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Evaluation of tinnitus retraining therapy for patients with normal audiograms versus patients with hearing loss

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ABSTRACT

Objective: A few chronic tinnitus patients show normal hearing thresholds in the pure tone audiometry from 125 Hz to 8000 Hz (≤20 dB). We report the characteristics of the course of those patients underwent tinnitus retraining therapy (TRT) compared with other patients suffering from chronic and severe tinnitus.

Methods: We identified 13 patients with normal hearing thresholds among 242 patients suffering over 3 months, Tinnitus Handicap Inventory (THI) ≥16/100, and follow up period is over 6 months. We divided into two groups – tinnitus with normal audiometry and with hearing loss – and contrasted these patients with age, gender, tinnitus duration, instruments for TRT, loudness and pitch of the tinnitus, THI and Visual Analogue Scale (VAS) scores.

Results: The pitch-match of the tinnitus was higher and tinnitus duration was shorter in normal audiometry. The age is younger and the tinnitus loudness was smaller in normal hearing group significantly. THI of normal audiogram group showed significant improvement on 18 months treatment, though it once got worse on 12 months. THI of hearing loss group showed significant decreases in first 3 months and decreased slightly until 48 months treatment. The VAS scores of annoyance also showed a large decrease in first 3 months and decreased slightly until 24 months. Both THI after 48 months and VAS scores after 24 months treatment showed almost stable until 72 months in hearing loss group.

Conclusion: Chronic tinnitus with normal audiometry and with hearing loss both showed adaptation with TRT. Normal audiometry group with chronic tinnitus may have damage in high frequency though there were not significant differences between two groups as to tinnitus pitch-match. They also need at least 18 months TRT to become adaptation, while 48 months treatment is enough and first 3 months treatment is very important for hearing loss with chronic tinnitus.

1. Introduction

Tinnitus is a common condition that occurs in 10–15% of the population [1] and has a serious effect on the quality of life in 1–2% [2]. It has been recently said that tinnitus have emerged mainly from the auditory nerve to the brain associated with hearing loss.

Pure tone audiometry (PTA) usually reveals hearing loss in patients with tinnitus, although some patients show normal hearing in the frequency range of conventional PTA (125 Hz–8000 Hz) [3]. It has been argued that a normal hearing threshold does not preclude cochlear damage and it has been suggested that cochlear injury and outer hair cell damage may still occur in the high frequency region [4]. In mice subjected to mild acoustic trauma, there was a temporary shift of the hearing threshold and permanent deafferentation of 50–60% of the auditory nerve fibers in the high frequency range [5].

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At our hospital, tinnitus retraining therapy (TRT) is performed on the basis of the neurophysiological model of tinnitus proposed by Jastreboff [6] to achieve habitation to the reactions evoked by tinnitus. TRT involves directive counseling by doctors and co-medical staffs combined with acoustic therapy using tinnitus control instruments, such as a sound generator (SG) or hearing aid (HA) and other audiological instruments such as radio noise and environmental noises (running water, waves, etc.). The aim of this study is to reveal the clinical characteristics of patients with chronic severe tinnitus undergoing TRT, and compared those who had a normal audiogram with those who had hearing loss. In addition, distortion product otoacoustic emissions were recorded in patients with a normal audiogram to detect subtle hearing impairment.

2. Materials and methods

The protocol for the human study was approved by Institutional Review Board of Shi-Suma General Hospital in accordance with the ethical standards. Data were analyzed for 707 patients presenting with acute or chronic subjective tinnitus between 2005 and 2015. We selected the patients whose tinnitus duration was over 3 months and the THI score was over 16/100. The counseling was done by the doctors and the co-medicals before the medical instrument was used. We used the HA when the patient had mild or severe hearing disorder (>50 dB) in one ear or both ears and recommended the SG or other audiological instruments like iPod or radio in one ear to the patients who had slight hearing loss or normal hearing. Patients who used other audiological instruments

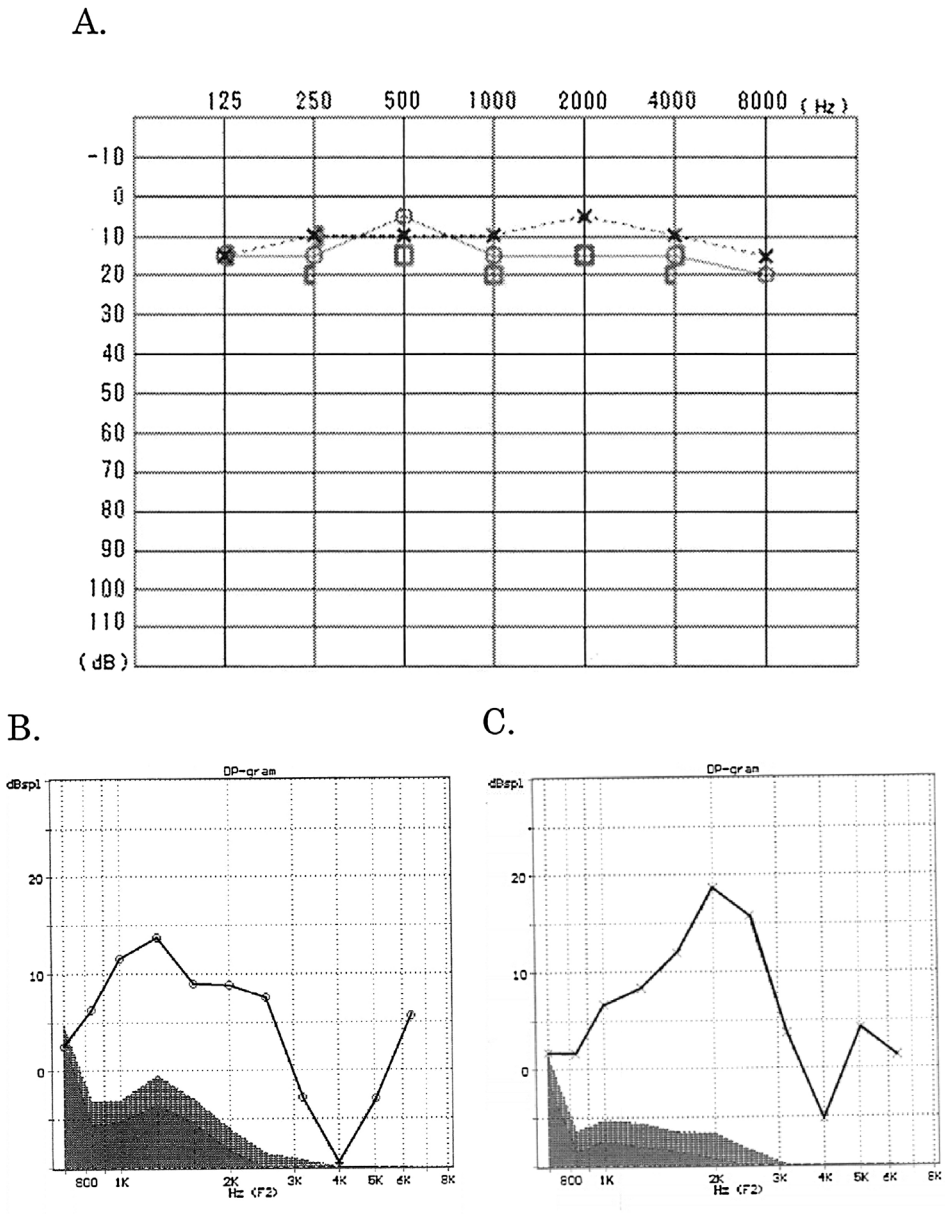

Fig. 1. PTA and DPOAEs in a patient with bilateral tinnitus (Case 1).
A. PTA; B. DPOAE (right); C. DPOAE (left).
DPOAEs show a dip at 4 kHz bilaterally, while PTA is normal especially in the high-frequency region.

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