

Inspiratory muscle training in adults with chronic obstructive pulmonary disease: an update of a systematic review

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CRD summary

The authors concluded that targeted inspiratory resistive, threshold or normocapnic hyperventilation inspiratory muscle training (IMT) significantly improved outcomes compared to sham IMT in adults with COPD. The clinical importance of the findings remained unclear. This was a well-conducted review and the authors' cautious conclusions reflect the evidence presented.

Authors' objectives

To update a review on the effect of inspiratory muscle training (IMT) in adults with chronic obstructive pulmonary disease (COPD).

Searching

MEDLINE and CINAHL databases were searched up to August 2003. Updated searches were conducted from September 2003 to January 2007. EMBASE was searched from inception to January 2007. All searches were restricted to English-language publications. Reference lists and targeted journals were searched and authors contacted to obtain additional relevant publications.

Study selection

Parallel and crossover randomised controlled trials (RCTs) that evaluated IMT in adult participants (18 years of age or older) with stable COPD were eligible for inclusion. Trials could compare IMT to sham IMT or no intervention, low versus high intensities of IMT or different modes of IMT. Outcomes assessed included measures of inspiratory muscle strength (PI_{max} cmH₂O; PI_{max} % predicted; peak inspiratory flow rate) and endurance (respiratory muscle endurance time; inspiratory threshold loading; maximum voluntary ventilation), exercise capacity (maximal oxygen consumption; maximum minute ventilation, Borg scale for respiratory effort; six-minute walk test; work rate maximum), dyspnoea (transitional dyspnoea index, focal score; functional impairment; magnitude of task; magnitude of effort) and quality of life (QoL).

This update review reported on only those studies that compared IMT (targeted, threshold or normocapnic hyperventilation types) with sham IMT (the same type of IMT device at an intensity of 8.3 cm H₂O or less for normocapnic individuals or 11.5 cm H₂O or less for individuals with moderate hypercapnia). The included participants had on average, very severe COPD, were predominantly male and had a mean age between 56 and 68 years. Mean baseline inspiratory muscle strength ranged from 42 to 72cmH₂O for studies that measured PI_{max} from residual volume or from 35.8 to 68.5 H₂O for studies that measured PI_{max} from functional residual capacity. Most studies used IMT in 15 or 20 minute sessions, usually with a threshold load trainer or a targeted inspiratory resistance trainer.

Two reviewers independently selected the studies for inclusion. Disagreements were resolved by a third reviewer.

Assessment of study quality

Validity of the included studies was assessed using criteria for randomisation, blinding, withdrawals, baseline comparability and intention-to-treat (ITT) analysis. Two reviewers assessed quality.

Data extraction

Means and standard deviations (SDs) were extracted for each outcome. Where necessary, trial authors were contacted for additional information.

Two reviewers independently extracted data. Discrepancies were resolved by consensus or by a third reviewer.

Methods of synthesis

A meta-analysis that examined pooled weighted mean difference (WMD) and 95% confidence intervals (CIs) was performed using a random-effects model. Studies that used targeted, threshold and normocapnic hyperventilation modes of IMT were considered to be comparable. Heterogeneity was assessed using X^2 . When there was significant heterogeneity, sensitivity analyses were conducted by systematic removal of studies from the analyses.

Results of the review

Nineteen RCTs were included in the original review and six were identified in the update. Sixteen trials (10 from the

original review and six from the update review) compared IMT to sham IMT and were included in the update review (n=426). Sample sizes ranged from 14 to 112.

Only three of the 16 trials described the randomisation process. Eleven studies were double-blind. Fourteen studies reported on participant withdrawal. Thirteen studies reported that treatment groups were comparable at baseline. Twelve studies used ITT.

Inspiratory muscle strength: There were significant improvements in PI_{max} (WMD 11.6cm H₂O, 95% CI 8.7 to 14.4), PI_{max} % predicted (WMD 23.2%, 95% CI 11.3 to 35.1) and peak inspiratory flow rate (WMD 12.6L/min, 95% CI 9.7 to 15.6) that favoured participants in the IMT group compared with the sham IMT group.

Inspiratory muscle endurance: There were significant improvements in respiratory muscle endurance time (WMD 4.4 min, 95% CI 0.7 to 8.2) and maximal inspiratory threshold load (WMD 1.4kPa, 95% CI 0.8 to 1.9) that favoured participants in the IMT group.

Exercise capacity: There were significant improvements in maximum exercise minute ventilation (4.9L/min, 95% CI -8.2 to -1.7), Borg score for respiratory effort (1.8, 95% CI -2.4 to -1.2) and six-minute walk test (32.1m, 95% CI 11.6 to 52.7) that favoured participants in the IMT group. There were no significant differences between groups for maximal oxygen consumption and work rate maximum.

Significant improvements that favoured participants in the IMT group in transitional dyspnoea index focal score and quality of life were reported.

The authors reported that all sensitivity analyses resulted in the same conclusions for overall effect; no further details were given.

There was significant statistical heterogeneity between the trials for most outcomes assessed.

Authors' conclusions

Targeted inspiratory resistive, threshold or normocapneic hyperventilation IMT significantly improved outcomes compared to sham IMT in adults with COPD. The clinical importance of the findings remained unclear.

CRD commentary

The review addressed a clear question and was supported by appropriate inclusion criteria. Attempts to identify relevant published studies were undertaken. The search was restricted by both language and publication status, so some relevant studies may have been missed. Validity was adequately assessed and reported and steps were taken to minimise reviewer error and bias. Comprehensive details of the studies were provided. Given statistical and possible clinical heterogeneity between the studies, it was debatable whether the results should have been pooled in a meta-analysis. The authors discussed the limitations of their review.

Aspects of this review were well conducted, but some limitations made it difficult to assess the generalisability and reliability of the author's conclusions.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that further research was needed to explore the impact that different training protocols (frequency, intensity and duration of IMT, supervision) may have on outcomes and determine the extent to which changes in outcomes associated with IMT translated into clinically important improvements.

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Other publications of related interest

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.