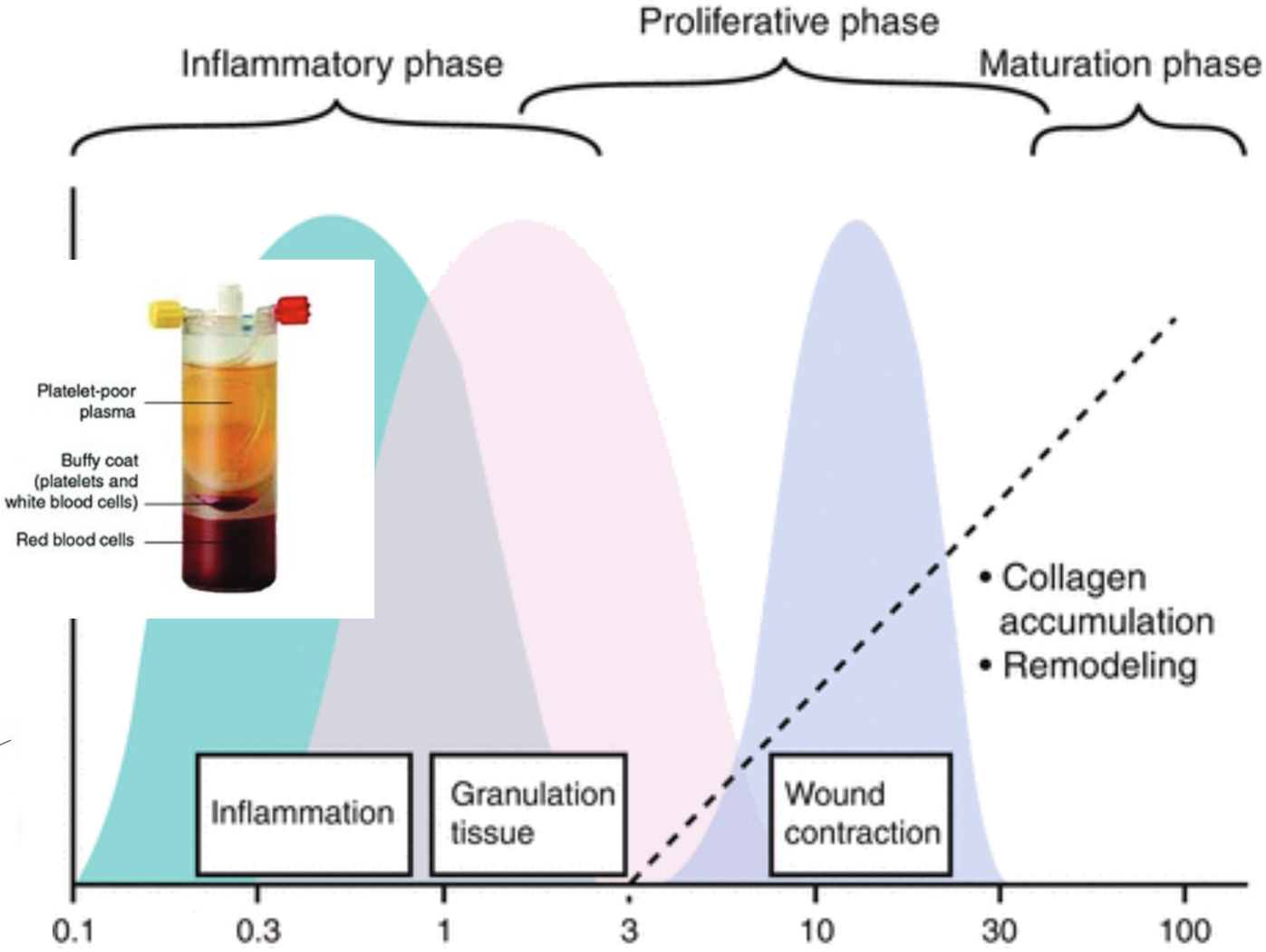
↑[Glucose]

Neurotransmitters:
NPY
Serotonin



Mercuri SR, Vollono L, Paolino G. The Usefulness of Platelet-Rich Plasma (PRP) for the Treatment of Vitiligo: State of the Art and Review. *Drug Des Devel Ther*. 2020

BASIC PRINCIPLES OF PLATELET RICH PLASMA INJECTIONS



Wound Healing Cascade

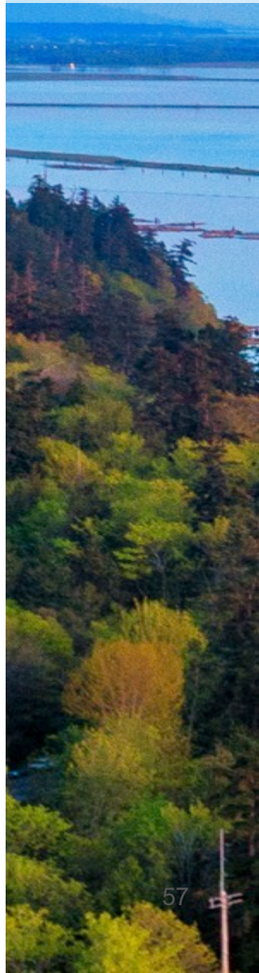
SUMMARY - ORTHOBIOLOGICS

List the **most commonly used** orthobiologic injections for musculoskeletal pain in Canada.

1. Prolotherapy
2. Platelet Rich Plasma (PRP)

Describe the **basic principles** behind orthobiologic injections.

Prolotherapy **starts** the inflammatory cascade by causing by local tissue trauma. PRP **augments it with supraphysiologic concentrations of platelets**, anti-inflammatory cells, growth factors and neuropeptides.



EVIDENCE FOR INTERVENTIONS IN PLANTAR FASCIITIS

Dextrose prolotherapy versus radial extracorporeal shock wave therapy in the treatment of chronic plantar fasciitis: A randomized, controlled clinical trial

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N=29, ESW

Patients hac

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Table 1
The baseline demographic and clinical characteristics of the patients.

Variable	ESWT (n = 29)	Prolotherapy (n = 30)	P value
Age (years)	43.7 ± 7.6	46.5 ± 6.5	0.133
Gender (female/male)	20/9	19/11	0.647
Disease duration (months)	4.8 ± 1.2	4.5 ± 1.3	0.361
BMI (kg/m^2)	26.5 ± 3.6	25.3 ± 4.2	0.244
VAS	72.32 ± 13.1	74.6 ± 11.1	0.387
FAAM-ADL (0–100)	74.2 ± 10.2	72.4 ± 12.6	0.543
FAAM-Sport (0–100)	72.6 ± 12.3	70.1 ± 11.8	0.428
Thickness (mm)	4.5 ± 0.6	4.7 ± 0.4	0.132

Abbreviations: BMI—Body mass index; VAS—Visual analogue scale; FAAM—Foot and ankle ability measure; ADL—Activities of daily living.

Table 2
The effects of the ESWT and prolotherapy on the VAS, FAAM questionnaire, and plantar fascia thickness (N = 59 feet).

Variable	Time of intervention	Intervention	Mean	SD		P-Value		P-Value
VAS	Baseline	ESWT	72.32	13.16	Group and Time Interaction	0.231	Baseline vs.12 weeks	
		Prolotherapy	74.66	11.15				0.102
	After 6 weeks	ESWT	56.55	12.52				
		Prolotherapy	53.31	10.11				
	After 12 weeks	ESWT	40.82	10.32				
	12 weeks	Prolotherapy	44.22	9.5				
FAAM-ADL	Baseline	ESWT	74.2	10.2	Group and Time Interaction	0.287	Baseline vs.12 weeks	0.183
		Prolotherapy	72.4	12.8				
	After 6 weeks	ESWT	88.3	7.2				
		Prolotherapy	87.5	8.7				
	After	ESWT	91.3	6.8				
	12 weeks	Prolotherapy	90	8.9				
FAAM-sport	Baseline	ESWT	72.6	12.3	Group and Time Interaction	0.038	Baseline vs.12 weeks	
		Prolotherapy	70.1	11.8				0.018
	After 6 weeks	ESWT	88.7	11.1				
		Prolotherapy	83.3	10.8				
	After	ESWT	92.3	10.2				
	12 weeks	Prolotherapy	85.8	9.3				
Fascia thickness	Baseline	ESWT	4.5	0.6	Group and Time Interaction	0.532	Baseline vs.12 weeks	0.072
		Prolotherapy	4.7	0.4				
	After 6 weeks	ESWT	4	0.3				
		Prolotherapy	4.1	0.3				
	After 12 weeks	ESWT	3.8	0.3				
		Prolotherapy	3.7	0.4				

Abbreviations: VAS—Visual analogue scale; ESWT—Extracorporeal shock wave therapy; FAAM—Foot and ankle ability measure; ADL—Activities of daily living.

Both groups showed significant decreases in pain scores and improvements in function and plantar fascia thickness. No superior treatment

SYSTEMATIC REVIEW AND META-ANALYSIS

Platelet rich plasma therapy versus other modalities for treatment of plantar fasciitis: A systematic review and meta-analysis

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N=21 articles; PRP vs. other modalities, total subjects = 1356 patients

Outcomes:

- Visual analog scale
- Plantar thickness
- Functional scores (Foot Function Index and American Orthopedic Foot and Ankle Society)
- Follow-up > 12 weeks

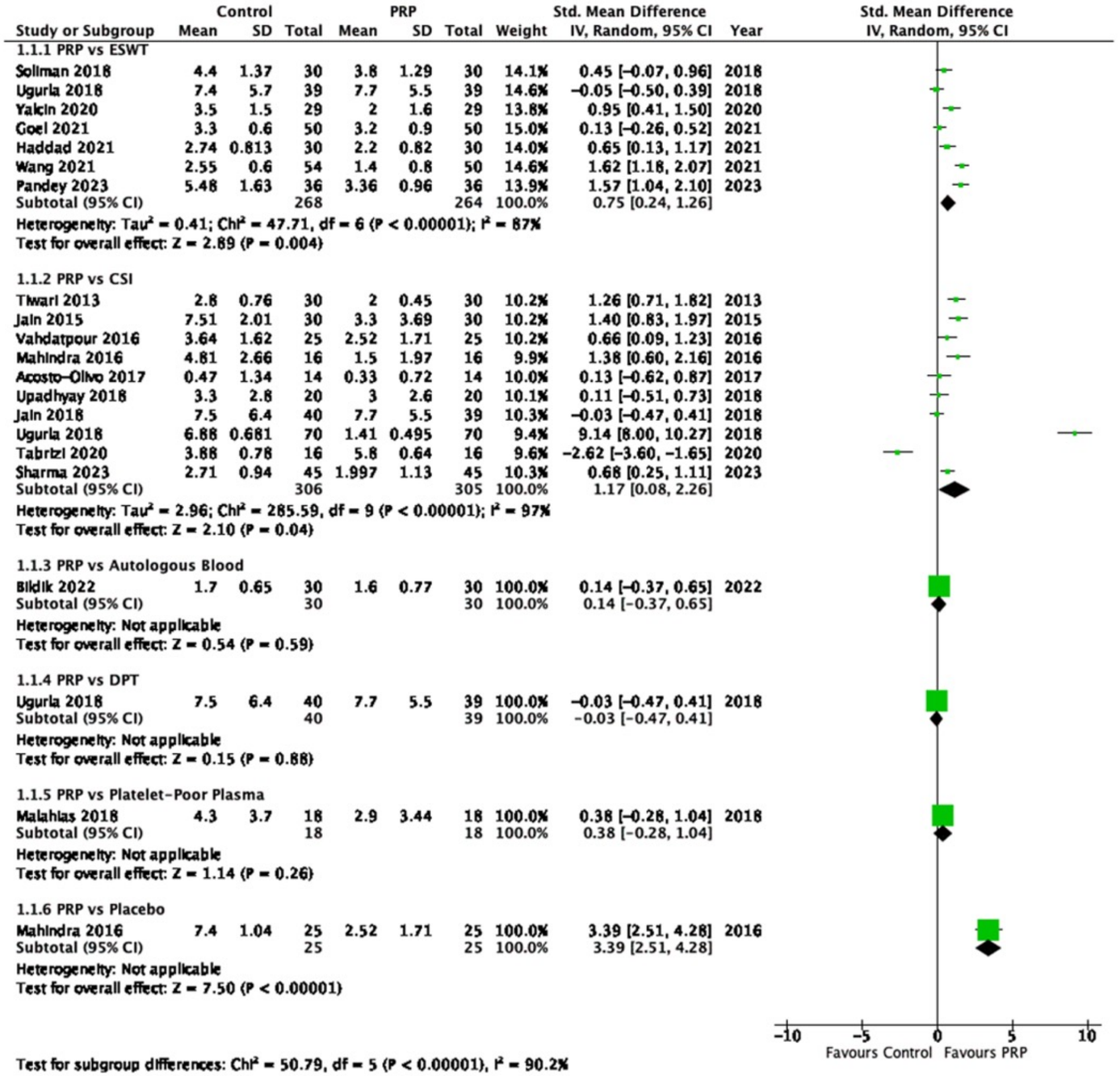

Fig. 3. Forest plot showing the improvement of VAS.

OTHER OUTCOMES

Plantar fascia thickness (N=456)

- No significant differences in fascia thickness among treatment modalities

Foot Function Index (N=105)

- PRP > phonophoresis
- No significant differences between PRP and other treatment modalities.

American Orthopedic Foot and Ankle Society (AOFAS) Score (N=637)

- PRP > cortisone, and placebo
- No significant differences between PRP and other treatment modalities.

APPLYING EVIDENCE TO PATIENTS

Shockwave therapy is not inferior to dextrose microtenotomy.

- Accessibility in community is reasonable. I usually suggest patients seek out a practitioner close to their work or home.

Trial of dextrose prolotherapy is less costly than PRP.

- In my clinical experience, if people respond to prolotherapy, they are more likely to respond to PRP.
- Usually 2-4 injections, 6 weeks apart vs. 1 PRP injection.

Shockwave can be used to augment orthobiologic injections.

Before PRP, always get advanced imaging.

- Tarsal tunnel syndrome
- Complex tears
- Infection

Summary

Intervention Type	PROS	CONS
Steroid	Cheap	Detrimental to structure, not used much anymore
ESWT	Non-invasive	Requires sessions weekly over 6-8 weeks.
Dextrose prolotherapy	Improves pain, effect vs. PRP unknown	Difficult to access in community, variable costs.
PRP	Superior to other treatments (CSI and shockwave)	$$$

OBJECTIVES

By the end of the session, **you will be able to**:

- ✓ Describe the pathophysiology of plantar fasciitis;
- ✓ Describe the basic principles behind orthobiologic treatments (ESWT, dextrose prolotherapy, PRP);
- ✓ Counsel a patient regarding the pro's and con's of interventional treatment for plantar fasciitis;
- ✓ Offer your patients some insights where orthobiologic injections might fit into their treatment plan.

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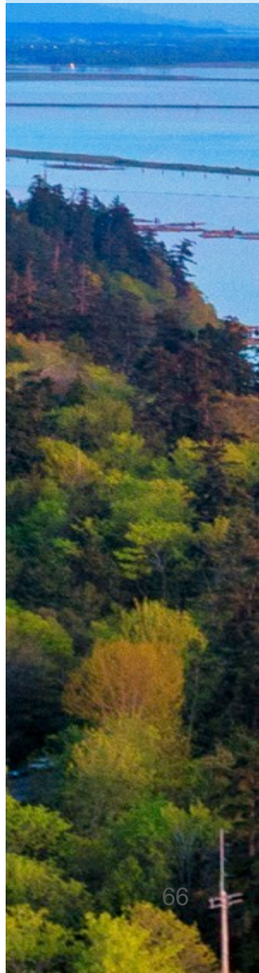

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