

Impact of Motion and Low Perfusion on SpO₂ & Pulse Rate in Three New Generation POs in Volunteers

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Introduction

Accurate vital signs monitoring is essential for the proper diagnosis and treatment of hospitalized patients. The accuracy of pulse oximetry technologies varies by manufacturer, however, even though all claim high performance. Differences in the accuracies of pulse oximetry technologies are most prominent during patient movement and low perfusion, when accurate monitoring is needed most. These researchers tested the accuracy of three market leading pulse oximetry technologies (Masimo Radical, Nellcor N-600 and Datex Ohmeda TruSat) during subject motion and induced low perfusion in both normoxia and hypoxia to determine which technology was the most accurate.

Methods

Optically shielded sensors were randomly placed on index, middle, and ring fingers of the left hand (test), and the right hand (control) of ten healthy volunteers. The room temperature was lowered to 16-18°C to reduce peripheral perfusion. A Masimo Radical pulse oximeter ear sensor was placed on the right ear and served as the control during hypoxia (SpO₂≈75%). During separate room air and desaturation events, motion consisted of random tapping (with sensor disconnect/reconnect) and random rubbing. Motions were both machine generated and subject generated. The sensors were rotated laterally and tested on all three fingers during the room air events. A computer recorded SpO₂ and pulse rate (PR) data. Parameters analyzed were % of time when SpO₂ was off by 7% and PR was off by 10%, Performance Index (defined as % of time when SpO₂ was within 7% of control and PR was within 10% of control), and zero out (defined as % of time when the pulse oximeter displays "--" or a zero for SpO₂ and/or PR). ANOVA was performed, with a Fischer's post hoc test, to compare the off 7% (SpO₂), off 10% (PR), and Zero Out (both SpO₂ and PR) results for the three pulse oximeters. A p<0.05 level (*) was considered statistically significant.

Results

Masimo significantly outperformed the Nellcor N-600 and Datex-Ohmeda pulse oximeters during SpO₂ and pulse rate measurement for both machine generated (MG) and subject generated (SG) random motions. The table below shows the results. "Off 7" and "Off 10" refers to the amount of time the SpO₂ and/or pulse rate did not corroborate the control pulse oximeter within 7% and 10%, respectively.

Device		SpO ₂			Pulse Rate		
Pulse Oximeter		Off 7% (min)	Performance Index (%)	Zero Out (%)	Off 10% (min)	Performance Index (%)	Zero Out (%)
Masimo SET Radical (v 5.0)	MG	4.6	97.5	0	31.7	82.9	0#
	SG	2.8	98.5	0#	21.3	88.5	0##
Nellcor N-600 (v 1.1.2.0)	MG	42.1*	72.3	9.3	50.4	61	22.2
	SG	33.6*	73.1	16.4	39.7	60.3	33.9
Datex-Ohmeda TruSat	MG	29.9*	83.2	1.3	37.3	78	1.7#
	SG	31.9*	81.9	1.7#	44.6	73.6	4.4##

* # p<0.05 compared to Masimo. ## p< 0.005 compared to Nellcor.

Authors' Conclusions

"Masimo Radical performed the best in this vigorous testing schedule for both SpO₂ and PR... It appears that Masimo Radical will give reliable SpO₂ & PR values for a greater period of time as compared to Datex-Ohmeda TruSat and Nellcor N-600 in the OR, PACU, and ICU."