



Hearing threshold in sport divers- Are divers really deaf?

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Introduction:

Diving puts the inner ear at risk. Both inner ear barotrauma (IEB) and inner ear decompression sickness (IEDCS) can lead to permanent sensorineural hearing loss, tinnitus and vertigo. If hearing function is only measured by air conduction there is also the possibility that residuals of middle ear barotrauma, which is the most often accident in diving, would influence the hearing test results.

Whether scuba-diving without diving accident is a risk factor for cochlear disorders is a matter of debate. In most of the studies diving was associated with occupational noise exposure¹⁻⁴. Therefore, the effect of acoustic trauma or potential harmful effects of increased pressure and partial pressures of breathing gases cannot be differentiated

The purpose of this study was to examine the cochlear function of non-professional divers with considerable diving experience but no increased exposure to noise during work and leisure time. These divers did not have a history of inner ear DCS or inner ear barotrauma. The results were compared with a group of non-diving control subjects.

Material and Methods

Divers:

Three divers had to be excluded because of a history of an inner ear barotrauma. Altogether 60 divers (43 male / 17 female) with an average age of 37 years ranging from 22 to 60 years were subdivided in three age groups: group one (18-30 years) showed 21 divers, group two (31-40 years) 21 divers and group three (41-60 years) 18 divers. The average diving experience was 10 years (range 4 to 27 years) and the divers had an average number of 650 dives (range 195 to 3500 dives) using air as the breathing gas.

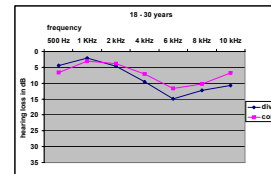
Controls:

The control group consisted of 63 patients who had a negative otologic history and were free of ear-related symptoms at the time of evaluation (30 male, 33 female). The age range in the control group was from 18 to 59 (mean 32 years, standard deviation 9 years). In analogy to the group of divers, control subjects were divided in three age groups: 33 in group one (18-30 years), 17 in group two (31-40 years) and 13 in group three (41-60 years).

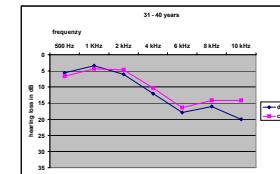
Assessment of both groups included microscopic otoscopy, tympanometry and pure tone audiometry. Hearing thresholds were measured by the same examiner with the same audiometer. Individual air conduction hearing threshold for a given frequency were defined as the mean of both ears.

Results

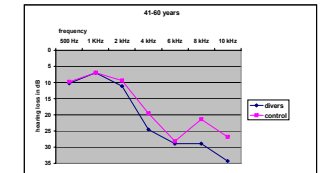
We compared the hearing results of divers and controls in 7 frequencies in three age groups with a Mann-Whitney-U-Test. Because of the multiple testing we had to use an adapted Bonferroni correction. Comparing the hearing test results of divers and non-divers with the Mann-Whitney-U-Test showed **no significant differences between all age groups in all tested frequencies.**



Graph 1: Hearing thresholds of divers and non-divers in the age group from 18 - 30 years. There are no significant differences between both groups.



Graph 2: Age group 31 - 40 years. Results of the average hearing loss in dB of both ears combined. The divers show a marginally poorer hearing levels but the differences are not significant.



Graph 3: Age group 41 to 60 years. Average hearing loss of both ears combined. There are no significant differences between both groups.

Discussion

The data collected in our study has the advantage that our divers did not have more exposure to noise than the control group of non-divers. Three divers were ruled out because of a history of inner ear barotrauma and the rest of the divers that were compared to the control group had no history of diving related inner ear accidents. Thus we can rule out these effects for a possible deterioration of the inner ear function. Regarding all testing results, pure tone audiometric thresholds did not reveal significant differences between divers and controls in all groups. But there are marked inter-individual differences in the hearing levels in each age group, so with increasing standard deviation the power of our statistical comparison is reduced. We can't prove that divers and non-divers had no differences of the hearing levels in all frequencies but we have an appropriate group size in most of the frequencies.

Conclusion

We didn't find statistically reduced hearing levels in sport divers compared to a non-diving control group. The reduced hearing levels of professional divers found in other studies are probably due to the high noise levels that they have to deal with or it may be a result of inner ear accidents.

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