



# Worth the Effort

## *Why the Oxygen First Aid for Scuba Diving Injuries Program Is the Right Thing To Do*

It makes sense: If a substance makes you feel ill, or if it affects you adversely in any way, ditch it. Remove it from your system. Don't take any more in. Find ways to get the rest out, and you should feel better.

While that sounds like a "cold turkey" description of kicking a drug habit, it also explains how oxygen first aid works with scuba diving injuries. Nitrogen can form bubbles in the bloodstream, causing decompression sickness (DCS) in divers. Eliminate the nitrogen from the gas an injured diver breathes and replace it with oxygen; this promotes healing and recovery.

### *How It Works: the Oxygen Window*

Breathe 100 percent oxygen after a dive injury. In the event of a dive emergency, doing so helps the body remove the nitrogen from blood and body tissues.

The human body always tries to achieve a balance. If there is a high concentration of nitrogen inside the body, but only oxygen in the gas the diver is breathing, the body will attempt to balance the two gases. It will move greater concentrations of oxygen in while moving nitrogen out.

This process of intentionally creating an imbalance in partial gas pressure is called the oxygen window. The greater the imbalance, the faster the process works. In other words, the higher concentration of oxygen in the breathing gas, the greater the imbalance, the faster the oxygen is moved in and the nitrogen moved out. One hundred percent oxygen is always better for this process than 80 percent or 50 percent.

### *Training and Recognition*

Thirteen years ago in 1991, DAN introduced its first training program for the diving public, Oxygen First Aid in Dive Accidents, which has since evolved into the Oxygen First Aid for Scuba Diving Injuries program that we know today. From these beginnings, nearly 120,000 people have taken a DAN oxygen first aid course offered by more than 11,000 DAN Instructors.

This program teaches the warning signs of decompression illness (DCI) and the best ways to deliver oxygen first aid. Some of the benefits include the fact that oxygen:

- Keeps more nitrogen from entering the bloodstream;
- Oxygenates tissues that are hypoxic due to blood supply blockage by nitrogen bubbles;
- Reduces tissue swelling caused by leakage of plasma induced by nitrogen bubbles;
- Reduces nitrogen bubble size;
- Eases breathing;
- Relieves symptoms; and
- Reduces the risk of residual symptoms after hyperbaric treatment.

In the DAN 2003 *Report on Decompression Illness, Diving Fatalities* and Project Dive Exploration, the research shows that injured divers with pain-only DCI report complete relief of symptoms prior to recompression therapy about 15 percent of the time, and another 5 percent

had their symptoms improve with oxygen. In all other categories, including arterial gas embolism, neurological DCI and lung barotrauma, oxygen first aid either resolved the symptoms or improved them substantially.

In the 2004 report, of the 69 injured divers for whom DAN received data about those receiving surface oxygen prior to recompression in 2002, improvement was reported after surface oxygen in 25 cases, and complete relief of symptoms before admission to the treating facility was reported in 34 cases. (See chart, top of page 37.)

Remember, though, that oxygen is still first aid: injured divers may feel better after receiving oxygen, but they still may require recompression therapy to heal their injuries. Many times, divers feel better after the oxygen and refuse further care. This is a mistake. Oxygen first aid simply makes the recompression therapy more effective. (See chart, middle of page 37.)

At their final discharge from the hospital and after all recompression treatments, divers who received oxygen first aid achieved complete relief significantly more often than divers who did not receive oxygen. Unfortunately, even with this strong evidence in favor of oxygen first aid, according to DAN statistics compiled over an 11-year period, only 50-60 percent of injured divers receive oxygen first aid prior to recompression.

BY ERIC DOUGLAS, DAN TRAINING DIRECTOR

## Delivery on Demand

Even when divers do receive oxygen first aid in response to a dive emergency, unfortunately, they aren't always receiving it in the best way possible.

To make the oxygen window as effective as it can be, you need to receive, or deliver, the highest concentration of oxygen possible. One of the best ways to deliver 100 percent oxygen is with the demand valve. Functioning just like a scuba regulator, this oxygen delivery system vents the diver's exhalations away from the mask and allows him to breathe 100 percent oxygen directly from the tank. The demand valve works with any breathing, injured diver. (See chart, bottom of page 37.)

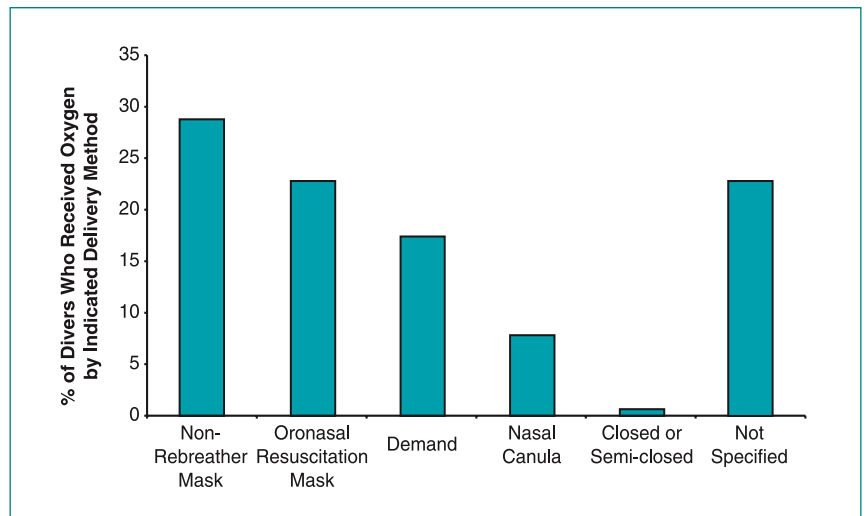
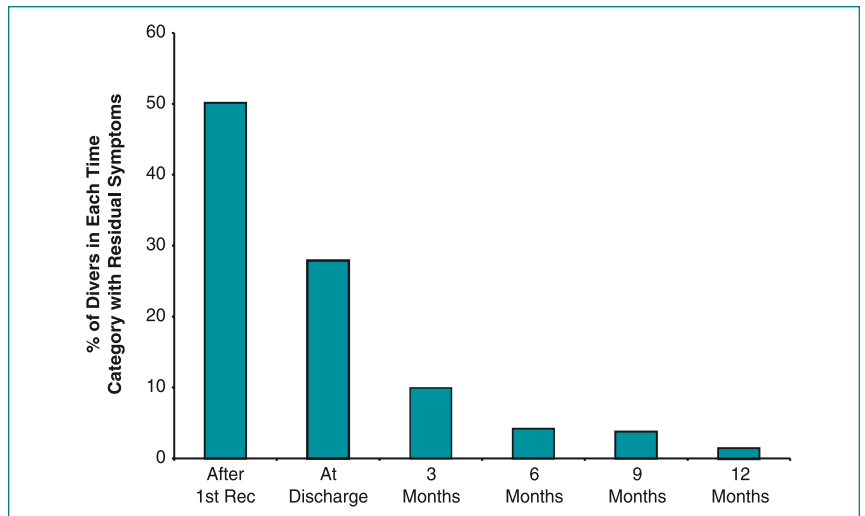
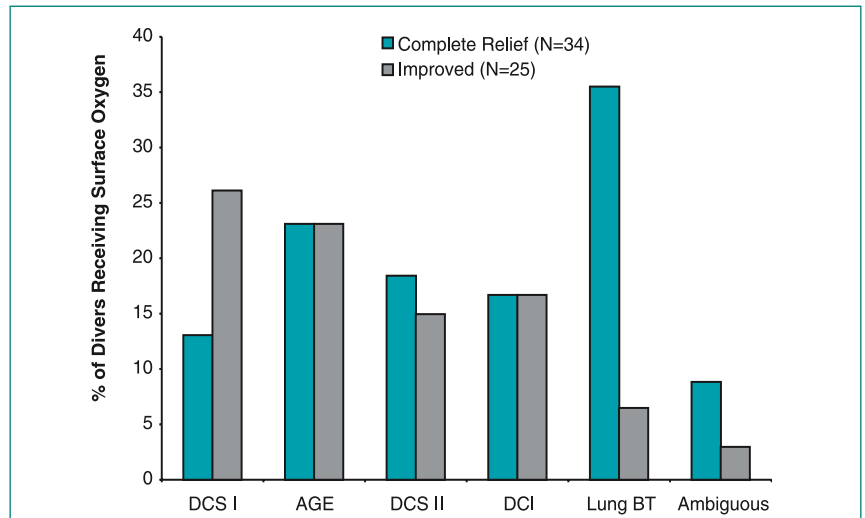
Accident statistics show that the demand valve is only used about 20 percent of the time when a diver received oxygen. An additional 16 to 17 percent of the time is unspecified, so we don't really know how those people receive oxygen.

According to DAN statistics, the most popular oxygen deliver system is the non-rebreather mask. When used properly with high flow oxygen (15 liters per minute), it delivers close to 100 percent, but not quite. Assuming a good mask seal, the non-rebreather mask delivers approximately 92-94 percent oxygen. With a lower flow rate, the delivered oxygen content goes down dramatically. Every other oxygen delivery device delivers significantly less oxygen to the injured diver and reduces the effectiveness of the oxygen window.

## Learn the Warning Signs of DCI

One of the best things divers can do for themselves is learn to recognize the signs and symptoms of DCI and then act. On average, divers wait up to 18 hours before they seek treatment for their injuries. Why? Denial often causes an initial delay in reporting it. In general, it appears that divers don't readily report symptoms; they seek treatment because those symptoms don't go away.

On the other hand, divers who recognize the warning signs early and receive timely oxygen first aid and recompression treatment are more likely to achieve complete resolution of their symptoms.



Considering these overwhelming statistics that show oxygen first aid increases an injured diver's chances of recovery, it is surprising that many divers still don't receive oxygen when they need it.

Talk to your local DAN Instructor or Instructor Trainer about taking a DAN Oxygen First Aid for Scuba Diving Injuries class. You can learn how to recognize DCI and act to provide oxygen first aid.