

A Comparison of the Accuracy of Three New Generation Pulse Oximeters (POs) During Motion and Low Perfusion in Human Volunteers

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Introduction

Pulse oximetry can be evaluated in terms of “sensitivity” and “specificity,” where sensitivity is defined as the ability to detect true alarm events, and specificity is defined as the ability to resist false alarms. Using adult volunteers, these researchers tested the Masimo SET Radical, Philips CMS, and Nonin 9700 pulse oximeters during normoxia and laboratory-induced hypoxia combined with machine generated (MG) or subject generated (SG) motion.

Methods

189 motion tests during normoxia and hypoxia were performed on 9 adult volunteers. The testing room was initially cooled to 16-18 degrees Celsius to reduce peripheral perfusion. Volunteers were then outfitted with optically shielded, randomly placed finger sensors, which were then placed on a motor-driven random motion table, subjecting the hand to induced rubbing and tapping motions. A Masimo ear sensor was used as a control during the hypoxia studies. Hypoxia was induced using a re-breathing circuit with a CO₂ absorber to reach approximately 75% SpO₂ (ear). The subject was then given 100% O₂ until the control pulse oximeters reached 100%. Motion tests were run both using the motion table and using subject generated motions. Data for motion table and self-driven motion were recorded separately. Data was recorded during normoxic and hypoxic conditions. False alarms were noted when SpO₂ dropped below 90% during normoxic conditions. A missed event was defined as the inability of the monitor to recover after the desaturation, by the time the control monitor reached 100%.

Results

Missed events (desaturation/resaturation) were counted for the 54 motion events during hypoxia (36 with MG and 18 with SG) and false alarms were counted for the 135 room air motions (81 with MG and 54 with SG). As seen in the table below, the Masimo SET Radical has significantly higher sensitivity and specificity than either the Philips CMS (rev C1) or the Nonin 9700 (2004) pulse oximeters.

Sensitivity and Specificity of Pulse Oximeters during Motion					
Pulse Oximeter		Missed Event	Sensitivity	False Alarm	Specificity
Masimo SET Radical (v4.3)	MG	1/36	97%	1/81	99%
	SG	0/18	100%	0/54	100%
Philips CMS (rev C1)	MG	6/36	83%*	3/81	96%*
	SG	2/18	89%*	4/54	93%*
Nonin 9700 (2004)	MG	13/36	64%*	7/81	86%*
	SG	9/18	50%*	11/54	80%*

*p<0.05 vs. Masimo Radical

Authors' Discussion and Conclusions

“During hypoxic and low perfusion states, Masimo Radical PO (v4.3) outperformed Philips CMS (rev C1) and Nonin 9700 (2004) with respect to maintaining accurate readings during motion. Thus Masimo Radical may provide better patient safety by more accurate monitoring of SpO₂ and PR.”