Effects of long duration dive (8 and 10 hours) with hyperbaric hyperoxia on Navy divers' eye and visual function: preliminary results

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Abstract

Purpose: To assess anatomical and functional effects of long duration dive (8 and 10 hours) on the eye, by reproducing all the constraints undergone by professional divers and to make sure that this kind of diving doesn't present any danger to the diver's eye and visual function.

Methods: 12 professional male Navy divers (31,5 +/- 3,2 y/o) executed a prolonged immersion (8 and 10 hours), breathing 50% Nitrox or 100% 02, depending on the depth of immersion (from 7 to 20 msw), corresponding to 1.54 to 1.7 ATA partial oxygen pressure (PaO2). They were regularly fed and hydrated. For each diver, we studied several parameters 24 hours before and 15 hours after immersion: visual acuity, low spatial contrast sensitivity, color vision (desaturated 15 Hue® test), eye refraction, ocular examination, visual field (Metrovision®, MIXTE and STAT 57C program, studying 24° and 10° central visual field), full-field clinical electroretinography (Metrovision®) using a short protocol (pupillary dilation, photopic response with 16 white standard flash and 16 red flash, 4 minutes to dark adaptation, scotopic response with 8 blue flash and 8 attenuated white flash), and multifocal electroretinography (Metrovision®). Wilcoxon test was used to assess differences between results for each diver, before and after immersion.

Results: None of the 12 divers had any loss of visual acuity, nor any loss of spatial contrast sensitivity. We didn't notice any difference on color vision. Moreover, we didn't observe any modification of eye refraction nor any alteration of visual field parameters (corrected mean deviation, temporal and spatial deviation, foveolar threshold). Ocular examination was normal for all the divers, before and after immersion. Regarding full-field

clinical electroretinography, b-wave was significantly decreased after immersion (p = 0,002) on scotopic response with white attenuated stimulation. Regarding to multifocal electroretinography, amplitude of P1-wave beyond central 15°was increased (p = 0,035) and N2-wave beyond 15° was deeper (p = 0,032).
Conclusions: These findings suggest long duration dive with hyperbaric hyperoxia doesn't induce any immediate danger for the eye. However, subclinical functional effects on vision seem to exist, affecting rod-cell function, as it's suggested by electroretinography results. Further studies are needed to try and confirm these results.

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