

TINNITUS AND THE AUTONOMIC NERVOUS SYSTEM

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The role of the autonomic system in tinnitus is hardly being investigated, even though it might offer an entry as a treatment modality for tinnitus. Most people who have tinnitus can effectively cope with it, however a small percentage of tinnitus sufferers demonstrate maladaptive coping. It has recently been suggested that maladaptive coping would suggest a sympathetic hyperactivity, whereas an effective coping attitude might be the result of a parasympathetic dominance. Neuroimaging and neurophysiological studies reveal a neural emotional 'stress' circuit consisting of the medial prefrontal, anterior and posterior cingulate, caudate, putamen, thalamus, (para)hippocampus, amygdala and insula. These studies also demonstrated a sympathetic lateralization in the right hemisphere and, parasympathetic predominance in the left hemisphere. Neuroendocrine studies demonstrate that patients with an uncoping stress profile show increased catecholamine plasma levels with altered noradrenaline/adrenaline ratio, increased plasma cortisol and increased free serotonin. Heart rate variability (HRV) can be used as a simple and non-invasive quantitative marker of autonomic function. The proposed study aims at visualizing an important part of the autonomic neural circuit involved in tinnitus as well as its neuroendocrine counterpart, using LORETA EEG, blood tests, HRV and questionnaires (tinnitus, coping, depression questionnaires), based on the hypothesis that maladaptive coping demonstrates signs of sympathetic activation and adaptive coping signs of parasympathetic activation. In a second phase the signs of maladaptive tinnitus coping will be analysed before and after tinnitus suppression, using auditory cortex stimulation.

Most people who have tinnitus can effectively cope with it, however a small percentage of tinnitus sufferers demonstrate maladaptive coping, inducing a stress reaction. A stress reaction is initially helpful, but when stress becomes chronic and the energy reserves become depleted the organism becomes exhausted. Thus long term stress becomes destructive on the body. Understanding how this tinnitus related stress reaction works in the brain and how it influences our hormonal system is the aim of this study. People who can perfectly live with their tinnitus will be compared to non-coping patients, using 1. LORETA EEG, a technique in which spontaneous abnormal brain activity is fused on a MRI scan image, using 2. blood samples analyzing stress hormones and by 3. measuring stress on the heart. These tests will then be related to the tinnitus severity, depression severity and coping skills using standardized questionnaires.

In a second phase the data of non-coping patients will be analyzed before and after treatment of their tinnitus, using auditory cortex implantations as way to suppress the tinnitus.