Supplementary Material

Supplementary information 1: other complications of the subjects

The tinnitus subject was consistently having follow-up visit for sleep apnea and restless leg syndrome to neurology department.

The hyperacusis subject had no other symptom during the clinical trial period. However, on 19th Oct. 2018, when nine months later after completing clinical trial, the hyperacusis patient complained about the newly developed symptom. Recently, she had pain when taste banana and she felt too spicy to eat.

Both two subjects had no psychiatric disease and no one reported and showed central neurological symptoms.

Supplementary information 2: detailed description of methods

S2.1. Noise environment

S2.1.1. Common ground in the subjects

- *The noise features of the occupational environments*: High intensity and high frequency noise, long-term and long-time exposure of noisy background with burst and/or consistent loud and high frequency-mixed noise.
- *EEG Recording environments*: We analyzed both EEG data of silent state in a noise-shielded room. Severe temporal hyper-activated states (STHS) were not the result of analyzing the state after noise induced or exposed (aNI), that is, it did not include the epoch time of being exposed or listening to noise or speech sound.

S2.1.2. Differences between the subjects

- *Occupation and working place*: Industry (construction site, tinnitus subject), education (girl's high school, hyperacusis subject)
- *Noise stimulation for the noise-induced (NI) temporal hyper-activated state*: In tinnitus subject, EEG data of the working day were used to reflect noise-induced status of the brain activity. The hyperacusis subject was exposed to 20 dB of 2−3 seconds length speech sound (F/28)

S2.2. Analysis of the EEG data

S2.2.1. Common analyzed features in the subjects

- *Analyzed the brain oscillation*, which is represented the pathological states of cortical activity.
  i.e., Severe temporal hyper-activated state (STHS) and mild temporal hyper-activated state (MTHS): The analyzed severe hyper-activated states are A and B (Case 1) and G (b, c) - I (Case 2) in Supplementary Fig. 2 in the online-only Data Supplement. Mild hyper-activated state was analyzed using D (Case 1) and E, F and J (Case 2) in Supplementary Fig. 2 in the online-only Data Supplement).
- *Electrodes used for statistical analysis*
- : For auditory cortex, we used 4 electrodes from 31 channels map followed 10-20 montages (T3, T4 were used for detecting activity of the primary and secondary cortex and similar activity of that was shown in the TP7, TP8)
- For other brain areas, we used total 27 electrodes (Fp1, Fpz, Fp2, F7, F3, Fz, F4, F8, FT7, FC3, FCz, FC4, FT8, C3, Cz, C4, CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz, O2)
- *Post-processing* of the EEG data included artifact rejection and baseline correction with averaging using independent component analysis methods. We used seven frequency bands, delta, theta, alpha 1-2, beta 1-3 and gamma, introduced and modified in a previous study [17].
- *The maximum Power thresholds* of the scale bar were normalized after the analysis process, and the gamma frequency figures were normalized to 20, and the frequency rates were 300%. To compare the neuronal activity, among 31 brain areas, the topography of the brain activity was analyzed and represented with a color scale bar.

S2.2.2. Difference between the subjects

- *The length* of analyzed epoch time
- : The severe temporal hyper-activated state of Case 1 was analyzed with a 5-minute epoch and a 53-second epoch for Case 2. The mild temporal hyper-activated state was about 92 seconds in case 1 (Supplementary Fig. 1D in the online-only Data Supplement) and 244 seconds in case 2.