The Effect of Improper Pulse Oximetry Sensor Placement on SpO2 Measurement Accuracy.

Campbell S.E., Hyde L.,. Chung P.A,. ONeil M.P, Mannheimer P.D. 2007. *Anesth Analg* 105; (6):S100.

In clinical settings, the accuracy of pulse oximeter sensors is often presumed, even when the sensor is used "off-label" in alternative locations such as the ear, cheek, tongue, forehead, or nasal septum. Although Spo2 data can often be obtained from these malpositioned sensors, to date, no studies have demonstrated whether such usage is accurate across the full range of saturation. This study compared the accuracy of malpositioned sensors with their properly placed counterparts, using a properly placed forehead sensor as reference (Nellcor Max Fast sensor, ARMS _ 2.0).

Sensors examined in this study focused on disposable digit sensors (Nellcor Max-A, Masimo LNOP-Adt, Nonin 7000A, and the Datex Ohmeda Oxy-Tip) placed on the ear, forehead, or cheek, and reusable sensors (Nellcor DS100-A, Masimo LNCS, Nonin 8000A) placed sideways on a digit. The protocol used to assess Spo2 across a range of saturations followed standard methodology recommended by ISO 9919.

Results demonstrate that regardless of sensor make or type, SpO2 reading accuracy is no longer maintained when sensors are malpositioned. This is increasingly obvious at lower saturation levels. In a 2nd analysis of the number of readings within 2% SpO2 compared with the reference sensor readings (A), between 2% and 5% (B), and greater than 5% (C), every malpositioned sensor had more readings in the B and C category than their properly placed counterparts (P <0.001). The increase in A_{RMS} for all sensors was statistically significant when sensors were malpositioned (P <0.05), with the exception of the Masimo LNOP-Adt (P= 0.059).

The results from the present study highlight the importance of placing the sensors properly, especially in patients at risk of desaturations.

Disposable Sensors

	Max-A			LNOP-Adt			Oxy-Tip		7000A	
	Proper	Ear	Brow	Proper	Ear	Brow	Proper	Ear	Proper	Cheek
A	81.7	35.8	21.7	59.1	50.9	47.9	75.4	51.9	68.7	53.9
B	18.3	35.8	25.0	26.2	24.8	30.8	19.4	24.0	29.8	29.1
C	0.0	28.3	53.3	14.7	24.4	21.4	5.2	24.0	1.6	17.1
A_{RMS}	1.9	5.1	10.4	4.4	6.9	5.3	3.4	5.4	2.5	4.2

Reusable Sensors

	DS-100A		LNCS DSI		8000A	
	Proper	Sideways	Proper	Sideways	Proper	Sideways
A	79.8	55.1	60.7	54.7	45.2	32.9
B	18.7	22.6	28.2	20.9	39.7	31.0
C	1.6	22.2	11.1	24.4	15.1	36.0
A_{RMS}	2.1	5.3	3.7	5.4	4.1	5.4

All values given are in percentages.