

Transcutaneous Electrical Nerve Stimulation (TENS)

Author: SCIRE Community Team | Reviewer: [Amrit Dhaliwal](#) | Published: 27 July 2017 | Updated: ~

Transcutaneous electrical nerve stimulation (TENS) is a non-drug treatment option for pain and spasticity. This page outlines basic information about TENS and its use after spinal cord injury (SCI).

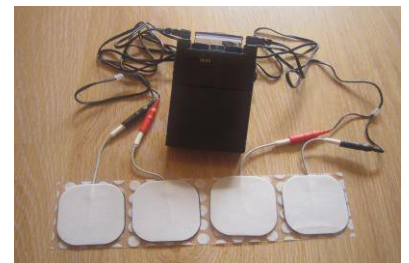
Key points

- TENS is a common form of electrotherapy typically used to treat pain.
- TENS is delivered using electrotherapy machines that send pulsed electrical currents to the body through electrodes placed on the skin's surface.
- TENS is a relatively safe, non-invasive, and well-tolerated treatment option for pain and spasticity after SCI.
- There is moderate evidence that TENS works for neuropathic pain after SCI and strong evidence that TENS works for spasticity after SCI. TENS has not been studied for musculoskeletal pain after SCI, but appears to work for this type of pain in other populations.

What is “transcutaneous electrical nerve stimulation” (TENS)?

Transcutaneous electrical nerve stimulation (TENS, pronounced “tens”) is a common electrotherapy primarily used to treat pain. TENS is a type of electrical stimulation that is delivered using electrical therapy machines connected to electrodes placed on the skin's surface.

For people with SCI, TENS is used as a treatment option for musculoskeletal pain, neuropathic pain, and spasticity.



How is TENS used?

It is important to speak with a health provider before using TENS to make sure it is safe and suitable for you and to learn how to use the equipment correctly.

Most machines used for TENS are portable battery-powered devices with adjustable settings like intensity, frequency, and pulse duration. Changing the settings can provide different types of stimulation. The most common types of stimulation are:

- *Conventional TENS* uses high frequency stimulation to produce sensations of ‘tingling’ or ‘pins and needles’ in areas with normal sensation.
- *Acupuncture-like TENS* uses low frequency stimulation which may or may not cause muscle twitches in the area.



Electrodes placed on the skin²

The machine is connected to a set of electrodes by electrical wires (leads). The electrodes may be self-adhesive or applied with conductive gel onto clean, intact skin. Electrodes may be placed near the area of your symptoms or in other areas directed by your health provider.

Once the electrodes and machine have been set up and connected, the intensity is then slowly turned up until it feels ‘strong but comfortable’ or reaches a set intensity. It should not cause any pain or discomfort.

Your health provider will determine how long the stimulation is used for based on the goals of the treatment. After the TENS machine has been safely turned off and the electrodes have been removed, the skin is inspected for any redness or irritation.

Using TENS below the level of injury

TENS should be used cautiously in areas with reduced or absent sensation because it can cause electrical burns, skin irritation, or autonomic reactions if the person cannot feel that the intensity is too strong.

However, TENS can be used below the level of injury if certain precautions are taken. It should be tried only under the supervision of a health provider. It should be tested in an area of sensation to ensure that there are no harmful reactions and monitored carefully during use.

How does TENS work?

Electrical signals are a natural part of how the nervous system works. Signals that are sent along the nerves are relayed in part as electrical impulses. Because the nerves are naturally susceptible to electrical signals, they can be stimulated by electrical therapies like TENS.



TENS stimulates nerve fibres involved in touch. This might work to treat pain and spasticity in several ways:

- TENS may reduce pain by blocking pain signals so you can feel other sensations instead. This works in the same way as when you rub the skin over a sore area of your body. The unusual “tingling” feeling of the TENS stimulation is sent to the brain instead of pain signals.
- TENS may cause the release of endorphins within the nervous system that may help to reduce pain.
- TENS may affect spasticity by making it less likely that the nerve cells to the muscles (*motor neurons*) will fire.

Are there restrictions or precautions for TENS?

Although there are few reported medical complications caused by using TENS devices, there are many situations in which it could be unsafe to use. The following conditions are some possible restrictions on the use of TENS. Consult a health provider for further safety information.

TENS should **not** be used in the following situations:

- Near the neck or head of people who have had seizures
- Near implanted medical devices like cardiac pacemakers
- On the abdomen or low back of pregnant women (except during labor and delivery)
- On areas of active cancer (except under medical supervision in palliative care)
- On areas with blood clots, bleeding, or infection
- On the chest of people with major heart problems
- By people who are unable to follow instructions or provide accurate feedback
- Electrodes should not be placed over the eyes, through the head, through the chest, on the front of the neck or genitals, or over damaged skin or open wounds



TENS can interfere with the function of cardiac pacemakers.⁴

TENS should be used **with caution** in the following situations:

- In areas of reduced or absent sensation (such as below the level of injury) – please see above for information on using TENS below the level of injury
- By people prone to autonomic dysreflexia (people with cervical and thoracic injuries)

What are the risks and side effects of TENS?

TENS is a relatively safe and well-tolerated treatment for people who can use it safely (see above for restrictions on using TENS). Serious medical complications from using TENS are rare. However, there are risks and side effects that should be discussed with a health provider before using TENS.

The most common risks and side effects of TENS include:

- Skin discomfort, irritation, or redness near the electrodes
- Allergy to the conductive gel
- Mild electrical burns near the electrodes
- An increase in pain or discomfort
- Mild electrical shocks (from improper use or faulty equipment)

Other less common risks and side effects of TENS include:

- Autonomic reactions, like nausea, light-headedness, fainting, or autonomic dysreflexia
- An increase in spasticity

In some cases, risks and side effects may be caused by improper use of the equipment. For this reason, it is essential to learn to use the equipment from a health provider and to only use TENS according to their direction.

Is TENS effective for treating pain and spasticity after SCI?

TENS for nerve pain after SCI

Five studies have tested TENS as a treatment for neuropathic pain after SCI, although only three of these studies were suitable to draw conclusions from. These studies provide moderate evidence that TENS is effective for treating neuropathic pain after SCI.

TENS for muscle, bone, and joint pain after SCI

Research has not explored whether TENS is effective for treating musculoskeletal pain after SCI. However, because this type of pain is experienced in areas of normal sensation (above the level of injury), studies done outside of SCI might help provide some guidance about how well this treatment works.

Reviews of research studies done in conditions like knee arthritis, general acute pain, and chronic low back pain have shown that TENS may be effective for treating musculoskeletal pain from these conditions. However, much of the research included in these reviews (and for TENS generally) is low quality, making it hard to make strong conclusions about whether TENS works for musculoskeletal pain.



A health provider using TENS on a person's leg⁵

TENS for spasticity after SCI

Based on six studies that have tested TENS as a treatment for spasticity after SCI, there is strong evidence that an ongoing program of TENS reduces spasticity after SCI. These studies also show that TENS reduces spasticity even after a single session; although the effects are greater when TENS is used as part of an ongoing program.

The bottom line

Overall, there is moderate evidence that TENS works for neuropathic pain after SCI and strong evidence that TENS works for spasticity after SCI. TENS has not been studied for musculoskeletal pain after SCI, but appears to work for this type of pain in other populations.

TENS appears to be safe to use for most people and is widely available as a low cost treatment option. Until more research is done, it is best to discuss this treatment with your health providers to find out more about if it is a suitable treatment option for you.

For a list of included studies, please see the Reference List. For a review of what we mean by “strong”, “moderate”, and “weak” evidence, please see [SCIRE Community Evidence Ratings](#).

Related resources

SCIRE Community. "Pain after Spinal Cord Injury". Available from: <https://community.scireproject.com/topic/pain/>

SCIRE Community. "Spasticity". Available from: <https://community.scireproject.com/topic/spasticity/>

Abbreviated reference list

This page has been adapted from SCIRE Project (Professional) "Pain Management" and "Spasticity" Chapters:

Mehta S, Teasell RW, Loh E, Short C, Wolfe DL, Hsieh JTC (2014). Pain Following Spinal Cord Injury. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Noonan VK, Loh E, McIntyre A, editors. Spinal Cord Injury Rehabilitation Evidence. Version 5.0: p 1-79.

Available from: <https://scireproject.com/evidence/rehabilitation-evidence/pain-management/>

Hsieh JTC, Wolfe DL, Townson AF, Short C, Connolly SJ, Mehta S, Curt A, Foulon BL (2012). Spasticity Following Spinal Cord Injury. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Noonan V, Mehta S, Sakakibara BM, Boily K, editors. Spinal Cord Injury Rehabilitation Evidence. Version 4.0.

Available from: <https://scireproject.com/evidence/rehabilitation-evidence/spasticity/>

Full reference list available from: <https://community.scireproject.com/topic/tens/#reference-list>

Glossary terms available from: <https://community.scireproject.com/topics/glossary/>

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