



AUTOMATED OXYGEN ADMINISTRATION VS CONVENTIONAL OXYGEN THERAPY

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- Historical aspects of Oxygen delivery systems
- Reasons for initiating Oxygen therapy
- Balancing between hypoxemia and hyperoxia
- Automated O₂ delivery system as part of PRECISION MEDICINE
- Head to head – Conventional vs Automated delivery.
- Conclusions

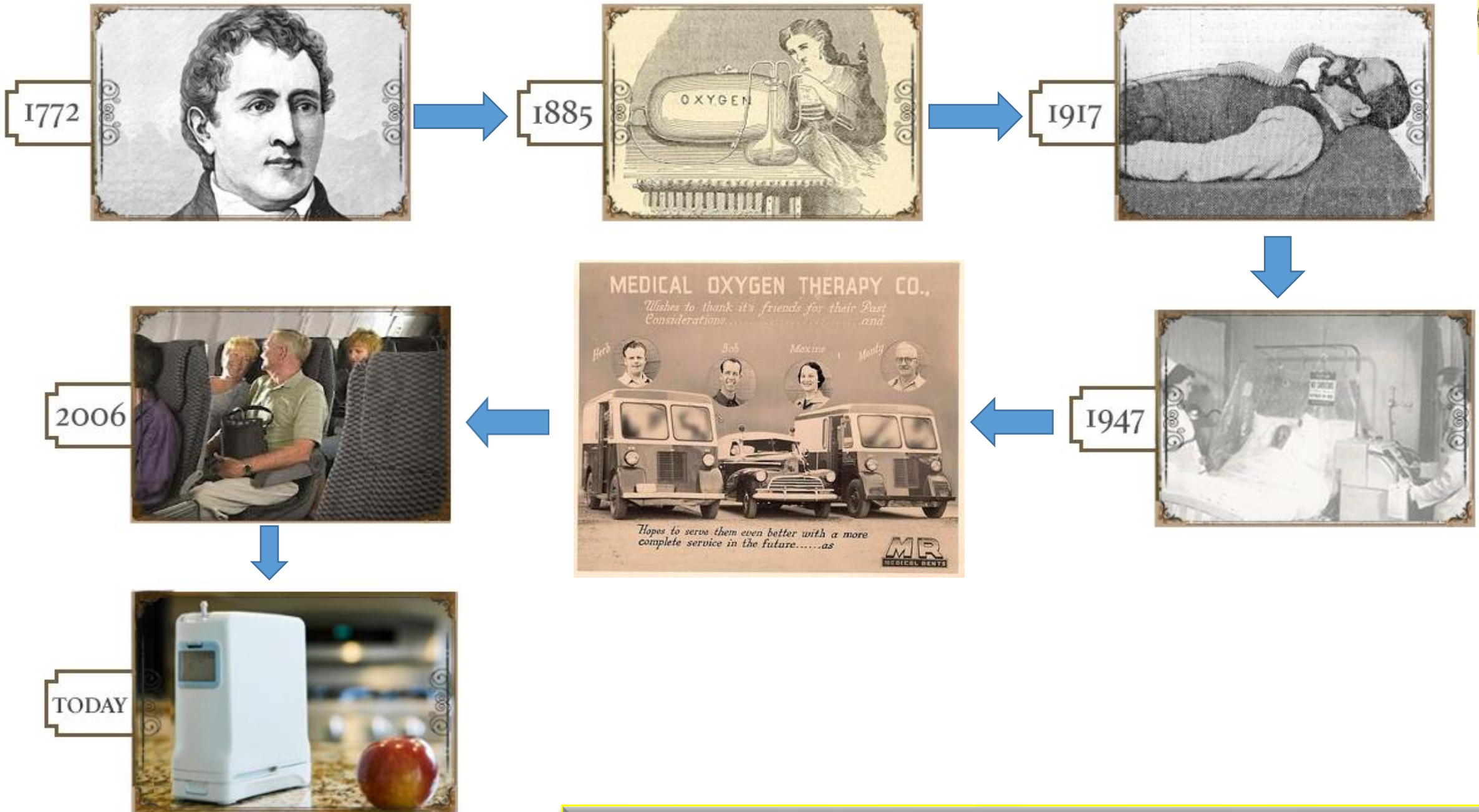


A BRIEF HISTORY

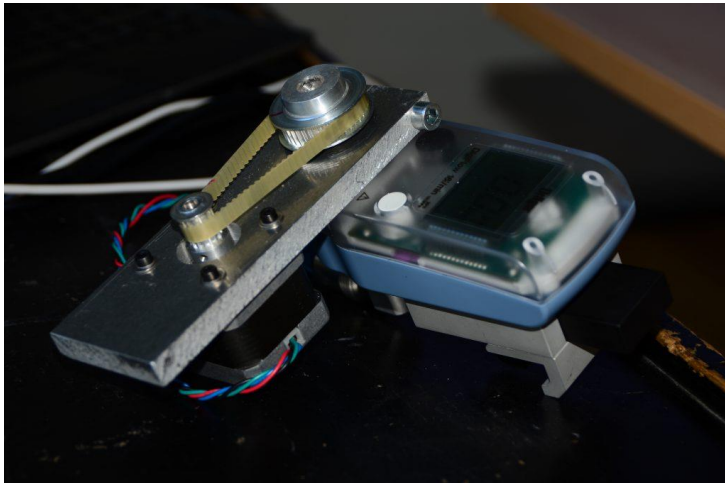
- Joseph Priestly discovered Oxygen in 1774
- Carl Scheele publishes findings on oxygen in the same year.
- Oxygen cylinders were invented
- Use of Oxygen as a “cure all” for a vast number of diseases including Asthma and Consumption.



- 1899 James Lorraine Smith published evidence of Oxygen related toxicities and the useless use of Oxygen in some disorders.
- 1920 detrimental effects of tissue hypoxia were recognized
- 1925 onwards – More and more studies emerged regarding the therapeutic effects of Oxygen supplementation.
- 1970 Commercially available home oxygen concentrators were manufactured by Union Carbide and Bendix corporation U.S.A
- Currently Oxygen is a part of WHO's list of Essential medications



AUTOMATED O2 DELIVERY SYSTEMS



2013 PROTOTYPE



2014- 15 2ND PROTOTYPE



THIRD PROTOTYPE 2016





Reasons for initiating O₂ therapy

- Documented Hypoxemia Pa o₂ < 60mmHg or SpO₂ < 90%
- Acute Respiratory Distress , tachypnea
- Acute Myocardial Infarction
- Low cardiac output + metabolic acidosis
- Acute exacerbation of Obstructive airway disease
- Pulmonary embolism (tachypnea)
- Pneumothorax



RELATIVE INDICATIONS

- Severe Trauma
- Dyspnea without hypoxemia (palliative)
- Low cardiac output state with hypotension
- Sickle cell pain crisis



STRIKING A BALANCE BETWEEN HYPOXIA AND HYPEROXIA



HYPOXIA

- SPO₂ < 88%
- Tachypnea
- Tachycardia
- Elevated Blood Pressure
- Reduced Work Capacity Of Muscles
- Drowsiness
- Impaired Judgement
- Headache
- Right Heart Disease
- Brain Atrophy (Chronic)
- Hypoxic Encephalopathy

SWEET SPOT :
SPO₂ 88% to 94% SPO₂ for
COPD Patients

SPO₂ 95 – 98% for patients
without OAD

HYPEROXIA

Exposure to high FIO₂ more than necessary to maintain physiologic values of PaO₂ for a prolonged time.

Mitochondrial damage,
Lipid peroxidation of neuronal cells
Increase in reactive oxygen species

FiO₂ > 0.90 causes direct damage to pulmonary capillary endothelium.



AUTOMATED O₂ DELIVERY/ TITRATION SYSTEM

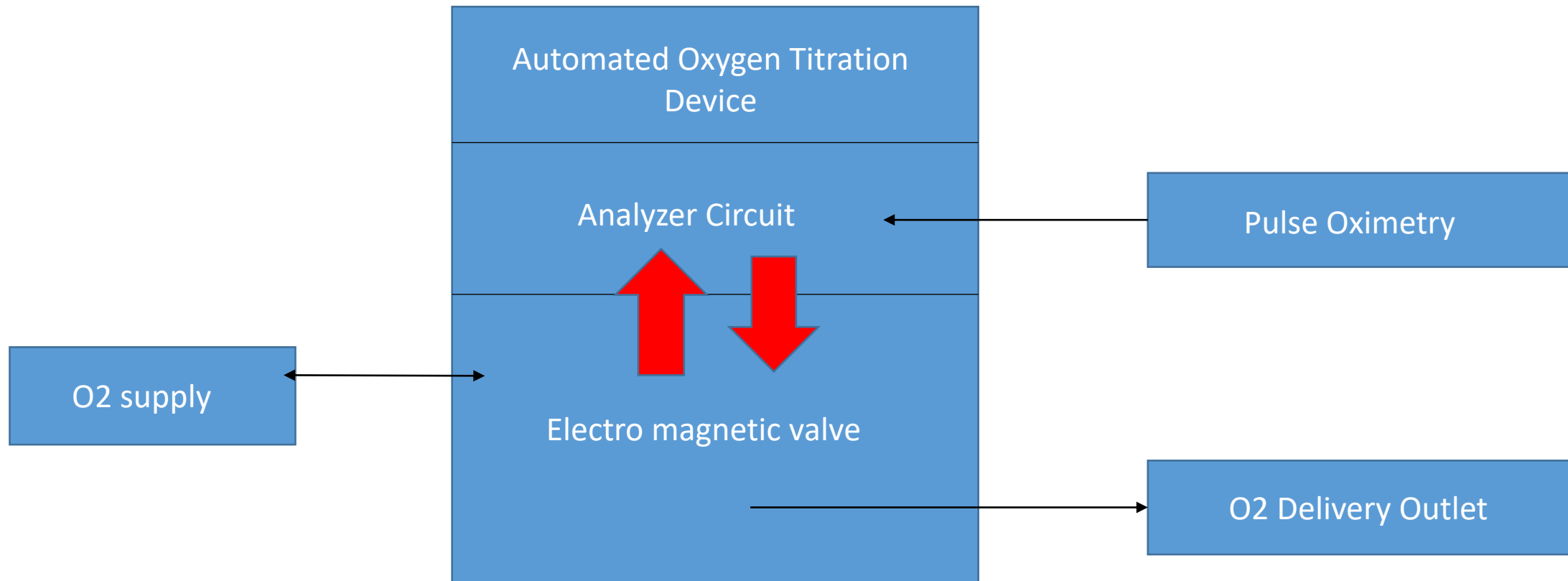
- Works with Low flow and high flow systems
- The device consists of an analyzer module, which controls an electromagnetic valve.
- The target range of SpO₂ for the patient is set on the device.
- The input signals from a pulse oximeter are analysed by the module software (runs on C++)
- The valve is actuated via input from the analyzer module and flow of oxygen is controlled in real time



- Device was developed as an instrument running on the principle of “Precision medicine”
- Definition of Precision medicine
 - **Precision medicine (PM)** is a medical model that proposes the customization of healthcare, with medical decisions, treatments, practices, or products being tailored to the individual patient.
 - The titration parameter ie the range of spo2 can be customized for the specific patient and their oxygen requirement, based on Spo2 readings.



AUTOMATED OXYGEN DELIVERY SYSTEM PRINCIPLE



HEAD TO HEAD : CONVENTIONAL VS AUTOMATED O2 DELIVERY



Parameter	Automated O2 Delivery System	Conventional O2 Delivery System
Flow	Low Flow	Low Or High Flow
Control	Program Preset Control	Manual
Titration Frequency	Varies – Every Few Seconds To Minutes	Depends On Individual Monitoring Preference
Indication	Mainly For Weaning/ O2 Titration And Patients On L.T.O.T	Can Be Used In Acute Setting Also
Ease Of Use	Automated System, One Touch Settings	Needs Operator Expertise, Monitoring
Ideal For	Old Age Homes, Domestic Use Where Constant Monitoring By Trained Staff Is Not Available	Mainly In Hospitals, Acute Care Settings Where Trained Staff Are Available
Cost	Currently Expensive , Not Readily Available	No Added Cost
Co2 Retention	No Parameter For Detection	Manually Detected Via ABG Monitoring



CONCLUSIONS

- Should you get one? Yes and No.
- Main application is for titration of oxygen in places where frequent monitoring is not possible/ staff aren't adequately trained.
- May be used in old age homes/ patients house as part of Long term oxygen therapy.
- The device is still in early stages of development
- Incorporation of percutaneous capnographic probe can prevent CO₂ retention



- Monitoring by a trained staff such as a Resp therapist/ ICU staff cannot be entirely substituted by an automated system in its infancy.
- Devices are prone to failure, malfunction.
- When the best Ventilators fail that's when the Bag, Mask and valve systems are used - by well trained healthcare professionals.



“Progress is made by the improvement of people, not the improvement of machines.”

— Adrian Tchaikovsky



Thank You