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Title: Nasal high flow therapy - The effect on exercise performance in patients with Chronic Obstructive Pulmonary Disease
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Introduction:
Nasal High Flow Therapy (NHFT) is indicated as a treatment when a patient has limitations with their ventilation; it has been used extensively and successfully in neonatal respiratory conditions, respiratory distress and in ICU. NHFT aids ventilation and the proposed mechanisms of action allowing this are washing out of the nasopharyngeal dead space and by decreasing the work of breathing. This therapy is provided using an AIRVO machine, which heats the air to 37°C, humidifies it to 100% humidification and delivers it at up to 60L.min-1 through a nasal cannula.

Finding ways to improve management and quality of life in patients with Chronic Obstructive Pulmonary Disease (COPD) is pertinent, as COPD has a huge prevalence worldwide and in New Zealand (in 2010 the global prevalence was estimated to be 11.7%). COPD is a disease primarily defined by limited ventilation, this is thought to be due to an increased work of breathing and an increase in dead space ventilation during exercise. Limited ventilation reduces the patients' exercise capacity and this significantly decreases their quality of life and severely hinders their management. Exercise rehabilitation is the key to management of COPD, so patients need the capacity to exercise to benefit from it.

Since the proposed mechanisms of how NHFT improves ventilation (decreasing dead-space and decreasing the work of breathing) aligns with how COPD limits it (increased dead-space and increased work of breathing), theoretically, NHFT should help to combat the limitations in ventilation in patients with COPD.

To investigate exercise capacity a six-minute walk test (6MWT) is used which is the standardised measure of exercise performance.

Aim:
The purpose of this study is to investigate the effect of NHFT on exercise capacity in patients with COPD. The proposed mechanisms of action of NHFT will also be investigated. Our hypothesis is that participants using the NHFT will have increased exercise performance, which will be shown by an increased distance walked during the 6MWT.

Impact:
If NHFT can improve a patient's ventilation, it should improve their exercise capacity. This could optimise the outcome from rehabilitation and improve quality of life.

Method:
21 participants with COPD were recruited from Pulmonary Rehabilitation classes, Respiratory Relief classes and from the Respiratory Outpatient clinics at Christchurch Hospital. Participants were required to have had lung functions tests in the last 3 months showing a diagnosis of moderate, moderately severe, severe or very severe obstructive lung disease. Volunteers who did not have this, performed baseline function tests prior to participating in the study.

Each participant performed two 6MWT, once while using the NHFT and once without. The NHFT was provided by an AIRVO machine, which was mounted with a battery pack to a walking frame. This frame was used during both tests. The participants were randomised as to which order they did the

two tests and had a thirty-minute rest period between them. A bike computer attached to the walking frame measured the distance the participants walked, this being the primary outcome. The secondary outcomes were measured using a Noxturnal Device connected to a pulse oximeter and respiratory bands. This allowed for a continuous measure of the physiological data, the SpO2, Pulse Rate and Respiration Rate. Their perceived exertion was measured by asking participants how they felt in terms of breathlessness and fatigue using the Borg scale, before and after each walk test.

We interpreted the results using paired statistical analysis using Graphpad Prism software.

Results:
The mean distance participants walked using NHFT was 349 $\pm$ 116m and in the control it was 351 $\pm$107m ($\pm$1 standard deviation), the difference was not statistically significant. The physiological data collected showed no statistical significance between the tests in the SpO2 or Pulse Rate. The mean End SpO2 found in NHFT and control was 91% and 88% respectively, the mean Minimum SpO2 was 87% and 88%. The mean End Pulse Rate found in the NHFT and control test was 103b.min-1 and 101b.min-1 respectively, the mean Maximum Pulse Rate was 108b.min-1 and 107b.min-1. The Borg score from the participants before and after the two walk tests, (measuring dyspnoea and fatigue) had no statistical significance to the differences found.

Conclusion:
Using High Flow Nasal Therapy did not improve the exercise performance in participants with COPD while performing the 6MWT, within the parameters of our study. There was no effect of NHFT on the SpO2 or Pulse Rate nor the perceived exertion of these participants. These results suggest that the proposed mechanisms of action for NHFT, that it washes out the nasopharyngeal dead space and decreases the work of breathing, may not be correct. To obtain a better understanding of the mechanisms we need further investigate respiratory mechanisms which we have collected data for, but have yet to analyse.