A clinical study of short-term sternal photoplethysmography: recordings from patients with obstructive airways diseases

Traditionally, measurements of the oxygen saturation ($S_pO_2$) has been confounded to the extremities. In this study, we therefore investigated the possibility for reliable estimation of clinically relevant $S_pO_2$ levels from photoplethysmography (PPG) obtained on the sternum of patients with obstructive airway diseases. We initiated the study with a calibration of a prototype sternal PPG sensor. In accordance with the ISO 80601-2-61:2011 guidelines, the calibration was conducted as a controlled desaturation study. We obtained a calibration accuracy of 1.75% which is well within the clinically and commercially accepted range. We then compared the $S_pO_2$ levels simultaneously obtained from the sternal PPGs and a commercially available finger pulse oximeter on 28 admitted patients with either asthma or Chronic Obstructive Pulmonary Disease (COPD). The Pearson correlation between the $S_pO_2$ levels estimated from the two body locations was found to be 0.89 ($p<0.05$) and the mean system bias was only 0.052% with upper and lower limits of agreement of 2.5% and -2.4%, respectively. This finding is very promising for the future design of new sternum based patch technologies that might be able to provide continuous estimates of the $S_pO_2$ levels on critically or chronically ill patients.

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