

A Comparison of Nellcor N-395, N-595, and Masimo Radical Pulse Oximeters During Motion and Hypoxemia.

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Summary: We compared performance of Nellcor N-395, N-595, and Masimo Radical pulse oximeters during combined motion and hypoxemia using our standardized laboratory protocol. The Masimo demonstrated superior performance in sensitivity, specificity, and failure rate.

Introduction: Pulse oximeters are subject to a number of errors caused by patient motion, including failure to display current S_pO_2 values and displaying inaccurate values that are either high or low. We have developed a standardized volunteer protocol that has been successfully used to compare the performances of many instruments during motion and hypoxemia. (1,2) This protocol has yielded results that are consistent with published clinical studies. (3) In the current experiments, we compared a new instrument from Nellcor, the N-595, with both the N-395 and the latest version of the Masimo Radical.

Methods: Six healthy volunteers were studied, with IRB approval and informed consent. As per our standard protocol, each subject was instrumented with three oximeter sensors on the moving (test) hand, and three on the stationary (control) hand. Standard, motor-driven, continuous motions were used as described in Ref. 2. Values obtained during motion were compared with simultaneous values from the control hand. Data were recorded during motion while breathing room air, and during rapid arterial desaturations to $S_pO_2 = 75\%$. Tabulated results include sensitivity and specificity for detection of hypoxemia (threshold: $S_pO_2 < 90\%$), missed hypoxemic events, false alarms, failures to display a pulse rate value, and %-time during which no pulse rate is displayed.

Results: Results are shown in Table 1. Masimo Radical has the highest sensitivity, followed by N-395 and then N-595. Radical also has the highest specificity (fewer false alarms) followed by N-595 and then N-395. The two Nellcor instruments exhibited failures to display a pulse rate for 6.2% (N-595) and 4.5% (N-395) of the time, while the Masimo experienced no pulse rate failures.

Discussion: Nellcor has recently released the N-595 pulse oximeter as an improvement in performance over their N-395. In our standardized motion/hypoxemia protocol, we did not find N-595 performance to be significantly better than that of N-395. The Masimo Radical performed better than either Nellcor model.

REFERENCES

1. Barker S: *Anesthesiology* 1997; 86: 101-108.
2. Barker S: *Anesth Analg* 2002; 95: 967-972.
3. Bohnhorst B: *Crit Care Med* 2000;28(5):1565-1568

Table 1. Sensitivity, specificity, and other statistics for three pulse oximeters.

Pulse oximeter	Missed events	Sensitivity	False Alarms	Specificity	Pulse rate failures	Pulse Rate failure %
Radical	1	96	0	100	0	0
N-595	6	75	5	86	10	6.2
N-395	4	83	7	81	9	4.5