SURGICAL, MINIMALLY INVASIVE PROCEDURES AND NON-INVASIVE PROCEDURES FOR THE TREATMENT OF PLANTAR FASCIITIS

TREATMENT THEORIES

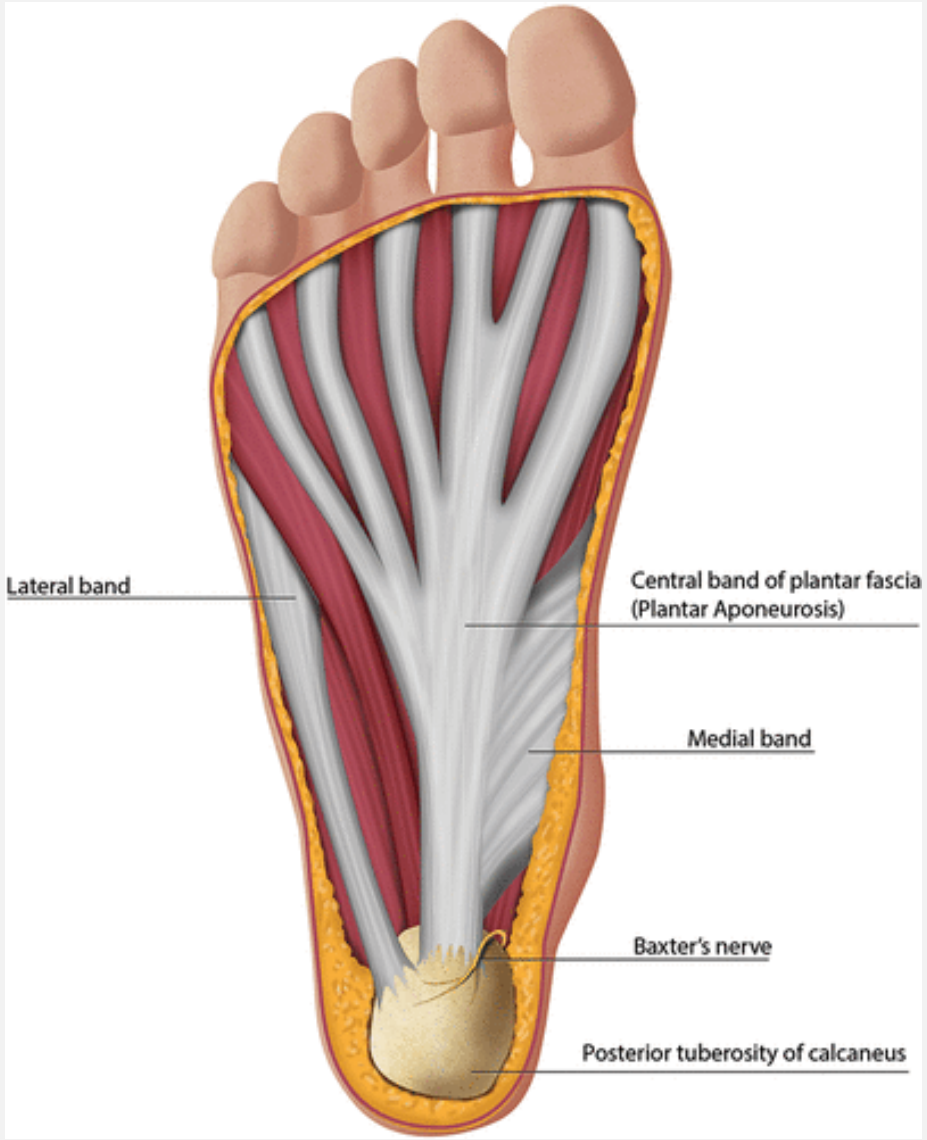
Doctors and allied health practitioners over the past few decades have devised several techniques to decreased pain and promote healing of the plantar fascia

Some attempt to break up scar tissue that has built up around the plantar fascia

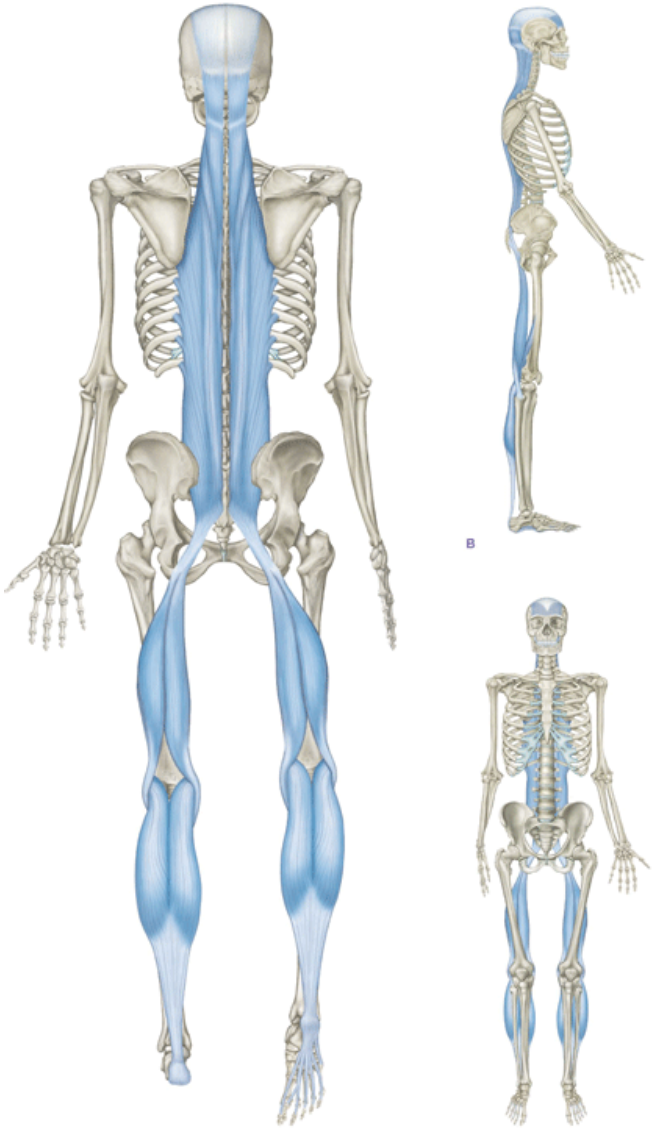
Others attempt to stimulate healing by increasing local blood flow to the plantar fascia

PLANTAR FASCIA ANATOMY

- The medial and lateral bands are infrequently involved in PF
- The central band (aka the plantar aponeurosis) is the thickest, strongest, and most often involved in PF
- It divides into five bundles at the midtarsal level, with each band attaching to the plantar plate of one of the proximal phalanges



ANATOMY TRAINS



DIFFERENTIAL DIAGNOSES

Neurologic

- Peripheral neuropathy (diabetes, idiopathic, nutritional)
- Baxter's neuroma (neuritis)
- L5/S1 neural foraminal impingement or lumbar spinal stenosis
- Tarsal Tunnel Syndrome

Rheumatologic

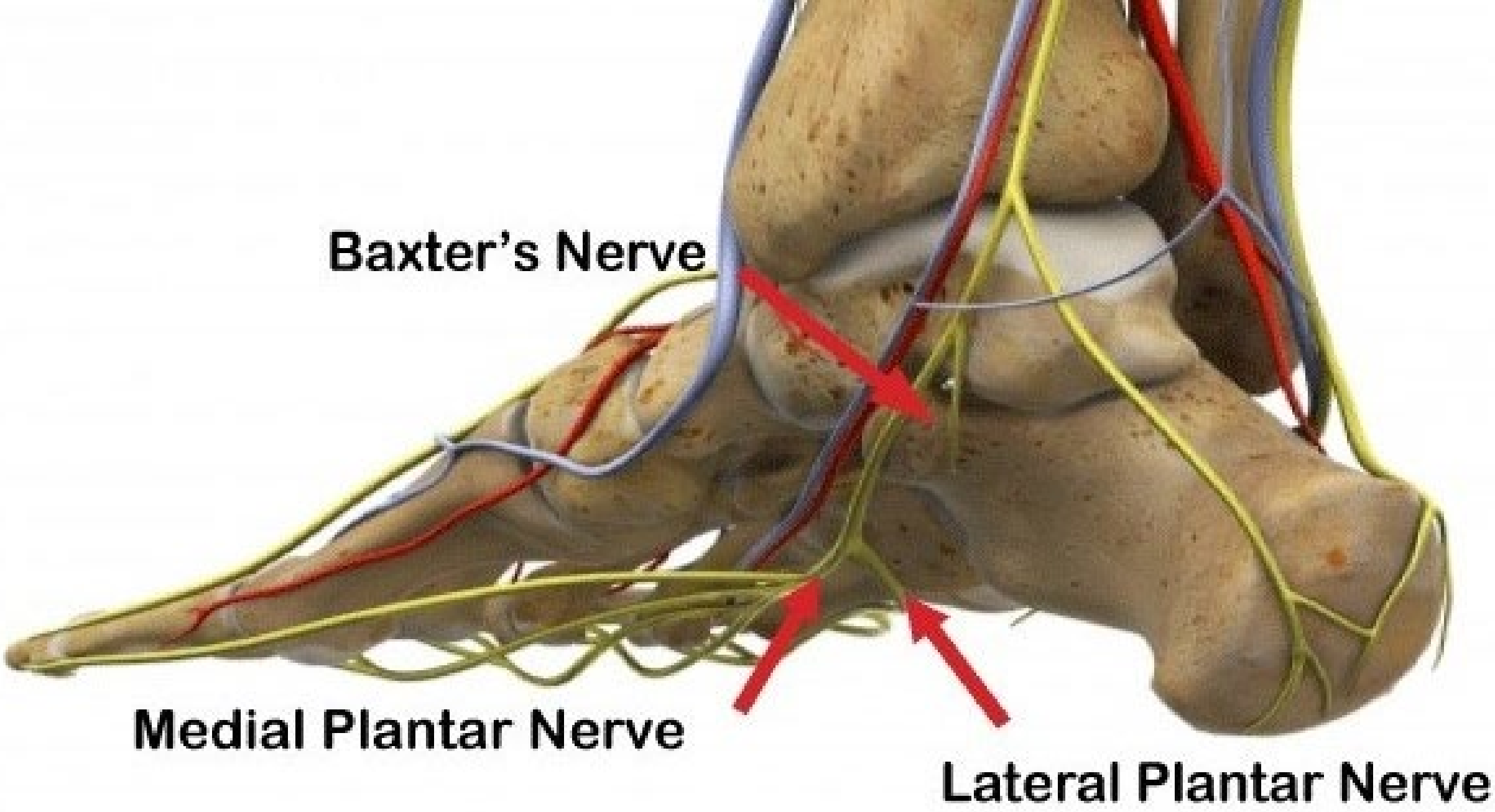
- Rheumatoid arthritis
- Psoriatic arthritis
- Reactive arthritis
- Seronegative spondyloarthropathy

Degenerative

- Plantar fasciopathy
- Fat pad atrophy

Traumatic

- Calcaneal fracture
- Plantar fascia rupture


Baxter's Nerve
Medial Plantar Nerve
Lateral Plantar Nerve

MINIMALLY INVASIVE PROCEDURES

- Platelet-Rich Plasma (PRP) injections
- Cortisone injections
- Prolotherapy

PLATELET-RICH PLASMA INJECTIONS

- PRP is a technique whereby a patient's own whole blood is placed in a centrifuge which when accelerated causes parts of blood to separate
- The portion of blood that rises to the top of the test tube is PRP
- PRP is rich in oxygen, and several other tissue healing by-products
- When injected into tissue that have been injured or are inflamed it stimulates a natural healing affect
- The cytokines and growth factors present in PRP may play an important role in the treatment of PF.
- PRP is rich in transforming growth factor, vascular endothelial growth factor, and platelet-derived growth factor. In addition, PRP also has some anti-inflammatory and pro-inflammatory cytokines and interleukins, such as interleukin 4, 8, 13, interferon-α, and tumor necrosis factor-α
- The combination of these growth and anti-inflammatory components is necessary to initiate the healing stages and to reverse the degenerative process at the base of the plantar fascia

CONTRA-INDICATIONS

- Local abscess
- Bleeding disorders
- Patients on anticoagulant medication
- Acute infections such as cellulitis
- Septic arthritis

ADVERSE EFFECTS

- Mild bleeding
- Local hypersensitivity
- Stiffness
- Facial flushing
- Local infection
- Allergic reactions
- Numbness at the site of injection
- Mild pain and irritation at the site of injection for up to 72 hours post injection

PROS & CONS

Pros

- Benefits usually felt within the first three months after injection
- One injection can provide pain relief that last up to 6 months
- Low risk of adverse events
- Good long-term effects

Cons

- Is a quite painful procedure
- A referral to a radiologist or sports medicine doctor is required
- Relatively expensive procedure (between $200-1000 per injection: 1-3 injections are generally required).
- Risk of infection since it is an invasive procedure
- Poor short-term benefits (1-3 months)

CORTISONE INJECTIONS

- Cortisone is a steroidal anti-inflammatory
- When injected into the plantar fascia it is generally paired with a local anaesthetic.
- Local anaesthetic has immediate effects and reduces the discomfort of the injection, which tends to be quite painful
- Some practitioners may also inject a nerve block in the ankle (posterior tibial nerve) so that the injection into the plantar fascia is more tolerable.[19]

CONTRA-INDICATIONS

- Local abscess
- Bleeding disorders
- Patients on anticoagulant medication
- Known allergy to local anaesthetic
- Acute infections such as cellulitis
- Septic arthritis

ADVERSE EFFECTS

- Mild bleeding
- Local skin atrophy
- Local hypersensitivity
- Stiffness
- Facial flushing
- Local infection
- Osteomyelitis
- Allergic reactions
- Numbness at the site of injection
- Mild pain and irritation at the site of injection for up to 72 hours post injection
- Irreversible atrophy of the fat pad of the heel
- Plantar fascia rupture in 2.4-6.7% of patients (occurred more often with an increased number of injections as well as increased BMI[20]

PROS & CONS

Pros

- Gives immediate relief
- One injection can provide pain relief that last up to 3 months
- Low risk of adverse events
- Low cost
- Can be administered by a GP, however, radiologists who use ultrasound guided injections tend to have fewer complications
- Good short-term effects

Cons

- It is quite painful procedure
- Many cortisone injections are not successful after one injection, and may require multiple injections, which is associated with increased risk of potential complications
- Effects only last 4-12 weeks (poor long-term effects)
- Risk of infection since it is an invasive procedure
- Injection into the medial lobe of the calcaneus can lead to irreversible atrophy of the fat pad of the heel
- Possible nonserious adverse effects
- Plantar fascia rupture occurs in 2.4-10% of patients, with a greater risk associated with the higher number of injections[17]

MINIMALLY INVASIVE SURGICAL PROCEDURES

- Topaz procedure
- Tenjet procedure
- Tenex FAST procedure

TOPAZ PROCEDURE

- This procedure involves the injection of a local anesthetic and then systematically punctures the heel multiple times with a needle-like instrument called a wand
- The wand delivers radio frequency waves that break up scar tissue within the plantar fascia
- This procedure is purported to increase blood flow to the injured plantar fascia area and may facilitate healing
- Recovery is approximately 4 weeks and a moonboot is worn for up to 3 weeks after the procedure
- Rehabilitation exercises are recommended to decrease pain sensitivity and promote healing

TENEX FAST PROCEDURE

- During this procedure, the doctor uses a handheld device to deliver ultrasonic energy (sound waves) to the plantar fascia
- The goal is to is break up and remove dead or contaminated tissue and stimulate healing
- This procedure requires an injection of local anesthetic and one or more small incisions

SURGICAL PROCEDURES

- Partial Plantar Fasciotomy
  - Open
  - Endoscopic

PARTIAL PLANTAR FASCIOTOMY

- These procedures are only indicated for chronic recalcitrant PF cases that do not respond to 6-12 months of conservative treatment
- Partial plantar fasciotomy involves partial transection of the PF to stimulate a healing response
- It can be performed via open surgery or endoscopic surgery
- The procedure involves making small cuts in a fraction of the fibers that make up the plantar fascia
- This is done in order to relieve tension and stress in the ligament
- Despite the popularity of plantar fascia release, there is only weak evidence to support its use

CONTRA-INDICATIONS

- Local abscess
- Bleeding disorders
- Patients on anticoagulant medication
- Known allergy to local anaesthetic
- Acute infections such as cellulitis
- Septic arthritis
- Venous insufficiency
- Peripheral neuropathy

ADVERSE EFFECTS

- Nerve problems, such as nerve damage, nerve entrapment or tarsal tunnel syndrome
- Recurring heel pain
- Neuroma, a benign tumour made of nerve cells and nerve fibres
- Delayed wound healing
- Infection
- Risks of anaesthesia
- Possibility that symptoms could get worse after surgery (rare)
- Loss of height in the longitudinal arch
- Unresolved symptoms

OPEN PARTIAL PLANTAR FASCIOTOMY

- A small area in the bottom of the foot is cut to give access to the plantar fascia to allow your surgeon to see it
- By partially cutting this tissue, the surgeon releases tension and allows the plantar fascia to lengthen and heal
- Trapped nerves or bone spurs can also be removed at this time
- The surgical wound is closed with suture following irrigation and covered with sterile dressings

PROS & CONS

Pros

- Surgery offers another treatment option for patients who fail conservative treatment
- Gives immediate relief
- Only one surgery is generally required for long lasting relief
- This procedure allows direct visualisation of the plantar fascia in an area that is at low risk for nerve entrapment

Cons

- Can only be performed in a hospital setting
- Patients need to wear a cast or brace for the first two or three weeks of recovery
- Expensive procedure (surgery varies by your location, the type of insurance you have but is generally $5-10k)
- Long rehabilitation period (6-10 weeks before unassisted walking can resume, and approx. 3-8 months for full recovery)
- Risk of infection since it is an invasive procedure
- Scar tissue forms from the surgical procedure
- Many possible adverse effects
- A general anaesthetic is required
- 5-8% of patients end up with a tender plantar scar

ENDOSCOPIC PARTIAL PLANTAR FASCIOTOMY

- This procedure is indicated only for the release of the proximal medial aspect of the plantar fascia in cases that do not respond to conservative treatment
- Involves two small incisions 5-10mm long under the ankle bone, each less than 1c long
- The surgeon will insert a small camera, called an endoscope, in one of the openings and a tiny knife in the other to release the plantar fascia
- By partially cutting this tissue, the surgeon releases tension and allows the plantar fascia to lengthen and heal
- The incisions are then sutured and bandaged with sterile dressings

ADVERSE EFFECTS

- Nerve problems, such as nerve damage, nerve entrapment or tarsal tunnel syndrome
- Recurring heel pain
- Neuroma, a benign tumour made of nerve cells and nerve fibres
- Delayed wound healing
- Infection
- Risks of anaesthesia
- Possibility that symptoms could get worse after surgery (rare)
- Excessive release causing loss of height in the longitudinal arch

PROS & CONS

Pros

- Can be performed with a local anaesthetic or mild sedative
- Surgery offers another treatment option for patients who fail conservative treatment
- The procedure can be done in a hospital, surgical center, or doctor's office
- Patients able to walk normally after three to six weeks
- Gives immediate relief
- Only one surgery is generally required for long lasting relief
- Endoscopic surgery generally has a shorter recovery time over open surgery
- Only a small incision is made
- Patient's do not need to wear a cast and can start unassisted weight bearing when they feel comfortable to do so

Cons

- Expensive procedure (surgery varies by your location, the type of insurance you have but is generally $5-10k)
- Risk of infection since it is an invasive procedure
- Scar tissue forms from the surgical procedure
- Many possible adverse effects

STATISTICS

- Approximately 5-10% of PF patients will require surgery
- Retrospective studies have shown success rates vary from 56%-96%[24]
- PF more often affects only one foot, although approximately 30% of patients have bilateral symptoms
- Many of these studies report worsening and/or persistent heel pain in an unacceptably high percentage of patients

NON-INVASIVE TECHNIQUES

- Low Level Laser Therapy (LLLT)
- RelēF
- Extracorporeal Shock Wave Therapy (ESWT)

LOW LEVEL LASER THERAPY (LLLT)

- LLLT (aka Cold Laser) is believed to cause physiological adaptations due to tissue stimulation via photochemical (non-thermal) effects on cells.[13]
- Photons from the laser are absorbed by cellular photoreceptors and triggers chemical changes.
- It increases cell metabolism by increasing the permeability of cell membranes and accelerates fibroblast activity.[12]
- Effects include neovascularization, promote angiogenesis and increase collagen synthesis to aid in the healing of acute and chronic wounds.[15]
- A study by Kiristi et al. demonstrated used ultrasound imaging after LLLT treatment to show plantar fascia thickness was significantly decreased when compared to a placebo group.[14]
- The exact mechanism of action of LLLT-mediated pain relief has not been identified.

LIST OF THE POSSIBLE MECHANISM OF ACTION OF LLLT

- Peripheral neural blockade
- Enhancement of peripheral endogenous opioids
- Suppression of central synaptic activity
- Inhibition of histamine release
- modulation of neurotransmitters
- Promotion of adenosine triphosphate (ATP) production
- Reduction of muscle spasm
- Increased production of anti-inflammatory cytokines

CONTRA-INDICATIONS

1. Pregnant women (relative contraindication)
2. Local tumors / cancers
3. Epileptics

*Low frequency pulsed visible light (<30Hz) might trigger a seizure in photosensitive, epileptic patients

ADVERSE EFFECTS

- There are no known long-term side effects of this form of light therapy
- May cause damage to the eye if shown or reflected into the eye (mitigated by wearing protective goggles)

PROS & CONS

Pros

- Totally painless procedure
- No adverse events post treatment (when administered correctly)
- Relatively inexpensive treatment
- Fast acting pain relief – within the treatment session
- Low risk of adverse events
- Low cost
- Can be done it most allied health clinics (chiro, osteo, physio, massage)

Cons

- Nonserious adverse events include skin burn or irritation if distance from source is not maintained or dose tolerance is exceeded
- Poor long-term benefits (>3 months)
- Need to find a clinic that has a low-level laser

RELĒF

- RelēF utilizes a process called electrocoagulation which is a form of radio frequency to break down scar tissue and stimulate the body's natural healing process
- The process increases the temperature of deep targeted tissues up to 50˚C while leaving the superficial layers (skin) cool
- The skin is cooled by a patented liquid mist technology while the heat is transferred to the deeper tissue
- It uses "pulses of energy" lasting less than 3 seconds each. A full treatment consists of up to 100 pulses.
- There is little or no discomfort following the treatment
- This treatment does not require anesthesia, injections or incisions and is usually painless
- The foot is placed in a boot for one week afterward

CONTRA-INDICATIONS

1. Pregnant women
2. Local tumors / cancers
3. Bleeding disorders
4. Patients taking prescription blood thinners (Warfarin)
5. Local cortisone injections (Ok 6 wks post injection)

ADVERSE EFFECTS

- There are no none adverse effects related to this procedure

PROS & CONS

Pros

- Gives immediate relief
- One treatment can provide pain and healing effects up to 3 months later
- No adverse events post treatment
- Pain free procedure
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Cons

- Moderately expensive procedure
- Procedure is not available at many clinics

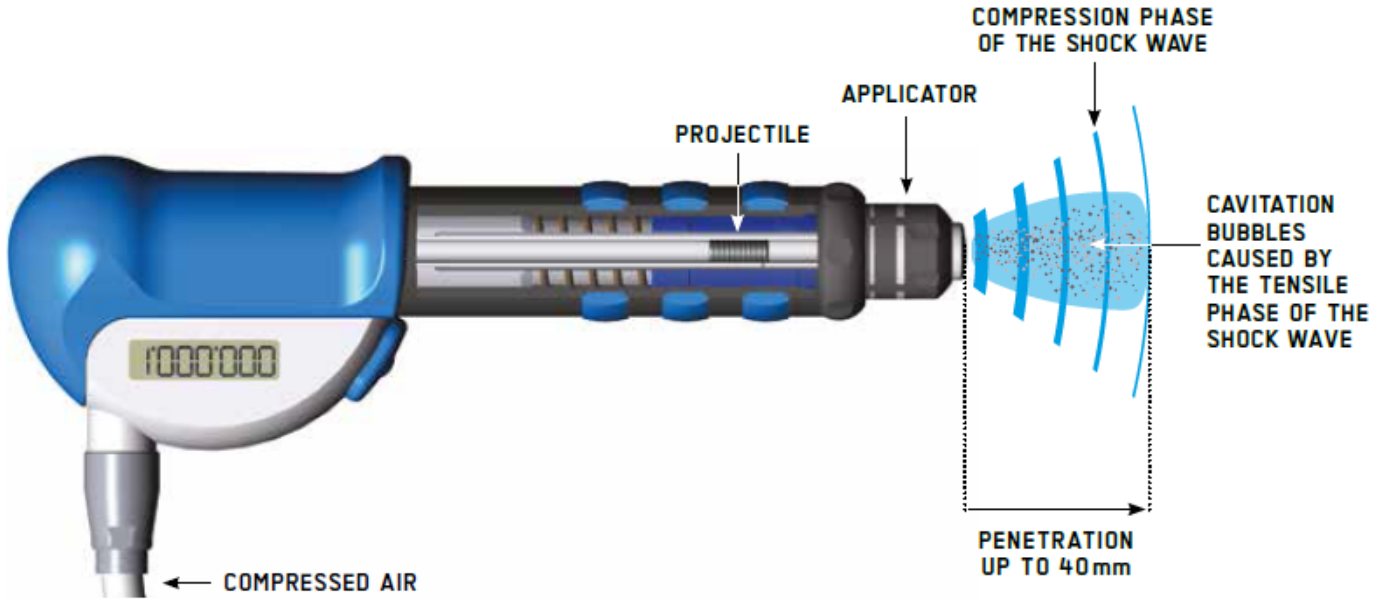
EXTRACORPOREAL SHOCKWAVE THERAPY

- Extracorporeal shock wave therapy (ESWT) has been used to treat several musculoskeletal disorders for the past 30 years
- A shock wave is a single acoustic pressure pulse. It is characterised by a rapid rise to a high peak pressure followed by a rapid drop to below ambient pressure
- The energy promotes repair and regenerative processes of bones, tendons, muscles, and other soft tissues

HOW IT WORKS

- A projectile in the handpiece is accelerated at high speed by means of precisely controlled bursts of compressed air
- When the projectile strikes the applicator inside the handpiece, its kinetic energy is converted into a mechanical energy force
- This energy is transmitted along the applicator without creating any noticeable movement
- The shock wave energy is then emitted at the tip of the applicator and applied to the patient's affected tissue
- To minimise transmission losses - which would occur in the air between applicator and skin interface – contact gel is used to guide the shock wave

> Compressed air accelerates a projectile that strikes a fixed applicator at high speed (up to 90 km/h) – the kinetic energy is converted into a shock wave delivered to the target tissue through the skin



CONTRA-INDICATIONS

1. Air filled tissues: lung, gut
2. Pregnant women (relative)
3. Local tumors / cancers
4. Bleeding disorders
5. Patients taking prescription blood thinners (Warfarin)
6. Local cortisone injections (Ok 6 wks post injection)
7. Patients under the age of 18 (except Osgood Schlatter)
8. Pre-ruptured tendons

ADVERSE EFFECTS

- Pain and discomfort during and after treatment (anesthesia is not necessary)
- Reddening of the skin
- Petechia
- Swelling and numbness of the skin over the treatment area
- These device-related nonserious adverse effects usually disappear within 36 hours of the treatment

EVIDENCE FOR THE SAFETY AND EFFECTIVENESS OF ESWT

- Lioa, Xie, Tsauo, Chen and Liou
- ***Efficacy of extracorporeal shock wave therapy for knee tendinopathies and other soft tissue disorders: a meta-analysis of randomized controlled trial.***
- BMC Musculoskeletal Disorders 2018; 19:278
- **Conclusion:**
- "Out of 19 RCTs and 1189 patients – no adverse events, side effects, or complications were reported after ESWT."
- "Both fESWT and rESWT with long intervention periods are superior to those with shorter intervention periods, regardless of the energy level."

PROS & CONS

Pros

- Gives immediate relief
- One treatment can provide pain and healing effects up to 3 months later
- No adverse events post treatment
- Relatively inexpensive treatment
-

Cons

- Is a mild to moderately painful procedure
- Need to use contact gel on the skin
- Need to find a practitioner that has a shock wave machine