THE BREATHER vs OTHER DEVICES

Devices that do PEP or OPEP (Flutter, Aerobika, Acapella, D R Burton, Portex TheraPEP), have very little to no impact on the **respiratory muscle strength** as the generated pressures are usually too low for muscle strengthening.

- The Breather provides resistance training, strengthening the respiratory muscles.
- Furthermore, the Breather can provide PEP if set at a low setting.

Devices that do PEP or OPEP (Flutter, Aerobika, Acapella, D R Burton, Portex TheraPEP) provide improved **mucus clearance and airway defense**.

- That is true, but respiratory muscle strength provided by the Breather improves immediate and long-term cough capacity, which will be more effective for unassisted long-term airway clearance than PEP/OPEP devices.

Devices that do PEP or OPEP (Flutter, Aerobika, Acapella, D R Burton, Portex TheraPEP) do not have any impact on **inspiratory muscles**.

- The Breather strengthens both expiratory and inspiratory muscles. A recent study found that: "I*n order to improve cough capacity in (stroke) patients, it is necessary to conduct both inspiratory and expiratory muscle training. In particular, increase in MEP is closely related to the improvement of cough capacity in (stroke) patients."* PEP/OPEP do not improve cough capacity as they do not strengthen the respiratory muscles, they just provide immediate relief for enhanced mucus secretion, and may therefore provide useful add-on therapy to RMT.

Devices that do high frequency chest wall oscillation (HFCWO) (no direct competitors as these are typically vests) provide **mucus clearance and airway defense**.

- Evidence from cystic fibrosis patients comparing PEP to HFCWO devices (these are not OPEP devices, but similar in that they provide oscillation) has shown that PEP is associated with fewer respiratory exacerbations than HFCWO, making PEP the favored method. The Breather can do PEP, but not oscillation.

Devices that provide **EMT only**, which are predominantly used for cough, airway clearance and swallow problems (EMST-150, Resistex), fail to address the importance of the inspiratory muscles for these functions (see above for IMT and cough).

- While EMT undoubtedly has a beneficial effect on dysphagia and swallowing, studies on people with neurological disease have shown that "*(the) number of swallows per bolus and swallowing time correlated to maximal inspiratory pressures (MIPs) but not to maximal expiratory pressures (MEP).*" Inspiratory muscle strength therefore is essential for swallowing function, a fact that is widely neglected.

- The Breather provides both IMT and EMT and offers a more balanced effect, training all respiratory muscles, increasing both MIP and MEP, which should enhance the effect on swallowing function in dysphagia.

Devices that provide **IMT only** (Threshold IMT, PowerBreathe, Ultrabreathe, Pflex, Portex IMT, O2 Trainer) have a proven effect on COPD and most other disease described and are the predominant device used in RCTs. While they are undoubtedly effective, the fail to address the importance of **strengthening the expiratory muscles**.

- Strengthening the expiratory muscles by EMT in addition to IMT by using the Breather increases the list of provided benefits to encompass all functions of the respiratory muscles, improving dyspnea, exercise tolerance, quality of life, sleep disturbances, plus improving cough function, swallow function, and speech quality, among many others.

- **Only a combination of IMT and EMT will provide all of these benefits.**

Many hospitals still use routine **incentive spirometry (IS)** to prevent postoperative pulmonary complications (PPC) such as pneumonia and atelectasis. However, the guidelines published by the AARC (American Association for Respiratory Care) clearly recommend that IS should **not** be used in routine pre- or perioperative care to prevent RRC, due to a lack of evidence that IS is more efficient than standard care including/or breathing exercises.

- In contrast, a recent systematic literature search (performed to comparable standards as the IS guidelines) shows that RMT significantly increases respiratory muscle strength in the early postoperative period, and reduces the risk of PPC such as pneumonia by 50%.
- Furthermore, a RCT applying RMT preoperatively to patients undergoing coronary artery bypass graft including 279 patients found a reduction in PPC as well as reduced duration of postoperative hospitalization.

RMT, in contrast to IS, is clinically efficient in reducing PPC and might reduce healthcare costs due to reduced hospitalization. It should therefore be recommended to include RMT into standard pre- and perioperative care to reduce PPC incidence.

Devices that provide **PAP (positive airway pressure)** to mobilize secretions, reduce air trapping or to prevent or reverse atelectasis.

- CPAP applies positive pressure, keeping the airways open to prevent and potentially reverse atelectasis - RMT does not do that and therefore is not intended to replace CPAP in a critical or emergency care setting.
- CPAP does provide minimal inspiratory strength training due to inspiration against resistance - RMT provides high intensity respiratory muscle training and would therefore be a useful adjunct therapy during CPAP therapy.
- Both PAP and RMT increase tidal volume.
- RMT using the Breather provides inspiratory and expiratory muscle training, making it more efficient at providing pulmonary hygiene than PAP or PEP alone.
- Due to the higher intensity of pressures generated, RMT would be predicted to improve cough function, peak inspiratory and peak expiratory flow more efficiently than PAP and PEP.

During indications of CPAP (imminent respiratory crisis or risk of atelectasis), RMT may be a useful adjunct therapy to improve airway clearance capacity and to prevent atelectasis. After resolution of crisis, RMT may be the more useful maintenance therapy for improved pulmonary hygiene, prevention of further exacerbations and recurrence of atelectasis.

TIMELINE OF RMT BENEFITS

The first noticeable benefits of RMT can be seen within 5 days, and include:

- increase in oxygen saturation by 4%
- increase in tidal volume by 16%
- decrease in respiratory rate by 29%
- increase in maximum inspiratory pressure by 61%
- increased weaning success by 40%
- reduced weaning duration by 2.5 days (17%)
- reduced hospital LOS by 4.5 days (24%)
- reduced ICU LOS by 4.5 days (26%)

These results are based on COPD patients in ICU after acute exacerbation and respiratory failure.

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