Flying After Diving Calibration Study

Divers may require flying soon after diving. To reduce the risk of decompression sickness (DCS) as a result of flying after diving (FAD), guidelines were published in the *US Navy Diving Manual* that specify how long a diver should wait between dive and flight. The Navy guidelines were developed in part with data from previous FAD studies for recreational divers done at Duke (Vann *et al.*, 2007*). Additional testing is required to evaluate profiles not previously tested. These include some very long dives and decompression dives. In addition, studies will be conducted to investigate the possibility of decreasing preflight surface intervals by breathing oxygen before flight.

*Vann RD, Pollock NW, Freiberger JJ, Natoli MJ, Denoble PJ, Pieper CF. Influence of bottom time on preflight surface intervals before flying after diving. *Undersea Hyperb Med* 2007; 34(3): 211-20.

The three specific goals of the FAD project are:

- Test air dive-flight profiles included in the U.S. Navy flying-after-diving tables that would benefit from additional validation.
- Use existing data and data generated from Aim 1 to develop a decompression model capable of computing risk of DCS for altitude exposures following air dives.
- Use the resultant decompression model to (a) compute a comprehensive set of flying-after-diving guidelines for air diving; (b) make predictions for dive-altitude exposures for nitrogen oxygen mixtures other than air; and (c) make preliminary predictions for diving at altitude procedures.

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The results of all our related studies are pooled to form a decompression model calibration data set.

Methods

The FAD Calibration study will be limited to tests of only a few specific dive-altitude combinations because of time and cost considerations. A comprehensive medical screening questionnaire and medical examination by a physician will ensure that subjects meet the physical requirements for participation. The studies are conducted in the hypo-/hyperbaric chambers at Duke University.

Subjects will perform light exercise continuously throughout the simulated dive, randomly either while dry or immersed as randomly assigned. Dive depths between 60 and 100 feet of seawater (FSW) or between 18 and 30 metres of seawater (MSW) will be used with bottom times selected from the US Navy dive tables. Following a planned surface interval, subjects will complete a resting exposure of four hours at a pressure equivalent to an 8 000-foot (2 438-m) altitude. This is the maximum altitude (minimum pressure) allowed in commercial, pressurised aircraft.

The outcome of each experimental dive-surface interval-flight profile will be evaluated statistically to determine the next profile to be tested. Three alternatives are possible:

1. Accept the surface interval without additional testing and begin testing a shorter surface interval.
2. Reject the surface interval from further testing and begin testing a longer surface interval.

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3. Test a different dive-surface interval-flight profile.

Two experiments, with up to four subjects per experiment, are conducted monthly. Exercise will be administered using a specially designed leg cycle ergometers for both dry and immersed exercise. Subjects are certified scuba divers or experienced in hypo-/hyperbaric exposures who are qualified upon completion of:

1. a medical history review and physical examination by a hyperbaric centre physician;
2. body composition assessment; and
3. baseline ultrasonic measures.

Subjects will be monitored for bubbles throughout the study with precordial doppler (sound only) and transthoracic echocardiographic (two-dimensional picture) ultrasound for the presence of bubbles in the circulation.

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