defecation. He had a similar pain in both ankles and heels, which were both quite numb with reduced pinprick sensation. He had a prickly sensation in his right eyebrow, both eyelids and inside his mouth. He was taking fluoxetine hydrochloride (Prozac) at night and naproxen. A trial of clonazepam (Rivotril), 0.5 mg mane, was effective within minutes of administration. On this he slept better, the pins and needles virtually went and he was happy for the first time in years.

December 1996

The Accident Compensation Commission refused to authorise any further treatment for DCI. He had constant pain in both shins, hands and feet. Feet numbness had returned. But clonazepam (Rivotril) was effective for skin itchiness. He had variable skin sensation, reduced pin prick anywhere. He still was often dropping tools, forgetting where they were. He had poor libido (marriage fine) but normal erections. Lethargy was constant but his memory was improving.

February 1997

He was still very fatigued. After 2-3 days at work he had to go home to rest. His mood was stable but he had decided to sell the business. His alcohol intake was minimal. He was on fluoxetine hydrochloride (Prozac) 20 mg nocte, clonazepam (Rivotril) 0.5 mg mane and naproxen prn, which had helped. On examination his SRT was 30 seconds and he had a shorter gait step.

April 1997

Hands were seizing up. He had to straighten his fingers out with the other hand. Dropping tools was very frequently through inattention only, a daily hassle. Naproxen was helpful, but he was fed up and the business still for sale. He could not continue with his job.

In short a poor outcome.

Dr Peter Chapman-Smith, Dip DHM, is a general practitioner. His address is Maunu Medical Centre, 67 Maunu Road, Whangarei, New Zealand. Telephone +64-(09)-438-1550. Fax +64-(09)-438-9754. E-mail chappie@clear.net.nz

OXYGEN THERAPY EQUIPMENT A THEORETICAL REVIEW

Michael Davis

Key Words

Accidents, equipment, first aid, oxygen.

Summary

The basic needs for oxygen therapy equipment are control of inspired oxygen concentration, prevention of carbon dioxide accumulation, minimal resistance to breathing, efficient and economic oxygen use, adaptability to different gas mixtures and adaptability to different modes of respiration. Understanding the performance characteristics of oxygen therapy devices enables better selection of equipment for diving accident management. Physiological studies have shown that these devices may be subdivided into *fixed performance* and *variable performance* systems. The *fixed performance* devices, when used properly, supply the predetermined oxygen concentration irrespective of the patient's ventilation characteristics. *Variable performance* devices provide variable oxygen enrichment (always less than 100%) depending on the interrelationship of oxygen flow, device factors such as functional apparatus dead space and patient factors such as the peak inspiratory flow rate. For supporting diving operations, ruggedness of construction, simplicity of design and use, ease of training and maintenance and purchase price are all of importance. The newer demand regulator and rebreather systems (both fixed performance) in robust casings are well suited to the early care of diving accidents. However, they are moderately expensive, may require considerable training and carry an obligation on the part of the user to learn, and maintain, airway management skills.

Introduction

Oxygen therapy is an important component of the early management of many medical and trauma emergencies including diving accidents. All ambulance and field medical rescue teams carry oxygen as an integral part of their equipment and there are virtually no emergency situations in medical practice in which oxygen could potentially be harmful administered in high concentrations for short periods.

Unfortunately, medical students have been taught for many years about the potential dangers of oxygen therapy in a small group of patients with chronic obstructive pulmonary disease who are dependent on an hypoxic drive for their continued spontaneous respiratory effort. This view has now been largely discredited.[1] In addition, the pulmonary toxic effects of high concentrations of oxygen, the so-called Lorraine-Smith effect, have become well recognised and emphasised in teaching. Sadly this has sometimes been misinterpreted to mean that oxygen therapy may do more harm than good. This is an unfortunate failure to recognise that oxygen, like any pharmacological agent, has its own therapeutic range and ratio, an understanding of which is essential to its proper administration. At normal ambient pressure (one bar or less) within the first 12-24 hours of administration of 100% oxygen these issues are almost totally irrelevant to the practice of emergency medicine.

In order to administer oxygen correctly then, an understanding is required of:

a The mechanisms of uptake and delivery of oxygen in the body and the factors that alter its delivery to intracellular systems in vital organs,
b The dose dependent toxic effects of oxygen at partial pressures greater than that in room air, and
c The performance characteristics of oxygen therapy devices.

The reader is referred to recognised texts for an understanding of the first two components.[2,3] This paper is intended to provide an understanding of the function of oxygen equipment from a theoretical viewpoint, with reference on its use under field conditions at normal ambient pressure (**not under hyperbaric conditions**). For a detailed theoretical analysis and an insight into some of the original work the reader is referred to Leigh.[4] For an excellent practical review of commercially available equipment in Australasia and its use, all SPUMS members should carry their own copy of Lippmann's *Oxygen First Aid*.[5]

Basic requirements

The basic requirements for oxygen therapy equipment for field use are summarised in Table 1. Many devices on the market were not designed with these requirements in mind and may fall short of current Australian standards.[6] In addition, few users have any real understanding of whether their equipment meets these criteria nor of the principles underlying oxygen therapy.

One could argue, as has Acott,[7] that this does not matter so long as some degree of enhanced inspired oxygen is administered to the diver patient. This, however, is a nihilistic view. Awareness of the performance characteristics of various devices enables more appropriate selection and purchasing of equipment. As a minimum one must ask three questions:

1 What is the inspired oxygen fraction (F_IO_2)?
2 What is the inspired carbon dioxide fraction (F_ICO_2)?
3 How long, under normal operating conditions will the provided oxygen supply last with this device?

Correct use at sea and for diving activities requires this information.

On the basis of physiological studies, oxygen therapy devices have been classified by Leigh into *fixed performance* and *variable performance* systems with respect to the delivered oxygen concentration.[4] The *fixed performance* devices, when used properly, supply the predetermined oxygen concentration (up to almost 100%) irrespective of the characteristics of the patient's ventilation. *Variable performance* devices give more than 21% but less than 100% oxygen depending on the interrelationship of oxygen flow, device factors such as functional apparatus dead space and patient factors such as the peak inspiratory flow rate (PIFR) and the length of the expiratory pause. These factors result in both between patient and within patient variations of F_IO_2 on a breath by breath basis.

Importance of ventilatory flow and the expiratory pause

Figure 1 shows typical respiratory flow patterns for a spontaneously breathing individual. The respiratory wave-form is essentially sinusoidal with the PIFR occurring during the middle of inspiration. PIFR varies from breath to breath in an individual even when resting (Figure 1) and also from individual to individual. When respiratory rate and minute ventilation increase for any reason, exercise, pain, anxiety, pyrexia, cold, shock, etc., then PIFR increases proportionately (Figure 2). In order to provide a fixed F_IO_2 therefore, an oxygen delivery device must provide flow rates to the patient at least equal to the PIFR. If it does not do so under all normal operating conditions then increased air entrainment with consequent reduction in F_IO_2 and rebreathing leading to both reduced F_IO_2 and increased F_ICO_2 will occur, depending on the type of device being used.

In resting subjects, if a continuous oxygen flow is supplied, oxygen accumulates within the upper airway and in the volume of the apparatus during the expiratory pause. This oxygen also helps wash out carbon dioxide. Since the

TABLE 1

BASIC REQUIREMENTS FOR OXYGEN THERAPY EQUIPMENT

1 Control over oxygen percentage of the inspired gas
2 Minimal accumulation of carbon dioxide
3 Minimal resistance to breathing (both inspiratory and expiratory)
4 Efficiency and economy in the use of oxygen
5 Adaptability to different gas mixes
6 Adaptability to different modes of respiration
7 Sufficient oxygen supplies to meet field requirements

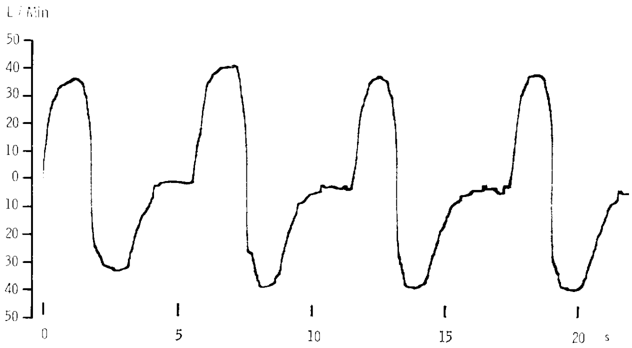

Figure 1. Inspiratory and expiratory flows measured over 20 seconds with a pneumotachograph in a resting healthy subject. Reproduced by kind permission of the author and publisher from Leigh JA, in *Scientific Foundations of Anaesthesia*.[4]

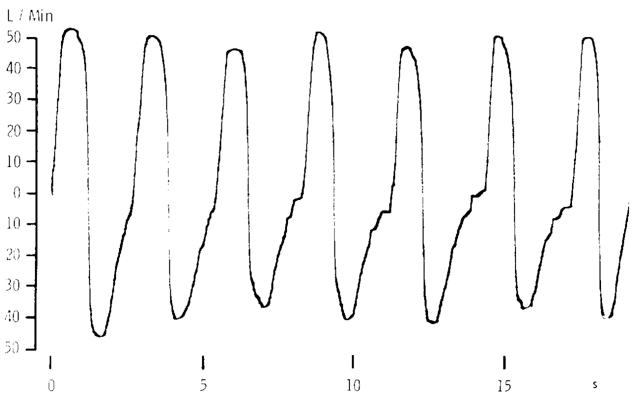

Figure 2. Pneumotachograph of the same subject in a "breathless" state. Note the increase in PIFR and the decrease in the time intervals. Reproduced by kind permission of the author and publisher from Leigh JA, in *Scientific Foundations of Anaesthesia.*[4]

expiratory pause is variable, the amount of oxygen accumulated also varies and so the shorter the pause the less oxygen accumulates. Figure 2 shows that when the respiratory rate increases the expiratory pause virtually disappears. So in some devices both PIFR and respiratory rate will alter F_IO_2 (Table 2).

Variable Performance Devices

Variable performance devices are functionally subdivided into three groups, no-capacity systems, and small or large capacity systems (Table 2). No-capacity systems, e.g. nasal catheter, are not often used in the field, though their inherent simplicity and cheapness have much to commend them over other variable performance devices.

SMALL CAPACITY DEVICES

Here apparatus dead space is added in the form of a mask shell, resulting in rebreathing of carbon dioxide and oxygen. During inspiration, the mask, the volume of which is small relative to tidal volume, empties initially in series with entrained air so the higher F_IO_2s are inhaled at the beginning of inspiration. F_IO_2 then falls markedly and variably during mid-inspiration when PIFR is at its greatest.

This results in a scatter of inspired oxygen concentrations. The extent of this scatter of F_IO_2s may be assessed by multiple breath sampling techniques and plotting the measured oxygen and carbon dioxide concentrations of these separate expiratory gas samples on the O_2/CO_2 diagram as shown in Figure 3. The possible scatter of inspired oxygen concentrations in subjects breathing from a variable performance device is indicated by the broken 'R' lines and in this case varies between 40 and 73%. This variability may be overcome at lower F_IO_2s by employing the Venturi principle in the mask device (Figure 3, left-hand plot).

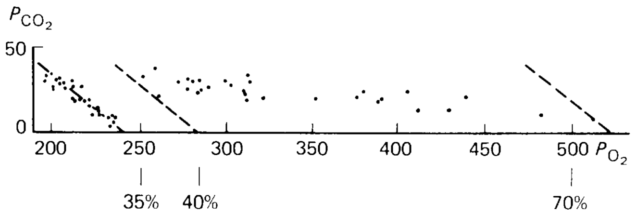

Figure 3. Comparison between fixed and variable performance oxygen systems. A 35% Ventimask has a single R line showing a fixed F_IO_2 of 35% (left-hand sloping dashed line). A variable performance system, MC mask with oxygen flow of 5 l/min, shows a wide scatter of inspired concentrations between 40 to 73% (between middle and right-hand dotted lines). Reproduced by kind permission of the author and publisher from Leigh JA in: *Scientific Foundations of Anaesthesia*.[4]

Rebreathing and apparatus dead space

Functional dead space is often less than the actual physical volume of the device, being that part of the previous expirate which is re-inhaled. Dead space results in rebreathing and the potential for carbon dioxide accumulation which may have deleterious effects on some patients. Functional dead space is increased if the volume of the device is large, the flow of oxygen is low, the expiratory pause is short or the mask is a good fit with reduced air entrainment (or increased resistance to air entrainment through the mask vent).

TABLE 2

VARIABLE PERFORMANCE OXYGEN SUPPLY DEVICES
(F_IO_2 affected by patient factors)

System	Characteristics	Examples
No Capacity	F_IO_2 subject mainly to between-patient variation	Nasal cannulae < 3 l/min flow
Capacity	F_IO_2 subject to both between and within patient variation Apparatus deadspace is added, resulting in rebreathing of O_2 and CO_2	
Small capacity		O_2 mask without reservoir bag
Large capacity		O_2 mask with reservoir bag incubators, oxygen tents

LARGE CAPACITY DEVICES

These devices incorporate a rebreathing, or reservoir, bag in the system and their contents empty in parallel with entrained air (Table 2). Since breath by breath times, volumes and resultant flows and resistance to breathing all vary, the performance of these devices is very variable. The shorter the expiratory pause and the greater the expired volume in the bag, the less oxygen will be delivered to the patient and the more carbon dioxide will accumulate.

In summary, the factors influencing F_IO_2 in variable performance oxygen devices are shown in Table 3. Which of these several factors become of practical importance will depend on the device and the way in which it is being used.

TABLE 3

FACTORS INFLUENCING F_IO_2 IN VARIABLE PERFORMANCE OXYGEN DEVICES

1	Type of oxygen device in use
2	Apparatus dead space (rebreathing)
3	Mask/Mouthpiece seal (air entrainment/vent resistance)
4	Peak Inspiratory Flow Rate (PIFR)
5	Expiratory pause

Variable performance devices were the standard for field oxygen resuscitation equipment for decades.

A good example of the type is the Oxy-Viva apparatus with continuous oxygen flow (4-10 l/min) into a simple mask shell such as a Hudson or MC mask.[5] Such devices are unsuitable for divers, but are certainly better than no oxygen at all.

Fixed performance devices

Fixed performance devices are listed in Table 4. The fixed performance devices, when used correctly supply a predetermined F_IO_2 irrespective of the respiratory pattern of the patient. However, even devices classified as having fixed performance may ,under certain conditions, fail to deliver a constant F_IO_2.

As inspiratory flow is sinusoidal in nature, if an oxygen device is to deliver a fixed F_IO_2 then it must deliver the chosen mixture at a rate equal to or greater than PIFR. This may be achieved in one of five ways. Of these high flow gas blender/humidifiers and oxygen concentrators, will not be discussed as they have no application in emergency resuscitation.

HIGH FLOW

Air-entrainment devices

The oxygen fresh gas flow enters the mask through a venturi device and entrains a high flow of air so that the total gas flow into the mask exceeds PIFR under most conditions (Figure 3, left-hand plot). Venturi-type masks are therefore fixed performance devices, but are only efficient in the F_IO_2 range 24-40% and, even then, the oxygen flow into the device may need to be doubled from that recommended by manufacturers to achieve a fixed F_IO_2 since the entrainment ratio remains the same whilst the total mixture flow increases.

For instance, if a venturi-type mask is rated to deliver a F_IO_2 = 0.35 (35%) with a recommended oxygen flow rate of 6 l/min it is easily calculated that the flow of air entrained must be approximately 28 l/min giving a total fresh gas flow rate of about 34 l/min. This is very close to the resting PIFR in Figure 1 and well below that in Figure 2. In the latter case F_IO_2 would fall in mid-inspiration (the most important part of the inspiratory phase for oxygen delivery)

TABLE 4

FIXED PERFORMANCE OXYGEN DEVICES

F_IO_2 is independent of patient factors

System	Method	Examples
High Flow	Venturi operated Demand regulator	Hudson Multivent mask DAN oxygen resuscitator
Low Flow	Constant flow	Some anaesthetic circuits Komesaroff resuscitator (OxyDive 1)[16] Wenoll oxgen delivery system[17]

unless the oxygen flow is increased to 10 l/min or above. A detailed study of one type of venturi mask has been provided by Woolner and Larkum.[8]

While venturi-masks have some very definite applications in medicine, their use is not indicated in diving accident resuscitation.

Demand regulators

The demand regulator is a very familiar device to scuba divers. Indeed one of the earliest approaches to providing 100% oxygen to diving accident victims utilised an adaptor block placed over a pin-indexed cylinder valve (or screwed into a bull-nosed cylinder valve) to which an ordinary scuba two stage regulator could be mounted by its A-clamp.[5] In those early days (late 1960s) the need for oxygen-compatible cleaning of the regulator was not appreciated by many, thus carrying the risks of fire and oxygen explosions. However only one fire, in a home-made adaptor, has been reported.[9]

The principles of demand regulators do not require explanation here. In spontaneously breathing subjects, these devices are triggered by the negative pressure generated in the airway by the inspiratory muscles and they deliver a fresh gas flow equal to the breather's demands. PIFR is matched and the total gas flow from the regulator equals minute ventilation which in the resting unstressed subject will be in the range 5-8 l/min, but in some situations may be 2-3 times higher than this. Thus the patient's minute ventilation determines the rate of consumption of the oxygen supply.

Demand regulator resuscitators are now widely marketed for diving applications, for instance as the DAN oxygen resuscitator, the LSP Portable Resuscitator and the Laerdal OxiDive 3, all of which utilise regulators manufactured by Life Support Products.[5] When used properly, their main advantage is that close to 100% inspired oxygen (F_IO_2=1) is achieved consistently, though this may be at the expense of high oxygen usage in the distressed patient.

Several factors influence how close to 100% oxygen the F_IO_2 actually achieved will be. Most important is the seal between the mask (or mouthpiece) and the patient's face (lips). Any leaks will result in air entrainment during inspiration and a fall in F_IO_2, particularly during mid-inspiration. It is rare for the seal to be perfect, particularly with face masks, where the design and matching to facial features may be poor. Beards make leaks more likely. Therefore some degree of air entrainment is extremely likely. This has been studied under hyperbaric conditions using the Scott Mask demand regulator where it was shown that a F_IO_2 of 1.0 (100%) was never achieved even under ideal conditions in trained nursing attendants and was less than 0.8 in some cases.[10]

Intermittent positive pressure ventilation (IPPV) in the non-breathing victim is not discussed in this paper. However IPPV is only possible with demand regulator systems where the exhalation mechanism is not automatically opened by positive pressure within the mask or is overridden by a manual triggering mechanism. Pulmonary overpressure injuries and gastric distension are life-threatening complications of IPPV in unskilled hands. The Laerdal MTV-100 (manufactured by Life Support Products) is an example of a demand valve that may be used for spontaneously-breathing patients or for manually-triggered positive pressure breathing and which meets the new Australian Standard 2488.[6] Some existing oxygen kits may not meet this standard.

LOW FLOW DEVICES

Semi-closed Rebreather Systems

All such systems consist of a fresh gas inlet into a circuit containing, at the least, a reservoir for the breathing gases in the circuit, one or two hoses to deliver the inspired and expired gas volumes to and from the patient and an exhaust valve or opening to release surplus gases from the circuit. In order to economise on fresh gas flows, a system for removing carbon dioxide from the breathing gases is usually incorporated. If one-way valves are placed in the circuit to ensure unidirectional gas flow within the device, then this is called a "circle" system.

All anaesthetic circuits in use today follow these basic design concepts. The basic principles underlying their function are much the same as those outlined recently in the SPUMS Journal by Elliott and Hamilton for diving rebreathers.[11-13]

Again, the principle applies that, in order to deliver a fixed F_IO_2, the device must be capable of delivering the chosen gas mixture at a rate at least equal to PIFR. In a rebreathing circuit this criterion is satisfied as flow is met by partial collapse of the reservoir bag during inspiration, but only if the bag has filled properly during the previous expiratory phase and expiratory pause (see Figures 1 and 2). Once the reservoir bag is filled during exhalation, any surplus gases are dumped from the circuit via the exhaust valve. The great advantage of semi-closed rebreathers incorporating CO_2 removal is the economy of fresh gas flow achieved, with flows of less than one l/min being theoretically possible. In practice, higher flows than this are usually necessary.

This type of equipment is much more complex to use and requires training and repeated practice. Not only is the mask seal (and design) vital in both the spontaneously breathing[14,15] and apnoeic patient for effective oxygen therapy, but problems may arise with circuit integrity. Besides disconnections and other causes of leaks (e.g. splits in delivery hoses or connectors), unrecognised exhaustion of the carbon dioxide absorber, malfunction (usually sticking open) of the one-way valves in the circuit (both of which result in increased F_ICO_2) and malfunction of the exhaust valve may occur. Despite these problems, in the hands of experienced, trained personnel (such as anaesthetists and paramedics) these devices are extremely efficient and effective in terms of oxygen delivery.

An added advantage is that some warming and humidification of inspired gases occurs due to rebreathing of the expired gas and the generation of water vapour and heat by the CO_2 absorber. Dilution of fresh gases by the patient's expirate results in a fall in F_IO_2, the extent and duration of which is dependent on the oxygen fresh gas flow rate and metabolic oxygen uptake by the patient. Even at an initial oxygen flow rate of 8 l/min into a rebreather circle system, and under ideal conditions, it takes several minutes to achieve an F_IO_2 of greater than 0.95.[14,15]

In the diving setting initial oxygen flow rates should be higher than those recommended for general use and the circuit flushed out periodically to enhance nitrogen off-gassing. This is likely to result in an averaged flow rate approaching 3 l/min. Some air entrainment during spontaneous inspiration is inevitable, especially if masks are held to rather than strapped onto the face, and will be greater the lower the fresh oxygen flow rate into the circuit.

One such rebreather circle system now available on the Australasian market incorporates several unique design features, particularly related to the carbon dioxide absorber canister and the exhaust valve, and is marketed by Laerdal as the OxiDive1 resuscitator kit.[5,16] A Swiss designed rebreather for divers (Wenoll oxgen delivery system) was recently described.[16]

Oxygen supply duration

The quantity of oxygen that should be carried by any diving operation depends on:

a the type of oxygen resuscitator to be supplied,

b the distance/time to access medical assistance and

c practicalities such as the space available on a diving vessel.

Table 5 provides approximate durations for several cylinder sizes using three flow rates that are typical of those required for a rebreather circle system (3 l/min), a demand regulator in an undistressed, average-sized diver (6 l/min) and a mask with continuous high flow oxygen to achieve a high F_IO_2 (15 l/min).

TABLE 5

DURATION (IN HOURS) OF OXYGEN CYLINDERS AT THREE FLOW RATES

Cylinder			**O_2 Flow Rate l/min**		
			3 lpm	**6 lpm**	**15 lpm**
Size	**Water volume (l)**	**Contains (m^3)**	(Rebreather)	(Demand regulator)	(High flow with mask)
C	2.84	0.49	2.5	1.25	0.5
D	9.5	1.64	9	4.5	1.75
E	23.8	2.26	12.5	6.25	2.5
G	48.0	7.01	39	19.5	7.75

Most oxygen first aid equipment in Australia is supplied with a C size cylinder with a capacity of 490 l, whereas in New Zealand this is not available, the equivalent being the smaller A size cylinder with a capacity of 440 l. For diving locations close to urban areas where running times to shore, helicopter retrieval, etc, are less than two hours an A cylinder is adequate with rebreathers but marginal in supply duration with demand regulators. In all other situations where delay in evacuation over two hours is likely or only a continuous flow device is available, an A size cylinder is quite inadequate. The most convenient cylinder size to carry under these circumstances is the D size which is similar in size to larger scuba tanks and therefore relatively easily handled and stored. In remote regions it may be necessary to carry several of these rather than opting for heavy G storage cylinders.

Other requirements

For wide application in the diving community, it is not only the theoretical performance characteristics of oxygen resuscitation equipment that are important. Of equal importance are ruggedness of construction, simplicity of design and use, the training requirements for safe and effective use, ease of maintenance and the cost.

The recent introduction onto the market of demand regulator and rebreather systems (both fixed performance) in robust waterproof casings is a major step forward in the field care of diving accidents. However, they carry with them a need for considerably more training and an obligation on the part of oxygen attendants to maintain airway management skills. This is especially the case with a circle system resuscitator like the OxiDive1 which is excellent for the trained and experienced physician or paramedic but which the average diver with basic first aid or a DAN oxygen course under his belt would have some difficulty using without full training in its use.

The various performance characteristics, and some of the advantages and disadvantages, of the three main types of oxygen resuscitators commonly available, continuous flow oxygen via a low capacity device, a demand regulator and a rebreather circle system, are summarised in Table 6. Several resuscitators on the market incorporate both the first

TABLE 6

CHARACTERISTICS OF OXYGEN SUPPLY DEVICES

Oxygen device	**Mask with continuous flow**	**Demand regulator**	**Rebreather System**
Device type	Variable F_IO_2	Fixed F_IO_2	Fixed F_IO_2
Oxygen economy	Poor (8-12 l/min)	Moderate (5-15 l/min)	Efficient (2-3 l/min)
Likely F_IO_2	Well below 100%	80-95 %	90- 95 %
Inspired humidity	Drier than air	Very dry	Warm and humid
IPPV *	No	Some types	Yes
Ease of use	Simple	Familiar concept Mask/mouthpiece seal critical	Mask seal and circuit-integrity critical
Problems	Inefficient	Air entrainment Overpressure injuries can occur when using IPPV	Air entrainment Disconnections Reservoir bag collapse CO_2 absorber failure Expiratory valve sticking
Training needs	Minimal	Moderate	Considerable
Cost	Cheapest	Moderate	More expensive Ongoing for consumables

* IPPV = Intermittent positive pressure ventilation

two types of device in a single oxygen regulator. A wide range of commercially available resuscitators is well illustrated by Lippmann[5]

Conclusions

A wide range of oxygen therapy equipment is now marketed and an Australian Standard is in place.[6] A clear need exists for independent assessment of equipment performance to identify those systems and designs most suited to diving operations ranging from recreational shore diving to the off-shore oil industry. This would provide a valuable SPUMS diploma thesis.

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Dr Michael Davis, MD, FANZCA, DipDHM, who was Convener of the 1997 Annual Scientific Meeting, is Medical Director, Hyperbaric Medicine Unit, Christchurch, Hospital, Private Bag 4710, Christchurch, New Zealand. Fax +64-3-364-0187. E mail hbu@chhlth.govt.nz .

CRITICAL INCIDENT STRESS DEBRIEFING

Jeff Bertsch

Key Words

Accidents, stress, trauma, treatment.

This talk is about trying to prevent post-traumatic stress disorder, which we call PTSD. The hyperbaric unit where I work is very much involved with the diving community. Our marketeers boast the Florida Keys as the diving capital of the world, which is debatable, after having been diving around the world! But we have a large number of diving professionals (dive pros) at work in the area. Dive shops in the Florida Keys put about 10,000 divers in the water a month. As a result our unit sees about 40 diving accidents a year. We have only been open about three years, but around 50% of our cases are acute cases. By that I mean, that the when the diver ascends, he is either unconscious, paralysed or there are other acute or severe neurological symptoms present.

We have done a very good job at this conference talking about providing care, the best care possible, to our injured divers. I would like to shift the conversation just a little bit and talk a little bit about caring for the health care providers. This is something that has not been discussed much in diving and hyperbaric medicine. However, it has been discussed and looked at length and in a great detail involving emergency medical services (EMS) and public safety personnel. I have become involved with this over the past couple of years.

First of all, I would like to define a “critical incident”. It is typically an event where there is loss of life or near loss of life. Tragedies, death, serious injuries, threatening situations are all something that we as health care providers and as diving professionals can see. I look at diving professionals as being the first line of health care providers. In our area the care that a diving professional