

Spasticity

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Spasticity is a common symptom of spinal cord injury (SCI) that causes movement problems and other symptoms. This page outlines basic information about spasticity and how it is treated after SCI.

Key points

- Spasticity is a disorder of movement control that causes muscle spasms, increased muscle tone, and overactive reflexes. It can happen when the brain or spinal cord are damaged.
- Spasticity may cause problems with movement and posture, pain, fatigue, and many other symptoms. However, spasticity can also have benefits for movement and health.
- It is important to work together with your health team to decide whether your spasticity is problematic and worth treating.
- Treatment for spasticity usually begins with identifying specific triggers that make it worse. Management of these spasticity triggers along with other conservative treatments may alleviate these symptoms. Many of these treatments provide short-term relief of spasticity.
- Oral medications and botulinum toxin injections are also commonly used and effective for treating spasticity after SCI.

What is spasticity?

Spasticity is a movement control disorder that happens when the brain and spinal cord are damaged or do not develop properly. It is usually experienced as involuntary muscle spasms, increased muscle tone, and overactive reflexes.

Spasticity is a common symptom of SCI that can affect as many as three-quarters of people with SCI. It is more common among people with cervical and incomplete SCI. Spasticity can also be a symptom of other conditions like brain injury, stroke, and multiple sclerosis.



What does spasticity feel or look like?

Spasticity can be experienced in many different ways depending on the person and the characteristics of their SCI.

Signs and symptoms of spasticity

- Muscles that are constantly and involuntarily tensed (increased muscle tone)
- Stiff muscles that resist movement
- Muscle pain and fatigue
- Muscle spasms or jerky movements

- Uncontrolled movements or difficulty coordinating movements
- Exaggerated reflexes
- Altered posture or positioning

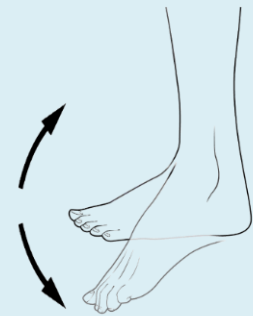
Spasticity is different from normal muscle tension because the amount of tension depends on the speed that the muscle is stretched. Faster movement speeds cause greater tension and resistance to movement.

Clonus

Clonus is a series of involuntary, rhythmic muscle contractions and relaxations, which often accompanies spasticity.

Clonus is most often seen in the ankle as a rhythmic tapping or beating motion of the foot that is triggered when there is stimulus to the ball of the foot. This can happen when putting weight onto the foot during transfers, standing, or walking. Clonus can also be experienced in other joints. Clonus can last for anywhere from a few seconds to several minutes.

Clonus is not the same as spasticity, but a related symptom that happens for similar reasons.



Clonus is often seen as rhythmic tapping or beating motion of the foot at the ankle.²

Spasticity may be constant or triggered by something

The symptoms of spasticity may be constant or come and go. They may also change over time. Some people will have muscle tension that is always present, while others will have spasticity that comes on or gets worse when it is triggered by something.

Common spasticity triggers include:

- Movement of the arms or legs, especially quick movements
- Position changes, such as transfers, walking, or moving in bed
- Stretching
- Tight clothing or other discomfort below the level of injury
- Pressure sores, skin irritation, or wounds
- Bladder problems
- Bowel problems
- Cold temperatures
- Menstrual cycle or pregnancy
- Emotional or psychological stress
- Poor positioning in the wheelchair or bed
- Any other illnesses

Refer to our chapters on [Pressure Sores and Bladder Health](#) for more information!



Transfers are a common trigger of spasticity.³



A change in spasticity can be a sign of other health problems

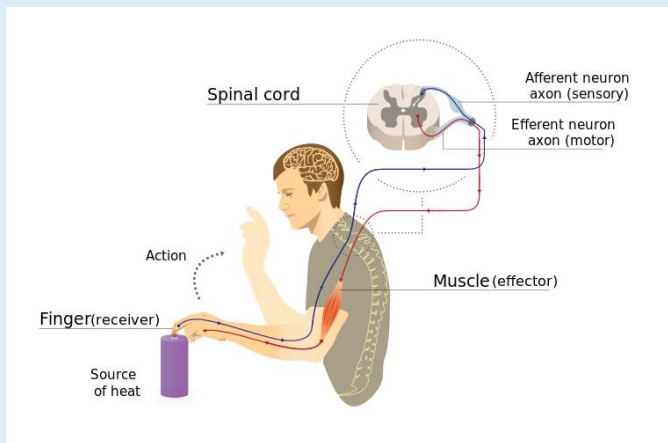
Sudden or unexplained changes in spasticity can sometimes signal a health problem that needs attention – mostly commonly a bladder infection or skin breakdown. If you are not sure why your spasticity has changed, speak to your health providers for further testing.

Why does spasticity happen?

Spasticity is related to several changes to the body that happen after SCI. The main reason for spasticity after SCI is a reduced ability of the brain to calm down overactive reflexes. Over time, the muscles and tendons may also change, becoming tenser and stiffer, which also contributes to the symptoms of spasticity.

The stretch reflex

The *stretch reflex* is an automatic movement response that happens when a muscle is stretched quickly, causing the muscle to tense. It is commonly tested as the ‘tendon tap’ below the kneecap.



Pain signals from touching something hot travels to the spinal cord and back to the muscles without going to the brain first.⁴

When a muscle is quickly stretched, it activates special stretch sensors called *muscle spindles*. They send a signal through sensory neurons to the spinal cord. In the spinal cord, the message is passed along to motor neurons, which send a movement command back to the muscle, causing it to contract. This reflex happens in the spinal cord without traveling to the brain first.

Like muscle stretch, pain can also trigger spinal cord reflexes that use the same nerve pathway as the stretch reflex. For example, stepping on something sharp or touching a hot burner activates spinal cord reflexes.

The brain normally dampens spinal cord reflexes

Although the stretch reflex happens in the spinal cord, the brain influences how sensitive the reflex is. The brain normally sends signals down the spinal cord, which dampen the sensitivity of reflexes in a process called *descending inhibition*. Descending inhibition is important because it tells the stretch reflex to calm down so it doesn't get in the way of normal movements.

Spinal cord injury prevents the brain from dampening spinal cord reflexes

When the spinal cord is injured, descending inhibition from the brain is cut off. Without its calming effects, the stretch reflex becomes overactive. This can lead to a constant level of muscle tension (called *muscle tone*) and excessive reflexes which cause the muscles to tighten uncontrollably or unexpectedly and the other symptoms of spasticity.



Watch SCIRE's [YouTube video](#) explaining why spasticity happens after SCI.⁵

How is spasticity diagnosed?

The main way that spasticity is diagnosed and monitored is through a physical examination. Your health providers will talk to you about your symptoms, functional abilities, and current treatment plan, look at your muscles and posture, and test the muscles in various ways. This may include:

- Hands-on tests where the joints are moved slowly and quickly
- Active tests of strength and movement
- Testing your reflexes

Your health providers may also observe tasks like walking, transferring, and eating – this can help them understand how spasticity affects you in your everyday life.

Health providers often use special collections of questions and tests called *outcome measures*, which help them accurately keep track of changes in spasticity. Spasticity may change over time so regular check-ins with your health team, especially while figuring out what works best for you, are often an important part of managing your spasticity.



Your health provider may perform a physical exam to help determine your need for spasticity treatment.⁶

Should spasticity be treated?

Spasticity can negatively affect the health and wellness of some people, but it can sometimes have benefits as well. It is important to determine whether your spasticity is a problem for you. Treating spasticity unnecessarily can have drawbacks, such as unwanted side effects, costs, and time. It is important that you discuss your treatment options and weigh the pros and cons of treating spasticity together with your health team to determine the best course of action for you.

Problems with spasticity

Muscles spasms and reflexes can contribute to a number of potential problems, such as:

- Pain
- Sleep problems
- Reduced mobility and function
- Difficulties maintaining posture and positioning
- Skin breakdown and hygiene concerns
- Bladder and bowel accidents
- Joint contractures
- Sexual and reproductive health issues
- Difficulties with care



Benefits of spasticity

Spasticity can also have some benefits for people with SCI, which may include:

- Better mobility, standing, and walking
- Assistance with transfers (such as supporting the body weight while transferring from a wheelchair to a bed or chair)
- Preventing muscle wasting or weakening due to inactivity
- Improved circulation
- Intentionally triggered spasms can help to empty the bowel and bladder in people with certain types of bowel or bladder problems
- Reflex erections during sexual activity
- It may serve as a warning sign of infections or other health issues



Watch SCIRE's [YouTube video](#) about the downsides of treating non-problematic spasticity.⁸

How is spasticity treated?

There are many different treatments for spasticity. Every person's spasticity is different, so finding the best treatment or combination of treatments often involves trial and error.

Spasticity treatment usually starts with conservative treatments such as positioning and maintaining good muscle length. If these do not provide enough relief, spasticity medications and injections may be recommended. Surgical treatments are considered as a last option for severe spasticity.

Avoiding spasticity triggers

An important part of managing spasticity is learning how to manage your spasticity triggers. Spasticity is often triggered by bladder, bowel, skin, or other health issues, so maintaining good overall health and taking care of these issues is an important part of managing spasticity. Speak to your health providers about optimizing your self-care routines to prevent spasticity.

Movement and therapeutic treatment options

There are a number of different movement, hands-on, and electrical treatments that may be done on your own, with a caregiver, or in conjunction with a therapist. These treatments generally produce fewer side effects than medications or surgeries; however, they also tend to have short-term effects.

- **Posture and positioning**
Good posture and positioning may help to keep the muscles at an appropriate length and help prevent contractures. You may need to work with your health providers to determine the best positions and equipment to manage your spasticity.
- **Stretching and range of motion**
Stretching and range of motion exercises are commonly used treatments to reduce spasticity and minimize complications like contractures after SCI. Stretching is often achieved through prolonged positioning, such as placing a wedge between the knees to stretch the hips.

- **Bracing and casting**

Various braces, orthoses, and casts may be used to maintain proper positioning of the arms and legs to help reduce spasticity, improve function, and prevent complications.

- **Standing**

Standing can provide a prolonged stretch to certain muscles, such as the calf and hamstring muscles, which may help with spasticity. For some people, standing may be done using specialized equipment such as tilt tables, standing frames, and standing wheelchairs.



Standing frames allow people with SCI to stretch their leg muscles.⁹

- **Neurodevelopmental therapy**

Neurodevelopmental therapy (NDT, sometimes called Bobath therapy) is a type of physiotherapy and occupational therapy treatment where a therapist uses hands-on techniques to guide a person through movements. It is used to help practice quality functional movements.

- **Walking**

Walking may be done by some people (typically with incomplete SCI) with or without gait aids or assistance from health providers or with the use of specialized equipment such as body weight supported treadmill training or robotic exoskeletons.

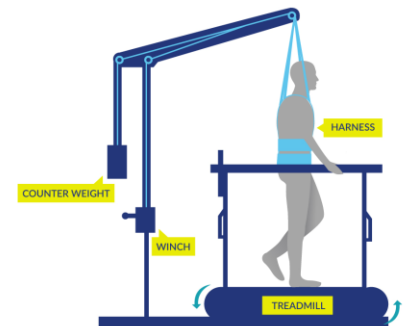


Diagram of a body weight supported treadmill¹⁰

- **Functional electrical stimulation exercise**

Functional electrical stimulation (FES) involves the use of electrical stimulation to activate specific muscles of the arms or legs during an activity such as stationary cycling, arm exercises or walking.

- **Massage**

Massaging muscles may help to stimulate the sensory nerves, which are part of the reflex spasticity response.

- **Transcutaneous electrical nerve stimulation**

Transcutaneous electrical nerve stimulation (TENS) involves the use of electrodes placed on the skin to stimulate the sensory nerves without producing muscle tension.

Refer to our chapters on [Standing](#), [FES](#) and [TENS](#) for more information!



Do movement and therapeutic treatment options work?

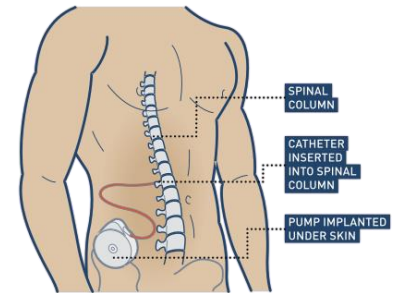
Although many of these treatments are commonly used in the treatment of spasticity, the research is unclear about whether a number of these therapies, including stretching and range of motion, standing, neurodevelopmental therapy, and massage; are actually effective for reducing spasticity after SCI. However, many of these treatments often have several therapeutic purposes after SCI (such as reducing pain or preventing contractures), which may explain their widespread use. Further research is needed to better understand the effects of these treatments on spasticity.

However, there is evidence that body weight supported treadmill training, robotic exoskeleton walking, FES exercise, and TENS are effective treatments for reducing spasticity after SCI.

Medications

Oral medications are typically prescribed for treatment of widespread spasticity. Finding the right medication may involve trial and error and involves working with your doctor to find the best fit for you.

- **Baclofen (tablets and baclofen pumps)**
Baclofen (Lioresal) is a muscle relaxant that is commonly used to treat spasticity. It can be taken as tablets by mouth or administered into the sac surrounding the spinal cord (called *intrathecal baclofen*) through a surgically implanted *baclofen pump*. Baclofen is effective for treating spasticity after SCI. However, it can have several side effects such as dizziness, drowsiness, anxiety, confusion, and weakness. Extra care is also needed when discontinuing therapy to avoid withdrawal symptoms. Baclofen is the most common medication prescribed for spasticity after SCI.
- **Other spasticity medications**
A number of other medications are used clinically or have been studied for their effects on spasticity after SCI. Speak to your doctor or pharmacist for more information about these medications.



Baclofen is commonly used for controlling spasticity after a spinal cord injury. This can be achieved by surgically implementing a pump that connects directly to the spinal cord.¹¹

Medications that **are** effective for spasticity after SCI:

- Tizanidine
- Clonidine
- Cyproheptadine

Medications that **may be** effective for spasticity after SCI:

- Cannabinoid medications (Dronabinol and Nabilone)
- Gabapentin
- Orphenadrine Citrate
- Diazepam
- Dantrolene

Medications that **are not** supported for treating spasticity after SCI:

- Fampridine (4-Aminopyridine)
- Levitiracetam



Injections

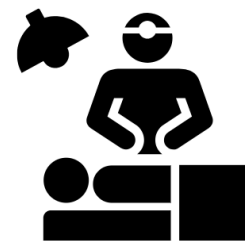
Injections into the nerves and muscles may be used to help manage localized areas of spasticity.

- **Botulinum toxin (Botox) injections**
Botulinum toxin is a toxin that can cause muscle paralysis. Very small doses of certain strains of botulinum toxin can be injected into muscles to treat spasticity. It is commonly known for its cosmetic use by its trade names Botox, Dysport, and Xeomin. Botulinum toxin injections are temporary, with effects that wear off over time (usually around 3 to 6 months). Research evidence supports that botulinum toxin is effective to reduce focal spasticity after SCI.
- **Phenol injections**
Phenol injections involve injecting a type of alcohol into nerves which supply the spastic muscle. Phenol damages the nerve axons, so the nerves cannot send signals to the muscles that cause

spasticity. This procedure is also sometimes used with another alcohol, *ethanol*. Phenol injections may be effective for reducing spasticity after SCI.

Surgical treatments

Surgery is typically reserved for when other treatments do not work or in individuals with joint contractures that are impacting care, function and quality of life.



- Tendon releases or transfers

Tendon releases are surgeries that lengthen shortened tendons (the part of the muscle that attaches to a bone) affected by spasticity. Tendon transfers involve surgically moving tendons that attach to muscles. These techniques can assist with better positioning of the feet or arms when excessive spasticity interferes with safe or appropriate positioning. However, there is limited research investigating the specific effects with SCI.

- Myelotomy and Rhizotomy

Myelotomy and rhizotomy are surgical procedures that involve intentionally damaging part of the spinal cord (*myelotomy*) or nerve (*rhizotomy*) to reduce spasticity. Damaging the nerve fibers related to spasticity can prevent them from communicating and causing unwanted muscle spasms. These techniques are not common because they are permanent and invasive. They are only used for severe and intolerable spasticity that does not respond to other treatments. Myelotomy is effective for reducing spasticity after SCI.

Other treatments



Alternative treatments like TMS are being explored as a potential treatment for SCI spasticity.¹⁴

A number of other medical, alternative, and self-management treatments may be used to manage spasticity. There is some limited evidence that other treatments, such as *transcranial magnetic stimulation* (TMS), *hippotherapy* (therapeutic horseback riding), and others may help to treat spasticity after SCI. However, these treatments are not typically used or available in standard practice at this time. Speak with your health providers about any treatments you are considering trying as a treatment for your spasticity.

The bottom line

The research evidence suggests that conservative treatments that involve active movement and electrical stimulation help to reduce spasticity short-term after SCI. It is not clear whether passive movement therapies like stretching help treat spasticity.

Medications and injections may include baclofen and botulinum toxin injections, which are effective for treating spasticity but may have additional side effects. There are many other drugs and treatment that may require further research. Surgery may be considered as a last resort if other treatments fail.

It is important to discuss any questions or concerns that you have about your treatment options in detail with your health providers to find the best management options for you.

Related resources

Spasticity Video Series: <https://community.scireproject.com/videos/spasticity/>

Baclofen: <https://community.scireproject.com/topic/baclofen/>

Botulinum Toxin: <https://community.scireproject.com/topic/botulinum-toxin/>

Cannabis (Marijuana) and Cannabinoids: <https://community.scireproject.com/topic/cannabis-marijuana-cannabinoids/>

Functional Electrical Stimulation (FES): <https://community.scireproject.com/topic/functional-electrical-stimulation/>

Transcutaneous Electrical Nerve Stimulation (TENS): <https://community.scireproject.com/topic/tens/>

Abbreviated reference list

Parts of this page have been adapted from the SCIRE Project (Professional) “Spasticity” Chapter:

Hsieh JTC, Connolly SJ, McIntyre A, Townson AF, Short C, Mills P, Vu V, Benton B, Wolfe DL (2016). Spasticity Following Spinal Cord Injury. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Curt A, Mehta S, Sakakibara BM, editors. Spinal Cord Injury Rehabilitation Evidence. Version 6.0.

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

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

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

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