

The Top Ten Tips For Optimizing Oxygen Therapy in Your Practice

Editorial Summary

Oxygen therapy is a well evidenced modality of care in clinical wound practice. It can provide many benefits, such as a reduction in hospitalizations and amputations for diabetic foot ulceration patients. This article provides a practical top ten tips for the methods of optimization of oxygen therapy in your practice; taking into account factors for delivery of this modality such as activity, wound impacting factors; comfort, economic impact; geographic factors, capable participation level; compliance/ adherence, number of wounds and severity, and active infections, all of which will be discussed in this article to improve patient care delivery.

Introduction

This article is the second of two I have written on oxygen therapy for Wound Masterclass; the first, 'Optimizing Oxygen Therapy in Your Clinical Wound Practice', published in the inaugural May - June issue, provided a concise background and overview to this modality. This second article is intended to complement the first with a practical 'Top Ten Tips' of use to the clinician, in introducing this modality to their practice and how to approach the various factors involved.

1. Activity Level

How active is my patient? If they need to be active because they are still working and supporting a family you may want to consider a portable continuous diffusion device. Are they retired and have a more sedentary lifestyle, where at home delivery devices that are not as mobile may be used? Is the mobility from some delivery systems beneficial for the patient, or will the ambulation and freedom from a more portable device enable your patient to partake in more activities than you recommend? The boot systems and chambers are great for providing guaranteed non ambulatory stationary time when activity restriction is desired. The pressurized system requires the patient to sit near the condenser unit, ensuring that during device use they cannot do much, thus allowing protected offloading time. If they do need to be mobile, the continuous delivery systems offer that freedom. If you want to limit mobility, the boot/ sleeve systems require close association to the base unit and do not allow free movement while on therapy.

2. Wound Impacting Factors

Some of the delivery systems differ in the ability to move edema during use, adding the benefit of fluid control. The cyclic pressurized TOT delivery system (not the continuous flow TOT systems) has the added benefit of sequential non-contact compression of the limb, which helps to reduce peripheral edema in addition to the oxygen, and promotes arterial blood flow. Wound bed dryness is another consideration. Topical oxygen requires delivery to the wound surface and requires a moist wound environment; HBOT delivers the oxygen systemically and does not have this requirement. Dry wound beds will have an issue with the diffusion of oxygen, and thick gel wound care products will inhibit diffusion of the oxygen molecules. Pressurized cyclical TOT has the added benefit of adding humidification for oxygen diffusion. Keep in mind, moist wound environments have better outcomes compared to dry wound therapy.

3. Comfort

For some, group settings have a positive impact on patients, while it makes others withdraw from social interactions because of the wounds. HBOT requires frequent interactions in a facility and may utilize multi-place units or single full body chambers, which have the additional claustrophobic issue. If the patient is not comfortable, they will not use the therapy and thus the treatment is ineffective. It has been well documented that oxygen therapy reduces wound pain; this benefit is achieved from both HBOT and TOT. Physical discomfort may come from devices that require



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seals (TOT boots/ sleeves) to achieve pressure, or from prolonged stationary positions (HBOT and high/ low pressurized TOT systems) for 60-120 minutes at a time. The TOT systems have less noticeable negative side effects during use compared to HBOT, which can cause temporary myopia, glycemic control issues, middle ear barotrauma, pulmonary oxygen toxicity, and CNS oxygen toxicity.

4. Economic Impact to the Patient

Can your patient afford to drive or take transportation daily to your office or treatment facility, if HBOT is the recommendation? Does their insurance plan cover the therapy or is it an out-of-pocket expense? Can they maintain their job occupation under the therapy, or do they need to take time away in order to utilize the therapy?

5. Geographic Location

Where is the patient located? What if your patient is in a rural area and can only make infrequent appointments? Don't forget about the homebound patients who cannot leave, and telehealth patients who prefer to stay virtual. HBOT requires daily transportation to a specific location. TOT devices can be used at home and do not require transportation, and can also be used in skilled facilities and inpatient settings.

6. Capable Participation Level

How involved is your patient in their care? Are they capable of performing their own dressing changes and therapy or do they rely on others to help, and are they capable of helping with the therapy prescribed? Patients that cannot perform their own care but have no problem getting transportation may do better with HBOT. Pressurized TOT systems are daily applications; patients or caregivers that can participate in donning and doffing of boot/

chamber delivery systems daily will find benefit from this therapy. Continuous TOT device systems may stay in place in the dressing for 1 - 2 weeks and do not need to be changed as often, but do require batteries that need to be charged/ changed often, which can also be problematic. Cognition deficiencies pose wound care problems in general with dressing changes, without the added daily application or battery changes.

7. Compliance/ Adherence

No matter which therapy you think would be best, it all comes down to your patient's willingness to participate. If you know your patient misses recommended appointments but oxygen therapy is indicated, then a system which requires the least amount of patient involvement would likely work better. Continuous diffusion systems do not need to be changed/ used daily and do not require daily transportation to another location. Home health agencies can preform the dressing changes and they are user friendly, for the more independent individual.

8. Number of Wounds and Severity

Let's face it, some patients unfortunately have more than one wound or wounds that are very large. Continuous TOT devices are designed for single wounds or smaller wounds grouped together. They rely on tubing under occlusive dressing to deliver the oxygen. Larger wounds and patients with multiple wounds need a larger surface area of coverage, which would best be found from the pressurized devices and HBOT.

9. Active Infection

All oxygen delivery systems can be used in conjunction with treated infections but are not a substitute for antibiotic therapy. HBOT has the added benefit of being synergistic with some antibiotics due to its systemic delivery

where the TOT do not, and HBOT also has a specific indication for osteomyelitis. HBOT has the strongest evidence of support with severe infections to include necrotizing and clostridial. Cyclic pressurized TOT systems, along with HBOT, have been shown to increase local wound partial oxygen tension. Increasing the wound oxygen tension has a direct effect on leukocyte activity in clearing the infection. Activated neutrophils produce NADPH oxidase to generate reactive oxygen species, which also consumes the available oxygen.

Between the cellular activity needed to fight an infection, the now increased metabolic demand of oxygen to heal damage tissue, and bacterial or fungi consumption thereof, the wound tends to be depleted of available oxygen creating a hypoxic like environment.

Chronic wounds with suspected biofilms will have a chronic increase of neutrophils, thereby high oxygen consumption that continues to impede wound healing.

10. Dressing Compatibility

HBOT can be used with any dressing choice. Topical delivery systems cannot be used in conjunction with gels, as they hinder the oxygen from getting into the wound bed (they can be wiped out before device use for the non-continuous delivery devices). Continuous non pressurized devices require occlusive dressings to keep the oxygen locally and if not kept in check can lead to maceration of the periwound. Pressurized systems can go through breathable dressings like unna boots, compression systems, and even TCC.

Figure 1: Overview of oxygen delivery.

	Cyclical Pressurized TOT	Non-cyclical pressurized TOT	Continuous non-pressurized TOT	HBOT
ACTIVITY LEVEL DESIRED	60-90 minutes daily stationary time	60-90 minutes daily stationary time	Allows 24 hour mobility	Up tp 2 hours daily stationary time
PROMOTES OFFLOADING OF WOUND AREA DURING USE	Highly likely	Highly likely	None	Likely
EDEMA CONTROL	Yes	Little	None	Little
HUMIDIFICATION	Yes	No	Yes	No
NEEDS INTACT VASCULATURE FOR DELIVERY	No	No	No	Yes
LOCATION COMFORT	Home based	Home based	Home based	Facility based only
PHYSICAL COMFORT	Limited-Stationary near device	Limited-stationary near device	Allows flexibility in positioning	Limited-facility arranged setting
WOUND COMFORT	Evidence of pain reduction	Evidence of pain reduction	Evidence of pain reduction	Evidence of pain reduction
DEVICE DELIVERY DISCOMFORT	Some may	Some may	Less likely	More likely
ADDITIONAL COSTS	Some insurance coverage	Some insurance coverage	Some insurance coverage	Most insurance coverage. Requires daily transportation to a facility
LOCATION OF THERAPY	Medical settings Home use	Medical settings Home use	No restriction on location	Only at a HBOT facility
PATIENT PARTICIPATION	Self care Care giver	Self care Care giver	Self care Care giver H/H agency	Rely on facility Rely on transportation
DEVICE USE REQUIRES	Ability to preform donning and doffing Breathable dressing	Ability to preform donning and doffing Breathable dressing	Daily charging of batteries Disposable unit for application Occlusive dressing	A health care professional
COMPLIANCE	Patient dependant unless in a facility	Patient dependant unless in a facility	Patient dependant	Patient dependant Transportation dependant
VARIABLE WOUND SIZES	Yes	Yes	No, limited to smaller wounds	Yes
WOUND DEPTH	All	All	All	Deeper wounds
ACTIVE INFECTION	Yes with infection treatment	Yes with infection treatment	Yes with infection treatment	Yes with infection treatment
DRESSING SELECTION	Flexible (remove or use with breathable dressing)	Flexible (remove or use with breathable dressing)	Occlusive	Flexible
OINTMENTS/ GEL USE	Must be wiped off prior to use	Must be wiped off prior to use	No	Yes