

PULSE METER

Ghulam Rasool

Lecturer AHS, SMC



PULSE RATE AND OXYGEN SATURATION MONITORING



Pulse Oximetry

- ✦ Introduced in early 1980s.
- ✦ Non-invasive measurement of Pulse rate and oxygen saturation.
- ✦ Safe
- ✦ Inexpensive



Pulse Oximetry?

- ✦ Pulse oximetry is a non-invasive method concerned with the monitoring of a patient's pulse rate and blood oxygen saturation level.
- ✦ **The pulse rate**
 - ✦ is a measurement of the heart rate, or the number of heart beats per minute.
 - ✦ Normal pulse rate in adults varies from 72 to 80 beats per minute.
- ✦ **Blood Oxygen Saturation**
 - ✦ The degree to which the oxygen-carrying capacity of haemoglobin is saturated with oxygen, normally 98-100%.

Why is Pulse Oximetry important?

A patient's Heart rate and SpO₂ level is the most common and widespread monitored parameter.

To ensure the patient has an adequate supply of oxygen to the whole body.

When patients do not have enough oxygen 'hypoxia' can result

Hypoxia:

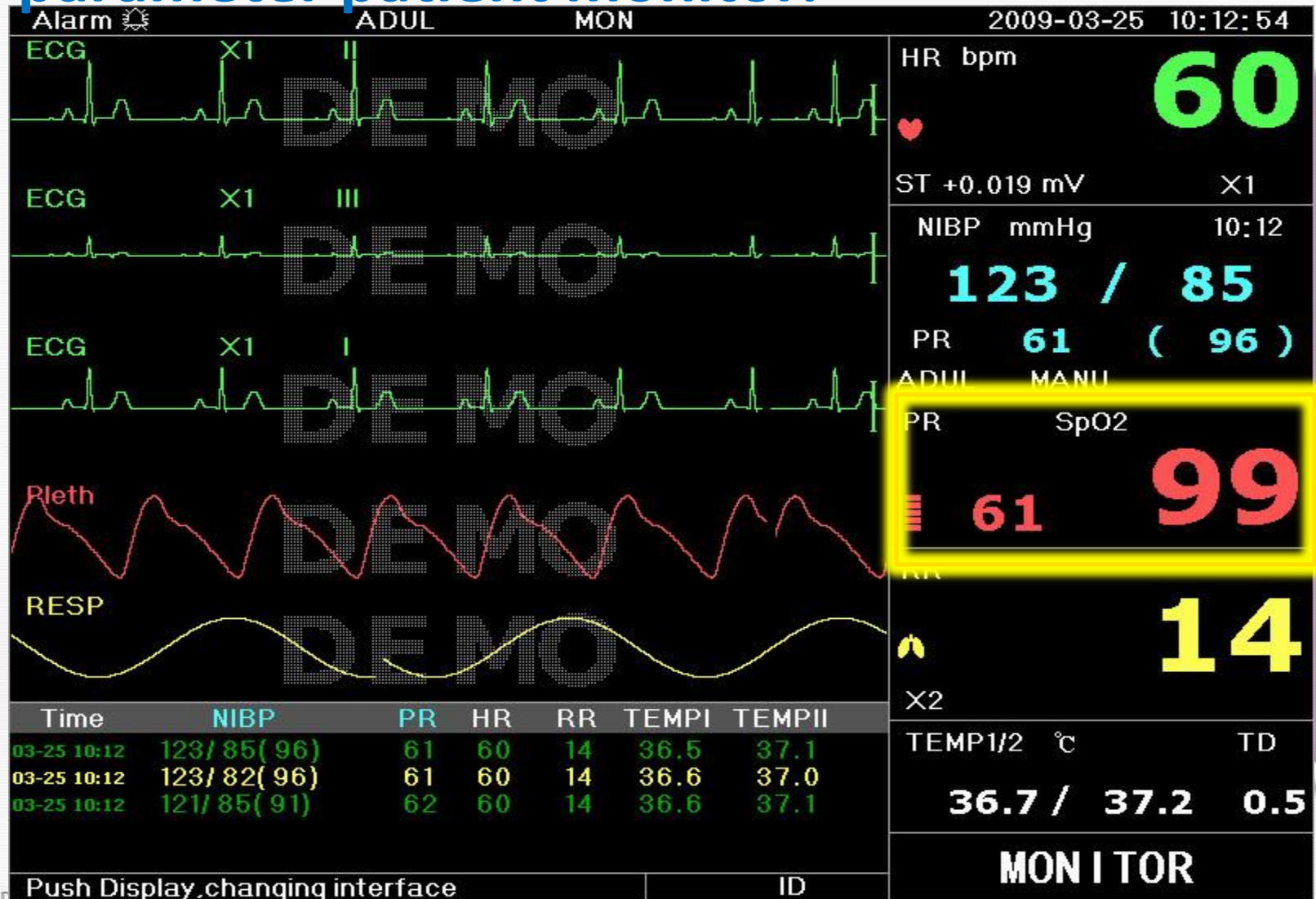
- ✦ When the whole or region of the body is deprived of oxygen
- ✦ Symptoms include: headaches, fatigue, shortness of breath and nausea.
- ✦ In severe hypoxic cases changes in levels of consciousness, seizures, coma and death.
- ✦ Heart rate is important parameter to monitor bradycardia and Tachycardia

Where & when is pulse oximetry used?

Pulse Oximetry is used in a variety of situations:

- ✚ Throughout anaesthesia during surgery
- ✚ During the recovery phase
- ✚ In intensive care during respiratory or cardiac problems
- ✚ In wards and casualty departments
- ✚ When patients are sedated for procedures such as endoscopy
- ✚ In patients with longstanding respiratory disease

⚡ A pulse oximeter can be a stand alone unit or alternatively can be incorporated into a multi-parameter patient monitor.



TYPES OF OXIMETERS

- ✦ Pulse Oximeter as part of an anesthetic machine
- ✦ A portable desktop unit
- ✦ A finger pulse Oximeter



Pulse Oximeter as part of an anesthetic machine



Pulse Oximeters (continue)

Portable Desktop unit

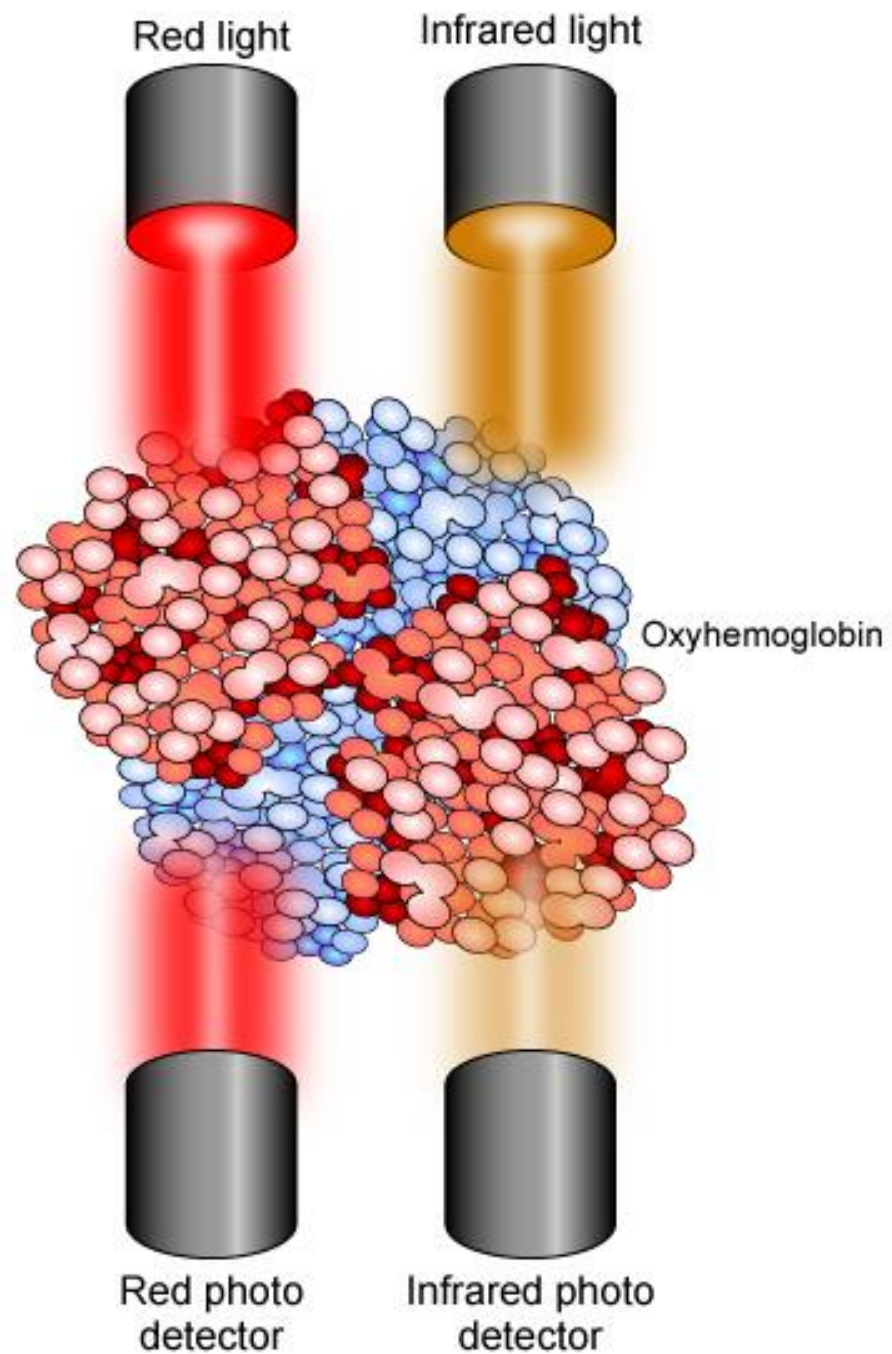
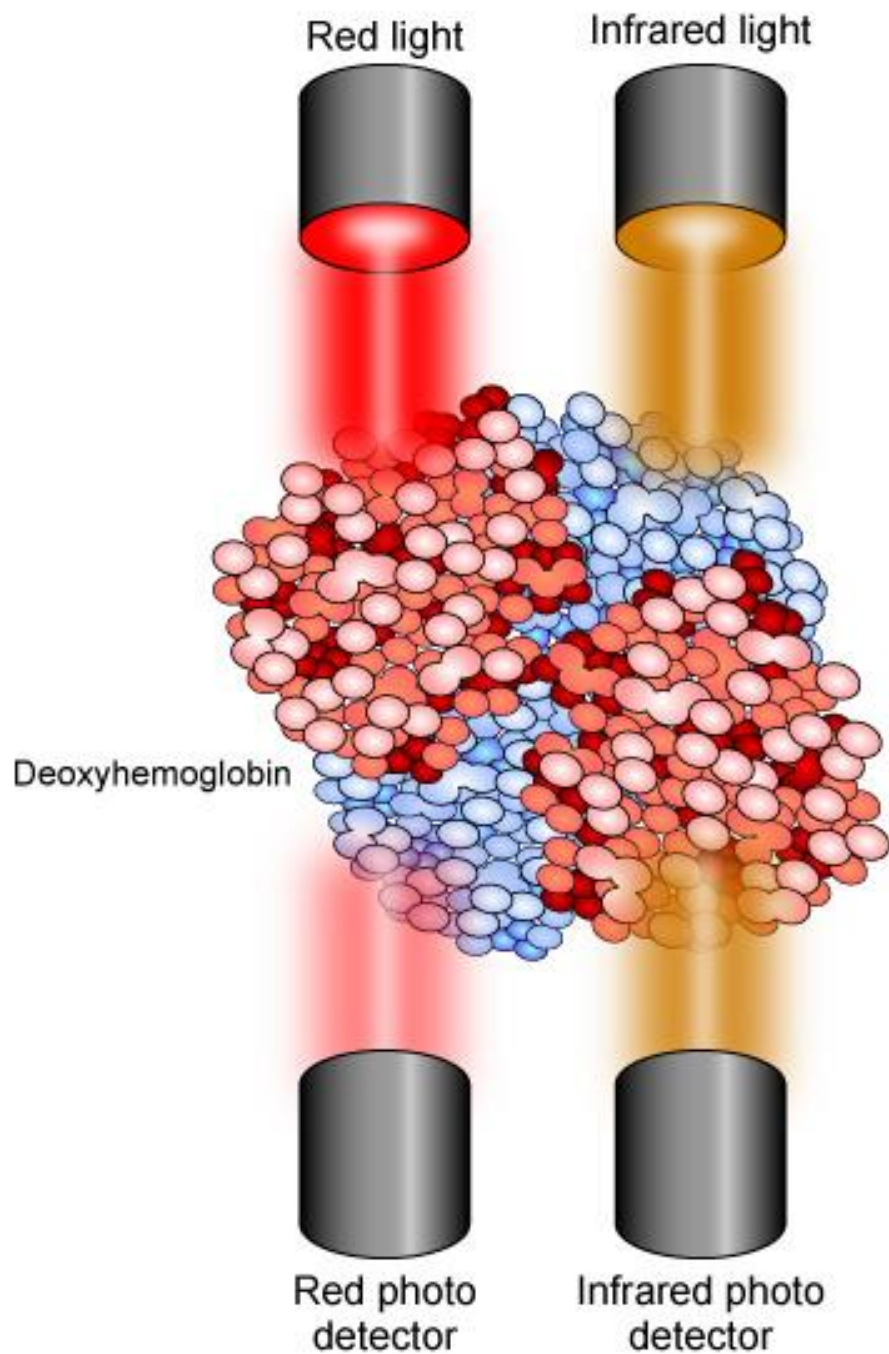


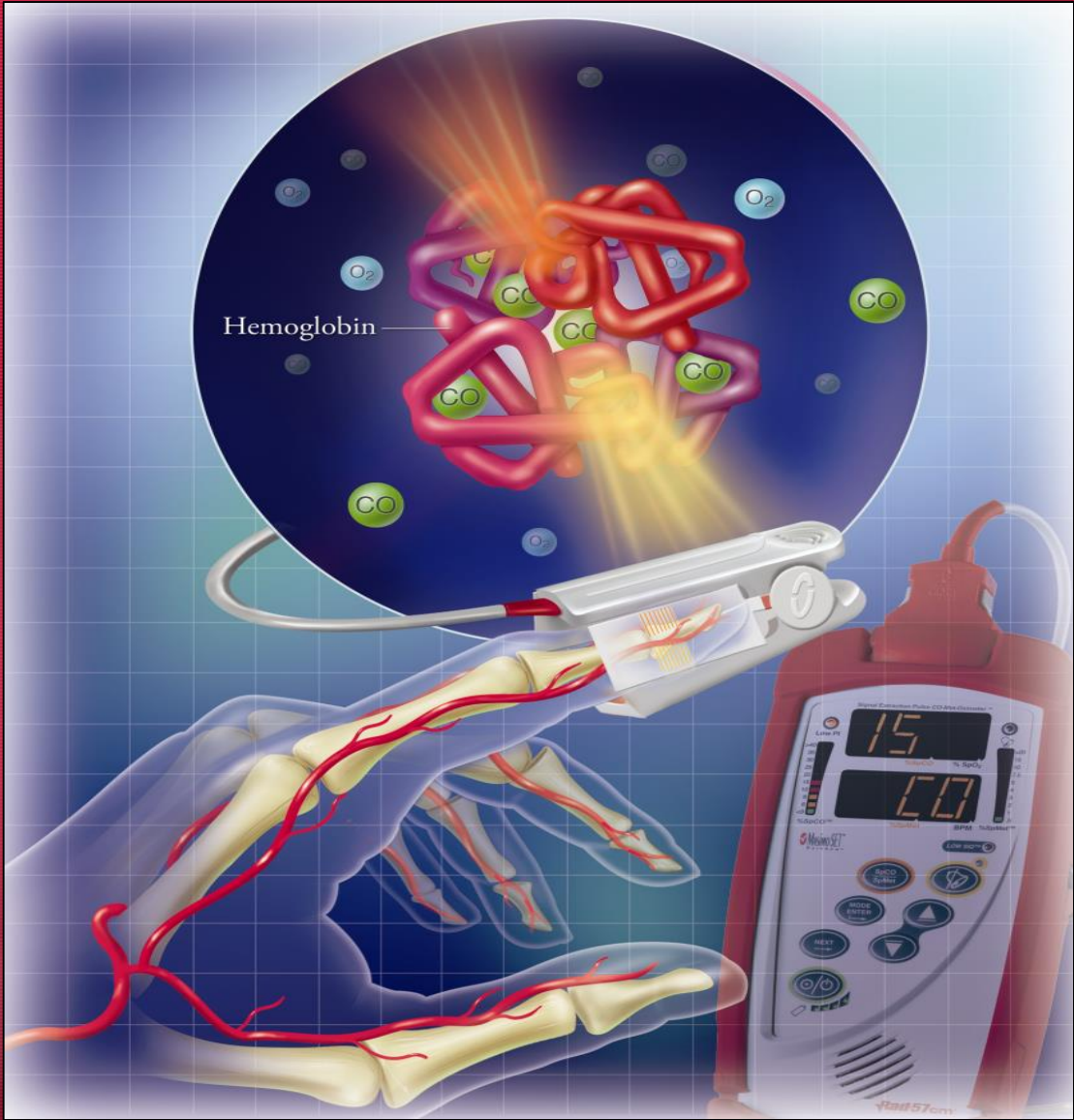
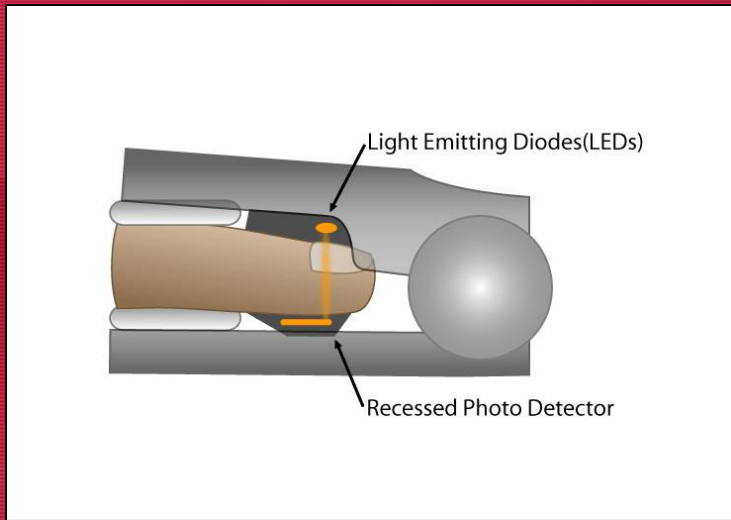
Finger/mobile



How does a pulse oximeter work?

- ✦ The pulse oximeter consists of a probe attached to the patient's finger, toe, ear lobe, nose or forehead which is linked to a computerised unit.
- ✦ Typically the probe has a pair of small light-emitting diodes (LEDs) that shine through a translucent part of the patient's body, usually a fingertip or an earlobe, onto a photodiode.
- ✦ One LED is red, with wavelength of 660 nm, and the other is infrared, 905, 910, or 940 nm.
- ✦ Absorption of these wavelengths differs significantly between the oxygenated and deoxygenated haemoglobin.
- ✦ Therefore from the ratio of the absorption of the red and infrared light the oxy/deoxyhaemoglobin ratio can be calculated and blood oxygen saturation level expressed as a %.





- ✦ Only inflow of blood is used to determine peripheral capillary oxygen saturation (SpO_2).
- ✦ Hb and HbO_2 absorb light at different rates due to color and conformation.



- ✦ **HbO₂ absorbs more infrared light than Hb.**
- ✦ **Hb absorbs more red light than HbO₂.**
- ✦ **Difference in absorption is measured.**
- ✦ **Ratio of absorbance matched with SpO₂ levels stored in the microprocessor.**



Pulse Oximetry Sensors

- ✦ 2000 & 3000 Series
- ✦ Viamed 4000 Series
- ✦ Many more



2000 & 3000 Series Sensors

2000 Series Includes:

- Reusable finger sensors
- Reusable multi-site 'Y' sensors
- Disposable sensors
- Extension cables
- Adapter cables

3000 Series Includes:

- Nellcor compatible disposable sensors

Disposable Sensors:

- Variety of application sites: finger, great toe, foot
- Variety of sizes: adult, paediatric, infant, neonatal
- Variety of tape material: cloth, foam, vinyl



Viamed 4000 Series Sensors

Series includes

- 3rd generation soft silicone sensors
- Reusable finger sensors
- Reusable wrap sensors
- Disposable sensors
- Extension & adapter cables

Easy to use

High performance

Reliable and accurate

Either original or fully compatible replacement sensors



4000 Series Disposable SpO₂ Sensors

⚡ Patient types available

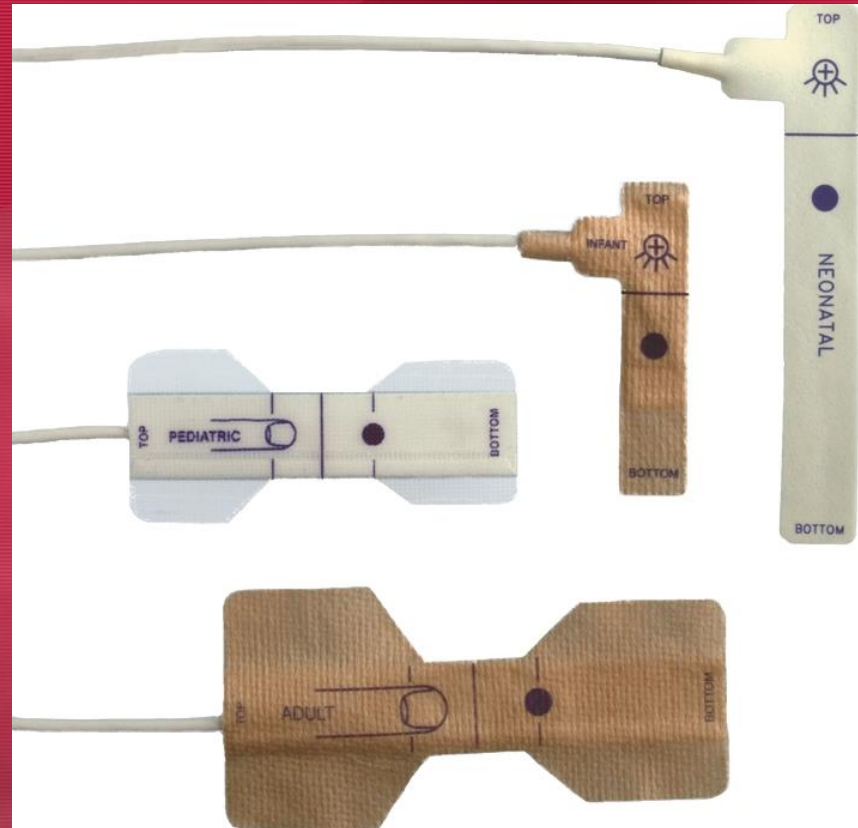
- ⚡ Adult
- ⚡ Paediatric
- ⚡ Infant
- ⚡ Neonatal

⚡ Tape materials available

- ⚡ Micro Foam
- ⚡ Transpore
- ⚡ Plaster

⚡ Cable lengths available

- ⚡ Adult & Paediatric – 0.45m (18")
- ⚡ Infant & Neonatal – 0.90m (3')



4000 Series Soft Sensors

- ✦ **3rd generation soft silicone sensors**
- ✦ **Extremely robust and durable**
- ✦ **Extremely accurate**
- ✦ **Comfortable and secure fit**

- ✦ **Patient Types Available**
 - ✦ Adult
 - ✦ Paediatric

- ✦ **Bio-compatible and latex free silicone to help prevent allergic reactions**

- ✦ **Can be easily and thoroughly cleaned**



4000 Reusable Sensors

- ✦ Finger Sensors
- ✦ Wrap Sensors
- ✦ Extension Cables
- ✦ Robust and reliable
- ✦ Comfortable fit
- ✦ Quality design



Equipment


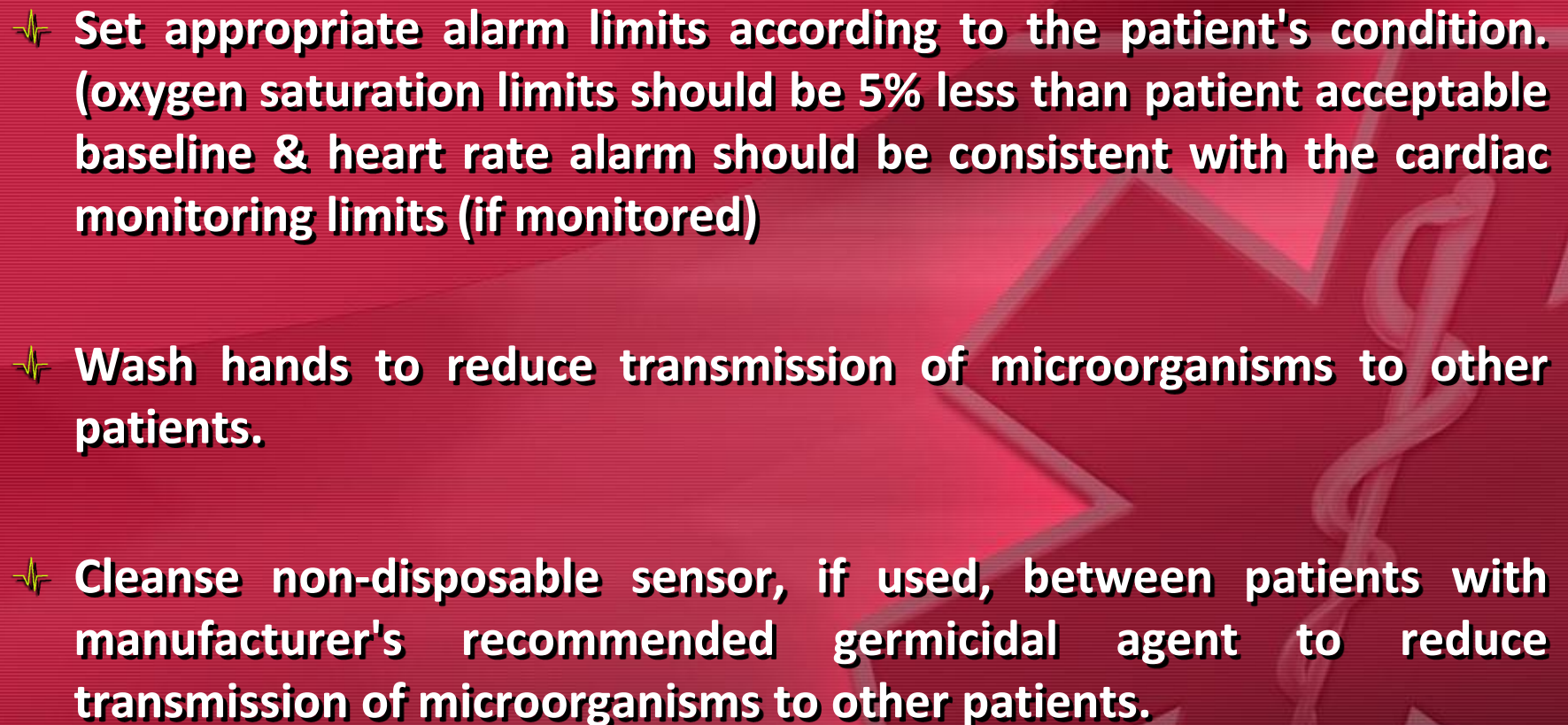
- ✦ Cable and sensor
- ✦ Manufacturer's recommended germicidal agent for cleaning the non- disposable sensor
(used for cleaning between patients).

Patient preparation

- ✚ Explain the need for determination of oxygen saturation with a pulse oximeter to inform the patient of the purpose of monitoring and to enhance patient cooperation and decrease patient anxiety
- ✚ Explain that the value displayed may vary by patient movement, amount of environmental light, patient level of consciousness (awake or a sleep), and position of the sensor to decrease patient and family anxiety over the constant variability of the values

Procedure

- ✦ Wash hands to reduce the transmission of microorganisms and body secretions (standard precautions)
- ✦ Use personal protective equipment to reduce the transmission of microorganisms and body secretions (standard precautions)
- ✦ Select the appropriate pulse oximeter sensor for the area with the best pulsatile vascular bed to obtain accurate spo₂ (peripheral capillary oxygen saturation) measurements. Use of finger sensors produce the best results over other sites.
- ✦ Plug sensor into oximeter cable, allowing Spo₂ measurement.
- ✦ Turn instrument on with the power switch
- ✦ Allow 30 seconds for self-testing procedures and for detection and analysis of wave forms before value are displayed

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- ✦ **Set appropriate alarm limits according to the patient's condition. (oxygen saturation limits should be 5% less than patient acceptable baseline & heart rate alarm should be consistent with the cardiac monitoring limits (if monitored))**
 - ✦ **Wash hands to reduce transmission of microorganisms to other patients.**
 - ✦ **Cleanse non-disposable sensor, if used, between patients with manufacturer's recommended germicidal agent to reduce transmission of microorganisms to other patients.**

Precautions

- ⚡ Do not use one manufacturer's sensor with another manufacturer's pulse oximeter unless compatibility has been verified
- ⚡ Select desired sensor site, assess for warmth and capillary refill. Confirm the presence of an arterial blood flow to the area monitored because adequate arterial pulse strength is necessary for obtaining accurate Spo₂ measurements
- ⚡ Avoid sites distal to indwelling arterial; catheters, blood pressure cuffs, arteriovenous fistula, blood transfusions to obtain accurate Spo₂ measurements.

- ⚡ Plug oximeter into grounded wall outlet if the unit is not portable. If the unit is portable , ensure sufficient battery charge by turning it on before using .
- ⚡ Apply the sensor in a manner that allows the light source (light-emitting diodes) to be directly opposite the light detector (photodetector) to determine a pulse oximetry value properly, protect from excessive environmental light because light from sources such as examination lights or overhead lights can cause elevated oximetry values.
- ⚡ Troubleshoot by reapplying the sensor or shielding the sensor with a towel or blanket.
- ⚡ Positioned the oxymeter in such a manner so that all sensor emitted light comes in contact with perfused tissue beds and is not seen by the other side of the sensor or without coming in contact with the area to be read.

- ✦ Gently position the sensor so that it does not cause restriction to arterial flow or venous return because the pulse oximeter is unable to distinguish between true arterial pulsations and fluid waves (e.g., venous engorgement or fluid accumulation)
- ✦ Restriction of arterial blood flow can cause a falsely low value and lead to vascular compromise , causing potential loss of viable tissues.
- ✦ Edema from restriction of venous return can cause venous pulsation. Evaluating the site above the level of the heart reduces the possibility of venous pulsation (Moving the sensor to another site on a routine schedule also reduces tissue compromise

- ⚡ Never place the sensor on an extremity that has decreased or absent sensation because the patient may not be able to identify discomfort or the signs and symptoms of loss of circulation or tissue compromise
- ⚡ Determine accuracy of detected wave form by comparing the numeric heart rate value with that of a monitored heart rate or an apical heart rate or both (if there is insufficient arterial blood flow through the sensor, the heart rate values vary significantly. (consider moving the sensor to another site, such as the earlobe or the nose) (if the pulse rate detected by oximeter does not correlate with the patient's heart rate, the oximeter is not detecting sufficient arterial blood flow of accurate values (this problem occurs particularly with the use of the fingers and the toes in conditions of low blood flow .