Studiensammlung

inkl. Anwenderbefragung /

study summary

incl. user survey

Atemtherapie & Atemtraining

CEGLA
MEDIZINTECHNIK

1 Inhalt

Please be aware that some studies have only been published in the German speaking area and therefore have not been translated.

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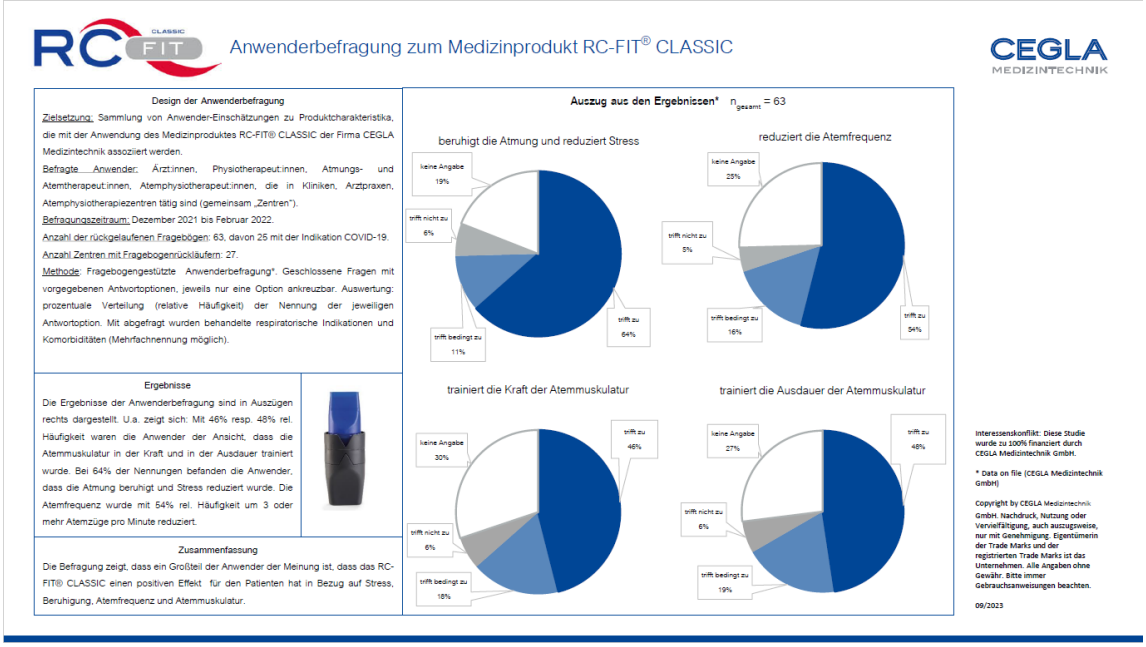
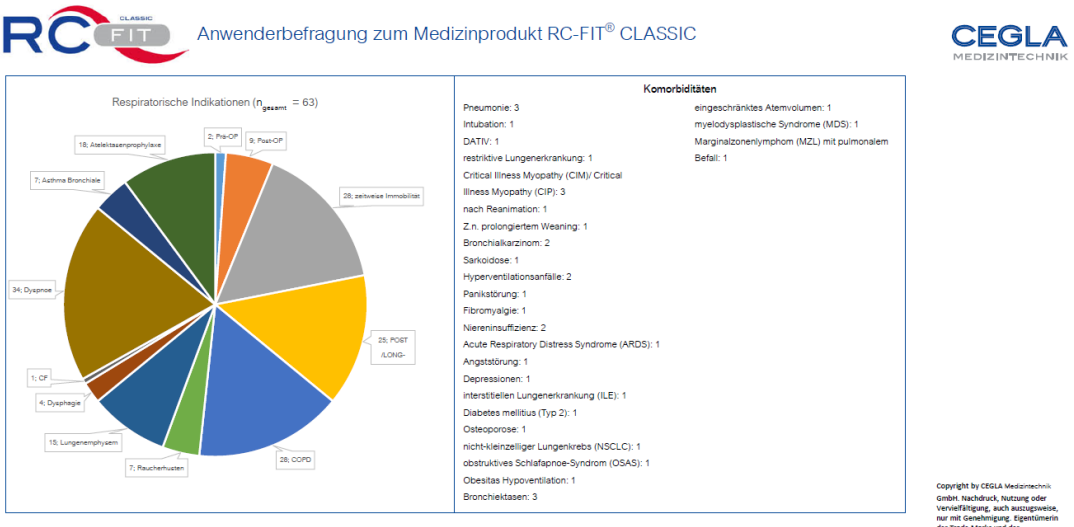
2: Anwenderbefragung zum Medizinproduktes RC-FIT® / *topical subject: test user survey of the respiratory therapy and training device RC-FIT®*

Bei den Darstellungen aus den beiden nachfolgenden Kapiteln handelt es sich um Auszüge der Untersuchung. Die gesamte Erprobung ist auf Nachfrage einsehbar.

2.1 RC-FIT® CLASSIC





2.2 RC-FIT® CLASSIC – Filterung COVID-19 (POST-/LONG-Covid) / *filtering COVID-19 (POST-/LONG-Covid)*

Anwenderbefragung zum Medizinprodukt RC-FIT® CLASSIC – POST-/LONG-COVID

Design der Anwenderbefragung

Zielsetzung: Sammlung von Anwender-Einschätzungen zu Produktcharakteristika, die mit der Anwendung des Medizinproduktes RC-FIT® CLASSIC der Firma CEGLA Medizintechnik im Kontext von COVID-19 assoziiert werden.

Befragte Anwender: Ärzt:innen, Physiotherapeut:innen, Atmungs- und Atemtherapeut:innen, Atemphysiotherapeut:innen, die in Kliniken, Arztpraxen, Atemphysiotherapiezentren tätig sind (gemeinsam „Zentren").

Befragungszeitraum: Dezember 2021 bis Februar 2022.

Anzahl der rückgelaufenen Fragebögen: 25.

Anzahl Zentren mit Fragebogenrückläufern: 17.

Methode: Fragebogengestützte Anwenderbefragung*. Geschlossene Fragen mit vorgegebenen Antwortoptionen, jeweils nur eine Option ankreuzbar. Auswertung: prozentuale Verteilung (relative Häufigkeit) der Nennung der jeweiligen Antwortoption. Mit abgefragt wurden behandelte respiratorische Indikationen und Komorbiditäten (Mehrfachnennung mögl.).

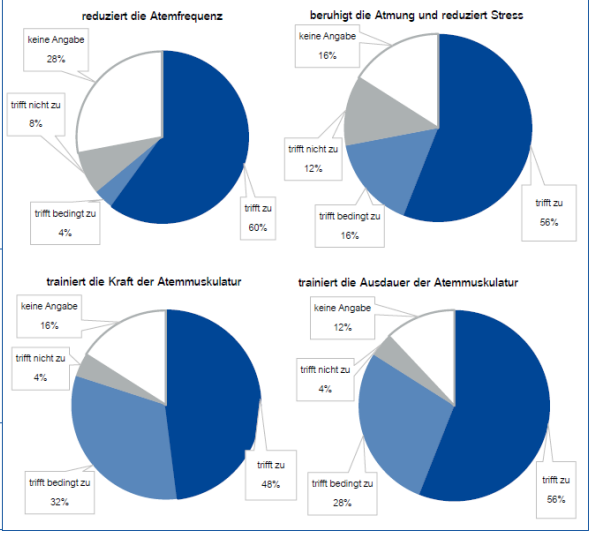
Ergebnisse

Die Ergebnisse der Anwenderbefragung sind in Auszügen rechts dargestellt. U.a. zeigt sich: Mit 48% rel. Häufigkeit waren die Anwender der Ansicht, dass die Atemmuskulatur in der Kraft und mit 56% ebenfalls in der Ausdauer trainiert wurde. Bei 60% der Nennungen reduzierte sich die Atemfrequenz und mit 56% rel. Häufigkeit wurde nach Einschätzung des Fachpersonals die Atmung beruhig und Stress reduziert.

Zusammenfassung

Die Befragung zeigt, dass ein Großteil der Anwender der Meinung ist, dass das RC-FIT® CLASSIC einen positiven Effekt für den Post-/ Long-COVID-Patienten hat in Bezug auf Stress, Beruhigung, Atemfrequenz und Atemmuskulatur.

Auszug aus den Ergebnissen* n_{gesamt} = 25



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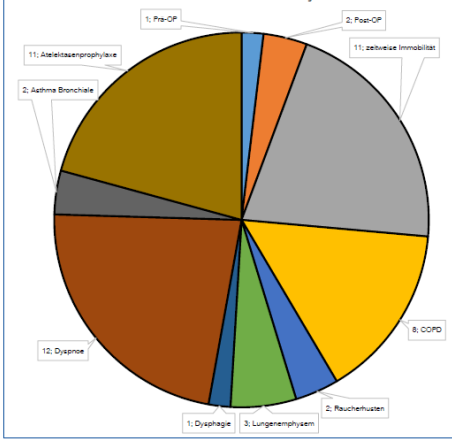
Anwenderbefragung zum Medizinprodukt RC-FIT® CLASSIC – POST-/LONG-*COVID*

Respiratorische Indikationen (n_{gesamt} = 25)



Komorbiditäten

Pneumonie: 2
Intubation: 1
DATIV: 1
Hyperventilationsanfälle: 2
Panikstörung: 1
Fibromyalgie: 1
Niereninsuffizienz: 1
Acute Respiratory Distress Syndrome (ARDS): 1

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2.3 RC-FIT® OIMT

Anwenderbefragung zum Medizinprodukt RC-FIT® OIMT

Design der Anwenderbefragung

Zielsetzung: Sammlung von Anwender-Einschätzungen zu Produktcharakteristika, die mit der Anwendung des Medizinproduktes RC-FIT® OIMT der Firma CEGLA Medizintechnik assoziiert werden.

Befragte Anwender: Arzt:innen, Physiotherapeut:innen, Atmungs- und Atemtherapeut:innen, Atemphysiotherapeut:innen, die in Kliniken, Arztpraxen, Atemphysiotherapiezentren tätig sind (gemeinsam „Zentren").

Befragungszeitraum: Dezember 2021 bis Februar 2022.

Anzahl der rückgelaufenen Fragebögen: 32, davon 22 mit der Indikation COVID-19.

Anzahl Zentren mit Fragebogenrücklaufern: 16.

Methode: Fragebogengestützte Anwenderbefragung*. Geschlossene Fragen mit vorgegebenen Antwortoptionen, jeweils nur eine Option ankreuzbar. Auswertung: prozentuale Verteilung (relative Häufigkeit) der Nennung der jeweiligen Antwortoption. Mit abgefragt wurden behandelte respiratorische Indikationen und Komorbiditäten (Mehrfachnennung mögl.).

Ergebnisse

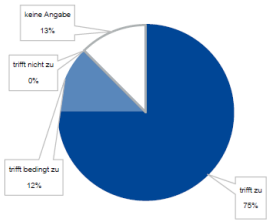
Die Ergebnisse der Anwenderbefragung sind in Auszügen rechts dargestellt. U.a. zeigt sich: Mit 75% rel. Häufigkeit waren die Anwender der Ansicht, dass die Atemmuskulatur in der Kraft und mit 69% ebenfalls in der Ausdauer trainiert wurde. Bei 28% der Nennungen wurde nach Ansicht des Fachpersonals Sekret gelöst; bei 34% verbesserte sich die Sauerstoffsättigung. Auch die Atemfrequenz (nicht grafisch dargestellt) konnte mit 44% rel. Häufigkeit signifikant reduziert werden.

Zusammenfassung

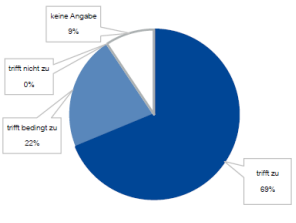
Die Befragung zeigt, dass ein Großteil der Anwender der Meinung ist, dass das RC-FIT® OIMT einen positiven Effekt für den Patienten hat in Bezug auf Kraft und Ausdauer der Einatemmuskulatur, Sekretolyse und in geringerem Maße auf die Sauerstoffsättigung.

Auszug aus den Ergebnissen* $n_{gesamt} = 32$

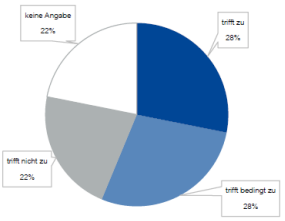
trainiert die Kraft der Einatemmuskulatur



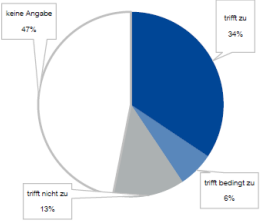
trainiert die Ausdauer der Einatemmuskulatur



löst Sekret



verbessert die Sauerstoffsättigung



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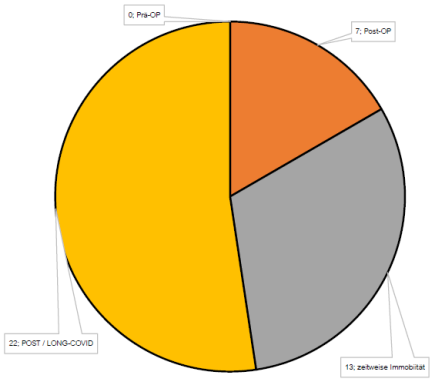
Anwenderbefragung zum Medizinprodukt RC-FIT® OIMT

Respiratorische Indikationen (n_{gesamt} = 32)



Komorbiditäten

Pleuraergüsse: 1
Herzinsuffizienz: 1
Narkolepsie: 1
Raucher: 1
Stress: 1
Hyperventilationssyndrom: 1
Migräne: 1
Belastungsdyspnoe: 2
Panikstörung: 1
Alveolitis: 1
Schädelhirntrauma: 1
Spastik (3. Grad): 1
Lungenquetschung: 1
komplette Lungenresektion rechts: 1
Pneumonie: 1
Video-assistierte Thorakoskopie (VATS): 1
Hodgkin-Lymphom: 1
aktuelle Chemotherapie: 1
kardiale Dekompensation: 1
Asthma Bronchiale: 1

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2.4 RC-FIT® OPEP

Anwenderbefragung zum Medizinprodukt RC-FIT® OPEP

Design der Anwenderbefragung

Zielsetzung: Sammlung von Anwender-Einschätzungen zu Produktcharakteristika, die mit der Anwendung des Medizinproduktes RC-FIT® OPEP der Firma CEGLA Medizintechnik assoziiert werden.

Befragte Anwender: Ärzt:innen, Physiotherapeut:innen, Atmungs- und Atemtherapeut:innen, Atemphysiotherapeut:innen, die in Kliniken, Arztpraxen, Atemphysiotherapiezentren tätig sind (gemeinsam „Zentren").

Befragungszeitraum: Dezember 2021 bis Februar 2022.

Anzahl der rückgelaufenen Fragebögen: 46, davon 6 mit der Indikation COVID-19.

Anzahl Zentren mit Fragebogenrückläufern: 20.

Methode: Fragebogengestützte Anwenderbefragung*. Geschlossene Fragen mit vorgegebenen Antwortoptionen, jeweils nur eine Option ankreuzbar. Auswertung: prozentuale Verteilung (relative Häufigkeit) der Nennung der jeweiligen Antwortoption. Mit abgefragt wurden behandelte respiratorische Indikationen und Komorbiditäten (Mehrfachnennung mögl.).

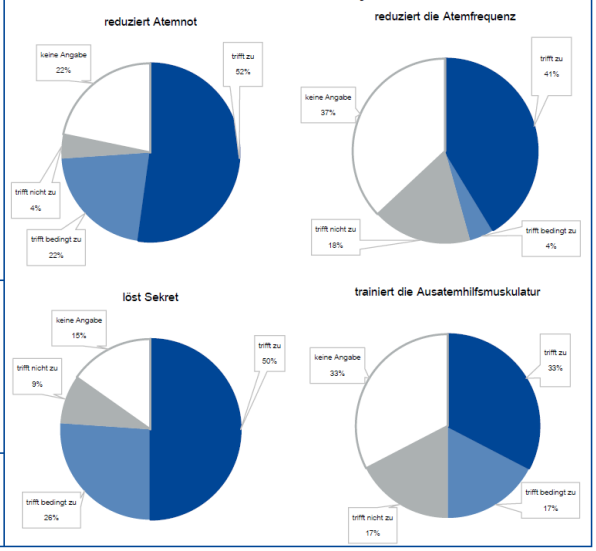
Ergebnisse

Die Ergebnisse der Anwenderbefragung sind in Auszügen rechts dargestellt. U.a. zeigte sich: Mit 52% rel. Häufigkeit waren die Anwender der Ansicht, dass die Atemnot reduziert wurde; mit 50%, dass Sekret gelöst wurde. Auch die Ausatemhilfsmuskulatur konnte bei 33% der Einschätzungen der Experten trainiert werden. Bei 41% rel. Häufigkeit verbesserte sich die Atemfrequenz deutlich.

Zusammenfassung

Die Befragung zeigt, dass ein Großteil der Anwender der Meinung ist, dass das RC-FIT® OPEP einen positiven Effekt für den Patienten hat in Bezug auf Sekretolyse, Atemnot, Atemfrequenz und Ausatemhilfsmuskulatur.

Auszug aus den Ergebnissen* $n_{gesamt} = 46$



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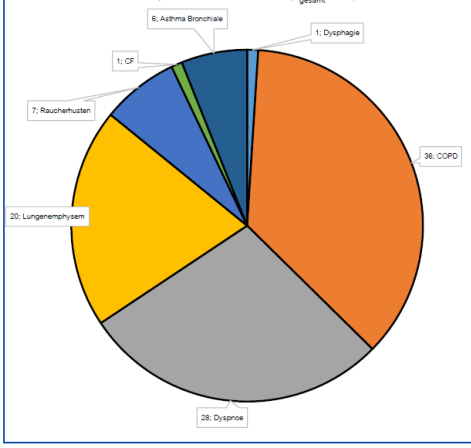
Anwenderbefragung zum Medizinprodukt RC-FIT® OPEP

Respiratorische Indikationen ($n_{gesamt} = 46$)



Komorbiditäten

COVID-19: 2
Post/Long COVID: 4
Schlaganfall: 1
Bronchialkarzinom: 1
OSAS: 4
LTOT-Therapie: 2
Tachyarrhythmia absoluta: 2
koronare Herzkrankheit (KHK): 1
peripheren arteriellen Verschlusskrankheit (PAVK): 2
arterielle Hypertonie: 3
Depressionen: 2
mikrozytäre Anämie: 1
Angiodysplasie des Magens: 1
Demenz: 1
transitorische ischämische Attacke (TIA): 1
Hemiparese rechts1
kardiologisch dekompensiert: 1
Post OP: 1
Pollenallergie: 1
RR erhöht: 1
Alkoholabusus: 1
Nikotinabusus: 1
Acute Respiratory Distress Syndrome (ARDS): 1
Zwerchfellparese rechts: 1
Bullektomie: 1
Fazialisparese + exazerbierte COPD (rezidiv): 1
atypische Pneumonie bei Kollagenose: 1
Obesitas-Hypoventilationssyndrom (OHS): 1
Atelektasen: 1
Vorhofflimmern (VHF): 1
Akute Myeloische Leukämie: 1
Myelodysplastisches Syndrom: 1

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2.5 RC-FIT® PEP/IMT

Anwenderbefragung zum Medizinprodukte RC-FIT® PEP/IMT

Design der Anwenderbefragung

Zielsetzung: Sammlung von Anwender-Einschätzungen zu Produktcharakteristika, die mit der Anwendung des Medizinproduktes RC-FIT® PEP/IMT der Firma CEGLA Medizintechnik assoziiert werden.

Befragte Anwender: Ärzt:innen, Physiotherapeut:innen, Atmungs- und Atemtherapeut:innen, Atemphysiotherapeut:innen, die in Kliniken, Arztpraxen, Atemphysiotherapiezentren tätig sind (gemeinsam „Zentren").

Befragungszeitraum: Dezember 2021 bis Februar 2022.

Anzahl der rückgelaufenen Fragebögen: 35.

Anzahl Zentren mit Fragebogenrückläufern: 20.

Methode: Fragebogengestützte Anwenderbefragung*. Geschlossene Fragen mit vorgegebenen Antwortoptionen, jeweils nur eine Option ankreuzbar. Auswertung: prozentuale Verteilung (relative Häufigkeit) der Nennung der jeweiligen Antwortoption. Mit abgefragt wurden behandelte respiratorische Indikationen und Komorbiditäten (Mehrfachnennung mögl.).

Ergebnisse

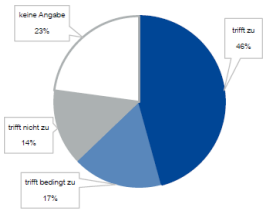
Die Ergebnisse der Anwenderbefragung sind in Auszügen rechts dargestellt. U.a. zeigt sich: Mit 48% rel. Häufigkeit waren die Anwender der Ansicht, dass die Atemmuskulatur in der Kraft und mit 37% Häufigkeit ebenfalls in der Ausdauer trainiert wurde. Mit 37% rel. Häufigkeit befanden die Anwender die Atemnot reduziert. Die Atemfrequenz wurde bei 48% der Nennungen signifikant reduziert.

Zusammenfassung

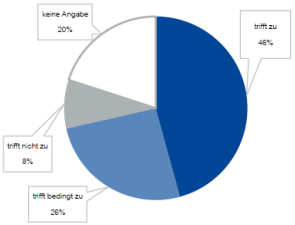
Die Befragung zeigt, dass ein Großteil der Anwender der Meinung ist, dass das RC-FIT® PEP/IMT einen positiven Effekt für den Patienten hat in Bezug auf Atemnot, Atemfrequenz und Atemmuskulatur.

Auszug aus den Ergebnissen* n_{gesamt} = 35

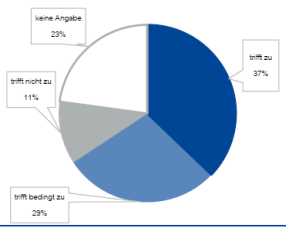
reduziert die Atemfrequenz



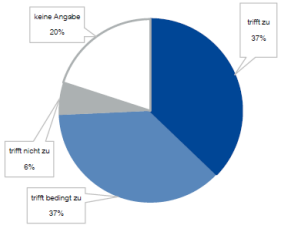
trainiert die Kraft der Atemmuskulatur



reduziert Atemnot



trainiert die Ausdauer der Atemmuskulatur



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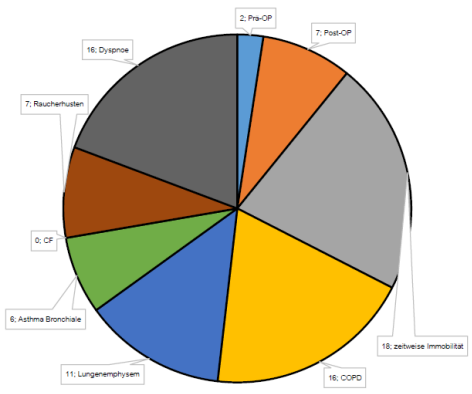
Anwenderbefragung zum Medizinprodukte RC-FIT® PEP/IMT

Respiratorische Indikationen (n_{gesamt} = 35)



Komorbiditäten

POST/LONG COVID: 6
Restriktive Lungenerkrankung: 1
COVID-19: 2
Tracheomalazie: 1
Destroyed Lung: 1
OL-Resektion: 1
koronaren Herzkrankheit (KHK): 1
arterielle Hypertonie: 1
Bypass : 1
Hypothyreose: 1
Epilepsie: 1
Schlaganfall (Apoplex): 2
tiefe Venenthrombose (TVT): 1
Demenz: 1
Adipositas: 1
psychische Belastung: 1
ALS: 1
Polyneuropathie: 1
Diabetes mellitus: 1
beidseitige Pneumonie : 1
respiratorische Insuffizienz: 1
z.n. Tonsillen CA: 1
neck dissection: 1
CRT-D Abfrage: 1
ICD Taschenentzündung: 1
Vorhofflimmern: 1
z.n. Thymustherapie (THX): 1

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3 Studien zur OPEP-Therapie / *studies on OPEP therapy*

3.1 Current devices of respiratory physiotherapy.

AUTOR: IN / AUTHOR:

Hristara-Papadopoulou, A., Tsanakas, J., Diomou, G., Papadopoulou, O.

QUELLE / SOURCE:

Hippokratia, 2008, Vol. 12, 211–220

ABSTRAKT / ABSTRACT:

In recent years patients with respiratory diseases use various devices, which help the removal of mucus from the airways and the improvement of pulmonary function. The aim of the present study is to determine the effectiveness of the current devices of respiratory physiotherapy, as it comes from the review of literature. The current devices of physiotherapy for patients with respiratory diseases, are presented as an alternative therapy method or a supplemental therapy and they can motivate patients to apply therapy by themselves. These devices seem to increase patients' compliance to daily treatment, because they present many benefits, as independent application, full control of therapy and easy use. These devices are the Positive Expiratory Pressure, the High Frequency Chest Wall Oscillation, the Oral High Frequency Oscillation, the Intrapulmonary Percussive Ventilation, the Incentive Spirometry the Flutter and the Acapella and the Cornet. Current devices seem to be effective in terms of mucus expectoration and pulmonary function improvement, as it is shown by published studies. The choice of the suitable device for each patient is a challenge for the physiotherapist in order to achieve better compliance in daily treatment. More controlled studies are needed due to the fact that the number of published studies is limited.

3.2 Airway clearance, mucoactive therapies and pulmonary rehabilitation in bronchiectasis

AUTOR: IN / AUTHOR:

O'Neill, Katherine, O'Donnell, Anne E., Bradley, Judy M.

QUELLE / SOURCE:

Respirology, 2019/january, Vol. 24, No. 3, 227–237, DOI: https://doi.org/10.1111/resp.13459

ABSTRAKT / ABSTRACT:

This paper aims to provide physiological rationale for airway clearance, mucoactive therapy and pulmonary rehabilitation (PR) (or exercise interventions) in bronchiectasis. There is increasing emphasis on the role of airway clearance techniques (ACT) in the management of bronchiectasis. No single ACT has currently shown superior effect over another. Given the large range of different techniques available, consideration of the physiological effects underpinning a technique including expiratory flow, ventilation and oscillation, is essential to effectively personalize ACT. Key clinical trials of mucoactives in bronchiectasis are underway and will provide clarity on the role of these agents in the management of patients with bronchiectasis. Prescription of mucoactive therapies should be done in conjunction with ACT and therefore the mechanism of action of mucoactive drugs and their timing with ACT should be taken into consideration. PR and/or exercise training are recommended in all current bronchiectasis guidelines. There is a clear physiological rationale that muscle weakness and physical inactivity may play a role in disease progression as well as impacting health-related quality of life, frequency of pulmonary exacerbations and ability to mobilize sputum. However, there are residual unanswered questions surrounding the delivery and accessibility to PR. This review summarizes the physiological principles and supporting evidence for airway clearance, mucoactive medication and PR, which are key components in the management of bronchiectasis.

3.3 Comparison of 6 Oscillatory Positive Expiratory Pressure Devices During Active Expiratory Flow

AUTOR: IN / AUTHOR:

Poncin, William, Reychler, Grégory, Liistro, Massimo, Liistro, Giuseppe

QUELLE / SOURCE:

Respiratory Care, 2019/november, Vol. 65, No. 4, 492–499, DOI: https://doi.org/10.4187/respcare.07271

ABSTRAKT / ABSTRACT:

Background: Air-flow oscillations generated by exhaling through oscillatory positive expiratory pressure (OPEP) devices favor airway clearance. Variations in mechanical properties between different devices may influence therapeutic efficacy. The objective of this study was to assess mechanical properties in vitro and to compare the performance of 6 OPEP devices at different resistance levels under active expiratory flow patterns.

Methods: 4 gravity-dependent OPEP devices (ie, Flutter, Gelomuc, Pari O-PEP, Shaker Medic Plus) and 2 gravity-independent OPEP devices (ie, Acapella Choice and Aerobika) were each tested at low, medium, and high resistance settings. All devices were independently connected to a pulmonary waveform generator that reproduced active exhalation flows. Expiratory flow-volume curves were retrieved from 4 subjects with different stages of obstruction severity and were scaled according to either peak expiratory flow (4, 6, and 8 L/s) or volumes (2, 3 and 4 L), thus amounting to 24 active exhalations. Resulting waveforms were divided into 4 parts and the 2 middle parts were used to extract the following mechanical data: positive expiratory pressure (PEP), maximum expiratory pressure (Ppeak), oscillation frequency, and flow oscillation amplitude. The percentage of tests achieving oscillation frequencies $\geq$ 12 Hz and PEP $\geq$ 10 cm H2O was calculated for each device.

Results: Mechanistic effects of the Acapella, Aerobika, and Shaker devices were not comparable. The Flutter, Gelomuc, and Pari devices behaved similarly and achieved more tests with optimum oscillation frequency and PEP values than the other devices. These 3 devices also produced the highest oscillation amplitudes at the low-resistance level, whereas the Aerobika elicited higher and consistent oscillation amplitudes at medium and high resistance settings.

Conclusions: Operational parameters differed between and within devices, yet the Flutter, Gelomuc, and Pari devices were similar in many aspects. Therapeutic efficacy may depend on the selected OPEP device and set resistance.

Keywords: OPEP; air flow oscillations; airway clearance techniques; mechanical evaluation; oscillatory positive expiratory pressure; physiotherapy; secretion clearance.

3.4 Physical Therapist Management of COVID-19 in the Intensive Care Unit: The West China Hospital Experience

AUTOR: IN / AUTHOR:

Li, Lei, Yu, Pengming, Yang, Mengxuan, Xie, Wei, Huang, Liyi, He, Chengqi, Gosselink, Rik, Wei, Quan, Jones, Alice Y. M.

QUELLE / SOURCE:

Physical Therapy, 2020/november, Vol. 101, No. 1, DOI: https://doi.org/10.1093/ptj/pzaa198

ABSTRAKT / ABSTRACT:

Objective: Coronavirus disease 2019 (COVID-19) has dominated the attention of health care systems globally since January 2020. Various health disciplines, including physical therapists, are still exploring the best way to manage this new disease. The role and involvement of physical therapists in the management of COVID-19 are not yet well defined and are limited in many hospitals. This article reports a physical therapy service specially commissioned by the Health Commission of Sichuan Province to manage COVID-19 during patients' stay in the intensive care unit (ICU) at the Public Health Clinical Center of Chengdu in China.
Methods: Patients diagnosed with COVID-19 were classified into 4 categories under a directive from the National Health Commission of the People's Republic of China. Patients in the "severe" and "critical" categories were admitted to the ICU irrespective of mechanical ventilation was required. Between January 31, 2020, and March 8, 2020, a cohort of 16 patients was admitted to the ICU at the Public Health Clinical Center of Chengdu. The median (minimum to maximum) hospital and ICU stays for these patients were 27 (11-46) and 15 (6-38) days, respectively. Medical management included antiviral, immunoregulation, and supportive treatment of associated comorbidities. Physical therapist interventions included body positioning, airway clearance techniques, oscillatory positive end-expiratory pressure, inspiratory muscle training, and mobility exercises. All patients had at least 1 comorbidity. Three of the 16 patients required mechanical ventilation and were excluded for outcome measures that required understanding of verbal instructions. In the remaining 13 patients, respiratory outcomes-including the Borg Dyspnea Scale, peak expiratory flow rate, Pao2/Fio2 ratio, maximal inspiratory pressure, strength outcomes, Medical Research Council Sum Score, and functional outcomes (including the Physical Function in Intensive Care Test score, De Morton Mobility Index, and Modified Barthel Index)-were measured on the first day the patient received the physical therapist intervention and at discharge.

Results: At discharge from the ICU, while most outcome measures were near normal for the majority of the patients, 61% and 31% of these patients had peak expiratory flow rate and maximal inspiratory pressure, respectively, below 80% of the predicted value and 46% had De Morton Mobility Index values below the normative value.

Conclusion: The respiratory and physical functions of some patients remained poor at ICU discharge, suggesting that long-term rehabilitation may be required for these patients.

Impact: Our experience in the management of patients with COVID-19 has revealed that physical therapist intervention is safe and appears to be associated with an improvement in respiratory and physical function in patients with COVID-19 in the ICU.

3.5 Oscillatory positive expiratory pressure therapy in COPD (O-COPD): a randomised controlled trial

AUTOR: IN / AUTHOR:

Alghamdi, Saeed M., Alsulayyim, Abdullah S., Alasmari, Ali M., Philip, Keir E. J., Buttery, Sara C., Banya, Winston A. S., Polkey, Michael I., Birring, Surinder S., Hopkinson, Nicholas S.

QUELLE / SOURCE:

Thorax, 2022/august, Vol. 78, No. 2, 136–143, DOI: https://doi.org/10.1136/thorax-2022-219077

ABSTRAKT / ABSTRACT:

Background: Oscillatory positive expiratory pressure (OPEP) devices are intended to facilitate sputum clearance and reduce cough, but there is limited evidence for their effectiveness in COPD, or to guide patient selection. We aimed to assess the impact of OPEP therapy on quality of life and objective measures of cough and sleep disturbance in patients with COPD with regular sputum production.

Methods: We enrolled stable patients with COPD, who reported sputum production every day or most days, into an assessor-blind, parallel-group, randomised controlled trial comparing 3 months of using an Acapella device against usual care (including use of the active cycle of breathing technique). The primary outcome was cough-related quality of life measured using the Leicester Cough Questionnaire (LCQ). Secondary outcomes included fatigue (Functional Assessment of Chronic Illness Therapy, FACIT score) and generic quality of life (EuroQol-5 Dimensions, EQ-5D). In a substudy (n=45), objective monitoring of cough and disturbance/movement during sleep were also available.

Results: 122 participants (61/61 OPEP/control) were recruited, 40% female, 17% smokers, FEV1 38 (25-56)% predicted, and age 62±10 years. 103 completed the study (55/48 OPEP/control). Use of OPEP was associated with an improvement in LCQ compared with controls; MD (95% CI) 1.03 (0.71 to 2.10); (p=0.03), FACIT score 4.68 (1.34 to 8.02); (p<0.001) and EQ-5D 4.00 (0.49 to 19.75); (p=0.04). There was also an improvement in cough frequency -60 (-43 to -95) coughs/24 hours (p<0.001), but no statistically significant effect on sleep disturbance was identified.

Conclusions: Regular use of an Acapella device improves symptoms and quality of life in people with COPD who produce sputum daily or most days.

Trial registration number: ISRCTN44651852.

3.6 The use of oscillatory respiratory therapy with positive expiratory pressure (PEP-therapy) to restore the functional state of the lungs in patients after cardiac surgery

AUTOR: IN / AUTHOR:

Eremenko, A. A., Zyulyaeva, T. P., Alferova, A. P., Fomina, D. V., Grekova, M. S., Grin, O. O., Dmitrieva, S. S., Molochkov, A. V., Gens, A. P., Kotenko, K. V.

QUELLE / SOURCE:

Voprosy kurortologii, fizioterapii i lechebnoi fizicheskoi kul'tury, 2023, Vol. 100, No. 6, 21, DOI: https://doi.org/10.17116/kurort202310006121

ABSTRAKT / ABSTRACT:

Postoperative pulmonary complications in cardiac surgery patients occur in 10-35% of cases, depending on differences in their definition, patient characteristics and type of surgical intervention, most of them are associated with ineffective coughing and evacuation of bronchial secretions.

Objective: To determine the effectiveness of stimulating the evacuation of bronchial secretions with the help of oscillating PEP therapy carried out during the first three days.

Material and methods: A randomized prospective study of 60 adult patients after elective cardiac surgery was performed (Clinical Trials.gov. protocol number NCT05159401). Oscillatory PEP-therapy was performed in 30 patients using Acapella DHGreen device (SmithMedicalASD, USA) 10-12 hours after tracheal extubation 3 times a day for 3 days after surgery. The control group (30 patients). The inclusion criteria: age over 18 years, spontaneous breathing after tracheal extubation, clear consciousness and productive contact with the patient, the ability to maintain adequate gas exchange on the low-flow oxygen inhalation, adequate analgesia (<2 points of VAS). Exclusion criteria: the need for re-intubation and mechanical ventilation, non-invasive mask ventilation, high-flow oxygen therapy, acute cerebrovascular accident, ongoing bleeding, cardiac insufficiency (inotropic index >10), shocks syndrome of various etiologies, the use of any extracorporeal support, any neuromuscular disorders, pneumothorax, hydro-or hemothorax. Before each session and 20 minutes after its end, when breathing air, blood oxygen saturation was recorded using a pulse oximeter (SpO2), the maximum inspiratory capacity (MIC) was measured using a Coach-2 incentive spirometer from SmithsMedical and spirometry with a portable ultrasonic spirometer Spiro Scout (Schiller, Switzerland). For the purposes of this work, the total index of the spirometry maximum inspiratory capacity (SMIC) was used - the sum of the respiratory volume and the reserve volume of inspiration in ml.

Results: Difficulties in evacuation of sputum were noted in 90% of patients. Three-day sessions of oscillating PEP- therapy are accompanied by a significant improvement in the passage of sputum, as evidenced by a 3-fold increase in the number of patients with productive cough. The increase in MIC in the main group was 46.9% and 21.3%, respectively ($p=0.042$), and the number of patients with values greater than MICo. 1500 ml increased from 23.3% to 7.6% ($p<0.001$). The effectiveness of oscillatory PEP-therapy is confirmed by a 7-fold decrease in the frequency of radiological changes in the lungs at the end of sessions ($p<0.001$), while in the control group the frequency of their occurrence practically did not change and remained at a high level. The total number of patients with respiratory insufficiency ($SpO2 \leq 92\%$) decreased by 8.6 times after completion of all PEP- therapy sessions ($p=0.001$), however, without statistically significant difference with the control group.

Conclusions: Oscillatory PEP- therapy in cardiac surgery patients has a positive effect on sputum passage, ventilation parameters and oxygenating lung function. The procedure was well tolerated and there were no complications associated with it.

3.7 Effects of oscillatory positive expiratory pressure therapy in patients undergoing thoracic or upper abdominal surgery: A systematic review and meta-analysis

AUTOR: IN / AUTHOR:

You, Jinzhi, Jiang, Bo, Dai, Ninghuang, Lu, Bo, Zhao, Chengguang, Zheng, Zhongfeng

QUELLE / SOURCE:

Heliyon, 2024/september, Vol. 10, No. 18, e37798, DOI: https://doi.org/10.1016/j.heliyon.2024.e37798

ABSTRAKT / ABSTRACT:

Background Preventing postoperative complications and accelerating patient recovery are critical issues in clinical treatment and nursing care. This meta-analysis aimed to evaluate the effects of oscillatory positive expiratory pressure therapy (OPEPT) in patients undergoing thoracic or abdominal surgery. Methods We searched PubMed, the Cochrane Library, Web of Science, EBSCO, SinoMed, Weipu, WanFang, and China National Knowledge Infrastructure (CNKI) for randomized controlled trials (RCTs) on the role of OPEPT on patients undergoing thoracic and upper abdominal surgeries. Two researchers independently conducted literature screening, quality assessment, and data extraction based on the inclusion and exclusion criteria, and used the RevMan 5.4 software to perform the meta-analysis.

Results A total of 13 RCTs involving 1166 patients undergoing thoracic or abdominal surgery were included. The meta-analysis results showed that the decreases in FEV1[MD = 0.30, 95%CI (0.22, 0.38), P < 0.001] and FVC levels [MD = 0.38, 95%CI (0.26, 0.49), P < 0.001] were statistically less in the OPEPT group than those in the control group. OPEPT could increase the postoperative drainage volume [MD = 91.53, 95%CI (57.55, 125.50), P < 0.001] and reduce the length of hospital stay [MD = −1.85, 95%CI (−3.42, −0.28), P = 0.02]. no significant effects on the FEV1/FVC [MD = 2.60, 95%CI (−0.46, 5.67), P = 0.10] and the indwelling time of drainage tube [MD = −1.39, 95%CI (−3.18, 0.41), P = 0.13] between patients undergoing OPEPT and routine care. No publication bias was detected amongst the synthesized outcomes (all P > 0.05).

Conclusion OPEPT, with its promising therapeutic approach, has shown to positively influence the recovery process for patients undergoing thoracic and upper abdominal surgeries. More high-quality, large-sample studies are needed in the future to explore the efficacy and safety of OPEPT.

3.8 Performance Characteristics of Positive Expiratory Pressure Devices

AUTOR: IN / AUTHOR:

Demchuk, Angela M., Chatburn, Robert L.

QUELLE / SOURCE:

Respiratory Care, 2021/march, Vol. 66, No. 3, 482

ABSTRAKT / ABSTRACT:

Background: Positive expiratory pressure (PEP) therapy imposes expiratory flow resistance to increase airway diameter and enhance mucus clearance. PEP is achieved several ways. Oscillatory PEP devices (OPEP) generate repeated occlusions that are known to reduce mucus viscosity. There are many marketed devices, but comparative performance is mostly unreported. The purpose of this study was to evaluate performance characteristics of many PEP/OPEP devices. For OPEP devices, we defined an optimal performance metric by creating an oscillation index that combines the OPEP performance characteristics.

Methods: PEP devices (TheraPEP, EzPAP, VersaPAP, Resistex, AccuPEP, AccuPAP, and Threshold PEP) and OPEP devices (Acapella DH, Acapella DM, Acapella Choice, ShurClear, Aerobika, VibraPEP, vPEP, and PocketPEP with and without the Oxyjet attachment) were tested by adjusting simulated expiratory flow from 5 L/min to 30 L/min in increments of 5 L/min using a standard flow meter. Results: All devices showed varying performance characteristics. As expiratory flow increased, mean PEP increased for most devices. The TheraPEP showed a mean PEP of 13 cm H2O across all settings. For OPEP devices, there was a major difference between pressure and flow waveforms. The Acapella DH, ShurClear, and Aerobika showed the highest flow amplitude, flow frequency, and oscillation index.

Conclusions: PEP devices behaved similarly and as expected, with increased pressure with increased flow (flow resistors) or flow independence (threshold resistors). There was much greater variation in the performance of the OPEP devices. A higher oscillation index indicates better mechanical performance characteristics. Many devices have similar characteristics. However, the devices with the highest oscillation index have the highest flow amplitude and frequency, which may indicate better clinical performance.

3.9 Effects of treadmill exercise versus Flutter® on respiratory flow and sputum properties in adults with cystic fibrosis: a randomised, controlled, cross-over trial

AUTOR: IN / AUTHOR:

Dwyer, Tiffany J., Zainuldin, Rahizan, Daviskas, Evangelia, Bye, Peter T. P., Alison, Jennifer A.

QUELLE / SOURCE:

BMC Pulmonary Medicine, 2017/january, Vol. 17, No. 1, DOI: https://doi.org/10.1186/s12890-016-0360-8

ABSTRAKT / ABSTRACT:

Background: Treadmill exercise and airway clearance with the Flutter® device have previously been shown to improve mucus clearance mechanisms in people with cystic fibrosis (CF) but have not been compared. It is therefore not known if treadmill exercise is an adequate form of airway clearance that could replace established airway clearance techniques, such as the Flutter®. The aim of this study was to evaluate respiratory flow, sputum properties and subjective responses of treadmill exercise and Flutter® therapy, compared to resting breathing (control).

Methods: Twenty-four adults with mild to severe CF lung disease (FEV1 28-86% predicted) completed a three-day randomised, controlled, cross-over study. Interventions consisted of 20 min of resting breathing (control), treadmill exercise at 60% of the participant's peak oxygen consumption and Flutter® therapy. Respiratory flow was measured during the interventions. Sputum properties (solids content and mechanical impedance) and subjective responses (ease of expectoration and sense of chest congestion) were measured before, immediately after the interventions and after 20 min of recovery.

Results: Treadmill exercise and Flutter® resulted in similar significant increases in peak expiratory flow, but only Flutter® created an expiratory airflow bias (i.e. peak expiratory flow was at least 10% higher than peak inspiratory flow). Treadmill exercise and Flutter® therapy resulted in similar significant reductions in sputum mechanical impedance, but only treadmill exercise caused a transient increase in sputum hydration. Treadmill exercise improved ease of expectoration and Flutter® therapy improved subjective sense of chest congestion.

Conclusions: A single bout of treadmill exercise and Flutter® therapy were equally effective in augmenting mucus clearance mechanisms in adults with CF. Only longer term studies, however, will determine if exercise alone is an adequate form of airway clearance therapy that could replace other airway clearance techniques.

3.10 Effect of Cornet Device to Clear the Excess Trachea Bronchial Secretions in a 45 Year Old Right Middle and Lower Lobe Pneumonia Patient- A Case Report

AUTOR: IN / AUTHOR:

Muthukumar, T. S.

QUELLE / SOURCE:

MOJ Yoga & Physical Therapy, 2016/july, Vol. 1, No. 1, DOI:
https://doi.org/10.15406/mojypt.2016.01.00001

ABSTRAKT / ABSTRACT:

45- year old woman diagnosed as right middle and lower lobe pneumonia had been referred for chest physiotherapy to evacuate secretions and to improve oxygenation. The X-ray and Computed tomography findings revealed patchy areas of collapse, consolidation and fibrotic strands in right middle and lower lobes. The physical examination findings also confirmed the signs of consolidation and collapse i.e. decreased air entry on right side and presence of crepitations. Chest physiotherapy mainly aimed to clear the excess trachea bronchial secretions in pneumonia. Chest physiotherapy with the help of positive expiratory device – Cornet was given twice daily for ten days. Cornet device uses the principle of positive expiratory pressure which creates an airway oscillation inside the airways. This causes thinning down of mucus and the patient can expectorate the secretions with the help of cough or huff. The X-ray findings showed improvement in right lower lobe and there was no radiological evidence of consolidation and collapse post chest physiotherapy. The patient responded to treatment well and she was discharged successfully. It is concluded that the present case study advocates the use of Cornet device to clear the excess tracheobronchial secretions. Cornet device is easy to use without any supervision and the patient may use at home also.

3.11 The use of a modified, oscillating positive expiratory pressure device reduced fever and length of hospital stay in patients after thoracic and upper abdominal surgery: a randomised trial

AUTOR: IN / AUTHOR:

Zhang, Xiang-yu, Wang, Qixing, Zhang, Shouqin, Tan, Weilin, Wang, Zheng, Li, Jue

QUELLE / SOURCE:

Journal of Physiotherapy, 2015/january, Vol. 61, No. 1, 16–20, DOI: https://doi.org/10.1016/j.jphys.2014.11.013

ABSTRAKT / ABSTRACT:

Question: Does the use of an oscillating positive expiratory pressure (PEP) device reduce postoperative pulmonary complications in thoracic and upper abdominal surgical patients? Design: A multi-centre, parallel-group, randomised controlled trial with intention-to-treat analysis, blinding of some outcomes, and concealed allocation. Participants: A total of 203 adults after thoracic or upper abdominal surgery with general anaesthesia. Intervention: Participants in the experimental group used an oscillating PEP device, thrice daily for 5 postoperative days. Both the experimental and control groups received standard medical postoperative management and early mobilisation. Outcome measures: Fever, days of antibiotic therapy, length of hospital stay, white blood cell count, and possible adverse events were recorded for 28 days or until hospital discharge. Results: The 99 participants in the experimental group and 104 in the control group were well matched at baseline and there was no loss to follow-up. Fever affected a significantly lower percentage of the experimental group (22%) than the control group (42%), with a RR of 0.56 (95% CI 0.36 to 0.87, NNT 6). Similarly, length of hospital stay was significantly shorter in the experimental group, at 10.7 days (SD 8.1), than in the control group, at 13.3 days (SD 11.1); the mean difference was 2.6 days (95% CI 0.4 to 4.8). The groups did not differ significantly in the need for antibiotic therapy, white blood cell count or total expense of treatment. Conclusion: In adults undergoing thoracic and upper abdominal surgery, postoperative use of an oscillating PEP device resulted in fewer cases of fever and shorter hospital stay. However, antibiotic therapy and total hospital expenses were not significantly reduced by this intervention.

3.12 Oscillatory Positive Expiratory Pressure in Chronic Obstructive Pulmonary Disease

AUTOR: IN / AUTHOR:

Svenningsen, Sarah, Paulin, Gregory A., Sheikh, Khadija, Guo, Fumin, Hasany, Aasim, Kirby, Miranda, Etemad Rezai, Roya, McCormack, David G., Parraga, Grace

QUELLE / SOURCE:

COPD: Journal of Chronic Obstructive Pulmonary Disease, 2015/october, Vol. 13, No. 1, 66–74, DOI: https://doi.org/10.3109/15412555.2015.1043523

ABSTRAKT / ABSTRACT:

RATIONALE: Airway clearance methods such as oscillating positive expiratory pressure (oPEP) are proposed to provide benefit in patients with chronic obstructive pulmonary disease (COPD) and bronchiectasis by mobilizing secretions and enhancing mucous movement. METHODS: A six-week cross-over study was completed in 29 subjects (n=15 COPD, n=14 bronchiectasis) who provided written informed consent and were randomized to oPEP therapy (Aerobika®, Trudell Medical International) four-times daily. Pulmonary function tests, the Six Minute Walk distance (6MWD), St George's Respiratory Questionnaire (SGRQ) and the Patient Evaluation Questionnaire (PEQ) were used to evaluate therapy effects. RESULTS: There were no adverse events related to oPEP use. There were statistically significant improvements in 6MWD (p=0.01), SGRQ total score (p=0.01), and the PEQ Cough Frequency (p=0.006), dyspnea (p=0.03) and ease in bringing up sputum (p<0.0001). CONCLUSIONS: In subjects with COPD and bronchiectasis, three weeks of oPEP therapy (Aerobika®) was welltolerated and there was improved dyspnea, quality of life, exercise capacity and ease in bringing up sputum.

3.13 Physiotherapy treatment in cystic fibrosis: airway clearance techniques

AUTOR: IN / AUTHOR:

S. Ammani Prasad, MCSP, Tamara Orska M.C.S.P. Kate Ferguson M.C.S.P. Penny Agent M. C. S. P., Mary Dodd, F.C.S.P. on behalf of the Association of Chartered Physiotherapists in Cystic Fibrosis. Updated by Elaine DhouiebMC. S. P., MCSP., Alison Gates

QUELLE / SOURCE:

Cystic Fibrosis our focus, 2011, 9

ABSTRAKT / ABSTRACT:

The RC-Cornet® consists of a curved hard plastic tube within which sits a soft flexible rubber tube. It works in a very similar way as the flutter, producing a vibration and PEP effect in the airways. The degree of PEP and vibration can be altered by changing the twist in the rubber tube. The RC-Cornet® can be used in any treatment position and like the flutter a combination of breathing techniques are used to help to move and clear secretions".

3.14 Ist Atemphysiotherapie evidenzbasierte Therapie?

AUTOR: IN / AUTHOR:

Cegla, U. H.

QUELLE / SOURCE:

Atemwegs- und Lungenkrankheiten, Jahrgang 36, No. 5/2010, 205

ABSTRAKT / ABSTRACT:

Von der heutigen Therapie wird verlangt, dass sie evidenzbasiert ist, das heißt ihre Wirksamkeit muss durch klinische Studien, die festgelegten statistischen Anforderungen genügen, bewiesen sein. Für die oszillierenden PEP-Geräte (Flutter, RC-Cornet® und Acapella) ist diese “Wirksamkeit” bewiesen. Die einzelnen Geräte zeigen bei unterschiedlicher Einstellung bzw. Neigung (Flutter) bei gleich großem Atemdruck unterschiedliche Flüsse und Frequenzen. Darüber hinaus ist bei den einzelnen Geräten je nach Einstellung auch der entstehende positive Ausatemdruck (PEP) im Sinne eines dauerpositiven Drucks, wie bei der PEP-Maske (statischer PEP), bzw. kombinierter PEP (Dauer positiver Druck mit aufgesetzten Druckschwankungen) oder dynamischer PEP (der Druck steigt von Null auf ein Maximum und fällt auf Null zurück) zu erreichen. Auch das zeitliche Verhalten des PEP-Anstiegs kann durch die Geräteeinstellungen beeinflusst werden (symmetrischer PEP, meist in Form einer Sinusschwingung, und asymmetrischer PEP, bei dem der Druck langsam ansteigt, um dann abrupt abzufallen). Das Druck-und Frequenzverhalten der einzelnen oszillierenden PEP-Geräte bei steigendem Druck wurde untersucht. Bei Normalpersonen wurde an den oszillierenden PEP-Geräten in verschiedenen Einstellungen der als “angenehm empfundene Druck” ermittelt; dieser lag deutlich höher (etwa ein Drittel) als bei einer Gruppe von 50 obstruktiven Patienten, bei denen der jeweils aufgebrachte Druck beim Blasen in die verschiedenen Einstellungen des RC-Cornet® gemessen wurde. Anhand der entstehenden unterschiedlichen PEP-Druck-Formen werden Vorschläge zur Einstellung der Geräte zur Therapie unterschiedlicher Störungen gemacht. Die Durchsicht der bestehenden Literatur zeigt, dass die Therapie mit oszillierenden PEP-Geräten evidenzbasiert ist.

3.15 Influência da técnica de pressão expiratória positiva oscilante utilizando pressões expiratórias pré-determinadas na viscosidade e na transportabilidade do escarro em pacientes com bronquiectasia

AUTOR: IN / AUTHOR:

Ramos, Ercy Mara Cipulo, Ramos, Dionei, Iyomasa, Daniela Mizusaki, Moreira, Graciane Laender, Melegati, Kátia Cristina Teixeira, Vanderlei, Luiz Carlos Marques, Jardim, José Roberto, Oliveira, Adriana Siqueira de

QUELLE / SOURCE:

Jornal Brasileiro de Pneumologia, 2009/december, Vol. 35, No. 12, 1190–1197, DOI: https://doi.org/10.1590/s1806-37132009001200005

ABSTRAKT / ABSTRACT:

OBJECTIVE: To determine the effectiveness of oscillating positive expiratory pressure (OPEP) using predetermined expiratory pressures on the viscosity and transportability of sputum in patients with bronchiectasis. METHODS: The study involved 15 stable patients with bronchiectasis (7 males; mean age = 53 +/- 16 years), submitted to two consecutive OPEP interventions, with a 24-h interval between the two, using positive expiratory pressures set at 15 cmH2O (P15) and 25 cmH2O (P25). The protocol consisted of a voluntary cough; another voluntary cough 20 min later, designated time zero (T0); a 10-min rest period; and two 10-min series (S1 and S2, using OPEP at P15 and P25 in both), with a 10-min interval between the two. The viscosity and transportability of sputum were evaluated by viscometry, relative transport velocity on frog palate, transport in a simulated cough machine and contact angle. Sputum samples were collected at T0, after S1 and after S2. Specific statistical tests were performed depending on the type of data distribution. RESULTS: In comparison with the values obtained at T0, sputum viscosity decreased significantly after S1 at P15 and after S2 at P25. There were no significant differences among all of the samples in terms of transportability.

CONCLUSIONS: The fact that sputum viscosity decreased whether OPEP was performed at P15 or at P25 suggests that there is no need to generate high expiratory pressure to achieve the desired result.

3.16 The immediate effects of breathing with oscillated inspiratory and expiratory airflows on secretion clearance in intubated patients with cervical spinal cord injury

AUTOR: IN / AUTHOR:

Kluayhomthong, Sujittra, Ubolsakka-Jones, Chulee, Domthong, Pornanan, Reechaipichitkul, Wipa, Jones, David A.

QUELLE / SOURCE:

Spinal Cord, 2018/november, Vol. 57, No. 4, 308–316, DOI: https://doi.org/10.1038/s41393-018-0220-x

ABSTRAKT / ABSTRACT:

Study design: A prospective, randomized crossover trial.

Objectives: To evaluate the efficacy of the combination of incentive spirometry with oscillation (OIS) and positive expiratory pressure with oscillation (OPEP) to promote secretion clearance in intubated patients with cervical spinal cord injury.

Setting: Spinal cord unit, tertiary care hospital, North East Thailand.

Methods: Thirteen intubated patients (C4-7, AIS score C) with secretion retention performed three interventions randomly allocated on consecutive days, a Sham deep breathing, OPEP and OPEP + OIS breathing exercise. Secretions were collected by sterile suction for 3 h before, and 3 h after, each intervention and wet weight recorded. Cardiopulmonary parameters were measured before and after each intervention.

Results: The median (IQR) secretion wet weight pre-intervention was 2.61 g (2.21, 3.85) and in the 3 h after Sham there was an increase of 1.97 g (0.6, 3.6). The increase after OPEP was 2.67 g (1.7, 3.9) and after OPEP + OIS, 4.28 g (2.4, 6.7); all the increases being significant ($p \leq 0.007$). The clearance after OPEP and OPEP + OIS were both greater than Sham while OPEP + OIS was greater than OPEP ($p \leq 0.019$). There were no significant changes in cardiopulmonary measures following any intervention or when compared between interventions.

Conclusions: Deep breathing with an oscillated and humidified air flow in a combination of OIS + OPEP more than doubled secretion clearance and was more effective than OPEP or Sham deep breathing. There were no adverse effects of the procedures which were well tolerated by the patients and may be used to complement existing methods for secretion clearance.

3.17 The Use of Oscillating Positive Expiratory Pressure (OPEP) Therapy in Patients with COPD or Chronic Bronchitis with Excess Mucus Secretion: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

van Es, M., Schokker, S., Been-Buck, S., Wiersema, W., Klemmeier-Boekholt, T., Jacobs, W.

QUELLE / SOURCE:

American Journal of Respiratory and Critical Care Medicine 2019;199:A1114, 2019/05, DOI: https://doi.org/10.1164/ajrccm-conference.2019.199.1_MeetingAbstracts.A1114

3.18 Effectiveness of the use of an oscillating positive expiratory pressure device in bronchiectasis with frequent exacerbations: a single-arm pilot study

AUTOR: IN / AUTHOR:

Kim, So Rae, Kim, Sun-Hyung, Kim, Geun-Hyeong, Cho, Jun Yeun, Choi, Hayoung, Lee, Hyun, Ra, Seung Won, Lee, Ki Man, Choe, Kang Hyeon, Oh, Yeon-Mok, Shin, Yoon Mi, Yang, Bumhee

QUELLE / SOURCE:

Frontiers in Medicine, 2023/05, Vol. 10, DOI: https://doi.org/10.3389/fmed.2023.1159227

ABSTRAKT / ABSTRACT:

Impaired airway clearance in patients with non-cystic fibrosis bronchiectasis causes frequent bacterial infection, chronic inflammation, and progressive tissue destruction. We aimed to evaluate whether an oscillating positive expiratory pressure (OPEP) device could allow effective sputum expectoration and prevent acute exacerbations in patients with bronchiectasis who had frequent acute exacerbations. This open-label, single-arm, prospective study included 17 patients who experienced three or more acute exacerbations in the past year. We evaluated the prevention of acute exacerbations, subjective symptom improvement, and change in sputum amount during the use of the Aerobika (Trudell Medical International, London, ON) OPEP device twice daily for 6 months. Of all enrolled patients, only two acute exacerbations occurred during the study period, indicating a significant decrease compared with the number of acute exacerbations before the device use ($p < 0.001$). Additionally, Bronchiectasis Health Questionnaire score changed from 58.7 to 66.6, showing significant improvement over the treatment period ($p < 0.001$). The largest sputum volume was observed 3 months after OPEP device use (baseline: 10 ml, 3rd month 25 ml, $p = 0.325$). There were no major adverse events related to the use of OPEP devices. Twice-daily physiotherapy with OPEP device in patients with bronchiectasis who have frequent exacerbations may facilitate symptomatic improvement and prevention of acute exacerbations without serious adverse events.

3.19 Effect of OPEP on lung recruitment and gas distribution in post-surgery patients: A pilot study

AUTOR: IN / AUTHOR:

Xu, Jing, Zhang, Rui, Guan, Jiayi, Qi, Xiaoling, Tan, Ruoming, Wang, Xiaoli, Pan, Tingting, Qu, Hongping, Liu, Jialin

QUELLE / SOURCE:

Trends in Anaesthesia and Critical Care, 2024/october, Vol. 58, 101383, DOI: https://doi.org/10.1016/j.tacc.2024.101383

ABSTRAKT / ABSTRACT:

Background Oscillatory positive expiratory pressure (OPEP) devices are airway clearance tools generating positive pressure, yet evidence supporting their efficacy post-surgery for lung recruitment and gas distribution is limited. Objectives Investigate OPEP's impact on lung recruitment and gas distribution using Electrical impedance tomography (EIT) in post-surgery patients. Methods 26 ICU-extubated patients post-major surgery used OPEP at five levels with EIT monitoring. Primary outcome: change in end-expiratory lung impedance (ΔEELI) post-OPEP; secondary outcomes: global inhomogeneity index (GI), respiratory rate, oxygen saturation, blood pressure, and heart rate. Results Significant ΔEELI increase during OPEP versus baseline, correlating with OPEP level. ROI3 (mid-dorsal lung) exhibited highest ΔEELI. Oxygen saturation improved post-OPEP. Conclusions OPEP effectively increased end-expiratory lung volume post-major surgery, notably in mid-dorsal regions, enhancing short-term oxygenation.

4 Studien zur PEP-Therapie / *studies on PEP therapy*

4.1 An integrative review on the positive expiratory pressure (PEP)‐bottle therapy for patients with pulmonary diseases

AUTOR: IN / AUTHOR:

Liverani, Benedetta, Nava, Stefano, Polastri, Massimiliano

QUELLE / SOURCE:

Physiotherapy Research International, 2019/november, Vol. 25, No. 1, DOI: https://doi.org/10.1002/pri.1823

ABSTRAKT / ABSTRACT:

Background and Purpose Positive expiratory pressure (PEP)-bottle device delivers a PEP within a range of 10–20 cmH2O. PEP treatment is applied to different pathological conditions also in combination with other physiotherapeutic techniques. The primary aim of the present review was to investigate the effects of PEP-bottle therapy in patients with pulmonary diseases and, secondarily, to provide a physiological analysis of its use.

Methods The databases PubMed, Scopus, Web of Science, Cinahl, and Cochrane Library were searched for citations published from their inception until May 2019. Adult participants (>18 years) with pulmonary disease who underwent PEP-bottle treatment, with no restriction on gender, were included in the study. There were no restrictions about the therapeutic settings and the condition of the disease (either acute or chronic).

Results The literature review returned 97 citations. After duplicates removal, the remaining 77 articles have been screened: 66 have been assessed as not eligible at first because the abstract did not meet the inclusion criteria. Eleven articles were left after the first two steps of selection: four have been excluded after full-text reading.

Conclusion PEP-bottle therapy has been proved to improve lung volume, to reduce hyperinflation, and to remove secretions. The device delivers a pressure equal to the water column only if the inner diameter of the tubing and the width of the air escape orifice are equal or greater than 8 mm, and the length of tubing ranges between 20 and 80 cm. The cost of a PEP-bottle device is significantly lower if compared with other commercially available devices having the same therapeutic purposes.

4.2 European Respiratory Society statement on airway clearance techniques in adults with bronchiectasis

AUTOR: IN / AUTHOR:

Herrero-Cortina, Beatriz, Lee, Annemarie L., Oliveira, Ana, O'Neill, Brenda, Jácome, Cristina, Dal Corso, Simone, Poncin, William, Muñoz, Gerard, Inal-Ince, Deniz, Alcaraz-Serrano, Victoria, Reychler, Gregory, Bellofiore, Angela, Posthumus, Annette, Tonia, Thomy, Chalmers, James D., Spinou, Arietta

QUELLE / SOURCE:

European Respiratory Journal, 2023/05, Vol. 62, No. 1, 2202053, DOI: https://doi.org/10.1183/13993003.02053-2022

ABSTRAKT / ABSTRACT:

Airway clearance techniques (ACTs) are part of the main management strategy for patients with bronchiectasis. Despite being a priority for patients, accessibility, implementation and reporting of ACTs are variable in clinical settings and research studies. This European Respiratory Society statement summarises current knowledge about ACTs in adults with bronchiectasis and makes recommendations to improve the future evidence base. A task force of 14 experts and two patient representatives (10 countries) determined the scope of this statement through consensus and defined six questions. The questions were answered based on systematic searches of the literature. The statement provides a comprehensive review of the physiological rationale for ACTs in adults with bronchiectasis, and the mechanisms of action along with the advantages and disadvantages of each ACT. Evidence on ACTs in clinical practice indicates that the most frequently used techniques are active cycle of breathing techniques, positive expiratory pressure devices and gravity-assisted drainage, although there is limited evidence on the type of ACTs used in specific countries. A review of 30 randomised trials for the effectiveness of ACTs shows that these interventions increase sputum clearance during or after treatment, reduce the impact of cough and the risk of exacerbations, and improve health-related quality of life. Furthermore, strategies for reducing the risk of bias in future studies are proposed. Finally, an exploration of patients' perceptions, barriers and enablers related to this treatment is also included to facilitate implementation and adherence to ACTs.

4.3 PILOT STUDY: HYOLARYNGEAL MUSCLE ACTIVATION IN RESPONSE TO RMT USING THE BREATHER

AUTOR: IN / AUTHOR:

Matthew Dumican, M.S.C.C.C.-S.L.P., Christopher Watts, Ph. D.

QUELLE / SOURCE:

Poster Presentation – DYSPHAGIA RESEARCH SOCIETY, San Diego, CA, 2019

ABSTRAKT / ABSTRACT:

Key findings:

- In neuromuscular disease, such as Parkinson's, activation of muscle groups for voice and swallowing may be impaired, causing dysphonia and dysphagia.
- Strengthening those muscle groups by respiratory muscle training (RMT) can improve voice and swallow function, and health-related quality of life.
- In the study presented here, activation of the hyolaryngeal muscles in response to RMT using The Breather is assessed by surface electromyograph (sEMG).
- RMT using The Breather improved muscle activation both during inspiration as well as during expiration against resistance significantly above baseline level.
- The Breather can be recommended as a useful exercise tool to maintain swallow function longer

4.4 Rehabilitation of Swallowing and Cough Functions Following Stroke: An Expiratory Muscle Strength Training Trial

AUTOR: IN / AUTHOR:

Hegland, Karen Wheeler, Davenport, Paul W., Brandimore, Alexandra E., Singletary, Floris F., Troche, Michelle S.

QUELLE / SOURCE:

Archives of Physical Medicine and Rehabilitation, 2016/august, Vol. 97, No. 8, 1345–1351, DOI: https://doi.org/10.1016/j.apmr.2016.03.027

ABSTRAKT / ABSTRACT:

Objective: To determine the effect of expiratory muscle strength training (EMST) on both cough and swallow function in stroke patients.

Design: Prospective pre-post intervention trial with 1 participant group.

Setting: Two outpatient rehabilitation clinics.

Participants: Adults (N=14) with a history of ischemic stroke in the preceding 3 to 24 months.

Intervention: EMST. The training program was completed at home and consisted of 25 repetitions per day, 5 days per week, for 5 weeks.

Main outcome measures: Baseline and posttraining measures were maximum expiratory pressure, voluntary cough airflows, reflex cough challenge to 200μmol/L of capsaicin, sensory perception of urge to cough, and fluoroscopic swallow evaluation. Repeated measures and 1-way analyses of variance were used to determine significant differences pre- and posttraining.

Results: Maximum expiratory pressure increased in all participants by an average of 30cmH2O posttraining. At baseline, all participants demonstrated a blunted reflex cough response to 200μmol/L of capsaicin. After 5 weeks of training, measures of urge to cough and cough effectiveness increased for reflex cough; however, voluntary cough effectiveness did not increase. Swallow function was minimally impaired at baseline, and there were no significant changes in the measures of swallow function posttraining.

Conclusions: EMST improves expiratory muscle strength, reflex cough strength, and urge to cough. Voluntary cough and swallow measures were not significantly different posttraining. It may be that stroke patients benefit from the training for upregulation of reflex cough and thus improved airway protection.

4.5 Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study

AUTOR: IN / AUTHOR:

Liu, Kai, Zhang, Weitong, Yang, Yadong, Zhang, Jinpeng, Li, Yunqian, Chen, Ying

QUELLE / SOURCE:

Complementary Therapies in Clinical Practice, 2020/05, Vol. 39, 101166, DOI: https://doi.org/10.1016/j.ctcp.2020.101166

ABSTRAKT / ABSTRACT:

Background: Different degrees of disorders are reported in respiratory function, physical function and psychological function in patients with corona virus disease 2019 (COVID-19), especially in elderly patients. With the experience of improved and discharged COVID-19 patients, timely respiratory rehabilitation intervention may improve prognosis, maximize functional preservation and improve quality of life (QoL), but there lacks of studies worldwide exploring the outcome of this intervention.

Objective: To investigate the effects of 6-week respiratory rehabilitation training on respiratory function, QoL, mobility and psychological function in elderly patients with COVID-19.

Methods: This paper reported the findings of an observational, prospective, quasi-experimental study, which totally recruited 72 participants, of which 36 patients underwent respiratory rehabilitation and the rest without any rehabilitation intervention. The following outcomes were measured: pulmonary function tests including plethysmography and diffusing lung capacity for carbon monoxide (DLCO), functional tests (6-min walk distance test), Quality of life (QoL) assessments (SF-36 scores), activities of daily living (Functional Independence Measure, FIM scores), and mental status tests (SAS anxiety and SDS depression scores).

Results: After 6 weeks of respiratory rehabilitation in the intervention group, there disclosed significant differences in FEV1(L), FVC(L), FEV1/FVC%, DLCO% and 6-min walk test. The SF-36 scores, in 8 dimensions, were statistically significant within the intervention group and between the two groups. SAS and SDS scores in the intervention group decreased after the intervention, but only anxiety had significant statistical significance within and between the two groups.

Conclusions: Six-week respiratory rehabilitation can improve respiratory function, QoL and anxiety of elderly patients with COVID-19, but it has little significant improvement on depression in the elderly.

4.6 Respiratory muscle training improves swimming endurance in divers

AUTOR: IN / AUTHOR:

Wylegala, Juli A., Pendergast, David R., Gosselin, Luc E., Warkander, Dan E., Lundgren, Claes E. G.

QUELLE / SOURCE:

European Journal of Applied Physiology, 2006/december, Vol. 99, No. 4, 393–404, DOI: https://doi.org/10.1007/s00421-006-0359-6

ABSTRAKT / ABSTRACT:

Respiratory muscles can fatigue during prolonged and maximal exercise, thus reducing performance. The respiratory system is challenged during underwater exercise due to increased hydrostatic pressure and breathing resistance. The purpose of this study was to determine if two different respiratory muscle training protocols enhance respiratory function and swimming performance in divers. Thirty male subjects (23.4 +/- 4.3 years) participated. They were randomized to a placebo (PRMT), endurance (ERMT), or resistance respiratory muscle training (RRMT) protocol. Training sessions were 30 min/day, 5 days/week, for 4 weeks. PRMT consisted of 10-s breath-holds once/minute, ERMT consisted of isocapnic hyperpnea, and RRMT consisted of a vital capacity maneuver against 50 cm H(2)O resistance every 30 s. The PRMT group had no significant changes in any measured variable. Underwater and surface endurance swim time to exhaustion significantly increased after RRMT (66%, P < 0.001; 33%, P = 0.003) and ERMT (26%, P = 0.038; 38%, P < 0.001). Breathing frequency (f (b)) during the underwater endurance swim decreased in RRMT (23%, P = 0.034) and tidal volume (V (T)) increased in both the RRMT (12%, P = 0.004) and ERMT (7%, P = 0.027) groups. Respiratory endurance increased in ERMT (216.7%) and RRMT (30.7%). Maximal inspiratory and expiratory pressures increased following RRMT (12%, P = 0.015, and 15%, P = 0.011, respectively). Results from this study indicate that respiratory muscle fatigue is a limiting factor for underwater swimming performance, and that targeted respiratory muscle training (RRMT > ERMT) improves respiratory muscle and underwater swimming performance.

4.7 THE EFFECTS OF RESPIRATORY MUSCLE TRAINING ON VO2 MAX, THE VENTILATORY THRESHOLD AND PULMONARY FUNCTION

AUTOR: IN / AUTHOR:

AMONETTE, W.I.L.L.I.A.M. E., DUPLER, T.E.R.R.Y. L.

QUELLE / SOURCE:

JEPonline, 2002, Vol. 5, No. 2, 29

ABSTRAKT / ABSTRACT:

THE EFFECTS OF RESPIRATORY MUSCLE TRAINING ON VO2 MAX, THE VENTILATORY THRESHOLD AND PULMONARY FUNCTION. William E. Amonette, Terry L. Dupler. JEPonline. 2002;5(2):29-35. This study evaluated the effect of inspiratory and expiratory muscle training on pulmonary function and maximal exercise performance in competitive triathletes and marathon runners. The participants in this study (N=12) had a mean weekly aerobic training time of 7.5 hours per week of swimming, cycling, or running. Eight subjects were assigned to a pulmonary resistance treatment group and four control subjects were given a sham device that allowed no greater than 15% resistance on inspiration or expiration. The subjects performed 30 maximal inhalation/exhalation maneuvers on their respective devices two times per day for four weeks. The subjects were tested for forced vital capacity (FVC), forced expiratory volume in one second (FEV1), FEV1/FVC ratio, forced inspiratory vital capacity (FIVC), peak inspiratory flow rate (PIFR), and peak expiratory flow rate (PEFR). Each subject was also tested for peak exhalation force (PEF) as well as a maximal oxygen consumption (VO2 max), carbon dioxide production (VCO2), tidal volume (VT), ventilation (VE), ventilatory threshold (VT), and respiration rate (RR). The data revealed that training using the pulmonary resistance device produced significant increases in maximal VE and maximal VT while decreasing RR (although not statistically significant) at maximum exercise. However, no significant changes were seen in VO2 or any pulmonary function variables measured.

4.8 The Impact of Positive Expiratory Pressure Therapy on Hyperinflation in Patients With COPD

AUTOR: IN / AUTHOR:

de Macedo, Juliana Ribeiro Fonseca Franco, Conceiçãodos dos Santos, Elinaldo da, Reychler, Gregory, Poncin, William

QUELLE / SOURCE:

Respiratory Care, 2024/february, Vol. 69, No. 3, 366–375, DOI: https://doi.org/10.4187/respcare.11039

ABSTRAKT / ABSTRACT:

Background: Lung hyperinflation is a typical clinical feature of patients with COPD. Given the association between breathing at elevated lung volumes and the manifestation of severe debilitating symptoms, therapeutic interventions such as positive expiratory pressure (PEP) therapy and its variations (temporary, oscillatory) have been devised to mitigate lung hyperinflation. However, the efficacy of these interventions remains to be conclusively demonstrated.

Methods: A systematic review with meta-analysis of randomized trials was conducted following the PRISMA guidelines. Seven databases were screened with no date or language restriction. Two authors independently applied eligibility criteria and assessed the risk of bias of included studies using the Cochrane risk-of-bias tool. Outcomes were lung hyperinflation measures detected through changes in inspiratory capacity (IC), functional residual capacity (FRC), total lung capacity (TLC), and residual volume (RV), as well as FEV1, FVC, dyspnea, and physical capacity. Pooled standardized mean differences (SMDs) or mean differences (MDs) and 95% CI were calculated using a random-effects model.

Results: Seven trials, all with a high risk of bias, were included. Compared to control group, RV significantly decreased (4 studies, n = 231; SMD -0.42 [95% CI -0.77 to -0.08], P = .02), dyspnea improved (n = 321, SMD -1.17 [95% CI -1.68 to -0.66], P < .001), and physical capacity increased (5 studies, n = 311; MD 30.1 [95% CI 19.2-41.0] m, P < .001) with PEP therapy. There was no significant difference between PEP therapy and the control group in TLC, FVC, or FEV1. Only one study reported changes in inspiratory capacity as well as FRC.

Conclusions: In patients with COPD, the effect of PEP therapy on lung hyperinflation is unclear owing to the non-consistent change in lung hyperinflation outcomes, insufficient data, and lack of high-quality trials. Dyspnea and physical capacity might improve with PEP therapy.

4.9 Technical Aspects of Devices and Equipment for Positive Expiratory Pressure With and Without Oscillation

AUTOR: IN / AUTHOR:

Fagevik Olsén, Monika, Olofsson, Peter, Frejd, Peter, Lannefors, Louise, Westerdahl, Elisabeth

QUELLE / SOURCE:

Respiratory Care, 2021/february, Vol. 66, No. 5, 862–877, DOI: https://doi.org/10.4187/respcare.08003

ABSTRAKT / ABSTRACT:

BACKGROUND: Breathing exercises with positive expiratory pressure (PEP) and oscillating PEP are common treatments for patients with respiratory impairments. There are several trials evaluating the clinical effects of a variety of commercially available and self-made devices. There is a lack of evaluation concerning technical aspects and construction of the devices. The aims of this review were to describe and compare technical aspects of devices and equipment used for PEP and oscillating PEP as a basis for clinical decisions regarding prescriptions.

METHODS: In this systematic review, we included trials evaluating different technical aspects of devices and equipment for PEP and oscillating PEP until June 2019. The literature search was performed in PubMed, CINAHL, Cochrane Library, Embase and PEDro.

RESULTS: The literature search resulted in 812 studies, which, after being read by 2 independent reviewers, were reduced to 21 trials that matched the inclusion criteria. The achieved PEP is dependent on the given resistance or achieved expiratory flow through the devices and their separate parts. Oscillation frequency in oscillating PEP devices affects the pressure and oscillation amplitude and flow. For some devices, the device's position also has an impact on the outcome. There are similarities and differences among all of the devices, and the equipment components are not interchangeable without changing the achieved PEP levels.

CONCLUSIONS: Many devices are available to provide PEP and oscillating PEP treatment. These devices differ substantially in design as well as in performance. When using PEP devices, it is important to understand how all parts of the devices affect outcomes. An increased understanding of how PEP is produced for the spontaneously breathing patient is important to achieve desired treatment effects.

4.10 Expiratory and Expiratory Plus Inspiratory Muscle Training Improves Respiratory Muscle Strength in Subjects With COPD: Systematic Review

AUTOR: IN / AUTHOR:

Neves, Leonardo F., Reis, Manoela H., Plentz, Rodrigo D. M., Matte, Darlan L., Coronel, Christian C., Sbruzzi, Graciele

QUELLE / SOURCE:

Respiratory Care, 2014/april, Vol. 59, No. 9, 1381–1388, DOI: https://doi.org/10.4187/respcare.02793

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) produces beneficial effects in COPD subjects, but the effects of expiratory muscle training (EMT) and EMT plus IMT in ventilatory training are still unclear. The aim of this study was to systematically review the effects of EMT and EMT plus IMT compared to control groups of COPD subjects.

Methods: This study is a systematic review and meta-analysis. The search strategy included MEDLINE, Embase, LILACS, PEDro, and Cochrane CENTRAL and also manual search of references in published studies on the subject. Randomized trials comparing EMT and EMT plus IMT versus control groups of subjects with COPD were included. The outcomes analyzed were respiratory muscle strength and functional capacity. Two reviewers independently extracted the data.

Results: The search retrieved 609 articles. Five studies were included. We observed that EMT provided higher gain in maximum expiratory pressure (P(E(max)) 21.49 cm H2O, 95% CI 13.39-29.59) and maximum inspiratory pressure (P(I(max)) 7.68 cm H2O, 95% CI 0.90-14.45) compared to control groups. There was no significant difference in the 6-min walk test distance (29.01 m, 95% CI -39.62 to 97.65) and dyspnea (0.15, 95% CI -0.77 to 1.08). In relation to EMT plus IMT, we observed that P(E(max)) (31.98 cm H2O, 95% CI 26.93-37.03) and P(I(max)) (27.98 cm H2O, 95% CI 20.10-35.85) presented higher values compared to control groups.

Conclusions: EMT and EMT plus IMT improve respiratory muscle strength and can be used as part of the treatment during pulmonary rehabilitation of subjects with severe to very severe COPD.

4.11 Effects of a simple prototype respiratory muscle trainer on respiratory muscle strength, quality of life and dyspnea, and oxidative stress in COPD patients: a preliminary study

AUTOR: IN / AUTHOR:

Leelarungrayub, Jirakrit, Pinkaew, Decha, Puntumetakul, Rungthip, Klaphajone, Jakkrit

QUELLE / SOURCE:

International Journal of Chronic Obstructive Pulmonary Disease, 2017/05, Vol. Volume 12, 1415–1425, DOI: https://doi.org/10.2147/copd.s131062

ABSTRAKT / ABSTRACT:

Background: The aim of this study was to evaluate the efficiency of a simple prototype device for training respiratory muscles in lung function, respiratory muscle strength, walking capacity, quality of life (QOL), dyspnea, and oxidative stress in patients with COPD.

Methods: Thirty COPD patients with moderate severity of the disease were randomized into three groups: control (n=10, 6 males and 4 females), standard training (n=10, 4 males and 6 females), and prototype device (n=10, 5 males and 5 females). Respiratory muscle strength (maximal inspiratory pressure [PImax] and maximal expiratory pressure [PEmax]), lung function (forced vital capacity [FVC], percentage of FVC, forced expiratory volume in 1 second [FEV1], percentage of FEV1 [FEV1%], and FEV1/FVC), 6-minute walking distance (6MWD), QOL, and oxidative stress markers (total antioxidant capacity [TAC]), glutathione (GSH), malondialdehyde (MDA), and nitric oxide (NO) were evaluated before and after 6 weeks of training. Moreover, dyspnea scores were assessed before; during week 2, 4, and 6 of training; and at rest after training.

Results: All parameters between the groups had no statistical difference before training, and no statistical change in the control group after week 6. FVC, FEV1/FVC, PImax, PEmax, QOL, MDA, and NO showed significant changes after 6 weeks of training with either the standard or prototype device, compared to pre-training. FEV1, FEV1%, 6MWD, TAC, and GSH data did not change statistically. Furthermore, the results of significant changes in all parameters were not statistically different between training groups using the standard and prototype device. The peak dyspnea scores increased significantly in week 4 and 6 when applying the standard or prototype device, and then lowered significantly at rest after 6 weeks of training, compared to pre-training.

Conclusion: This study proposes that a simple prototype device can be used clinically in COPD patients as a standard device to train respiratory muscles, improving lung function and QOL, as well as involving MDA and NO levels.

4.12 Effects of a new respiratory muscle training device in community-dwelling elderly men: an open-label, randomized, non-inferiority trial

AUTOR: IN / AUTHOR:

Kim, Sang Hun, Shin, Myung-Jun, Lee, Jang Mi, Huh, Sungchul, Shin, Yong Beom

QUELLE / SOURCE:

BMC Geriatrics, 2022/february, Vol. 22, No. 1, DOI: https://doi.org/10.1186/s12877-022-02828-8

ABSTRAKT / ABSTRACT:

BACKGROUND: Respiratory muscle training (RMT) has various clinical benefits in older adults; however, the low adherence to training remains a challenging issue. The present study aimed to confirm the efficacy of a new device that combines inspiratory muscle training and a positive expiratory pressure (IMT/PEP) compared to that of a Threshold IMT device (Philips Respironics Inc), and to determine whether home-based training differed from rehabilitation center training. METHODS: This four-arm, multicenter, parallel, non-inferiority trial randomized 80 active community-dwelling older men (mean age = 72.93 ± 5.02 years) to center-based groups (new IMT/PEP device or Threshold IMT device; 16 supervised sessions) or home-based groups (new IMT/PEP device or Threshold IMT device; 2 supervised sessions and individual sessions). Participants in all groups performed RMT twice a day for 8 weeks. Assessments were performed at baseline and post-training. The primary outcomes were maximum inspiratory pressure and maximal expiratory pressure. Secondary outcomes included forced vital capacity, forced expiratory volume in the first second, peak cough flow, diaphragm thickness, VO2 peak, the International Physical Activity Questionnaire score, electromyographic activities of the sternocleidomastoid muscle, and skeletal muscle mass and phase angle as measured by bioimpedance analysis. RESULTS: Among all groups, the maximal inspiratory pressure was improved post-training, while the maximal expiratory pressure showed improvement only in the IMT/PEP groups. The overall non-inferiority of the IMT/PEP device was thus validated. A statistically significant improvement in diaphragm thickness was found. However, no consistent improvement was shown in other secondary outcomes. No significant difference in training adherence rate between protocols was observed (mean adherence rate of 91-99%). CONCLUSION: Compared to the Threshold IMT, the new IMT/PEP device did not result in a significant difference in maximal inspiratory pressure but did improve maximal expiratory pressure in older men. The IMT/PEP device's improved usability, which is associated with exercise adherence, provided distinct advantages in this cohort. If proper education is first provided, home-based RMT alone may provide sufficient

effects in older individuals. TRIAL REGISTRATION: This trial was registered in the database cris.nih.go.kr (registration number KCT0003901) on 10/05/2019.

4.13 Efficacy and safety of long-term use of a positive expiratory pressure device in chronic obstructive pulmonary disease patients, a randomized controlled trial

AUTOR: IN / AUTHOR:

Xu, Zhaoning, Han, Zhuo, Ma, Dedong

QUELLE / SOURCE:

BMC Pulmonary Medicine, 2023/january, Vol. 23, No. 1, DOI: https://doi.org/10.1186/s12890-023-02319-5

ABSTRAKT / ABSTRACT:

BACKGROUND: Exercise intolerance is a common symptom in COPD, associated with lung dynamic hyperinflation (DH). Positive expiratory pressure (PEP) may reduce DH. This study evaluated the efficacy and safety of long-term use of a PEP device in COPD patients. METHODS: A randomized controlled trial was conducted with 25 COPD subjects randomized to PEP device or Sham-PEP device. The PEP device was used for 4 hours per day for 2 months. Measures like 6MWT, pulmonary function, and dyspnea were evaluated. RESULTS: The intervention group showed significant improvements in 6MWD, dyspnea, and fatigue. No adverse events were reported.

CONCLUSIONS: Regular daily use of PEP device improves exercise capacity and is safe. It can be added to pulmonary rehabilitation programs.

4.14 Oral Positive Expiratory Pressure Device for Excessive Dynamic Airway Collapse Caused by Emphysema

AUTOR: IN / AUTHOR:

Zafar, Muhammad Ahsan, Sengupta, Ruchira, Bates, Alister, Woods, Jason C., Radchenko, Christopher, McCormack, Francis X., Panos, Ralph J.

QUELLE / SOURCE:

Chest, 2021/october, Vol. 160, No. 4, e333–e337, DOI: https://doi.org/10.1016/j.chest.2021.04.059

ABSTRAKT / ABSTRACT:

Excessive dynamic airway collapse (EDAC) contributes to breathlessness and reduced quality of life in individuals with emphysema. We tested a novel, portable, oral positive expiratory pressure (o-PEP) device in a patient with emphysema and EDAC. MRI revealed expiratory tracheal narrowing to 80 mm2 that increased to 170 mm2 with the o-PEP device. After 2-weeks use of the o-PEP device for 33% to 66% of activities, breathlessness, quality of life, and exertional dyspnea improved compared with minimal clinically important differences (MCID): University of California-San Diego Shortness of Breath questionnaire score declined 69 to 42 (MCID, $\geq$5), St. George's Respiratory Questionnaire score decreased 71 to 27 (MCID, $\geq$4), and before and after the 6-minute walk test Borg score difference improved from Δ3 to Δ2 (MCID, $\geq$1). During the 6-minute walk test on room air without the use of the o-PEP device, oxyhemoglobin saturation declined 91% to 83%; whereas, with the o-PEP device, the nadir was 90%. Use of the o-PEP device reduced expiratory central airway collapse and improved dyspnea, quality of life, and exertional desaturation in a patient with EDAC and emphysema.

5 Studien zur „OIMT“ / *studies on „OIMT“*

5.1 High-Frequency Airway Oscillating Device for Respiratory Muscle Training in Subjects With COPD

AUTOR: IN / AUTHOR:

Daynes, Enya, Greening, Neil J., Harvey-Dunstan, Theresa C., Singh, Sally J.

QUELLE / SOURCE:

Respiratory Care, 2018/march, Vol. 63, No. 5, 584–590, DOI: https://doi.org/10.4187/respcare.05837

ABSTRAKT / ABSTRACT:

Background: COPD is characterized by expiratory flow limitation, which results in symptomatic dyspnea and reduced exercise capacity. Changes in breathing mechanics mean the respiratory muscles are unable to respond to the ventilatory demands, increasing the sensation of dyspnea. A high-frequency oscillating device has been developed to improve dyspnea in patients with COPD. We conducted a feasibility trial to gain insight into the potential for recruitment, retention, and study design for a future randomized controlled trial.

Methods: Symptomatic subjects with COPD were included on the basis of a Medical Research Council (MRC) score $\geq$ 3 and FEV1/FVC < 0.70). Patients were excluded if they received pulmonary rehabilitation within the last 6 months. The intervention employed the device for 8 weeks, 3 times daily. Clinical outcomes included the MRC score, maximal expiratory and inspiratory pressures (PEmax/PImax), the incremental shuttle walk test (ISWT), and the endurance shuttle walk test (ESWT).

Results: We successfully recruited 23 subjects with established COPD (65.2% male, mean age 65 ± 5.03 y, mean % predicted FEV1 43.9 ± 16, mean FEV1/FVC ratio 0.46 ± 0.13, and median [interquartile range] MRC 4 [3-5]). There was a significant change in MRC from 4 to 3 pre to post intervention (P = .003). There was a statistically significant difference in PEmaxP < .008 and PImaxP = .044. There were no significant differences observed in the ISWT or ESWT.

Conclusions: This study design appeared feasible to proceed to a clinical effectiveness trial. The use of the device for 8 weeks showed a significant improvement in PEmax, PImax, and reduced symptomatic dyspnea on the MRC dyspnea score. The results of this study should encourage a randomized controlled trial.

5.2 The immediate effects of breathing with oscillated inspiratory and expiratory airflows on secretion clearance in intubated patients with cervical spinal cord injury

AUTOR: IN / AUTHOR:

Kluayhomthong, Sujittra, Ubolsakka-Jones, Chulee, Domthong, Pornanan, Reechaipichitkul, Wipa, Jones, David A.

QUELLE / SOURCE:

Spinal Cord, 2018/november, Vol. 57, No. 4, 308–316, DOI: https://doi.org/10.1038/s41393-018-0220-x

ABSTRAKT / ABSTRACT:

Study design: A prospective, randomized crossover trial.

Objectives: To evaluate the efficacy of the combination of incentive spirometry with oscillation (OIS) and positive expiratory pressure with oscillation (OPEP) to promote secretion clearance in intubated patients with cervical spinal cord injury.

Setting: Spinal cord unit, tertiary care hospital, North East Thailand.

Methods: Thirteen intubated patients (C4-7, AIS score C) with secretion retention performed three interventions randomly allocated on consecutive days, a Sham deep breathing, OPEP and OPEP + OIS breathing exercise. Secretions were collected by sterile suction for 3 h before, and 3 h after, each intervention and wet weight recorded. Cardiopulmonary parameters were measured before and after each intervention.

Results: The median (IQR) secretion wet weight pre-intervention was 2.61 g (2.21, 3.85) and in the 3 h after Sham there was an increase of 1.97 g (0.6, 3.6). The increase after OPEP was 2.67 g (1.7, 3.9) and after OPEP + OIS, 4.28 g (2.4, 6.7); all the increases being significant ($p \leq 0.007$). The clearance after OPEP and OPEP + OIS were both greater than Sham while OPEP + OIS was greater than OPEP ($p \leq 0.019$). There were no significant changes in cardiopulmonary measures following any intervention or when compared between interventions.

Conclusions: Deep breathing with an oscillated and humidified air flow in a combination of OIS + OPEP more than doubled secretion clearance and was more effective than OPEP or Sham deep breathing. There were no adverse effects of the procedures which were well tolerated by the patients and may be used to complement existing methods for secretion clearance.

6.1 Studien zu IMT / *studies on IMT*

6.1.1 Time to Move Beyond a “One-Size Fits All” Approach to Inspiratory Muscle Training

AUTOR: IN / AUTHOR:

Shei, Ren-Jay, Paris, Hunter L., Sogard, Abigail S., Mickleborough, Timothy D.

QUELLE / SOURCE:

Frontiers in Physiology, 2022/january, Vol. 12, DOI: https://doi.org/10.3389/fphys.2021.766346

ABSTRAKT / ABSTRACT:

Inspiratory muscle training (IMT) has been studied as a rehabilitation tool and ergogenic aid in clinical, athletic, and healthy populations. This technique aims to improve respiratory muscle strength and endurance, which has been seen to enhance respiratory pressure generation, respiratory muscle weakness, exercise capacity, and quality of life. However, the effects of IMT have been discrepant between populations, with some studies showing improvements with IMT and others not. This may be due to the use of standardized IMT protocols which are uniformly applied to all study participants without considering individual characteristics and training needs. As such, we suggest that research on IMT veer away from a standardized, one-size-fits-all intervention, and instead utilize specific IMT training protocols. In particular, a more personalized approach to an individual's training prescription based upon goals, needs, and desired outcomes of the patient or athlete. In order for the coach or practitioner to adjust and personalize a given IMT prescription for an individual, factors, such as frequency, duration, and modality will be influenced, thus inevitably affecting overall training load and adaptations for a projected outcome. Therefore, by integrating specific methods based on optimization, periodization, and personalization, further studies may overcome previous discrepancies within IMT research.

6.1.2 A pilot study of respiratory muscle training to improve cough effectiveness and reduce the incidence of pneumonia in acute stroke: study protocol for a randomized controlled trial

AUTOR: IN / AUTHOR:

Kulnik, Stefan Tino, Rafferty, Gerrard Francis, Birring, Surinder S., Moxham, John, Kalra, Lalit

QUELLE / SOURCE:

Trials, 2014/april, Vol. 15, No. 1, DOI: https://doi.org/10.1186/1745-6215-15-123

ABSTRAKT / ABSTRACT:

Background After stroke, pneumonia is a relevant medical complication that can be precipitated by aspiration of saliva, liquids, or solid food. Swallowing difficulty and aspiration occur in a significant proportion of stroke survivors. Cough, an important mechanism protecting the lungs from inhaled materials, can be impaired in stroke survivors, and the likely cause for this impairment is central weakness of the respiratory musculature. Thus, respiratory muscle training in acute stroke may be useful in the recovery of respiratory muscle and cough function, and may thereby reduce the risk of pneumonia. The present study is a pilot study, aimed at investigating the validity and feasibility of this approach by exploring effect size, safety, and patient acceptability of the intervention.

Methods/design Adults with moderate to severe stroke impairment (National Institutes of Health Stroke Scale (NIHSS) score 5 to 25 at the time of admission) are recruited within 2 weeks of stroke onset. Participants must be able to perform voluntary respiratory maneuvers. Excluded are patients with increased intracranial pressure, uncontrolled hypertension, neuromuscular conditions other than stroke, medical history of asthma or chronic obstructive pulmonary disease, and recent cardiac events. Participants are randomized to receive inspiratory, expiratory, or sham respiratory training over a 4-week period, by using commercially available threshold resistance devices. Participants and caregivers, but not study investigators, are blind to treatment allocation. All participants receive medical care and stroke rehabilitation according to the usual standard of care. The following assessments are conducted at baseline, 4 weeks, and 12 weeks: Voluntary and reflex cough flow measurements, forced spirometry, respiratory muscle strength tests, incidence of pneumonia, assessments of safety parameters, and self-reported activity of daily living. The primary outcome is peak expiratory cough flow of voluntary cough, a parameter indicating the effectiveness of cough. Secondary outcomes are incidence of pneumonia, peak expiratory cough flow of reflex cough, and maximum inspiratory and expiratory mouth pressures.

Discussion Various novel pharmacologic and nonpharmacologic approaches for preventing stroke-associated pneumonia are currently being researched. This study investigates a novel strategy based on an exercise intervention for cough rehabilitation.

6.1.3 Aktivierung der Atemmuskulatur durch spezifisches Atemmuskeltraining - Quantifizierung durch EMG

AUTOR: IN / AUTHOR:

Pietsch, Fabian

QUELLE / SOURCE:

Inaugural-Dissertation zur Erlangung des Meidzinischen doktorgrades der Medizinischen Fakultät der albert-Ludwigs-Universität Freiburg im Breisgau, 2014

ABSTRAKT / ABSTRACT:

Ziel dieser Pilotstudie war es, die Atemmuskelaktivierung durch drei wissenschaftlich anerkannte Methoden des Atemmuskeltrainings miteinander zu vergleichen. Für das Inspiratory pressure threshold loading (IPTL) wurde der POWERbreathe® (PB), für das Inspiratory flow resistive loading (IFRL) der Respifit® im Ausdauermodus (RFa) und für die Voluntary isocapnic hyperpnea (VIH) der SpiroTiger® (ST) verwendet. Zum Vergleich dynamischer Atemmanöver (PB, ST, RFa) mit statischen Atemmanövern führte jeder Proband zusätzlich ein statisches Atemmanöver (80% des PImax) mit dem Atemmuskeltrainer Respifit® im Kraftmodus (RFk) durch. Bei 41 gesunden Probanden wurde die elektromyographische Aktivität des Zwerchfells (Dia), der parasternalen Intercostalmuskulatur (Para) und des M. sternocleidomastoideus (SCM) über Hautelektroden während des Trainings mit den Atemmuskeltrainern gemessen. Die Atemmuskeltrainer ST, RFa und RFk wurden gemäß Bedienungsanleitung verwendet, der PB wurde auf 80% PImax eingestellt. Die H0-Hypothese besagte, dass es keinen Unterschied in der Muskelaktivierung der verschiedenen Trainingsmethoden gebe. Es zeigte sich, dass ST und PB alle drei Muskeln stärker aktivierten als RFa. Das Zwerchfell wurde am stärksten durch den PB aktiviert, die Aktivierung durch den RFk unterschied sich in allen drei Muskeln nicht von jener durch den PB. Die Ho-Hypothese konnte somit verworfen werden. Beim Vergleich der Aktivierungsgrade von SCM, Para und Dia durch denselben Atemmuskeltrainer zeigte sich, dass ST und PB die Atemhilfsmuskulatur stärker aktivierten als das Zwerchfell. Sowohl bei RFa als auch bei RFk gab es keinen Unterschied in der Aktivierung von SCM, Para und Dia. In einem zusätzlichen Studienteil wurde bei 10 Probanden ein Vergleich von PB und RFa bei gleichen Munddrücken durchgeführt. Unter dieser Bedingung zeigten sich in allen Muskeln keine Unterschiede der beiden Atemmuskeltrainer bei Munddrücken von 20%, 40%, 60% und 80% des PImax. Es konnte gezeigt werden, dass sich bei gleichem Munddruck weder IPTL und IFRL noch IPTL und 80% PImax in ihrer Muskelaktivierung unterscheiden. Es konnte weder im Vergleich der Atemmuskeltrainer miteinander noch beim Vergleich der Aktivierungsgrade von SCM, Para und Dia durch denselben Atemmuskeltrainer eine spezifische Zwerchfellaktivierung einzelner Verfahren gefunden werden.

6.1.4 Aerobic and breathing exercises improve dyspnea, exercise capacity and quality of life in idiopathic pulmonary fibrosis patients: systematic review and meta-analysis

AUTOR: IN / AUTHOR:

Hanada, Masatoshi, Kasawara, Karina Tamy, Mathur, Sunita, Rozenberg, Dmitry, Kozu, Ryo, Hassan, S. Ahmed, Reid, W. Darlene

QUELLE / SOURCE:

Journal of Thoracic Disease, 2020/march, Vol. 12, No. 3, 1041–1055, DOI: https://doi.org/10.21037/jtd.2019.12.27

ABSTRAKT / ABSTRACT:

Background Idiopathic pulmonary fibrosis (IPF) is a progressive disease associated with significant dyspnea and limited exercise capacity. This systematic review aimed to synthesize evidence of exercise interventions during pulmonary rehabilitation that aim to improve exercise capacity, dyspnea, and health-related quality of life (HRQL) in IPF patients.

Methods Searches were performed in MEDLINE, Embase, CENTRAL, SPORTDiscus, PubMed and PEDro from inception to January 2019 using search terms for: (I) participants: 'IPF or interstitial lung disease'; (II) interventions: 'aerobic training or resistance training or respiratory muscle training'; and (III) outcomes: 'exercise capacity or dyspnea or health-related quality of life'. Two reviewers independently screened titles, abstracts and full texts to identify eligible studies. Methodological quality of studies was assessed using the Downs and Black checklist and meta-analyses were performed.

Results Of 1,677 articles identified, 14 were included (four randomized controlled trials and 10 prospective pre-post design studies) that examined 362 patients receiving training and 95 control subjects. Exercise capacity was measured with the 6-minute walk distance, peak oxygen consumption, peak work rate, or endurance time for constant work rate cycling, which increased after exercise [aerobic exercise; aerobic and breathing exercises; aerobic and inspiratory muscle training (IMT) exercises] compared to the control groups. Dyspnea scores improved after aerobic and breathing exercises. HRQL also improved after aerobic exercise training alone or combined with breathing exercises. Aerobic training alone or combined with IMT or breathing exercises improved exercise capacity.

Conclusions Breathing exercises appears to complement exercise training towards improved dyspnea and HRQL in patients with IPF.

6.1.5 Benefits of combining inspiratory muscle with 'whole muscle' training in children with cystic fibrosis: a randomised controlled trial

AUTOR: IN / AUTHOR:

Santana-Sosa, Elena, Gonzalez-Saiz, Laura, Groeneveld, Iris F., Villa-Asensi, José R., Barrio Gómez de Aguero, María I., Fleck, Steven J., López-Mojares, Luis M., Pérez, Margarita, Lucia, Alejandro

QUELLE / SOURCE:

British Journal of Sports Medicine, 2013/05, Vol. 48, No. 20, 1513–1517, DOI: https://doi.org/10.1136/bjsports-2012-091892

ABSTRAKT / ABSTRACT:

Background: The purpose of this study (randomised controlled trial) was to assess the effects of an 8-week combined 'whole muscle' (resistance+aerobic) and inspiratory muscle training (IMT) on lung volume, inspiratory muscle strength (PImax) and cardiorespiratory fitness (VO2 peak) (primary outcomes), and dynamic muscle strength, body composition and quality of life in paediatric outpatients with CF (cystic fibrosis, secondary outcomes). We also determined the effects of a detraining period.

Methods: Participants were randomly allocated with a block on gender to a control (standard therapy) or intervention group (initial n=10 (6 boys) in each group; age 10±1 and 11±1 years). The latter group performed a combined programme (IMT (2 sessions/day) and aerobic+strength exercises (3 days/week, in-hospital)) that was followed by a 4-week detraining period. All participants were evaluated at baseline, post-training and detraining.

Results: Adherence to the training programme averaged 97.5%±1.7%. There was a significant interaction (group×time) effect for PImax, VO2peak and five-repetition maximum strength (leg-press, bench-press, seated-row) (all ($p<0.001$), and also for %fat ($p<0.023$) and %fat-free mass ($p=0.001$), with training exerting a significant beneficial effect only in the intervention group, which was maintained after detraining for PImax and leg-press.

Conclusion: The relatively short-term (8-week) training programme used here induced significant benefits in important health phenotypes of paediatric patients with CF. IMT is an easily applicable intervention that could be included, together with supervised exercise training in the standard care of these patients.

6.1.6 Can inspiratory muscle training improve weaning outcomes in difficult to wean patients? A protocol for a randomised controlled trial (IMweanT study)

AUTOR: IN / AUTHOR:

Hoffman, Mariana, Van Hollebeke, Marine, Clerckx, Beatrix, Muller, Johannes, Louvaris, Zafeiris, Gosselink, Rik, Hermans, Greet, Langer, Daniel

QUELLE / SOURCE:

BMJ Open, 2018/june, Vol. 8, No. 6, e021091, DOI: https://doi.org/10.1136/bmjopen-2017-021091

ABSTRAKT / ABSTRACT:

Introduction: Respiratory muscle dysfunction has been associated with failure to wean from mechanical ventilation. It has therefore been hypothesised that these patients might benefit from inspiratory muscle training (IMT). Evidence, however, is thus far limited to data from small, single-centre studies with heterogeneity in inclusion criteria, training modalities and outcomes. The aim of this study is to evaluate the effects of a novel IMT method on weaning outcomes in selected patients with weaning difficulties.

Methods: This study is designed as a double-blind, parallel-group, randomised controlled superiority trial with 1:1 allocation ratio. Patients with weaning difficulties will be randomly allocated into either an IMT group (intervention) or a sham-IMT group (control). Ninety patients (45 in each group) will be needed to detect a 28% difference in the proportion of weaning success between groups (estimated difference in primary outcome based on previous studies) with a risk for type I error (α) of 5% and statistical power (1-β) of 80%. Patients will perform four sets of 6-10 breaths daily against an external load using a tapered flow resistive loading device (POWERbreathe KH2, HaB International, UK). Training intensity in the intervention group will be adjusted to the highest tolerable load. The control group will train against a low resistance that will not be modified during the training period. Training will be continued until patients are successfully weaned or for a maximum duration of 28 days. Pulmonary and respiratory muscle function, weaning duration, duration of mechanical ventilation, ventilator-free days and length of stay in the intensive care unit will be evaluated as secondary outcomes. $X2$ tests and analysis of covariance with adjustments for baseline values of respective outcomesas covariates will be used to compare results after the intervention period between groups.

Ethics and dissemination: Ethics approval was obtained from the local ethical committee (Ethische Commissie Onderzoek UZ/KU Leuven protocol ID: S60516). Results from this randomised controlled trial will be presented at scientific meetings as abstracts for poster or oral presentations and published in peerreviewed journals.

Trial status: Enrolment into the study have started in August 2017. Data collection and data analysis are expected to be completed in September 2021.

6.1.7 Daily inspiratory muscle training lowers blood pressure and vascular resistance in healthy men and women

AUTOR: IN / AUTHOR:

DeLucia, Claire M., De Asis, Roxanne M., Bailey, E. Fiona

QUELLE / SOURCE:

Experimental Physiology, 2018/january, Vol. 103, No. 2, 201–211, DOI: https://doi.org/10.1113/ep086641

ABSTRAKT / ABSTRACT:

New findings: What is the central question of this study? What impact does inspiratory muscle training have on systemic vascular resistance, cardiac output and baroreflex sensitivity in adult men and women? What is the main finding and its importance? Inspiratory muscle training exerts favorable effects on blood pressure, vascular resistance and perception of stress. This exercise format is well-tolerated and equally effective whether implemented in men or women.

Abstract: Previous work has shown that inspiratory muscle training (IMT) lowers blood pressure after a mere 6 weeks, identifying IMT as a potential therapeutic intervention to prevent or treat hypertension. Here, we explore the effects of IMT on respiratory muscle strength and select cardiovascular parameters in recreationally active men and women. Subjects were randomly assigned to IMT (n = 12, 75% maximal inspiratory pressure) or sham training (n = 13, 15% maximal inspiratory pressure) groups and underwent a 6-week intervention comprising 30 breaths day-1 , 5 days week-1 . Pre- and post-training measures included maximal inspiratory pressure and resting measures of blood pressure, cardiac output, heart rate, spontaneous cardiac baroreflex sensitivity and systemic vascular resistance. We evaluated psychological and sleep status via administration of the Cohen-Hoberman inventory of physical symptoms and the Epworth sleepiness scale. Male and female subjects in the IMT group showed declines in systolic/diastolic blood pressures (-4.3/-3.9 mmHg, $P < 0.025$) and systemic vascular resistance (-3.5 mmHg min l-1 , $P = 0.008$) at week 6. There was no effect of IMT on cardiac output ($P = 0.722$), heart rate ($P = 0.795$) or spontaneous cardiac baroreflex sensitivity ($P = 0.776$). The IMT subjects also reported fewer stress-related symptoms (pre- versus post-training, 12.5 ± 8.5 versus 7.2 ± 9.7, $P = 0.025$). Based on these results, we suggest that a short course of IMT confers significant respiratory and cardiovascular improvements and parallel (modest) psychological benefits in healthy men and women.

6.1.8 Daily respiratory training with large intrathoracic pressures, but not large lung volumes, lowers blood pressure in normotensive adults

AUTOR: IN / AUTHOR:

Vranish, Jennifer R., Bailey, E. Fiona

QUELLE / SOURCE:

Respiratory Physiology & Neurobiology, 2015/september, Vol. 216, 63–69, DOI: https://doi.org/10.1016/j.resp.2015.06.002

ABSTRAKT / ABSTRACT:

Inspiratory muscle training holds promise as a non-pharmacologic treatment that can improve respiratory muscle strength, reduce blood pressure, and improve autonomic balance in hypertensive patients. There is a gap in knowledge regarding the specific respiratory stimulus that gives rise to these favorable outcomes. We implemented five respiratory training protocols that differed in the magnitude and direction of the lung volumes and/or intrathoracic pressures generated by subjects in training. Normotensive adults were randomly assigned to each group and trained daily for 6 weeks. Pre-post and weekly measures of blood pressure showed significant declines in systolic [-8.96 mmHg (95% CI, 7.39-10.53)] and diastolic [-5.25 mmHg (95% CI, 3.67-6.83)] blood pressures for subjects who trained with large positive or negative intrathoracic pressures. Subjects who trained with modest intrathoracic pressures or large lung volumes saw no improvement in blood pressure ($P > 0.3$). Large intra-thoracic pressures are the specific respiratory stimulus underpinning breathing training related improvements in blood pressure.

6.1.9 Effect of Inspiratory Muscle Training Intensities on Pulmonary Function and Work Capacity in People Who Are Healthy: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

Enright, Stephanie J., Unnithan, Viswanath B.

QUELLE / SOURCE:

Physical Therapy, 2011/june, Vol. 91, No. 6, 894–905, DOI: https://doi.org/10.2522/ptj.20090413

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) has been shown to improve inspiratory muscle function, lung volumes (vital capacity [VC] and total lung capacity [TLC]), work capacity, and power output in people who are healthy; however, no data exist that demonstrate the effect of varying intensities of IMT to produce these outcomes.

Objectives: The purpose of this study was to evaluate the impact of IMT at varying intensities on inspiratory muscle function, VC, TLC, work capacity, and power output in people who are healthy.

Design: This was a randomized controlled trial.

Setting: The study was conducted in a clinical laboratory.

Participants: Forty people who were healthy (mean age=21.7 years) were randomly assigned to 4 groups of 10 individuals.

Interventions: Three of the groups completed an 8-week program of IMT set at 80%, 60%, and 40% of sustained maximum inspiratory effort. Training was performed 3 days per week, with 24 hours separating training sessions. A control group did not participate in any form of training.

Measurements: Baseline and posttraining measurements of body composition, VC, TLC, inspiratory muscle function (including maximum inspiratory pressure [MIP] and sustained maximum inspiratory pressure [SMIP]), work capacity (minutes of exercise), and power output were obtained.

Results: The participants in the 80%, 60%, and 40% training groups demonstrated significant increases in MIP and SMIP, whereas those in the 80% and 60% training groups had increased work capacity and power output. Only the 80% group improved their VC and TLC. The control group demonstrated no change in any outcome measures.

Limitations: This study may have been underpowered to demonstrate improved work capacity and power output in individuals who trained at 40% of sustained maximum inspiratory effort.

Conclusion: High-intensity IMT set at 80% of maximal effort resulted in increased MIP and SMIP, lung volumes, work capacity, and power output in individuals who were healthy, whereas IMT at 60% of maximal effort increased work capacity and power output only. Inspiratory muscle training intensities lower than 40% of maximal effort do not translate into quantitative functional outcomes.

6.1.10 Effectiveness of inspiratory muscle training on sleep and functional capacity to exercise in obstructive sleep apnea: a randomized controlled trial

AUTOR: IN / AUTHOR:

Souza, Adília Karoline Ferreira, Dornelas de Andrade, Armèle, de Medeiros, Ana Irene Carlos, de Aguiar, Maria Inês Remígio, Rocha, Taciano Dias de Souza, Pedrosa, Rodrigo Pinto, de Lima, Anna Myrna Jaguaribe

QUELLE / SOURCE:

Sleep and Breathing, 2017/november, Vol. 22, No. 3, 631–639, DOI: https://doi.org/10.1007/s11325-017-1591-5

ABSTRAKT / ABSTRACT:

Purpose: The aim of this study was to evaluate the effectiveness of inspiratory muscle training (IMT) on sleep and functional capacity to exercise in subjects with obstructive sleep apnea (OSA).

Methods: This is a controlled, randomized, double-blind study conducted in 16 OSA patients divided into two groups: training (IMT: n = 8) and placebo-IMT (P-IMT: n = 8). IMT was conducted during 12 weeks with a moderate load (50-60% of maximal inspiratory pressure-MIP), while P-IMT used a load < 20% of MPI. Total daily IMT time for both groups was 30 min, 7 days per week, twice a day.

Results: There was no difference comparing IMT to P-IMT group after training for lung function ($p > 0.05$) and respiratory muscle strength ($p > 0.05$). Maximal oxygen uptake (VO2Max) was not significantly different between IMT and P-IMT group (mean difference - 1.76, confidence interval (CI) - 7.93 to 4.41, $p = 0.71$). The same was observed for the other ventilatory and cardiometabolic variables measured ($p > 0.05$). A significant improvement in sleep quality was found when Pittsburgh Sleep Quality Index (PSQI) values of IMT and P-IMT group after training were compared (mean difference: 3.7, confidence interval 95% (CI95%) 0.6 to 6.9, $p = 0.02$) but no significant changes were seen in daytime sleepiness between both groups after the intervention (mean difference: 3.4, CI 95%: - 3.3 to 10.0; $p = 0.29$).

Conclusion: According to these results, 12 weeks of moderate load IMT resulted in improved sleep quality, but there were no significant repercussions on functional capacity to exercise or excessive daytime sleepiness.

6.1.11 Effects of inspiratory muscle training in COPD patients: A systematic review and meta-analysis

AUTOR: IN / AUTHOR:

Beaumont, Marc, Forget, Patrice, Couturaud, Francis, Reychler, Gregory

QUELLE / SOURCE:

The Clinical Respiratory Journal, 2018/05, Vol. 12, No. 7, 2178–2188, DOI: https://doi.org/10.1111/crj.12905

ABSTRAKT / ABSTRACT:

Objectives: In chronic obstructive pulmonary disease (COPD), quality of life and exercise capacity are altered in relationship to dyspnea. Benefits of inspiratory muscle training (IMT) on quality of life, dyspnea, and exercise capacity were demonstrated, but when it is associated to pulmonary rehabilitation (PR), its efficacy on dyspnea is not demonstrated. The aim of this systematic review with meta-analysis was to verify the effect of IMT using threshold devices in COPD patients on dyspnea, quality of life, exercise capacity, and inspiratory muscles strength, and the added effect on dyspnea of IMT associated with PR (vs. PR alone).

Study selection: This systematic review and meta-analysis was conducted on the databases from PubMed, Science direct, Cochrane library, Web of science, and Pascal. Following key words were used: inspiratory, respiratory, ventilatory, muscle, and training. The searching period extended to December 2017. Two reviewers independently assessed studies quality.

Results: Forty-three studies were included in the systematic review and thirty-seven studies in the meta-analysis. Overall treatment group consisted of six hundred forty two patients. Dyspnea (Baseline Dyspnea Index) is decreased after IMT. Quality of life (Saint George's Respiratory Questionnaire), exercise capacity (6 min walk test) and Maximal inspiratory pressure were increased after IMT. During PR, no added effect of IMT on dyspnea was found.

Conclusion: IMT using threshold devices improves inspiratory muscle strength, exercise capacity and quality of life, decreases dyspnea. However, there is no added effect of IMT on dyspnea during PR (compared with PR alone).

6.1.12 Effects of Inspiratory Muscle Training in Elderly Women on Respiratory Muscle Strength, Diaphragm Thickness and Mobility

AUTOR: IN / AUTHOR:

Souza, H., Rocha, T., Pessoa, M., Rattes, C., Brandao, D., Fregonezi, G., Campos, S., Aliverti, A., Dornelas, A.

QUELLE / SOURCE:

The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2014/november, Vol. 69, No. 12, 1545–1553, DOI: https://doi.org/10.1093/gerona/glu182

ABSTRAKT / ABSTRACT:

Background: Aging results in a decline in the function of the respiratory muscles. Inspiratory muscle training is emerging as a possible intervention to attenuate the decline of respiratory muscles in the elderly. The aim of this study was to evaluate the efficacy of inspiratory muscle training on respiratory strength, diaphragm thickness, and diaphragmatic mobility in elderly women.

Methods: This was a controlled, randomized, and double-blind clinical trial, performed on 22 elderly women distributed in two groups, training (TG) and control (CG). Over an 8-week period a moderate intensity inspiratory muscle training protocol was followed in the TG, while CG followed a sham protocol. In addition maximum expiratory and inspiratory pressure, mobility of the diaphragm and diaphragmatic thickness were evaluated by ultrasound.

Results: After training, in TG maximal inspiratory pressure, maximal expiratory pressure, diaphragm thickness, and mobility increased by 37%, 13%, 11%, and 9% respectively, and their values were significantly higher than CG ($p < .005$, $p = .013$, $p = .001$, and $p = .001$).

Conclusion: Inspiratory muscle training of moderate intensity improves respiratory muscle strength, diaphragm thickness, and diaphragm mobility in elderly women and it should be considered to minimize changes associated with senescence.

6.1.13 Effects of inspiratory muscle training on dynamic hyperinflation in patients with COPD

AUTOR: IN / AUTHOR:

Petrovic, Milos, Reiter, Wanke, Pohl, Zipko

QUELLE / SOURCE:

International Journal of Chronic Obstructive Pulmonary Disease, 2012/november, 797, DOI: https://doi.org/10.2147/copd.s23784

ABSTRAKT / ABSTRACT:

Dynamic hyperinflation has important clinical consequences in patients with chronic obstructive pulmonary disease (COPD). Given that most of these patients have respiratory and peripheral muscle weakness, dyspnea and functional exercise capacity may improve as a result of inspiratory muscle training (IMT). The aim of the study was to analyze the effects of IMT on exercise capacity, dyspnea, and inspiratory fraction (IF) during exercise in patients with COPD. Daily inspiratory muscle strength and endurance training was performed for 8 weeks in 10 patients with COPD GOLD II and III. Ten patients with COPD II and III served as a control group. Maximal inspiratory pressure (Pimax) and endurance time during resistive breathing maneuvers (tlim) served as parameter for inspiratory muscle capacity. Before and after training, the patients performed an incremental symptom limited exercise test to maximum and a constant load test on a cycle ergometer at 75% of the peak work rate obtained in the pretraining incremental test. ET was defined as the duration of loaded pedaling. Following IMT, there was a statistically significant increase in inspiratory muscle performance of the Pimax from 7.75 ± 0.47 to 9.15 ± 0.73 kPa ($P < 0.01$) and of tlim from 348 ± 54 to 467 ± 58 seconds ($P < 0.01$). A significant increase in IF, indicating decreased dynamic hyperinflation, was observed during both exercise tests. Further, the ratio of breathing frequency to minute ventilation ($bf/V'E$) decreased significantly, indicating an improved breathing pattern. A significant decrease in perception of dyspnea was also measured. Peak work rate during the incremental cycle ergometer test remained constant, while ET during the constant load test increased significantly from 597.1 ± 80.8 seconds at baseline to 733.6 ± 74.3 seconds ($P < 0.01$). No significant changes during either exercise tests were measured in the control group. The present study found that in patients with COPD, IMT results in improvement in performance, exercise capacity, sensation of dyspnea, and improvement in the IF prognostic factor.

6.1.14 Efficacy of a Novel Method for Inspiratory Muscle Training in People With Chronic Obstructive Pulmonary Disease

AUTOR: IN / AUTHOR:

Langer, Daniel, Charususin, Noppawan, Jácome, Cristina, Hoffman, Mariana, McConnell, Alison, Decramer, Marc, Gosselink, Rik

QUELLE / SOURCE:

Physical Therapy, 2015/september, Vol. 95, No. 9, 1264–1273, DOI: https://doi.org/10.2522/ptj.20140245

ABSTRAKT / ABSTRACT:

Background: Most inspiratory muscle training (IMT) interventions in patients with chronic obstructive pulmonary disease (COPD) have been implemented as fully supervised daily training for 30 minutes with controlled training loads using mechanical threshold loading (MTL) devices. Recently, an electronic tapered flow resistive loading (TFRL) device was introduced that has a different loading profile and stores training data during IMT sessions.

Objective: The aim of this study was to compare the efficacy of a brief, largely unsupervised IMT protocol conducted using either traditional MTL or TFRL on inspiratory muscle function in patients with COPD.

Design: Twenty patients with inspiratory muscle weakness who were clinically stable and participating in a pulmonary rehabilitation program were randomly allocated to perform 8 weeks of either MTL IMT or TFRL IMT.

Methods: Participants performed 2 daily home-based IMT sessions of 30 breaths (3-5 minutes per session) at the highest tolerable intensity, supported by twice-weekly supervised sessions. Adherence, progression of training intensity, increases in maximal inspiratory mouth pressure (Pimax), and endurance capacity of inspiratory muscles (Tlim) were evaluated.

Results: More than 90% of IMT sessions were completed in both groups. The TFRL group tolerated higher loads during the final 3 weeks of the IMT program, with similar effort scores on the 10-Item Borg Category Ratio (CR-10) Scale, and achieved larger improvements in Pimax and Tlim than the MTL group.

Limitations: A limitation of the study was the absence of a study arm involving a sham IMT intervention.

Conclusions: The short and largely home-based IMT protocol significantly improved inspiratory muscle function in both groups and is an alternative to traditional IMT protocols in this population. Participants in the

TFRL group tolerated higher training loads and achieved larger improvements in inspiratory muscle function than those in the MTL group.

6.1.15 Effects of Inspiratory Muscle Training in Older Adults

AUTOR: IN / AUTHOR:

Seixas, Mariana B., Almeida, Leonardo B., Trevizan, Patrícia F., Martinez, Daniel G., Laterza, Mateus C., Vanderlei, Luiz Carlos M., Silva, Lilian P.

QUELLE / SOURCE:

Respiratory Care, 2019/october, Vol. 65, No. 4, 535–544, DOI: https://doi.org/10.4187/respcare.06945

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) has been widely applied to different populations, including the general population of older adults. In addition to increasing inspiratory muscle strength, other benefits of IMT in the health of this population have been reported. The primary aim of this study was to review the effects of IMT on the general parameters of health (eg, respiratory, functional, physical, and other variables) in older adults (≥ 60 y), and the secondary aim was to analyze the main IMT protocol used in the studies.

Methods: We searched the MEDLINE, PEDro, SciELO, and LILACS databases to identify relevant randomized controlled clinical trials, and we assessed their methodological quality according to the PEDro scale. The Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) guidelines were used to guide the development of the protocol for this systematic review.

Results: The search yielded 7 studies involving 248 participants from 917 titles. The main outcomes investigated in response to IMT were related to the respiratory, functional, and physical variables. The results indicate that IMT promotes an increase of inspiratory muscle strength and diaphragmatic thickness in older adults. There was heterogeneity in the protocols described for this population with respect to the total training time (4-8 weeks), intensity (30-80% of the maximum inspiratory pressure), and weekly frequency (5 or 7 sessions).

Conclusions: The reviewed studies revealed a positive trend for the effectiveness of IMT in improving inspiratory muscle performance in elderly subjects. More randomized studies are needed to evaluate other outcomes (eg, functional capacity, exercise capacity, cardiac autonomic control, quality of life, and others) to provide robust evidence that this training modality can promote improvements in health parameters in this population. In addition, the usual IMT prescription in this population is based on sets and repetitions, of mild to moderate intensity, performed on most days of the week, for ≥ 4 weeks.

6.1.16 Effects of respiratory muscle training versus placebo on endurance exercise performance

AUTOR: IN / AUTHOR:

Sonetti, David A., Wetter, Thomas J., Pegelow, David F., Dempsey, Jerome A.

QUELLE / SOURCE:

Respiration Physiology, 2001/september, Vol. 127, No. 2–3, 185–199, DOI: https://doi.org/10.1016/s0034-5687(01)00250-x

ABSTRAKT / ABSTRACT:

We evaluated the effects of a 5 week (25 sessions); (30-35 min/day, 5 days/week), respiratory muscle training (RMT) program in nine competitive male cyclists. The experimental design included inspiratory resistance strength training (3-5 min/session) and hyperpnea endurance training (30 min/session), a placebo group which used a sham hypoxic trainer (n=8), and three exercise performance tests, including a highly reproducible 8 km time trial test. RMT intensity, measured once a week in terms of accumulated inspiratory pressure and the level of sustainable hyperpnea increased significantly after 5 weeks (+64% and +19%, respectively). The RMT group showed a significant 8% increase in maximal inspiratory pressure ($P<0.05$) while the placebo group showed only a 3.7% increase ($P>0.10$). RMT and placebo groups both showed significant increases in the fixed work-rate endurance test performance time (+26% and +16%, respectively) and in the peak work-rate achieved during the incremental maximal oxygen consumption (V(O2)max) test (+9 and +6%). The 8 km time trial performance increased 1.8+/-1.2% (or 15+/-10 sec; $P<0.01$) in the RMT group with 8 of 9 subjects increasing; the placebo group showed a variable non-significant change in 5 of 8 subjects (-0.3+/-2.7%, $P=0.07$). The changes observed in these three performance tests were not, however, significantly different between the RMT and placebo groups. Heart rate, ventilation, or venous blood lactate, at equal work-rates during the incremental exercise test or at equal times during the fixed work-rate endurance test were not changed significantly across these exercise trials in either group. We propose that the effect of RMT on exercise performance in highly trained cyclists does not exceed that in a placebo group. Significant placebo and test familiarization effects must be accounted for in experimental designs utilizing performance tests which are critically dependent on volitional effort.

6.1.17 Effects of Inspiratory Muscle Training by Using Breather Device in Participants with Chronic Obstructive Pulmonary Disease (COPD)

AUTOR: IN / AUTHOR:

Shaikh1, Dr. Sana, Vardhan2, Dr. G. D. Vishnu, andDr. Aashirwad Mahajan3, Dr. Sambhaji Gunjal3, Lamuvel, Dr. Maria

QUELLE / SOURCE:

International Journal of Health Sciences & Research, 2019/april, Vol. 9, No. 4, 68

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle weakness is a clinical feature in patients with COPD. Due to hyperinflation, the shortened diaphragms generate lower force during contraction, contributing to dyspnea and reduced exercise tolerance. Due to pathological changes the strength of inspiratory muscle is reduced which leads to early fatigue and reduce in functional capacity. Therefore, inspiratory muscle training in COPD patients is designed to enhance respiratory muscle function and to reduce the severity of breathlessness and improve exercise tolerance. Objective: To study the effect of the Breather device on inspiratory muscle strength and functional capacity by measuring Maximum Inspiratory Pressure (Pimax) and 6 Minute Walk Distance (6MWD). Methodology: Thirty participants both male and female diagnosed with COPD were included in the study and were divided into two groups. Baseline assessment was done using Pimax and 6MWD. Participants in group A performed inspiratory muscle training by using breather device and diaphragmatic breathing and group B performed diaphragmatic breathing exercise twice a day for 2 weeks. Reassessment was done and data was compared. Results: There was a highly significant (p=<0.0001) difference in Pimax between the pre (57.66±7.76cmH2o) and post (75.33±9.90cmH2o) intervention in group A with significant difference of 56±6.3cmH2o and 60±7.07cmH2o between the groups. Also there was significant (p=<0.0001) difference in 6MWD between the pre(273.66 ±25.07m) and post (273.66 ±25.07m) intervention in group A with the mean difference of 54.73m and 35.4m when compared between the two groups.
Conclusion: The use of breather device for inspiratory muscle training showed significant improvement in Pimax and 6MWD in participants with COPD.

6.1.18 Effects of a simple prototype respiratory muscle trainer on respiratory muscle strength, quality of life and dyspnea, and oxidative stress in COPD patients: a preliminary study

AUTOR: IN / AUTHOR:

Leelarungrayub, Jirakrit, Pinkaew, Decha, Puntumetakul, Rungthip, Klaphajone, Jakkrit

QUELLE / SOURCE:

International Journal of Chronic Obstructive Pulmonary Disease, 2017/05, Vol. Volume 12, 1415–1425, DOI: https://doi.org/10.2147/copd.s131062

ABSTRAKT / ABSTRACT:

Background: The aim of this study was to evaluate the efficiency of a simple prototype device for training respiratory muscles in lung function, respiratory muscle strength, walking capacity, quality of life (QOL), dyspnea, and oxidative stress in patients with COPD.

Methods: Thirty COPD patients with moderate severity of the disease were randomized into three groups: control (n=10, 6 males and 4 females), standard training (n=10, 4 males and 6 females), and prototype device (n=10, 5 males and 5 females). Respiratory muscle strength (maximal inspiratory pressure [PImax] and maximal expiratory pressure [PEmax]), lung function (forced vital capacity [FVC], percentage of FVC, forced expiratory volume in 1 second [FEV1], percentage of FEV1 [FEV1%], and FEV1/FVC), 6-minute walking distance (6MWD), QOL, and oxidative stress markers (total antioxidant capacity [TAC]), glutathione (GSH), malondialdehyde (MDA), and nitric oxide (NO) were evaluated before and after 6 weeks of training. Moreover, dyspnea scores were assessed before; during week 2, 4, and 6 of training; and at rest after training.

Results: All parameters between the groups had no statistical difference before training, and no statistical change in the control group after week 6. FVC, FEV1/FVC, PImax, PEmax, QOL, MDA, and NO showed significant changes after 6 weeks of training with either the standard or prototype device, compared to pre-training. FEV1, FEV1%, 6MWD, TAC, and GSH data did not change statistically. Furthermore, the results of significant changes in all parameters were not statistically different between training groups using the standard and prototype device. The peak dyspnea scores increased significantly in week 4 and 6 when applying the standard or prototype device, and then lowered significantly at rest after 6 weeks of training, compared to pre-training.

Conclusion: This study proposes that a simple prototype device can be used clinically in COPD patients as a standard device to train respiratory muscles, improving lung function and QOL, as well as involving MDA and NO levels.

6.1.19 High-intensity inspiratory muscle training in COPD

AUTOR: IN / AUTHOR:

Hill, K.

QUELLE / SOURCE:

European Respiratory Journal, 2006/june, Vol. 27, No. 6, 1119–1128, DOI:
https://doi.org/10.1183/09031936.06.00105205

ABSTRAKT / ABSTRACT:

The aim of the present study was to investigate the effects of an interval-based high-intensity inspiratory muscle training (H-IMT) programme on inspiratory muscle function, exercise capacity, dyspnoea and health-related quality of life (QoL) in subjects with chronic obstructive pulmonary disease. A double-blind randomised controlled trial was performed. Sixteen subjects (11 males, mean forced expiratory volume in one second (FEV(1)) 37.4+/-12.5%) underwent H-IMT performed at the highest tolerable inspiratory threshold load (increasing to 101% of baseline maximum inspiratory pressure). Seventeen subjects (11 males, mean FEV(1)36.5+/-11.5%) underwent sham inspiratory muscle training (S-IMT) at 10% of maximum inspiratory pressure. Training took place three times a week for 8 weeks and was fully supervised. Pre- and post-training measurements of lung function, maximum inspiratory pressure, maximum threshold pressure, exercise capacity, dyspnoea and QoL (Chronic Respiratory Disease Questionnaire; CRDQ) were obtained. H-IMT increased maximum inspiratory pressure by 29%, maximum threshold pressure by 56%, 6-min walk distance by 27 m, and improved dyspnoea and fatigue (CRDQ) by 1.4 and 0.9 points per item, respectively. These changes were significantly greater than any seen following S-IMT. In conclusion, high-intensity inspiratory muscle training improves inspiratory muscle function in subjects with moderate-to-severe chronic obstructive pulmonary disease, yielding meaningful reductions in dyspnoea and fatigue.

6.1.20 High-Intensity Inspiratory Muscle Training Improves Scalene and Sternocleidomastoid Muscle Oxygenation Parameters in Patients With Weaning Difficulties: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

Van Hollebeke, Marine, Poddighe, Diego, Clerckx, Beatrix, Muller, Jan, Hermans, Greet, Gosselink, Rik, Langer, Daniel, Louvaris, Zafeiris

QUELLE / SOURCE:

Frontiers in Physiology, 2022/february, Vol. 13, DOI: https://doi.org/10.3389/fphys.2022.786575

ABSTRAKT / ABSTRACT:

Background: Critically ill patients who have difficulties weaning from the mechanical ventilator are prone to develop respiratory muscle weakness. Inspiratory muscle training (IMT) can improve respiratory muscle strength. Whether IMT can improve scalene and sternocleidomastoid muscle oxygenation parameters is unknown.

Aim: To compare changes in muscle oxygenation parameters of scalene and sternocleidomastoid inspiratory muscles during a standardized task between patients with weaning difficulties who received either high-intensity IMT (intervention) or sham low-intensity IMT (control).

Method: Forty-one patients performed daily IMT sessions (4 sets, 6-10 breaths) until weaning success or for 28 consecutive days. The training load was progressively adjusted in the intervention group (n = 22) to the highest tolerable load, whilst the control group (n = 19) kept training at 10% of their baseline maximal inspiratory pressure (PImax). Breathing characteristics (i.e., work and power of breathing, PoB), respiratory muscle function [i.e., PImax and forced vital capacity (FVC)] were measured during a standardized loaded breathing task against a load of 30% of baseline PImax before and after the IMT period. In addition, during the same loaded breathing task, absolute mean and nadir changes from baseline in local scalene and sternocleidomastoid muscle oxygen saturation index (Δ%StiO2) (an index of oxygen extraction) and nadir Δ%StiO2 normalized for the PoB were measured by near-infrared spectroscopy.

Results: At post measures, only the intervention group improved mean PoB compared to pre measures (Pre: 0.42 ± 0.33 watts, Post: 0.63 ± 0.51watts, p-value < 0.01). At post measures, both groups significantly improved nadir scalene muscles StiO2% normalized for the mean PoB (ΔStiO nadir %/watt) compared to pre measurements and the improvement was not significant different between groups (p-value = 0.40). However, at post measures, nadir sternocleidomastoid muscle StiO2% normalized for the mean PoB (ΔStiO nadir

%/watt) was significantly greater improved in the intervention group (mean difference: +18.4, 95%CI: -1.4; 38.1) compared to the control group (mean difference: +3.7, 95%CI: -18.7; 26.0, between group p-value < 0.01). Both groups significantly improved PImax (Intervention: +15 ± 13 cmH2O p-value < 0.01, Control: +13 ± 15 cmH2O p-value < 0.01). FVC only significantly improved in the intervention group (+0.33 ± 0.31 L p < 0.01) report also change in control group.

Conclusion: This exploratory study suggests that high-intensity IMT induces greater improvements in scalene and sternocleidomastoid muscle oxygenation parameters attributed for oxygen delivery, utilization and oxygen saturation index compared to low-intensity IMT in patients with weaning difficulties.

6.1.21 Inspiratory muscle training in children and adolescents living with neuromuscular diseases: A pre-experimental study

AUTOR: IN / AUTHOR:

Human, Anri, Morrow, Brenda M.

QUELLE / SOURCE:

South African Journal of Physiotherapy, 2021/august, Vol. 77, No. 1, DOI: https://doi.org/10.4102/sajp.v77i1.1577

ABSTRAKT / ABSTRACT:

Background: Children with neuromuscular diseases (NMD) are at risk of morbidity and mortality because of progressive respiratory muscle weakness and ineffective cough. Inspiratory muscle training (IMT) aims to preserve or improve respiratory muscle strength, thereby reducing morbidity and improving health-related quality of life (HRQoL).

Objectives: To describe the safety and feasibility of a 6-week IMT programme using an electronic threshold device (Powerbreathe®). Any adverse events and changes in functional ability, spirometry, peak expiratory cough flow (PECF), inspiratory muscle strength and HRQoL (Pediatric Quality of Life [PedsQL]) were recorded.

Methods: A convenience sample of eight participants (n = 4 boys; median [interquartile range IQR] age: 12.21 [9.63-16.05] years) with various NMD were included in a pre-experimental, observational pre-test post-test feasibility study. Training consisted of 30 breaths, twice daily, 5 days a week, for 6 weeks.

Results: There were significant pre- to post-intervention improvements in upper limb function and coordination ($p = 0.03$) and inspiratory muscle strength: maximum inspiratory mouth pressure (Pimax) ($p = 0.01$); strength-index ($p = 0.02$); peak inspiratory flow (PIF) ($p = 0.02$), with no evidence of change in spirometry, PECF or HRQoL. No adverse events occurred and participant satisfaction and adherence levels were high.

Conclusion: Inspiratory muscle training (at an intensity of 30% Pimax) appears safe, feasible and acceptable, in a small sample of children and adolescents with NMD and was associated with improved inspiratory muscle strength, PIF and upper limb function and coordination.

Clinical implications: Larger, longer-term randomised controlled trials are warranted to confirm the safety and efficacy of IMT as an adjunct respiratory management strategy in children with NMD.

6.1.22 Inspiratory muscle strength training improves weaning outcome in failure to wean patients: a randomized trial

AUTOR: IN / AUTHOR:

Martin, A. Daniel, Smith, Barbara K., Davenport, Paul D., Harman, Eloise, Gonzalez-Rothi, Ricardo J., Baz, Maher, Layon, A. Joseph, Banner, Michael J., Caruso, Lawrence J., Deoghare, Harsha, Huang, Tseng-Tien, Gabrielli, Andrea

QUELLE / SOURCE:

Critical Care, 2011/march, Vol. 15, No. 2, DOI: https://doi.org/10.1186/cc10081

ABSTRAKT / ABSTRACT:

Introduction Most patients are readily liberated from mechanical ventilation (MV) support, however, 10% - 15% of patients experience failure to wean (FTW). FTW patients account for approximately 40% of all MV days and have significantly worse clinical outcomes. MV induced inspiratory muscle weakness has been implicated as a contributor to FTW and recent work has documented inspiratory muscle weakness in humans supported with MV.

Methods We conducted a single center, single-blind, randomized controlled trial to test whether inspiratory muscle strength training (IMST) would improve weaning outcome in FTW patients. Of 129 patients evaluated for participation, 69 were enrolled and studied. 35 subjects were randomly assigned to the IMST condition and 34 to the SHAM treatment. IMST was performed with a threshold inspiratory device, set at the highest pressure tolerated and progressed daily. SHAM training provided a constant, low inspiratory pressure load. Subjects completed 4 sets of 6-10 training breaths, 5 days per week. Subjects also performed progressively longer breathing trials daily per protocol. The weaning criterion was 72 consecutive hours without MV support. Subjects were blinded to group assignment, and were treated until weaned or 28 days.

Results Groups were comparable on demographic and clinical variables at baseline. The IMST and SHAM groups respectively received 41.9 ± 25.5 vs. 47.3 ± 33.0 days of MV support prior to starting intervention, P = 0.36. The IMST and SHAM groups participated in 9.7 ± 4.0 and 11.0 ± 4.8 training sessions, respectively, P = 0.09. The SHAM group's pre to post-training maximal inspiratory pressure (MIP) change was not significant (-43.5 ± 17.8 vs. -45.1 ± 19.5 cm H2O, P = 0.39), while the IMST group's MIP increased (-44.4 ± 18.4 vs. -54.1 ± 17.8 cm H2O, P < 0.0001). There were no adverse events observed during IMST or SHAM treatments. Twenty-five of 35 IMST subjects weaned (71%, 95% confidence interval (CI) = 55% to 84%), while 16 of 34 (47%, 95%

CI = 31% to 63%) SHAM subjects weaned, P = .039. The number of patients needed to be treated for effect was 4 (95% CI = 2 to 80).

Conclusions An IMST program can lead to increased MIP and improved weaning outcome in FTW patients compared to SHAM treatment.

6.1.23 Inspiratory muscle training in obstructive lung disease

AUTOR: IN / AUTHOR:

McConnell, A. K., Romer, L. M., Weiner, P.

QUELLE / SOURCE:

Breathe, 2005/september, Vol. 2, No. 1, 38–49, DOI: https://doi.org/10.1183/18106838.0201.38

ABSTRAKT / ABSTRACT:

Key points

Dyspnoea is influenced by inspiratory muscle strength and the load placed upon the inspiratory muscles.

Dynamic hyperinflation is a major cause of dyspnoea and exercise intolerance in patients with expiratory flow limitation due to its detrimental effect upon inspiratory muscle loading.

Specific IMT improves inspiratory muscle strength, reduces dyspnoea and improves exercise tolerance, even in individuals without inspiratory muscle weakness or hyperinflation.

Pressure threshold IMT is the most reliable, convenient and commonly used method of IMT, eliciting improvements in a wide range of muscle functional characteristics, including strength, shortening velocity, power and endurance.

Inspiratory muscles adhere to the same training principles as other skeletal muscles, with respect to overload, specificity and reversibility.

Training loads must exceed 30% of inspiratory muscle strength, with at least once daily training and weekly increases in training load. Programmes should be least 6 weeks in duration, after which frequency can be reduced to two sessions, three times per week.

IMT can be implemented as a stand-alone intervention or as part of a comprehensive programme of rehabilitation.

Monitored outcomes should include inspiratory muscle strength, an index of dyspnoea (e.g. BDI/TDI and/or Borg CR-10) and exercise tolerance (e.g. 6MWD).

Educational aims

To provide an overview of the role of respiratory muscle function in the genesis of dyspnoea.

To describe the response of inspiratory muscles to different types of training stimuli.

To offer guidance on the implementation and monitoring of IMT.

Summary Dyspnoea is strongly influenced by respiratory muscle function. Patients with obstructive lung disease become hyperinflated and experience an associated functional deficit in inspiratory muscle function,

as well as a concomitant increase in the work of breathing. These changes result in a heightened sense of respiratory effort and a propensity for inspiratory muscle fatigue. There is now convincing evidence that specific inspiratory muscle training (IMT) improves respiratory muscle function, reduces dyspnoea and improves exercise tolerance. This review will describe the two most commonly implemented methods of IMT, and the specific functional adaptations that are elicited by each. It will also describe successful, evidence-based implementation and monitoring of the most commonly used method of IMT.

6.1.24 Inspiratory Muscle Training Affects Proprioceptive Use and Low Back Pain

AUTOR: IN / AUTHOR:

JANSSENS, L. O. T. T. E., MCCONNELL, A.L.I.S.O.N. K., PIJNENBURG, M. A. D. E. L. O. N., CLAEYS, K. U. R. T., GOOSSENS, N. I. N. A., LYSENS, R. O. E. L. A. N. D., TROOSTERS, T. H. I. E. R. R. Y., BRUMAGNE, S. I. M. O. N.

QUELLE / SOURCE:

Medicine & Science in Sports & Exercise, 2015/january, Vol. 47, No. 1, 12–19, DOI: https://doi.org/10.1249/mss.0000000000000385

ABSTRAKT / ABSTRACT:

Purpose: We have shown that individuals with recurrent nonspecific low back pain (LBP) and healthy individuals breathing against an inspiratory load decrease their reliance on back proprioceptive signals in upright standing. Because individuals with LBP show greater susceptibility to diaphragm fatigue, it is reasonable to hypothesize that LBP, diaphragm dysfunction, and proprioceptive use may be interrelated. The purpose of this study was to investigate whether inspiratory muscle training (IMT) affects proprioceptive use during postural control in individuals with LBP.

Methods: Twenty-eight individuals with LBP were assigned randomly into a high-intensity IMT group (high IMT) and low-intensity IMT group (low IMT). The use of proprioception in upright standing was evaluated by measuring center of pressure displacement during local muscle vibration (ankle, back, and ankle-back). Secondary outcomes were inspiratory muscle strength, severity of LBP, and disability.

Results: After high IMT, individuals showed smaller responses to ankle muscle vibration, larger responses to back muscle vibration, higher inspiratory muscle strength, and reduced LBP severity ($P < 0.05$). These changes were not seen after low IMT ($P > 0.05$). No changes in disability were observed in either group ($P > 0.05$).

Conclusions: After 8 wk of high IMT, individuals with LBP showed an increased reliance on back proprioceptive signals during postural control and improved inspiratory muscle strength and severity of LBP, not seen after low IMT. Hence, IMT may facilitate the proprioceptive involvement of the trunk in postural control in individuals with LBP and thus might be a useful rehabilitation tool for these patients.

6.1.25 Inspiratory muscle training does not improve clinical outcomes in 3-week COPD rehabilitation: results from a randomised controlled trial

AUTOR: IN / AUTHOR:

Schultz, Konrad, Jelusic, Danijel, Wittmann, Michael, Krämer, Benjamin, Huber, Veronika, Fuchs, Sebastian, Lehbert, Nicola, Wingart, Silke, Stojanovic, Dragan, Göhl, Oliver, Alma, Harma J., de Jong, Corina, van der Molen, Thys, Faller, Hermann, Schuler, Michael

QUELLE / SOURCE:

European Respiratory Journal, 2018/january, Vol. 51, No. 1, 1702000, DOI: https://doi.org/10.1183/13993003.02000-2017

ABSTRAKT / ABSTRACT:

The value of inspiratory muscle training (IMT) in pulmonary rehabilitation in chronic obstructive pulmonary disease (COPD) is unclear. The RIMTCORE (Routine Inspiratory Muscle Training within COPD Rehabilitation) randomised controlled trial examined the effectiveness of IMT added to pulmonary rehabilitation.In total, 611 COPD patients (Global Initiative for Chronic Obstructive Lung Disease stage II-IV) received a 3-week inpatient pulmonary rehabilitation, of which 602 patients were included in the intention-to-treat analyses. The intervention group (n=300) received highly intensive IMT and the control group (n=302) received sham IMT. The primary outcome was maximal inspiratory pressure (PImax). The secondary outcomes were 6-min walk distance, dyspnoea, quality of life and lung function. Outcomes were assessed pre- and post-pulmonary rehabilitation. ANCOVA was used.The intervention group showed higher effects in PImax ($p<0.001$) and forced inspiratory volume in 1 s ($p=0.013$). All other outcomes in both study groups improved significantly, but without further between-group differences. Sex and pulmonary rehabilitation admission shortly after hospitalisation modified quality of life effects. IMT as an add-on to a 3-week pulmonary rehabilitation improves inspiratory muscle strength, but does not provide additional benefits in terms of exercise capacity, quality of life or dyspnoea. A general recommendation for COPD patients to add IMT to a 3-week pulmonary rehabilitation cannot be made.

6.1.26 Inspiratory muscle training facilitates weaning from mechanical ventilation among patients in the intensive care unit: a systematic review

AUTOR: IN / AUTHOR:

Elkins, Mark, Dentice, Ruth

QUELLE / SOURCE:

Journal of Physiotherapy, 2015/july, Vol. 61, No. 3, 125–134, DOI: https://doi.org/10.1016/j.jphys.2015.05.016

ABSTRAKT / ABSTRACT:

Question: Does inspiratory muscle training improve inspiratory muscle strength in adults receiving mechanical ventilation? Does it improve the duration or success of weaning? Does it affect length of stay, reintubation, tracheostomy, survival, or the need for post-extubation non-invasive ventilation? Is it tolerable and does it cause adverse events?

Design: Systematic review of randomised trials.

Participants: Adults receiving mechanical ventilation.

Intervention: Inspiratory muscle training versus sham or no inspiratory muscle training.

Outcome measures: Data were extracted regarding: inspiratory muscle strength and endurance; the rapid shallow breathing index; weaning success and duration; duration of mechanical ventilation; reintubation; tracheostomy; length of stay; use of non-invasive ventilation after extubation; survival; readmission; tolerability and adverse events.

Results: Ten studies involving 394 participants were included. Heterogeneity within some meta-analyses was high. Random-effects meta-analyses showed that the training significantly improved maximal inspiratory pressure (MD 7 cmH2O, 95% CI 5 to 9), the rapid shallow breathing index (MD 15 breaths/min/l, 95% CI 8 to 23) and weaning success (RR 1.34, 95% CI 1.02 to 1.76). Although only assessed in individual studies, significant benefits were also reported for the time spent on non-invasive ventilation after weaning (MD 16 hours, 95% CI 13 to 18), length of stay in the intensive care unit (MD 4.5 days, 95% CI 3.6 to 5.4) and length of stay in hospital (MD 4.4 days, 95% CI 3.4 to 5.5). Weaning duration decreased in the subgroup of patients with known weaning difficulty. The other outcomes weren't significantly affected or weren't measured.

Conclusion: Inspiratory muscle training for selected patients in the intensive care unit facilitates weaning, with potential reductions in length of stay and the duration of non-invasive ventilatory support after extubation. The heterogeneity among the results suggests that the effects of inspiratory muscle training may vary; this perhaps depends on factors such as the components of usual care or the patient's characteristics.

6.1.27 Inspiratory Muscle Training Improves Sleep and Mitigates Cardiovascular Dysfunction in Obstructive Sleep Apnea

AUTOR: IN / AUTHOR:

Vranish, Jennifer R., Bailey, E. Fiona

QUELLE / SOURCE:

Sleep, 2016/june, Vol. 39, No. 6, 1179–1185, DOI: https://doi.org/10.5665/sleep.5826

ABSTRAKT / ABSTRACT:

Study objectives: New and effective strategies are needed to manage the autonomic and cardiovascular sequelae of obstructive sleep apnea (OSA). We assessed the effect of daily inspiratory muscle strength training (IMT) on sleep and cardiovascular function in adults unable to use continuous positive airway pressure (CPAP) therapy.

Methods: This is a placebo-controlled, single-blind study conducted in twenty four adults with mild, moderate, and severe OSA. Subjects were randomly assigned to placebo or inspiratory muscle strength training. Subjects in each group performed 5 min of training each day for 6 w. All subjects underwent overnight polysomnography at intake and again at study close.

Results: We evaluated the effects of placebo training or IMT on sleep, blood pressure, and plasma catecholamines. Relative to placebo-trained subjects with OSA, subjects with OSA who performed IMT manifested reductions in systolic and diastolic blood pressures (-12.3 ± 1.6 SBP and -5.0 ± 1.3 DBP mmHg; $P < 0.01$); plasma norepinephrine levels (536.3 ± 56.6 versus 380.6 ± 41.2 pg/mL; $P = 0.01$); and registered fewer nighttime arousals and reported improved sleep (Pittsburgh Sleep Quality Index scores: 9.1 ± 0.9 versus 5.1 ± 0.7; $P = 0.001$). These favorable outcomes were achieved without affecting apneahypopnea index.

Conclusions: The results are consistent with our previously published findings in normotensive adults but further indicate that IMT can modulate blood pressure and plasma catecholamines in subjects with ongoing nighttime apnea and hypoxemia. Accordingly, we suggest IMT offers a low cost, nonpharmacologic means of improving sleep and blood pressure in patients who are intolerant of CPAP.

6.1.28 Inspiratory muscle training in addition to physical exercise for idiopathic pulmonary fibrosis

AUTOR: IN / AUTHOR:

Nykvist, Maria, Sköld, Magnus, Ferrara, Giovanni, Faager, Gun

QUELLE / SOURCE:

2016/september, OA1518, DOI: https://doi.org/10.1183/13993003.congress-2016.oa1518

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) has beneficial effects on dyspnoea, physical function and health related quality of life (HRQL) in patients with COPD but has not yet been evaluated in idiopathic pulmonary fibrosis (IPF). The aim of the study was to compare IMT and physical exercise (PE) with PE alone in patients with IPF.

Method: In a randomised controlled study, patients with IPF were randomised to IMT(n=14) or sham IMT(n=10) during an 8-week exercise programme. Exercise capacity was assessed with six minute walking test (6 MWT), respiratory muscle strength (PI,max, PE,max), dyspnea by modified Medical Council Scale and quality of life with Chronic respiratory disease questionnaire (CRQ-SAS) including the dimension of dyspnoea, at baseline and after 8 weeks PE. In addition, lung function test was measured.

Results: Patients performing IMT and PE had a significant reduction in the dimension dyspnoea of CRQ-SAS($p \leq 0.05$) compared to controls. The IMT-group improved their walking distance from 466(±66) to 513(±102) m ($p \leq 0.05$), PI,max, from 90(±24) to 112(±29) cmH2O ($p \leq 0.001$), PE,max, from 109(±27) to 121(±37) cmH2O ($p \leq 0.05$). Fatigue ($p \leq 0.05$) and total score ($p \leq 0.05$) of CRQ-SAS was also improved. The IMT sham group improved significantly PI,max($p \leq 0.05$) after eight weeks.

Conclusion: Inspiratory muscle training in combination with exercise in patients with IPF showed a significant improvement in dyspnoea compared with sham IMT and exercise. The study also showed a positive trend in favour of IMT in addition to exercise compared to exercise alone in exercise capacity, fatigue and HRQL in patients with IPF. IMT may therefore be a valuable addition to PE in patients with IPF.

6.1.29 Inspiratory Muscle Training in Obstructive Sleep Apnea Associating Diabetic Peripheral Neuropathy: A Randomized Control Study

AUTOR: IN / AUTHOR:

Moawd, Samah A., Azab, Alshimaa R., Alrawaili, Saud M., Abdelbasset, Walid Kamal

QUELLE / SOURCE:

BioMed Research International, 2020/june, Vol. 2020, 1–8, DOI: https://doi.org/10.1155/2020/5036585

ABSTRAKT / ABSTRACT:

Objective This work is aimed at assessing the effects of inspiratory muscle training on lung functions, inspiratory muscle strength, and aerobic capacity in diabetic peripheral neuropathy (DPN) patients with obstructive sleep apnea (OSA).

Methods A randomized control study was performed on 55 patients diagnosed with DPN and OSA. They were assigned to the training group (IMT, n = 28) and placebo training group (P-IMT, n = 27). Inspiratory muscle strength, lung functions, and aerobic capacity were evaluated before and after 12 weeks postintervention. An electronic inspiratory muscle trainer was conducted, 30 min a session, three times a week for 12 consecutive weeks.

Results From seventy-four patients, 55 have completed the study program. A significant improvement was observed in inspiratory muscle strength ($p < 0.05$) in the IMT group while no changes were observed in the P-IMT group ($p > 0.05$). No changes were observed in the lung function in the two groups ($p > 0.05$). Also, VO2max and VCO2max changed significantly after training in the IMT group ($p < 0.05$) while no changes were observed in the P-IMT group ($p > 0.05$). Other cardiopulmonary exercise tests did not show any significant change in both groups ($p > 0.05$).

Conclusions Based on the outcomes of the study, it was found that inspiratory muscle training improves inspiratory muscle strength and aerobic capacity without a notable effect on lung functions for diabetic patients suffering from DPN and OSA.

6.1.30 Inspiratory muscle training in pulmonary rehabilitation program in COPD patients

AUTOR: IN / AUTHOR:

Magadle, Rasmi, McConnell, Alison K., Beckerman, Marinella, Weiner, Paltiel

QUELLE / SOURCE:

Respiratory Medicine, 2007/july, Vol. 101, No. 7, 1500–1505, DOI: https://doi.org/10.1016/j.rmed.2007.01.010

ABSTRAKT / ABSTRACT:

Most pulmonary rehabilitation (PR) programs do not currently incorporate IMT in their PR programs for COPD patients. The aim of the present study was to assess the influence of adding IMT to the patients already involved in a rehabilitation program. Thirty-four patients with significant COPD were recruited for the study. All patients participated in a general exercise reconditioning (GER) program for 12 weeks. The patients were then randomized to receive IMT or sham IMT, in addition to GER for the next 6 months. Following three months of GER training there was a significant increase in the 6-min walk test (6MWT) (from mean+/-SEM 254+/-38 to 322+/-42 m, $p<0.01$), and small but non-significant decreases in the perception of dyspnea (POD), and in the St. George Respiratory Questionnaire score (SGRQ). Following the addition of IMT to the GER program there was a significant increase in the PI(max) in the GER+IMT group (from 66+/-4.7 to 78+/-4.5 cm H(2)O, $p<0.01$). This was accompanied by a significant improvement in the POD and a further significant improvement in the SGRQ score. IMT provides additional benefits to patients undergoing PR program and is worthwhile even in patients who have already undergone a GER program.

6.1.31 Inspiratory Muscle Training May Increase Peak Inspiratory Flow in Chronic Obstructive Pulmonary Disease

AUTOR: IN / AUTHOR:

Weiner, Paltiel, Weiner, Margalit

QUELLE / SOURCE:

Respiration, 2006, Vol. 73, No. 2, 151–156, DOI: https://doi.org/10.1159/000088095

ABSTRAKT / ABSTRACT:

Background: When choosing a specific inhalation device for a chronic obstructive pulmonary disease (COPD) patient, the internal airflow resistance and the ability of the patient to overcome it and to create an optimal inspiratory flow are essential.

Objectives: The purpose of the present study was to investigate: (1) the peak inspiratory flow (PIF) that a patient with COPD can generate while breathing through two dry powder inhalers and (2) whether in patients with low PIF specific inspiratory muscle training (SIMT) will increase the PIF and exceed the minimal PIF that is considered necessary to guarantee optimal lung deposition of the drug.

Methods: Inspiratory muscle strength and PIFs were measured in 60 patients with COPD. Then 28 patients with severe COPD and low PIF were randomized to receive SIMT or to a control group.

Results: With the Turbuhaler, 12 patients (20%) could not generate the optimal flow of 60 l/min. PIF correlated very well with maximal inspiratory mouth pressure (PI(max)) for the Diskus and the Turbuhaler, as well as for both males and females ($p < 0.001$). Following the training period, there was a statistically significant increase in the PI(max) in the training group. This increase was associated with a significant increase in the PIF. All patients overcame the minimal threshold PIF following the training.

Conclusions: Some patients with severe COPD are not able to generate adequate flow to secure optimal lung deposition of the inhalation with the Turbuhaler. SIMT improves inspiratory muscle strength as well as PIF. Following 8 weeks of training, the optimal PIF enabling adequate lung deposition of the drug was attained in all the trained patients.

6.1.32 Inspiratory muscle training reduces blood pressure and sympathetic activity in hypertensive patients: A randomized controlled trial

AUTOR: IN / AUTHOR:

Ferreira, Janaína Barcellos, Plentz, Rodrigo Della Méa, Stein, Cinara, Casali, Karina Rabello, Arena, Ross, Lago, Pedro Dal

QUELLE / SOURCE:

International Journal of Cardiology, 2013/june, Vol. 166, No. 1, 61–67, DOI: https://doi.org/10.1016/j.ijcard.2011.09.069

ABSTRAKT / ABSTRACT:

Background: Autonomic imbalance, characterized by sympathetic hyperactivity and diminished vagal tone, is a known mechanism for essential hypertension. Inspiratory muscle training (IMT) demonstrates beneficial outcomes in a number of cardiovascular populations, which may potentially extend to patients with hypertension. The aim of this study was to further elucidate the effects of IMT on blood pressure and autonomic cardiovascular control in patients with essential hypertension.

Methods: Thirteen patients with hypertension were randomly assigned to an eight-week IMT program (6 patients) or to a placebo-IMT (P-IMT, 7 patients) protocol. We recorded RR interval for posterior analysis of heart rate variability and blood pressure, by ambulatory blood pressure monitoring (ABPM), before and after the program.

Results: There was a significant increase in inspiratory muscle strength in the IMT group (82.7 ± 28.8 vs 121.5 ± 21.8 cmH2O, P<0.001), which was not demonstrated by P-IMT (93.3 ± 25.3 vs 106.1 ± 25.3 cmH2O, P>0.05). There was also a reduction in 24-hour measurement of systolic (133.2 ± 9.9 vs 125.2 ± 13.0 mm Hg, P=0.02) and diastolic (80.7 ± 12.3 vs 75.2 ± 1.0 mm Hg, P=0.02) blood pressure, as well as in daytime systolic (136.8 ± 12.2 vs 127.6 ± 14.2 mm Hg, P=0.008) and diastolic (83.3 ± 13.1 vs. 77.2 ± 12.2 mm Hg, P =0.01) blood pressure in the IMT group. In relation to autonomic cardiovascular control, we found increased parasympathetic modulation (HF: 75.5 ± 14.6 vs. 84.74 ± 7.55 n.u, P=0.028) and reduced sympathetic modulation (LF: 34.67 ± 20.38 vs. 12.81 ± 6.68 n.u; P=0.005). Moreover, there was reduction of cardiac sympathetic discharge (fLF) in IMT group (P=0.01).

Conclusions: IMT demonstrates beneficial effects on systolic and diastolic blood pressure as well as autonomic cardiovascular control in hypertensive patients.

6.1.33 Inspiratory muscle training reduces diaphragm activation and dyspnea during exercise in COPD

AUTOR: IN / AUTHOR:

Langer, Daniel, Ciavaglia, Casey, Faisal, Azmy, Webb, Katherine A., Neder, J. Alberto, Gosselink, Rik, Dacha, Sauwaluk, Topalovic, Marko, Ivanova, Anna, O'Donnell, Denis E.

QUELLE / SOURCE:

Journal of Applied Physiology, 2018/august, Vol. 125, No. 2, 381–392, DOI: https://doi.org/10.1152/japplphysiol.01078.2017

ABSTRAKT / ABSTRACT:

Among patients with chronic obstructive pulmonary disease (COPD), those with the lowest maximal inspiratory pressures experience greater breathing discomfort (dyspnea) during exercise. In such individuals, inspiratory muscle training (IMT) may be associated with improvement of dyspnea, but the mechanisms for this are poorly understood. Therefore, we aimed to identify physiological mechanisms of improvement in dyspnea and exercise endurance following inspiratory muscle training (IMT) in patients with COPD and low maximal inspiratory pressure (Pimax). The effects of 8 wk of controlled IMT on respiratory muscle function, dyspnea, respiratory mechanics, and diaphragm electromyography (EMGdi) during constant work rate cycle exercise were evaluated in patients with activity-related dyspnea (baseline dyspnea index <9). Subjects were randomized to either IMT or a sham training control group (n = 10 each). Twenty subjects (FEV1 = 47 ± 19% predicted; Pimax = -59 ± 14 cmH2O; cycle ergometer peak work rate = 47 ± 21% predicted) completed the study; groups had comparable baseline lung function, respiratory muscle strength, activity-related dyspnea, and exercise capacity. IMT, compared with control, was associated with greater increases in inspiratory muscle strength and endurance, with attendant improvements in exertional dyspnea and exercise endurance time (all P < 0.05). After IMT, EMGdi expressed relative to its maximum (EMGdi/EMGdimax) decreased (P < 0.05) with no significant change in ventilation, tidal inspiratory pressures, breathing pattern, or operating lung volumes during exercise. In conclusion, IMT improved inspiratory muscle strength and endurance in mechanically compromised patients with COPD and low Pimax. The attendant reduction in EMGdi/EMGdimax helped explain the decrease in perceived respiratory discomfort despite sustained high ventilation and intrinsic mechanical loading over a longer exercise duration. NEW & NOTEWORTHY In patients with COPD and low maximal inspiratory pressures, inspiratory muscle training (IMT) may be associated with improvement of dyspnea, but the mechanisms for this are poorly understood. This study showed that 8 wk of home-based, partially supervised IMT improved respiratory muscle strength and endurance, dyspnea, and exercise

endurance. Dyspnea relief occurred in conjunction with a reduced activation of the diaphragm relative to maximum in the absence of significant changes in ventilation, breathing pattern, and operating lung volumes.

6.1.34 Inspiratory muscle training with threshold or incentive spirometry: Which is the most effective?

AUTOR: IN / AUTHOR:

Paiva, Dulciane Nunes, Assmann, Laíse Bender, Bordin, Diogo Fanfa, Gass, Ricardo, Jost, Renan Trevisan, Bernardo-Filho, Mario, França, Rodrigo Alves, Cardoso, Dannuey Machado

QUELLE / SOURCE:

Revista Portuguesa de Pneumologia (English Edition), 2015/march, Vol. 21, No. 2, 76–81, DOI: https://doi.org/10.1016/j.rppnen.2014.05.005

ABSTRAKT / ABSTRACT:

Inspiratory muscular training (IMT) increases the respiratory muscle strength, however, there is no data demonstrating its superiority over the incentive spirometry (IS) in doing so. Values of muscle strength after IMT (Threshold IMT(®)) and by the IS (Voldyne(®)) in healthy females was compared. Subjects (n=40) were randomly divided into control group (CG, n=14), IS group (ISG, n=13) and threshold group (TG, n=13). PImax was measured before (pre-IMT), at 15 and 30 days of IMT. There was an increase in PImax of the TG at 15 days ($p<0.001$) and 30 days of IMT ($p<0.001$). The same occurred with the ISG, which increased the PImax at 15 days ($p<0.001$) and 30 days of training ($p<0.001$). After 30 days of IMT, the TG presented a PImax which was significantly higher than ISG and the CG ($p=0.045$ and $p<0.001$, respectively). It can be concluded that IMT by threshold was more effective in increasing muscle strength than the Voldyne.

6.1.35 Postoperative outcomes following preoperative inspiratory muscle training in patients undergoing cardiothoracic or upper abdominal surgery: a systematic review and meta analysis

AUTOR: IN / AUTHOR:

Mans, Christina M., Reeve, Julie C., Elkins, Mark R.

QUELLE / SOURCE:

Clinical Rehabilitation, 2014/august, Vol. 29, No. 5, 426–438, DOI: https://doi.org/10.1177/0269215514545350

ABSTRAKT / ABSTRACT:

Objective: To evaluate whether preoperative inspiratory muscle training is effective in preventing postoperative pulmonary complications and reducing length of hospital stay in people undergoing cardiothoracic or upper abdominal surgery.

Data sources: Medline, CINAHL, AMED, PsychINFO, Scopus, PEDro, and the Cochrane Library.

Review methods: A systematic review and meta analysis of randomized controlled trials (or quasi-randomized controlled trials) investigating a form of preoperative inspiratory muscle training, compared with sham or no inspiratory muscle training. Participants were adults (16 years and over) awaiting elective open cardiac, thoracic, or upper abdominal surgery. Methodological quality was assessed using the PEDro scale.

Results: Eight studies involving 295 participants were eligible for inclusion. The trained group had significantly higher maximal inspiratory pressure at the end of the preoperative training period (mean difference: 15 cm H2O, 95% confidence interval (CI): 9 to 21). This benefit was maintained through the early postoperative period, when lung function also recovered significantly more quickly in the trained group. Inspiratory muscle training also substantially reduced postoperative pulmonary complications (relative risk 0.48, 95% CI 0.26 to 0.89). Although not statistically significant, length of hospital stay also tended to favour the trained group. There were no statistically significant differences between the groups for the remaining outcomes. Participant satisfaction with inspiratory muscle training was high.

Conclusion: Preoperative inspiratory muscle training significantly improves respiratory (muscle) function in the early postoperative period, halving the risk of pulmonary complications. The training does not increase length of stay, but more data are required to confirm whether it reduces length of stay.

6.1.36 Preoperative inspiratory muscle training for postoperative pulmonary complications in adults undergoing cardiac and major abdominal surgery

AUTOR: IN / AUTHOR:

Katsura, Morihiro, Kuriyama, Akira, Takeshima, Taro, Fukuhara, Shunichi, Furukawa, Toshi A.

QUELLE / SOURCE:

Cochrane Database of Systematic Reviews, 2015/october, Vol. 2015, No. 10, DOI: https://doi.org/10.1002/14651858.cd010356.pub2

ABSTRAKT / ABSTRACT:

Background: Postoperative pulmonary complications (PPCs) have an impact on the recovery of adults after surgery. It is therefore important to establish whether preoperative respiratory rehabilitation can decrease the risk of PPCs and to identify adults who might benefit from respiratory rehabilitation.

Objectives: Our primary objective was to assess the effectiveness of preoperative inspiratory muscle training (IMT) on PPCs in adults undergoing cardiac or major abdominal surgery. We looked at all-cause mortality and adverse events.

Search methods: We searched the Cochrane Central Register of Controlled Trials (CENTRAL; 2014, Issue 10), MEDLINE (1966 to October 2014), EMBASE (1980 to October 2014), CINAHL (1982 to October 2014), LILACS (1982 to October 2014), and ISI Web of Science (1985 to October 2014). We did not impose any language restrictions.

Selection criteria: We included randomized controlled trials that compared preoperative IMT and usual preoperative care for adults undergoing cardiac or major abdominal surgery.

Data collection and analysis: Two or more review authors independently identified studies, assessed trial quality, and extracted data. We extracted the following information: study characteristics, participant characteristics, intervention details, and outcome measures. We contacted study authors for additional information in order to identify any unpublished data.

Main results: We included 12 trials with 695 participants; five trials included participants awaiting elective cardiac surgery and seven trials included participants awaiting elective major abdominal surgery. All trials contained at least one domain judged to be at high or unclear risk of bias. Of greatest concern was the risk of bias associated with inadequate blinding, as it was impossible to blind participants due to the nature of the study designs. We could pool postoperative atelectasis in seven trials (443 participants) and postoperative pneumonia in 11 trials (675 participants) in a meta-analysis. Preoperative IMT was associated with a reduction

of postoperative atelectasis and pneumonia, compared with usual care or non-exercise intervention (respectively; risk ratio (RR) 0.53, 95% confidence interval (CI) 0.34 to 0.82 and RR 0.45, 95% CI 0.26 to 0.77). We could pool all-cause mortality within postoperative period in seven trials (431 participants) in a meta-analysis. However, the effect of IMT on all-cause postoperative mortality is uncertain (RR 0.40, 95% CI 0.04 to 4.23). Eight trials reported the incidence of adverse events caused by IMT. All of these trials reported that there were no adverse events in both groups. We could pool the mean duration of hospital stay in six trials (424 participants) in a meta-analysis. Preoperative IMT was associated with reduced length of hospital stay (MD -1.33, 95% CI -2.53 to -0.13). According to the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) Working Group guidelines for evaluating the impact of healthcare interventions, the overall quality of studies for the incidence of pneumonia was moderate, whereas the overall quality of studies for the incidence of atelectasis, all-cause postoperative death, adverse events, and duration of hospital stay was low or very low.

Authors' conclusions: We found evidence that preoperative IMT was associated with a reduction of postoperative atelectasis, pneumonia, and duration of hospital stay in adults undergoing cardiac and major abdominal surgery. The potential for overestimation of treatment effect due to lack of adequate blinding, small-study effects, and publication bias needs to be considered when interpreting the present findings.

6.1.37 PILOT STUDY: HYOLARYNGEAL MUSCLE ACTIVATION IN RESPONSE TO RMT USING THE BREATHER

AUTOR: IN / AUTHOR:

Matthew Dumican, M. S. C. C. C.-S. L. P., Christopher Watts, Ph. D.

QUELLE / SOURCE:

Poster Presentation – DYSPHAGIA RESEARCH SOCIETY, San Diego, CA, 2019

ABSTRAKT / ABSTRACT:

Key findings:

In neuromuscular disease, such as Parkinson's, activation of muscle groups for voice and swallowing may be impaired, causing dysphonia and dysphagia. - Strengthening those muscle groups by respiratory muscle training (RMT) can improve voice and swallow function, and health-related quality of life. - In the study presented here, activation of the hyolaryngeal muscles in response to RMT using The Breather is assessed by surface electromyograph (sEMG). - RMT using The Breather improved muscle activation both during inspiration as well as during expiration against resistance significantly above baseline level. - The Breather can be recommended as a useful exercise tool to maintain swallow function longer

6.1.38 Preliminary study: comparative effects of lung volume therapy between slow and fast deep-breathing techniques on pulmonary function, respiratory muscle strength, oxidative stress, cytokines, 6-minute walking distance, and quality of life in persons with COPD

AUTOR: IN / AUTHOR:

Leelarungrayub, Jirakrit, Puntumetakul, Rungthip, Sriboonreung, Thanyaluck, Pothasak, Yothin, Klaphajone, Jakkrit

QUELLE / SOURCE:

International Journal of Chronic Obstructive Pulmonary Disease, 2018/december, Vol. Volume 13, 3909–3921, DOI: https://doi.org/10.2147/copd.s181428

ABSTRAKT / ABSTRACT:

Hintergrund: Die Lungenvolumentherapie mit dem Voldyne ®- Gerät kann das Lungenvolumen verbessern und hat über die langsame Tiefenatmungstechnik (SDBT) einen nicht signifikanten Nutzen für die Atemmuskelkraft; das Atemmuskeltraining mit einem Atemmuskeltrainer über die schnelle Tiefenatmungstechnik (FDBT) hat hingegen bei Menschen mit COPD eine signifikante Verbesserung bewirkt. Ziel dieser Studie war es daher, die Effizienz der Lungenvolumentherapie mit dem Voldyne ®- Gerät mit der SDBT und FDBT in Bezug auf Lungenfunktion, Atemmuskelkraft, oxidativen Stress, Zytokine, Gehfähigkeit und Lebensqualität (QoL) bei Menschen mit COPD zu vergleichen.

Methoden: Insgesamt 30 freiwillige COPD-Patienten mit leichter (Stadium I) bis mittelschwerer (Stadium II) Schwere wurden in zwei Gruppen randomisiert: SDBT (n = 15) und FDBT (n = 15). Lungenfunktion (FVC, FEV1 und FEV1 / FVC), maximaler inspiratorischer Munddruck (PI max), oxidativer Stressstatus (totale antioxidative Kapazität [TAC], Glutathion [GSH], Malondialdehyd [MDA] und Stickstoffmonoxid [NO]), entzündliche Zytokine (Tumornekrosefaktor-Alpha [TNF-α] und IL-6), 6-Minuten-Gehstrecke (6MWD) und der Gesamtwert des klinischen COPD-Fragebogens (CCQ) wurden vor und nach 4-wöchigem Training ausgewertet.

Ergebnisse: Vor dem Training unterschieden sich alle Parameter statistisch nicht zwischen den Gruppen. PI max , TAC, IL-6, der gesamte QoL-Score und 6MWD änderten sich nach dem 4-wöchigen Experiment in der SDBT-Gruppe im Vergleich zur vorexperimentellen Phase signifikant, während FVC, FEV1 , FEV1 % , FEV1 / FVC%, PI max , TAC, MDA, NO, TNF-α, IL-6, 6MWD und der gesamte CCQ-Score sich in der FDBT-Gruppe im Vergleich zur vorexperimentellen Phase signifikant änderten. FEV1 % , PI max , TNF-α, IL-6 und der

gesamte CCQ-Score unterschieden sich in der nachexperimentellen Phase in der FDBT-Gruppe signifikant von denen in der SDBT-Gruppe.

Schlussfolgerung: Diese vorläufige Studie kam zu dem Schluss, dass die Anwendung der Anreizspirometrie mit dem Gerät Voldyne® durch schnelles, tiefes Atmen möglicherweise die Kraft der Atemmuskulatur und die Lebensqualität verbesserte und entzündliche Zytokine, MDA und NO besser reduzierte als durch langsames, tiefes Atmen bei Menschen mit COPD.

6.1.39 Respiratory muscle training programs: impact on the functional autonomy of the elderly

AUTOR: IN / AUTHOR:

Fonseca, Marilia de Andrade, Cader, Samaria Ali, Dantas, Estelio Henrique Martin, Bacelar, Silvia Correa, Silva, Elirez Bezerra da, Leal, Silvania Matheus de Oliveira

QUELLE / SOURCE:

Revista da Associação Médica Brasileira, 2010, Vol. 56, No. 6, 642–648, DOI: https://doi.org/10.1590/s0104-42302010000600010

ABSTRAKT / ABSTRACT:

Objective: To compare two respiratory muscle training programs for improving the functional autonomy of institutionalized elderly.

Methods: Clinical randomized trial conducted at a long stay institution with 42 elderly volunteers that were divided into three groups: Group ® Threshold (GT) with mean age (70.93 ± 8.41), Group Voldyne ® (GV) (70.54 ± 7.73) and Control Group (CG) (73.92 ± 7.28). Groups GT and GV were treated with breathing exercises and muscle training by Threshold and Voldyne, respectively while the CG did just breathing exercises. Training of groups took 10 weeks. To assess the functional autonomy, the elderly were evaluated before and after training, according to the GDLAM protocol.

Results: All intra-group comparison (pre x post-test) showed a significant difference in GT for all tests (C10M: Δ% = -20.57, p = 0.0001; LPS: Δ% = -13.53, p = 0.020; VTC: Δ% = -27.96, p = 0.0001; LCLC: Δ% = -18.71, p = 0.0001 and IG:% Δ = -18.43, p = 0.0001), except in LPDV. In GV there was a significant difference only (p <0.05) for the C10M (% Δ = -17.11, p = 0.004). In the comparison between (post x post), there was a statistical significance (p <0.05) for VTC test between the GT and GV (Δ = -3.62%, p = 0.017), with favorable results for the GT. Similarly, there was a statistical difference (p <0.05) in GT C10M (% Δ = -3.83, p = 0.023), LCLC (Δ = -34.02%, p = 0.012) and IG (Δ% = -13.63, p = 0.004) compared to GC.

Conclusion: The trained groups improved functional autonomy, reaching 27.42; considered to be a weak level in both pre-and post-training.

6.1.40 Respiratory muscle training with normocapnic hyperpnea improves ventilatory pattern and thoracoabdominal coordination, and reduces oxygen desaturation during endurance exercise testing in COPD patients

AUTOR: IN / AUTHOR:

Bernardi, Eva, Pomidori, Luca, Bassal, Faisy, Contoli, Marco, Cogo, Annalisa

QUELLE / SOURCE:

International Journal of Chronic Obstructive Pulmonary Disease, 2015/september, 1899, DOI: https://doi.org/10.2147/copd.s88609

ABSTRAKT / ABSTRACT:

Background: Few data are available about the effects of respiratory muscle training with normocapnic hyperpnea (NH) in COPD. The aim is to evaluate the effects of 4 weeks of NH (Spirotiger(®)) on ventilatory pattern, exercise capacity, and quality of life (QoL) in COPD patients.

Methods: Twenty-six COPD patients (three females), ages 49-82 years, were included in this study. Spirometry and maximal inspiratory pressure, St George Respiratory Questionnaire, 6-minute walk test, and symptom-limited endurance exercise test (endurance test to the limit of tolerance [tLim]) at 75%-80% of peak work rate up to a Borg Score of 8-9/10 were performed before and after NH. Patients were equipped with ambulatory inductive plethysmography (LifeShirt(®)) to evaluate ventilatory pattern and thoracoabdominal coordination (phase angle [PhA]) during tLim. After four supervised sessions, subjects trained at home for 4 weeks - 10 minutes twice a day at 50% of maximal voluntary ventilation. The workload was adjusted during the training period to maintain a Borg Score of 5-6/10.

Results: Twenty subjects completed the study. After NH, maximal inspiratory pressure significantly increased (81.5±31.6 vs 91.8±30.6 cmH2O, P<0.01); exercise endurance time (+150 seconds, P=0.04), 6-minute walk test (+30 meters, P=0.03), and QoL (-8, P<0.01) all increased. During tLim, the ventilatory pattern changed significantly (lower ventilation, lower respiratory rate, higher tidal volume); oxygen desaturation, PhA, and dyspnea Borg Score were lower for the same work intensity (P<0.01, P=0.02, and P<0.01, respectively; one-way ANOVA). The improvement in tidal volume and oxygen saturation after NH were significantly related (R (2)=0.65, P<0.01).

Conclusion: As expected, NH improves inspiratory muscle performance, exercise capacity, and QoL. New results are significant change in ventilatory pattern, which improves oxygen saturation, and an improvement in

thoracoabdominal coordination (lower PhA). These two facts could explain the reduced dyspnea during the endurance test. All these results together may play a role in improving exercise capacity after NH training.

6.1.41 Atemmuskeltraining: State-of-the-Art

AUTOR: IN / AUTHOR:

Göhl, O., Walker, D., Walterspacher, S., Langer, D., Spengler, C., Wanke, T., Petrovic, M., Zwick, R.-H., Stieglitz, S., Glöckl, R., Dellweg, D., Kabitz, H.-J.

QUELLE / SOURCE:

Pneumologie, 2016/january, Vol. 70, No. 01, 37–48, DOI: https://doi.org/10.1055/s-0041-109312

ABSTRAKT / ABSTRACT:

Specific respiratory muscle training (IMT) improves the function of the inspiratory muscles. According to literature and clinical experience, there are 3 established methods: 1.) resistive load 2.) threshold load and 3.) normocapnic hyperpnea. Each training method and the associated devices have specific characteristics. Setting up an IMT should start with specific diagnostics of respiratory muscle function and be followed by detailed individual introduction to training. The aim of this review is to take a closer look at the different training methods for the most relevant indications and to discuss these results in the context of current literature. The group of neuromuscular diseases includes muscular dystrophy, spinal muscular atrophy, amyotrophic lateral sclerosis, paralysis of the phrenic nerve, and injuries to the spinal cord. Furthermore, interstitial lung diseases, sarcoidosis, left ventricular heart failure, pulmonary arterial hypertension (PAH), kyphoscoliosis and obesity are also discussed in this context. COPD, asthma, cystic fibrosis (CF) and non-CF-bronchiectasis are among the group of obstructive lung diseases. Last but not least, we summarize current knowledge on weaning from respirator in the context of physical activity.

6.1.42 Respiratory muscle training improves swimming endurance in divers

AUTOR: IN / AUTHOR:

Wylegala, Juli A., Pendergast, David R., Gosselin, Luc E., Warkander, Dan E., Lundgren, Claes E. G.

QUELLE / SOURCE:

European Journal of Applied Physiology, 2006/december, Vol. 99, No. 4, 393–404, DOI: https://doi.org/10.1007/s00421-006-0359-6

ABSTRAKT / ABSTRACT:

Respiratory muscles can fatigue during prolonged and maximal exercise, thus reducing performance. The respiratory system is challenged during underwater exercise due to increased hydrostatic pressure and breathing resistance. The purpose of this study was to determine if two different respiratory muscle training protocols enhance respiratory function and swimming performance in divers. Thirty male subjects (23.4 +/- 4.3 years) participated. They were randomized to a placebo (PRMT), endurance (ERMT), or resistance respiratory muscle training (RRMT) protocol. Training sessions were 30 min/day, 5 days/week, for 4 weeks. PRMT consisted of 10-s breath-holds once/minute, ERMT consisted of isocapnic hyperpnea, and RRMT consisted of a vital capacity maneuver against 50 cm H(2)O resistance every 30 s. The PRMT group had no significant changes in any measured variable. Underwater and surface endurance swim time to exhaustion significantly increased after RRMT (66%, P < 0.001; 33%, P = 0.003) and ERMT (26%, P = 0.038; 38%, P < 0.001). Breathing frequency (f (b)) during the underwater endurance swim decreased in RRMT (23%, P = 0.034) and tidal volume (V (T)) increased in both the RRMT (12%, P = 0.004) and ERMT (7%, P = 0.027) groups. Respiratory endurance increased in ERMT (216.7%) and RRMT (30.7%). Maximal inspiratory and expiratory pressures increased following RRMT (12%, P = 0.015, and 15%, P = 0.011, respectively). Results from this study indicate that respiratory muscle fatigue is a limiting factor for underwater swimming performance, and that targeted respiratory muscle training (RRMT > ERMT) improves respiratory muscle and underwater swimming performance.

6.1.43 The effects of threshold inspiratory muscle training in patients with obstructive sleep apnea: a randomized experimental study

AUTOR: IN / AUTHOR:

Lin, Huei-Chen, Chiang, Ling-Ling, Ong, Jun-Hui, Tsai, Kun-ling, Hung, Ching-Hsia, Lin, Cheng-Yu

QUELLE / SOURCE:

Sleep and Breathing, 2019/05, Vol. 24, No. 1, 201–209, DOI: https://doi.org/10.1007/s11325-019-01862-y

ABSTRAKT / ABSTRACT:

Objectives: Patients with obstructive sleep apnea (OSA) (an obstructed airway and intermittent hypoxia) negatively affect their respiratory muscles. We evaluated the effects of a 12-week threshold inspiratory muscle training (TIMT) program on OSA severity, daytime sleepiness, and pulmonary function in newly diagnosed OSA.

Methods: Sixteen patients with moderate-to-severe OSA were randomly assigned to a TIMT group and 6 to a control group. The home-based TIMT program was 30-45 min/day, 5 days/week, for 12 weeks using a TIMT training device. Their apnea-hypopnea index (AHI), Epworth sleepiness scale (ESS), and forced vital capacity (FVC) scores were evaluated pre- and post-treatment. Polysomnographic (PSG) analysis showed that 9 TIMT-group patients had positively responded (TIMT-responder group: post-treatment AHI < pre-treatment) and that 7 had not (TIMT non-responder group: post-treatment AHI > pre-treatment).

Results: Post-treatment AHI and ESS scores were significantly (both $P < 0.05$) lower 6% and 20.2%, respectively. A baseline AHI $\leq$ 29.0/h predicted TIMT-responder group patients (sensitivity 77.8%; specificity 85.7%). FVC was also significantly ($P < 0.05$) higher 7.2%. Baseline AHI and FEV6.0 were significant predictors of successful TIMT-responder group intervention. OSA severity and daytime sleepiness were also significantly attenuated.

Conclusions: Home-based TIMT training is simple, efficacious, and cost-effective.

6.1.44 Time-Efficient Inspiratory Muscle Strength Training Lowers Blood Pressure and Improves Endothelial Function, NO Bioavailability, and Oxidative Stress in Midlife/Older Adults With Above-Normal Blood Pressure

AUTOR: IN / AUTHOR:

Craighead, Daniel H., Heinbockel, Thomas C., Freeberg, Kaitlin A., Rossman, Matthew J., Jackman, Rachel A., Jankowski, Lindsey R., Hamilton, Makinzie N., Ziemba, Brian P., Reisz, Julie A., D'Alessandro, Angelo, Brewster, L. Madden, DeSouza, Christopher A., You, Zhiying, Chonchol, Michel, Bailey, E. Fiona, Seals, Douglas R.

QUELLE / SOURCE:

Journal of the American Heart Association, 2021/july, Vol. 10, No. 13, DOI: https://doi.org/10.1161/jaha.121.020980

ABSTRAKT / ABSTRACT:

Background: High-resistance inspiratory muscle strength training (IMST) is a novel, time-efficient physical training modality. Methods and Results: We performed a double-blind, randomized, sham-controlled trial to investigate whether 6 weeks of IMST (30 breaths/day, 6 days/week) improves blood pressure, endothelial function, and arterial stiffness in midlife/older adults (aged 50-79 years) with systolic blood pressure ≥120 mm Hg, while also investigating potential mechanisms and long-lasting effects. Thirty-six participants completed high-resistance IMST (75% maximal inspiratory pressure, n=18) or low-resistance sham training (15% maximal inspiratory pressure, n=18). IMST was safe, well tolerated, and had excellent adherence (≈95% of training sessions completed). Casual systolic blood pressure decreased from 135±2 mm Hg to 126±3 mm Hg (P<0.01) with IMST, which was ≈75% sustained 6 weeks after IMST (P<0.01), whereas IMST modestly decreased casual diastolic blood pressure (79±2 mm Hg to 77±2 mm Hg, P=0.03); blood pressure was unaffected by sham training (all P>0.05). Twenty-four hour systolic blood pressure was lower after IMST versus sham training (P=0.01). Brachial artery flow-mediated dilation improved ≈45% with IMST (P<0.01) but was unchanged with sham training (P=0.73). Human umbilical vein endothelial cells cultured with subject serum sampled after versus before IMST exhibited increased NO bioavailability, greater endothelial NO synthase activation, and lower reactive oxygen species bioactivity (P<0.05). IMST decreased C-reactive protein (P=0.05) and altered select circulating metabolites (targeted plasma metabolomics) associated with cardiovascular function. Neither IMST nor sham training influenced arterial stiffness (P>0.05). Conclusions: High-resistance IMST is a safe, highly adherable lifestyle intervention for improving blood pressure and endothelial function in midlife/older adults with above-normal initial systolic blood pressure.

6.1.45 THE EFFECTS OF RESPIRATORY MUSCLE TRAINING ON VO2 MAX, THE VENTILATORY THRESHOLD AND PULMONARY FUNCTION

AUTOR: IN / AUTHOR:

AMONETTE, W.I.L.L.I.A.M. E., DUPLER, T.E.R.R.Y. L.

QUELLE / SOURCE:

JEPonline, 2002, Vol. 5, No. 2, 29

ABSTRAKT / ABSTRACT:

THE EFFECTS OF RESPIRATORY MUSCLE TRAINING ON VO2 MAX, THE VENTILATORY THRESHOLD AND PULMONARY FUNCTION. William E. Amonette, Terry L. Dupler. JEPonline. 2002;5(2):29-35. This study evaluated the effect of inspiratory and expiratory muscle training on pulmonary function and maximal exercise performance in competitive triathletes and marathon runners. The participants in this study (N=12) had a mean weekly aerobic training time of 7.5 hours per week of swimming, cycling, or running. Eight subjects were assigned to a pulmonary resistance treatment group and four control subjects were given a sham device that allowed no greater than 15% resistance on inspiration or expiration. The subjects performed 30 maximal inhalation/exhalation maneuvers on their respective devices two times per day for four weeks. The subjects were tested for forced vital capacity (FVC), forced expiratory volume in one second (FEV1), FEV1/FVC ratio, forced inspiratory vital capacity (FIVC), peak inspiratory flow rate (PIFR), and peak expiratory flow rate (PEFR). Each subject was also tested for peak exhalation force (PEF) as well as a maximal oxygen consumption (VO2 max), carbon dioxide production (VCO2), tidal volume (VT), ventilation (VE), ventilatory threshold (VT), and respiration rate (RR). The data revealed that training using the pulmonary resistance device produced significant increases in maximal VE and maximal VT while decreasing RR (although not statistically significant) at maximum exercise. However, no significant changes were seen in VO2 or any pulmonary function variables measured.

6.1.46 Expiratory and Expiratory Plus Inspiratory Muscle Training Improves Respiratory Muscle Strength in Subjects With COPD: Systematic Review

AUTOR: IN / AUTHOR:

Neves, Leonardo F., Reis, Manoela H., Plentz, Rodrigo D. M., Matte, Darlan L., Coronel, Christian C., Sbruzzi, Graciele

QUELLE / SOURCE:

Respiratory Care, 2014/april, Vol. 59, No. 9, 1381–1388, DOI: https://doi.org/10.4187/respcare.02793

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) produces beneficial effects in COPD subjects, but the effects of expiratory muscle training (EMT) and EMT plus IMT in ventilatory training are still unclear. The aim of this study was to systematically review the effects of EMT and EMT plus IMT compared to control groups of COPD subjects.

Methods: This study is a systematic review and meta-analysis. The search strategy included MEDLINE, Embase, LILACS, PEDro, and Cochrane CENTRAL and also manual search of references in published studies on the subject. Randomized trials comparing EMT and EMT plus IMT versus control groups of subjects with COPD were included. The outcomes analyzed were respiratory muscle strength and functional capacity. Two reviewers independently extracted the data.

Results: The search retrieved 609 articles. Five studies were included. We observed that EMT provided higher gain in maximum expiratory pressure (P(E(max)) 21.49 cm H2O, 95% CI 13.39-29.59) and maximum inspiratory pressure (P(I(max)) 7.68 cm H2O, 95% CI 0.90-14.45) compared to control groups. There was no significant difference in the 6-min walk test distance (29.01 m, 95% CI -39.62 to 97.65) and dyspnea (0.15, 95% CI -0.77 to 1.08). In relation to EMT plus IMT, we observed that P(E(max)) (31.98 cm H2O, 95% CI 26.93-37.03) and P(I(max)) (27.98 cm H2O, 95% CI 20.10-35.85) presented higher values compared to control groups.

Conclusions: EMT and EMT plus IMT improve respiratory muscle strength and can be used as part of the treatment during pulmonary rehabilitation of subjects with severe to very severe COPD.

6.1.47 Effect of Respiratory Muscle Training on Exercise Performance in Healthy Individuals: A Systematic Review and Meta-Analysis

AUTOR: IN / AUTHOR:

Illi, Sabine K., Held, Ulrike, Frank, Irène, Spengler, Christina M.

QUELLE / SOURCE:

Sports Medicine, 2012/august, Vol. 42, No. 8, 707–724, DOI: https://doi.org/10.1007/bf03262290

ABSTRAKT / ABSTRACT:

Objectives: Two distinct types of specific respiratory muscle training (RMT), i.e. respiratory muscle strength (resistive/threshold) and endurance (hyperpnoea) training, have been established to improve the endurance performance of healthy individuals. We performed a systematic review and meta-analysis in order to determine the factors that affect the change in endurance performance after RMT in healthy subjects.

Data sources: A computerized search was performed without language restriction in MEDLINE, EMBASE and CINAHL and references of original studies and reviews were searched for further relevant studies.

Review methods: RMT studies with healthy individuals assessing changes in endurance exercise performance by maximal tests (constant load, time trial, intermittent incremental, conventional [non-intermittent] incremental) were screened and abstracted by two independent investigators. A multiple linear regression model was used to identify effects of subjects' fitness, type of RMT (inspiratory or combined inspiratory/expiratory muscle strength training, respiratory muscle endurance training), type of exercise test, test duration and type of sport (rowing, running, swimming, cycling) on changes in performance after RMT. In addition, a meta-analysis was performed to determine the effect of RMT on endurance performance in those studies providing the necessary data.

Results: The multiple linear regression analysis including 46 original studies revealed that less fit subjects benefit more from RMT than highly trained athletes (6.0% per 10 mL · kg^{-1} · min^{-1} decrease in maximal oxygen uptake, 95% confidence interval [CI] 1.8, 10.2%; p = 0.005) and that improvements do not differ significantly between inspiratory muscle strength and respiratory muscle endurance training (p = 0.208), while combined inspiratory and expiratory muscle strength training seems to be superior in improving performance, although based on only 6 studies (+12.8% compared with inspiratory muscle strength training, 95% CI 3.6, 22.0%; p = 0.006). Furthermore, constant load tests (+16%, 95% CI 10.2, 22.9%) and intermittent incremental tests (+18.5%, 95% CI 10.8, 26.3%) detect changes in endurance performance better than conventional

incremental tests (both $p < 0.001$) with no difference between time trials and conventional incremental tests ($p = 0.286$). With increasing test duration, improvements in performance are greater (+0.4% per minute test duration, 95% CI 0.1, 0.6%; $p = 0.011$) and the type of sport does not influence the magnitude of improvements (all $p > 0.05$). The meta-analysis, performed on eight controlled trials revealed a significant improvement in performance after RMT, which was detected by constant load tests, time trials and intermittent incremental tests, but not by conventional incremental tests.

Conclusion: RMT improves endurance exercise performance in healthy individuals with greater improvements in less fit individuals and in sports of longer durations. The two most common types of RMT (inspiratory muscle strength and respiratory muscle endurance training) do not differ significantly in their effect, while combined inspiratory/expiratory strength training might be superior. Improvements are similar between different types of sports. Changes in performance can be detected by constant load tests, time trials and intermittent incremental tests only. Thus, all types of RMT can be used to improve exercise performance in healthy subjects but care must be taken regarding the test used to investigate the improvements.

6.1.48 Safety and efficacy of inspiratory muscle training for preventing adverse outcomes in patients at risk of prolonged hospitalisation

AUTOR: IN / AUTHOR:

Nepomuceno, Balbino Rivail Ventura, Barreto, Mayana de Sá, Almeida, Naniane Cidreira, Guerreiro, Caroline Ferreira, Xavier-Souza, Eveline, Neto, Mansueto Gomes

QUELLE / SOURCE:

Trials, 2017/december, Vol. 18, No. 1, DOI: https://doi.org/10.1186/s13063-017-2372-y

ABSTRAKT / ABSTRACT:

Background: The early institution of inspiratory muscle training on hospitalised patients with no established respiratory deficits could prevent in-hospital adverse outcomes that are directly or indirectly associated to the loss of respiratory muscle mass inherent to a prolonged hospital stay. The objective of the clinical trial is to assess the impact of inspiratory muscle training on hospital inpatient complications.

Methods: This is a double-blind randomised controlled trial. Subjects in the intervention group underwent an inspiratory muscle training loaded with 50% maximum inspiratory pressure twice daily for 4 weeks from study enrolment. Patients were randomly assigned to an inspiratory muscle training group or a sham inspiratory muscle training group. All patients received conventional physiotherapy interventions. Baseline and post-intervention respiratory and peripheral muscle strength, functionality (performance of activities of daily living), length of hospital stay, and death were evaluated. Clinical outcomes were assessed until hospital discharge. This study was approved by the Institutional Hospital Ethics Committee (03/2014).

Results: Thirty-one patients assigned to the inspiratory muscle training group and 34 to the sham inspiratory muscle training group were analysed. Patients in the inspiratory muscle training group had a shorter mean length of hospital stay (35.3 ± 2.7 vs. 41.8 ± 3.5 days, $p < 0.01$) and a lower risk of endotracheal intubation (relative risk (RR) = 0.36; 95% confidence interval (CI) 0.27-0.97; $p = 0.03$) as well as muscle weakness (RR = 0.36; 95% CI 0.19-0.98; $p = 0.02$) and mortality (RR = 0.23; 95% CI 0.2-0.94; $p = 0.04$). The risk of adverse events did not differ significantly between groups.

Conclusion: Inspiratory muscle training was a protective factor against endotracheal intubation, muscle weakness, and mortality.

6.1.49 The Effects of Inspiratory Muscle Training in Older Adults

AUTOR: IN / AUTHOR:

MILLS, D.E.A.N. E., JOHNSON, M.I.C.H.A.E.L. A., BARNETT, Y.V.O.N.N.E. A., SMITH, W.I.L.L.I.A.M. H. T., SHARPE, G.R.A.H.A.M. R.

QUELLE / SOURCE:

Medicine & Science in Sports & Exercise, 2015/april, Vol. 47, No. 4, 691–697, DOI: https://doi.org/10.1249/mss.0000000000000474

ABSTRAKT / ABSTRACT:

Purpose: Declining inspiratory muscle function and structure and systemic low-level inflammation and oxidative stress may contribute to morbidity and mortality during normal ageing. Therefore, we examined the effects of inspiratory muscle training (IMT) in older adults on inspiratory muscle function and structure and systemic inflammation and oxidative stress, and reexamined the reported positive effects of IMT on respiratory muscle strength, inspiratory muscle endurance, spirometry, exercise performance, physical activity levels (PAL), and quality of life (QoL).

Methods: Thirty-four healthy older adults (68 ± 3 yr) with normal spirometry, respiratory muscle strength, and physical fitness were divided equally into a pressure-threshold IMT or sham-hypoxic placebo group. Before and after an 8-wk intervention, measurements were taken for dynamic inspiratory muscle function and inspiratory muscle endurance using a weighted plunger pressure-threshold loading device; diaphragm thickness by using B-mode ultrasonography; plasma cytokine concentrations by using immunoassays; DNA damage levels in peripheral blood mononuclear cells by using comet assays; spirometry, maximal mouth pressures, and exercise performance by using a 6-min walk test; PAL by using a questionnaire and accelerometry; and QoL using a questionnaire.

Results: Compared with placebo, IMT increased maximal inspiratory pressure (+34% ± 43%, P = 0.008), diaphragm thickness at residual volume (+38% ± 39%, P = 0.03), and peak inspiratory flow (+35% ± 42%, P = 0.049) but did not change other spirometry measures, plasma cytokine concentrations, DNA damage levels in peripheral blood mononuclear cells, dynamic inspiratory muscle function, inspiratory muscle endurance, exercise performance, PAL, or QoL.

Conclusion: These novel data indicate that in healthy older adults, IMT elicits some positive changes in inspiratory muscle function and structure but neither attenuates systemic inflammation and oxidative stress nor improves exercise performance, PAL, or QoL.

6.1.50 The effects of inspiratory muscle training based on the perceptions of patients with advanced lung disease: a qualitative study

AUTOR: IN / AUTHOR:

Hoffman, Mariana, Assis, Marcella G., Augusto, Valéria Maria, Silveira, Bruna Mara F., Parreira, Verônica F.

QUELLE / SOURCE:

Brazilian Journal of Physical Therapy, 2018/05, Vol. 22, No. 3, 215–221, DOI: https://doi.org/10.1016/j.bjpt.2017.12.003

ABSTRAKT / ABSTRACT:

Background: Advanced lung disease is a chronic non-neoplastic disease that compromises activities of daily living. Treatment includes pulmonary rehabilitation and inspiratory muscle training. Studies have shown the effectiveness of inspiratory muscle training in lung disease patients, but literature is scarce on the patients' perceptions about this topic.

Objective: To explore the perceptions of patients with advanced lung disease about inspiratory muscle training.

Methods: Qualitative study. Interviews were conducted using a semi-structured questionnaire regarding topics on the participation of patients in inspiratory muscle training and on daily activities performed before and after training. Interviews were transcribed and analyzed according to thematic content analysis.

Results: Ten patients (eight women and 2 men, ranging in age from 27 to 89 years) with inspiratory muscle weakness (maximal inspiratory pressure=44±13.9cmH2O) were included. Five patients were diagnosed with Chronic Obstructive Pulmonary Disease, two with bronchiectasis and three with pulmonary fibrosis. All patients completed at least 80% of the total training sessions. The reports were grouped into four thematic categories: (1) impact of inspiratory muscle training on breathlessness (e.g., "I wasn't feeling as tired as I previously felt."); (2) change in daily activities (e.g., "I needed to go to the supermarket, I felt less tired doing it."); (3) improved mobility (e.g., "I could not stand for long periods […] walking, for example […] Now I stand more, I have more capability."); and (4) increased communication (e.g., "More power, right? Even in speaking […] When I could, I felt my voice coming out better.").

Conclusion: There were improvements in breathlessness, daily activities, mobility, and communication, which positively affected the psychological and social aspects of the patients.

6.1.51 The Effects of 1 Year of Specific Inspiratory Muscle Training in Patients With COPD

AUTOR: IN / AUTHOR:

Beckerman, Marinella, Magadle, Rasmi, Weiner, Margalit, Weiner, Paltiel

QUELLE / SOURCE:

Chest, 2005/november, Vol. 128, No. 5, 3177–3182, DOI: https://doi.org/10.1378/chest.128.5.3177

ABSTRAKT / ABSTRACT:

Aim: We assessed the long-term benefits of inspiratory muscle training (IMT) on inspiratory muscle strength, exercise capacity, the perception of dyspnea, quality of life, primary care use, and hospitalizations in patients with significant COPD.

Patients: Forty-two consecutive COPD patients with FEV(1) < 50% of predicted were randomized into a group that received IMT for 1 year, and a control group that received training with a very low load.

Results: There was a statistically significant increase in inspiratory muscle strength (at the end of the third month of training) as assessed by maximal inspiratory pressure (from 71 +/- 4.9 to 90 +/- 5.1 cm H(2)O [+/- SEM], $p < 0.005$) and 6-min walk distance (at the end of the third month of training; from 256 +/- 41 to 312 +/- 54 m; $p < 0.005$), a decrease in the mean Borg score during breathing against resistance (at the end of the ninth month of training), improvement in the health-related quality-of-life scores (at the end of the sixth month of training) in the training group but not in the control group. At the end of the training year, these changes were maintained; in addition, a decrease in primary health-care use and hospitalization days was observed.

Conclusions: Our study shows that during IMT in patients with significant COPD, there is an increase in exercise capacity, improvement in quality of life, and decrease in dyspnea. Our study also provides evidence that long-term IMT can decrease the use of health services and hospitalization days.

6.1.52 Effects of a new respiratory muscle training device in community-dwelling elderly men: an open-label, randomized, non-inferiority trial

AUTOR: IN / AUTHOR:

Kim, Sang Hun, Shin, Myung-Jun, Lee, Jang Mi, Huh, Sungchul, Shin, Yong Beom

QUELLE / SOURCE:

BMC Geriatrics, 2022/february, Vol. 22, No. 1, DOI: https://doi.org/10.1186/s12877-022-02828-8

ABSTRAKT / ABSTRACT:

BACKGROUND: Respiratory muscle training (RMT) has various clinical benefits in older adults; however, the low adherence to training remains a challenging issue. The present study aimed to confirm the efficacy of a new device that combines inspiratory muscle training and a positive expiratory pressure (IMT/PEP) compared to that of a Threshold IMT device (Philips Respironics Inc), and to determine whether home-based training differed from rehabilitation center training. METHODS: This four-arm, multicenter, parallel, non-inferiority trial randomized 80 active community-dwelling older men (mean age = 72.93 ± 5.02 years) to center-based groups (new IMT/PEP device or Threshold IMT device; 16 supervised sessions) or home-based groups (new IMT/PEP device or Threshold IMT device; 2 supervised sessions and individual sessions). Participants in all groups performed RMT twice a day for 8 weeks. Assessments were performed at baseline and post-training. The primary outcomes were maximum inspiratory pressure and maximal expiratory pressure. Secondary outcomes included forced vital capacity, forced expiratory volume in the first second, peak cough flow, diaphragm thickness, VO2 peak, the International Physical Activity Questionnaire score, electromyographic activities of the sternocleidomastoid muscle, and skeletal muscle mass and phase angle as measured by bioimpedance analysis. RESULTS: Among all groups, the maximal inspiratory pressure was improved post-training, while the maximal expiratory pressure showed improvement only in the IMT/PEP groups. The overall non-inferiority of the IMT/PEP device was thus validated. A statistically significant improvement in diaphragm thickness was found. However, no consistent improvement was shown in other secondary outcomes. No significant difference in training adherence rate between protocols was observed (mean adherence rate of 91-99%). CONCLUSION: Compared to the Threshold IMT, the new IMT/PEP device did not result in a significant difference in maximal inspiratory pressure but did improve maximal expiratory pressure in older men. The IMT/PEP device's improved usability, which is associated with exercise adherence, provided distinct advantages in this cohort. If proper education is first provided, home-based RMT alone may provide sufficient

effects in older individuals. TRIAL REGISTRATION: This trial was registered in the database cris.nih.go.kr (registration number KCT0003901) on 10/05/2019.

6.1.53 Improving respiratory muscle strength and health status in burn patients: a randomized controlled trial

AUTOR: IN / AUTHOR:

Abazarnejad, Elahe, Froutan, Razieh, Ahmadabadi, Ali, Mazlom, Seyed Reza

QUELLE / SOURCE:

Quality of Life Research, 2021/september, Vol. 31, No. 3, 769–776, DOI: https://doi.org/10.1007/s11136-021-02996-x

ABSTRAKT / ABSTRACT:

Purpose: Pulmonary complications are a significant concern in burn patients. This study evaluates the effect of inspiratory muscle training (IMT) using the Powerbreathe device on respiratory muscle strength and health status. Method: 64 burn patients were randomly assigned to Powerbreathe IMT or chest physiotherapy with incentive spirometry. Results: Significant improvement in respiratory muscle strength and health status was seen in the Powerbreathe group. Conclusion: IMT using Powerbreathe is recommended to improve pulmonary outcomes in burn patients.

6.1.54 Effects of Different Inspiratory Muscle Training Protocols on Exercise Capacity, Respiratory Muscle Strength, and Health-Related Quality of Life in Patients with Hypertension

AUTOR: IN / AUTHOR:

Hüzmeli, İrem, Katayıfçı, Nihan, Yalçın, Fatih, Hüzmeli, Esra Doğru

QUELLE / SOURCE:

International Journal of Clinical Practice, 2024/february, Vol. 2024, 1–13, DOI: https://doi.org/10.1155/2024/4136457

ABSTRAKT / ABSTRACT:

Purpose: To explore the effects of different inspiratory muscle training (IMT) loads on exercise capacity, respiratory function, and quality of life in hypertension (HT) patients. Method: 45 HT patients were randomized into three groups with varying IMT loads (control, low-load, high-load). Results: Both low- and high-load IMT groups showed significant improvements in exercise capacity and respiratory function, with high-load showing the most improvement in physical activity levels. Conclusion: IMT effectively improves physical and respiratory outcomes in HT patients, with high-load protocols showing greater benefits.

6.1.55 Ventilatory Muscle Training for Early Cardiac Rehabilitation Improved Functional Capacity and Modulated Vascular Function of Individuals Undergoing Coronary Artery Bypass Grafting: Pilot Randomized Clinical Trial

AUTOR: IN / AUTHOR:

Eibel, Bruna, Marques, Juliana R., Dipp, Thiago, Waclawovsky, Gustavo, Marschner, Rafael A., Boll, Liliana C., Kalil, Renato A. K., Lehnen, Alexandre M., Sales, Allan R. K., Irigoyen, Maria Claudia Costa

QUELLE / SOURCE:

International Journal of Environmental Research and Public Health, 2022/july, Vol. 19, No. 15, 9340, DOI: https://doi.org/10.3390/ijerph19159340

ABSTRAKT / ABSTRACT:

Purpose: To assess the effects of early ventilatory muscle training (VMT) on functional capacity and vascular function in individuals post-CABG (coronary artery bypass grafting). Method: Patients were randomly assigned to ventilatory muscle training (VMT), handgrip exercise (isometric), or a control group (conventional therapy). Results: VMT improved functional capacity (6-MWT) and had a positive impact on vascular function (flow-mediated dilation). Conclusion: VMT can improve functional capacity and modulate vascular function in CABG patients, suggesting its inclusion in early cardiac rehabilitation.

6.1.56 Effect of respiratory muscle training on dysphagia in stroke patients—A retrospective pilot study

AUTOR: IN / AUTHOR:

Arnold, Robert J., Bausek, Nina

QUELLE / SOURCE:

Laryngoscope Investigative Otolaryngology, 2020/october, Vol. 5, No. 6, 1050–1055, DOI: https://doi.org/10.1002/lio2.483

ABSTRAKT / ABSTRACT:

Background Dysphagia is prevalent with cerebrovascular accidents and contributes to the burden of disease and mortality. Strengthening dysfunctional swallow muscles through respiratory muscle training (RMT) has proven effective in improving swallow effectiveness and safety. However, approaches to strengthen only the expiratory muscle groups (EMST) dominate the clinical study literature, with variable outcomes. This study investigated the effect of simultaneous inspiratory-expiratory muscle strengthening to improve swallowing function in stroke patients.

Methods Recorded data of 20 patients receiving pro bono medical care for dysphagia following stroke were allocated to intervention (IG) or control group (CG) based upon whether they chose combined RMT (cRMT) or not while awaiting swallow therapy services. The intervention group was treated with three 5-minute sessions of resistive respiratory muscle training for 28 days, while the control group received no RMT or other exercise intervention. Respiratory and swallow outcomes were assessed pre- and post-intervention and included Mann Assessment of Swallowing Ability (MASA), fiberoptic endoscopic evaluation of swallowing (FEES) with penetration-aspiration scale (PAS), functional oral intake scale (FOIS), patient visual analogue scale (VAS), and peak expiratory flow (PEF).

Results After 28 days, the intervention group demonstrated greater improvements (P value < 0.05) in PEF (IG: 168.03% vs CG: 17.47%), VAS (IG: 103.85% vs CG: 27.54%), MASA (IG: 37.28% vs CG: 6.92%), PAS (IG: 69.84% vs CG: 12.12%), and FOIS (IG: 93.75% vs CG: 21.21%).

Conclusion cRMT is a feasible and effective method to improve signs and symptoms of dysphagia while improving airway protection.

6.1.57 Respiratory muscle dysfunction in acute and chronic respiratory failure: how to diagnose and how to treat?

AUTOR: IN / AUTHOR:

Poddighe, Diego, Van Hollebeke, Marine, Rodrigues, Antenor, Hermans, Greet, Testelmans, Dries, Kalkanis, Alexandros, Clerckx, Beatrix, Gayan-Ramirez, Ghislaine, Gosselink, Rik, Langer, Daniel

QUELLE / SOURCE:

European Respiratory Review, 2024/october, Vol. 33, No. 174, 240150, DOI: https://doi.org/10.1183/16000617.0150-2024

ABSTRAKT / ABSTRACT:

Assessing and treating respiratory muscle dysfunction is crucial for patients with both acute and chronic respiratory failure. Respiratory muscle dysfunction can contribute to the onset of respiratory failure and may also worsen due to interventions aimed at treatment. Evaluating respiratory muscle function is particularly valuable for diagnosing, phenotyping and assessing treatment efficacy in these patients. This review outlines established methods, such as measuring respiratory pressures, and explores novel techniques, including respiratory muscle neurophysiology assessments using electromyography and imaging with ultrasound.

Additionally, we review various treatment strategies designed to support and alleviate the burden on overworked respiratory muscles or to enhance their capacity through training interventions. These strategies range from invasive and noninvasive mechanical ventilation approaches to specialised respiratory muscle training programmes. By summarising both established techniques and recent methodological advancements, this review aims to provide a comprehensive overview of the tools available in clinical practice for evaluating and treating respiratory muscle dysfunction. Our goal is to present a clear understanding of the current capabilities and limitations of these diagnostic and therapeutic approaches. Integrating advanced diagnostic methods and innovative treatment strategies should help improve patient management and outcomes. This comprehensive review serves as a resource for clinicians, equipping them with the necessary knowledge to effectively diagnose and treat respiratory muscle dysfunction in both acute and chronic respiratory failure scenarios.

6.1.58 Similar Weaning Success Rate with High-Intensity and Sham Inspiratory Muscle Training: A Randomized Controlled Trial (IMweanT)

AUTOR: IN / AUTHOR:

Van Hollebeke, Marine, Poddighe, Diego, Hoffman, Mariana, Clerckx, Beatrix, Muller, Jan, Louvaris, Zafeiris, Hermans, Greet, Gosselink, Rik, Langer, Daniel

QUELLE / SOURCE:

American Journal of Respiratory and Critical Care Medicine, 2024/november, DOI: https://doi.org/10.1164/rccm.202405-1042oc

ABSTRAKT / ABSTRACT:

Rationale: Inspiratory muscle training (IMT) improves respiratory muscle function in patients with weaning difficulties. IMT protocols involve performing daily sets of breaths against external loads. However, the impact of IMT on weaning outcomes while incorporating sham control interventions remains unclear. Objectives: To compare the effects of a high-intensity IMT (Hi-IMT) intervention with a sham low-intensity (Lo-IMT) control group on weaning outcomes, respiratory muscle and pulmonary function 28 days after inclusion, in patients with weaning difficulties. Methods: Both groups underwent daily IMT sessions until successful weaning or a maximum of 28 days. The Hi-IMT group (n=44, 61% male, 57±15 years) performed maximal inspirations initiated from residual volume against an external load representing 30-50% of maximal inspiratory pressure (PImax), while the control group (n=46, 52% male, 60±12 years) performed maximal inspirations against a load $\leq$10% PImax. Measurements and Main Results: Training adherence (completed/planned sessions) was comparable between the groups (Hi-IMT: 77±20%, Lo-IMT: 72±17%, p=0.25). Weaning success (64% Hi-IMT and 76% Lo-IMT; p=0.43) and weaning duration (Hi-IMT: 45±48 days, Lo-IMT: 37±26 days, p=0.33) were similar between groups. Both groups similarly improved PImax (Hi-IMT: +15cmH2O [95%CI: 9 ; 20], Lo-IMT: +14cmH2O [95%CI: 9 ; 19], p=0.72). Forced vital capacity improved more in the Hi-IMT than Lo-IMT group (Hi-IMT: +0.33L [95%CI: 0.22 ; 0.43], Lo-IMT: +0.16L [95%CI: 0.07 ; 0.25], p=0.04). Conclusions: Both high-intensity IMT and sham low-intensity IMT, with high adherence to the protocol, resulted in similar weaning success rates and pronounced improvements in maximal inspiratory muscle strength. Clinical trial registration available at www.clinicaltrials.gov, ID: NCT03240263.

6.2 Studien zu IMT bei Herzinsuffizienz / *studies on IMT in heart failure*

6.2.1 The Need for Breathing Training Techniques: The Elephant in the Heart Failure Cardiac Rehabilitation Room: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

Farghaly, Abeer, Fitzsimons, Donna, Bradley, Judy, Sedhom, Magda, Atef, Hady

QUELLE / SOURCE:

International Journal of Environmental Research and Public Health, 2022/november, Vol. 19, No. 22, 14694, DOI: https://doi.org/10.3390/ijerph192214694

ABSTRAKT / ABSTRACT:

Background: Although solid evidence has indicated that respiratory symptoms are common amongst patients with chronic heart failure (CHF), state-of-the-art cardiac rehabilitation (CR) programs do not typically include management strategies to address respiratory symptoms. This study investigated the effect of the addition of breathing exercises (BE) to the CR programs in CHF. Methods: In a two parallel-arm randomized controlled study (RCT), 40 middle-aged patients with CHF and respiratory symptoms were recruited and randomized into two equal groups (n = 20); group (A): standard CR with BE and group (B): standard CR alone. Primary outcomes were respiratory parameters and secondary outcomes included cardiovascular and cardiopulmonary outcomes. All the participants attended a program of aerobic exercise (three sessions/week, 60–75% MHR, 45–55 min) for 12 weeks, plus educational, nutritional, and psychological counseling. Group (A) patients attended the same program together with BE using inspiratory muscle training (IMT) and breathing calisthenics (BC) (six sessions/week, 15–25 min) for the same duration. Results: There was a significant improvement in the respiratory outcomes, and most of the cardiovascular and cardiopulmonary outcomes in both groups with a greater change percentage in group A ($p < 0.05$). Conclusions: These results indicate that the addition of BE to the CR programs in CHF is effective and is a “patient-centered” approach.

6.2.2 Effects of Respiratory Muscle Training on Exercise Capacity, Quality of Life, and Respiratory and Pulmonary Function in People With Ischemic Heart Disease: Systematic Review and Meta-Analysis

AUTOR: IN / AUTHOR:

Fabero-Garrido, Raúl, del Corral, Tamara, Plaza-Manzano, Gustavo, Sanz-Ayan, Paz, Izquierdo-García, Juan, López-de-Uralde-Villanueva, Ibai

QUELLE / SOURCE:

Physical Therapy, 2023/november, Vol. 104, No. 3, DOI: https://doi.org/10.1093/ptj/pzad164

ABSTRAKT / ABSTRACT:

Objective: This systematic review and meta-analysis aimed to evaluate the effects of respiratory muscle training (RMT) on functional exercise capacity, health-related quality of life (HRQoL), respiratory muscle function, and pulmonary function in individuals with ischemic heart disease (IHD).

Methods: The MEDLINE, Web of Science, Scopus, PEDro, CINAHL, Science Direct, and CENTRAL electronic databases were searched in January 2023. Randomized controlled trials published in English, Spanish, or Portuguese that were conducted to determine the effect of RMT versus passive control and/or sham RMT on the target variables in individuals with IHD, irrespective of age or sex were included. Two reviewers performed the searches and extraction of the most relevant data. The quality and risk of bias for each included study were examined with the PEDro scale and Cochrane risk-of-bias tool.

Results: Thirteen studies (849 participants) were included. The meta-analysis showed a significant increase in peak oxygen consumption (mean difference [MD] = 2.18 mL·kg-1·min-1 [95% CI = 0.54 to 3.83]), inspiratory muscle strength (MD = 16.62 cm H2O [95% CI = 12.48 to 20.77]), inspiratory muscle endurance (standardized mean difference = 0.39 [95% CI = 0.19 to 0.60]), and expiratory muscle strength (MD = 14.52 cm H2O [95% CI = 5.51 to 23.53]). There were no benefits in 6-minute walking distance (MD = 37.57 m [95% CI = -36.34 to 111.48]), HRQoL (standardized mean difference = 0.22 [95% CI = -0.16 to 0.60]), pulmonary function (forced vital capacity; MD = 2.07% of predicted value [95% CI = -0.90 to 5.03], or forced expiratory volume at the first second (MD = -0.75% of predicted value [95% CI = -5.45 to 3.95]).

Conclusion: This meta-analysis provided high- and moderate-quality evidence that inspiratory muscle training (IMT) improves inspiratory muscle strength and endurance, respectively; and very low-quality evidence for effects on peak oxygen consumption and expiratory muscle strength in individuals with IHD. No superior

effects were found in the 6-minute walking test, HRQoL, or pulmonary function compared with the control group.

Impact: The results shown in this systematic review with meta-analysis will provide clinicians a better understanding of the effects of IMT in people with IHD. IMT could be integrated into the cardiac rehabilitation management, although more research is needed.

6.2.3 Best mode of inspiratory muscle training in heart failure patients: a systematic review and meta-analysis

AUTOR: IN / AUTHOR:

Sadek, Zahra, Salami, Ali, Joumaa, Wissam H., Awada, Charifa, Ahmaidi, Said, Ramadan, Wiam

QUELLE / SOURCE:

European Journal of Preventive Cardiology, 2018/august, Vol. 25, No. 16, 1691–1701, DOI: https://doi.org/10.1177/2047487318792315

ABSTRAKT / ABSTRACT:

Objectives:The objective of this study was to evaluate the effects of inspiratory muscle training on inspiratory musclestrength, functional capacity and dyspnoea for patients with chronic heart failure, by summarising the published researchon the effects of inspiratory muscle training. To identify the best mode of intervention in terms of: the load of maximalinspiratory pressure; the frequency of sessions; and the total duration of intervention.Methods:A relevant literature research using the PubMed database, Cochrane and references of published studies,from 1998 to 2016, was conducted. Out of 65 randomised controlled trials, seven were considered as potentiallyrelevant and were retrieved for detailed analysis. The methodological quality of each randomised controlled trial wasrated using the physiotherapy evidence database scale.Results:The included seven studies contained data on 203 patients. Typical training protocols involved training three, sixor seven times per week with intensity ranging from 30% to 60% and for a duration ranging from 6 to 12 weeks. Maximalinspiratory pressure, walking distance and dyspnoea were improved in all studies and especially in those who set a load of60% in their maximal inspiratory pressure, and have trained patients six times per week for 12 weeks.Conclusion:In chronic heart failure patients, inspiratory muscle training results in a marked improvement in inspiratorymuscle strength, walking distance and dyspnoea, notably when training patients at 60% of maximal inspiratory pressure,six times per week and for 12 weeks. A small number of studies and heterogeneity among studies may limit the findingsof the present study.

6.2.4 2022 ACC/AHA/HFSA Guideline for the Management of Heart Failure

AUTOR: IN / AUTHOR:

Heidenreich, Paul A., Bozkurt, Biykem, Aguilar, David, Allen, Larry A., Byun, Joni J., Colvin, Monica M., Deswal, Anita, Drazner, Mark H., Dunlay, Shannon M., Evers, Linda R., Fang, James C., Fedson, Savitri E., Fonarow, Gregg C., Hayek, Salim S., Hernandez, Adrian F., Khazanie, Prateeti, Kittleson, Michelle M., Lee, Christopher S., Link, Mark S., Milano, Carmelo A., Nnacheta, Lorraine C., Sandhu, Alexander T., Stevenson, Lynne Warner, Vardeny, Orly, Vest, Amanda R., Yancy, Clyde W., Beckman, Joshua A., O'Gara, Patrick T., Al-Khatib, Sana M., Armbruster, Anastasia L., Birtcher, Kim K., Cigarroa, Joaquin E., de las Fuentes, Lisa, Deswal, Anita, Dixon, Dave L., Fleisher, Lee A., Gentile, Federico, Goldberger, Zachary D., Gorenek, Bulent, Haynes, Norrisa, Hernandez, Adrian F., Hlatky, Mark A., Joglar, José A., Jones, W. Schuyler, Marine, Joseph E., Mark, Daniel B., Mukherjee, Debabrata, Palaniappan, Latha P., Piano, Mariann R., Rab, Tanveer, Spatz, Erica S., Tamis-Holland, Jacqueline E., Wijeysundera, Duminda N., Woo, Y. Joseph

QUELLE / SOURCE:

Journal of Cardiac Failure, 2022/05, Vol. 28, No. 5, e1–e167, DOI: https://doi.org/10.1016/j.cardfail.2022.02.010

ABSTRAKT / ABSTRACT:

Aim: The "2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure" replaces the "2013 ACCF/AHA Guideline for the Management of Heart Failure" and the "2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure." The 2022 guideline is intended to provide patient-centric recommendations for clinicians to prevent, diagnose, and manage patients with heart failure.

Methods: A comprehensive literature search was conducted from May 2020 to December 2020, encompassing studies, reviews, and other evidence conducted on human subjects that were published in English from MEDLINE (PubMed), EMBASE, the Cochrane Collaboration, the Agency for Healthcare Research and Quality, and other relevant databases. Additional relevant clinical trials and research studies, published through September 2021, were also considered. This guideline was harmonized with other American Heart Association/American College of Cardiology guidelines published through December 2021.

Structure: Heart failure remains a leading cause of morbidity and mortality globally. The 2022 heart failure guideline provides recommendations based on contemporary evidence for the treatment of these patients. The recommendations present an evidence-based approach to managing patients with heart failure, with the

intent to improve quality of care and align with patients' interests. Many recommendations from the earlier heart failure guidelines have been updated with new evidence, and new recommendations have been created when supported by published data. Value statements are provided for certain treatments with high-quality published economic analyses

6.2.5 Inspiratory Muscle Training in Patients With Heart Failure: What Is New? Systematic Review and Meta-Analysis

AUTOR: IN / AUTHOR:

Azambuja, Aline de Cassia Meine, de Oliveira, Luma Zanatta, Sbruzzi, Graciele

QUELLE / SOURCE:

Physical Therapy, 2020/september, Vol. 100, No. 12, 2099–2109, DOI: https://doi.org/10.1093/ptj/pzaa171

ABSTRAKT / ABSTRACT:

Objective: The benefits of inspiratory muscle training (IMT) have already been demonstrated in patients with heart failure (HF), but the best mode of training and which patients benefit from this intervention are not clear. The purpose of this study was to review the effects of IMT on respiratory muscle strength, functional capacity, pulmonary function, quality of life, and dyspnea in patients with HF; IMT isolated or combined with another intervention (combined IMT), the presence of inspiratory muscle weakness, training load, and intervention time were considered.

Methods: The search included the databases MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, Physiotherapy Evidence Database, and LILACS database through September 2019. The review included randomized studies that assessed IMT in isolation or combined with another intervention-in comparison with a control group, a placebo, or another intervention-in patients with HF. Fourteen studies were included, 13 for meta-analysis (10 for isolated IMT and 3 for combined IMT).

Results: Isolated IMT demonstrated an increase in maximal inspiratory pressure (MIP) (25.12 cm H2O; 95% CI = 15.29 - 34.95), 6-Minute Walk Test (81.18 m; 95% CI = 9.73 - 152.63), maximum oxygen consumption (12 weeks: 3.75 mL/kg/min; 95% CI = 2.98 to 4.51), and quality of life (-20.68; 95% CI = -29.03 to -12.32). The presence of inspiratory muscle weakness, higher loads, and longer intervention times resulted in greater increases in MIP. IMT combined with another intervention demonstrated an increase only in MIP.

Conclusions: Isolated IMT resulted in an increase in inspiratory muscle strength, functional capacity, and quality of life. IMT combined with another intervention resulted only in a small increase in inspiratory strength. Isolated IMT with higher loads can be considered an adjuvant intervention, especially for those who do not adhere to conventional rehabilitation and who have respiratory muscle weakness.

Impact: A systematic review was necessary to review the effects of IMT on respiratory muscle strength, lung function, functional capacity, quality of life, and dyspnea in patients with HF. Various clinical issues important for a better training prescription were considered; these included whether the performance of the training IMT as a form of isolated training benefits patients with HF, whether the combination of IMT with another intervention has additional effects, whether any patient with HF can benefit from IMT (alone or combined with another intervention), and whether only patients who already have respiratory muscle weakness benefit. Also important was establishing which training load provides the best result and the best intervention time, so that health care can be provided more efficiently.

Lay summary: For people with heart failure, IMT by itself, without being combined with other exercise, can improve ease of breathing, increase the amount of distance that they can walk, and improve quality of life. Inspiratory training with higher loads might be helpful for those with respiratory muscle weakness who are unable to do conventional exercise.

6.2.6 Combined aerobic/inspiratory muscle training vs. aerobic training in patients with chronic heart failure: The Vent-HeFT trial: a European prospective multicentre randomized trial

AUTOR: IN / AUTHOR:

Adamopoulos, Stamatis, Schmid, Jean-Paul, Dendale, Paul, Poerschke, Daniel, Hansen, Dominique, Dritsas, Athanasios, Kouloubinis, Alexandros, Alders, Toon, Gkouziouta, Aggeliki, Reyckers, Ilse, Vartela, Vasiliki, Plessas, Nikos, Doulaptsis, Costas, Saner, Hugo, Laoutaris, Ioannis D.

QUELLE / SOURCE:

European Journal of Heart Failure, 2014/march, Vol. 16, No. 5, 574–582, DOI: https://doi.org/10.1002/ejhf.70

ABSTRAKT / ABSTRACT:

Aims Vent-HeFT is a multicentre randomized trial designed to investigate the potential additive benefits of inspiratory muscle training (IMT) on aerobic training (AT) in patients with chronic heart failure (CHF).

Methods and results Forty-three CHF patients with a mean age of 58 ± 12 years, peak oxygen consumption (peak VO2) 17.9 ± 5 mL/kg/min, and LVEF 29.5 ± 5% were randomized to an AT/IMT group (n = 21) or to an AT/SHAM group (n = 22) in a 12-week exercise programme. AT involved 45 min of ergometer training at 70–80% of maximum heart rate, three times a week for both groups. In the AT/IMT group, IMT was performed at 60% of sustained maximal inspiratory pressure (SPImax) while in the AT/SHAM group it was performed at 10% of SPImax, using a computer biofeedback trainer for 30 min, three times a week. At baseline and at 3 months, patients were evaluated for exercise capacity, lung function, inspiratory muscle strength (PImax) and work capacity (SPImax), quality of life (QoL), LVEF and LV diameter, dyspnoea, C-reactive protein (CRP), and NT-proBNP. IMT resulted in a significantly higher benefit in SPImax ($P = 0.02$), QoL ($P = 0.002$), dyspnoea ($P = 0.004$), CRP ($P = 0.03$), and NT-proBNP ($P = 0.004$). In both AT/IMT and AT/SHAM groups PImax ($P < 0.001$, $P = 0.02$), peak VO2 ($P = 0.008$, $P = 0.04$), and LVEF ($P = 0.005$, $P = 0.002$) improved significantly; however, without an additional benefit for either of the groups.

Conclusion This randomized multicentre study demonstrates that IMT combined with aerobic training provides additional benefits in functional and serum biomarkers in patients with moderate CHF. These findings advocate for application of IMT in cardiac rehabilitation programmes.

6.2.7 Effects of resistive breathing on exercise capacity and diaphragm function in patients with ischaemic heart disease

AUTOR: IN / AUTHOR:

Darnley, G. Murray, Gray, Alison C., McClure, Samuel J., Neary, Paul, Petrie, Mark, McMurray, John J. V., MacFarlane, Niall G.

QUELLE / SOURCE:

European Journal of Heart Failure, 1999/august, Vol. 1, No. 3, 297–300, DOI: https://doi.org/10.1016/s1388-9842(99)00027-6

ABSTRAKT / ABSTRACT:

Background: Muscle weakness has been suggested to result from the deconditioning that accompanies decreased activity levels in chronic cardiopulmonary diseases. The benefits of standard exercise programmes on exercise capacity and muscular strength in disease and health are well documented and exercise capacity is a significant predictor of survival in patients with chronic heart failure (CHF). Selective respiratory muscle training has been shown to improve exercise tolerance in CHF and such observations have been cited to support the suggestion that respiratory muscle weakness contributes to a reduced exercise capacity (despite biopsies showing the metabolic profile of a well trained muscle).

Aims: This study aimed to determine the effects of selective inspiratory muscle training on patients with chronic coronary artery disease to establish if an improved exercise capacity can be obtained in patients that are not limited in their daily activities.

Methods: Nine male patients performed three exercise tests (with respiratory and diaphragm function assessed before the third test) then undertook a 4-week programme of inspiratory muscle training. Exercise tolerance, respiratory and diaphragmatic function were re-assessed after training.

Results: Exercise capacity improved from 812+/-42 to 864+/-49 s, P<0.05, and velocity of diaphragm shortening increased (during quiet breathing from 12.8+/-1.6 to 19.4+/-1.1 mm s(-1), P<0.005, and sniffing from 71.9+/-9.4 to 110.0+/-12.3 mm s(-1), P<0.005). In addition, five from nine patients were stopped by breathlessness before training; whereas only one patient was stopped by breathlessness after training.

Conclusion: The major findings in this study were that a non-intensive 4-week training programme of resistive breathing in patients with chronic coronary artery disease led to an increase in exercise capacity and a

decrease in dyspnoea when assessed by symptom limited exercise testing. These changes were associated with significant increases in the velocity of diaphragmatic excursions during quiet breathing and sniffing. Patients that exhibited small diaphragmatic excursions during quiet breathing were most likely to improve their exercise capacity after the training programme. However, the inspiratory muscle-training programme was not associated with any significant changes in respiratory mechanics when peak flow rate, forced expiratory volume and forced vital capacity were measured. The resistive breathing programme used here resulted in a significant increase in the velocity of diaphragm movement during quiet breathing and sniffing. In other skeletal muscles, speed of contraction can be determined by the relative proportion of fibre types and muscle length (Jones, Round, Skeletal Muscle in Health and Disease. Manchester: University Press, 1990). The intensity of the training programme used here, however, is unlikely to significantly alter muscle morphology or biochemistry. Short-term training studies have shown that there can be increases in strength and velocity of shortening that do not relate to changes in muscle biochemistry or morphology. These changes are attributed to the neural adaptations that occur early in training (Northridge et al., Br. Heart J. 1990; 64: 313-316). Independent of the mechanisms involved, this small, uncontrolled study suggests that inspiratory muscle training may improve exercise capacity, diaphragm function and symptoms of breathlessness in patients with chronic coronary artery disease even in the absence of heart failure.

6.2.8 Inspiratory Muscle Training Improves Blood Flow to Resting and Exercising Limbs in Patients With Chronic Heart Failure

AUTOR: IN / AUTHOR:

Chiappa, Gaspar R., Roseguini, Bruno T., Vieira, Paulo J. C., Alves, Cristiano N., Tavares, Angela, Winkelmann, Eliane R., Ferlin, Elton L., Stein, Ricardo, Ribeiro, Jorge P.

QUELLE / SOURCE:

Journal of the American College of Cardiology, 2008/april, Vol. 51, No. 17, 1663–1671, DOI: https://doi.org/10.1016/j.jacc.2007.12.045

ABSTRAKT / ABSTRACT:

Objectives: We tested the hypothesis that inspiratory muscle loading could result in exaggerated peripheral vasoconstriction in resting and exercising limbs and that inspiratory muscle training (IMT) could attenuate this effect in patients with chronic heart failure (CHF) and inspiratory muscle weakness.

Background: Inspiratory muscle training improves functional capacity of patients with CHF, but the mechanisms of this effect are unknown.

Methods: Eighteen patients with CHF and inspiratory muscle weakness (maximal inspiratory pressure <70% of predicted) and 10 healthy volunteers participated in the study. Inspiratory muscle loading was induced by the addition of inspiratory resistance of 60% of maximal inspiratory pressure, while blood flow to the resting calf (CBF) and exercising forearm (FBF) were measured by venous occlusion plethysmography. For the patients with CHF, blood flow measurements as well as ultrasound determination of diaphragm thickness were made before and after a 4-week program of IMT.

Results: With inspiratory muscle loading, CHF patients demonstrated a more marked reduction in resting CBF and showed an attenuated rise in exercising FBF when compared with control subjects. After 4 weeks of IMT, CHF patients presented hypertrophy of the diaphragm and improved resting CBF and exercise FBF with inspiratory muscle loading.

Conclusions: In patients with CHF and inspiratory muscle weakness, inspiratory muscle loading results in marked reduction of blood flow to resting and exercising limbs. Inspiratory muscle training improves limb blood flow under inspiratory loading in these patients.

6.2.9 Inspiratory muscle training in heart disease and heart failure: a review of the literature with a focus on method of training and outcomes

AUTOR: IN / AUTHOR:

Cahalin, Lawrence P., Arena, Ross, Guazzi, Marco, Myers, Jonathan, Cipriano, Gerson, Chiappa, Gaspar, Lavie, Carl J., Forman, Daniel E.

QUELLE / SOURCE:

Expert Review of Cardiovascular Therapy, 2013/february, Vol. 11, No. 2, 161–177, DOI: https://doi.org/10.1586/erc.12.191

ABSTRAKT / ABSTRACT:

Evidence to date strongly suggests that poor inspiratory muscle performance is associated with dyspnea, poor exercise tolerance and poor functional status in patients with heart failure (HF). A growing body of literature has examined the effects of inspiratory muscle training (IMT) in HF patients with the majority of studies reporting favorable effects on several of the above limitations and a substantial number of related deficiencies due to inadequate inspiration and inspiratory muscle strength and endurance. The domains and manifestations of HF, which were significantly improved by IMT in one or more of the 18 out of 19 studies of IMT, included dyspnea, quality of life, balance, peripheral muscle strength and blood flow, peripheral muscle sympathetic nervous activity, heart rate, respiratory rate, peak VO2, 6-min walk test distance, ventilation, VE/VCO2 slope, oxygen uptake efficiency, circulatory power, recovery oxygen kinetics and several indices of cardiac performance. This paper will also review the available IMT literature with a focus on methods of IMT and clinical outcomes. Key differences between available IMT methods will be highlighted with a goal to improve IMT efforts and decrease the pathophysiological manifestations of heart disease and HF.

6.2.10 A comparison of the effects of inspiratory muscle strength and endurance training on exercise capacity, respiratory muscle strength and endurance, and quality of life in pacemaker patients with heart failure: A randomized study

AUTOR: IN / AUTHOR:

Katayıfçı, Nihan, BoŞnak Güçlü, Meral, Şen, Fatih

QUELLE / SOURCE:

Heart & Lung, 2022/september, Vol. 55, 49–58, DOI: https://doi.org/10.1016/j.hrtlng.2022.04.006

ABSTRAKT / ABSTRACT:

BACKGROUND: Studies have widely investigated the effects of inspiratory muscle strength training in patients with heart failure (HF). The effects of inspiratory muscle strength or endurance training on outcomes in patients with pacemakers have not been adequately studied.

OBJECTIVES: The aim was to compare the effects of inspiratory muscle strength and endurance training on exercise capacity, quality of life (QoL), peripheral and respiratory muscle strength, respiratory muscle endurance, pulmonary function, dyspnea, fatigue, and physical activity levels in pacemaker patients with HF.

RESULTS: Significant improvements were present in MIP, MEP, respiratory muscle endurance, peripheral muscle strength, 6MWT and ISWT walking distances, dyspnea, QoL, physical activity level, fatigue scores within groups. However, no significant differences between the groups.

CONCLUSIONS: Inspiratory muscle strength and endurance training similarly improve respiratory and peripheral muscle strength, exercise capacity, QoL, physical activity level, and decrease dyspnea and fatigue in pacemaker patients with HF.

6.2.11 Application of Inspiratory Muscle Training to Improve Physical Tolerance in Older Patients with Ischemic Heart Failure

AUTOR: IN / AUTHOR:

Piotrowska, Monika, Okrzymowska, Paulina, Kucharski, Wojciech, RoŻek-Piechura, Krystyna

QUELLE / SOURCE:

International Journal of Environmental Research and Public Health, 2021/november, Vol. 18, No. 23, 12441, DOI: https://doi.org/10.3390/ijerph182312441

ABSTRAKT / ABSTRACT:

OBJECTIVES: The aim was to evaluate the effect of inspiratory muscle training (IMT) on exercise tolerance and the functional parameters of respiratory muscle strength in patients with heart failure involved in cardiac rehabilitation. The study included 90 patients with HF.

RESULTS: Significant statistical improvement was observed in hemodynamic parameters, lung function parameters, and respiratory muscle strength in the IMT group.

CONCLUSIONS: The addition of IMT to the standard rehabilitation process increases the therapeutic effect and improves some of the measured parameters, including exercise tolerance and respiratory function.

6.2.12 Effects of high intensity interval-based inspiratory muscle training in patients with heart failure: A single-blind randomized controlled trial

AUTOR: IN / AUTHOR:

Tanriverdi, Aylin, Savci, Sema, Ozcan Kahraman, Buse, Odaman, Huseyin, Ozpelit, Ebru, Senturk, Bihter, Ozsoy, Ismail, Baran, Agah, Akdeniz, Bahri, Acar, Serap, Balci, Ali

QUELLE / SOURCE:

Heart & Lung, 2023/november, Vol. 62, 1–8, DOI: https://doi.org/10.1016/j.hrtlng.2023.05.011

ABSTRAKT / ABSTRACT:

OBJECTIVES: The study aimed to determine the effects of high-intensity interval-based inspiratory muscle training (H-IMT) on cardiovascular, pulmonary, physical, and psychosocial functions in patients with heart failure and reduced ejection fraction (HFrEF).

RESULTS: Statistically significant between-group differences were observed in heart rate variability, arterial stiffness, inspiratory and quadriceps muscle strength, respiratory muscle endurance, diaphragm thickness, functional capacity, frailty, dyspnea, fatigue, and quality of life in favor of the H-IMT group.

CONCLUSIONS: H-IMT is an effective protocol for improving cardiac autonomic function, arterial stiffness, muscle strength, respiratory muscle endurance, functional capacity, frailty, and quality of life in patients with HFrEF.

6.2.13 Effects of Inspiratory Muscle Training in Patients With Class III and IV Heart Failure

AUTOR: IN / AUTHOR:

Andrade, Carla Cristina Ferreira, Silva, Rodrigo Tavares, Brunherotti, Marisa Afonso de Andrade

QUELLE / SOURCE:

Current Problems in Cardiology, 2022/october, Vol. 47, No. 10, 101307, DOI: https://doi.org/10.1016/j.cpcardiol.2022.101307

ABSTRAKT / ABSTRACT:

OBJECTIVES: The study evaluated the effects of inspiratory muscle training (IMT) on functional capacity and quality of life in patients with heart failure (HF) in functional class III and IV.

RESULTS: Significant improvements in 6-minute walk test, heart rate, respiratory rate, respiratory muscle strength, and systolic/diastolic blood pressure were observed. An increase in quality of life was also noted ($P < 0.01$).

CONCLUSIONS: IMT improved functional capacity and quality of life in patients with advanced HF, suggesting its inclusion in rehabilitation programs for these patients.

6.2.14 A randomized controlled trial of high-intensity interval training and inspiratory muscle training for chronic heart failure patients with inspiratory muscle weakness

AUTOR: IN / AUTHOR:

Sadek, Zahra, Salami, Ali, Youness, Mahmoud, Awada, Charifa, Hamade, Malek, Joumaa, Wissam H., Ramadan, Wiam, Ahmaidi, Said

QUELLE / SOURCE:

Chronic Illness, 2020/05, Vol. 18, No. 1, 140–154, DOI: https://doi.org/10.1177/1742395320920700

ABSTRAKT / ABSTRACT:

OBJECTIVES: The study aimed to investigate whether combining high-intensity interval training (HI-AIT) with inspiratory muscle training (IMT) would improve inspiratory muscle function, exercise capacity, and quality of life in chronic heart failure patients with inspiratory muscle weakness.

RESULTS: The combined group showed additional significant improvement in inspiratory muscle function, exercise time, and quality of life compared to the HI-AIT and IMT alone groups.

CONCLUSIONS: The combination of HI-AIT and IMT is more effective than either treatment alone in improving respiratory muscle function, exercise performance, and quality of life in chronic heart failure patients.

6.2.15 Inspiratory muscle training in stroke patients with congestive heart failure: A CONSORT-compliant prospective randomized single-blind controlled trial

AUTOR: IN / AUTHOR:

Chen, Po-Cheng, Liaw, Mei-Yun, Wang, Lin-Yi, Tsai, Yu-Chin, Hsin, Yi-Jung, Chen, Yung-Che, Chen, Shyh-Ming, Lin, Meng-Chih

QUELLE / SOURCE:

Medicine, 2016/september, Vol. 95, No. 37, e4856, DOI: https://doi.org/10.1097/md.0000000000004856

ABSTRAKT / ABSTRACT:

Background Cardiopulmonary function can be adversely affected after a cerebrovascular accident in patients with congestive heart failure (CHF). The aim of this study was to investigate the efficacy and feasibility of inspiratory muscle training (IMT) for stroke patients with CHF.

Methods A prospective randomized single-blind controlled trial was conducted in a single tertiary medical center in southern Taiwan between May 2011 and July 2015. Forty-one patients were enrolled, of whom 21 completed the study (IMT group n = 11 and control group n = 10). Both groups participated in a conventional stroke rehabilitation program. Patients in the IMT group received an additional IMT program beginning with an intensity of 30% maximal inspiratory pressure (MIP), then increased by 2cmH2O each week for 30 minutes daily for at least 5 days a week for 10 weeks. MIP, maximal expiratory pressure, spirometry, resting oxyhemoglobin saturation, modified Borg Scale, Fatigue Assessment Scale, and Barthel Index were assessed in each patient.

Results There were significant differences from baseline in MIP (P = 0.008), percent predicted forced vital capacity (P = 0.033), forced expiratory volume in 1 second (FEV1) (P = 0.008), percent predicted FEV1 (P = 0.008), and Barthel Index (P = 0.012) in the IMT group, and Barthel Index (P = 0.027) in the control group. There were significant differences between groups in MIP (20.91 ± 19.73 vs −9.00 ± 26.01, adjusted P value = 0.023) and Barthel Index (24.55 ± 22.30 vs 7.50 ± 8.25, adjusted P value = 0.044).

Conclusion The 10-week IMT was feasible and effective in improving inspiratory force and activities of daily living for the stroke patients with CHF.

6.2.16 Respiratory training interventions improve health status of heart failure patients: A systematic review and network meta-analysis of randomized controlled trails

AUTOR: IN / AUTHOR:

Wang, Mei-Hua, Yeh, Mei-Ling

QUELLE / SOURCE:

World Journal of Clinical Cases, 2019/september, Vol. 7, No. 18, 2760–2775, DOI: https://doi.org/10.12998/wjcc.v7.i18.2760

ABSTRAKT / ABSTRACT:

Background: Prior studies indicate that doing breathing exercises improves physical performance and quality of life (QoL) in heart failure patients. However, these effects remain unclear and contradictory.

Aim: To determine the effects of machine-assisted and non-machine-assisted respiratory training on physical performance and QoL in heart failure patients.

Methods: This was a systematic review and network meta-analysis study. A literature search of electronic databases was conducted for randomized controlled trials (RCTs) on heart failure. Respiratory training interventions were grouped as seven categories: IMT_Pn (inspiratory muscle training without pressure or < 10% maximal inspiratory pressure, MIP), IMT_Pl (inspiratory muscle training with low pressure, 10%-15% MIP), IMT_Pm (inspiratory muscle training with medium pressure, 30%-40% MIP), IMT_Ph (inspiratory muscle training with high pressure, 60% MIP or MIP plus aerobics), Aerobics (aerobic exercise or weight training), Qi_Ex (tai chi, yoga, and breathing exercise), and none. The four outcomes were heart rate, peak oxygen uptake (VO2 peak), 6-min walking distance test (6MWT), and Minnesota Living with Heart Failure QoL. The random-effects model, side-splitting model, and the surface under the cumulative ranking curve (SUCRA) were used to test and analyze the data.

Results: A total of 1499 subjects from 31 RCT studies were included. IMT_Ph had the highest effect sizes for VO2 peak and 6MWT, IMT_Pm highest for QoL, and Qi_Ex highest for heart rate. Aerobics had the second highest for VO2 peak, Qi_Ex second highest for 6MWT, and IMT_Ph second highest for heart rate and QoL.

Conclusion: This study supports that high- and medium-intensity machine-assisted training improves exercise capacity and QoL in hospital-based heart failure patients. After hospital discharge, non-machine-assisted training continuously improves cardiac function.

6.3 Studien zu IMT bei Asthma / *studies on IMT in asthma*

6.3.1 Effect of Inspiratory Muscle Training in the Management of Patients With Asthma: A RANDOMIZED CONTROLLED TRIAL

AUTOR: IN / AUTHOR:

Duruturk, Neslihan, Acar, Manolya, Doğrul, Mustafa Ilgaz

QUELLE / SOURCE:

Journal of Cardiopulmonary Rehabilitation and Prevention, 2018/05, Vol. 38, No. 3, 198–203, DOI: https://doi.org/10.1097/hcr.0000000000000318

ABSTRAKT / ABSTRACT:

Purpose: The aim of this study was to investigate the effects of inspiratory muscle training (IMT) on respiratory muscle strength, exercise capacity, dyspnea, fatigue, quality of life, and daily living activities of asthmatic patients.

Methods: Thirty-eight asthmatic patients, between 18 and 65 years of age, were enrolled in the study and randomly divided into 2 groups; IMT (n = 20) or control (n = 18). Participants in the IMT group performed 30 breaths using a patient-specific threshold pressure device, twice daily for 6 wk at 50% maximal inspiratory pressure (MIP), in addition to "breathing training" during this period. Participants in the control group performed only the "breathing training" (sham or no threshold pressure device). Outcome measurements, performed before and after the intervention, included pulmonary function test, respiratory muscle strength, 6-min walk test, modified Medical Research Council dyspnea scale, St George's Respiratory Questionnaire, Fatigue Severity Scale, and London Chest Activity of Daily Living scale.

Results: Among the outcomes in the study, changes to key variables including MIP (P < .01); MIP, percent predicted (P < .01); maximal expiratory pressure (MEP), percent predicted (P < .01); 6-min walk test walking distance (P = .001); modified Medical Research Council scale (P =<.001); Fatigue Severity Scale (P = .03); St George's Respiratory Questionnaire symptoms (P = .03); London Chest Activity of Daily Living domestic (P = .03); and London Chest Activity of Daily Living leisure (P = .01) were significantly different in favor of IMT versus control.

Conclusion: These findings suggest that IMT may be an effective modality to enhance respiratory muscle strength, exercise capacity, quality of life, daily living activities, reduced perception of dyspnea, and fatigue in asthmatic patients.

6.3.2 Inspiratory muscle training and respiratory exercises in children with asthma

AUTOR: IN / AUTHOR:

Lima, Elisângela Veruska Nóbrega Crispim Leite, Lima, Willy Leite, Nobre, Adner, Santos, Alcione Miranda dos, Brito, Luciane Maria Oliveira, Costa, Maria do Rosário da Silva Ramos

QUELLE / SOURCE:

Jornal Brasileiro de Pneumologia, 2008/august, Vol. 34, No. 8, 552–558, DOI: https://doi.org/10.1590/s1806-37132008000800003

ABSTRAKT / ABSTRACT:

Objective: The aim of the present study was to evaluate the effects that inspiratory muscle training (IMT) and respiratory exercises have on muscle strength, peak expiratory flow (PEF) and severity variables in children with asthma.

Methods: This was a randomized analytical study involving 50 children with asthma allocated to one of two groups: an IMT group, comprising 25 children submitted to IMT via an asthma education and treatment program; and a control group, comprising 25 children who were submitted only to monthly medical visits and education on asthma. The IMT was performed using a pressure threshold load of 40% of maximal inspiratory pressure (MIP). The results were evaluated using analysis of variance, the chi-square test and Fisher's exact test, values of $p > 0.05$ being considered significant.

Results: In the comparative analysis, pre- and post-intervention values of MIP, maximal expiratory pressure (MEP) and PEF increased significantly in the IMT group: MIP from -;48.32 +/- 5.706 to -;109.92 +/- 18.041 ($p < 0.0001$); MEP from 50.64 +/- 6.55 to 82.04 +/- 17.006 ($p < 0.0001$); and PEF from 173.6 +/- 50.817 to 312 +/- 54.848 ($p < 0.0001$). In the control group, however, there were no significant differences between the two time points in terms of MIP or MEP, although PEF increased from 188 +/- 43.97 to 208.80 +/- 44.283 ($p < 0.0001$). There was a significant improvement in the severity variables in the IMT group ($p < 0.0001$).

Conclusions: Programs involving IMT and respiratory exercises can increase mechanical efficiency of the respiratory muscles, as well as improving PEF and severity variables.

6.3.3 Inspiratory muscle training for asthma

AUTOR: IN / AUTHOR:

Silva, Ivanizia S., Fregonezi, Guilherme A. F., Dias, Fernando A. L., Ribeiro, Cibele T. D., Guerra, Ricardo O., Ferreira, Gardenia M. H.

QUELLE / SOURCE:

Cochrane Library, 2013/september

ABSTRAKT / ABSTRACT:

Background: In some people with asthma, expiratory airflow limitation, premature closure of small airways, activity of inspiratory muscles at the end of expiration and reduced pulmonary compliance may lead to lung hyperinflation. With the increase in lung volume, chest wall geometry is modified, shortening the inspiratory muscles and leaving them at a sub-optimal position in their length-tension relationship. Thus, the capacity of these muscles to generate tension is reduced. An increase in cross-sectional area of the inspiratory muscles caused by hypertrophy could offset the functional weakening induced by hyperinflation. Previous studies have shown that inspiratory muscle training promotes diaphragm hypertrophy in healthy people and patients with chronic heart failure, and increases the proportion of type I fibres and the size of type II fibres of the external intercostal muscles in patients with chronic obstructive pulmonary disease. However, its effects on clinical outcomes in patients with asthma are unclear.

Objectives: To evaluate the efficacy of inspiratory muscle training with either an external resistive device or threshold loading in people with asthma.

Search methods: We searched the Cochrane Airways Group Specialised Register of trials, Cochrane Central Register of Controlled Trials (CENTRAL), ClinicalTrials.gov and reference lists of included studies. The latest search was performed in November 2012.

Selection criteria: We included randomised controlled trials that involved the use of an external inspiratory muscle training device versus a control (sham or no inspiratory training device) in people with stable asthma.

Data collection and analysis: We used standard methodological procedures expected by The Cochrane Collaboration.

Main results: We included five studies involving 113 adults. Participants in four studies had mild to moderate asthma and the fifth study included participants independent of their asthma severity. There were substantial

differences between the studies, including the training protocol, duration of training sessions (10 to 30 minutes) and duration of the intervention (3 to 25 weeks). Three clinical trials were produced by the same research group. Risk of bias in the included studies was difficult to ascertain accurately due to poor reporting of methods.The included studies showed a statistically significant increase in inspiratory muscle strength, measured by maximal inspiratory pressure (PImax) (mean difference (MD) 13.34 cmH2O, 95% CI 4.70 to 21.98, 4 studies, 84 participants, low quality evidence). Our other primary outcome, exacerbations requiring a course of oral or inhaled corticosteroids or emergency department visits, was not reported. For the secondary outcomes, results from one trial showed no statistically significant difference between the inspiratory muscle training group and the control group for maximal expiratory pressure, peak expiratory flow rate, forced expiratory volume in one second, forced vital capacity, sensation of dyspnoea and use of beta2-agonist. There were no studies describing inspiratory muscle endurance, hospital admissions or days off work or school.

Authors' conclusions: There is no conclusive evidence in this review to support or refute inspiratory muscle training for asthma. The evidence was limited by the small number of trials with few participants together with the risk of bias. More well conducted randomised controlled trials are needed. Future trials should investigate the following outcomes: lung function, exacerbation rate, asthma symptoms, hospital admissions, use of medications and days off work or school. Inspiratory muscle training should also be assessed in people with more severe asthma and conducted in children with asthma.

6.3.4 Influence of Gender and Inspiratory Muscle Training on the Perception of Dyspnea in Patients With Asthma

AUTOR: IN / AUTHOR:

Weiner, Paltiel, Magadle, Rasmi, Massarwa, Fareed, Beckerman, Marinella, Berar-Yanay, Noah

QUELLE / SOURCE:

Chest, 2002/july, Vol. 122, No. 1, 197–201, DOI: https://doi.org/10.1378/chest.122.1.197

ABSTRAKT / ABSTRACT:

Background: Men and women respond differently to asthma.

Patients and methods: Maximal inspiratory mouth pressure (P(Imax)), beta(2)-agonist consumption, and perception of dyspnea (POD) were measured in 22 women and 22 men with mild persistent-to-moderate asthma. Next, the women were randomized into two groups: those who received inspiratory muscle training and those who received sham training. The training ended when the P(Imax) of the training group was equal to that of the male subjects. POD was then measured once again.

Results: Baseline P(Imax) was significantly lower ($p < 0.01$) while POD and mean daily beta(2)-agonist consumption were significantly higher in the female subjects. P(Imax) reached the level of the male subjects at the end of the 20th week of training. The increase in the P(Imax) was associated with a statistically significant decrease in mean daily beta(2)-agonist use and in POD to a similar level as in male subjects.

Conclusions: POD and mean daily beta(2)-agonist consumption in asthmatic women are significantly higher, and the P(Imax) significantly lower, than that of their male counterparts. When the P(Imax) of female subjects following training is equal to that in male subjects, the differences in POD and mean daily beta(2)-agonist consumption disappear.

6.3.5 The role of inspiratory muscle training in the management of asthma and exercise-induced bronchoconstriction

AUTOR: IN / AUTHOR:

Shei, Ren-Jay, Paris, Hunter L. R., Wilhite, Daniel P., Chapman, Robert F., Mickleborough, Timothy D.

QUELLE / SOURCE:

The Physician and Sportsmedicine, 2016/april, Vol. 44, No. 4, 327–334, DOI: https://doi.org/10.1080/00913847.2016.1176546

ABSTRAKT / ABSTRACT:

Asthma is a pathological condition comprising of a variety of symptoms which affect the ability to function in daily life. Due to the high prevalence of asthma and associated healthcare costs, it is important to identify low-cost alternatives to traditional pharmacotherapy. One of these low cost alternatives is the use of inspiratory muscle training (IMT), which is a technique aimed at increasing the strength and endurance of the diaphragm and accessory muscles of respiration. IMT typically consists of taking voluntary inspirations against a resistive load across the entire range of vital capacity while at rest. In healthy individuals, the most notable benefits of IMT are an increase in diaphragm thickness and strength, a decrease in exertional dyspnea, and a decrease in the oxygen cost of breathing. Due to the presence of expiratory flow limitation in asthma and exercise-induced bronchoconstriction, dynamic lung hyperinflation is common. As a result of varying operational lung volumes, due in part to hyperinflation, the respiratory muscles may operate far from the optimal portion of the length-tension curve, and thus may be forced to operate against a low pulmonary compliance. Therefore, the ability of these muscles to generate tension is reduced, and for any given level of ventilation, the work of breathing is increased as compared to non-asthmatics. Evidence that IMT is an effective treatment for asthma is inconclusive, due to limited data and a wide variation in study methodologies. However, IMT has been shown to decrease dyspnea, increase inspiratory muscle strength, and improve exercise capacity in asthmatic individuals. In order to develop more concrete recommendations regarding IMT as an effective low-cost adjunct in addition to traditional asthma treatments, we recommend that a standard treatment protocol be developed and tested in a placebo-controlled clinical trial with a large representative sample.

6.4 Studien zu IMT bei COVID-19 / *studies on IMT in COVID-19*

6.4.1 Effect of a home-based inspiratory muscle training programme on functional capacity in postdischarged patients with long COVID: the InsCOVID trial

AUTOR: IN / AUTHOR:

Palau, Patricia, Domínguez, Eloy, Gonzalez, Cruz, Bondía, Elvira, Albiach, Cristina, Sastre, Clara, Martínez, Maria Luz, Núñez, Julio, López, Laura

QUELLE / SOURCE:

BMJ Open Respiratory Research, 2022/december, Vol. 9, No. 1, e001439, DOI: https://doi.org/10.1136/bmjresp-2022-001439

ABSTRAKT / ABSTRACT:

Background: Fatigue and exercise intolerance are the most common symptoms in patients with long COVID.

Aims: This study aimed to evaluate whether a home-based inspiratory muscle training (IMT) programme improves maximal functional capacity in patients' long COVID after a previous admission due to SARS-CoV-2 pneumonia.

Methods: This study was a single-centre, blinded assessor, randomised controlled trial. Twenty-six patients with long COVID and a previous admission due to SARS-CoV-2 pneumonia were randomly assigned to receive either a 12-week IMT or usual care alone (NCT05279430). The physiotherapist and participants were not blinded. Patients allocated to the IMT arm were instructed to train at home twice daily using a threshold inspiratory muscle trainer and to maintain diaphragmatic breathing during the training session. The usual care arm received no intervention.The primary endpoint was the change in peak oxygen consumption (peakVO2). Secondary endpoints were changes in quality of life (QoL), ventilatory efficiency and chronotropic response during exercise (evaluated by chronotropic index-CIx- formula). We used linear mixed regression analysis for evaluating changes in primary and secondary endpoints.

Results: The mean age of the sample and time to first visit after discharge were 50.4±12.2 years and 362±105 days, respectively. A total of 11 (42.3%) were female. At baseline, the mean of peakVO2, ventilatory efficiency and CIx were 18.9±5 mL/kg/min, 29.4±5.2 and 0.64±0.19, respectively. The IMT arm improved their peakVO2 significantly compared with usual care (+Δ 4.46 mL/kg/min, 95% CI 3.10 to 5.81; p<0.001). Similar positive findings were found when evaluating changes for CIx and some QoL dimensions. We did not find significant changes in ventilatory efficiency.

Conclusion: In long COVID patients with a previous admission due to SARS-CoV-2 pneumonia, IMT was associated with marked improvement in exercise capacity and QoL.

6.4.2 Effects of a concurrent training, respiratory muscle exercise, and self-management recommendations on recovery from post-COVID-19 conditions: the RECOVE trial

AUTOR: IN / AUTHOR:

Jimeno-Almazán, Amaya, Buendía-Romero, Ángel, Martínez-Cava, Alejandro, Franco-López, Francisco, Sánchez-Alcaraz, Bernardino Javier, Courel-Ibáñez, Javier, Pallarés, Jesús G.

QUELLE / SOURCE:

Journal of Applied Physiology, 2023/january, Vol. 134, No. 1, 95–104, DOI: https://doi.org/10.1152/japplphysiol.00489.2022

ABSTRAKT / ABSTRACT:

The aim of this study was to determine the effectiveness of physical exercise, respiratory muscle training, and the self-management World Health Organization (WHO) recommendations leaflet on the recovery of physical fitness, quality of life, and symptom status in people with post-COVID-19 conditions. Eighty nonhospitalized adults with a post-COVID-19 condition were randomly assigned to one of four 8-wk parallel intervention groups: 1) multicomponent exercise program based on concurrent training (CT, number of subjects (n) = 20; 3 resistance and endurance supervised sessions per week at low-moderate intensity); 2) inspiratory muscle training (RM, n = 17; 2 standardized daily sessions); 3) a combination of both of the above (CTRM, n = 23); and 4) control group (CON, n = 20; following the WHO guidelines for post-COVID-19-related illness rehabilitation). No significant differences between groups were detected at baseline. Although no significant differences between interventions were detected in the $\dot{V}o_2max$, significant individual improvements were identified in the CT (7.5%; effect size, ES = 0.28) and CTRM (7.8%; ES = 0.36) groups. Lower body muscle strength significantly improved in the CT and CTRM (14.5%-32.6%; ES = 0.27-1.13) groups compared with RM and CON (-0.3% to 11.3%; ES = 0.10-0.19). The CT and CTRM groups improved significantly for dyspnea and fatigue, as did the health status. In addition, significant differences between interventions were described in fatigue and depression scales favoring CT and CTRM interventions. An individualized and supervised concurrent training with or without inspiratory muscle training was safe and more effective than self-care recommendations and inspiratory muscle training alone, to regain cardiovascular and muscular fitness, improve symptom severity, and health status in outpatients with post-COVID-19 conditions.NEW & NOTEWORTHY Eight weeks of concurrent training, with or without inspiratory muscle exercise, was better than WHO "Support for Rehabilitation: Self-Management after COVID-19-Related Illness" recommendations or inspiratory muscle training alone to improve cardiopulmonary fitness, strength, and symptom severity, in a

safe and effective manner. The RECOVE trial proved the benefits and utility of a supervised exercise program in people with post-COVID-19 conditions after mild COVID-19 in an ambulatory setting.

6.4.3 Inspiratory muscle training enhances recovery post-COVID-19: a randomised controlled trial

AUTOR: IN / AUTHOR:

McNarry, Melitta A., Berg, Ronan M. G., Shelley, James, Hudson, Joanne, Saynor, Zoe L., Duckers, Jamie, Lewis, Keir, Davies, Gwyneth A., Mackintosh, Kelly A.

QUELLE / SOURCE:

European Respiratory Journal, 2022/march, Vol. 60, No. 4, 2103101, DOI: https://doi.org/10.1183/13993003.03101-2021

ABSTRAKT / ABSTRACT:

Background: Many people recovering from coronavirus disease 2019 (COVID-19) experience prolonged symptoms, particularly breathlessness. We urgently need to identify safe and effective COVID-19 rehabilitative strategies. The aim of the current study was to investigate the potential rehabilitative role of inspiratory muscle training (IMT).

Methods: 281 adults (age 46.6±12.2 years; 88% female) recovering from self-reported COVID-19 (9.0±4.2 months post-acute infection) were randomised 4:1 to an 8-week IMT or a "usual care" waitlist control arm. Health-related quality-of-life and breathlessness questionnaires (King's Brief Interstitial Lung Disease (K-BILD) and Transition Dyspnoea Index (TDI)), respiratory muscle strength, and fitness (Chester Step Test) were assessed pre- and post-intervention. The primary end-point was K-BILD total score, with the K-BILD domains and TDI being key secondary outcomes.

Results: According to intention to treat, there was no difference between groups in K-BILD total score post-intervention (control: 59.5±12.4; IMT: 58.2±12.3; $p<0.05$) but IMT elicited clinically meaningful improvements in the K-BILD domains for breathlessness (control: 59.8±12.6; IMT: 62.2±16.2; $p<0.05$) and chest symptoms (control: 59.2±18.7; IMT: 64.5±18.2; $p<0.05$), along with clinically meaningful improvements in breathlessness according to TDI (control: 0.9±1.7 versus 2.0±2.0; $p<0.05$). IMT also improved respiratory muscle strength and estimated aerobic fitness.

Conclusions: IMT may represent an important home-based rehabilitation strategy for wider implementation as part of COVID-19 rehabilitative strategies. Given the diverse nature of long COVID, further research is warranted on the individual responses to rehabilitation; the withdrawal rate herein highlights that no one strategy is likely to be appropriate for all.

6.4.4 Physical Therapist Management of COVID-19 in the Intensive Care Unit: The West China Hospital Experience

AUTOR: IN / AUTHOR:

Li, Lei, Yu, Pengming, Yang, Mengxuan, Xie, Wei, Huang, Liyi, He, Chengqi, Gosselink, Rik, Wei, Quan, Jones, Alice Y. M.

QUELLE / SOURCE:

Physical Therapy, 2020/november, Vol. 101, No. 1, DOI: https://doi.org/10.1093/ptj/pzaa198

ABSTRAKT / ABSTRACT:

Objective: Coronavirus disease 2019 (COVID-19) has dominated the attention of health care systems globally since January 2020. Various health disciplines, including physical therapists, are still exploring the best way to manage this new disease. The role and involvement of physical therapists in the management of COVID-19 are not yet well defined and are limited in many hospitals. This article reports a physical therapy service specially commissioned by the Health Commission of Sichuan Province to manage COVID-19 during patients' stay in the intensive care unit (ICU) at the Public Health Clinical Center of Chengdu in China.

Methods: Patients diagnosed with COVID-19 were classified into 4 categories under a directive from the National Health Commission of the People's Republic of China. Patients in the "severe" and "critical" categories were admitted to the ICU irrespective of mechanical ventilation was required. Between January 31, 2020, and March 8, 2020, a cohort of 16 patients was admitted to the ICU at the Public Health Clinical Center of Chengdu. The median (minimum to maximum) hospital and ICU stays for these patients were 27 (11-46) and 15 (6-38) days, respectively. Medical management included antiviral, immunoregulation, and supportive treatment of associated comorbidities. Physical therapist interventions included body positioning, airway clearance techniques, oscillatory positive end-expiratory pressure, inspiratory muscle training, and mobility exercises. All patients had at least 1 comorbidity. Three of the 16 patients required mechanical ventilation and were excluded for outcome measures that required understanding of verbal instructions. In the remaining 13 patients, respiratory outcomes-including the Borg Dyspnea Scale, peak expiratory flow rate, Pao2/Fio2 ratio, maximal inspiratory pressure, strength outcomes, Medical Research Council Sum Score, and functional outcomes (including the Physical Function in Intensive Care Test score, De Morton Mobility Index, and Modified Barthel Index)-were measured on the first day the patient received the physical therapist intervention and at discharge.

Results: At discharge from the ICU, while most outcome measures were near normal for the majority of the patients, 61% and 31% of these patients had peak expiratory flow rate and maximal inspiratory pressure, respectively, below 80% of the predicted value and 46% had De Morton Mobility Index values below the normative value.

Conclusion: The respiratory and physical functions of some patients remained poor at ICU discharge, suggesting that long-term rehabilitation may be required for these patients.

Impact: Our experience in the management of patients with COVID-19 has revealed that physical therapist intervention is safe and appears to be associated with an improvement in respiratory and physical function in patients with COVID-19 in the ICU.

6.4.5 Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study

AUTOR: IN / AUTHOR:

Liu, Kai, Zhang, Weitong, Yang, Yadong, Zhang, Jinpeng, Li, Yunqian, Chen, Ying

QUELLE / SOURCE:

Complementary Therapies in Clinical Practice, 2020/05, Vol. 39, 101166, DOI: https://doi.org/10.1016/j.ctcp.2020.101166

ABSTRAKT / ABSTRACT:

Background: Different degrees of disorders are reported in respiratory function, physical function and psychological function in patients with corona virus disease 2019 (COVID-19), especially in elderly patients. With the experience of improved and discharged COVID-19 patients, timely respiratory rehabilitation intervention may improve prognosis, maximize functional preservation and improve quality of life (QoL), but there lacks of studies worldwide exploring the outcome of this intervention.

Objective: To investigate the effects of 6-week respiratory rehabilitation training on respiratory function, QoL, mobility and psychological function in elderly patients with COVID-19.

Methods: This paper reported the findings of an observational, prospective, quasi-experimental study, which totally recruited 72 participants, of which 36 patients underwent respiratory rehabilitation and the rest without any rehabilitation intervention. The following outcomes were measured: pulmonary function tests including plethysmography and diffusing lung capacity for carbon monoxide (DLCO), functional tests (6-min walk distance test), Quality of life (QoL) assessments (SF-36 scores), activities of daily living (Functional Independence Measure, FIM scores), and mental status tests (SAS anxiety and SDS depression scores).

Results: After 6 weeks of respiratory rehabilitation in the intervention group, there disclosed significant differences in FEV1(L), FVC(L), FEV1/FVC%, DLCO% and 6-min walk test. The SF-36 scores, in 8 dimensions, were statistically significant within the intervention group and between the two groups. SAS and SDS scores in the intervention group decreased after the intervention, but only anxiety had significant statistical significance within and between the two groups.

Conclusions: Six-week respiratory rehabilitation can improve respiratory function, QoL and anxiety of elderly patients with COVID-19, but it has little significant improvement on depression in the elderly.

6.4.6 Wirksamkeit von Inspirationsmuskeltraining in der pneumologischen Rehabilitation bei Post-Covid-19-Patienten

AUTOR: IN / AUTHOR:

Merkl, S., Limbach, M., Hayden, M., Schwarzl, G., jakab, K., Nowak, D., Schuler, M., Schultz, K.

QUELLE / SOURCE:

2021/april, DOI: https://doi.org/10.1055/s-0041-1723362

ABSTRAKT / ABSTRACT:

Einleitung: Viele Post-Covid-19-Patienten leiden auch nach der Akutphase noch unter Atembeschwerden. Es gibt Hinweise, dass hieran eine Dysfunktion der Atemmuskulatur beteiligt ist. Diese kann durch ein Inspirationsmuskeltraining (IMT) gekräftigt werden. Die Wirksamkeit des IMT bei diesen Patienten ist bisher jedoch kaum untersucht. Ziel ist eine Analyse der Wirksamkeit von IMT bzgl. der maximalen Inspirationsmuskelkraft während einer 3-wöchigen pneumologischen Rehabilitation (PR) bei Post-Covid-19-Patienten.

Methode: Im Rahmen einer prospektiven Studie wurde direkt nach Aufnahme (T1) sowie vor Entlassung (T2) eine Lungenfunktion durchgeführt und die 6-Minuten-Gehstrecke (6MWD) gemessen. Analysiert wurden PI max und Vitalkapazität (VC). Die Erfassung der Leitsymptome Atemnot und Fatigue sowie von Lebensqualität (LQ) und Angst erfolgte mittels Fragebogen. Als Kontraindikation (KI) für ein IMT galten klinische Hinweise auf Thrombosen und erhöhte D-Dimere-Werte. Zudem wurde IMT nur bei Patienten mit reduziertem PI max verordnet (Hygienegründe). Das tägliche IMT wurde mit wöchentlicher Supervision zusätzlich zum routinemäßigen Post-Covid-Reha-Programm durchgeführt.

Ergebnisse: Es wurden 108 Patienten in die Analyse eingeschlossen (45,4% weiblich, Ø Alter 55 ± 9,6 Jahre; Range 33 – 86, mittlerer BMI 30 ± 6,0).

28 Patienten ohne KI und zumeist reduziertem PI max führten das IMT täglich zusätzlich zur sonstigen Standard-Reha durch. Die Gruppe ohne IMT ist in [Tab. 1] als orientierender Vergleich dargestellt, ist jedoch nicht als ‚Kontrollgruppe' zu sehen.

PImax nahm in der Gruppe mit IMT am Ende der Reha signifikant zu (s. [Tab. 1]). In der Gruppe, die kein IMT erhielt (n = 80) änderte sich PI max nicht. VC verbesserte sich in beiden Gruppen vergleichbar. Beide Gruppen verbesserten sich bzgl. Dyspnoe, LQ und 6MWD gleichermaßen und mit großer Effektstärke.

Diskussion: Die Daten legen nahe, dass ein Add-on-IMT die Inspirationsmuskelkraft während einer 3-wöchigen-PR steigern kann. Inwieweit daraus ein Zusatznutzen bzgl. Dyspnoe, LQ oder 6MWD resultiert, kann aufgrund der Daten nicht beurteilt werden, hierfür wäre eine randomisierte Studie erforderlich.

6.4.7 Efficacy of home-based inspiratory muscle training in patients post-covid-19: Protocol for a randomized clinical trial

AUTOR: IN / AUTHOR:

Gonçalo Silva, Gabriely Azevêdo, Nogueira, Ivan Daniel Bezerra, da Silva Chiappa, Gaspar Rogério, Nogueira, Patrícia Angélica de Miranda Silva

QUELLE / SOURCE:

PLOS ONE, 2023/05, Vol. 18, No. 5, e0279310, DOI: https://doi.org/10.1371/journal.pone.0279310

ABSTRAKT / ABSTRACT:

Purpose: To evaluate the effectiveness of home-based inspiratory muscle training (IMT) in improving respiratory muscle strength, dyspnea, and quality of life in patients post-COVID-19. Method: A randomized controlled trial with two groups: active IMT (using Powerbreathe) and SHAM. The training protocol involves increasing load and repetitions over six weeks.

Results: Various assessments (e.g., respiratory strength, pulmonary function, fatigue) will be conducted before, after, and 24 weeks after the training. Conclusion: The trial will determine the effectiveness of IMT in improving respiratory function and quality of life in post-COVID patients.

6.4.8 Effects of a respiratory and neurological rehabilitation treatment plan in post Covid-19 affected university students. Randomized clinical study

AUTOR: IN / AUTHOR:

Sánchez Milá, Zacarías, Rodríguez Sanz, David, Martín Nieto, Ana, Jiménez Lobo, Ana, Ramos Hernández, Manuel, Campón Chekroun, Angélica, Frutos Llanes, Raúl, Barragán Casas, José Manuel, Velázquez Saornil, Jorge

QUELLE / SOURCE:

Chronic Respiratory Disease, 2024/january, Vol. 21, DOI: https://doi.org/10.1177/14799731241255967

ABSTRAKT / ABSTRACT:

Purpose: To evaluate the efficacy of a combined pulmonary and neurological rehabilitation program for post-COVID university students. Method: A randomized controlled study with two groups—one receiving inspiratory muscle training, aerobic exercise, and neurological rehabilitation (olfactory and gustatory training) and the other as a control group. Results: Significant improvements were observed in respiratory parameters (e.g., FVC, inspiratory pressure, dyspnea) and neurological functions (olfactory and gustatory perception). Conclusion: Combined pulmonary and neurological rehabilitation is an effective treatment for post-COVID sequelae.

6.4.9 Practical Recommendations for Exercise Training in Patients with Long COVID with or without Post-exertional Malaise: A Best Practice Proposal

AUTOR: IN / AUTHOR:

Gloeckl, Rainer, Zwick, Ralf H., Fürlinger, Ulrich, Schneeberger, Tessa, Leitl, Daniela, Jarosch, Inga, Behrends, Uta, Scheibenbogen, Carmen, Koczulla, Andreas Rembert

QUELLE / SOURCE:

Sports Medicine - Open, 2024/april, Vol. 10, No. 1, DOI: https://doi.org/10.1186/s40798-024-00695-8

ABSTRAKT / ABSTRACT:

People with long COVID may suffer from a wide range of ongoing symptoms including fatigue, exertional dyspnea, reduced exercise performance, and others. In particular, impaired exercise performance is a condition that can be recovered in many people through an individualized physical exercise training program. However, clinical experience has shown that the presence of post-exertional malaise (PEM) is a significant barrier to physical exercise training in people with long COVID. Currently, there is no guideline or consensus available on how to apply exercise training in this cohort. Therefore, we conducted a literature review in the PubMed library using the following search terms: “COVID”, “post-COVID”, “long COVID” and “exercise” searching for studies from January 2020 to January 2024. Data from 46 trials were included. Exercise training regimes were very heterogeneous and none of these studies reported on the management of PEM in the context of an exercise training program. Based on the feedback from an additional survey that was answered by 14 international experts in the field of exercise training in long COVID, combined with the authors´ own extensive practical experience, a best practice proposal for exercise training recommendations has been developed. This proposal differentiates exercise procedures according to the presence of no, mild/moderate or severe PEM in people with long COVID. These recommendations may guide allied healthcare professionals worldwide in initiating and adjusting exercise training programs for people with long COVID, stratified according to the presence and severity of PEM.

7 Studien zu EMT / *studies on EMT*

7.1 Expiratory Muscle Strength Training for Therapy of Pharyngeal Dysphagia in Parkinson's Disease

AUTOR: IN / AUTHOR:

Claus, Inga, Muhle, Paul, Czechowski, Judith, Ahring, Sigrid, Labeit, Bendix, Suntrup-Krueger, Sonja, Wiendl, Heinz, Dziewas, Rainer, Warnecke, Tobias

QUELLE / SOURCE:

Movement Disorders, 2021/march, Vol. 36, No. 8, 1815–1824, DOI: https://doi.org/10.1002/mds.28552

ABSTRAKT / ABSTRACT:

Background: Pharyngeal dysphagia in Parkinson's disease (PD) is a common and clinically relevant symptom associated with poor nutrition intake, reduced quality of life, and aspiration pneumonia. Despite this, effective behavioral treatment approaches are rare.

Objective: The objective of this study was to verify if 4 week of expiratory muscle strength training can improve pharyngeal dysphagia in the short and long term and is able to induce neuroplastic changes in cortical swallowing processing.

Methods: In this double-blind, randomized, controlled trial, 50 patients with hypokinetic pharyngeal dysphagia, as confirmed by flexible endoscopic evaluation of swallowing, performed a 4-week expiratory muscle strength training. Twenty-five participants used a calibrated ("active") device, 25 used a sham handheld device. Swallowing function was evaluated directly before and after the training period, as well as after a period of 3 month using flexible endoscopic evaluation of swallowing. Swallowing-related cortical activation was measured in 22 participants (active:sham; 11:11) using whole-head magnetencephalography.

Results: The active group showed significant improvement in the flexible endoscopic evaluation of swallowing-based dysphagia score after 4 weeks and after 3 months, whereas in the sham group no significant changes from baseline were observed. Especially, clear reduction in pharyngeal residues was found. Regarding the cortical swallowing network before and after training, no statistically significant differences were found by magnetencephalography examination.

Conclusions: Four-week expiratory muscle strength training significantly reduces overall dysphagia severity in PD patients, with a sustained effect after 3 months compared with sham training. This was mainly achieved by improving swallowing efficiency. The treatment effect is probably caused by peripheral mechanisms, as no

changes in the cortical swallowing network were identified. © 2021 The Authors. Movement Disorders published by Wiley Periodicals LLC on behalf of International Parkinson and Movement Disorder Society.

7.2 High-Frequency Airway Oscillating Device for Respiratory Muscle Training in Subjects With COPD

AUTOR: IN / AUTHOR:

Daynes, Enya, Greening, Neil J., Harvey-Dunstan, Theresa C., Singh, Sally J.

QUELLE / SOURCE:

Respiratory Care, 2018/march, Vol. 63, No. 5, 584–590, DOI: https://doi.org/10.4187/respcare.05837

ABSTRAKT / ABSTRACT:

Background: COPD is characterized by expiratory flow limitation, which results in symptomatic dyspnea and reduced exercise capacity. Changes in breathing mechanics mean the respiratory muscles are unable to respond to the ventilatory demands, increasing the sensation of dyspnea. A high-frequency oscillating device has been developed to improve dyspnea in patients with COPD. We conducted a feasibility trial to gain insight into the potential for recruitment, retention, and study design for a future randomized controlled trial.

Methods: Symptomatic subjects with COPD were included on the basis of a Medical Research Council (MRC) score $\geq$ 3 and FEV1/FVC < 0.70). Patients were excluded if they received pulmonary rehabilitation within the last 6 months. The intervention employed the device for 8 weeks, 3 times daily. Clinical outcomes included the MRC score, maximal expiratory and inspiratory pressures (PEmax/PImax), the incremental shuttle walk test (ISWT), and the endurance shuttle walk test (ESWT).

Results: We successfully recruited 23 subjects with established COPD (65.2% male, mean age 65 ± 5.03 y, mean % predicted FEV1 43.9 ± 16, mean FEV1/FVC ratio 0.46 ± 0.13, and median [interquartile range] MRC 4 [3-5]). There was a significant change in MRC from 4 to 3 pre to post intervention (P = .003). There was a statistically significant difference in PEmaxP < .008 and PImaxP = .044. There were no significant differences observed in the ISWT or ESWT.

Conclusions: This study design appeared feasible to proceed to a clinical effectiveness trial. The use of the device for 8 weeks showed a significant improvement in PEmax, PImax, and reduced symptomatic dyspnea on the MRC dyspnea score. The results of this study should encourage a randomized controlled trial.

7.3 Impact of expiratory strength training in amyotrophic lateral sclerosis: Results of a randomized, sham-controlled trial

AUTOR: IN / AUTHOR:

Plowman, Emily K., Tabor-Gray, Lauren, Rosado, K. Michelle, Vasilopoulos, Terrie, Robison, Raele, Chapin, Jennifer L., Gaziano, Joy, Vu, Tuan, Gooch, Clifton

QUELLE / SOURCE:

Muscle & Nerve, 2018/november, Vol. 59, No. 1, 40–46, DOI: https://doi.org/10.1002/mus.26292

ABSTRAKT / ABSTRACT:

Introduction: The purpose of this study was to determine the impact of an in-home expiratory muscle strength training (EMST) program on pulmonary, swallow, and cough function in individuals with amyotrophic lateral sclerosis (ALS).

Methods: EMST was tested in a prospective, single-center, double-blind, randomized, controlled trial of 48 ALS individuals who completed 8 weeks of either active EMST (n = 24) or sham EMST (n = 24). The primary outcome to assess treatment efficacy was change in maximum expiratory pressure (MEP). Secondary outcomes included: cough spirometry; swallowing; forced vital capacity; and scoring on the ALS Functional Rating Scale-Revised.

Results: Treatment was well tolerated with 96% of patients completing the protocol. Significant differences in group change scores were noted for MEP and Dynamic Imaging Grade of Swallowing Toxicity scores ($P < 0.02$). No differences were noted for other secondary measures.

Discussion: This respiratory training program was well-tolerated and led to improvements in respiratory and bulbar function in ALS. Muscle Nerve 59:40-46, 2019.

7.4 PILOT STUDY: HYOLARYNGEAL MUSCLE ACTIVATION IN RESPONSE TO RMT USING THE BREATHER

AUTOR: IN / AUTHOR:

Matthew Dumican, M. S. C. C. C.-S. L. P., Christopher Watts, Ph. D.

QUELLE / SOURCE:

Poster Presentation – DYSPHAGIA RESEARCH SOCIETY, San Diego, CA, 2019

ABSTRAKT / ABSTRACT:

In neuromuscular disease, such as Parkinson's, activation of muscle groups for voice and swallowing may be impaired, causing dysphonia and dysphagia. - Strengthening those muscle groups by respiratory muscle training (RMT) can improve voice and swallow function, and health-related quality of life. - In the study presented here, activation of the hyolaryngeal muscles in response to RMT using The Breather is assessed by surface electromyograph (sEMG). - RMT using The Breather improved muscle activation both during inspiration as well as during expiration against resistance significantly above baseline level. - The Breather can be recommended as a useful exercise tool to maintain swallow function longer

7.5 Rehabilitation of Swallowing and Cough Functions Following Stroke: An Expiratory Muscle Strength Training Trial

AUTOR: IN / AUTHOR:

Hegland, Karen Wheeler, Davenport, Paul W., Brandimore, Alexandra E., Singletary, Floris F., Troche, Michelle S.

QUELLE / SOURCE:

Archives of Physical Medicine and Rehabilitation, 2016/august, Vol. 97, No. 8, 1345–1351, DOI: https://doi.org/10.1016/j.apmr.2016.03.027

ABSTRAKT / ABSTRACT:

Objective: To determine the effect of expiratory muscle strength training (EMST) on both cough and swallow function in stroke patients.

Design: Prospective pre-post intervention trial with 1 participant group.

Setting: Two outpatient rehabilitation clinics.

Participants: Adults (N=14) with a history of ischemic stroke in the preceding 3 to 24 months.

Intervention: EMST. The training program was completed at home and consisted of 25 repetitions per day, 5 days per week, for 5 weeks.

Main outcome measures: Baseline and posttraining measures were maximum expiratory pressure, voluntary cough airflows, reflex cough challenge to 200μmol/L of capsaicin, sensory perception of urge to cough, and fluoroscopic swallow evaluation. Repeated measures and 1-way analyses of variance were used to determine significant differences pre- and posttraining.

Results: Maximum expiratory pressure increased in all participants by an average of 30cmH2O posttraining. At baseline, all participants demonstrated a blunted reflex cough response to 200μmol/L of capsaicin. After 5 weeks of training, measures of urge to cough and cough effectiveness increased for reflex cough; however, voluntary cough effectiveness did not increase. Swallow function was minimally impaired at baseline, and there were no significant changes in the measures of swallow function posttraining.

Conclusions: EMST improves expiratory muscle strength, reflex cough strength, and urge to cough. Voluntary cough and swallow measures were not significantly different posttraining. It may be that stroke patients benefit from the training for upregulation of reflex cough and thus improved airway protection.

7.6 Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study

AUTOR: IN / AUTHOR:

Liu, Kai, Zhang, Weitong, Yang, Yadong, Zhang, Jinpeng, Li, Yunqian, Chen, Ying

QUELLE / SOURCE:

Complementary Therapies in Clinical Practice, 2020/05, Vol. 39, 101166, DOI: https://doi.org/10.1016/j.ctcp.2020.101166

ABSTRAKT / ABSTRACT:

Background: Different degrees of disorders are reported in respiratory function, physical function and psychological function in patients with corona virus disease 2019 (COVID-19), especially in elderly patients. With the experience of improved and discharged COVID-19 patients, timely respiratory rehabilitation intervention may improve prognosis, maximize functional preservation and improve quality of life (QoL), but there lacks of studies worldwide exploring the outcome of this intervention.

Objective: To investigate the effects of 6-week respiratory rehabilitation training on respiratory function, QoL, mobility and psychological function in elderly patients with COVID-19.

Methods: This paper reported the findings of an observational, prospective, quasi-experimental study, which totally recruited 72 participants, of which 36 patients underwent respiratory rehabilitation and the rest without any rehabilitation intervention. The following outcomes were measured: pulmonary function tests including plethysmography and diffusing lung capacity for carbon monoxide (DLCO), functional tests (6-min walk distance test), Quality of life (QoL) assessments (SF-36 scores), activities of daily living (Functional Independence Measure, FIM scores), and mental status tests (SAS anxiety and SDS depression scores).

Results: After 6 weeks of respiratory rehabilitation in the intervention group, there disclosed significant differences in FEV1(L), FVC(L), FEV1/FVC%, DLCO% and 6-min walk test. The SF-36 scores, in 8 dimensions, were statistically significant within the intervention group and between the two groups. SAS and SDS scores in the intervention group decreased after the intervention, but only anxiety had significant statistical significance within and between the two groups.

Conclusions: Six-week respiratory rehabilitation can improve respiratory function, QoL and anxiety of elderly patients with COVID-19, but it has little significant improvement on depression in the elderly.

7.7 Respiratory muscle training improves swimming endurance in divers

AUTOR: IN / AUTHOR:

Wylegala, Juli A., Pendergast, David R., Gosselin, Luc E., Warkander, Dan E., Lundgren, Claes E. G.

QUELLE / SOURCE:

European Journal of Applied Physiology, 2006/december, Vol. 99, No. 4, 393–404, DOI: https://doi.org/10.1007/s00421-006-0359-6

ABSTRAKT / ABSTRACT:

Respiratory muscles can fatigue during prolonged and maximal exercise, thus reducing performance. The respiratory system is challenged during underwater exercise due to increased hydrostatic pressure and breathing resistance. The purpose of this study was to determine if two different respiratory muscle training protocols enhance respiratory function and swimming performance in divers. Thirty male subjects (23.4 +/- 4.3 years) participated. They were randomized to a placebo (PRMT), endurance (ERMT), or resistance respiratory muscle training (RRMT) protocol. Training sessions were 30 min/day, 5 days/week, for 4 weeks. PRMT consisted of 10-s breath-holds once/minute, ERMT consisted of isocapnic hyperpnea, and RRMT consisted of a vital capacity maneuver against 50 cm H(2)O resistance every 30 s. The PRMT group had no significant changes in any measured variable. Underwater and surface endurance swim time to exhaustion significantly increased after RRMT (66%, P < 0.001; 33%, P = 0.003) and ERMT (26%, P = 0.038; 38%, P < 0.001). Breathing frequency (f (b)) during the underwater endurance swim decreased in RRMT (23%, P = 0.034) and tidal volume (V (T)) increased in both the RRMT (12%, P = 0.004) and ERMT (7%, P = 0.027) groups. Respiratory endurance increased in ERMT (216.7%) and RRMT (30.7%). Maximal inspiratory and expiratory pressures increased following RRMT (12%, P = 0.015, and 15%, P = 0.011, respectively). Results from this study indicate that respiratory muscle fatigue is a limiting factor for underwater swimming performance, and that targeted respiratory muscle training (RRMT > ERMT) improves respiratory muscle and underwater swimming performance.

7.8 THE EFFECTS OF RESPIRATORY MUSCLE TRAINING ON VO2 MAX, THE VENTILATORY THRESHOLD AND PULMONARY FUNCTION

AUTOR: IN / AUTHOR:

AMONETTE, W.I.L.L.I.A.M. E., DUPLER, T.E.R.R.Y. L.

QUELLE / SOURCE:

JEPonline, 2002, Vol. 5, No. 2, 29

ABSTRAKT / ABSTRACT:

This study evaluated the effect of inspiratory and expiratory muscle training on pulmonary function and maximal exercise performance in competitive triathletes and marathon runners. The participants in this study (N=12) had a mean weekly aerobic training time of 7.5 hours per week of swimming, cycling, or running. Eight subjects were assigned to a pulmonary resistance treatment group and four control subjects were given a sham device that allowed no greater than 15% resistance on inspiration or expiration. The subjects performed 30 maximal inhalation/exhalation maneuvers on their respective devices two times per day for four weeks. The subjects were tested for forced vital capacity (FVC), forced expiratory volume in one second (FEV1), FEV1/FVC ratio, forced inspiratory vital capacity (FIVC), peak inspiratory flow rate (PIFR), and peak expiratory flow rate (PEFR). Each subject was also tested for peak exhalation force (PEF) as well as a maximal oxygen consumption (VO2 max), carbon dioxide production (VCO2), tidal volume (VT), ventilation (VE), ventilatory threshold (VT), and respiration rate (RR). The data revealed that training using the pulmonary resistance device produced significant increases in maximal VE and maximal VT while decreasing RR (although not statistically significant) at maximum exercise. However, no significant changes were seen in VO2 or any pulmonary function variables measured.

7.9 Expiratory and Expiratory Plus Inspiratory Muscle Training Improves Respiratory Muscle Strength in Subjects With COPD: Systematic Review

AUTOR: IN / AUTHOR:

Neves, Leonardo F., Reis, Manoela H., Plentz, Rodrigo D. M., Matte, Darlan L., Coronel, Christian C., Sbruzzi, Graciele

QUELLE / SOURCE:

Respiratory Care, 2014/april, Vol. 59, No. 9, 1381–1388, DOI: https://doi.org/10.4187/respcare.02793

ABSTRAKT / ABSTRACT:

Background: Inspiratory muscle training (IMT) produces beneficial effects in COPD subjects, but the effects of expiratory muscle training (EMT) and EMT plus IMT in ventilatory training are still unclear. The aim of this study was to systematically review the effects of EMT and EMT plus IMT compared to control groups of COPD subjects.

Methods: This study is a systematic review and meta-analysis. The search strategy included MEDLINE, Embase, LILACS, PEDro, and Cochrane CENTRAL and also manual search of references in published studies on the subject. Randomized trials comparing EMT and EMT plus IMT versus control groups of subjects with COPD were included. The outcomes analyzed were respiratory muscle strength and functional capacity. Two reviewers independently extracted the data.

Results: The search retrieved 609 articles. Five studies were included. We observed that EMT provided higher gain in maximum expiratory pressure (P(E(max)) 21.49 cm H2O, 95% CI 13.39-29.59) and maximum inspiratory pressure (P(I(max)) 7.68 cm H2O, 95% CI 0.90-14.45) compared to control groups. There was no significant difference in the 6-min walk test distance (29.01 m, 95% CI -39.62 to 97.65) and dyspnea (0.15, 95% CI -0.77 to 1.08). In relation to EMT plus IMT, we observed that P(E(max)) (31.98 cm H2O, 95% CI 26.93-37.03) and P(I(max)) (27.98 cm H2O, 95% CI 20.10-35.85) presented higher values compared to control groups.

Conclusions: EMT and EMT plus IMT improve respiratory muscle strength and can be used as part of the treatment during pulmonary rehabilitation of subjects with severe to very severe COPD.

7.10 Effect of Respiratory Muscle Training on Exercise Performance in Healthy Individuals: A Systematic Review and Meta-Analysis

AUTOR: IN / AUTHOR:

Illi, Sabine K., Held, Ulrike, Frank, Irène, Spengler, Christina M.

QUELLE / SOURCE:

Sports Medicine, 2012/august, Vol. 42, No. 8, 707–724, DOI: https://doi.org/10.1007/bf03262290

ABSTRAKT / ABSTRACT:

Objectives: Two distinct types of specific respiratory muscle training (RMT), i.e. respiratory muscle strength (resistive/threshold) and endurance (hyperpnoea) training, have been established to improve the endurance performance of healthy individuals. We performed a systematic review and meta-analysis in order to determine the factors that affect the change in endurance performance after RMT in healthy subjects.

Data sources: A computerized search was performed without language restriction in MEDLINE, EMBASE and CINAHL and references of original studies and reviews were searched for further relevant studies.

Review methods: RMT studies with healthy individuals assessing changes in endurance exercise performance by maximal tests (constant load, time trial, intermittent incremental, conventional [non-intermittent] incremental) were screened and abstracted by two independent investigators. A multiple linear regression model was used to identify effects of subjects' fitness, type of RMT (inspiratory or combined inspiratory/expiratory muscle strength training, respiratory muscle endurance training), type of exercise test, test duration and type of sport (rowing, running, swimming, cycling) on changes in performance after RMT. In addition, a meta-analysis was performed to determine the effect of RMT on endurance performance in those studies providing the necessary data.

Results: The multiple linear regression analysis including 46 original studies revealed that less fit subjects benefit more from RMT than highly trained athletes (6.0% per 10 mL · kg^{-1} · min^{-1} decrease in maximal oxygen uptake, 95% confidence interval [CI] 1.8, 10.2%; p = 0.005) and that improvements do not differ significantly between inspiratory muscle strength and respiratory muscle endurance training (p = 0.208), while combined inspiratory and expiratory muscle strength training seems to be superior in improving performance, although based on only 6 studies (+12.8% compared with inspiratory muscle strength training, 95% CI 3.6, 22.0%; p = 0.006). Furthermore, constant load tests (+16%, 95% CI 10.2, 22.9%) and intermittent incremental tests (+18.5%, 95% CI 10.8, 26.3%) detect changes in endurance performance better than conventional

incremental tests (both $p < 0.001$) with no difference between time trials and conventional incremental tests ($p = 0.286$). With increasing test duration, improvements in performance are greater (+0.4% per minute test duration, 95% CI 0.1, 0.6%; $p = 0.011$) and the type of sport does not influence the magnitude of improvements (all $p > 0.05$). The meta-analysis, performed on eight controlled trials revealed a significant improvement in performance after RMT, which was detected by constant load tests, time trials and intermittent incremental tests, but not by conventional incremental tests.

Conclusion: RMT improves endurance exercise performance in healthy individuals with greater improvements in less fit individuals and in sports of longer durations. The two most common types of RMT (inspiratory muscle strength and respiratory muscle endurance training) do not differ significantly in their effect, while combined inspiratory/expiratory strength training might be superior. Improvements are similar between different types of sports. Changes in performance can be detected by constant load tests, time trials and intermittent incremental tests only. Thus, all types of RMT can be used to improve exercise performance in healthy subjects but care must be taken regarding the test used to investigate the improvements.

7.11 Effect of respiratory muscle training on dysphagia in stroke patients—A retrospective pilot study

AUTOR: IN / AUTHOR:

Arnold, Robert J., Bausek, Nina

QUELLE / SOURCE:

Laryngoscope Investigative Otolaryngology, 2020/october, Vol. 5, No. 6, 1050–1055, DOI: https://doi.org/10.1002/lio2.483

ABSTRAKT / ABSTRACT:

Background Dysphagia is prevalent with cerebrovascular accidents and contributes to the burden of disease and mortality. Strengthening dysfunctional swallow muscles through respiratory muscle training (RMT) has proven effective in improving swallow effectiveness and safety. However, approaches to strengthen only the expiratory muscle groups (EMST) dominate the clinical study literature, with variable outcomes. This study investigated the effect of simultaneous inspiratory-expiratory muscle strengthening to improve swallowing function in stroke patients.

Methods Recorded data of 20 patients receiving pro bono medical care for dysphagia following stroke were allocated to intervention (IG) or control group (CG) based upon whether they chose combined RMT (cRMT) or not while awaiting swallow therapy services. The intervention group was treated with three 5-minute sessions of resistive respiratory muscle training for 28 days, while the control group received no RMT or other exercise intervention. Respiratory and swallow outcomes were assessed pre- and post-intervention and included Mann Assessment of Swallowing Ability (MASA), fiberoptic endoscopic evaluation of swallowing (FEES) with penetration-aspiration scale (PAS), functional oral intake scale (FOIS), patient visual analogue scale (VAS), and peak expiratory flow (PEF).

Results After 28 days, the intervention group demonstrated greater improvements (P value < 0.05) in PEF (IG: 168.03% vs CG: 17.47%), VAS (IG: 103.85% vs CG: 27.54%), MASA (IG: 37.28% vs CG: 6.92%), PAS (IG: 69.84% vs CG: 12.12%), and FOIS (IG: 93.75% vs CG: 21.21%).

Conclusion cRMT is a feasible and effective method to improve signs and symptoms of dysphagia while improving airway protection.

7.12 S2k Leitlinie Parkinson-Krankheit

AUTOR: IN / AUTHOR:

Federführend: Prof. Dr. Günter Höglinger, München; Prof. Dr. Claudia Trenkwalder, Kassel/Göttingen

QUELLE / SOURCE:

Herausgegeben von der Kommission Leitlinien der Deutschen Gesellschaft für Neurologie, 2023

AWMF-Registernummer: 030/010

8 Studien zu Vibrationstraining und Ganzkörpervibrationen / *studies on vibration training and whole body vibration*

8.1 Effect of resistance training with vibration and compression on the formation of muscle and bone

AUTOR: IN / AUTHOR:

Zinner, Christoph, Baessler, Bettina, Weiss, Kilian, Ruf, Jasmine, Michels, Guido, Holmberg, Hans-Christer, Sperlich, Billy

QUELLE / SOURCE:

Muscle & Nerve, 2017/march, Vol. 56, No. 6, 1137–1142, DOI: https://doi.org/10.1002/mus.25560

ABSTRAKT / ABSTRACT:

Introduction: In this study we investigated the effects of resistance training with vibration in combination with leg compression to restrict blood flow on strength, muscle oxygenation, muscle mass, and bone formation.

Methods: Twelve participants were tested before and after 12 weeks of resistance training with application of vibration (VIBRA; 1-2 mm, 30 Hz) to both legs and compression (~35 mm Hg, VIBRA+COMP) to only 1 leg.

Results: VIBRA+COMP and VIBRA improved 1 repetition maximum (1-RM), increased the number of repetitions preceding muscle exhaustion, enhanced cortical bone mass, and lowered the mass and fat fraction in the thigh, with no changes in total muscle mass. The mass of cancellous bone decreased to a similar extent after VIBRA and VIBRA+COMP.

Discussion: Resistance training with VIBRA+COMP and VIBRA improved 1-RM, increased the number of repetitions preceding muscular exhaustion, and enhanced formation of cortical bone, with no alteration of muscle mass. Muscle Nerve 56: 1137-1142, 2017.

8.2 Effects of 8 weeks of vibration training at different frequencies (1 or 15 Hz) in senior sportsmen on torque and force development and of 1 year of training on muscle fibers

AUTOR: IN / AUTHOR:

Kern, H., Kovarik, J., Franz, C., Vogelauer, M., Löfler, S., Sarabon, N., Grim-Stieger, M., Biral, D., Adami, N., Carraro, U., Zampieri, S., Hofer, Ch.

QUELLE / SOURCE:

Neurological Research, 2010/february, Vol. 32, No. 1, 26–31, DOI: https://doi.org/10.1179/016164110x12556180206310

ABSTRAKT / ABSTRACT:

Objective: To examine the effects of 8 weeks of vibration training at different frequencies (1 and 15 Hz) on maximal isometric torque and force development in senior sportsmen, and of 1 year of heavy-resistance and vibration trainings on muscle fibers.

Methods: Seven healthy senior sportsmen (mean age: 69.0 +/- 5.4 years) performed an 8 weeks of strength training of knee extensors. Vibrations were applied vertically to the axis of movement during training. One leg of each subject was trained at a frequency of 1 Hz, while the other leg was trained at 15 Hz. Measures of isometric peak torque (at knee-angles of 60, 90 and 120 degrees) and force development were recorded before and after training. Four sportsmen continued a year-long heavy-resistance training adding every second week a session of vibration training. After training, muscle biopsies were harvested from their quadriceps muscles and used for structural analyses. Morphometry of muscle fibers was performed by light microscopy. Immunohistochemistry using anti-MHCemb and anti-N-CAM antibodies was performed to measure potential muscle damage. Data from muscle morphometry were compared to that of a series of vastus lateralis biopsies harvested from 12 young sportsmen and four healthy elderly.

Results: Our results showed a significant increase in isometric peak torque at both 1 and 15 Hz vibration frequency in all three measured angles of the knee. There was no significant difference between the two frequencies, but we could find a higher increase in percentage of maximum power after the 1 Hz training. The results of force development showed a slight increase at the 1 Hz training in measured time frames from 0 to 50 and 200 ms, without statistical significance. A trend to significance was found at the 1 Hz training at the time window up to 200 ms. The 15 Hz training showed no significant changes of force development. Muscle biopsies show that the muscles of these well trained senior sportsmen contain muscle fibers which are 35%

larger than those of sedentary elderly and, unexpectedly, 10% larger than those of young sportsmen. Despite 1 year of heavy resistance and vibration training, no evidence of muscle damage or denervation/reinnervation could be observed by light microscopy analyses, ATPase histochemistry and immunohistochemistry using anti-N-CAM or anti-MHC-emb antibodies.

Discussion: Integration of vibration to conventional strength training in elderly sportsmen induces similar improvement of isometric peak torque and force development independently from the vibration frequency after 8 weeks of training, and long-term results in the surprising evidence of hypertrophic muscle fibers larger than those of young active sportsmen. The observation that the vibration training with low frequency is safe opens the possibility to test these rehabilitation procedures in sedentary elderly.

8.3 High-Frequency Airway Oscillating Device for Respiratory Muscle Training in Subjects With COPD

AUTOR: IN / AUTHOR:

Daynes, Enya, Greening, Neil J., Harvey-Dunstan, Theresa C., Singh, Sally J.

QUELLE / SOURCE:

Respiratory Care, 2018/march, Vol. 63, No. 5, 584–590, DOI: https://doi.org/10.4187/respcare.05837

ABSTRAKT / ABSTRACT:

Background: COPD is characterized by expiratory flow limitation, which results in symptomatic dyspnea and reduced exercise capacity. Changes in breathing mechanics mean the respiratory muscles are unable to respond to the ventilatory demands, increasing the sensation of dyspnea. A high-frequency oscillating device has been developed to improve dyspnea in patients with COPD. We conducted a feasibility trial to gain insight into the potential for recruitment, retention, and study design for a future randomized controlled trial.

Methods: Symptomatic subjects with COPD were included on the basis of a Medical Research Council (MRC) score $\geq$ 3 and FEV1/FVC < 0.70). Patients were excluded if they received pulmonary rehabilitation within the last 6 months. The intervention employed the device for 8 weeks, 3 times daily. Clinical outcomes included the MRC score, maximal expiratory and inspiratory pressures (PEmax/PImax), the incremental shuttle walk test (ISWT), and the endurance shuttle walk test (ESWT).

Results: We successfully recruited 23 subjects with established COPD (65.2% male, mean age 65 ± 5.03 y, mean % predicted FEV1 43.9 ± 16, mean FEV1/FVC ratio 0.46 ± 0.13, and median [interquartile range] MRC 4 [3-5]). There was a significant change in MRC from 4 to 3 pre to post intervention (P = .003). There was a statistically significant difference in PEmaxP < .008 and PImaxP = .044. There were no significant differences observed in the ISWT or ESWT.

Conclusions: This study design appeared feasible to proceed to a clinical effectiveness trial. The use of the device for 8 weeks showed a significant improvement in PEmax, PImax, and reduced symptomatic dyspnea on the MRC dyspnea score. The results of this study should encourage a randomized controlled trial.

8.4 Intra versus extra-thoracic oscillations in chronic obstructive pulmonary disease

AUTOR: IN / AUTHOR:

Mohamed1, Alaa M., Badr2, Nagwa M., Hagag3, Aisha A., Mohamed, Yasser M.

QUELLE / SOURCE:

Journal of Advanced Pharmacy Education & Research, 2019/july, Vol. 9, No. 3

ABSTRAKT / ABSTRACT:

Objective: This study was conducted to compare the efficacy of intra versus extra-thoracic oscillations in chronic obstructive pulmonary disease (COPD) patients. Subjects and methods: Sixty male patients with COPD with an age range between 50-60 years were randomly divided into two groups, equal in number. Patients in Group (A) were treated by Oscillatory Positive Expiratory Pressure Quake device and patients in Group (B) were treated by High-frequency chest wall oscillation (HFCWO) vest. The treatment protocol was 30-45 minutes 4 sessions/week for 6 weeks for both groups in addition to COPD medications. All patients were evaluated before and after treatment by spirometry and impulse oscillometry. Results: Pre and Post-study comparison demonstrated that there was a significant improvement in the spirometric indices (FEV1, FVC, FEV1/FVC, and FEF25%-75%) and impulse oscillometry parameters (R5, X5) in both groups. A statistically significant difference was also found between the Quake device and vest HFCWO in most of the measured post-treatment parameters in favor of Quake device.

Conclusion: Both intra (Quake) and extra (vest HFCWO) thoracic oscillations have high effectiveness in the treatment of COPD patients by improving the impulse oscillometry parameters and ventilatory function with better results in favor of intrathoracic oscillations (Quake device).

8.5 The effects of whole-body vibration on muscle strength and power: a meta-analysis

AUTOR: IN / AUTHOR:

Osawa, Y., Oguma, Y., Ishii, N.

QUELLE / SOURCE:

J Musculoskelet Neuronal Interact, 2013, Vol. 13, No. 3, 380

ABSTRAKT / ABSTRACT:

Objectives: Patients with obstructive sleep apnea (OSA) (an obstructed airway and intermittent hypoxia) negatively affect their respiratory muscles. We evaluated the effects of a 12-week threshold inspiratory muscle training (TIMT) program on OSA severity, daytime sleepiness, and pulmonary function in newly diagnosed OSA.

Methods: Sixteen patients with moderate-to-severe OSA were randomly assigned to a TIMT group and 6 to a control group. The home-based TIMT program was 30-45 min/day, 5 days/week, for 12 weeks using a TIMT training device. Their apnea-hypopnea index (AHI), Epworth sleepiness scale (ESS), and forced vital capacity (FVC) scores were evaluated pre- and post-treatment. Polysomnographic (PSG) analysis showed that 9 TIMT-group patients had positively responded (TIMT-responder group: post-treatment AHI < pre-treatment) and that 7 had not (TIMT non-responder group: post-treatment AHI > pre-treatment).

Results: Post-treatment AHI and ESS scores were significantly (both $P < 0.05$) lower 6% and 20.2%, respectively. A baseline AHI $\leq$ 29.0/h predicted TIMT-responder group patients (sensitivity 77.8%; specificity 85.7%). FVC was also significantly ($P < 0.05$) higher 7.2%. Baseline AHI and FEV6.0 were significant predictors of successful TIMT-responder group intervention. OSA severity and daytime sleepiness were also significantly attenuated.

Conclusions: Home-based TIMT training is simple, efficacious, and cost-effective.

8.6 Vibrating Platform Training Improves Respiratory Muscle Strength, Quality of Life, and Inspiratory Capacity in the Elderly Adults: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

Pessoa, Maíra Florentino, Brandão, Daniela Cunha, Sá, Rafaela Barros de, Barcelar, Jacqueline de Melo, Rocha, Taciano Dias de Souza, Souza, Helga Cecília Muniz de, Dornelas de Andrade, Armele

QUELLE / SOURCE:

The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2016/july, glw123, DOI: https://doi.org/10.1093/gerona/glw123

ABSTRAKT / ABSTRACT:

Background: Aging affects respiratory strength that could cause reduction in functional capacity and quality of life, playing a fundamental role in healthy aging and survival. To prevent these declines, the whole body vibration (WBV) has been proposed to increase strength and functional capacity. The aim of the study was to evaluate the effects of WBV on respiratory muscle strength, thoracoabdominal ventilation, and quality of life in the elderly adults.

Methods: This study was a controlled, randomized double-blind clinical trial. The study included 28 elderly adults randomized into three groups: Resistance (n = 9), WBV (n = 9), or WBV + resistance exercises (n = 10), performing training, sham, or double training for 3 months, twice per week. The variables of the study were as follows: maximal inspiratory and expiratory pressures (MIP and MEP), distribution of thoracoabdominal volumes variation in optoelectronic plethysmography (pulmonary rib cage-VRCp, abdominal rib cage-VRCa, and abdomen-VAB), and quality of life.

Results: After training, WBV and WBV + resistance groups increased MIP and MEP ($p < .001$). During inspiratory capacity maneuver, WBV groups had incremental increases in chest wall total volume ($p < .001$), showing a rise in pulmonary rib cage ($p = .03$) and abdominal rib cage ($p = .04$). Furthermore, WBV groups improved SF-36 scores in functional capacity, physical aspects, energy, pain, and general heath domains.

Conclusions: The WBV is a training that could improve respiratory muscle strength and quality of life and promote different ventilatory strategies in chest wall and thoracoabdominal compartments in healthy elderly adults.

8.7 Vibration as an exercise modality: how it may work, and what its potential might be

AUTOR: IN / AUTHOR:

Rittweger, Jörn

QUELLE / SOURCE:

European Journal of Applied Physiology, 2009/december, Vol. 108, No. 5, 877–904, DOI: https://doi.org/10.1007/s00421-009-1303-3

ABSTRAKT / ABSTRACT:

Whilst exposure to vibration is traditionally regarded as perilous, recent research has focussed on potential benefits. Here, the physical principles of forced oscillations are discussed in relation to vibration as an exercise modality. Acute physiological responses to isolated tendon and muscle vibration and to whole body vibration exercise are reviewed, as well as the training effects upon the musculature, bone mineral density and posture. Possible applications in sports and medicine are discussed. Evidence suggests that acute vibration exercise seems to elicit a specific warm-up effect, and that vibration training seems to improve muscle power, although the potential benefits over traditional forms of resistive exercise are still unclear. Vibration training also seems to improve balance in sub-populations prone to fall, such as frail elderly people. Moreover, literature suggests that vibration is beneficial to reduce chronic lower back pain and other types of pain. Other future indications are perceivable.

8.8 What's the secret behind the benefits of whole-body vibration training in patients with COPD? A randomized, controlled trial

AUTOR: IN / AUTHOR:

Gloeckl, Rainer, Jarosch, Inga, Bengsch, Ulrike, Claus, Magdalena, Schneeberger, Tessa, Andrianopoulos, Vasileios, Christle, Jeffrey W., Hitzl, Wolfgang, Kenn, Klaus

QUELLE / SOURCE:

Respiratory Medicine, 2017/05, Vol. 126, 17–24, DOI: https://doi.org/10.1016/j.rmed.2017.03.014

ABSTRAKT / ABSTRACT:

Background: Several studies have shown that whole-body vibration training (WBVT) improves exercise capacity in patients with severe COPD. The aim of this study was to investigate the determinants of improved exercise capacity following WBVT.

Methods: Seventy-four COPD patients (FEV1: 34 ± 9%predicted) were recruited during a 3-week inpatient pulmonary rehabilitation (PR) program. Conventional endurance and strength exercises were supplemented with self-paced dynamic squat training sessions (4bouts*2min, 3times/wk). Patients were randomly allocated to either a WBVT-group performing squat training on a side-alternating vibration platform (Galileo) at a high intensity (24-26 Hz) or a control group performing squat training without WBVT.

Results: Patients in the WBVT group significantly improved postural balance in several domains compared to the control-group (i.e. tandem stance: WBVT +20% (95%CI 14 to 26) vs. control -10% (95%CI 6 to 15), $p < 0.001$; one-leg stance: WBVT +11% (95%CI 4 to 19) vs. control -8% (95%CI -19 to 3), $p = 0.009$). Six-minute walk distance and muscle power but not muscle strength were also significantly improved compared to control group.

Conclusions: Implementation of WBVT improves postural balance performance and muscle power output. The neuromuscular adaptation related to improved balance performance may be an important mechanism of the improvement in exercise capacity after WBVT especially in COPD patients with impaired balance performance and low exercise capacity.

8.9 Was ist dran am Klopfen?

AUTOR: IN / AUTHOR:

Pfeiffer, Antonia

QUELLE / SOURCE:

Psychotherapeutenjournal, 2018/march, 235

ABSTRAKT / ABSTRACT:

Zusammenfassung: Die sogenannten Klopftechniken wie die Prozess- und Embodimentfokussierte Psychologie (PEP) oder die Emotional Freedom Technique (EFT) haben auch in Deutschland längst Einzug in den klinischen Alltag gehalten. Vor allem Krankheitsbilder mit einem hohen körperlichen Arousal scheinen, will man den Anwendern1 Glauben schenken, gut auf die Behandlung mit Klopftechniken anzusprechen. Aufgrund der esoterisch anmutenden Wirkhypothesen einiger Techniken stehen ihnen jedoch weiterhin viele klassisch ausgebildete Psychotherapeuten kritisch gegenüber. Doch was sagen die wissenschaftlichen Studien der letzten Jahre über die Wirksamkeit der Klopftechniken? Für welche Krankheitsbilder ist eine Anwendung zu empfehlen? Die vorliegende Übersichtsarbeit soll einen Einblick in die Studienlage geben, die einzelnen Studien kritisch analysieren und ihre Ergebnisse mit Studien anderer Psychotherapieformen vergleichen. Auf dieser Grundlage sollen ferner wissenschaftliche Wirkhypothesen diskutiert werden.

8.10 Exploring vibroacoustic therapy in adults experiencing pain: a scoping review

AUTOR: IN / AUTHOR:

Kantor, Jiří, Campbell, Elsa A., Kantorová, Lucia, Marečková, Jana, Regec, Vojtěch, Karasová, Kristýna, Sedláčková, Dagmar, Klugar, Miloslav

QUELLE / SOURCE:

BMJ Open, 2022/april, Vol. 12, No. 4, e046591, DOI: https://doi.org/10.1136/bmjopen-2020-046591

ABSTRAKT / ABSTRACT:

Objective: To explore the characteristics and outcomes of vibroacoustic therapy (VAT) in adults experiencing pain. To give directions for future research and clinical applications of VAT in pain management for adults.
Design: Scoping review.
Data sources: BMČ, CINAHL Plus, Cochrane Library, EBSCOhost, EBM Reviews, EMBASE, Epistemonikos, ERIC, MEDLINE complete, Scopus, Web of Science, Google Scholar, ProQuest, hand search in unpublished sources.
Study selection: All quantitative and qualitative research studies and systematic reviews, without any date or language limit.
Data extraction: Two independent reviewers extracted data on the study design, location and setting, the causes of pain, participants, vibroacoustic intervention, measurement tools, and key findings related to pain.
Results: From 430 records, 20 were included for narrative synthesis. Fifteen studies researched chronic pain, two studies acute pain, two studies both types of pain and one study experimentally induced pain. The description of VAT applied in studies usually included the description of research experiments, vibroacoustic devices and frequencies of sinusoidal sound. There was high heterogeneity in study protocols, however, 40 Hz was predominantly used, most sessions ranged between 20 and 45 min, and the frequency of treatment was higher for acute pain (daily) compared with chronic pain (daily to once a week). Outcomes related to pain focused mainly on perceived pain; however, other surrogate measures were also considered, for example, an increased number of treatment days or pain medication usage.
Conclusions: Research in this area is too sparse to identify properties of VAT that are beneficial for pain management. We suggest VAT researchers describe a minimum of four measurements-frequency, amplitude, pulsation and loudness. Randomised controlled trials are needed to establish reliable scientific proof of VAT effectiveness for both acute and chronic pain. Furthermore, clinical practice would benefit from researching patients' experiences and preferences of vibroacoustic treatment and its psychosocial components.

8.11 Acoustic resonance therapy is safe and effective for the treatment of nasal congestion in rhinitis: A randomized sham-controlled trial

AUTOR: IN / AUTHOR:

Luong, Amber U., Yong, Michael, Hwang, Peter H., Lin, Bryant Y., Gopi, Paramesh, Mohan, Vivek, Ma, Yifei, Johnson, Jacob, Yen, David M., DeMera, Richard S., Bleier, Benjamin S.

QUELLE / SOURCE:

International Forum of Allergy & Rhinology, 2023/october, Vol. 14, No. 5, 919–927, DOI: https://doi.org/10.1002/alr.23284

ABSTRAKT / ABSTRACT:

Background: Acoustic resonance therapy (ART) is a novel vibrational treatment that delivers patient-specific resonant frequency acoustic energy to the sinonasal cavities. In a pilot study, ART was effective for the acute treatment of nasal congestion. We conducted a sham-controlled randomized trial to validate the efficacy of ART when administered daily for 2 weeks.

Methods: A total of 52 adult patients were enrolled in a multi-center, randomized, double-blinded, sham-controlled, interventional study evaluating ART administered by a vibrational headband. Patients received either active treatment or a non-therapeutic sham treatment twice daily over 2 weeks. Clinical endpoints were the average change in nasal congestion sub-score of the Total Nasal Symptom Score (TNSS) and the average change in composite TNSS.

Results: ART resulted in a significantly greater mean change in the nasal congestion sub-score compared to sham (-0.87 [95% confidence interval [CI] -1.11, -0.62] vs. -0.44 [95% CI -0.64, -0.23], p = 0.008). ART also resulted in a significantly greater reduction in the composite TNSS versus sham, (-2.85 [95% CI -3.85, -1.85], vs. -1.32 [95% CI -2.27, -0.36], p = 0.027). The response rate, determined by a nasal congestion sub-score minimal clinically important difference of 0.23, was 80.8% for ART and 46.2% for sham, with an adjusted risk ratio of 1.95 (95% CI 1.26, 3.02, p = 0.003) in favor of ART. Safety endpoints showed no adverse events.

Conclusion: ART is a safe and effective non-pharmacologic alternative for the treatment of nasal congestion.

9 Studien zur Entwöhnung / *studies on weaning*

9.1 AARC Clinical Practice Guideline: Spontaneous Breathing Trials for Liberation From Adult Mechanical Ventilation

AUTOR: IN / AUTHOR:

Roberts, Karsten J., Goodfellow, Lynda T., Battey-Muse, Corinne M., Hoerr, Cheryl A., Carreon, Megan L., Sorg, Morgan E., Glogowski, Joel, Girard, Timothy D., MacIntyre, Neil R., Hess, Dean R.

QUELLE / SOURCE:

Respiratory Care, 2024/march, Vol. 69, No. 7, 891–901, DOI: https://doi.org/10.4187/respcare.11735

9.2 Can inspiratory muscle training improve weaning outcomes in difficult to wean patients? A protocol for a randomised controlled trial (IMweanT study)

AUTOR: IN / AUTHOR:

Hoffman, Mariana, Van Hollebeke, Marine, Clerckx, Beatrix, Muller, Johannes, Louvaris, Zafeiris, Gosselink, Rik, Hermans, Greet, Langer, Daniel

QUELLE / SOURCE:

BMJ Open, 2018/june, Vol. 8, No. 6, e021091, DOI: https://doi.org/10.1136/bmjopen-2017-021091

ABSTRAKT / ABSTRACT:

Introduction: Respiratory muscle dysfunction has been associated with failure to wean from mechanical ventilation. It has therefore been hypothesised that these patients might benefit from inspiratory muscle training (IMT). Evidence, however, is thus far limited to data from small, single-centre studies with heterogeneity in inclusion criteria, training modalities and outcomes. The aim of this study is to evaluate the effects of a novel IMT method on weaning outcomes in selected patients with weaning difficulties.

Methods: This study is designed as a double-blind, parallel-group, randomised controlled superiority trial with 1:1 allocation ratio. Patients with weaning difficulties will be randomly allocated into either an IMT group (intervention) or a sham-IMT group (control). Ninety patients (45 in each group) will be needed to detect a 28% difference in the proportion of weaning success between groups (estimated difference in primary outcome based on previous studies) with a risk for type I error (α) of 5% and statistical power (1-β) of 80%. Patients will perform four sets of 6-10 breaths daily against an external load using a tapered flow resistive loading device (POWERbreathe KH2, HaB International, UK). Training intensity in the intervention group will be adjusted to the highest tolerable load. The control group will train against a low resistance that will not be modified during the training period. Training will be continued until patients are successfully weaned or for a maximum duration of 28 days. Pulmonary and respiratory muscle function, weaning duration, duration of mechanical ventilation, ventilator-free days and length of stay in the intensive care unit will be evaluated as secondary outcomes. $X2$ tests and analysis of covariance with adjustments for baseline values of respective outcomesas covariates will be used to compare results after the intervention period between groups.

Ethics and dissemination: Ethics approval was obtained from the local ethical committee (Ethische Commissie Onderzoek UZ/KU Leuven protocol ID: S60516). Results from this randomised controlled trial will be presented at scientific meetings as abstracts for poster or oral presentations and published in peerreviewed journals.

Trial status: Enrolment into the study have started in August 2017. Data collection and data analysis are expected to be completed in September 2021.

9.3 High-Intensity Inspiratory Muscle Training Improves Scalene and Sternocleidomastoid Muscle Oxygenation Parameters in Patients With Weaning Difficulties: A Randomized Controlled Trial

AUTOR: IN / AUTHOR:

Van Hollebeke, Marine, Poddighe, Diego, Clerckx, Beatrix, Muller, Jan, Hermans, Greet, Gosselink, Rik, Langer, Daniel, Louvaris, Zafeiris

QUELLE / SOURCE:

Frontiers in Physiology, 2022/february, Vol. 13, DOI: https://doi.org/10.3389/fphys.2022.786575

ABSTRAKT / ABSTRACT:

Background: Critically ill patients who have difficulties weaning from the mechanical ventilator are prone to develop respiratory muscle weakness. Inspiratory muscle training (IMT) can improve respiratory muscle strength. Whether IMT can improve scalene and sternocleidomastoid muscle oxygenation parameters is unknown.

Aim: To compare changes in muscle oxygenation parameters of scalene and sternocleidomastoid inspiratory muscles during a standardized task between patients with weaning difficulties who received either high-intensity IMT (intervention) or sham low-intensity IMT (control).

Method: Forty-one patients performed daily IMT sessions (4 sets, 6-10 breaths) until weaning success or for 28 consecutive days. The training load was progressively adjusted in the intervention group (n = 22) to the highest tolerable load, whilst the control group (n = 19) kept training at 10% of their baseline maximal inspiratory pressure (PImax). Breathing characteristics (i.e., work and power of breathing, PoB), respiratory muscle function [i.e., PImax and forced vital capacity (FVC)] were measured during a standardized loaded breathing task against a load of 30% of baseline PImax before and after the IMT period. In addition, during the same loaded breathing task, absolute mean and nadir changes from baseline in local scalene and sternocleidomastoid muscle oxygen saturation index (Δ%StiO2) (an index of oxygen extraction) and nadir Δ%StiO2 normalized for the PoB were measured by near-infrared spectroscopy.

Results: At post measures, only the intervention group improved mean PoB compared to pre measures (Pre: 0.42 ± 0.33 watts, Post: 0.63 ± 0.51watts, p-value < 0.01). At post measures, both groups significantly improved nadir scalene muscles StiO2% normalized for the mean PoB (ΔStiO nadir %/watt) compared to pre measurements and the improvement was not significant different between groups (p-value = 0.40). However, at post measures, nadir sternocleidomastoid muscle StiO2% normalized for the mean PoB (ΔStiO nadir

%/watt) was significantly greater improved in the intervention group (mean difference: +18.4, 95%CI: -1.4; 38.1) compared to the control group (mean difference: +3.7, 95%CI: -18.7; 26.0, between group p-value < 0.01). Both groups significantly improved PImax (Intervention: +15 ± 13 cmH2O p-value < 0.01, Control: +13 ± 15 cmH2O p-value < 0.01). FVC only significantly improved in the intervention group (+0.33 ± 0.31 L p < 0.01) report also change in control group.

Conclusion: This exploratory study suggests that high-intensity IMT induces greater improvements in scalene and sternocleidomastoid muscle oxygenation parameters attributed for oxygen delivery, utilization and oxygen saturation index compared to low-intensity IMT in patients with weaning difficulties.

9.4 Inspiratory muscle strength training improves weaning outcome in failure to wean patients: a randomized trial

AUTOR: IN / AUTHOR:

Martin, A. Daniel, Smith, Barbara K., Davenport, Paul D., Harman, Eloise, Gonzalez-Rothi, Ricardo J., Baz, Maher, Layon, A. Joseph, Banner, Michael J., Caruso, Lawrence J., Deoghare, Harsha, Huang, Tseng-Tien, Gabrielli, Andrea

QUELLE / SOURCE:

Critical Care, 2011/march, Vol. 15, No. 2, DOI: https://doi.org/10.1186/cc10081

ABSTRAKT / ABSTRACT:

Introduction Most patients are readily liberated from mechanical ventilation (MV) support, however, 10% - 15% of patients experience failure to wean (FTW). FTW patients account for approximately 40% of all MV days and have significantly worse clinical outcomes. MV induced inspiratory muscle weakness has been implicated as a contributor to FTW and recent work has documented inspiratory muscle weakness in humans supported with MV.

Methods We conducted a single center, single-blind, randomized controlled trial to test whether inspiratory muscle strength training (IMST) would improve weaning outcome in FTW patients. Of 129 patients evaluated for participation, 69 were enrolled and studied. 35 subjects were randomly assigned to the IMST condition and 34 to the SHAM treatment. IMST was performed with a threshold inspiratory device, set at the highest pressure tolerated and progressed daily. SHAM training provided a constant, low inspiratory pressure load. Subjects completed 4 sets of 6-10 training breaths, 5 days per week. Subjects also performed progressively longer breathing trials daily per protocol. The weaning criterion was 72 consecutive hours without MV support. Subjects were blinded to group assignment, and were treated until weaned or 28 days.

Results Groups were comparable on demographic and clinical variables at baseline. The IMST and SHAM groups respectively received 41.9 ± 25.5 vs. 47.3 ± 33.0 days of MV support prior to starting intervention, P = 0.36. The IMST and SHAM groups participated in 9.7 ± 4.0 and 11.0 ± 4.8 training sessions, respectively, P = 0.09. The SHAM group's pre to post-training maximal inspiratory pressure (MIP) change was not significant (-43.5 ± 17.8 vs. -45.1 ± 19.5 cm H2O, P = 0.39), while the IMST group's MIP increased (-44.4 ± 18.4 vs. -54.1 ± 17.8 cm H2O, P < 0.0001). There were no adverse events observed during IMST or SHAM treatments. Twenty-five of 35 IMST subjects weaned (71%, 95% confidence interval (CI) = 55% to 84%), while 16 of 34 (47%, 95%

CI = 31% to 63%) SHAM subjects weaned, P = .039. The number of patients needed to be treated for effect was 4 (95% CI = 2 to 80).

Conclusions An IMST program can lead to increased MIP and improved weaning outcome in FTW patients compared to SHAM treatment.

9.5 Inspiratory muscle training facilitates weaning from mechanical ventilation among patients in the intensive care unit: a systematic review

AUTOR: IN / AUTHOR:

Elkins, Mark, Dentice, Ruth

QUELLE / SOURCE:

Journal of Physiotherapy, 2015/july, Vol. 61, No. 3, 125–134, DOI: https://doi.org/10.1016/j.jphys.2015.05.016

ABSTRAKT / ABSTRACT:

Question: Does inspiratory muscle training improve inspiratory muscle strength in adults receiving mechanical ventilation? Does it improve the duration or success of weaning? Does it affect length of stay, reintubation, tracheostomy, survival, or the need for post-extubation non-invasive ventilation? Is it tolerable and does it cause adverse events?

Design: Systematic review of randomised trials.

Participants: Adults receiving mechanical ventilation.

Intervention: Inspiratory muscle training versus sham or no inspiratory muscle training.

Outcome measures: Data were extracted regarding: inspiratory muscle strength and endurance; the rapid shallow breathing index; weaning success and duration; duration of mechanical ventilation; reintubation; tracheostomy; length of stay; use of non-invasive ventilation after extubation; survival; readmission; tolerability and adverse events.

Results: Ten studies involving 394 participants were included. Heterogeneity within some meta-analyses was high. Random-effects meta-analyses showed that the training significantly improved maximal inspiratory pressure (MD 7 cmH2O, 95% CI 5 to 9), the rapid shallow breathing index (MD 15 breaths/min/l, 95% CI 8 to 23) and weaning success (RR 1.34, 95% CI 1.02 to 1.76). Although only assessed in individual studies, significant benefits were also reported for the time spent on non-invasive ventilation after weaning (MD 16 hours, 95% CI 13 to 18), length of stay in the intensive care unit (MD 4.5 days, 95% CI 3.6 to 5.4) and length of stay in hospital (MD 4.4 days, 95% CI 3.4 to 5.5). Weaning duration decreased in the subgroup of patients with known weaning difficulty. The other outcomes weren't significantly affected or weren't measured.

Conclusion: Inspiratory muscle training for selected patients in the intensive care unit facilitates weaning, with potential reductions in length of stay and the duration of non-invasive ventilatory support after extubation. The heterogeneity among the results suggests that the effects of inspiratory muscle training may vary; this perhaps depends on factors such as the components of usual care or the patient's characteristics.

10 Studien zur Musik-Therapie / *studies on music therapy*

10.1 Die Wirksamkeit von Musiktherapie in der Palliativmedizin – Eine randomisiert-kontrollierte Studie zu psychologischen und physiologischen Effekten einer rezeptiven Entspannungstechnik

AUTOR: IN / AUTHOR:

sc. hum. Marco Warth, Dr.

QUELLE / SOURCE:

Medizinische Fakultät Heidelberg und Uniklinikum, Universitätsklinik für Anaesthesiologie, 2017

10.2 Physiological responses to and subjective estimates of soundscape elements

AUTOR: IN / AUTHOR:

Hume, Ken, Ahtamad, Mujthaba

QUELLE / SOURCE:

Applied Acoustics, 2013/february, Vol. 74, No. 2, 275–281, DOI:
https://doi.org/10.1016/j.apacoust.2011.10.009

ABSTRAKT / ABSTRACT:

Soundscapes provide complex auditory experiences with emotional content, but there are few and limited objective tools available to investigate the relative benefits of soundscape elements. As part of the Positive Soundscapes (UK) project, the effects of individual soundscape elements on the subjective assessment of pleasantness and arousal were compared with associated physiological responses: Heart Rate (HR), Respiratory Rate (RR) and forehead electromyography (EMG) levels. Eighty subjects listened to 18 × 8 s sound-clips from soundscapes. HR, RR and EMG were recorded and the subjective pleasantness and arousal were assessed on 9 point scales. The data were analysed via a linear mixed-model ANOVA. Listening to sound-clips lowered HR slightly but significantly. Male subjects had significantly lower HR before and during sound-clips than female subjects. More unpleasant sound-clips caused larger falls in HR, which was greater in males. Listening to a sound-clip raised RR slightly but significantly. The more pleasant the sound-clip was judged the greater was the rise in RR. This direct relationship between pleasantness and RR response was greater in males. The EMG tended to be raised by unpleasant sound-clips, in both males and females. Distinctive relationships were found between physiological measurements and the subjective estimates of the pleasantness of the presented sound-clips.

10.3 The effect of playing a wind instrument or singing on risk of sleep apnea: a systematic review and meta-analysis

AUTOR: IN / AUTHOR:

van der Weijden, Fawn N., Lobbezoo, Frank, Slot, Dagmar E.

QUELLE / SOURCE:

Journal of Clinical Sleep Medicine, 2020/september, Vol. 16, No. 9, 1591–1601, DOI: https://doi.org/10.5664/jcsm.8628

ABSTRAKT / ABSTRACT:

Study Objectives: To systematically survey the scientific literature concerning the effect of playing a wind instrument or singing on sleep, snoring, and/or obstructive sleep apnea.

Methods: The PubMed, EMBASE, and Cochrane databases were searched up to December 2019. Observational studies and (Randomized) Controlled Clinical Trials that assessed sleep, snoring, or obstructive sleep apnea as clinical outcome or via a questionnaire were included. For the individual studies, the potential risk of bias was scored. Data between oral musicians and control participants were extracted. Descriptive analysis and meta-analysis were performed.

Results: Six eligible studies (5 cross-sectional, 1 randomized controlled trial) were retrieved, with an estimated potential bias ranking from low to high. The sample sizes ranged from 25 to 1,105 participants. Descriptive analysis indicated that players of a double-reed instrument have a lower risk of obstructive sleep apnea and that singers snore less compared with control participants. Playing a didgeridoo showed a positive effect on apnea-hypopnea index, daytime sleepiness, and partner's rating for sleep disturbance. The descriptive analysis could not be substantiated in the meta-analysis. The magnitude of the effect was zero to small, and the generalizability was limited because of long (professional) rehearsal time or small sample size.

Conclusions: Playing a wind instrument and singing may have a small but positive effect on sleep disorders. Considering the practicality and investment of (rehearsal) time, didgeridoo and singing are the most promising interventions to reduce obstructive sleep apnea and snoring, respectively. However, the results of this review are based on few studies and the synthesis of the evidence is graded to have low certainty.

Citation: van der Weijden FN, Lobbezoo F, Slot DE. The effect of playing a wind instrument or singing on risk of sleep apnea: a systematic review and meta-analysis. J Clin Sleep Med. 2020;16(9):1591–1601.

10.4 The Effects of Presleep Slow Breathing and Music Listening on Polysomnographic Sleep Measures – a pilot trial

AUTOR: IN / AUTHOR:

Kuula, Liisa, Halonen, Risto, Kajanto, Kristiina, Lipsanen, Jari, Makkonen, Tommi, Peltonen, Miina, Pesonen, Anu-Katriina

QUELLE / SOURCE:

Scientific Reports, 2020/05, Vol. 10, No. 1, DOI: https://doi.org/10.1038/s41598-020-64218-7

ABSTRAKT / ABSTRACT:

Knowledge on efficient ways to reduce presleep arousal and, therefore, improve sleep, is scanty. We explored the effects of presleep slow breathing and music listening conditions on sleep quality and EEG power spectral density in young adults in a randomized, controlled trial with a crossover design. Participants' (N = 20, 50% females) sleep was measured on two consecutive nights with polysomnography (40 nights), the other night serving as the control condition. The intervention condition was either a 30-minute slow breathing exercise or music listening (music by Max Richter: Sleep). The intervention and control conditions were placed in a random order. We measured heart rate variability prior to, during and after the intervention condition, and found that both interventions increased immediate heart rate variability. Music listening resulted in decreased N2 sleep, increased frontal beta1 power spectral density, and a trend towards increased N3 sleep was detected. In the slow breathing condition higher central delta power during N3 was observed. While some indices pointed to improved sleep quality in both intervention groups, neither condition had robust effects on sleep quality. These explorative findings warrant further replication in different populations.

10.5 The Influence of Listening to Nature Sounds on Mental Health

AUTOR: IN / AUTHOR:

Kazumi Nishida, Mayumi Oyama-Higa

QUELLE / SOURCE:

T.D. Pham et al. (Eds.): ACBIT, 2014, 319

ABSTRAKT / ABSTRACT:

The sounds of ocean waves, stream, thunderstorm and birds, which are called nature sounds, have a deep connection with the life of human beings in the process of evolution. However, people of today have been away from listening to those sounds. This study aims to prove our hypothesis that listening to the nature sounds can influence our mental conditions.

We measured plethysmogram in order to obtain the Largest Lyapunov Exponent (LLE) and the Autonomic Nervous Balance (ANB) as indexes of mental conditions. The subjects were 8 healthy people, including 3 males and 5 females, aging between 16 and 57.

The subjects were asked to listen to each of the 4 kinds of sounds, which includes 3 kinds of nature sounds—ocean waves, birds by the stream, and thunderstorm, as well as 1 electronic sound that imitates bird songs for comparison purpose. For each of them, plethysmogram was taken for 10 minutes. In addition, before and after the action of listening to these sounds, we also conducted a respective 5-minute measurement under the condition of no sound.

The result implied a possibility that nature sounds have a special effect on our mental conditions. Furthermore, ANB was used to show how nature sounds differ from electronic sounds in this effect.

10.6 Music therapy for stress reduction: a systematic review and meta-analysis

AUTOR: IN / AUTHOR:

de Witte, Martina, Pinho, Ana da Silva, Stams, Geert-Jan, Moonen, Xavier, Bos, Arjan E. R., van Hooren, Susan

QUELLE / SOURCE:

Health Psychology Review, 2020/november, Vol. 16, No. 1, 134–159, DOI:
https://doi.org/10.1080/17437199.2020.1846580

ABSTRAKT / ABSTRACT:

Music therapy is increasingly being used as an intervention for stress reduction in both medical and mental healthcare settings. Music therapy is characterized by personally tailored music interventions initiated by a trained and qualified music therapist, which distinguishes music therapy from other music interventions, such as 'music medicine', which concerns mainly music listening interventions offered by healthcare professionals. To summarize the growing body of empirical research on music therapy, a multilevel meta-analysis, containing 47 studies, 76 effect sizes and 2.747 participants, was performed to assess the strength of the effects of music therapy on both physiological and psychological stress-related outcomes, and to test potential moderators of the intervention effects. Results showed that music therapy showed an overall medium-to-large effect on stress-related outcomes (d = .723, [.51-.94]). Larger effects were found for clinical controlled trials (CCT) compared to randomized controlled trials (RCT), waiting list controls instead of care as usual (CAU) or other stress-reducing interventions, and for studies conducted in Non-Western countries compared to Western countries. Implications for both music therapy and future research are discussed.

11 Studien zur nasalen akustischen Vibrations- & OPEP Therapie / studies on nasal acoustic vibrations- & OPEP therapy

11.1 Treatment of sinus headache using a device that combines acoustic vibration with oscillating expiratory pressure

AUTOR: IN / AUTHOR:

Miglani, Amar, Germroth, Matthew, LaPointe, Kristina A., Nguyen, Shaun A., Meyer, Ted A.

QUELLE / SOURCE:

Laryngoscope Investigative Otolaryngology, 2023/july, Vol. 8, No. 4, 839–846, DOI: https://doi.org/10.1002/lio2.1124

ABSTRAKT / ABSTRACT:

Objective To determine if simultaneous administration of acoustic vibration and oscillating expiratory pressure affects the severity of facial pain among patients with complaint of “sinus headache”.

Methods This is a prospective single-arm observational study performed at a tertiary care medical center. Subjects with complaint of sinus headache without evidence of chronic rhinosinusitis on exam or computed tomography participated in a clinical study applying simultaneous acoustic vibrations and positive expiratory pressure to the nasal cavity twice daily over 4 weeks. Efficacy was assessed using three validated pain metrics—pain visual analog scale (VAS), brief pain inventory-short form (BPI-SF), and McGill pain questionnaire-short form (MPQ-SF). Device safety and patient satisfaction were also assessed using questionnaires.

Results Twenty-nine patients (mean age 49 years, 55% female) completed the study without any major adverse events. At the 4 week follow-up, facial pain VAS improved from mean ± SD of 59.6 ± 15.7 to 34.6 ± 21.7 ($p < .001$), BPI mean pain (mean ± standard deviation) improved from 4.4 ± 2.0 to 2.9 ± 1.9 ($p = .007$), and MPQ-SF total improved from 12.2 ± 6.5 to 6.5 ± 5.2 ($p < .001$) with approximately 70% of patients achieving a minimal clinically important difference (MCID) across all metrics. Additionally, pain VAS was assessed 5 min after a single use at baseline with significant improvement ($p < .001$). Eighty-six percent of subjects would both use device again and recommend it to others.

Conclusions Simultaneous administration of acoustic vibration and oscillating expiratory pressure appears to be a safe treatment for sinus headaches in patients without objective evidence of chronic sinusitis. Results from this initial study are promising with regard to efficacy in treatment of sinus headaches but will require further study.

11.2 Applications of vibrational energy in the treatment of sinonasal disease: A scoping review

AUTOR: IN / AUTHOR:

Phillips, Katie M., Roozdar, Pooya, Hwang, Peter H.

QUELLE / SOURCE:

International Forum of Allergy & Rhinology, 2022/march, Vol. 12, No. 11, 1397–1412, DOI: https://doi.org/10.1002/alr.22988

ABSTRAKT / ABSTRACT:

Background:Acoustic energy and vibration therapy are emerging as helpful adjuncts among many disease states. There has been interest in how this tech-nology can either serve as an alternative treatment or enhance delivery of med-ications to treat pathology within the nasal cavity and paranasal sinuses. Ourobjective was to perform a scoping review of the state of the science of vibrationtreatment used in sinonasal disease. Methods:A search of Embase, PubMed, and CINAHL databases was performedin November 2021. Included studies evaluated acoustic energy as a means oftreatment in sinonasal diseases. Data points collected included type of technol-ogy utilized, disease state treated, and outcomes. Results:The initial search identified 2902 studies, of which 44 met inclusion cri-teria. A wide array of vibrational technology such as ultrasound, sonic aerosols,and phonophoresis, with varying frequency and amplitude were described.Twenty-six studies evaluated the use of acoustic energy to treat sinonasal dis-ease itself, while 18 studies evaluated the use of acoustic energy to facilitate drugdelivery to the sinonasal cavity. Outcome measures among studies were highlyvaried. Conclusions:Vibration technology used in patients with sinonasal pathologyhas been shown to improve pain, sinonasal symptoms, and radiologic outcomemeasures in small studies. Given the heterogeneous study populations and out-comes, no conclusion could be reached regarding overall effectiveness of acous-tic energy as a primary treatment. Further research is required to study specific treatment indications in larger patient populations to fully understand the poten-tial clinical benefit and to determine optimal therapeutic characteristics of sound energy.

11.3 Physiotherapie der chronischen Rhino-Sinusitis (Postnasal drip Syndrom) mit dem RC-Cornet®N

AUTOR: IN / AUTHOR:

Urlich Hartman Cegla, A. Harten

ABSTRAKT / ABSTRACT:

Bei Betrachtung aller Patienten mit Postnasal-Drip-Syndrom kam es nach 3 Minuten nach Arbeiten mit den RCCornet ®N zu einem Abfallen des Rhinomanometriewertes , nach 5 Minuten war der Ausgangswert wieder erreicht, nach 15 Minuten leicht überschritten und nach einer Woche deutlich höher als der Ausgangswert. Zu keinem Zeitpunkt waren die Veränderungen der Rhinomanometrie gegenüber dem Ausgangswert statistisch signifikant different. Die vorliegenden Ergebnisse lassen sich bei aller Vorsicht heute wie folgt erklären: Im RC-Cornet®N wird zunächst ein positiver Druck, der im Bereich zwischen 20 und 30 cm Wassersäule liegt, erzeugt. Dieser Druck zeigt Oszillationen mit Schwankungen um etwa 5cm Wassersäule . Durch den Druck und die Schwankungen werden die Rugae der Schleimhaut des Nasenrachen-Raumes auseinander gedrückt und damit der Schleim abgeschert, ferner kommt es intermittierend zur Erweiterung der Ostien der Sinus und soweit diese Ostien nicht voll verschlossen sind, auch zur Ablösung von Schleim. (...) After 3 minutes of therapy with the RC-Cornet N all patients with postnasal-drip-syndrom showed a drop of the rhinomanometry-value, after 5 minutes the initial value vas reached again, after 15 minutes it was lightly exceeded and after one week it was obviously higher than the initial value. At no time the changes of the Rhinomanometrie were compared with the initial value statistically significantly different. The existing results can be explained very careful today as follows: The RC-Cornet N produces a positive pressure, which lies inbetween 20 to 30 cm H2O. This pressure shows oscillactions wiht variations around 5 cm H2O. Based on the pressure and the variations the rugae of the mucus of the nasal-throat-area is pressed apart and the mucus is shered-off, furthermore the ostia of the sinus are expanded intermittend and as soon as the ostia is not totally closed, mucus can be loosend. (...)_

11.4 Veränderung von postnasal drip, Reizhusten, Atemwegswiderstand und bronchialerHyperreagibilität bei Asthma bronchiale durch oszillierende PEP-Behandlung (RC-Cornet-N) desNasen-Rachen-Raums

AUTOR: IN / AUTHOR:

Cegla, Urlich Hartman, Jost., Hans Jürgen, Harten, A.

QUELLE / SOURCE:

Atemw.-Lungenkrkh, Jahrgang 29, No. 9/2003, 428

ABSTRAKT / ABSTRACT:

Veränderung von postnasal drip, Reizhusten, Atemwegswiderstand und bronchialer Hyperreagibilität bei Asthma bronchiale durch oszillierende PEP-Behandlung (RC-Cornet-N) des Nasen-Rachen-Raums. Eine randomisierte, gegen 0,9%-ige NaCl kontrollierte, prospektive 4-Wochen-Studie Postnasal drip ist eine häufige Ursache eines “ungeklärten” Hustens und verschlechtert eine Bronchialobstruktion. Mit Hilfe von szillierenden Druckschwankungen im Nasen-Rachen-Raum, wie sie bei der Anwendung eines RC-Cornet-N entstehen, kam es nach einer Woche bei 100 Patienten in 70% zu einer signifikanten Abnahme der Schleimsezernierung und des Reizhustens. Die Autoren haben nach einwöchiger Therapie mit dem RC-Cornet-N eine signifikante Zunahme der Weite der Nase und des Rachenraums mittels oszillatorischer Rhinomanometrie (von 45,9 ± 22,2 auf 57,0 ± 22,0 ml, p <0,00001) feststellen können. Eine Woche nach der Therapie waren der postnasal drip in 73% und der Reizhusten in 54% bei den 52 so behandelten Patienten verschwunden. In einer weiteren randomisierten, prospektiven, Double-Dummy-Studie über 4Wochen an 50 Asthmatikern, in der die eine Gruppe die Nase und den Rachenraum 2 × täglich mit physiologischer Kochsalzlösung spülte und die zweite Gruppe zu dieser Spülung 2 × täglich 2 Minuten mit dem RC-Cornet-N auf jedem Nasenloch arbeitete, wurden folgende Ergebnisse erzielt: In der RC-Cornet-NGruppe fiel bei sonst identischer Therapie der Atemwegswiderstand von 0,43 ± 0,06 in der zweiten Woche auf 0,38 ± 0,05 (p < 0,0269) und in der 4.Woche auf 0,37 ± 0,07 kPa×s/l (p< 0,0006) signifikant gegenüber dem Ausgangswert ab. Auch der PostbroncholyseAtemwegswiderstand (nach 2 Hub Salbutamol Dosieraerosol) sank von 0,35 ± 0,05auf 0,31 ± 0,06 kPa×s/l nach 4Wochen ab (p< 0,000001). Schon nach einerWoche gaben in der RC-Cornet-N-Gruppe 84% der Patienten an, daß der Reizhusten verschwunden seioder sich erheblich gebessert habe, gleiche Angaben machten 88% für den Postnasal drip. Die alleinige Kochsalz-Behandlungsgruppe zeigte bei identischen Ausgangswerten bezüglich der Lungenfunktion und der Beschwerden marginale Änderungen. Der pathophysiologische Hintergrund für dieseneue physikalische Therapie des Krankheitsbildes Postnasal-drip-Syndroms wird erörtert. Improvement of postnasal drip, dry cough, airway resistance and bronchial

hyperreactivity in asthmatics treated with oscillating pep (RC-Cornet-N) of the nasopharynx Postnasal drip is a common cause of chronic cough and deteriorates bronchial obstruction. By using oscillating pressure via the nose – produced by RC-Cornet-N – the postnasal drip and cough were stopped in 70% of the patients (n = 100) after 1 week. The authers examined the influence of nasal oscillating PEPon the patency of the nose and upper pharynx by oscillatory rhinomanometry. After 1-week use of the RC-Cornet-N 2 times daily the cavum volume increased from 45.9 ± 22.2 to 57.0 ± 22.0 ml, p <0.000011. At the same time, the cough disappeared in 54% and the postnasal drip in 73% of the 52 patients. In a randomized prospective, double-dummy controlled study in 50 asthmatics inwhom1 group irrigated the nose 2 times daily by 0.9% NaCl and the other group used after this irrigation the RC Cornet-N 2 times daily through every nostril. The following results had been achieved: the RC-Cornet-N reduced the airway resistance from 0.43 ± 0.06 to 0.38 ± 0.05 after 2 weeks (p < 0.0269) and to 0.37 ± 0.07 (kPa×s/l) after 4 weeks (p < 0.000001) in comparison to the beginning. Also the resistance after 2 puffs salbutamol fell from 0.35 ± 0.05 to 0.31 ± 0.06 (p < 0.000001) after 4-week Cornet-Ntherapy. At the end of the first week, in the RC-Cornet-N group 84% reported a significant decrease or loss of cough and 88% of the patients lost the postnasal drip. The “only” 0.9% NaCl group did not change either symptoms nor lung function over the 4 weeks. The pathophysiological background of this new physical therapy is discussed.

12 Leitlinien / *guidelines*

12.1 European Respiratory Society statement on airway clearance techniques in adults with bronchiectasis

AUTOR: IN / AUTHOR:

Herrero-Cortina, Beatriz, Lee, Annemarie L., Oliveira, Ana, O'Neill, Brenda, Jácome, Cristina, Dal Corso, Simone, Poncin, William, Muñoz, Gerard, Inal-Ince, Deniz, Alcaraz-Serrano, Victoria, Reychler, Gregory, Bellofiore, Angela, Posthumus, Annette, Tonia, Thomy, Chalmers, James D., Spinou, Arietta

QUELLE / SOURCE:

European Respiratory Journal, 2023/05, Vol. 62, No. 1, 2202053, DOI: https://doi.org/10.1183/13993003.02053-2022

ABSTRAKT / ABSTRACT:

Airway clearance techniques (ACTs) are part of the main management strategy for patients with bronchiectasis. Despite being a priority for patients, accessibility, implementation and reporting of ACTs are variable in clinical settings and research studies. This European Respiratory Society statement summarises current knowledge about ACTs in adults with bronchiectasis and makes recommendations to improve the future evidence base. A task force of 14 experts and two patient representatives (10 countries) determined the scope of this statement through consensus and defined six questions. The questions were answered based on systematic searches of the literature. The statement provides a comprehensive review of the physiological rationale for ACTs in adults with bronchiectasis, and the mechanisms of action along with the advantages and disadvantages of each ACT. Evidence on ACTs in clinical practice indicates that the most frequently used techniques are active cycle of breathing techniques, positive expiratory pressure devices and gravity-assisted drainage, although there is limited evidence on the type of ACTs used in specific countries. A review of 30 randomised trials for the effectiveness of ACTs shows that these interventions increase sputum clearance during or after treatment, reduce the impact of cough and the risk of exacerbations, and improve health-related quality of life. Furthermore, strategies for reducing the risk of bias in future studies are proposed. Finally, an exploration of patients' perceptions, barriers and enablers related to this treatment is also included to facilitate implementation and adherence to ACTs.

12.2 AARC Clinical Practice Guideline: Spontaneous Breathing Trials for Liberation From Adult Mechanical Ventilation

AUTOR: IN / AUTHOR:

Roberts, Karsten J., Goodfellow, Lynda T., Battey-Muse, Corinne M., Hoerr, Cheryl A., Carreon, Megan L., Sorg, Morgan E., Glogowski, Joel, Girard, Timothy D., MacIntyre, Neil R., Hess, Dean R.

QUELLE / SOURCE:

Respiratory Care, 2024/march, Vol. 69, No. 7, 891–901, DOI: https://doi.org/10.4187/respcare.11735

12.3 2022 ACC/AHA/HFSA Guideline for the Management of Heart Failure

AUTOR: IN / AUTHOR:

Heidenreich, Paul A., Bozkurt, Biykem, Aguilar, David, Allen, Larry A., Byun, Joni J., Colvin, Monica M., Deswal, Anita, Drazner, Mark H., Dunlay, Shannon M., Evers, Linda R., Fang, James C., Fedson, Savitri E., Fonarow, Gregg C., Hayek, Salim S., Hernandez, Adrian F., Khazanie, Prateeti, Kittleson, Michelle M., Lee, Christopher S., Link, Mark S., Milano, Carmelo A., Nnacheta, Lorraine C., Sandhu, Alexander T., Stevenson, Lynne Warner, Vardeny, Orly, Vest, Amanda R., Yancy, Clyde W., Beckman, Joshua A., O'Gara, Patrick T., Al-Khatib, Sana M., Armbruster, Anastasia L., Birtcher, Kim K., Cigarroa, Joaquin E., de las Fuentes, Lisa, Deswal, Anita, Dixon, Dave L., Fleisher, Lee A., Gentile, Federico, Goldberger, Zachary D., Gorenek, Bulent, Haynes, Norrisa, Hernandez, Adrian F., Hlatky, Mark A., Joglar, José A., Jones, W. Schuyler, Marine, Joseph E., Mark, Daniel B., Mukherjee, Debabrata, Palaniappan, Latha P., Piano, Mariann R., Rab, Tanveer, Spatz, Erica S., Tamis-Holland, Jacqueline E., Wijeysundera, Duminda N., Woo, Y. Joseph

QUELLE / SOURCE:

Journal of Cardiac Failure, 2022/05, Vol. 28, No. 5, e1–e167, DOI: https://doi.org/10.1016/j.cardfail.2022.02.010

ABSTRAKT / ABSTRACT:

Aim: The "2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure" replaces the "2013 ACCF/AHA Guideline for the Management of Heart Failure" and the "2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure." The 2022 guideline is intended to provide patient-centric recommendations for clinicians to prevent, diagnose, and manage patients with heart failure.

Methods: A comprehensive literature search was conducted from May 2020 to December 2020, encompassing studies, reviews, and other evidence conducted on human subjects that were published in English from MEDLINE (PubMed), EMBASE, the Cochrane Collaboration, the Agency for Healthcare Research and Quality, and other relevant databases. Additional relevant clinical trials and research studies, published through September 2021, were also considered. This guideline was harmonized with other American Heart Association/American College of Cardiology guidelines published through December 2021.

Structure: Heart failure remains a leading cause of morbidity and mortality globally. The 2022 heart failure guideline provides recommendations based on contemporary evidence for the treatment of these patients. The recommendations present an evidence-based approach to managing patients with heart failure, with the

intent to improve quality of care and align with patients' interests. Many recommendations from the earlier heart failure guidelines have been updated with new evidence, and new recommendations have been created when supported by published data. Value statements are provided for certain treatments with high-quality published economic analyses

12.4 Leitlinie zur Diagnostik und Therapie von Patienten mit chronisch obstruktiver Bronchitis und Lungenemphysem (COPD): herausgegeben von der Deutschen Gesellschaft für Pneumologie und Beatmungsmedizin e. V. und der Deutschen Atemwegsliga e. V., unter Beteiligung der Österreichischen Gesellschaft für Pneumologie

AUTOR: IN / AUTHOR:

Vogelmeier, C., Buhl, R., Burghuber, O., Criée, C.-P., Ewig, S., Godnic-Cvar, J., Hartl, S., Herth, F., Kardos, P., Kenn, K., Nowak, D., Rabe, K., Studnicka, M., Watz, H., Welte, T., Windisch, W., Worth, H.

QUELLE / SOURCE:

Pneumologie, 2018/march, Vol. 72, No. 04, 253–308, DOI: https://doi.org/10.1055/s-0043-125031

ABSTRAKT / ABSTRACT:

Das vorliegende Dokument ist eine Neufassung und Aktualisierung der Leitlinie zur Diagnostik und Therapie von Patienten mit COPD, die die bisherige Version aus dem Jahr 2007 ablöst. Die Fülle an neuen Erkenntnissen zu Risikofaktoren, Diagnostik, Schweregradeinschätzung, Prävention und medikamentösen sowie nicht medikamentösen Therapiemaßnahmen machten eine umfassende Überarbeitung erforderlich. Die neue Leitlinie baut auf das GOLD-Dokument unter Berücksichtigung von Besonderheiten in Deutschland und Österreich auf.

12.5 Nationale VersorgungsLeitlinie Asthma

AUTOR: IN / AUTHOR:

(BÄK), Bundesärztekammer, (KBV), Kassenärztliche Bundesvereinigung, der Wissenschaftlichen Medizinischen Fachgesellschaften (AWMF), Arbeitsgemeinschaft

QUELLE / SOURCE:

Programm für Nationale VersorgungsLeitlinien, 2024, Vol. Version 5.0.

12.6 S2k Leitlinie Parkinson-Krankheit

AUTOR: IN / AUTHOR:

Federführend: Prof. Dr. Günter Höglinger, München; Prof. Dr. Claudia Trenkwalder, Kassel/Göttingen

QUELLE / SOURCE:

Herausgegeben von der Kommission Leitlinien der Deutschen Gesellschaft für Neurologie, 2023

AWMF-Registernummer: 030/010

12.7 Standards of Care and GoodClinical Practice for the Physiotherapy Management of Cystic Fibrosis

AUTOR: IN / AUTHOR:

Lisa Morrison, Helen Parrott

QUELLE / SOURCE:

2020/november

13 Impressum / *imprint*

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