

Development of a Device to Measure Peak Expiratory Flow Rate and Peak Inspiratory Flow Rate during Manual Hyperventilation

I.P. Liyanage^{*1}, S. Rathnayake², A. Jayasinghe,³E. Liyanage¹, R.P.H. Anuradha¹,
D.A.R.K Dassanayaka¹, K.T Malwanage¹, M.M.J.P. Manchanayeka¹, S.I.
Wadugodapitiya¹, A.M.M.Rikas¹, S. Mayooran¹

¹*Department of Physiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka*

²*Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka*

³*Department of Radiography/Radiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka*

**indrajith@pdn.ac.lk*

Manual Hyperinflation (MHI) is a technique used to hyperinflate the lungs and remove secretion in mechanically intubated patients. The two-phase gas-liquid exchange theory states that the peak expiratory flow rate (PEFR) should be 10% more than the peak inspiratory flow rate (PIFR). It is reported that even after demonstrating the correct technique many physiotherapists often performed the technique in a manner that did not assist secretion removal. Any type of feedback offers insights into the results and performance during task execution, aiming to minimise errors and assist in attaining objectives. Hence it can be hypothesised that visual feedback of PEFR and PIFR will enable physiotherapists to change their technique such that it facilitates secretion clearance. This study aimed to design and develop a device to measure PEFR and PIFR with real-time visual feedback during the application of MHI in a laboratory setting. The device is equipped with two air pressure sensors, model HX710B, which were modified to measure the airflow rates. The device is connected to the MHI instrument. The input from two sensors was processed using an Arduino UNO microcontroller device. A simple application was developed to visualise the two outputs of PEFR and PIFR with a dual line graph. The PEFR and PIFR were measured when the patient connector was kept open for one selected Manual Hyperventilation unit. No significant expiratory flow rate was observed compared to the electronic and device noise of the developed device. However, the device should be calibrated and validated to be utilised in a training environment where feedback will assist in modifying the procedure for better results.

Keywords: Manual Hyperinflation, PEFR and PIFR Measurements

Acknowledgements: Technical support from W. M. E. G. P. B. Elliyadda, Vidyarthi College, Kandy Sri Lanka is greatly appreciated and his enthusiasm towards this work extremely enhanced the functionality of the prototype device.