

OXYGEN USE IN PHYSICAL THERAPY PRACTICE

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Supplemental Oxygen Advantages

- British Medical Research Council Clinical Trial

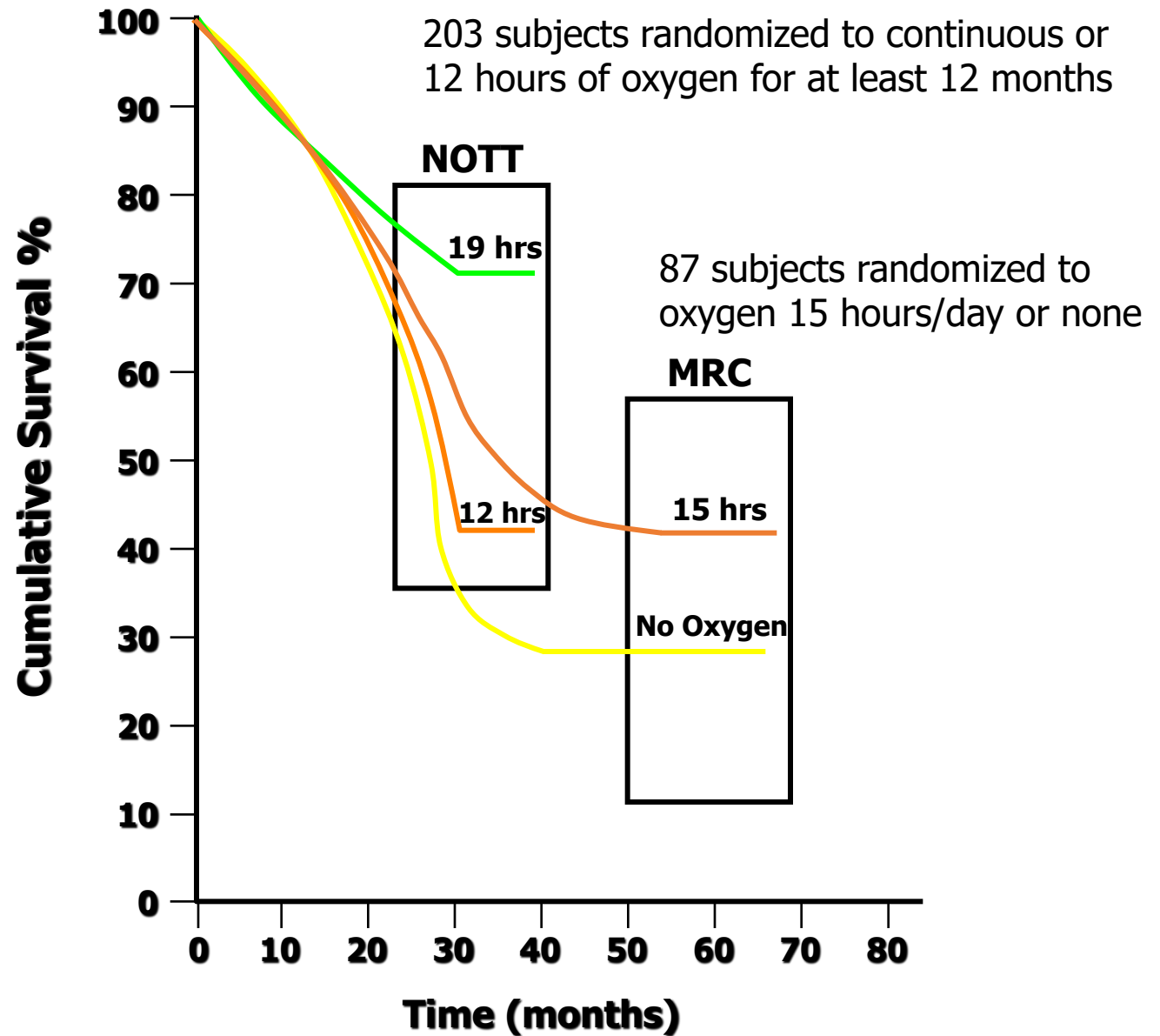
- Improved survival using oxygen 15 hrs/day compared to using no oxygen in patients with $\text{PaO}_2 \leq 55$ mm Hg
- Improved survival did not appear until after 500 days of oxygen use

- The Nocturnal Oxygen Therapy Trial (NOTT)

- Survival is better in COPD/chronic stable hypoxemic patients who use oxygen 12-15 hrs/day
- Survival best by using nearly continuous O₂

Supplemental Oxygen Advantages

- NOTT: Using nocturnal oxygen therapy (NOT) and continuous oxygen therapy (COT) improved brain function at 6 months
- NOTT: Using COT improved brain function at 1 year



Oxygen Prescription and Use

- FDA states: “medical oxygen is defined as a prescription drug which requires a prescription in order to be dispensed except....for emergency use”

APTA Statement Regarding Oxygen

- “APTA is unaware of any regulations that prohibit the use of oxygen for patient management if it is prescribed and if parameters set by the physician are maintained.”
- *APTA Guide to Physical Therapist Practice* (2nd ed):
supplemental oxygen listed as procedural intervention within the scope of P.T. practice under Prescription, Application, and, as appropriate, Fabrication of Devices and Equipment (supportive device) to improve ventilation and respiration/gas exchange

APTA Statement Regarding Oxygen

- Pharmacology in Physical Therapist Practice House Of Delegates (HOD) P06-04-14-14
 - “Physical therapist patient/client management integrates an understanding of a patient’s prescription and nonprescription medication regimen with consideration of its impact upon health, impairments, functional limitations, and disabilities. The administration and storage of medications used for physical therapy interventions is also a component of patient management and thus within the scope of physical therapist practice.”
 - Physical therapy interventions that may require the concomitant use of medications include, but are not limited to, agents that: Facilitate airway clearance and/or ventilation and respiration

Co-morbidities: Why are more patients needing supplemental oxygen?

- Older patients
- Multiple medical diagnoses
- Pulmonary diagnoses are increasing in incidence and prevalence

What are the advantages of Supplemental Oxygen?

- Oxygen during Exercise:
- 1)Decreases SOB
- 2)Decreases dynamic hyperinflation
- 3)Prolongs exercise tolerance
- 4)Improves sleep and mood
- 5)Increases mental alertness and stamina
- 6)Prevents/delays heart failure in severe lung disease

Oxygen Equipment

- Pulse oximeters



Oxygen Systems

- Oxygen Concentrator



Portable



Stationary

Oxygen Equipment

- Oxygen tanks



A

C

D

E

M

AEROX Cylinder Size

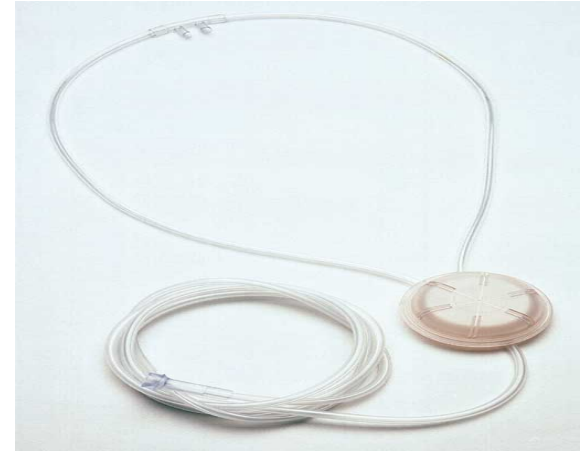
Choosing the Appropriate Delivery Device

- Nasal Cannula
- High Flow Nasal Cannula
- Oxymizer
- Venti-mask
- Partial Re-breather mask
- Non Re-breather mask
- Mask plus nasal cannula

Oxygen delivery devices



Nasal Cannula



Pendulum Reservoir (oxymizer)



Nasal Reservoir (oxymizer)

Nasal cannula: .25-6 LPM (22-45% FiO₂)
Oxymizer: 4 to ~10 LPM

Principles of Nasal Cannula Use

Liter Flow	Approximate Fraction of Inspired Oxygen (FiO ₂)
0 (Room Air)	21%
1	24%
2	28%
3	32%
4	36%
5	40%
6	44%

- Avoid using standard nasal cannula > 6 Liters
 - Membranes within nasal passages become dry, irritated
- Switch to different delivery source: high flow cannula, mask
- Amount of oxygen flowing from oxygen source is always 100%

Oxygen Devices



- Conserving device
- Soft nasal prongs
- Tube diameter slightly larger
- Green connector tubing
- Use up to 15 LPM
- Provides ~ 1 Liter more than regulator setting

High Flow Nasal Cannula

Oxygen Devices

Venturi Mask

Legend¹ Venturi Mask kit features six color-coded diluters that enable the accurate delivery of specific concentration of oxygen including 24%, 28%, 31%, 35%, 40% and 50%. The kit has the adapter for high humidity entrainment and 7 feet oxygen supply tubing.



Diluter Color	Diluter O ₂ %	Suggested O ₂ Flow	Total Gas Flow
Blue	24%	3 LPM	78 LPM
Yellow	28%	6 LPM	66 LPM
White	31%	8 LPM	72 LPM
Green	35%	12 LPM	72 LPM
Pink	40%	15 LPM	60 LPM
Orange	50%	15 LPM	40 LPM

Item#	Description	Pkg
RVM001	Venturi mask, adult	50/cs
RVM002	Venturi mask, pediatric	50/cs

Venti-Mask Settings



Partial Re-breather Mask



Oxygen Devices

Non-rebreathing face masks

- Face mask + oxygen reservoir + a valve at exhalation port + a valve between reservoir and mask
- Patient inhales oxygen from the bag and exhaled air escapes through flutter valves on the side of the mask
- Oxygen flow into the mask is adjusted to prevent the collapse of the reservoir (12 L/min)
- It prevent the room air from being entrained
- 10-15 L/min, FiO₂ 90-100%



6: 55-60%
8: 60-80%
10: 80-90%
12: 90%
15: 90-100%

Non-Rebreather Oxygen Mask



Knowledge of Indications for Oxygen and How to Administer

- Physicians often specify flow rate in orders
- Deviations from prescribed dosages require an updated order from the physician
- *****Alternately**** Physicians may prescribe maintenance of a specific oxygen saturation (SpO_2) level during rest and activity: “maintain $\text{SpO}_2 \geq$ ____%” (usually 88%-90%)
 - PTs may titrate oxygen flow to maintain patients at or above this threshold saturation value

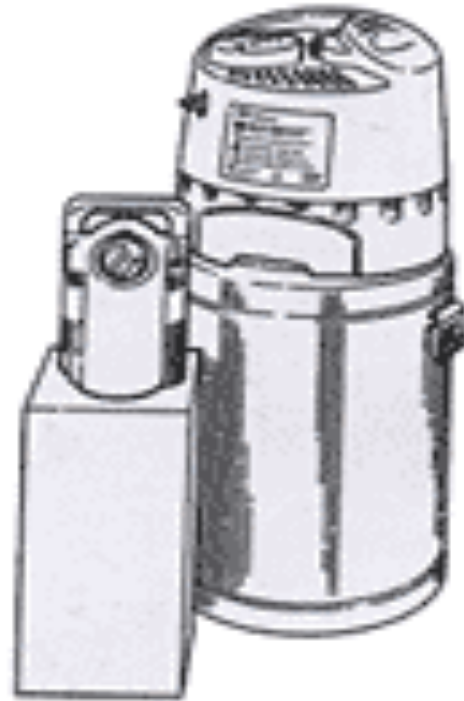
Oxygen ABC's

- Compressed gas cylinders



Oxygen ABC's

- Liquid oxygen—being discontinued



Oxygen ABC's

- Oxygen concentrators



Portable Oxygen Concentrator

- AC, DC, and battery operation
- 5-20 lbs.
- Continuous (up to 3 LPM)
- Intermittent (up to 6 LPM)
- Airplane travel OK
- Battery life variable



INOGEN ONE^{G4} System



**Only
2.8 pounds!**

The Inogen One® G4 System (IS-400):

- Unbelievably Compact and Lightweight
- Ultra-Quiet Operation
- Intelligent Pulse Oxygen Delivery
- Designed for 24 Hour Use

*Included with system

**Accessory sold separately



Inogen One®
AC Power Supply*
Item # BA-401



Inogen One® G4
DC Power Cable*
Item # BA-306



Inogen One® G4
Lithium Ion Battery*
Up to 2.7 hours run time
Item # BA-400



Inogen One® G4
Carry Strap*
Item # CA-401



Inogen One® G4
Bag*
Item # CA-400



Inogen One® G4
Extended Life Lithium Ion Battery**
Up to 5 hours run time
Item # BA-408

**New
Product!**

INOGEN^{G4}ONE

Oxygen. Anytime. Anywhere[®]

Weight	2.8 lbs. (includes single battery)
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Oxygen Flow	Pulse dose delivery system Three flow settings 1, 2, 3
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Battery	Duration (single battery): Up to 2.7 hours Recharge up to 3 hours with AC or DC power Duration (double battery): Up to 5 hours Recharge up to 5 hours with AC or DC power
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Warranty	3 year or lifetime limited warranty**
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Use	Designed for 24/7 use and conforms to all applicable FAA requirements for POC use on board an aircraft
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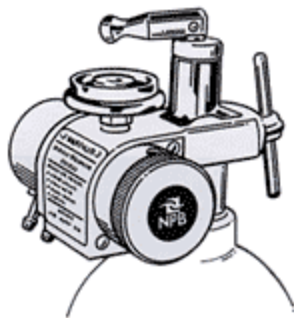


www.inogen.com
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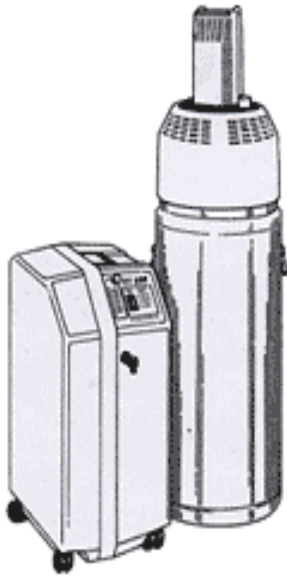
Oxygen ABC's

- Continuous flow vs Pulsed dose flow



Oxygen ABC's

- How to use a tank



Guidelines and Titrating Flows to Match Needs during Different Activities

- Flows may be different at rest, exercise, and sleep
- What if your patient is a Carbon Dioxide (CO₂) retainer?
- Flows are different for various pulmonary diagnoses
- Physical Therapy can determine this over time

Carbon Dioxide Retention

- Normal PCO_2 = 35-45 mmHg
- In long-standing COPD and Cystic Fibrosis, PCO_2 is chronically high, often > 45 mmHg
- Over time, the metabolic system of these patients learns to accommodate for consistently high CO_2 levels
- These patients do not react by going into Acute Respiratory Failure
- The pH level is “compensated” and within normal range

CO₂ Retention

- Fact: In healthy individuals, respiratory drive is stimulated by an increase in CO₂ levels (Increase RR to “blow off” extra CO₂)
- CO₂ and O₂ levels in the blood are detected by several structures within the vasculature
 - Aortic bodies
 - Carotid bodies



CO₂ Retention

- In long-standing COPD and CF, due to consistently high CO₂, the body becomes sensitive to Oxygen levels rather than CO₂ levels as a stimulus to increase or decrease RR
- In some cases, too much supplemental oxygen (higher liter flow) can blunt the stimulus to maintain an adequate RR
- Clinical S & S: somnolence, confusion, lack of rise of SpO₂ when increase FiO₂



Oxygen Logistics

- Patient provides his/her oxygen or will you provide?
- Oxygen storage
- Cost/billing
- Prescription from MD
- Pulse Oximetry

Common Oxygen-Related Questions/Comments

- “Will I be able to get off of my oxygen?”
- “I’ll just slow down my exercise so I won’t have to wear oxygen.”
- “Is oxygen addictive?”
- “Can I smoke while I wear my oxygen?”
- “My food doesn’t taste as good since I started wearing oxygen.”
- “I don’t want to wear oxygen when I’m in public.”
- “I wear my oxygen after I get back from the mailbox because I am so out of breath.”

Non-Invasive Ventilation

Definition

- **Non-invasive ventilation (NIV)** refers to the provision of ventilatory support through the patient's upper airway using a mask or similar device. This technique is distinguished from those which bypass the upper airway with a tracheal tube, laryngeal mask, or tracheostomy and are considered **invasive**

Negative Pressure Ventilation

- Drinker-Shaw iron lung
 - Late 1920's
 - Used to treat poliomyelitis



Positive Pressure NIV

- Using a mask
- Decreased respiratory rate
- Decrease in dyspnea
- Decreased hypercapnia
- Decreased work of breathing
- Increased tidal volume
- Rests the diaphragm
- Improved oxygenation

Delivery Choices

- Mouth piece
- Nasal mask
- Nasal prongs
- Face mask



Delivery

- Volume ventilation
 - Pressure support
 - Bilevel positive airway pressure (BiPAP)
 - Proportional-assist ventilation (PAV)
 - Continuous positive airway pressure (CPAP)
-
- Oxygen blended in for delivery of FiO_2

CPAP

- Increases air pressure in airway to prevent airway collapse
- Single pressure setting during inhalation and exhalation
- Indicated for patients with OSA with positive sleep study



Nasal Prongs

BiPAP

- Two pressure settings
- Higher pressure for inhalation (iPAP)
- Lower pressure for exhalation (ePAP)
- Used when CPAP not effective
- Indicated with CO₂ retention



Non-invasive Negative Pressure Ventilation

- Cuirass shell
- Vacuum device that lowers pressure surrounding the thorax
- Subatmospheric pressure—passively expands the chest wall with descent of diaphragm
- Lung inflation
- Exhalation = passive recoil

Cuirass Shell



Patient Population

- Initially:
 - Only polio patients
- Current Usage:
 - Acute and Chronic respiratory failure
 - Neuromuscular respiratory failure

Indications for Use

- Patient cooperation (an essential component that excludes agitated, belligerent, or comatose patients)
- Dyspnea (moderate to severe, but short of respiratory failure)
- Tachypnea (>24 breaths/min)
- Increased work of breathing (accessory muscle use, pursed-lips breathing)
- Hypercapnic [respiratory acidosis](#) (pH range 7.10-7.35)
- Hypoxemia ($\text{PaO}_2/\text{FIO}_2 < 200$ mm Hg, most effective in rapidly reversible causes of hypoxemia)

Suitable Clinical Conditions for NIV

***COPD

***Most common

***Cardiogenic pulmonary edema

*Following d/c of mechanical ventilation (COPD)

*Community-acquired pneumonia

*Asthma

*Immunocompromised state

*Post-op respiratory distress and failure

*DNR status

*Neuromuscular respiratory failure

*Decompensated OSA or Cor Pulmonale

*Cystic Fibrosis

*Mild Pneumocystic carinii pneumonia

New Supplemental Oxygen Evidence: LOTT Trial

- New England Journal of Medicine October 2016 Vol. 375 (17)
- 47 centers participated
- Stable COPD, moderate resting desaturation ($\text{SpO}_2=89-93\%$) or moderate exercise-induced desaturation during 6MWT ($\text{SpO}_2 >80\%$ for >5 min and $<90\%$ for >10 sec)

LOTT results

No difference in giving supplemental O₂ for:

- Time until death
- Time until 1st hospitalization
- Time to 1st COPD exacerbation
- Changes in QOL, depression, anxiety, functional status

“Long-Term oxygen therapy in patients with stable COPD and resting or exercise-induced moderate desaturation has no benefit with regard to the multiple outcomes measured”