

### Massage/muscle rubs

These can be most helpful in relaxing tense or cramped muscles, especially if oil such as lavender is used as this has muscle relaxant properties.

### Transcutaneous Electrical Nerve Stimulation:

Transcutaneous electrical nerve stimulation (TENS) is a commonly used form of electroanalgesia.

Whilst there have been hundreds of clinical reports of the effective use of TENS for various types of conditions such as low back pain (LBP), myofascial and arthritic pain, sympathetically mediated pain, bladder incontinence, neurogenic pain, visceral pain, and postsurgical pain, many of these studies were uncontrolled, which has led to ongoing debate about how effective a treatment it really is.

TENS is thought to produce analgesia by a mechanism of the analgesia explained by the gate control theory proposed by Melzack and Wall in 1965. The gate usually is closed, inhibiting constant nociceptive transmission via C fibres from the periphery to the T cell.

When painful peripheral stimulation occurs, the information carried by C fibres reaches the T cells and opens the gate, allowing pain transmission centrally to the thalamus and cortex, where it is interpreted as pain.

The gate control theory postulated a mechanism by which the gate is closed again, preventing further central transmission of the nociceptive information to the cortex.

The proposed mechanism for closing the gate is inhibition of the C-fibre nociception by impulses in activated myelinated fibres.

TENS is thought to produce neuromodulation by the following proposed mechanisms:

- Presynaptic inhibition in the dorsal horn of the spinal cord
- Endogenous pain control (via endorphins, enkephalins, and dynorphins)
- Direct inhibition of an abnormally excited nerve
- Restoration of afferent input
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Laboratory studies suggest that electrical stimulation delivered by a TENS unit reduces pain through nociceptive inhibition at the presynaptic level in the dorsal horn, thus limiting its central transmission.

The electrical stimuli on the skin preferentially activate low- threshold myelinated nerve fibres. The afferent input from these fibres inhibits propagation of nociception carried in the small unmyelinated C fibres by blocking transmission along these fibres to the target or T cells located in the substantia gelatinosa (laminae 2 and 3) of the dorsal horn.

A TENS unit consists of one or more electric signal generators, a battery, and 1 or 2 sets of electrodes. Stimuli have variable current strengths, pulse rates, and pulse widths. The preferred waveform is biphasic. The usual settings used clinically are:

- Amplitude - Current at low intensity, comfortable level, just above threshold
- Pulse width (duration) - 10-1000 microseconds
- Pulse rate (frequency) - 80-100 impulses per second (Hz); 0.5-10 Hz when stimulus intensity is set high

When used for pain control, it is best to try different frequencies and intensities to find the most

effective combination. Optimal settings are subjective and tend to be determined by trial and error.

Electrode positioning is an important factor and may require assistance from a helper. Usually, the electrodes are placed initially on the skin over the painful area, but other locations (e.g., over cutaneous nerves, trigger points, acupuncture sites) may actually be more effective.

There are 3 setting options:

1. Conventional: high stimulation frequency (40-150 Hz) and low intensity, just above threshold, with the current set between 10-30 mA. The pulse duration is short (up to 50 microseconds). Pain relief should be rapid and persist whilst the stimulus continues, but tends to diminish once the treatment is stopped. Patients tend to wear the TENS all day and turn it on for approximately 30-minute intervals throughout the day. For those who respond well, analgesia may persist for a variable time after the stimulation has stopped.
2. Acupuncture-type setting: the unit delivers low frequency stimulus trains at 1-10 Hz, at a high stimulus intensity, close to the tolerance limit of the patient. This may well be more effective but is often uncomfortable and therefore poorly tolerated. It may be worth trying in people who do not respond to conventional TENS treatment.
3. Pulsed (burst) TENS uses recurrent bursts at 1-2 Hz with a frequency of impulses within each burst of 100Hz. This is low-intensity stimulus with high frequency bursts. There has been no particular advantage established for this method.

The intensity of the impulse depends on both pulse duration and amplitude; the acupuncture-like method is less tolerable because the impulse intensity is higher.

The level of current flow depends on impedance of electrodes, skin and tissues (skin

impedance is reduced by application of electroconductive gel) and with repetitive stimulus, the skin impedance reduces, so that an increased current flow may occur as the stimulus continues.

Skin irritation can occur in around a third of patients, often in part due to the conductive gel drying out. Self-adhesive disposable electrodes may be helpful and repositioning them slightly for repeated applications can reduce skin irritation.

Indications for TENS use:

- Neurogenic pain (e.g., deafferentation pain, phantom pain), sympathetically mediated pain, postherpetic neuralgia, trigeminal neuralgia, atypical facial pain, brachial plexus avulsion, pain after spinal cord injury (SCI)
- Musculoskeletal pain: including joint pain from rheumatoid arthritis and osteoarthritis. Use of TENS in chronic LBP and myofascial pain is controversial, as placebo-controlled studies fail to show statistically significant beneficial results.
- Visceral pain and dysmenorrhoea
- urge incontinence
- Angina pectoris
- Dental anaesthesia.
- assist patients in regaining motor function following stroke,
- to control nausea in patients on chemotherapy

A recent Cochrane Review ( [\[1\]](#) ) on use of TENS in the treatment of chronic low back pain concluded:

“The results of the meta-analysis present no evidence to support the use of TENS in the treatment of chronic low back pain. Clinicians and researchers should consistently report the characteristics of the TENS device and the application techniques used.

New trials on TENS should make use of standardized outcome measures. This meta-analysis lacked data on how TENS effectiveness is affected by four important factors: type of applications, site of application, treatment duration of TENS, optimal frequencies and

intensities."

### Contraindications for the use of TENS

- Should not be used in patients with a pacemaker (especially of the demand type).
- Should not be used in pregnancy (may induce premature labour).
- Should not be applied over the carotid sinuses due to the risk of acute hypotension through a vasovagal reflex.
- Should not be placed over the anterior neck because of possible laryngospasm due to laryngeal muscle contraction.
- The electrodes should not be placed in an area of sensory impairment where the possibility of burns exists.
- TENS should be used cautiously in patients with a spinal cord stimulator or intrathecal pump.

### New techniques:

- 1. Interferential current therapy (IFC) is based on summation of 2 alternating current signals of slightly different frequency. The resultant current consists of cyclical modulation of amplitude, based on the difference in frequency between the 2 signals. When the signals are in phase, they stimulate, but no stimulation occurs when they are out of phase. The beat frequency of IFC is equal to the difference in the frequencies of the 2 signals. E.g. the beat frequency (stimulation rate) of a dual channel IFC unit with signals set at 4200 and 4100 Hz is 100 Hz. IFC therapy can deliver higher currents than TENS and can use 2, 4, or 6 applicators, arranged in either the same plane for use on regions such as the back or in different planes in complex regions (e.g., the shoulder).
- 2. Percutaneous electrical nerve stimulation (PENS) combines advantages of electroacupuncture and TENS. Instead of using surface electrodes, PENS uses acupuncture-like needle probes as electrodes, placed at dermatomal levels corresponding to local pathology. The main advantage of PENS over TENS is that it bypasses the local skin resistance and delivers electrical stimuli at the precisely desired level. In patients with chronic LBP and sciatica, PENS has been found to be more effective than TENS in providing short-term pain relief and improved function ( [\[2\]](#) ), including an improved quality of sleep and sense of well-being when used at 4 Hz. Ghoname et al. ( [\[3\]](#) ) found that the frequency of electrical stimulation is an important determinant of the analgesic

response. 40% of their patients reported that 15/30 Hz was the most desirable therapy, and it was also more effective in improving the patient's sense of well-being. Alternating stimulation at 15-Hz and 30-Hz frequencies was more effective than either 4 Hz or 100 Hz. PENS has also been used successfully in patients with herpes zoster (shingles), headache (

[\[4\]](#)

) and cancer with bony metastases.

Acupuncture: contact with patients who have tried this suggests that it is not as useful as could be hoped although some individuals do gain relief.

Beppu et al. ( [\[5\]](#) ) reported on the use of meridian acupuncture (alone or combined with moxibustion) on trigeminal neuralgia. Treatments were repeated 2-4 times a month.

The authors found

"Five patients were restored to a pain-free state. The other five patients noted a decrease in pain, but with some level of pain remaining (significant pain in one patient)."

They concluded that acupuncture was a useful treatment.

The World Health Organisation (WHO) lists a variety of medical condition that may benefit from treatment with acupuncture with or without moxibustion.

These include prevention and treatment of nausea and vomiting; treatment of pain and addictions to alcohol, tobacco and other drugs; treatment of pulmonary problems and rehabilitation from neurological damage such as that caused by stroke.

However, screening by doctors to ascertain suitability for acupuncture treatment is recommended.

The British Medical Acupuncture Society (BMAS) London Teaching Clinic at the Royal London Homeopathic Hospital lists the following indications for acupuncture: ( [6](#) )

### Primary myofascial pain

Pain from skeletal muscle; localised tender knot of muscle may have a wide pain referral pattern; frequently affects neck, shoulder girdle and hip girdle; this responds very well to direct trigger point needling.

- Nociceptive musculoskeletal pain  
osteoarthritis (especially knee, ankle, acromio-clavicular joint & cervical spine)
- Achilles tendonitis, lateral & medial epicondylitis (elbow pain)

### Functional, recurrent & other disorders

- irritable bladder symptoms (nocturia, frequency & urgency)
- irritable bowel syndrome
- migraine headaches
- dry eyes and xerostomia
- menstrual & menopausal symptoms (especially hot flushes)

### Allergies

Hayfever, allergic rhinitis, some forms of urticaria.

### Skin

Local acupuncture needling can be useful in the treatment of localised rashes and ulceration, whereas generalised chronic skin diseases are less likely to respond, although those with an allergic component (some forms of eczema) may do well. Acupuncture seems to be effective in treating itch.

### Fibromyalgia

One randomised controlled trial of high quality found a specific effect of electroacupuncture in fibromyalgia. In practice this condition is not easy to treat, but associated myofascial pain often responds well.

### Neuropathic pain

“Neuropathic pain is difficult to treat. Acupuncture will occasionally have dramatic effects, but often will do nothing for these conditions.”

Belgrade ( [7](#) ) notes:

“Stimulation-based therapies (e.g., transcutaneous electrical nerve stimulation, acupuncture, spinal stimulation, massage) can help in cases of neuropathic pain. However, occasionally these methods aggravate symptoms, especially when allodynia is present. In these cases, stimulation of adjacent uninvolved dermatomes may be effective.”

Acupuncture is also known as 'dry needling'.



Resteghini ( [\[8\]](#) ) discusses published medical literature on acupuncture:

Tulder (1997) conducted a systematic review of randomised controlled trials of common treatment for back pain, including acupuncture. He concluded that the trials had poor methodology. There is however, some evidence to suggest that acupuncture is effective.

Gunn (1980) looked at dry needling in patients with chronic low back and found that they did better than controls. Garvey (1989) compared dry-needling with local anaesthetic injection in patients with low back pain, and found that there was a 63% improvement rate with dry needling. Hong (1994) also supported the use of dry needling as opposed to injection of trigger points.

Acupuncture has been used in Asia for thousands of years for a wide variety of pain conditions, especially the chronic type.

In neuropathic pain the aim of acupuncture is to restore supersensitive structures to normal, rather than to provide pain relief.

How does acupuncture work?

Traditional theory suggests that acupuncture regulates the flow of Qi (life force), restoring a balance by moving it to areas where it is deficient and draining it from where it is in excess.

There is an important paradox in which localised acupuncture can produce analgesia in distant areas of the body.

This is called the nonsegmental analgesic effect. It is thought to arise due to generalized neurohormonal mechanisms, involving the release of free  $\beta$ -endorphin and apparently also of met-enkephalin, and by two descending neuronal mechanisms, the first of which is serotonergic and the second adrenergic.

A third descending system (diffuse noxious inhibitory controls) may also contribute in a minor way to the acupuncture effect.

When a needle is inserted into a tender area, it tends to initiate a lasting reduction in tenderness in the local area: this is the segmental effect.

Segmental acupuncture operates through a circuit involving inhibitory enkephalinergic stalked cells in the outer part of lamina II of the spinal grey matter, which are directly contacted by A ( / group II primary afferents. In addition, there is a considerable body of evidence implicating the sympathetic system effects.

Possible course of events after acupuncture.

Commonly after the initial treatment there is a fairly transient improvement, lasting 2 to 3 days.

Subsequent treatments may provide longer periods of remission, which may also be if greater therapeutic effect. The ideal aim is for total remission of symptoms after 3-6 treatments, but often relief may only be partial and symptoms may recur, necessitating further treatment at intervals.

It is also common for patients to experience an aggravation of existing symptoms, which rarely lasts more than 2 or 3 days, although occasionally it may last longer. The occurrence of an aggravation tends to suggest that there will be a later therapeutic response but this is not always the case.

IntraMuscular Stimulation.

Intramuscular Stimulation (IMS) is a system of diagnosis, physical analysis, and treatment of myofascial pain syndromes and chronic pain of neuropathic origin, based on acupuncture principles.

It was developed by Dr. Chan Gunn, a clinic physician at the Workers' Compensation Board of British Columbia. Dr. Gunn is now a clinical professor teaching IMS at the University of Washington's Multidisciplinary Pain Centre in Seattle and University of British Columbia's Medical School. IMS is also taught and utilised at many other pain centres around the world.

A very thin acupuncture needle is used, which is painless in normal muscle, but in supersensitive, shortened muscle, causes a discomfort similar to a muscle cramp, due to the muscle contracting around the needle. In fact, this is a good sign as it tends to precede a release of the muscle tension.

The effects of IMS are cumulative? dry needling is thought to stimulate healing.

Treatments are usually once a week, the number of treatments required depends on several factors including the duration and extent of your condition, how much scar tissue there is and how quickly your body can heal.

In published studies of patients with non-specific low back pain, the average number of IMS treatments required was 8.2. More may well be needed in arachnoiditis due to the complexity of the condition.

The goal of treatment is to release muscle shortening which presses on and irritates the affected nerves.

Physiotherapy: must be gentle as vigorous exercise may precipitate a flare-up. As in conditions such as Multiple Sclerosis, a non-fatiguing programme is likely to be the most beneficial.

However, even during a flare-up, maintaining mobility is vital. Range of movement exercises ensure that joints remain as supple as possible and help to reduce muscle spasm. Graded gentle increase in exercise capacity can be a helpful strategy to improve mobility, to enhance circulation and to reduce muscle spasm.

Dr. Paul Watson, the first physiotherapy consultant in the UK and a Senior Lecturer at the University of Leicester Medical School, has a special interest in chronic back pain.

Is it safe to exercise?

Dr. Watson's view at a meeting of the Pain Society in London in Autumn 2002, is that it is, provided that the body is structurally sound. Exercise reduces heart disease and stress illnesses.

However, Dr. Watson noted that in the case of neuropathic pain such as that experienced in arachnoiditis, the pain must be well controlled pharmacologically for exercise to be feasible.

He suggested that patients with this type of pain require slow desensitisation of the nervous system, which means a far longer time frame than other types of pain.

Individual rather than group therapy over 1-2 years may well be necessary, although it may not ultimately involve more overall hours than the standard pain management programme (PMP) alongside work with a psychologist.

When there is central pain, conventional physiotherapy involving phasic stimulation of the skin may trigger burning pain by creating skin friction and stimulating gamma pain (see above under central pain); the aim should be muscle stretch using a technique which moves the muscle without rubbing the skin.

However, this deep massage takes considerable time. The optimum may be to have 20 minutes of deep massage a day just prior to performing whatever necessary tasks the patient wishes to tackle.

Hydrotherapy: often very useful, but the water must not be too warm (heat intolerance is common in arachnoiditis patients)

Foot care: as with all cases of peripheral neuropathy causing loss of sensation in the feet, vigilance and early treatment of skin abrasions/damage/infection is essential. Close attention to the suitability of footwear etc. is important.

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[1] Milne S, Welch V, Brosseau L, Saginur M, Shea B, Tugwell P, Wells G. Transcutaneous electrical nerve stimulation (TENS) for chronic low back pain (Cochrane Review). In: *The Cochrane Library*, Issue 2 2003. Oxford: Update Software.

[2] Ghoname EA, White PF, Ahmed HE, Hamza MA, Craig WF, Noe CE. *Pain* 1999 Nov; 83(2):193-9 Percutaneous electrical nerve stimulation: an alternative to TENS in the management of sciatica.

[3] Ghoname ES, Craig WF, White PF, Ahmed HE, Hamza MA, Gajraj NM, Vakharia AS, Noe CE. *Anesth Analg* 1999 Apr; 88(4):841-6 The effect of stimulus frequency on the analgesic response to percutaneous electrical nerve stimulation in patients with chronic low back pain.

[4] Ahmed HE, White PF, Craig WF, Hamza MA, Ghoname ES, Gajraj NM. *Headache* 2000 Apr; 40(4):311-5 Use of percutaneous electrical nerve stimulation (PENS) in the short-term management of headache.

[5] Beppu S, Sato Y, Amemiya Y, Tode I. *Anesth Pain Control Dent* 1992 Spring; 1(2):103-8 Practical application of meridian acupuncture treatment for trigeminal neuralgia.

[6] <http://www.medical-acupuncture.co.uk/referral.shtml>

[7] Belgrade MJ *Postgraduate Medicine* 1999Nov; 106 (6) Following the clues to neuropathic pain.

[8] <http://www.istop.org/resteghini.htm>