PERFORMANCE OF DIVE COMPUTERS EXPOSED TO PROFILES WITH KNOWN HUMAN SUBJECT RESULTS

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ABSTRACT

Most dive computer manufacturers address responses to fixed decompression table schedules or fabricated dive profiles. This study tests the potential for evaluating dive computer algorithms by exposing them to profiles that have known human subject results. Fifteen dive computers were exposed to profiles with either “high,” “moderate,” or “low” risk ratings, based on occurrence of decompression sickness and Doppler score outcomes from human subject dives. Profiles fell within, and slightly outside, the standard operational range of recreational divers. The profiles included a multi-day, multi-level repetitive dive series of “low” risk profiles (<130 fsw [500 kPa]; 1/2), two “moderate risk” multi-level single dives (130 fsw to 60 fsw [286 kPa] maximum depths), a “moderate risk” short dive to a maximum depth of 60 fsw [80 kPa] decomposed into decompression dives of “low” risk (15 msw [468 kPa] decompression times) and “high” risk (30 msw [1350 kPa] decompression times). Results for decompression times were compared with either the profile’s decompression algorithm or the manual decompression schedule. The results from the multi-day multi-level “low risk” profiles range from 30 minutes NDT to 19 minutes TDT at the end of MLD 1 (Table 4). For the MLD 1 the original profile decompression times were extended by 19 minutes by the dive computer’s response to a multi-day, multi-level repetitive decompression profile. Response to the 165 fsw dive indicates that more conservative dive computer algorithms would be appropriate for short deep decompression dives. Since dive computer manufacturers do not validate their algorithms with human subject tests, running the algorithms against a battery of previously tested dive profiles provides some rudimentary level of validation.

METHODS

The fifteen dive computers that were tested and their decompression algorithms are listed in Table 1. Of these, twelve were models that had been evaluated by Scuba Diving Magazine at the Catalina Hyperbaric Chamber and released for this study. The remaining three were older dive computer models (shaded area in Table 1).

The fifteen dive computers were exposed to profiles categorized with either “high,” “moderate,” or “low” risk ratings, based on occurrence of decompression sickness (DCS) and Doppler bubble (VGE) outcomes from human subject dives. Decompression times calculated by the dive computers were compared to the tested decompression schedule and conclusions about the decompression algorithms were based on the dive computer’s response to the profile (Table 2).

DISCUSSION

Since dive computer manufacturers do not validate their algorithms with human subject tests, running the algorithms against a battery of previously tested dive profiles provides some rudimentary level of validation. Most dive computer manufacturers do not release their decompression algorithms and it is very difficult to run simulations on a personal computer. Running the dive computers side-by-side in a chamber is the next option. This allows the computer to be simultaneously exposed to a specific controlled profile.

Two cases of DCS / High VGE

None of the computers performed the “high” risk decompression profile (Figure 3). However, all cleared before the end of the first 30-minute decompression stop of the “moderate risk” 165 fsw decompression profile.

Table 1: Dive computers and their decompression algorithms

Table 2: Risk rating vs. dive computer response to profile

Table 3: Response of dive computers to multi-day, multi-level repetitive dive series

Table 4: Response of dive computers to multi-level-no-decompression and decompression dives.