NELLCOR

Pulse Oximetry

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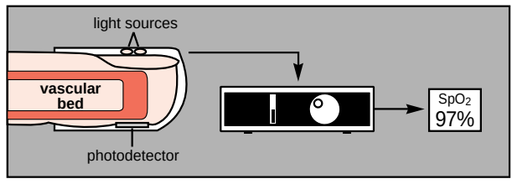
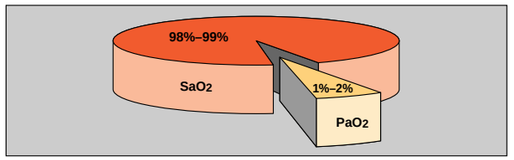
Pulse oximetry works by applying a sensor to a pulsating arteriolar vascular bed. The sensor contains a dual light source and photodetector.



Bone, tissue, pigmentation, and venous vessels normally absorb a constant amount of light over time. The arteriolar bed normally pulsates and absorbs variable amounts of light during systole and diastole, as blood volume increases and decreases. The ratio of light absorbed at systole and diastole is translated into an oxygen saturation measurement. An oxygen saturation measurement provided by a pulse oximeter is commonly referred to as "SpO_2."

Oxygen Concentration in Arterial Blood

Normally, 98% to 99% of the oxygen present in the blood is combined with the hemoglobin molecule.



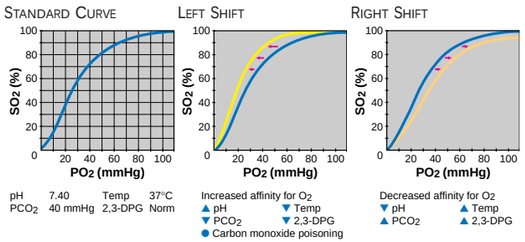
SaO_2 indicates oxygen (O_2) carried on arterial hemoglobin.

PaO_2 indicates oxygen (O_2) dissolved in arterial plasma.

Total oxygen concentration is comprised of oxygen carried on arterial hemoglobin and oxygen dissolved in plasma. Whenever SaO_2 falls, arterial oxygen concentration decreases and the risk of tissue hypoxia may increase.

Oxyhemoglobin Dissociation Curve (ODC)

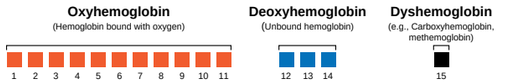
The ODC represents the relationship between SO_2 and PO_2.



Arterial oxygen saturation (SaO_2) values can be directly measured by a pulse oximeter or calculated by a blood gas analyzer. When patient temperature, pH, PCO_2 or 2,3-DPG values differ from the assumed standard curve, this measured saturation may differ from calculated saturation.

Dysfunctional Hemoglobins and Pulse Oximetry

Dysfunctional hemoglobins such as carboxyhemoglobin, methemoglobin or sulfhemoglobin are unable to carry oxygen. However, SpO_2 values only report functional saturation—oxygenated hemoglobin as a percentage of *functional* hemoglobin. Therefore, although the SpO_2 values reported by a pulse oximeter may appear normal when dysfunctional hemoglobins are elevated, oxygenation may be compromised due to decreased arterial oxygen content. A more complete assessment of oxygenation beyond pulse oximetry is recommended whenever dysfunctional hemoglobins are suspected.

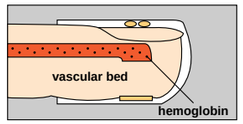


Pulse Oximeter (Functional Saturation)	Oxyhemoglobin / Oxy + Deoxyhemoglobin	x 100% = 11/14 x 100%	= 79% SpO_2
CO-Oximeter (Fractional Saturation)	Oxyhemoglobin / Oxy + Deoxy + Dyshemoglobins	x 100% = 11/15 x 100%	= 73% SaO_2

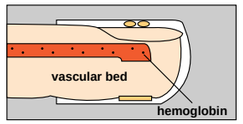
Anemia

Hemoglobin values must be considered when assessing the adequacy of arterial oxygen concentration. The anemic patient has fewer hemoglobin molecules than a normal patient. Consider an anemic patient and a normal patient who both have an SpO_2 close to 100%. Although all of the hemoglobin molecules in both patients are carrying oxygen, the total arterial oxygen concentration for the anemic patient is lower because there are fewer hemoglobin molecules to carry oxygen. This patient is at greater risk whenever oxygen demand increases or oxygen supply decreases.

NORMAL PATIENT



ANEMIC PATIENT

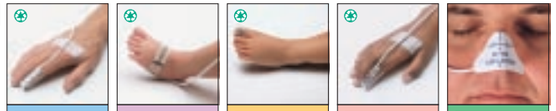


Nellcor Sensor Family

Adhesive Sensors

Check site at least every 8 hours as directed.

Sterile in unopened, undamaged package.



Patient Size	D-25*/D-25L*	N-25*	I-20*	D-20*	R-15*
	Oxisensor® II Adult	*Oxisensor II* Neonatal/Adult	*Oxisensor II* Infant	*Oxisensor II* Pediatric	*Oxisensor II* Adult Nasal
	>30 kg	<3 kg or >40 kg	3–20 kg	10–50 kg	>50 kg

Patient Size	A*	N	I	P*
	OxiCliq® Adult	*OxiCliq* Neonatal/Adult	*OxiCliq* Infant	*OxiCliq* Pediatric
	>30 kg	<3 kg or >40 kg	3–20 kg	10–50 kg

* Latex free.

These sensors are eligible for the Sensor Recycling Program. For more information on enrolling in the program, contact your local Nellcor representative. Currently available in the U.S. only.

Reusable Sensors

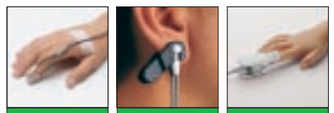
Change site at least every 4 hours as directed.

Patient Size	DS-100A*	OXI-A/N*	OXI-P/I*	RS-10
	Durasensor® Adult	*Oxiband®* Adult/Neonatal	*Oxiband* Pediatric/Infant	*RS-10 Adult* Reflectance
	>40 kg	<3 kg or >40 kg	3–40 kg	>40 kg

Warning: Carefully read the directions for use provided with Nellcor® sensors for complete description, instructions, warnings, cautions and specifications.

Change site at least every 4 hours as directed.

PediCheck for attended spot check only (not to exceed 20 minutes).



Patient Size	D-YS*	D-YSE*	D-YSPD*
	Dura-Y® Multisite	*D-YSE* Ear Clip *Use with Dura-Y sensor*	*PediCheck™* Pediatric Spot-Check *Use with Dura-Y sensor*
	>1 kg	>30 kg	3–40 kg

Basic Principles for Choosing and Using a Sensor

Adhesive and reusable sensors are available. The following considerations should be evaluated when choosing a sensor for your patient:

- Patient's body weight
- Duration of use (long-term, short-term, spot-check)
- Patient activity
- Infection control concerns

Tips for use:

- Ensure that the optical components of the sensor are properly aligned as outlined in the directions for use.
- Adhesive sensor sites must be checked at least every 8 hours and moved to a new site if necessary. Reusable sensors must be moved to a new site at least every 4 hours.
- Adhesive digit sensors may be reused on the same patient if the adhesive tape attaches without slipping. Replace the sensor whenever the adhesive quality is depleted.
- When selecting a sensor site, priority should be given to an extremity free of an arterial catheter, blood pressure cuff, or intravascular infusion line.
- Reusable sensors should be cleaned between patients. Refer to directions for use.

Pulse Oximetry: Clinical Considerations and Recommendations

Certain conditions may result in pulse oximetry readings that are unreliable, incorrect, or less informative, as described below.

CONSIDERATION	RECOMMENDATION
MOTION	Move sensor to a less active site or replace adhesive. Use a reflectance sensor on the forehead if the patient is not on a ventilator or placed in a Trendelenburg or supine position. Adjust averaging time on pulse oximeter if possible. In high-motion environments, use *Oxismart® XL†* or *Oxismart* technology if available.
NUISANCE ALARMS	Nuisance alarms may be caused by short, clinically insignificant desaturations that cross the alarm threshold for very brief periods. Initiate *SatSeconds™* Alarm Management feature, if available, to reduce these alarms. Also use *Oxismart XL†* or *Oxismart* technology to reduce false alarms caused from motion artifact.
POOR PERFUSION	Use an adhesive digit sensor or an R-15 nasal sensor if the patient is immobile. Protect sensor site from heat loss or rewarm site as permitted by hospital policy. Use *Oxismart XL†* or *Oxismart* technology if available.
VENOUS PULSATION	Position digit sensor at heart level. Avoid restrictive taping. Use care when interpreting SpO_2 values in patients with elevated venous pressure.
EDEMA	Position the sensor on nonedematous application sites. Otherwise, the fluid in the edematous tissue may cause the light from the LEDs to scatter and affect the SpO_2 readings.
LIGHT INTERFERENCE	Cover the sensor with an opaque material in the presence of bright light sources, including direct sunlight, surgical lamps, infrared warming lamps, and phototherapy lights.
ANEMIA	Anemia causes decreased arterial oxygen content. Although SpO_2 readings may appear normal, an anemic patient may be hypoxic. Correcting anemia can improve arterial oxygen content. The pulse oximeter may fail to provide an SpO_2 if hemoglobin levels fall below 5 gm/dl.
NAIL POLISH	Remove nail polish (especially browns, blue, green) or apply sensor to an unpolished site.
INTRAVASCULAR DYES	Use care when interpreting SpO_2 values after injection of intravascular dyes, which may affect the reading.
DYSHEMOGLOBINS	Dysfunctional hemoglobins such as carboxyhemoglobin and methemoglobin are unable to carry oxygen. SpO_2 readings may appear normal; however, a patient may be hypoxic because less hemoglobin is available to carry oxygen. Further assessment beyond pulse oximetry is recommended.

† *Oxismart XL* and *SatSeconds* technologies are found in newer Nellcor and Nellcor-compatible pulse oximetry monitors.

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