

Comparison of the Masimo Pulse Oximeter Utilizing Various Probe Sites at Rest and with Exercise Against a Laboratory Oximeter Using Arterial Blood.

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Introduction

Pulse oximetry is a noninvasive method of estimating the arterial oxygen saturation (SpO₂) from pulsatile absorption signals. The principle is based on the fact that oxyhemoglobin and deoxyhemoglobin have different absorption spectra. The Masimo Radical pulse oximeter uses a new process to quantify and qualify the signal from a pulse waveform for calculating SpO₂. This signal processing technology professes to derive more accurate values in the presence of low perfusion or excessive external noise, which can be a problem during exercise monitoring. Masimo also has two optional site probes, the forehead reflectance and ear clip, which we wanted to evaluate during exercise testing. *Hypothesis:* The Masimo Radical pulse oximeter is accurate at rest and during exercise testing when compared with a multi-wavelength laboratory oximeter which directly measures arterial saturation (SaO₂) and other dyshemoglobins (i.e. COHB). Ear and/or forehead probes offer an accurate and site-specific advantage during exercise.

Methods

Sixteen subjects (male=9, female=7; age 30-83, mean=66) for whom step exercise blood gas tests were ordered for clinical evaluation were included in the study. Two Masimo oximeters using forehead and ear probes were placed on the subject according to manufacturer's instructions. An arterial catheter was inserted according to laboratory protocol. A resting blood sample was obtained and simultaneously recorded SpO₂, HR and signal strength (S.S.) from both oximeters. Subjects exercised on a 9-inch step at a pace of 15 steps per minute (approx. 60 watts of work) for 3 minutes or until volitional termination. The end-exercise data from both oximeters (SpO₂, HR and S.S.) were recorded while harvesting the exercise blood sample. The samples were analyzed within 15 minutes using pre-calibrated and quality-controlled Instrumentation Laboratory (IL) 1715 analyzers.

Results

	Rest (range)	Exercise (range)
Forehead SpO ₂	97.9 (94-100)	94.9 (82-100)
Ear SpO ₂	96.2 (92-99)	92.7 (83-98)
SaO ₂ (IL 1715)	94.1 (90.3-95.9)	91.1 (80.4-96.4)
COHB (IL 1715)	1.2 (0-2.4)	1.1 (0-2.2)
Statistics Forehead sensor	R = 0.45, p<0.001	R = 0.88, p<0.001
Statistics Ear sensor	R = 0.58, p<0.001	R = 0.85, p<0.01

Conclusion

The Masimo pulse oximeter accurately measures functional saturation when compared to the laboratory's IL 1715 CO-Oximeter which measures fractional saturation during rest and exercise testing. However, even though there is no statistical difference between the two different measuring technologies, the forehead probe appears to overestimate arterial saturation with a unidirectional bias based on this sample size. Further study is needed to qualify and quantify these results.