Author Year Country Date included in the review Number of articles Level of evidence Type of study AMSTAR Score	Methods Databases	Conclusions
Schreiber et al. 2021 Canada Reviewed published articles up to August 2021 N = 39 **Level of evidence:** Newcastle–Ottawa Scale **Type of study:** N/A AMSTAR: 6	**Methods:** Investigate the probability of weaning success, duration of MV, mortality, and their predictors in mechanically ventilated adult patients with SCI. **Database:** OVID Medline, CINAHL, the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews, Ovid Embase and Scopus.	1. A total of 14,637 patients were enrolled (13,763 in ICU, 874 in rehabilitation units). The mean time from injury to hospitalization was 8 h [95% CI 7–9] for studies conducted in ICU, 40 days [95% CI 29–51] for studies performed in rehabilitative units. 2. Probability of weaning from MV after SCI: a. 63% [45–78%] of the patients hospitalized in ICU were completely separated from the ventilator; 72% [51–86%] of the patients admitted to a rehabilitative ward were completely, and 82% [70–90%] were either completely or partially liberated from the ventilator. Figure 1. 3. Secondary outcomes: a. In ICU, the mean duration of MV was 27 days, LOS 23

		days, hospital LOS 44 days. 81% of patients were tracheostomized and 30% of them were decannulated. Incidence of pneumonia and mortality were 40% and 8%, respectively. Figures 2 and 3. b. Patients hospitalized in rehabilitation centres were ventilated for a mean of 97 days (including duration of MV prior to admission and during the stay in rehabilitation) and stayed in the unit for 78 days. All patients were tracheostomized and 83% of them were decannulated; 36% developed pneumonia, and less than 1% died. Figures 2 and 3. 4. Predictors of weaning and duration of MV: a. A high number of comorbidities, high Injury Severity Score, high-level lesions (C1–C3 vs. C4–C7), elevated heart rate, and presence of TOT appeared

		to be associated with increased odds of weaning failure. b. Shorter time to admission to a specialized SCI center, high-level lesions (C1–C4 vs. C5–C8), complete lesion, low V_T and high positive end-expiratory pressure within 24 h from admission, and presence of TOT were associated to a longer duration of MV.

Figure 1. Forest plots for the outcome of complete liberation from the ventilator (left panel) and for the outcome of partial or complete weaning after rehabilitation (right panel). Studies are presented according to setting classification (intensive care units vs. rehabilitation units): both overall and subgroup estimates are reported.

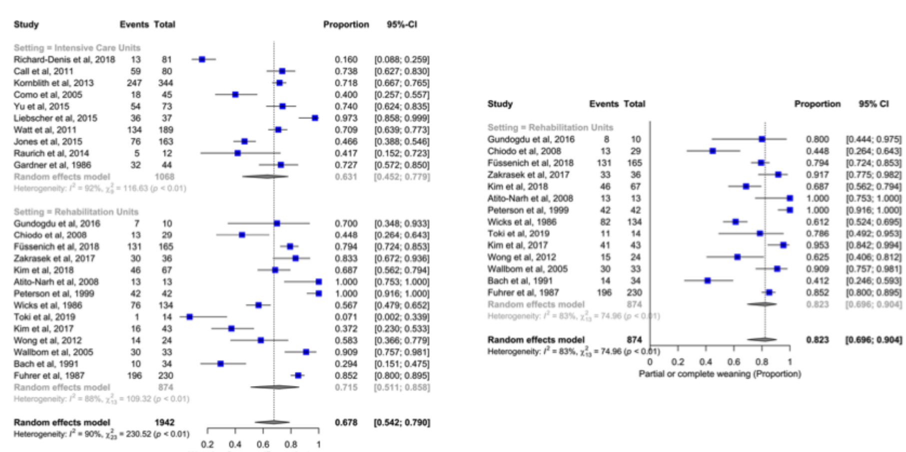

Figure 2. Forest plot for the outcome of duration of MV in intensive care units and rehabilitation units (upper panel). Studies
are presented according to setting classification (intensive care units vs. rehabilitation units): both overall and subgroup estimates are reported. Forest plots for the outcome of

	duration of MV for rehabilitation units (including the time to admission to rehabilitation) (lower panels). Weight refers to the relative contribution of each study to the meta-analytic estimate and is generated using the inverse variance method.

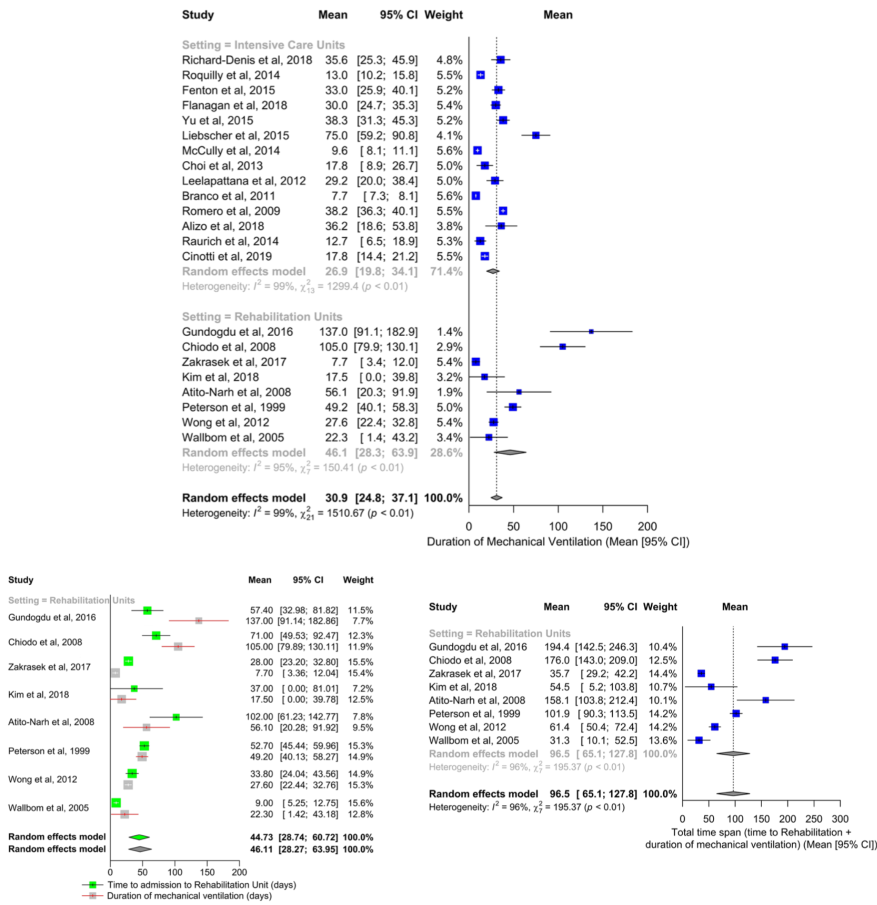

Figure 3. Forest plot for mortality. Studies are presented according to setting classification (intensive care units vs. rehabilitation units): both overall and subgroup estimates are reported.

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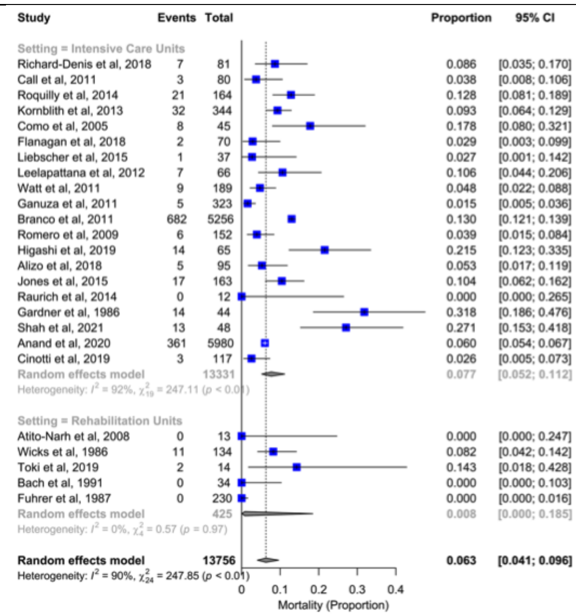

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<td>
Wang et al. 2020
China

Review published articles up to May 2019

N = 16

Level of evidence:
The Cochrane Collaboration risk of bias tool

Type of study:
RCTS

AMSTAR: 7
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<td>
Methods: To investigate the pulmonary function responses to respiratory muscle training (RMT) in people with tetraplegia.

Databases: PubMed, Embase, Cochrane Library, CNKI, Wanfang Data, and VIP.
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1. 237 patients and 211 controls were included in the review. Nine studies used inspiratory muscle training (IMT) or expiratory muscle training (EMT); and seven used IMT and EMT.
2. Meta-analysis showed that compared to the control, RMT did not improve FEV_1 (WMD: -0.26, 95% CI -0.54 to -0.02, P = 0:07, I^2 = 63.8%)), but RMT significantly improved:
a. VC (WMD: -0.40, 95% CI -0.69 to -0.12, P = 0.006, I^2 = 0%).
b. FVC (WMD: -0.43, 95% CI -0.84 to -
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		0.03, P = 0.037, I^2 = 80%). c. MEP (WMD: -13.08, 95% CI -23.78 to -2.37, P = 0:017, I^2 = 65.7%). d. MVV (WMD: -5.89, 95% CI -10.63 to -1.14, P = 0:015, I^2 = 43.1%). e. MIP (WMD: -13.14, 95% CI -18.01 to -8.27, P < 0:001, I^2 = 19.9%).

Forest plot of meta-analysis results for VC.

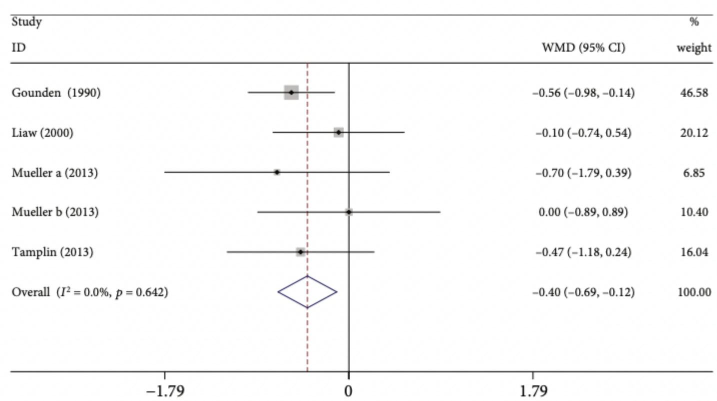

FIGURE 3: Forest plot of meta-analysis results for vital capacity.

Forest plot of meta-analysis results for FVC.

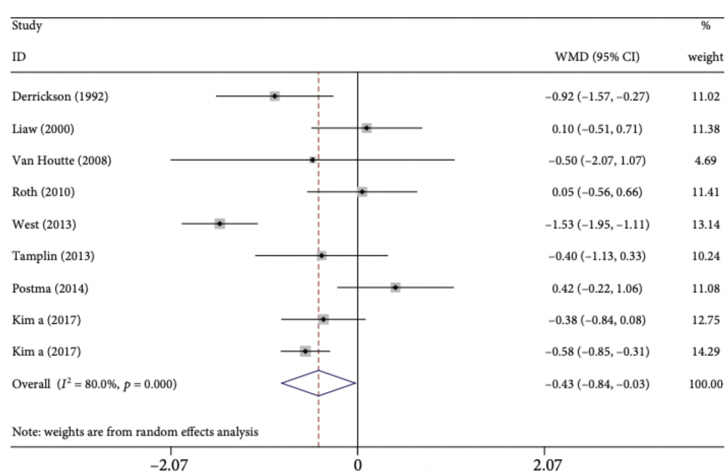

FIGURE 4: Forest plot of meta-analysis results for force vital capacity.

Forest plot of meta-analysis results for FVC1.

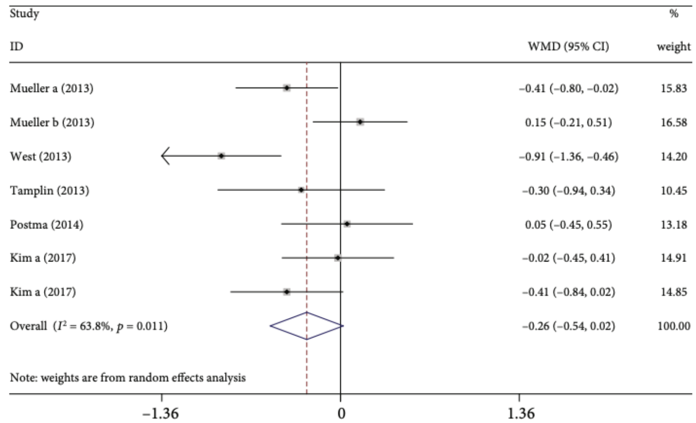

FIGURE 5: Forest plot of meta-analysis results for forced expiratory volume in 1 second.

Forest plot of meta-analysis results for maximum static expiratory pressure.

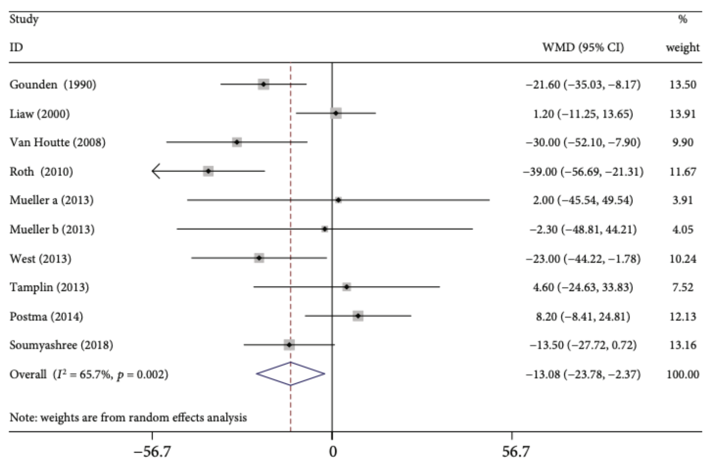

FIGURE 6: Forest plot of meta-analysis results for maximum static expiratory pressure.

Forest plot of meta-analysis results for MVV.

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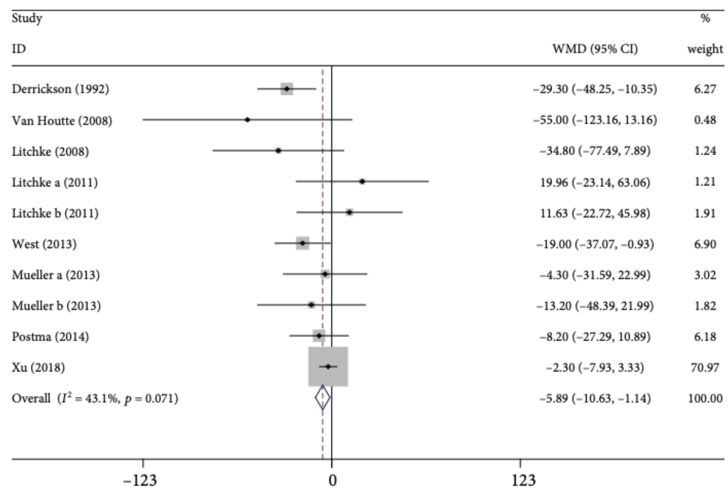
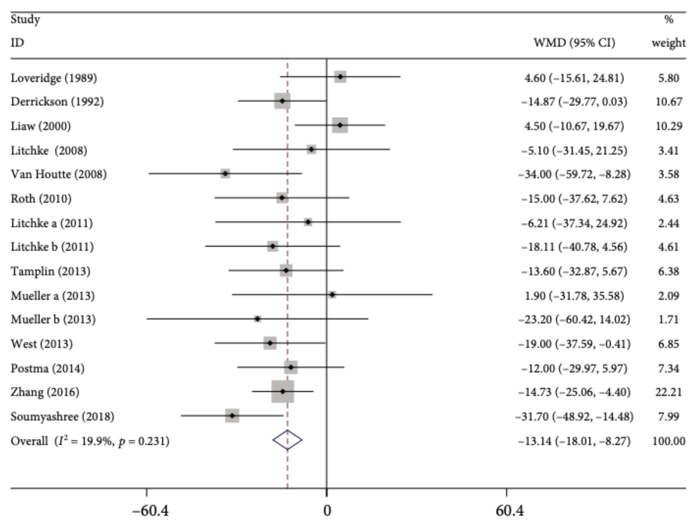


Forest plot of meta-analysis results for maximum static inspiratory pressure.



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<td>Lemos et al. 2020
Brazil

Reviewed published articles up to August 2018.

N = 17

Level of evidence:</td>
<td>Method: Reviewed new and emerging research related to the effects of RMT on pulmonary function, respiratory muscle strength and endurance, and cardiorespiratory fitness of athletes and non-athletes with SCI, and present an updated frequency, intensity, time, and type principle to RMT.</td>
<td>1. Training methods varied; 6 studies adopted the IMT; 6 used the RMT with bidirectional resistance; 3 had the EMT; 2 studies applied normocapnic hyperpnoea training.
2. RMT improves pulmonary function</td>
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PEDro scale. **Type of study:** Experimental (controlled, non-controlled and cross-over) studies AMSTAR: 5	**Database:** PubMed, Lilacs, Scopus, Web of Science, PEDro, SciELO and Cochrane.	and respiratory muscle strength and endurance in athletes and non-athletes with SCI, although no associations were found between the RMT and cardiorespiratory fitness (i.e., VO_2max). 3. Even though 7/17 studies scored ≥ 6 in the PEDro scale, more research is needed with greater sample sizes, standardization of methods and interventions.
McCaughey et al. 2016 Australia Reviewed published articles until 23 December 2014 N = 14 **Level of evidence:** N/A **Type of study:** Self-control (randomized crossover) and RCTs AMSTAR: 7	**Methods:** Systematic review and meta-analysis made to identify whether abdominal functional electrical stimulation (FES) is an effective intervention to improve respiratory function in both an acute and chronic manner after SCI. **Databases:** Pubmed. **Protocols of abdominal FES used:** The median maximum amplitude was 100 mA (range 100–450 mA), the mean pulsewidth (pulse duration) was 259 μs (range 25–400 μs) and almost all studies used a stimulation frequency of 50 Hz. There was a lack of homogeneity in electrode position, with a range of positions used to stimulate either or both the rectus abdominis and external oblique muscles.	1. Low participant numbers and heterogeneity across studies reduced the power of the meta-analysis (141 participants were included in total (n = 128 receiving abdominal FES; n = 13 acting as controls). 2. 10 studies assessed acute respiratory effects of abdominal FES and showed a significant acute improvement in cough peak flow (CPF) (figure 1) whereas FEV_1 approached significance (figure 2). 3. 4 studies assessed chronic respiratory effects of FES; showing only a significant increase

		and effect in FVC (P = 0.043), with a continued improvement after training; in VC (P = 0.013); and in PEF (P = 0.026).
Berlowitz & Tamplin 2013 (Tamplin & Berlowitz 2014) Australia Reviewed published articles (searches were not restricted by date, language, or publication status) N = 11 **Level of evidence:** PEDro scale was used to evaluate studies **Type of study:** RCTs AMSTAR: 10	**Method:** Systematically review the effectiveness of RMT on pulmonary function, dyspnea, respiratory complications, respiratory muscle strength, and quality of life (QOL) for people with cervical SCI. There were no date, language, or publication restrictions. Only RCTs were included. **Database:** Cochrane Injuries and Cochrane Neuromuscular Disease Groups' Specialized Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (2012, Issue 1), MEDLINE, EMBASE, CINAHL, ISI Web of Science, PubMed, and clinical trials registries (Australian New Zealand Clinical Trials Registry, Clinical Trials, Controlled Trials metaRegister), and hand searching.	1. 11 RCTs with 212 participants with cervical SCI were included. 2. Meta-analysis revealed a statistically significant effect of RMT for 3 outcomes: VC (MD mean end point 0.4L, 95% CI 0.1 to 0.7), MIP (MD mean end point 10.5 cmH_2O, 95% CI 3.4 to 17.6), and MEP (MD mean end point 10.3 cmH_2O, 95% CI 2.8 to 17.8). (Berlowitz & Tamplin 2013). 3. Meta-analysis revealed a statistically significant effect of RMT for 2 extended outcomes: MVV (MD mean end point 17.51L/min, 95% CI 5.20 to 29.81), and IC (MD mean end point 0.35L, 95% CI 0.05 to 0.65) (Tamplin & Berlowitz, 2014). 4. RMT showed a combined benefit in VC and FVC (MD mean end point 0.41L, 95% CI 0.17 to 0.64) (Tamplin & Berlowitz, 2014). 5. There was no effect on FVC_1 or dyspnoea.

		6. The results from QOL assessment tools could not be combined from the three studies for meta-analysis. 7. No adverse effects as a result of RMT were identified in cervical SCI.
Wadsworth et al. 2009 Australia Reviewed published articles from databases' inception to March 2008 N = 11 **Level of Evidence:** PEDro scale **Type of study:** 5 crossover randomized 1 crossover pseudorandomized 1 crossover 4 within-patient AMSTAR: 9	**Methods:** Literature search for randomized control and randomized crossover studies reporting the effects of AB in people with acute or chronic SCI. Interventions included different types of AB. **Databases:** MEDLINE, CINAHL, Cochrane, EMBASE, PEDro.	1. Some evidence that the use of an abdominal binder improves VC (by WMD 0.32 L, 95% CI 0.09 to 0.55) but decreases FRC (by WMD 0.41 L, 95% CI 0.14 to 0.67) when assuming the sitting or tilted position. 2. AB did not influence total lung capacity (TLC). 3. PEDro mean score of 4.3/8. 4. Available evidence is not yet sufficient to either support or discourage the use of an AB in this patient population.
Reid et al. 2010 Canada Reviewed published articles from databases' inception to May 2009	**Methods:** Literature search for English articles assessing physical therapy secretion removal techniques. **Databases:** MEDLINE/PubMed, CINAHL, EMBASE, and PsycINFO.	1. Level 4/5 evidence supports the use of secretion removal techniques in people with SCI. 2. Level 2 evidence (from 1 prospective controlled trial) and level 4 evidence

N = 24 **Level of Evidence:** PEDro scale – RCTs **Type of study:** 2 RCT 3 prospective controlled 9 pre-post 3 retrospective case series 7 case reports AMSTAR: 6		(based on 2 pre-post studies) support the effectiveness of abdominal binders for assisted breathing. 3. Level 1 evidence that RMT improves respiratory muscle strength and decreases the number of RI, both of which infer improved airway clearance. 4. Level 4 evidence based on 2 pre-post trials and level 5 evidence from 2 case reports support the use of electrical stimulation (ES) of the lower thoracic-lumbar spinal cord (T9, T11, and L1) and the abdominal wall muscles to improve expiratory flow rates during cough. 5. Level 2 (based on 2 prospective controlled trials) and level 4 (based on 1 pre-post trial) evidence support the effectiveness of assisted coughing by manual abdominal compression. 6. Insufflation combined with manual assisted cough provides the most consistent evidence for improving cough and/or PEFR.

Sheel et al. 2008 Canada Review published articles from 1980 to 2006 N = 13 **Level of Evidence:** PEDro scale – RCTs **Type of study:** 3 RCTs 1 pre-post 6 case series 2 cohort 1 case report AMSTAR: 6	**Methods:** Literature search for articles assessing exercise training and IMT for the improved respiratory function of patients with SCI. **Databases:** MEDLINE/ PubMed, CINAHL, EMBASE, PsycINFO.	1. There is Level 2 evidence supporting exercise training as an intervention to improve respiratory strength and endurance. 2. There is Level 4 evidence to support exercise training as an intervention to improve resting and exercising respiratory function in people with SCI. 3. There is Level 4 evidence to support IMT as an intervention to decrease dyspnea and improve cardiovascular function in people with SCI.
Van Houtte et al. 2006 Belgium Reviewed published articles from 1980 to November 2004 N = 21 **Level of Evidence:** Modification of the framework for methodological quality developed by Smith et al. and Lotters et al. - Max score of 40 **Type of study:**	**Methods:** Literature search for articles assessing the effectiveness of RMT on people with SCI. **Databases:** MEDLINE (National Library of Medicine, Bethesda, MD, USA) database (from 1980 to November 2004) and relevant references from peer-reviewed articles.	1. RMT tended to improve expiratory muscle strength, VC, and residual volume (RV). 2. Insufficient data was available to make conclusions concerning the effects on inspiratory muscle strength, respiratory muscle endurance, QOL, exercise performance and respiratory complications.

6 controlled studies 15 non controlled studies AMSTAR: 5		
Giannoccaro et al. 2013 Italy Reviewed published articles up to October 2012. N = 113 **Level of evidence:** Methodological quality was not assessed **Type of study:** Types of studies included not specified. AMSTAR: 1	**Method:** Reviewed the prevalence, features, and treatment of sleep disorders in SCI. Only studies published in English were included. **Database:** PubMed.	1. Little has been published on the treatment of obstructive sleep apnea (OSA) in patients with SCI, but some patients with SCI have been reported to respond to weight reduction, whereas changing sleep position is a more difficult measure to apply to these patients. 2. Two studies reported poor compliance with CPAP in patients with SCI with a significantly lower acceptance rate of 23-30% in higher level complete tetraplegic patients than the 60-80% acceptance described in non-SCI patients. However, data on long-term CPAP in one survey showed that 63% of patients used the treatment regularly. 3. A study reported that despite no significant difference in AHI between people with tetraplegia and non-SCI controls, the non-SCI people required significantly higher

		levels of CPAP to control their OSA than patients with tetraplegia, more than two thirds of whom (68.8%) required less than 10 cmH_2O of CPAP. This suggests that additional unknown factors may contribute to the high prevalence of OSA in tetraplegia.