

Physical Activity After Spinal Cord Injury

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Physical activity after spinal cord injury (SCI) can provide many health benefits, as in the able-bodied population. This page covers the benefits of exercising with an SCI, precautions, and adaptations to exercising with an SCI.

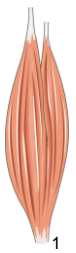
Key points

- Exercising after an SCI can improve muscle strength, type, and size, your abilities to do things on a day-to-day basis, your well-being, and decrease risks for secondary complications.
- There are many ways to get physically active, including sports, being active in the community, and going to the gym.
- Many exercises and sports can be adapted for those with SCI using adaptive equipment.
- Although rare, some secondary complications such as autonomic dysreflexia (AD), orthostatic hypotension (OH), skin breakdown, and temperature regulation, may arise.

What are the benefits of exercise after SCI?

After SCI, there is deconditioning of muscles, bones, joints, and changes in the heart and blood vessels due to inactivity. This can lead to various secondary complications, such as heart disease, breathing complications, weakening of the bones (*osteoporosis*), pain, spasticity, and diabetes. Exercise has many positive changes for those with an SCI including muscle type and size, improved muscle strength, independence, well-being, and helping to prevent secondary health complications.

Muscle type, size, and strength



In the body, there are 2 main types of muscle fibers: slow twitch (type I) and fast twitch (type II). Slow twitch muscles are known as the endurance muscles, as they are able to hold a contraction for a long period of time before getting tired. For example, the muscles that are used to keep your head up right are mostly made up of slow twitch muscle fibers. Type II fibers are known for their short burst of speed or strength. They can generate more strength, but get tired really quickly. Over time with an SCI, the muscles with the endurance type (type I) tends to turn into the more fatigable type (type II). There is some moderate-weak evidence that shows that among those with limited movement in their legs, the use of functional electrical stimulation (FES) can help shift muscle fibers from being more fatigable to more endurance based.

After injury, muscles in the body slowly begin to become smaller (atrophy). However, there is moderate to weak evidence that indicates that moving your arms and legs, either passively or actively, can help build muscle up again. Two (weak evidence) studies found that amongst those with limited to no leg function, electrical stimulation (Neuromuscular electrical stimulation (NMES) or FES) can increase the size of the thigh muscles. In addition, there is weak evidence that the use of a body-weight support treadmill can also increase the size of the lower leg muscle, resulting in a partial reversal of muscle shrinking.

There is strong-moderate evidence that exercising can help individuals of any injury level improve their strength. Among those with paraplegia, there is strong evidence that strength training (i.e., doing weight training) can improve muscle strength in the arms. There is also strong evidence showing that body weight support training can improve overall muscle strength, and moderate evidence that arm cycling can help strengthen the arms and the front of the shoulder. Among those with tetraplegia, there is strong evidence that the use of FES on the arm and shoulder can improve muscle strengthening. Moreover, strong evidence suggests that neuromuscular stimulation (NMES) can improve strength among those with cervical level injuries. If you are unable to access specialized equipment, strength training with free weights or using an arm cycle can show similar benefits as well.



Activities of Daily Living



There is some moderate evidence that shows that exercising can enhance the ability to perform daily tasks by yourself. Exercising improves your fitness level (such as your strength and endurance), which can help you perform daily tasks. More specifically, tasks may become easier by reducing physical strain and a decrease in the amount of time required to do an activity. One moderate evidence study found that doing physical therapy exercises in addition with neuromuscular stimulation enhanced participant's ability to perform self-care (e.g., dressing, feeding, toileting) and mobility (e.g., transferring, wheelchair pushing). Other weak evidence supports these findings, as they found that exercise can help improve transferring and the ability to put on/take off clothing, wheeling and cleaning. Furthermore, increased fitness levels have also been associated with return to work.

Well-being

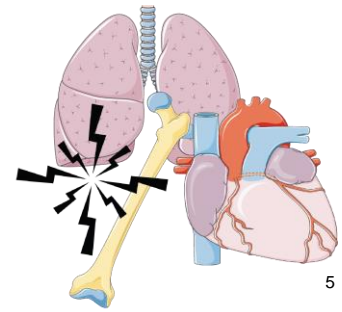


Some evidence suggests that exercise can help individuals improve perceptions of well-being. Well-being has been defined as how well an individual feels in their mind, their satisfaction with their health and functioning, and their overall satisfaction in life. Two aspects of well-being relatively well-researched is the impact of physical activity on depression and quality of life. There is weak evidence that found that all types of physical activity can help improve depressive symptoms and can improve quality of life. This relationship between physical activity and depressive symptoms and quality of life can be explained by a strong evidence study, which indicates that exercise can lead to decreased stress and pain. For example, strong evidence has shown that exercise can reduce shoulder pain, which can allow individuals to perform a more variety of movements without consequences. The reduction in stress and pain, in turn, is thought to improve quality of life and depressive symptoms. However, many of these studies lack a control group. As a result, we are unable to determine if physical activity alone has an influence on subjective well-being.

Secondary complications

After sustaining an SCI, multiple secondary complications can occur. However, research suggests that exercise can help prevent or reduce the severity of secondary complications, including:

- Conditions impacting the heart and blood vessels, by improving the strength of the heart and balancing out the sympathetic (fight or flight; stimulation) and parasympathetic (relax and slowing) nervous systems,
- Breathing complications, through strengthening the muscles required for breathing and through increasing the amounts of oxygen taken up by the body,
- Weakened bones, by increasing bone mass density,
- Type II diabetes, through improving the balance of blood sugar (glucose),
- Pain, through strengthening, and
- Spasticity, which can be reduced short term with exercising.



What are ways I can exercise after SCI?

There are many ways for you to remain physically active, even after SCI! Strength training can be done at a local community center or private gym, most often with the equipment already there. Strength training can also be done at home with free weights and exercise bands. Some equipment that can be used for strength training include free weights, exercise bands, and pulleys. For aerobic exercise, some alternatives include using an arm ergometer (arm cycle), a rowing machine (if possible), and adaptive rowers, such as the Ski-Erg.



If going to the gym is not for you, adaptive sports is another way to get active. There are a variety of adaptive sports, including court sports (e.g., basketball, rugby, tennis), water sports (e.g., sailing, kayaking), race sports (e.g., cycling, track and field), and winter sports (e.g., Nordic and alpine skiing).

Refer to our upcoming article on Adaptive Sports for more information!



Alternatively, specialty equipment is available to help facilitate exercise after SCI. However, this equipment is more commonly used in rehabilitation settings, as they are very expensive and additional assistance is often required. A Functional Electrical Stimulation (FES) bike can be used to simulate the legs while cycling, and has been shown improve strength and endurance. Body-weight Support Treadmills are specialized treadmills with a sling attached to it. This type of treadmill allows an individual to move their legs on the treadmill, while having their bodyweight supported by a sling. Some models are available to allow users to control how much of their bodyweight they feel while in the treadmill, which can alter the challenge of walking.



If going to the gym or playing sports is not your thing, there are still other ways to get active! Performing daily tasks can be hard work as well. For example, activities such as heavy gardening, going grocery shopping and carrying home groceries, doing a lot of housework such as vacuuming and cleaning the house, going for a push with family/friends are all ways of being active. However, if these are your activity of choice, you want to make sure you are pushing yourself enough to get your heart rate up and keep it up for a while.

What are the exercise guidelines?

In 2020, exercise guidelines for the SCI population were released. Currently, the starting level guidelines for fitness benefits are:

- at least 20 minutes of moderate to vigorous intensity endurance (aerobic) exercise, 2 times per week, and
- 3 sets of strength exercises for each major muscle group at a moderate to vigorous intensity, 2 times a week.

Refer to our article on [Exercise Guidelines after SCI](#) for more information!



The advance level provides guidelines for additional fitness and health benefits, such as reducing your risk for diabetes. It is recommended to get at least 30 minutes of moderate to vigorous intensity aerobic exercise at least 3 times a week, in addition to the 3 sets of strength exercises twice a week.

Another way to gauge your effort is through a Rating of Perceived Exertion (RPE). The RPE is a subjective rating scale where the individual rates how hard they feel they are working, where 0 is not working at all, and 10 is working at your absolute maximum. If someone is just starting off with exercising, starting between a 5-7 on the RPE scale is a good idea.

Rating of Perceived Exertion (RPE)
Use this rating scale to help keep track of how hard you are working

10	Maximum effort	As hard as you can, unable to maintain for a couple of minutes. Completely out of breath and unable to speak.
9	Extremely hard	Very difficult to maintain intensity, can barely breathe and only speak a few words
8	Very hard	You can still go on, but you really have to push
7	Harder	Strong effort needed, short of breath, can speak a sentence
6	Hard	You are definitely puffing, and are no longer in your comfort zone
5	Somewhat hard	Reasonably comfortable. You don't want to stop yet, but if you went much faster you'd be uncomfortable
4	Moderate	Still feels like you have lots of energy to keep going, but you are beginning to feel like you are doing something
3	Easy	Walking or wheeling at a comfortable pace. You can keep a conversation going
2	Easier	Slow walking or wheeling at your own very comfortable pace. You could keep going for hours
1	Very easy	Anything other than sleeping: watching TV, sitting, driving

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Watch SCIRE's [YouTube video](#) explaining how to use RPE when exercising.¹⁰

Another way to evaluate how hard you are working is through using the talk test. The talk test uses your ability to carry out a conversation while performing exercise to gauge exercise intensity. According to the talk test, a moderate intensity workout is achieved when one is able to talk to someone while working out, but not being able to sing. During a vigorous intensity workout, you would only be able to say a couple of words to someone, and speaking is difficult.

How can I adapt exercises?

Going back into a gym after an SCI may be daunting given that much of the equipment may no longer be accessible. However, there are a number of ways to adapt gym equipment, including grip assistance, transfer boards, chest straps, and using free weights and wedges. When exercising at a gym, you may require some additional assistance getting set up on pieces of equipment. If this is the case, consider going with a family member or a friend, and don't be afraid to ask the gym attendant for help.

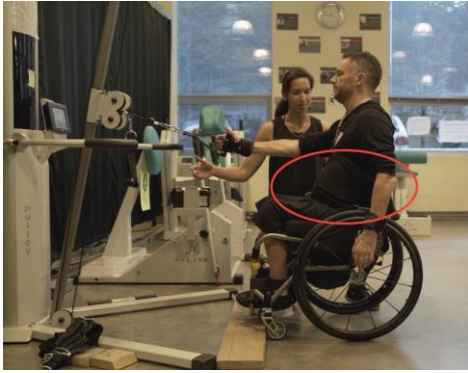


Watch SCIRE's [YouTube video](#) explaining how to adapt exercises.¹¹

After a high-level SCI, hand functioning may be impaired, resulting in a lack of ability to grip. To address this in a gym setting, some available options include using tensor bands, commercially available gloves, or weight-lifting cuffs. Tensor bandages can be used to wrap your hands around a handlebar. Benefits of using a tensor bandage include wide availability and low cost. Commercially available gloves, such as the Active Hands, are also available to assist with grip function on handles. These gloves provide a bit more support to the wrist and have a Velcro strap around the wrist. They also have a second Velcro that goes over the hand, which secures the hand to the handle. However, commercial gloves may not be as readily available and are usually expensive. Lastly, some individuals use weight-lifting cuffs, which are available at most gyms for use, to assist with grip function. These cuffs have a Velcro strap that goes around the wrist and a hook that can be connected to handlebars. Although commonly found in gyms, weightlifting cuffs only work for specific movements, such as pushing and pulling. In addition, they might not fit around handles of all sizes.



Adaptive grip aids include commercial gloves (left), tensor bandages (upper right) and weight lifting cuffs (bottom right).¹²



An abdominal binder (circled in red) being used to help keep an upright posture during rowing.¹³

Abdominal (core) function is often impacted with an SCI, which may limit the types of activities you are able to do. One way to address this issue is through the use of a chest strap. A chest strap is a neoprene strap that comes in differing widths but is often wide enough to cover your abdominal area. The idea is to wrap the chest strap around the backrest of your wheelchair and around your torso, preventing you from falling forward if you are doing a pulling exercise. Chest straps are commonly used in various wheelchair sports as well, to provide additional support.

Refer to our article on [Abdominal Binders](#) for more information!



When exercising in a wheelchair, you may find that the wheel lock still allows for some movement in the wheels, which may hinder an exercise. One way to address this situation is through adding additional support at the base of the wheel using wedges or free weights. Free weights can be placed behind the rear tire on both sides, or in front of the rear tire on both sides. In place, small wooden wedges (or door stoppers) can be placed under the tires on all four sides (in front and at the back) to help prevent rocking.

What should I be cautious of when exercising?

Exercise is relatively safe for individuals with SCI. However, there are some complications that, while rare, can arise.

Low blood pressure



When you first start exercising, it is common to possibly feel some nausea, or like you might pass out. This is a result of *exercise-induced (exertional) hypotension*, or a sudden drop in blood pressure due to exercise. One way

to overcome this is to build up your exercise routine. When doing aerobic exercises, try a discontinuous approach: exercise for 2-3 minutes, then take a break. The idea is to slowly increase the length of exercising before you require a break, working your way up to 20-30 minutes of exercise. Once you are able to continuously exercise for 20-30 minutes, then you may consider increasing the resistance.



Watch SCIRE's [YouTube video](#) explaining potential complications during exercise.¹⁴

Autonomic Dysreflexia

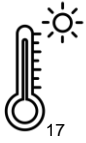


Autonomic dysreflexia is a condition where blood pressure suddenly increases to dangerous levels. If this occurs, stop exercising. Sit up and try to lower your legs if possible, loosen any tight clothing, and move off of any high-pressure areas (e.g., sit bones, hands/wrists if you are using assistive grip). If symptoms do not go away, seek medical attention.

Refer to our article on [Autonomic Dysreflexia](#) for more information!



Temperature regulation



With a high level injury, temperature dysregulation, or the body's inability to control temperature, may be influenced. The ability to produce sweat can be compromised with higher levels of injury, resulting in an inability to cool down the body. In colder environments, it may be harder to warm up.

When exercising in hot or warmer environments, make sure you are drinking water consistently throughout your workout. Consider wearing looser clothing, and try to work out in an environment with ventilation, fans, or air conditioning. If you notice that you tend to overheat during exercise and are unable to sweat, you can also try carrying a spray bottle with you and spray your face down to cool off. When exercising in cooler environments, be mindful of your hands, arms, legs, and feet and make sure they aren't getting too cold. Try dressing in layers so you can wear more if necessary, but also take layers off if you get warm.

Skin concerns

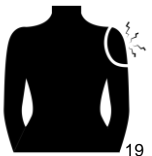


When exercising, it is important to be cautious of skin integrity, especially if you have no sensation. One area to be mindful of is the back when performing rocking or twisting motions. Rocking and twisting movements may cause the back to rub on the backrest of the wheelchair, creating a potential for skin breakdown. Another area to be mindful of is areas used with straps, such as the hands and sometimes the feet. For example, if using a grip aid for a longer duration of time to perform an activity, you may want to check for red spots that may have been caused by the straps. Ensure to check your skin after exercising for redness.

Refer to our article on [Pressure Injuries](#) for more information!



Overuse injuries



Overuse injuries occur when you exercise muscles that are already often used on a daily/frequent basis. An example of this is the shoulders, as it is used for pushing a wheelchair. To prevent overuse injury, make sure you have the correct posture when performing exercises. When working on the shoulder, try to consider alternatives to pushing your wheelchair as exercise, if possible. For example, the use of an arm bike could be an alternative to get around as they require less demand on your shoulders and arms. In addition, try to balance aerobic exercise and strength training in muscle groups prone to overuse injuries.

The bottom line

Participating in physical activity after SCI can be intimidating, but it is beneficial for your body. Being physically active can help improve your well-being and help reduce the impact of secondary complications after SCI. There are many ways to stay active after an injury, and many ways to adapt existing sports and equipment to help you get a good exercise. Although getting exercise is healthy, there are precautions to keep at the back of your mind when exercising. Overall, it is recommended that individuals with SCI stay active to promote a healthy lifestyle.

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

Related resources

[SCI Action Canada](#)

[Model System Knowledge Translation Center – Exercise after SCI](#)

Reference list

Parts of this page have been adapted from the SCIRE Project “Physical Activity” Chapter:

Wolfe DL, McIntyre A, Ravenek K, Martin Ginis KA, Latimer AE, Eng JJ, Hicks AL, Hsieh JTC (2013). Physical Activity and SCI. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Mehta S, Sakakibara BM, editors. Spinal Cord Injury Rehabilitation Evidence. Version 4.0.

Available from: scireproject.com/evidence/rehabilitation-evidence/physical-activity/

Full reference list available from: community.scireproject.com/topic/physical-activity-after-sci/#references

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