

Performance of Masimo versus Two Other Newer Generation Pulse Oximeters (POs) for SpO2 and PR during Motion and Low Perfusion in Volunteers.

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Introduction

Despite significant improvements in PO technology, the problem of obtaining an accurate reading during patient movement or in the presence of low perfusion states still persist. Many PO manufactures claim superior performance, thus we undertook the following study to compare major brands of POs during motion and low perfusion in volunteers.

Methods

After IRB approval, 9 adult ASA I volunteers (4-F & 5-M) between ages 18-40 years were consented and enrolled in the study. Masimo Radical version 4.3 was compared with Philips CMS (Rev C1) and Nonin 9700 (2004). The POs for the experimental conditions were placed on the index, middle, and ring fingers of the left hand and coverlets placed to shield extraneous light and to prevent optical cross talk. POs were placed with coverlets on the corresponding fingers of the right hand to serve as their controls. Sensors on both hands were rotated across all three fingers and testing repeated. A Masimo Radical PO placed on the right ear served as the control for the hypoxia blocks of study. The room was cooled down to a temperature of 16-18 degrees C to reduce peripheral perfusion. Motion was generated by a motor-driven motion table (MG) to obtain tapping at 3Hz with disconnect and reconnect of the sensors during motion, random tapping, tapping at 3Hz and random rubbing. Self-generated (SG) motion included random tapping with disconnect and reconnect and random rubbing. Hypoxia was induced by employing a disposable re-breathing circuit with a CO2 absorber to a SpO2 of 75% and the subject was then given 100% oxygen until the control SpO2 reached 100%. During hypoxemia, MG consisted of tapping at 3Hz, tapping at 3Hz with disconnect and reconnect of the sensors during motion, random tapping with disconnect & reconnect, and random rubbing. SG included a random tapping with disconnect-reconnect and random rubbing. PR & SpO2 data were recorded on-line for off-line analysis. Parameters recorded were % of time when SpO2 was off by 7% (off 7) and PR was off by 10% (off 10), performance index (PI) (defined as % of time when SpO2 was within 7% of control and PR was within 10% of control) and zero rate (defined as % of time when the POs zero out SpO2 and/or PR). A "Zero Out" is when the monitor either displays -- or zero. Analysis of Variance (ANOVA) was used for statistical analysis & p< 0.05 was considered statistically significant.

Results

Off 7(SpO2), Off 10(PR), Zero Rate and PI during MG and SG							
Device		SpO2		Pulse rate			
Pulse Oximeter		Off 7 (%)	Performance Index (%)	Zero Rate (%) (SpO2)	Off 10 (%)	Performance Index (%)	Zero Rate (%) (PR)
Masimo Radical (v4.3)	MG	1.2	98.8	0	4.6	95.4	0
Masimo Radical (v4.3)	SG	1.4	98.6	0	8.4	91.6	0
Philips CMS (Rev C1)	MG	7.3	92.7	0	14.3	85.7	0
Philips CMS (Rev C1)	SG	6.8	92.2	1.0	19.3*	79.7	1.0
Nonin 9700 (2004)	MG	14.1*	84.2	1.7*	17.3*	76.3	6.4*
Nonin 9700 (2004)	SG	17.4*	77.1	5.5*	15.0	66.3	18.7*

p<0.05 vs. Masimo Radical

Conclusion Masimo Radical performed the best in this vigorous testing schedule for both SpO2 and PR followed by Philips CMS and then Nonin. Furthermore, Nonin performed inferiorly for detection of PR in comparison to SpO2 detection

