The purpose of this article is to demonstrate how pulse oximetry monitoring can be a useful clinical tool in an occupational therapy setting. Pulse oximeters were developed more than 40 years ago and have been commercially available since 1981 (Szablarski & Cohen, 1989). "A pulse oximeter measures the absorption, or amplitude of two wavelengths of light (red and infrared) passing through body parts with a high perfusion of arterial blood" (Schroeder, 1989, p. 51). It measures the differences in the optical transmission spectrum of oxygenated and deoxygenated hemoglobin in the visible and near visible infrared portions of the light spectrum and processes the ratio of red to infrared light absorption to determine a person's oxygen saturation values. These saturation values are displayed on the monitor screen (Spyre & Preach, 1990).

Kochansky (1984) recommended pulse oximetry monitoring for use with patients in pulmonary rehabilitation programs who are at risk for hypoxemia. The pulse oximeter provides an early warning of low oxygen saturation levels that may indicate hypoxemia; whereas "the presence of cyanosis is an unreliable and late warning sign of hypoxemia" (Szablarski & Cohen, 1989, p. 444).

In the pulmonary rehabilitation program at our facility, we use pulse oximetry to give moment-by-moment feedback while the assessment or treatment is in progress. Pulse oximetry monitoring is used to substantiate modifications or cessation of activity if adverse clinical signs and symptoms such as dyspnea, changes in facial color, or rapid pulse exist.

In this area of practice, understanding oxygen saturation and what it means to purposeful activity in a patient with chronic obstructive pulmonary disease is as useful to occupational therapists as it is understanding the vital signs of the patient. "Skilled clinical observation of the patient while he or she performs selected activities of daily living, called monitored functional assessment, is a procedure used to assess the patient's present level of function and analyze problems related to the patient's approach to activity" (Ogden & deRenne, 1985, p. 126).

This article describes how pulse oximetry monitoring was used to identify current performance levels and poor perfusion conditions in a male patient with chronic obstructive pulmonary disease while he completed certain activities of daily living. Pulse oximetry monitoring was used to assess changes in his oxygen saturation and heart rate during functional activities. The results influenced the development of the occupational therapy intervention in assessment and treatment during functional activities.

**Patient History**

A 69-year-old single man diagnosed with chronic obstructive pulmonary disease was admitted to a Veterans Administration medical center in the Northwest because of...
increasing breathing problems. The patient had ended a 54-year smoking habit 4 months before hospitalization. His physical status had deteriorated to the point where he could no longer independently and consistently complete routine self-care activities. The patient was a retired truck driver who lived alone in a downtown apartment. He depended on Meals on Wheels for one meal per day and found the physical demands of housework, cooking, and cleaning to be a drain on his energy reserves. He used a portable oxygen carrier intermittently but sought hospitalization because he could no longer breathe comfortably on his own.

On the acute care unit of the medical center, a pulmonary function test revealed that the patient had moderate obstructive pulmonary impairment. Oxygen at 2 liters per minute was ordered, and a wheelchair with an oxygen tank carrier was issued. After the patient was medically stable for 2 weeks on the acute care unit, he was transferred to the nursing home unit for a 9-week course in pulmonary rehabilitation.

**Occupational Therapy**

Changes in the patient’s oxygen saturation and heart rate during the 9-week assessment and training period were monitored with a portable Criticare 501+ pulse oximeter1 (see Figure 1). A normal oxygen saturation value is considered to be in the 95% to 98% range (Spyre & Preach, 1990). When saturation is less than 90%, oxygen content rapidly declines and the patient is at risk for hypoxemia (Gilboy & McGaffigan, 1989). Therefore, a reading of less than 90% on the oximeter would call for immediate precautionary actions such as having the patient stop the activity and sit and perform slow breathing.

We wanted to know the extent of exertion or stress caused by the activities as the patient moved from sitting to standing or from standing to bending at the waist. After orienting the patient to the pulse oximeter’s function, the oximeter was used while the patient performed three functional self-care activities. Our primary focus was to monitor adequate oxygenation while the patient was engaging in routine activities of daily living. Our secondary focus was to make changes or adaptations in the activities when oxygen saturation values fell below the accepted level of 90%.

**Patient Activities**

*Walking to Dining Room*

Throughout the testing and treatment period at the medical center, the pulse oximeter was used while the patient walked from his bedside to the dining room with finger clamp remaining on the index finger. The clamp was opened wide enough to insert the thumb, index, or middle finger. The cable wire was taped to the back of the patient’s hand to stabilize the clamp. I saw the patient daily, except weekends, during the 9-week rehabilitation course. The nurse, physical therapist, or I carried the portable pulse oximeter and monitored the patient’s readings during rehabilitation sessions whether he was ambulating, standing, or sitting.

The distance from his bedside to the dining room was 150 ft. At bedside, the patient’s resting baseline reading on the pulse oximeter was 90% for oxygen saturation and 100 for heart rate. Oxygen flow remained at 2 liters, which was the prescribed rate determined by the physician. After walking to the dining room, his oxygen saturation fell to 85% and his heart rate was 110. The patient was visibly short of breath and needed to sit and rest for 15 min before attempting to eat breakfast.

To conserve the patient’s energy reserves, this activity was graded in two ways: First, the 150-ft length was divided into several ambulatory segments, and the patient rested between each segment. Second, the patient walked behind his wheelchair, using it as a support and stopping halfway to the dining room to sit and rest briefly. In addition, the patient was educated in pursing lips breathing and, to avoid the stress of being late, which also compromised his breathing, the patient was allotted extra time in his morning routine to get to the dining room. After 6 weeks, the patient’s oxygen saturation was 90% and his heart rate was 100 after walking to the dining room.

**Showering**

Before hospitalization, the patient’s showering attempts at home were unsuccessful and left him breathless. The

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pulse oximeter was used to identify how sharply his oxygen saturation dropped during a 10-min shower. Midway in the shower process, his oxygen saturation was 79% and his heart rate was 110.

To help the patient conserve energy and support breathing, four changes were recommended, as follows: (a) increase ventilation in the bathroom by leaving the door open to permit steam and condensation to escape, (b) keep a portable oxygen tank with nasal cannula within reach to be used when breathing becomes difficult, (c) use a bath seat and handheld shower, and (d) use a terry cloth robe instead of a towel for drying to reduce vigorous arm motions. After 9 weeks, the patient’s oxygen saturation was 90% and his heart rate was 100 midway in the shower process.

Shaving

The pulse oximeter reading taken during shaving indicated that the patient’s oxygen saturation was 87% and his heart rate was 107. It was observed that the patient held his breath and stood in front of the bathroom mirror during shaving. To help the patient conserve energy, it was recommended that he shave from a seated rather than a standing position. With this change, the patient reported less fatique and more hand control as he shaved. After 9 weeks, the patient’s oxygen saturation was 94% and his heart rate was 98 during shaving.

Discharge

After the 9-week pulmonary rehabilitation program, the patient was discharged to a new apartment with ground- level accessibility and a laundry facility. He was issued a portable oxygen tank and a wheelchair. His new apartment had improved ventilation systems and more room to physically move around in the bath area, making showering easier than it had been in his previous apartment. The pharmacist provided the patient with information about his discharge medications and potential side effects. The physical therapist reviewed lower extremity exercises that included warm ups and stretching routines as a part of his daily schedule. I reviewed diaphragmatic breathing, energy conservation protocols, and work simplification routines that the patient would encounter with the requirements of independent living. Occupational therapy follow-up indicated that at 8 weeks after discharge, the patient had resumed participation in former activities of interest, including taking a night college course and attending local sporting events.

Summary

Pulse oximetry monitoring was used with this patient to correlate his oxygen saturation with his functional activity. The primary focus was to monitor the patient’s oxygenation while he was engaging in routine activities of daily living. A secondary focus was to make changes or adaptations in the activity when his oxygen saturation values fell below the accepted level of 90%. The benefits of pulse oximetry include the simultaneous reporting of oxygen saturation and heart rate during the patient’s activities. Immediate instruction on how to adapt functional activities to conserve energy was given to the patient on the basis of the oximeter readings. For both patient and therapist, pulse oximeter was a relatively uncomplicated tool to use, and the information that it provided was useful in monitoring occupational therapy intervention during functional activity. Further research studies may support criteria for energy conservation protocols and activity prescription.

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References


