

Tinnitus and Dysfunctional Interactions between Distributed Resting State Networks

Abstract:

It is known that peripheral lesions in the cochlea or the auditory nerve produce dysfunctional input to central auditory structures and induce changes in the auditory system causing tinnitus. Recently, it has been proposed that the unified percept of tinnitus could be considered as an emergent property of multiple overlapping dynamic brain networks, each encoding a specific tinnitus characteristic.

The aim of our study was to investigate the neuronal activation patterns associated with specific clinical tinnitus characteristics using fMRI. We hypothesize that tinnitus clinical characteristics could be associated with specific resting-state activity and connectivity patterns and that this could be tested by looking at the spontaneous brain activity of 135 tinnitus patients. We combine individual independent component analysis (ICA) with graph theory (GraphICA) to select the 9 components of interest (resting-state networks) and calculate the graph properties of these networks. We performed an analysis to identify the correlation between different tinnitus characteristics (age, distress, loudness, intensity, duration and hearing loss) and the graph strength of the functional connectivity pattern of these 9 different resting-state networks.

Our findings provide evidence that alterations of functional interactions between key neural circuits of the brain are associated with mostly the subjective age, distress and duration of tinnitus. Specifically, the activity and connectivity patterns of the left executive control network are mostly being affected by the tinnitus distress. Further, this resting-state study indicates that longer the tinnitus is perceived, more changes are seen in the default mode network.