Title: Tinnitus: A Right OP3 ROI In Functional Connectivity With Auditory And Kinesthetic Illusions Brain Areas.

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Background: Mechanism originating the phantom sound is still unsolved. In acoustic trauma in human, a right insulo-parietal region in parietal operculum 3 (Right OP3 ROI), on the opposite bank to Heschl gyrus, was shown to be related to acoustically-induced tinnitus and suggested a disturbance of proprioceptive/kinesthetic integration of sensory information originating from middle-ear proprioceptors (Job et al. 2012, 2016). Resting-state functional connectivity from this region had never been studied and may help to better understand the functional role of this region in the tinnitus percept.

Methods: (text here)

FMRI resting-state acquisition were done in a chronic tinnitus group (n= 19, acoustically-induced tinnitus) and in an age-matched control group (n= 19). The MRI scanning sessions were performed on a 3T Philips Achieva-TX scanner (32 channel-head coil) at Grenoble MRI facility-IRMaGe. The MRI examination protocol included a 13 minutes and 20 seconds long fMRI resting-state acquisition (400 volumes) and a structural high resolution T1 weighted image. We processed and analyzed the fMRI data using SPM12, applied DARTEL registration and an accurate 1.5 grey matter template used in VBM methods compatible with the standard MNI coordinate system. We detected and remove artifacts in the individual time series using art toolbox. We then performed a seed-based functional connectivity analysis using the Conn toolbox. We analysed in each group the regions that were significantly correlated with the right OP3 ROI (height threshold, P < 0.001, cluster-size FDR-corrected P < 0.05). We then computed the regions where correlation with the right OP3 ROI were significantly higher (respectively lower) in the tinnitus group as compared to the control group. Regions with P < 0.001, T-value > 4 and extent > 7 voxels were further retained as significant and superimposed on the mean structural image of our group of subjects.

Results: The right OP3 ROI in tinnitus compared to controls had increased functional connectivity in left prefrontal cortex, left inferior occipital cortex but interestingly had increased connectivity at the junction pars opercularis/premotor cortex and in kinesthetic illusions brain areas common to all body joints (i.e., in the inferior parietal lobule and in the inferior fronto-parietal cortices). The cluster in the inferior fronto-parietal region extended to the temporal border seeming coupled with increased connectivity in primary auditory cortex.

Conclusions: Our findings are a further step that strengthen the hypothesis that acoustic trauma tinnitus possibly be a middle-ear kinesthetic illusion. From these cortico-cortical connections a top-down effect in the auditory pathway could arise in accordance to the corticofugal temporal dynamics usually observed in acoustic trauma tinnitus.