Methods

IIH and control subjects matched for age, sex and weight were enrolled for olfactory testing at the Center for Space Medicine, Baylor College of Medicine, Houston, Texas in a one year prospective study. Olfactory function was tested in upright (90 degrees) and six-degree HDT in all subjects using two different measures: University of Pennsylvania Smell Identification Test (SIT) and Olfactory Threshold (OT) with phenylethyl alcohol (PEA). The SIT measures ability to identify smells, while the OT determines minimum detection threshold of an odorant. We hypothesized that IIH patients would have impaired olfactory performance for both measures, but worse on the OT due to presumed peripheral olfactory structures being more affected given the proximity between the olfactory and cerebrospinal fluid (CSF) drainage pathways. We also hypothesized that HDT would worsen the olfactory performance. We also collected retrospective data from neuro-ophthalmology clinic visits including optical coherence tomography (OCT), Frisen grading, Humphrey visual fields (VFs), optic nerve sheath diameter (ONSD), duration of symptoms, and ICP values.

Results

We report a marked impairment of olfactory function in IIH patients compared to controls, more prominent with OT detection, but moderately decreased for identification. OT dilution levels were [3.83 (95% CI 7.04-11.10) and 9.07 (95% CI 3.43-37.18), p = 0.008] for IIH and controls respectively. The difference of 5 dilution levels of 1:2 represents a 32 fold difference in concentration for PEA detection in IIH versus control subjects. SIT scores were [32.47 (95% CI 30.85-34.09) vs. 35.61 (95% CI 34.03-37.18), p = 0.008] for IIH and controls respectively (Fig 2). The OT detection was mildly impaired by HDT compared to upright positioning in the combined subjects [6.05 (95% CI 4.58-7.51) vs. 6.85 (95% CI 5.43-8.27), p = 0.004](Fig 3). We observed a significant inverse correlation between SIT scores and ONSD (both eyes averaged)(Pearson coefficient, r = -0.73 and -0.60, p = 0.009 and 0.018), for upright and HDT positions respectively. Furthermore, IIH patients with a longer duration of symptoms had worse performance on both the SIT (-0.52, p =0.001 for the upright body position) and OT testing (-0.61 and -0.56, p =0.001 for the upright and HDT body positions, respectively). We did not find any significant correlations between olfactory performance and previous ICP value, OCT derived RNFL thickness, VF defects, or Frisen grade.

Conclusions

We report a marked impairment of olfactory function in IIH patients compared to controls, more prominent with OT detection, but moderately decreased for identification. OT dilution levels were [3.83 (95% CI 7.04-11.10) and 9.07 (95% CI 3.43-37.18), p = 0.008] for IIH and controls respectively. The difference of 5 dilution levels of 1:2 represents a 32 fold difference in concentration for PEA detection in IIH versus control subjects. SIT scores were [32.47 (95% CI 30.85-34.09) vs. 35.61 (95% CI 34.03-37.18), p = 0.008] for IIH and controls respectively (Fig 2). The OT detection was mildly impaired by HDT compared to upright positioning in the combined subjects [6.05 (95% CI 4.58-7.51) vs. 6.85 (95% CI 5.43-8.27), p = 0.004](Fig 3). We observed a significant inverse correlation between SIT scores and ONSD (both eyes averaged)(Pearson coefficient, r = -0.73 and -0.60, p = 0.009 and 0.018), for upright and HDT positions respectively. Furthermore, IIH patients with a longer duration of symptoms had worse performance on both the SIT (-0.52, p =0.001 for the upright body position) and OT testing (-0.61 and -0.56, p =0.001 for the upright and HDT body positions, respectively). We did not find any significant correlations between olfactory performance and previous ICP value, OCT derived RNFL thickness, VF defects, or Frisen grade.

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