

Inspiratory Muscle Training

Authors: SCIRE Community Team | Reviewed by: Shannon Sproule, PT | Last updated: Oct 11, 2017

Inspiratory muscle training is a treatment used to help with breathing and coughing after spinal cord injury (SCI). This page introduces inspiratory muscle training and its use after SCI.

Key points

- People with thoracic and cervical SCI may experience problems with breathing caused by weakness or paralysis of some of the breathing muscles.
- Inspiratory muscle training involves breathing exercises using simple equipment to strengthen the muscles used to breathe in.
- There are three types of devices that can be used during training: resistive trainers, threshold trainers, and isocapnic hyperpneic trainers.
- Studies have shown that inspiratory muscle training increases the strength and endurance of the inspiratory muscles in people with SCI.

What is 'inspiratory muscle training'?



Inspiratory muscle training describes a number of different techniques in which simple equipment is used to strengthen the muscles used to breathe in (*inspire*). The equipment is used to make breathing in more challenging. This causes the breathing muscles to work harder, so that they can adapt and become stronger with training.

How is inspiratory muscle training done?

Speak with a health provider before using inspiratory muscle training to make sure it is safe and suitable for you and to learn how to use the equipment correctly.

Inspiratory muscle training is done using a device that makes breathing in more challenging. The device has some type of mechanism that creates resistance when the person breathes in, but allows breathing out to occur freely. There are several different types of inspiratory muscle training devices:

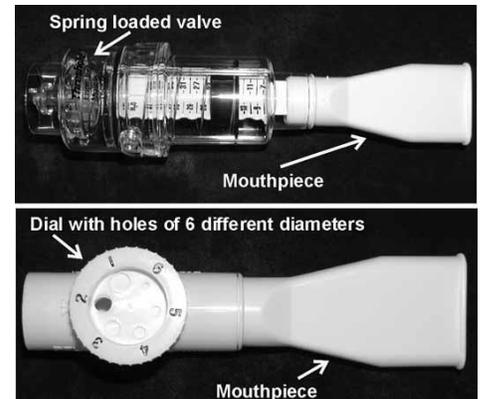
- **Resistive trainers** are the simplest trainers. They have a range of small diameter holes, which the person breathes in through. The smaller the hole, the greater the challenge is. The drawback of these trainers is that the resistance changes if you breathe in quickly or slowly.
- **Threshold trainers** have a spring-loaded valve that provides resistance. The valve can be adjusted for difficulty level. These trainers provide the same resistance if you breathe in quickly or slowly.

- *Isocapnic hyperpnea* involves a more complex device that allows breathing to be done at lower levels of resistance and higher flow rates. This device uses a rebreathing bag that helps maintain carbon dioxide levels in a normal range. This device uses targets to increase the intensity of breathing to a training level.

Your health provider will assist you with selecting an appropriate trainer and supervise your early training. The device is held to the mouth with a clip over the nose. Some people with reduced hand movement will need someone to position and hold the trainer during each training session. Alternatively, tilting the chair backwards or using a stand to hold the trainer may assist with positioning the mouthpiece independently.

Inspiratory muscle training involves regular sessions of breathing exercises consisting of a set number of breaths and sets. Sessions often last around 30 minutes and are done 2 to 3 times per day. However, the ideal protocol for inspiratory muscle training for people with SCI is not yet known.

Inspiratory muscle training is usually done for at least 6 weeks to allow enough time for the muscles to become stronger and adapt to training. Like other exercise, training should be continued regularly for strength to be maintained.



Different types of inspiratory muscle trainers – Top: threshold trainer; bottom: resistive trainer.

Why is inspiratory muscle training used?



Cervical and thoracic spinal cord injuries can cause paralysis or weakness of muscles of the neck, chest, and abdomen that are important for breathing and coughing. This can cause breathing problems that can contribute to shortness of breath, fatigue, and a need for mechanical ventilation.

Depending on the level of injury of the SCI, some of the muscles of breathing may still be able to be controlled. In some cases, strengthening these muscles can help to compensate for weakness in other muscles and improve breathing ability.

Inspiratory muscle training is used to strengthen the muscles that *can* be controlled to improve independent breathing ability. It may also be used to help prevent medical complications related to breathing and coughing problems, such as lung infections like pneumonia.

Who benefits from inspiratory muscle training?

Every person is unique, and how much inspiratory muscle training will benefit any individual depends on the characteristics of their SCI and their unique life circumstances.

That being said, in general, inspiratory muscle training is considered most beneficial for people with injuries in the mid-cervical to mid-thoracic spinal cord. These types of injuries tend to have breathing problems that could benefit from inspiratory muscle training and also have muscles available to train. People with upper cervical SCI usually have greater impairment of the breathing muscles that often requires more extensive breathing support instead, such as ongoing mechanical ventilation.

Are there restrictions or precautions for using inspiratory muscle training?

There are certain situations where extra attention is needed to determine whether inspiratory muscle training is appropriate and safe. Consult a qualified health provider for further safety information.

Restrictions or precautions for using inspiratory muscle training may include:

- Unstable asthma
- Previous collapsed lung (*pneumothorax*) not caused by a traumatic injury
- Unhealed collapsed lung (*pneumothorax*) caused by a traumatic injury
- Presence of air bubbles near the membranes lining the lungs
- By people with a low tolerance for shortness of breath
- By people with a ruptured eardrum or other ear conditions



What are the risks and side effects of using inspiratory muscle training?

Inspiratory muscle training is generally safe when used appropriately (see above for a list of situations in which inspiratory muscle training may not be safe). However, it is important to seek advice from a health provider to determine if this treatment is the best option for you.

Some possible risks and side effects of using inspiratory muscle training may include:

- Coughing
- If breathing is done too rapidly, it could cause hyperventilation, leading to light headedness, dizziness, or fainting
- Muscle tiredness or soreness
- Increased muscle spasms



Does inspiratory muscle training work for people with SCI?



Several research studies have shown that inspiratory muscle training helps to improve breathing after spinal cord injury. Inspiratory muscle training was found to improve strength and endurance of the breathing muscles. As well, it may reduce shortness of breath and chest infections in some people with SCI. These findings are supported by moderate evidence from five studies and weak evidence from six studies.

Research on whether inspiratory muscle training is effective to help with speaking and coughing and what its long-term effects are is currently lacking.

The bottom line

Breathing difficulties are common among people with thoracic and cervical injuries. Inspiratory muscle training is a safe treatment option for increasing strength of breathing muscles to aid breathing. The research evidence suggests inspiratory muscle training is effective in increasing strength and endurance of the breathing muscles after SCI.

It is important to discuss treatment options with your health providers to find out which treatments are suitable 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](#).

Abbreviated reference list

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

Sheel AW, Reid WD, Townson AF, Ayas N (2014). Respiratory Management 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. Vancouver: p. 1-54.

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

Full reference list available from: <https://scireproject.com/community/topic/inspiratory-muscle-training/#reference-list/>
Glossary terms available from: www.scireproject.com/community/about/glossary/

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