

Hypoxic Blackout at Recreational Snorkelling Workplaces

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Definitions

Where a person holds their breath on the surface, the irresistible urge to breathe is initiated mainly by a rise in CO₂ levels and to a lesser extent by a fall in arterial O₂. If a person's arterial O₂ levels drop below a critical level, hypoxia will develop and the person will suddenly lose consciousness and "blackout".

The term "shallow water blackout" is often used to describe this condition but is also used to describe a condition associated with closed circuit rebreathers. Hence the expression "hypoxic blackout" is used here.

In recreational snorkelling, there are two causes for this condition that can affect a "breath hold diver" who leaves the surface with a single breath. They are hyperventilation and ascent. These conditions may occur concurrently or independently.

Hyperventilation occurs when the person takes repeated deep breaths before descending. This affects the relative balance of CO₂ and arterial O₂ and can reduce the person's urge to breathe. It is a condition that is independent of depth and has been recorded in swimming pools.

Hypoxia of ascent occurs when the person descends to depth. There the elevated partial pressure of O₂ is sufficient for the person whilst they remain at depth, but falls rapidly to critical levels as the person ascends. This condition is more prevalent in persons who train to extend their breath hold and who dive deep, such as competitive breath hold divers, spear fishermen and photographers. Deaths have been recorded in depths from 3m to 30m.

Background

In December 2002 and January 2003 two breath hold divers died in separate incidents at recreational workplaces off the Queensland coast. Although post mortem examination reports have not been completed there is some evidence to suggest that both incidents were caused by hypoxic blackout leading to drowning.

Both men were well equipped and experienced snorkellers, one being a recreational dive instructor. One person was wearing a weightbelt and neither was with a buddy immediately to hand at the time of the incident.

The advice given to prospective recreational snorkellers in the Compressed Air Recreational Diving and Recreational Snorkelling Industry Code of Practice 2000, sections 3.2.2, 3.2.5 and 3.2.6 focuses primarily on other areas of risk to recreational snorkellers, those being:

- Medical conditions and fitness
- Inexperience and technical inability
- Lack of English language ability.

This advice is typically provided by recreational snorkelling operators using a combination of media including briefings, demonstrations, written materials, illustrations and videos.

Recommendations

Workplaces conducting recreational snorkelling activities should provide the following advice to prospective snorkellers who intend to breath hold dive:

- The risk posed to breath hold divers of hypoxic blackout that may lead to unconsciousness, drowning, serious injury or death.
- This risk is increased significantly for breath hold divers who hyperventilate by taking repeated deep breaths before descending or who do deep dives. Consequently divers are strongly advised not to hyperventilate.
- Experienced breath hold divers are at particular risk in that they have the ability and technique to do long and deep dives.
- Breath hold divers should always dive in buddy pairs where one buddy remains on the surface and observes the other buddy whilst they are diving.

- Breath hold divers using weightbelts should be carefully weighted to ensure that they are neutrally buoyant whilst at the surface. The weight belts should have a quick release mechanism and divers should be familiar with its operation.

Lookouts, snorkelling supervisors and snorkelling guides should be aware of which snorkellers intending to breath hold dive and provide them with additional levels of supervision.

References

Edmonds C, Lowry C, Pennefather J, Walker R, "Diving and Subaquatic Medicine" 4th Edition, pp202-204, Arnold, London 2002.

Edmonds C, "Snorkelling deaths in Australia 1987-1996" in Medical Journal of Australia, Vol 171 6/20 December 1999.

Francis J, "Breathhold Diving" in South Pacific Underwater Medicine Society (SPUMS) Journal Volume 32, No. 1, March 2002

Further Information

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