Author Year Country Research Design Score Sample Size	Methods	Outcome
McCaughey et al. 2015 USA Cohort Level 2 N = 10	**Population:** 10* patients ventilator-dependent with SCI and tetraplegia (8M, 2F) & N=9 retrospectively matched control patients (8M, 1F) Mean (SD) age: 48.2 (18.0) years *1 male excluded in analysis **Applicable to intervention group only **Treatment:** Abdominal FES. **Outcome Measures:** V_T, VC, time to ventilation weaning. **Chronicity:** Median (SD) DOI: 22.2 (12.0) days.	1. Significantly greater V_T in abdominal FES group compared to control group in 1 of 9 sessions, but not significant longitudinally. 2. Significantly greater VC in final 2 sessions (abdominal FES) or 3 sessions (control), compared to respective first session; no significant between-group difference. 3. No significant difference between groups in change of V_T and VC per week. 4. No significant between group difference in time to wean.
McBain et al. 2013 Australia RCT (crossover) PEDro = 5 Level 2 N = 15	**Population:** N=15 males with SCI (C4-T5); mean (SD) age: 45(4); DOI: 11.9(4.3) yrs. **Treatment:** All participants trained for 6 weeks, 5 days per week (5 sets of 10 coughs per day). Participants coughed voluntarily at the same time as a train of electrical stimulation was delivered over the abdominal muscles via posterolaterally positioned electrodes (50Hz, 3s). **Outcome Measures:** Pes and Pga expiratory pressures, peak	1. During voluntary coughs, FES cough stimulation improved Pga, Pes, and Pescough acutely, 20-fold, 4-fold, and 50%, respectively. 2. Six weeks of cough training caused further improvements. It significantly increased Pga (SD) from 37.1 (2.0) to 46.5 (2.9) cmH2O, Pes from 35.4

	expiratory flow (PEFcough) produced before, during, and after the training. **Chronicity:** Mean (± SD) time since injury was 1.4 (± 2.2) (from 0.2 to 7.8 years).	(2.7) to 48.1 (2.9)cm H2O, and PEFcough from 3.1 (0.1) to 3.6 (0.1) L/s. 3. Cough training also improved pressures and flow during voluntary unstimulated coughs.
Cheng et al. 2006 Taiwan RCT PEDro = 5 Level 2 N = 26	**Population:** N = 26 participants with traumatic cervical SCI; 21 males and 5 females; mean age 36.8 years; AIS A or B; and level of injury between C4 and C7. **Treatment:** Participants were randomly assigned to: • Control group (n = 13): Participants received a conventional rehabilitation program (which included passive range of motion, mattress exercise, sitting balance or upper extremity functional training). • NMES therapy group (n = 13): Patients underwent the conventional program plus NMES therapy (which consisted in NMES applied to the clavicular portion of the pectoralis major and abdominal muscle stimulation for 30 minutes daily, 5 days a week for 4 weeks). **Outcome Measures:** VC, FVC, FEV_1, PEF, MIP, MEP, and pulmonary complications were assessed before and after the	1. Significant improvements were found in the NMES therapy group vs. The control in VC, FVC, FEVi, PEF, MIP, and MEP at 4 weeks, at 3-month and 6-month follow-up testing, $p < 0.05$. 2. Six (46.1%) of the 13 patients in the control group suffered pulmonary complications in the follow-up period, while only 1 (7.7%) of the 13 patients in the NMES therapy group had pulmonary complications during this period ($p < 0.05$).

	4 weeks therapy and at 3- and 6-month follow-up. **Chronicity:** Mean time since was injury 2.45 months.	
McLachlan et al. 2013 UK Pre–post Level 4 N = 12	**Population:** N=12 participants with tetraplegia (11M;1F); median age: 31 yrs (range: 18-73); 7 AIS A, 5 AIS C; median DOI: 5 months (range: 2-94). **Treatment:** 3 weeks of abdominal muscle conditioning using transcutaneous abdominal functional electrical stimulation (AFES). **Outcome Measures:** FVC, FEV_1, PEFR, MEP. **Chronicity:** Median time since injury was 5 months, ranging from 2 to 94.	1. Mean (SD) FVC increased by 0.36(0.23) L during training. 2. No significant changes were found in mean FEV_1 and PEF. 3. No significant change was found in the outcome measures during a 1-week pre-training control phase and during a 3-week post-training phase.
Zupan et al. 1997 Slovenia Pre-Post Level 4 N=13	**Population:** 13 patients with tetraplegia; 11 men and 2 women; mean age 26.9 years; injury level C4 (n = 2), C5 (n = 2), C6 (n = 6), and C7 (n = 3); complete SCI (n = 10) and incomplete SCI (n = 3); and mean time between injury 7 months. *One patient with cavernoma had a history of disease for 10 years. **Treatment:** Each patient was subjected randomly for three periods: • Inspiratory muscle training, consisting of inspiratory muscles exercises for training both strength and endurance. • Expiratory muscle training, consisting of expiratory muscle	1. During condition 1, the measured RT in both positions (sitting and lying) revealed statistically significant increase ($P<0.05$) after the inspiratory muscle training; however, at the conclusion of expiratory muscle training, the measured RT revealed no statistically significant changes in sitting position but statistically significant changes in lying position. 2. During condition 2 and 4, the measured RT in both positions revealed statistically significant increase ($P<0.05$) following both kinds of training.

	exercises accompanied by electrical stimulation of the abdominal muscles. • 1-month without training. Both programs of respiratory muscle training consisted of seven different exercises and each one was repeated ten times. Each training session lasted 20 ± 30 min and was conducted twice a day six days a week for a period of 4 weeks. **Outcome Measures:** Respiratory tests (RT) (FVC and FEV_1) were conducted in sitting and lying positions at baseline and at the conclusion of each 1-month period. RT were conducted under four sets of conditions: • Condition 1: The patient's unassisted effort. • Condition 2: The patient's effort combined with pressure manually applied by a therapist to the upper part of their abdomen. • Condition 3 and 4: The patient's effort accompanied by electrical stimulation of the abdominal muscles during the early phase of expirium, once triggered by the therapist (3) and once by the patients themselves (4).	3. During condition 3, there was a significant increase ($P<0.05$) in measured RT in both positions after the period of inspiratory muscle training but no significant increase after the expiratory muscle training. 4. After the period without training no one measurement showed significant increase in RT. 5. The patient's voluntary effort combined with electrical stimulation (conditions 3 and 4) was more effective than voluntary effort alone. 6. Two patients complained of experiencing more spasms during the expiratory muscle training combined with electrical stimulation, and during measurements where patients voluntary effort was combined with the therapist's manual assistance or electrical stimulation.