



Delayed restoration of maximum speech discrimination scores in patients with idiopathic sudden sensorineural hearing loss



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ABSTRACT

Objective: To assess possible delayed recovery of the maximum speech discrimination score (SDS) when the audiometric threshold ceases to change.

Methods: We retrospectively examined 20 patients with idiopathic sudden sensorineural hearing loss (ISSNHL) (gender: 9 males and 11 females, age: 24–71 years). The findings of pure-tone average (PTA), maximum SDS, auditory brainstem responses (ABRs), and tinnitus handicap inventory (THI) were compared among the three periods of 1–3 months, 6–8 months, and 11–13 months after ISSNHL onset.

Results: No significant differences were noted in PTA, whereas an increase of greater than or equal to 10% in maximum SDS was recognized in 9 patients (45%) from the period of 1–3 months to the period of 11–13 months. Four of the 9 patients showed 20% or more recovery of maximum SDS. No significant differences were observed in the interpeak latency difference between waves I and V and the interaural latency difference of wave V in ABRs, whereas an improvement in the THI grade was recognized in 11 patients (55%) from the period of 1–3 months to the period of 11–13 months.

Conclusion: The present study suggested the incidence of maximum SDS restoration over 1 year after ISSNHL onset. These findings may be because of the effects of auditory plasticity via the central auditory pathway.

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1. Introduction

Idiopathic sudden sensorineural hearing loss (ISSNHL) is characterized by the rapid loss of hearing over a period of up to 3 days, and it is diagnosed based on findings of pure-tone audiometry showing HL of 30 dB or more over at least 3 connected frequencies [1]. This condition is frequently associated with tinnitus, aural fullness, and vertigo. Although

the etiology of ISSNHL remains unclear, viral infections, vascular disruptions, autoimmune responses, and cochlear membrane ruptures have been postulated as potential causes. ISSNHL is considered to be an otological emergency in terms of diagnosis and treatment, although cases of spontaneous recovery have been reported, with rates of 58–65% [2,3]. Therapeutic measures include the administration of systemic and intratympanic corticosteroids, antiviral and hemodilution agents, minerals, vitamins, and hyperbaric oxygen therapy.

With regard to longitudinal changes in the pure-tone audiometric threshold in ISSNHL patients, previous studies have reported that improvements in the audiometric threshold may occur beyond 2 months after the treatment for ISSNHL [4,5], whereas other studies showed the audiometric threshold

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to be fixed within 2 months after ISSNHL onset [6]. It is generally believed that hearing improvements occur within 1 month after the onset in most patients [1].

The characterization of ISSNHL currently depends on the audiometric threshold and, to a lesser extent, the speech discrimination score (SDS). Furthermore, time-course changes in SDS of ISSNHL patients have not been completely addressed. The aim of this study was to evaluate longitudinal changes in the maximum SDS and discuss the possible mechanisms of a delayed SDS recovery. Here, we analyzed changes in maximum SDS as well as pure-tone average (PTA) for 1 year after ISSNHL onset. In addition, we concurrently evaluated auditory brainstem responses (ABRs) and tinnitus handicap inventory (THI).

2. Materials and methods

2.1. Patients

This study conformed to the Declaration of Helsinki on research with humans and was approved by the Institutional Review Board of Tokyo Medical and Dental University Faculty of Medicine (No. 1536). In our medical records, 142 ISSNHL patients (75 males and 67 females) were identified to have visited our department from May 2008 to February 2011. ISSNHL was defined as follows: (1) rapid HL of unknown etiology, (2) onset occurring within 72 h, (3) HL of at least 30 dB in 3 connected frequencies, and (4) a negative otological history in the affected ear.

The study patients were selected from among the 142 ISSNHL patients if a patient underwent assessments of pure-tone audiometry, speech audiometry, and ABRs in at least 2 periods of 1–3 months and 11–13 months after ISSNHL onset. Patients were excluded if their hearing returned to normal within a period of 1–3 months. Therefore, a total of 20 patients (9 males and 11 females) were enrolled in the present study. No patient had any evidence of retrocochlear disease on MRI, and patient age ranged from 24 to 71 years (mean \pm SD: 49.2 \pm 11.4 years). Twenty patients (100%) exhibited tinnitus and 13 (65%) suffered from vertigo and/or dizziness at initial presentation. The patients began treatment with systemic corticosteroids, vitamin B₁₂, and adenosine triphosphate within 11 days of onset (1–11 days, mean \pm SD: 4.2 \pm 3.3). Eleven patients received hyperbaric oxygen therapy and 2 received intratympanic dexamethasone injection as salvage treatment. Data obtained after initial and salvage treatments were evaluated.

2.2. Audiological examinations

Pure-tone audiometry and speech audiometry were performed in a soundproof room using an audiometer type AA-71 device (Rion, Tokyo, Japan). On pure-tone audiometry, PTA was calculated from the audiometric thresholds at 4 frequencies (0.5, 1, 2, and 3 kHz), although the mean threshold at 2 and 4 kHz was used to represent the threshold at 3 kHz. If the patient did not respond to the maximum hearing level at a frequency, 5 dB was added to the maximum hearing level. A

decrease of greater than or equal to 10 dB in PTA was defined as indicating a recovery, and a change of less than 10 dB in PTA was considered as no change. The audiometric configurations at the period of 1–3 months included the high-tone type in 13 ears, flat type in 4 ears, low-tone type in 1 ear, middle-tone type in 1 ear, and low- and high-tone types in 1 ear (Supplementary Fig. 1). Regarding speech audiometry, maximum SDS and the intensity at maximum SDS were obtained using the Japanese monosyllabic word list (67-S) developed by the Japan Audiological Society [7]. The word list consisted of 20 Japanese monosyllables (17 consonant syllables and 3 vowel syllables). When an intensity level to a test ear exceeded a bone-conduction threshold at either 0.5, 1, or 2 kHz in a non-test ear by 40 dB or more, a speech-spectrum noise at the intensity level of -40 dB was basically delivered to the non-test ear. An increase of greater than or equal to 10% in the maximum SDS was defined as a recovery, and a change of less than 10% in the maximum SDS was considered as no change. ABR measurements were performed in another soundproof room using an ER-1100 device (GE Marquet, Tokyo, Japan). Alternating polarity clicks at an intensity of 90 dB normal hearing level (nHL) were presented as acoustic stimuli at a frequency of 9.5 Hz. The interpeak latency difference between waves I and V (IPL I–V) and the interaural latency difference of wave V (IT5) were evaluated.

Supplementary Fig. 1 related to this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.anl.2015.12.003>.

2.3. THI

A self-administered test using the Japanese version of THI was used to evaluate the degree of tinnitus handicap. The total THI score and grading scale (grade 1: 0–16, grade 2: 18–36, grade 3: 38–56, grade 4: 58–76, grade 5: 78–100) were assessed as indicators.

2.4. Time periods for analysis

PTA, maximum SDS, and THI scores were compared among the 3 periods of 1–3 months, 6–8 months, and 11–13 months after the onset of ISSNHL, and the data for the ABRs were compared between the two periods of 1–3 months and 11–13 months. The number of patients who underwent each test in each period is shown in Table 1. In the period of 6–8 months, pure-tone audiometry and speech audiometry tests were performed in 20 and 13 patients, respectively. ABRs were performed in all patients in the periods of 1–3 months and 11–13 months, whereas IPL I–V and/or IT5 could not be evaluated in some patients because of the disappearance of wave I and/or wave V. Findings for THI were obtained in 19 patients in the periods of 1–3 months and 11–13 months and 14 patients in the periods of 6–8 months.

2.5. Statistical analysis

Statistical analyses were conducted using the JMP 11.2 (SAS institute, Inc., Cary, NC, USA) running on a Macintosh

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