

USE OF THE INSPIRATORY MUSCLE TRAINER DEVICE (IMT) AFTER EXTUBATION IN A CRITICAL CARE SETTING

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ABSTRACT

Background: Mechanical ventilation (MV) and intensive care unit (ICU) admission are necessary medical interventions when required. However the effects of bed rest and immobility result in dysfunctions that occur within a very short period of time (Winkelman, 2007). The resultant diaphragmatic weakness results in weaning and extubation failure and may result in the need for re-intubation (Martin et al., 2013; Thille et al., 2013). In mechanically ventilated patients, inspiratory muscle training (IMT) has been administered to decrease weaning failure by increasing diaphragmatic strength (Cader et al., 2010). The use of IMT during prolonged MV reportedly improved the perception of dyspnoea, six minute walk test (6MWT) and the ability to perform activities of daily living (ADL) and the resultant quality of life (QOL) in some survivors of critical illness (Chang et al., 2005). The aim of this study was to establish the effect of the addition of IMT to standard in-hospital physiotherapy treatment on re-intubation rate and other outcomes of patients who were extubated after prolonged MV.

Method: A single-blinded randomised controlled trial was conducted using patients, who fitted the inclusion criteria for the trial, in the ICU of a quaternary hospital in Johannesburg. After extubation, the patients were randomly allocated to an intervention or control group using a computer generated randomisation list. Patients in the control group received standard in-patient physiotherapy rehabilitation. Those allocated to the intervention group received IMT therapy in addition to the standard in-patient physiotherapy management.

Results: The control group had a higher risk for mortality as measured by the APACHE II score; however their MV, ICU and hospital length of stay (LOS) was less than the intervention group. The effect of IMT on maximal inspiratory pressure (PiMax) was not statistically significant ($p=0.11$) between the intervention group and the control group over time at the different time points but might hold clinical significance as there was less deterioration in PiMax in the intervention group (2.4 cmH₂O) versus the control group (9.1 cmH₂O). Expiratory muscle strength had improved significantly (98.8 cmH₂O) for the intervention group at hospital discharge as compared to the control group (71.5 cmH₂O). This was statistically significant ($p=0.02$); however, this difference in maximal expiratory pressure (PeMax) between the groups was not noted at the one and three month assessments. The distance walked as assessed by the 6MWT had improved in the intervention group at the one month follow-up assessment (152 m) as compared to the control group (149.8 m). The intervention group were younger and had a longer LOS in ICU

and in hospital which might have resulted in decreased muscle strength; the predicted percentage of distance walked on the 6MWT could have been affected by these factors. Further to this, the decline in ability to perform the functional assessment as measured by the 6MWT could have resulted in the impairment or inability to perform ADL's. The intervention group scored higher than the control group when the health assessment questionnaire (HAQ) was assessed and the differences were statistically significant at each assessment. However this was not the case when the effect of IMT on quality of life (QOL) as measured by the HAQ was observed over time ($p=0.29$). At the discharge and three month time points respectively, the intervention group had a higher EQ-5D VAS rating (78.1%; 70.9%) than the control group participants (55.7%; 65.7%). This inferred that the participants in the intervention group considered themselves healthy.

Discussion: A correlation between the effects of IMT and re-intubation could not be confirmed. Inspiratory muscle strength improved for both groups, however no statistical difference was observed. Although PiMax had reportedly improved, the result cannot be attributed as a direct result of IMT. The initial intensity and progression of IMT training have been identified as limitations to this study. The use of IMT resulted in improved expiratory muscle strength. Results from the control group suggest that physiotherapy intervention alone results in improved overall muscle strength after critical illness.

Conclusion: The null hypothesis is supported by the results of this study. There was no statistical significance observed between the groups with regards to the improvement of inspiratory muscle strength. Physiotherapy intervention appears to play a vital role in the outcomes of patients recovering from critical illness.