Energy data: therapy source F7/G3

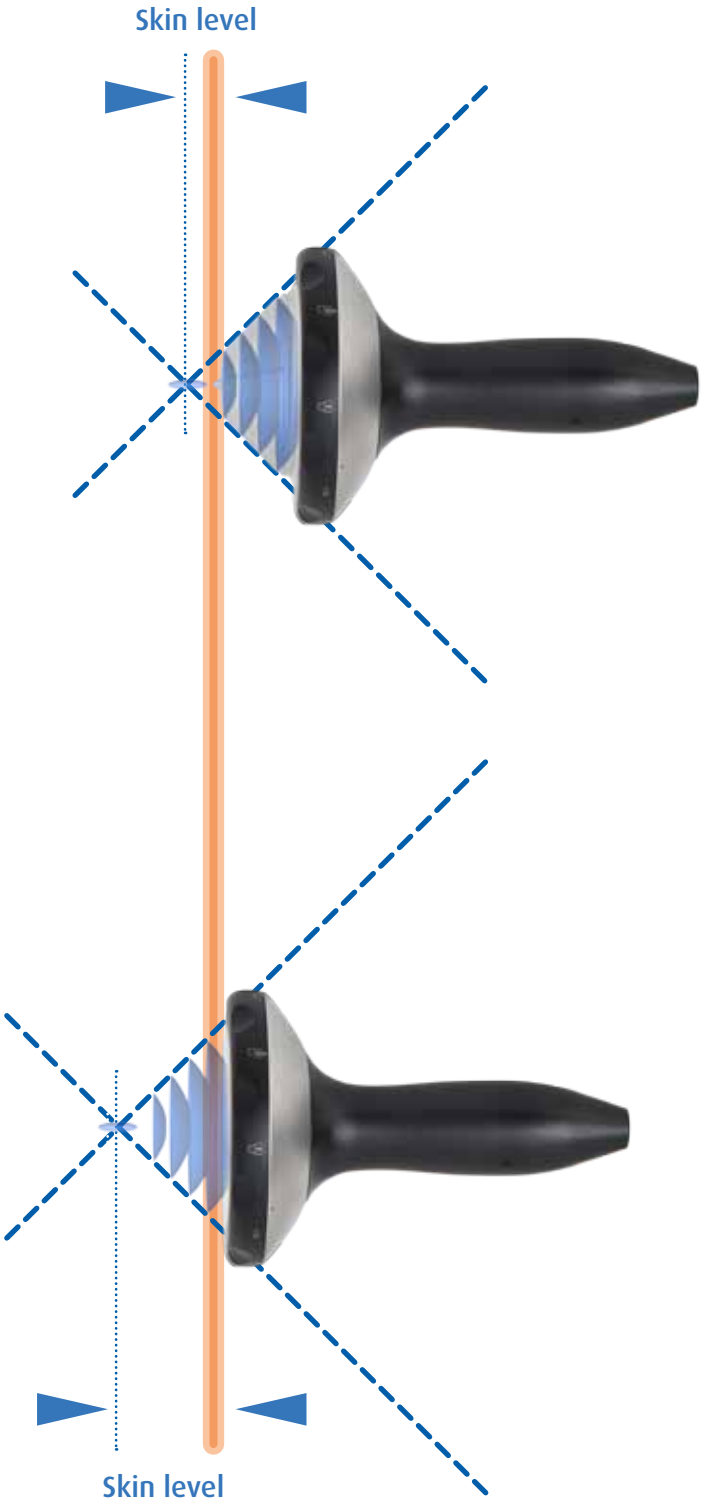
Level	Energy flux density (mJ/mm2)
0,1 - 1	0,018- 0.048
2	0.063
3	0.073
4	0.086
5	0.097
6	0.110
7	0.123
8	0.134
9	0.154
10	0.167
11	0.191
12	0.210
13	0.227
14	0.255
15	0.272
16	0.299
17	0.315
18	0.346
19	0.376
20	0.403

Penetration depth:

Piezoelectric shockwave therapy is applied using multiple applicator (gel) pads, which direct the therapeutic shockwaves to the desired tissue depth. The energy generated by the device literally passes through the tissue in the body without any impact, while the energy wave is concentrated and focused precisely at the desired tissue depth.

Anesthesia requirements:

Piezoelectric devices typically do not require patients be anesthetized for ESWT procedures, even when high energy settings are used.



TREATMENT

TECHNOLOGY

Disclaimer

All information in this brochure relating to settings, application positions, application duration and the use of instruments are based on clinical experience. This information are intended to provide supporting guidelines, the applicability of which must be verified by the trained medical end user. The information provided here is not intended as a substitute for the User Manuals. Depending on individual circumstances, it may be necessary to deviate from the values provided in this brochure. The usage protocols are based on experience obtained by medical professionals using the Richard Wolf PiezoWave shockwave unit. Richard Wolf Piezo Shockwave systems should only be used by experienced physicians trained in the application of shockwaves (ESWT). Avoid applying shockwave pulses to organs containing trapped air (e.g. lungs, intestines) or susceptible to shockwaves (e.g. brain, heart). Confirmation of the focused energy area based on the position of the therapy source, and position on the patient is advised. Nationally applicable ESWT guidelines and approvals must be complied with.

Calcific tendonitis

Etiology

Tendinosis calcarea is a common cause of shoulder pain, particularly in persons between the age of 30 and 60 years. The etiology of the disease has not yet been elucidated. Calcifications develop in the tendons of the rotator cuff and typically go through defined stages or evolutionary cycles. The supraspinatus and infraspinatus muscles are mainly affected.

Initially patients only report pain when performing certain movements, particularly circular movements or raising their arm above their head – movements in which the rotator cuff plays an important role. In later stages patients may experience pain even when at rest. Intermittent acute pain attacks are typical for calcific tendonitis of the shoulder. Focused shockwave therapy has become an established therapy in addition to classic treatment approaches. Studies have reported an increase in function and a decrease in pain after shockwave applications.

Preparation

Tendinosis calcarea is classically diagnosed using imaging. Imaging can clearly visualize the calcific deposits and localize them between the humeral head and the shoulder blade (acromion) and imaging can also be used to determine the penetration depth.

Positioning of the patient

- sitting or dorsal position

Treatment

- Gel pad: select required penetration depth based on previous diagnosis. Empirical value 15-25 mm
- Gel application: as described in the User Manual
- Intensity: start by administering 0.048 mJ/mm² and increase intensity until shockwaves can be felt distinctly. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.077-0.317 mJ/mm²
- Frequency of application: up to 3-5 times
- Treatment interval: 1-2 treatments per week
- Frequency: 2-5 Hz
- Impulses per session: 1500-2000 shocks
- Post treatment: no sports or only individually adapted sports activities for 4-6 weeks. Stretching exercises must be continued. Outcome must be reviewed after 8-12 weeks.

Epicondylitis - radial/ulnar

Etiology

Epicondylitis is a disease of the tendons and ligaments which also always involves the musculature, particularly at the muscular point of insertion. Typically it presents as painful changes at the point of insertion or point of origin of a muscle, tendon or ligament. Epicondylitis is caused by overexertion of the forearm musculature, i.e., extreme or repetitive movements or overstraining of the affected muscle. Patients describe strong pain in their elbow joint radiating out to their upper arm and forearm musculature. Studies show that ESWT may be a useful non-invasive treatment to reduce pain. The use of focused shockwaves for the treatment of trigger points triggered by epicondylitis has been shown to additionally improve outcomes.

Preparation

The diagnosis of epicondylitis is made based on strong symptoms of pain or tenderness at the point of condyle insertion or muscle group origin when pressure is exerted on these areas. Painful symptoms restrict movement of the elbow joint. So-called resistance tests may be carried out. The patient may be requested to form a fist and push upwards or downwards. If the patient has tennis or golfer's elbow, these movements will increase the pain sensation at the elbow joint. Forearm muscles are often tense and knotted. Additional imaging can contribute to the diagnosis and help determine the required penetration depth.

Positioning of the patient

- dorsal position
- position the arm somewhat higher

Treatment

- Gel pad: select required penetration depth based on previous diagnosis.
  Empirical value: 10-15 mm
- Gel application: as described in the User Manual
- Intensity: start by administering approx. 0.037 mJ/mm² and increase intensity until shock waves can be felt distinctly. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.089 -0.271 mJ/mm²
- Frequency of application: 3-5 times
- Treatment interval: 1-2 sessions per week
- Frequency: 2-5 Hz
- Impulses per session: 1000 - 3000 shocks
- Post treatment: no sports or only individually adapted sports activities for 4-6 weeks.
  Stretching exercises must be continued. Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the delta and biceps muscle

Trochanteric tendonitis

Etiology

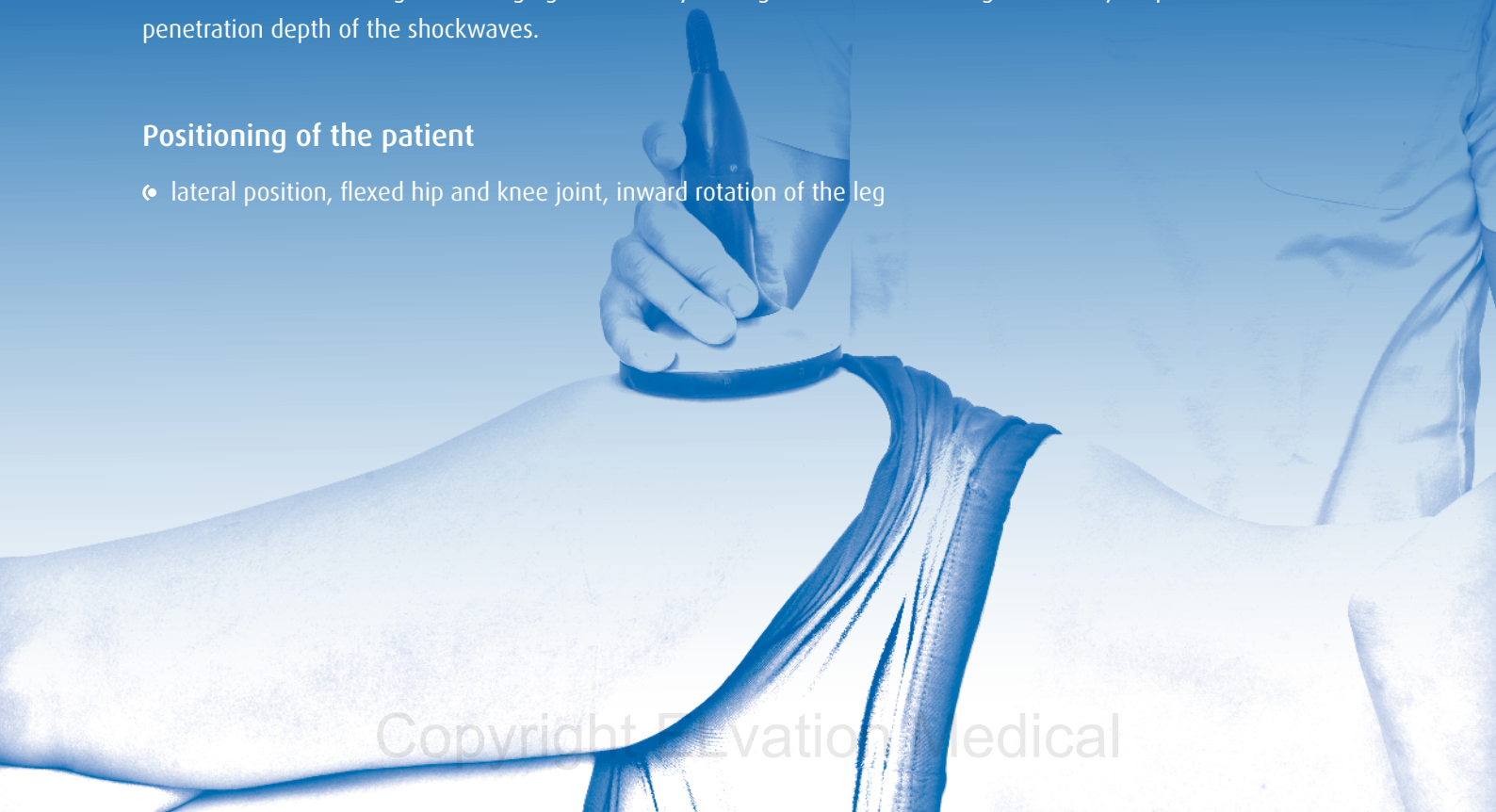
Trochanteric pain syndrome is a common regional pain syndrome. It is characterized by chronic and intermittent aching pain over the lateral side of the hip and a limitation of function. Precipitating factors are often slight malformations or minor deformities of the hip, found on X-ray examination, including a slight misalignment of the femur head. Overuse can lead to chronic irritation in the area of the trochanter causing inflammatory changes to the tissue. This may manifest as acute pain on palpation of the greater trochanter at the hip joint. Patients may experience pain on performing certain movements with the pain occasionally radiating out to the affected leg.

Preparation

Because there may be many causative factors, piezo shockwave applications to treat trochanteric tendonitis require a careful differential diagnosis. Imaging is necessary to diagnose structural changes and may help to determine the penetration depth of the shockwaves.

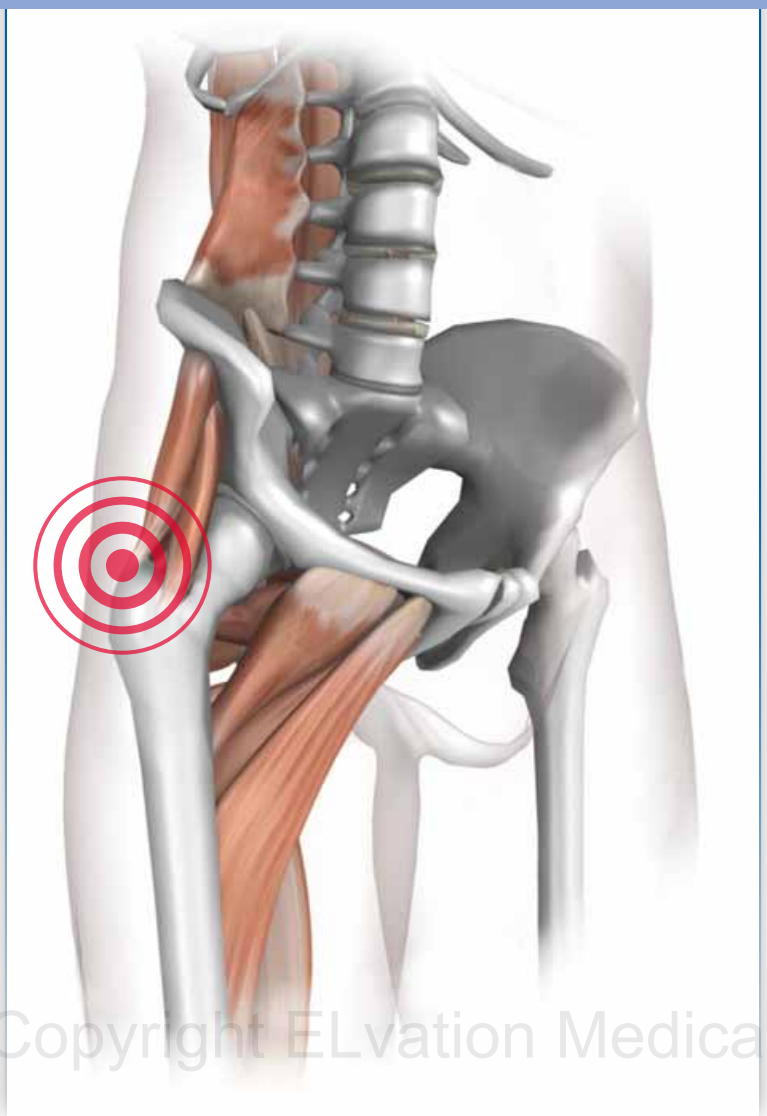
Positioning of the patient

- lateral position, flexed hip and knee joint, inward rotation of the leg



Treatment

- Gel pad: select required penetration depth based on previous diagnosis.
  Empirical value: 20-40 mm
- Gel application: as described in the User Manual
- Intensity: start by administering approx. 0.064 mJ/mm² and increase intensity until shock waves are felt slightly by the patient. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.15-0.355 mJ/mm²
- Frequency of application: 3-5 times
- Treatment interval: 7-14 days
- Frequency: 2-5 Hz
- Impulses per session: 1000-3000 shocks
- Post treatment: physiotherapy must be continued.
  Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the tensor fascia latae muscle



Patellar tendonitis / Jumper's knee

Etiology

Patellar tendonitis (jumper's knee) is a condition caused by overstraining of the patellar tendon due to repetitive, unusual and / or acute tension in the area where the tendon connects to the bone. Thus, athletes who perform sports requiring a lot of jumping, such as volleyball, basketball, high jump or long jump, but also runners and football players are particularly prone to patellar tendonitis / jumper's knee. Patients with patellar tendonitis / jumper's knee report pain at the bottom and front of the kneecap, especially when pressing or palpating this area as well as the area around the inferior tip of the patella, which increases during physical activity. Initially the pain may disappear during sports activities and return again after the sports activity has ended. In advanced stages of this condition the pain remains present throughout the whole activity.

Studies have shown that ESWT can be a useful non-invasive treatment to reduce pain and inflammation. Focused shockwave therapy to treat trigger points triggered by jumper's knee has been shown to improve pain conditions and outcomes.

Preparation

Diagnosis is based on the patient's previous history which will usually flag up a history of extensive jumping activities and quadriceps muscle activity. On clinical examination the patient will usually report tenderness above the bottom and front of the kneecap and the inferior tip of the patella. A pain sensation on stretching the lower leg when pushing against mechanical resistance is also typical for this condition.

If there is a suspicion of patellar tendonitis / jumper's knee, ultrasonography and magnetic resonance tomography (MRT) can help secure a diagnosis and determine the necessary penetration depth.

Positioning of the patient

- dorsal position with a supporting pad placed under the knee

Treatment

Preparation

- Gel pad: select required penetration depth based on previous diagnosis.
  Empirical value: 5-15 mm
- Gel application: as described in the User Manual
- Intensity: start by administering approx. 0.048 mJ/mm² and increase intensity until shock waves can be felt distinctly. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.089-0.271 mJ/mm²
- Frequency of application: 3-5 times
- Treatment interval: 7-12 days
- Frequency: 2-6 Hz
- Impulses per session: 1000-3000 shocks
- Post treatment: no sports or only individually adapted sports activities for 4 weeks.
  Stretching exercises must be continued. Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the Quadriceps muscle

Tibial stress syndrome

Etiology

Medial tibial stress syndrome refers to pain along or just behind the tibia. The cause is overexertion of the shinbone and its surrounding tissue. Tibial stress syndrome is commonly reported in athletes who participate in sports requiring frequent abrupt starts and stops. Runners are also often affected. The pain is caused by overstraining the connective tissue between muscles and periosteum of the bone. This leads to an inflammatory reaction of the bony attachment which can also often cause muscle cells to stiffen, creating myofascial trigger points which may manifest as either local or radiating pain.

The use of focused shockwave applications has been reported in the literature and described as a useful complement to traditional therapies.

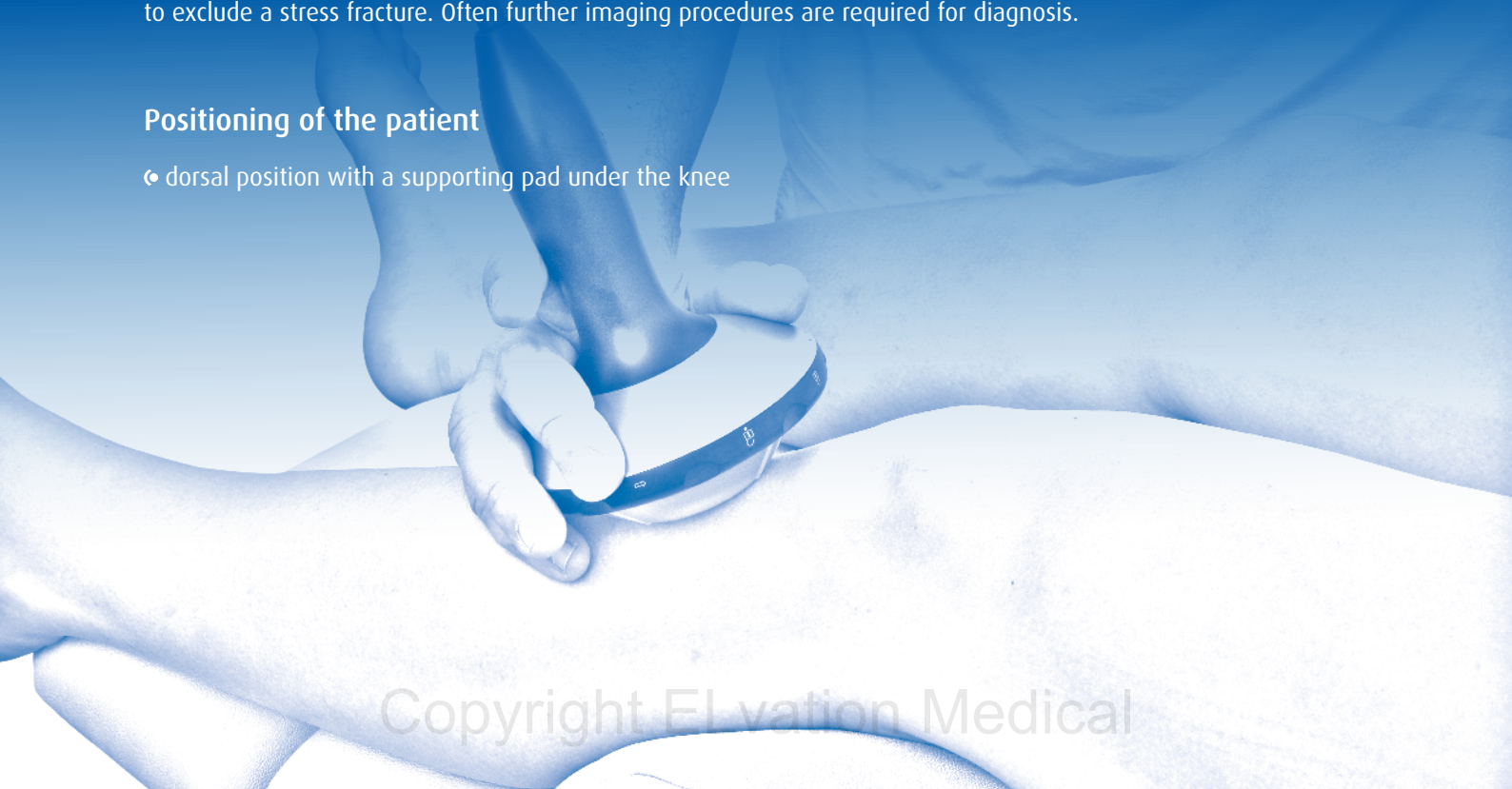
Preparation

After taking the patient's medical history the affected area is palpated.

Palpation may demonstrate tenderness accompanied by swelling along the tibia. X-ray examination is recommended to exclude a stress fracture. Often further imaging procedures are required for diagnosis.

Positioning of the patient

- dorsal position with a supporting pad under the knee



Treatment

- Gel pad: select required penetration depth based on previous diagnosis.
  Empirical value: 0.5-1 cm
- Gel application: as described in the User Manual
- Intensity: start by administering approx. 0.048 mJ/mm² and increase intensity until shock waves are felt slightly by the patient. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.089-0.271 mJ/mm²
- Frequency of application: 3-5 times
- Treatment interval: 7-14 days
- Frequency: 2-5 Hz
- Impulses per session: 1000-2500 shocks
- Post treatment: stretching exercises must be continued.
  Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the tibialis anterior muscle

Achillodynia

Etiology

Achillodynia is a pain syndrome of the Achilles tendon, the tendon that connects the musculature of the calf to the calcaneus bone, and is caused by overstraining of the tendon. It is an inflammatory reaction to a mechanical injury of the tendon through micro-trauma and is very common. Changes to tendon tissue are generally found around 2-6 cm above the calcaneus bone but may also occur at the bony attachment of the tendon. Patients complain of strong acute or chronic pain around the Achilles tendon with thickening in some areas.

Preparation

After taking the patient's medical history, the affected area is palpated. The pain is localized to the area around the Achilles tendon, with tenderness and thickening around the Achilles tendon and the area between the tendon and the calcaneus bone. If the patient additionally suffers from splay and spread foot, the patient may also present with symptoms of plantar heel spur or plantar fasciitis.

Treatment

- Gel pad: select required penetration depth based on previous diagnosis.
  Empirical value: 5-15 mm
- Gel application: as described in the User Manual
- Intensity: start by administering approx. 0.48 mJ/mm² and increase intensity until shock waves can be felt distinctly. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.089-0.238 mJ/mm²
- Frequency of application: 3-5 times
- Treatment interval: 1 per week
- Frequency: 2-6 Hz
- Impulses per session: 1000-3000 shocks
- Post treatment: no sports or only individually adapted sports activities for 4-6 weeks. Stretching exercises must be continued. Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the triceps surae muscle

Plantar fasciitis/heel spur

Etiology

Plantar fasciitis is a common condition. Plantar heel pain is generated when excessive strain is exerted at the insertion of the plantar fascia. The precise etiology of plantar fasciitis has not been elucidated. It has been suggested that it may have a multifactorial etiology, resulting from repetitive, mechanical overstraining at the source of the plantar aponeurosis. This leads to repeated micro-trauma to the plantar fascia with subsequent tissue inflammation.

Patients complain of intermittent pain which gradually increases over time, strongly affecting the heel's load bearing capacity. Characteristically, pain is greatest immediately on getting up in the morning or may appear after a longer period with no pressure exerted on the heel; this pain typically decreases or disappears after taking a few steps. The pain has been described as strong, sharp and stabbing. But patients may also have a pain that occurs during physical activity and abates when the foot is at rest.

Treatment with focused piezo shockwaves has shown a high potential for reducing the pain associated with chronic plantar fasciitis and increasing patient mobility. Studies have shown that its effects can be rapid and sustained in selected patients.

Preparation

The patient's medical history is generally sufficient for a diagnosis of plantar fasciitis. However, imaging may be used in cases where the diagnosis is unclear or in patients suffering continuous pain or to precisely determine the necessary penetration depth of the focused shockwaves. Focused shockwaves can additionally be used to localize/diagnose causative trigger points.

Positioning of the patient

- dorsal or prone position
- relaxation of calf musculature

Treatment

- Gel pad: select required penetration depth based on previous diagnosis. Empirical value 10-15 mm
- Gel application: as described in the User Manual
- Intensity: start by administering 0.055mJ/mm² and increase intensity until shockwaves can be felt distinctly. Avoid strong pain sensation. Carefully monitor patient feedback during application.
- Total energy flux density: 0.077-0.355 mJ/mm²
- Frequency of application: up to 3 times, maximum 5 times
- Treatment interval: 1-2 treatments per week
- Frequency: 2-5 Hz
- Impulses per session: 1500-3000 shocks
- Post treatment: no sports or only individually adapted sports activities for 4-6 weeks. Physiotherapy must be continued. Outcome must be reviewed after 8-12 weeks.
- Tip: Look for Trigger Points in the quadratus plantae muscle and also tibialis posterior muscle

Myofascial trigger point
Myofascial pain syndrome

Etiology

Myofascial trigger points (mTrP) are discrete, focal, hyper-irritable spots commonly located in a taut band of skeletal muscle but they may also be found in other soft tissues. They can trigger pain in an affected muscle and / or associated region even outside the palpated area (referred pain).

Preparation

Piezo shockwaves with their precise focus can be used to localize trigger points exactly and elicit important diagnostic criteria for the recognition of trigger points and referred pain. The shockwaves can even be used to diagnose and non-invasively treat deeper-lying trigger points. Thoroughful Palpation is necessary to diagnose myofascial trigger points and to determine the penetration depth of the shockwaves. Because there can be other causative factors, piezo shockwave applications, to treat myofascial pain require a careful differential diagnosis.

Positioning of the patient

- depends on the individual case. No anesthesia required.

Treatment

- Gel pad: select required penetration depth based on previous diagnosis.
- Gel application: as described in the User Manual
- Trigger point treatment with piezo shockwaves is based on feedback from the patient. Increase intensity until shockwaves are felt slightly by the patient. Avoid strong pain sensation. Monitor patient feedback with regard to recognition of trigger points and referred pain.
- Total energy flux density: 0.032-0.28 mJ/mm^2
- Frequency of application: 1-5 times
- Frequency: 4-5 Hz
- Impulses per session: 500-5000 shocks
- Post treatment: physiotherapy must be continued. Outcome must be reviewed after 8-12 weeks.