

# Two cases of intractable auditory hallucination successfully treated with sound therapy

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## Abstract

We report two cases of patients with schizoaffective disorder with treatment-refractory auditory verbal hallucinations (AVHs) who were successfully treated with sound therapy, which is effective to treat tinnitus. AVHs in both patients were alleviated within about one month, and no recurrence was reported for 31 and 17 months after the sound therapy together with medication. Further studies may confirm the therapeutic value of sound therapy in patients with intractable AVHs.

**Keywords:** auditory hallucinations, sound therapy.

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## INTRODUCTION

Auditory hallucinations (AHs) are generally defined as false perceptions manifesting as “voices commenting” or “voices conversing” in patients with schizophrenia and schizoaffective disorder. Auditory verbal hallucinations (AVHs) are one of the major symptoms for the diagnosis of these disorders as well as the evaluation of psychotic features. Recent developments in auditory neuroscience have increased our understanding of normal auditory perception<sup>1</sup>, leading to the neurocognitive model of the hallucinating brain<sup>2</sup>. AHs remain almost unresponsive to available antipsychotic medication in approximately 25-30% of patients with schizophrenia<sup>3</sup>. Patients who do respond to antipsychotic medications are very likely to suffer recurrence of AHs. A study using transcranial magnetic stimulation has suggested that the mechanism of AH may involve activation of the left temporoparietal cortex<sup>4</sup>.

Subjective tinnitus is defined as the false perception of sound in the absence of acoustic stimulus similar to AHs. Since the coexistence of tinnitus and AHs is not uncommon<sup>5</sup>, a common underlying neuromechanism has been proposed<sup>5,6</sup>. Tinnitus retraining therapy (TRT)<sup>7</sup>, which is a combination of directive counseling and sound therapy, has obtained improvement rates of 80% or more in patients with intractable tinnitus<sup>8,9</sup>.

We report two cases of AVHs successfully treated with sound therapy safely using a tinnitus control instrument (sound generator).

## METHODS

Audiological assessments used conventional pure-tone audiometry. Tinnitus was measured with a pitch-match method. Sound therapy was conducted with a tinnitus control instrument (TCI; Siemens AG, Munich, Germany) which is used in TRT. All treatments were conducted in accordance with the Declaration of Helsinki and all procedures were carried out with the adequate understanding and written consent of the patients.

### Case Reports

**Case 1:** A 19-year-old female first visited a psychiatrist 5 years previously complaining of severe insomnia. She visited our psychiatric hospital with complaints of AVHs and tinnitus in the right ear in August 2004. She was diagnosed with schizoaffective disorder based on the revision of the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). Magnetic resonance imaging revealed no structural abnormalities in the brain. The AVHs consisted of insulting or blaming voices, whereas the tinnitus was perceived as a mechanical sound. These auditory symptoms had remained unchanged despite antipsychotic medications including

levomepromazine and olanzapine, together with fluvoxamine maleate and sodium valproate during her hospitalization for 3 years. She then received a psychiatric referral to our ear clinic for audiological evaluation and treatment in August 2006. Her hearing level, calculated as the average across the frequencies 250, 500, 1000, and 2000 Hz, was 13.8 dB in the right ear and 18.8 dB in the left ear. Her tinnitus was pitch matched as 4000 Hz, 32 dB. Her tinnitus handicap inventory (THI) score was 70. Sound therapy within 30 dB was subsequently conducted with the TCI to treat the tinnitus in the right ear. The volume was set at a comfortable level which partially masked the tinnitus with only olanzapine medication. The patient could change the volume within a maximum of 10 dB, and could choose between white and pink noise. She felt comfortable when she first put the TCI on her right ear, her comfort level with regard to the AVHs improved within the first week, and her insomnia was alleviated 2 weeks later. She tried to take off the TCI during both working hours and at night after 3 weeks and then the AVHs recurred. She decided to use white noise after 4 weeks and the AVHs was alleviated but the tinnitus persisted. She began to turn off her TCI only when taking a bath after 6 weeks. The AVHs were reduced gradually and disappeared completely 8 weeks later. She continued to use the TCI but only occasionally after 9 months and then stopped the sound therapy. Her THI score was reduced to 30. She had suffered no recurrence of AVHs under medication with olanzapine 31 months later.

**Case 2:** A 33-year-old female first visited a psychiatric clinic complaining of visual hallucination and AHs associated with irritable moods which started following the birth of her first child at age 30 years. She was diagnosed with schizoaffective disorder according to DSM-IV. The AVHs consisted of blaming, insulting, name-calling voices, and the sound of a car horn. The AVHs remained unchanged despite antipsychotic medications such as levomepromazine, combined with milnacipran hydrochloride and carbamazepine over a period of 18 months hospitalization. Subsequently, the AVHs became so severe that sound therapy was applied after informed consent. Her hearing level was normal at 12.5 dB in the right ear and 10 dB in the left ear, and she had no tinnitus. We recommended that she use the TCI in the right ear for as long as possible in November 2007. She chose the pink noise at 30 dB as most comfortable. She was also able to control the volume within 10 dB. She reported a slight reduction in the AVHs after one week, decreased frequency of the AVHs from 5 times to once per day after 2 weeks, and seldom experienced AVHs after 3 weeks, so she stopped the sound therapy. The AVHs had completely disappeared after 6 weeks. She has been taking aripiprazole hydrochloride and milnacipran

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hydrochloride without recurrence of AVHs for 17 months.

Medication was continued in both patients and no adverse events occurred during and after sound therapy.

## DISCUSSION

Recently, repetitive transcranial magnetic stimulation (rTMS) was introduced as an alternative treatment for AHs in schizophrenic patients who failed to respond to antipsychotic medication. rTMS can also be used to treat tinnitus. However, the treatment results have been partial and transitory<sup>10,11</sup>.

The neurophysiological model of tinnitus postulates involvement of the limbic and autonomic nervous systems in clinically significant tinnitus, and emphasizes the importance of conscious and subconscious connections. The conventional sound therapy is aimed at inducing changes in limbic reaction evoked tinnitus through the sound pathways<sup>7</sup>.

Many studies showed that in addition to secondary sensory cortices, the dysfunction in prefrontal premotor, cingulate, subcortical and cerebellar regions contribute to hallucinatory experiences<sup>2,4</sup>. Sound therapy is expected to provide help from the auditory system to the limbic nerve system.

The present study showed that sound therapy induced complete remission of AVHs safely in 2 patients 2 years 7 months and 1 year 6 months. These results imply that the neuromechanism of AVHs is sensitive to sound therapy. Common underlying neuromechanisms for tinnitus and AVHs may be present. Further research is needed into the pathophysiology of AVHs and tinnitus.

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