



Oxygen Conserving Technology Peer Review Bibliography

Nocturnal Use of Oxygen Conserving Devices

The following are published clinical studies that demonstrate the effective use of oxygen conserving devices in a variety of clinical and patient conditions, including use during sleep.

1. Stegmaier JP, Chatburn RL, Lewarski JS. "Determination of an Appropriate Nocturnal Setting for a Portable Oxygen Concentrator with Pulsed-Dosed Delivery." *Respir Care* November 2006;51(11): 1305
 - i) Summary: the purpose of this study was to determine if a single titration of oxygen using a POC during ambulation/exercise would provide an appropriate setting for nocturnal use. The results suggested that an oxygen setting selection based on daytime ADL/ambulation appears to produce effective nocturnal oxygen therapy as evidenced by a mean sleeping SpO₂ of 92% and no clinically significant desaturation in any study participant.
2. Chatburn, R, Lewarski J, McCoy R. "Nocturnal oxygenation using a pulsed dose oxygen conserving device compared to continuous flow oxygen." *Respir Care* March 2006;51(3): 252-256
 - i) Summary: the study compared nocturnal oxygenation with continuous flow versus the Inogen One among a group of established LTOT users with chronic lung disease. The results support demonstrates that when appropriately titrated, the Inogen One is essentially clinically equivalent to continuous flow oxygen. The study also suggests that daytime pulse dose titrations may be effective in determining nocturnal oxygenation.
3. Gay, PC. "Chronic Obstructive Pulmonary Disease and Sleep." *Respir Care* Jan 2004;49(1):39-51
 - i) Summary: This is a very comprehensive review of the clinical issues and related science regarding COPD and sleep. The paper reviews in detail the science and issues regarding oxygen use with sleep.
4. Lewis, D. "Sleep in patients with asthma and chronic obstructive pulmonary disease." *Curr Opin Pulm Med* 2001;7:105-112
 - i) Summary: editorial review of current issues associated with sleep and lung disease, including COPD and oxygen. Discusses briefly the use of oxygen conservers in sleep based on the work of Cuvelier, et al (see below).
5. Cuvelier A, Muir J, Czernichow P, et al. "Nocturnal efficiency and tolerance of a demand oxygen delivery System in COPD patients with nocturnal hypoxemia." *CHEST* 1999 Vol. 116(1): 22-29.
 - i) Summary: compared efficacy of continuous flow versus pulse dosed oxygen in sleeping, hypoxemic patients measured through polysomnography. Concluded that the use of a pulse dosing oxygen delivery device did not induce any significant alteration physiologic parameters, as compared to continuous flow, in the majority of moderate to severe COPD patients requiring supplemental oxygen.
6. Kerby, G, O'Donahue W, Romberger D, et al. "Clinical efficacy and cost benefit of pulse flow oxygen in hospitalized patients." *CHEST* 1990 Vol. 97: 369-372
 - i) Summary: large (n=100), unblinded crossover study comparing continuous flow oxygen versus pulse dosed oxygen delivery in hospitalized patients. Concluded that both oxygen systems produce similar SpO₂ levels in hypoxemic patients over the course of day and night.
7. Bower, J, Brook, C, Zimmer K, Davis, D. "Performance of a demand oxygen saver system during rest, exercise and sleep in hypoxemic patients." *CHEST* 1988 Vol. 94: 77-80
 - i) Summary: compared continuous flow to demand pulse dosed oxygen during all patient activities, including sleep. Concluded that demand oxygen systems produced arterial oxygenation equivalent to continuous flow during all activities.



Efficacy of Pulse Dosing Concentrator Produced Oxygen

The following published studies demonstrate the clinical efficacy of pulse dosed oxygen produced from a concentrator as studied in a variety of applications

1. Case, R, Hausmann R. "Use of a portable oxygen concentrator with a fixed minute volume oxygen conserving device to deliver oxygen to exercising pulmonary rehabilitation patients." Abstract. *Respir Care* November 2005;50(11):1510.
 - i) Summary: the study concluded that the Inogen One was as clinically effective as continuous flow oxygen at maintaining target SpO₂ levels in high flow (4-5 lpm) oxygen users during intense exercise.
2. Stegmaier, J. "Mobility, remote activity & power supply utilization among oxygen dependent patients using a lightweight portable oxygen concentrator system." Abstract. *Respir Care* November 2005;50(11):1507
 - i) Summary: the study suggests that the power supply strategy of the Inogen One is very effective in meeting the ambulatory and mobility needs of highly active oxygen users. The 2-3 hour battery duration of the Inogen One does not inhibit remote activity, as patients were consistently able to access external power (AC or DC) during the course of their activities.
3. Lewarski, J, Mikus, G, Andrews, G, Chatburn, R. "A clinical comparison of portable oxygen system: Continuous flow compressed gas vs. oxygen concentrator gas delivered with an oxygen conserving device." Abstract. *Respir Care* 2003 Vol. 48(11); 1115
 - i) Summary: study concluded that there is no clinical or statistical difference in physiologic response and SpO₂ in exercising patients receiving continuous flow USP gas vs. pulsed dose gas produced in an oxygen concentrator.
4. Cuvelier, A, Nuir, J, Chakroun, N, et al. "Refillable oxygen cylinders may be an alternative for ambulatory oxygen therapy in COPD." *CHEST* 2002 Vol. 122 (2):451-456
 - i) Summary: study concluded that oxygen delivered via pulse dose from cylinders filled by concentrators is clinically equivalent to continuous flow oxygen delivered to exercising patients.

Nocturnal Oxygenation & Desaturation in Continuous Flow Oxygen Therapy

1. American Thoracic Society (ATS) Standards for the diagnosis and care of patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1995 152(5): S77-S121
 - i) Summary: Detailed, evidenced supported review of management of COPD. Establishes the definition of clinically significant nocturnal desaturation as an SpO₂ < 90% for >30% of the sleep time. Also recognizes the incident of desaturation in sleeping LTOT users and suggests increasing O₂ setting by 1 L/Min to compensate for reduced minute ventilation.
2. Plywaczewski R, et al. Incidence of nocturnal desaturation while breathing oxygen in COPD patients undergoing long-term oxygen therapy. *CHEST* 2000; 117(3): 679-83
 - i) Summary: large study (n = 82) of existing LTOT users well-managed with SpO₂ >90% on their usual O₂ prescription during the day. Studied concluded that nearly 50% of the patients experienced clinically significant (ATS definition) nocturnal desaturations on their usual oxygen prescription.
3. Tarrega J, et al. Are daytime arterial blood gases a good reflection of nighttime gas exchange in patients on long-term oxygen therapy? *Respir Care* 2002; 47(8): 882-6
 - i) Summary: Studied examined early morning ABGs and nocturnal SpO₂ in 39 patients on LTOT. Patients spent an average of 28% of their sleep time with an SpO₂ < 90%.



Nocturnal Oxygenation & Desaturation in Continuous Flow Oxygen Therapy

4. Sliwinski P, et al. The adequacy of oxygenation in COPD patients undergoing long-term oxygen therapy assessed by pulse oximetry at home. *Eur Respir J* 1994;7(2): 274-278
 - i) Summary: Study examined 24-hour oximetry data in 34 existing LTOT users and concluded that the basic prescription for LTOT was inadequate and failed to maintain appropriate SpO₂ levels for 85% of the patients. This was most evident with strenuous activity and during sleep.
5. Plywaczewski R, et al. Behavior of arterial blood gas saturation at night in patients with obstructive lung diseases qualifying for home oxygen therapy. *Pneumonol Alergol Pol* 1997;65(7-8): 494-499
 - i) Summary: Studied group included 101 patients and used overnight oximetry to evaluate nocturnal oxygenation. Researchers concluded that 33% of the COPD patients experienced desaturation and would benefit from an increased O₂ flow during sleep.