Health problem addressed

Devices that provide early detection of hypoxia before other signs such as cyanosis are observed, and may reduce the frequency of arterial puncture and laboratory blood gas analysis. It is also used in dentistry anesthesia, sleep studies, exercise testing, and home monitoring of certain patients, such as infants at risk for sudden infant death syndrome and patients requiring respiratory therapy.

Product description

A pulse oximeter consists of the unit and probes/sensors. Reusable sensors include spring clip-style probes, which can be applied to a measurement site (e.g., finger, ear). Disposable sensors, for single-patient use, are usually adhesive-style sensors that can be applied to a measurement site (e.g., finger, toe, foot). Sensors are available in various sizes. A printer/recorder may also be included or optional. Units are connected to the line and/or powered by internal batteries. Configurations include stand-alone units and modular units. MRI-compatible units are also available.

Principles of operation

Units use the principle of differential light absorption to determine the percentage of O$_2$ bound to hemoglobin in arterial blood. Two wavelengths of light (e.g., 660 nm [red] and 930 nm [infrared]) are transmitted through the skin into the tissue by the sensor’s light-emitting diodes (LEDs) and are differentially absorbed by the blood’s oxyhemoglobin (HbO$_2$), which is red and absorbs infrared light, and deoxyhemoglobin, which is blue and absorbs red light. The sensor’s photodetector converts the transmitted light into electrical signals proportional to the absorbance. The signal is then processed by the unit’s microprocessor, which derives a saturation reading and, if the reading is outside the alarm limits, sounds an alarm.

Operating steps

- Pulse oximetry sensors are applied to an area of the body, such as a finger, a toe, or an ear.
- The unit is turned on and processes the signal received.
- If the reading is outside the alarm limits, an alarm will sound.

Reported problems

The most common problem with oximeters is poor performance during excessive patient motion or with poor perfusion. Interference from the surrounding environment can limit the use of the device (e.g., high frequency currents can radiate to an oximeter probe). Bright visible light and infrared sources can interfere with sensors because they are designed to measure weak light signals transmitted through skin and tissue. Burns may result from using incompatible sensors, even if the sensors’ connectors are compatible with the oximeter.

Use and maintenance

User(s): Physicians, nurses, respiratory therapist, home care providers, other medical staff

Maintenance: Biomedical engineering staff and/or service contract with the manufacturer or third-party organization

Training: Initial training by manufacturer, operator’s manuals, user’s guide

Environment of use

Settings of use: Intensive care unit, operating room, patient bedside, burn units, cardiac catheterization laboratories, ambulances, long-term care, home, physician office

Requirements: Battery, line power

Product specifications

Approx. dimensions (mm): 130 x 90 x 40
Approx. weight (kg): 2
Consumables: Probes, sensors, batteries
Price range (USD): 275-6,800 (1,200 typical); price covers all types and variations
Typical product life time: 8 years
Shelf life (consumables): Variable

Types and variations

- Stand-alone
- Modular