

Exercise capacity and respiratory muscle training in athletes with cervical SCI



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 By:
 Lay Summary by Aleksander Walter

Edited by Rona Herzog

This lay summary is based on a research study conducted by ICORD researchers Cameron Gee, Alexandra Williams, [Dr. William Sheel](#), [Dr. Christopher West](#), and their colleague Neil Eves. To access the full article click [here](#). The researchers have also created a short video in collaboration with The Physiological Society, click here to access the [video](#).

Individuals with cervical spinal cord injuries (SCI) often experience reduced exercise capacity. This is based on a few important physiological factors, including:

- reduced blood redirection to exercising muscles
- limited maximum heart rate
- limited amount of blood the heart can pump with each beat
- impaired ability to return blood to the heart

All of the above factors can result in blood pooling, which occurs when blood fails to return to the heart. When blood begins to pool during exercise, it further decreases the individual's aerobic ability (i.e. their ability to exercise while oxygen is being utilized).

Purpose of the study:

The purpose of this study was to measure responses from the **circulatory** and **pulmonary** systems, and measure changes to overall exercise capacity in athletes with cervical SCIs following inspiratory and expiratory muscle training (IMT and EMT respectively).

How the study was conducted:

For this study, 6 wheelchair rugby players were recruited (5 male and 1 female). The participants took part in a 6-week intervention which consisted of RMT 5 days/week, with 2 sessions/day, and 30 breaths per session. During these sessions researchers measured the participants total lung capacity (TLC). *TLC is the volume of air measured in the chest after a maximal inspiration (breath in).*

Researchers also measured:

- resting pulmonary (lung) function; measured while individuals were in a seated position
- resting heart function; measured via echocardiogram while participants laid flat on their back at a 45-degree head tilt
- maximal exercise output; this was tested by athletes cycling until exhaustion on an arm cycle.
- submaximal exercise output; these tests were conducted in 4 four-minute stages at 20, 40, 60, and 80%
- field-based exercise performance; this was measured while participants sprinted 20x20m in order to replicate the strain of wheelchair rugby

The researchers performed these measurements for each athlete before and after RMT, and then again 6 weeks after RMT had concluded.

Findings:

Researchers discovered that RMT increased both inspiratory and expiratory muscle strength in athletes with cervical SCI, which was associated with improved exercise capacity. The improvement in exercise capacity may be due to the ability to generate stronger chest pressures that could help blood return to the heart rather than pooling in the abdomen.

The study discusses potential theoretical implications of RMT for athletes with cervical SCI. Researchers discuss how often individuals with cervical SCIs recruit specific back and chest muscles for active expiration. These muscles have the potential to be strengthened through EMT, which could lead to improved respiratory function, as well as improvements in wheelchair propulsion (the recruited muscles are actively used for wheelchair movement).

Limitations:

The applicability of these findings to the general SCI community is somewhat limited as the researchers only observed individuals with cervical SCI, who were highly-trained wheelchair rugby athletes. The decision to include only highly-trained athletes in the study, as opposed to using community-level athletes, was to reduce the chances of any exercise-based limitations that were not related to the cardiovascular system (for example, exercise capacity being limited due to muscle weakness). Therefore, the results of this study may not be replicated in individuals with SCIs that are not highly-trained athletes/do not have an athletic background. Further research must be done regarding non-athletes with cervical SCI and their response to IMT and EMT.

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2 THOUGHTS ON "EXERCISE CAPACITY AND RESPIRATORY MUSCLE TRAINING IN ATHLETES WITH CERVICAL SCI"



Sarmistha Sinha on [April 13, 2021 at 10:17](#) said:
 Though the study was conducted only on the highly-trained SCI athletes but it certainly gives a ray of hope to those young quadriplegics who acquire fresh injury. Sooner they undergo respiratory muscles training better becomes their future prospects in the field of para-sports.

Reply ↓



Crystal Han on [May 10, 2021 at 13:37](#) said:

For sure. Thank you for your comment!

Reply ↓

ICORD is a spinal cord injury research centre of the UBC Faculty of Medicine and VCH Research Institute. We are located in the Blusson Spinal Cord Centre at Vancouver General Hospital, 818 West 10th Avenue. ([Map](#))
 Phone: 604-675-8810



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SCInfo is an initiative of the Community SCI Resource Centre, a partnership between ICORD, Spinal Cord Injury BC and the Rick Hansen Foundation.

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