

Author Year; Country Score Research Design Total Sample Size	Methods	Outcome
Luz et al. 2023 Germany N=10 Level of evidence: Type of study: Scoping Review 2 case reports, 7 case series, 1 cohort study	Methods: Key word literature search for clinical studies reporting the effects of ESCS on lower and upper extremity sensorimotor function as well as on autonomic dysfunction after SCI. Databases: Medline, Cochrane, and Nature Medicine library	<ol style="list-style-type: none"> 1. Transcutaneous and epidural spinal cord stimulation increased blood pressure by 10-40 mmHg during orthostasis-challenging situations such as moving from supine to sitting or standing.
Flett et al. 2022 Canada N= 19 N=1889 Level of evidence: Type of study: 10 case reports, 7 case series, 1 parallel group design, 1 double blind crossover	Methods: Key word literature search for English-language journals restricted to the adult population with SCI on July 9, 2020 and repeated in May 2021. Databases: Medline, EMBASE, Scopus, CINAHL, SportDiscus, and Cochrane	<ol style="list-style-type: none"> 1. 5 studies demonstrate the possibility of increasing BP during orthostatic challenge (including supine to sitting, sitting to standing, or receiving a head-up tilt test while secured to a tilt-table) using ESCS or TSCS 2. TSCS at T7/T8 reduced rectal stimulation-induced rises in BP but increased orthostatic challenge-related BP responses
Aslan et al. 2018 North America Pre-post Level 4 N=7	Population: N=7 males with chronic C5-T4 SCI Treatment: All participants were assessed for orthostatic tolerance prior to scES implantation. EMG signals were recorded bilaterally while the participant was supine or standing in response to scES. Data from 3 min of continuous blood pressure recordings were obtained after the participant completed the transition from sit to stand, and the EMG voltage had	<ol style="list-style-type: none"> 1. Individuals who demonstrated orthostatic intolerance during the orthostatic stress test (group 1) showed increases in sBP, dBP, and HR in response to increases in voltage of scES. Individuals who did not show orthostatic intolerance (group 2) demonstrated no increase in BP. 2. Individuals in group 1 experienced profound drops in BP upon standing accompanied by feelings of

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	<p>reached the level to sustain stable standing.</p> <p>Outcome measures: Beat-by-beat blood pressure, ECG, and electromyography</p>	<p>dizziness or fatigue without scES. With scES, the drop in BP and orthostatic symptoms were reduced. Individuals in group 2 did not experience a drop in BP upon standing and the application of scES did not increase their BP further.</p>
<p>Phillips et al. 2018</p> <p>USA</p> <p>Pre-post</p> <p>Level 4</p> <p>N=5</p>	<p>Population: N=5, 4 individuals with motor-complete cervical injury, 1 individual with motor-complete thoracic injury</p> <p>Treatment: 15 minutes of supine rest while being fitted with assessment equipment, followed by 10 minutes of supine rest, followed by a progressive orthostatic challenge. Participants rank their nausea/dizziness 1-10 each minute. Once BP decreased to clinically indicate OH, 30Hz of transcutaneous stimulation was applied via a self-adhesive electrode and was increased from 10mA until BP was normalised, up to a maximum of 70mA.</p> <p>Outcome Measures: Left brachial artery BP, and beat by beat blood flow velocity in the middle and posterior cerebral arteries.</p>	<ol style="list-style-type: none"> 1. All participants experienced clinically defined OH which was reduced with stimulation at the TVII level. However, lower-limb skeletal muscle contraction did not occur, meaning the pressor response was not attributed to skeletal muscle pump action. 2. Heart rate did not decrease with stimulation leading SV to still be reduced
<p>Harkema et al. 2018a</p> <p>US</p> <p>Case series</p> <p>Level 4</p> <p>N=4</p>	<p>Population: N=4 with SCI, orthostatic hypotension, persistent low resting blood pressure, and symptoms of autonomic dysreflexia</p> <p>Treatment: participants completed 2 hour sessions of daily CV-scES training, measuring continuous blood pressure</p>	<ol style="list-style-type: none"> 1. Daily CV-scES training resolved orthostatic hypotension. Prior to training, participants experienced a significant decrease in mean BP and an increase in HR without stimulation, but with stimulation, sitting BP did not change significantly from supine values, and HR did not increase as significantly.

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	Outcome Measures: continuous blood pressure to assess hemodynamic response to orthostatic stress throughout training, with and without stimulation, sBP, dBP, and HR	2. Similar results were seen after daily CV-scES training, even when presented with orthostatic stress without stimulation.
Harkema et al. 2018b US Prospective cohort study Level 2 N=4	Population: N=4 with chronic motor complete, cervical SCI Treatment: Participants rested in seated position for 2h with continuous BP and HR monitoring. CV-scES was configured to maintain sBP within 105-120mmHg for 5 sessions of 2 hours each over 2 weeks. Outcomes measures: sBP, dBP, HR	1. Mean arterial pressure, sBP, and dBP increased significantly ($p=0.0001$) for each participant in response to CV-scES. Upon cessation of CV-scES, the rise in BP returned near or below each participant's baseline values within 15 minutes. 2. 3 individuals had no significant change in HR while 1 had a significant decrease during stimulation. Once CV-scES was turned off, HR was significantly greater than baseline for each participant. 3. Individuals reported physical changes during the sessions including: (1) a feeling of alertness or heightened awareness; (2) increased ability to project their voice and carry on conversations; (3) increased capacity to breathe and cough; and (4) overall improved sense of well-being.