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Consensus Statements on Tinnitus Treatment: A Delphi Study by the Korean Tinnitus Study Group

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ABSTRACT

Background: Tinnitus is a bothersome condition associated with various mechanisms of action. Although treatment methods vary according to these mechanisms, standardized guidelines would benefit both patients and clinicians. We conducted a Delphi study, a method that collects expert opinions through multiple rounds of questionnaires, to reach a consensus on tinnitus treatment with professional experts.

Methods: A two-round modified Delphi survey was conducted to develop a clinical consensus on tinnitus treatment. The experts scored each statement on a scale of 1 (highest disagreement) to 9 (highest agreement) for their level of agreement on tinnitus treatment. Consensus was defined when 75% or more of the participants scored 7–9, and 15% or less scored 1–3. To ensure reliability of the responses, the content validity ratio and Kendall's coefficient of concordance were evaluated.

Results: Approximately 19 of 31 statements reached a consensus. All 3 statements reached a consensus regarding the candidates for treatment. Regarding treatment, 3 of 8 statements on medication, 2 of 2 statements on tinnitus retraining therapy/cognitive behavioral therapy, and 5 of 7 statements on auditory rehabilitation reached a positive consensus. Although all 6 statements regarding miscellaneous treatment reached a consensus, most were negatively

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Disclosure

The authors have no potential conflicts of interest to disclose.

Author Contributions

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agreed. For treatment with neuromodulation, none of the 5 statements reached a consensus.

Conclusion: The experts reached a high level of consensus on treatment candidates, tinnitus retraining therapy/cognitive behavioral therapy, and auditory rehabilitation in this modified Delphi study. The results of this study can provide beneficial and practical information for clinicians regarding the treatment of tinnitus.

Keywords: Tinnitus; Treatment; Delphi Study

INTRODUCTION

Tinnitus is the awareness of sound without an external source.^{1,2} More than 740 million people are estimated to experience tinnitus, and more than 120 million people worldwide have severe tinnitus.^{3,4} Tinnitus affects sleep, attention, work, and social communication, inducing anxiety and depression.⁵ Severe tinnitus is related with hearing loss and impairs quality of life.³

Considering the high prevalence of tinnitus and its associated symptoms, appropriate treatment is important. Currently, there are no effective medications to treat tinnitus. Possible treatments include hearing aids when hearing loss exists, sound therapy, and counselling.⁶ The treatment of chronic tinnitus remains difficult owing to limited evidence for successful treatments from randomized clinical trials.⁷ In the clinical practice guidelines of tinnitus by the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNSF) in 2014, there were no strong recommendations regarding various treatments such as sound therapy, tinnitus retraining therapy (TRT), cognitive behavioral therapy (CBT), medical therapy, dietary supplements such as Ginkgo biloba, acupuncture, and transcranial magnetic stimulation, indicating a lack of strong evidence based on well-designed randomized controlled trials.¹

In this situation, clinicians must reach an agreement regarding tinnitus treatment. In this study, a 2-round Delphi survey—using questionnaires to gather expert opinions and build a consensus—was conducted with the Korean Tinnitus Study Group, accompanied by a systematic literature review, to establish a consensus on tinnitus treatment among experts in tinnitus management.

METHODS

Study method

The Delphi technique, which was used in this study, is a method utilized to collect opinions on a particular topic. This is based on the premise that pooled intelligence reinforces individual judgments through the collection of expert opinions. In the conventional Delphi technique, the first questionnaire is sent to a group of experts, and the second questionnaire is sent based on the results of the first questionnaire. Subsequent questionnaires can enable refinement of the facts or proposals. A modified Delphi technique is a shorter method where the process is conducted during the course of a meeting, gathering responses immediately.⁸ A 2-round Delphi survey was conducted by an expert panel of otologists to draw a clinical consensus on tinnitus treatment (Fig. 1).

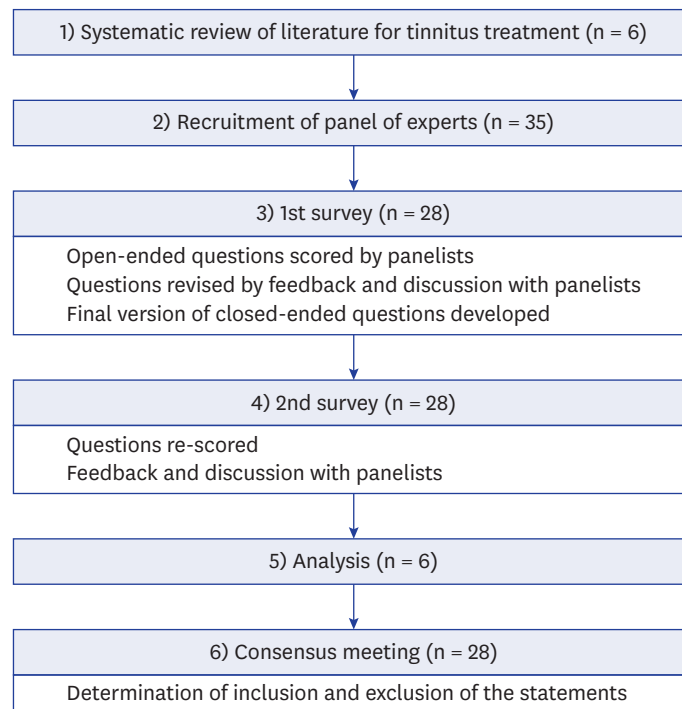


Fig. 1. Process of the Delphi study regarding tinnitus treatment with the number of experts at each stage.

Preliminary systematic review for treatment of tinnitus

Before the Delphi survey, previous studies on tinnitus treatment were comprehensively reviewed to set the statements for the Delphi survey questionnaire. The reviewers examined a total of 2 Cochrane reviews published after 2010, as well as 16 review articles, and 4 randomized controlled studies identified through searches on PubMed.

Recruitment of panelists

Expert otologists in tinnitus in Korea were recruited as panelists for the Delphi survey in 2021. A Delphi survey was conducted between January 2022 and March 2022. First, invitation emails were sent to professional experts (members of the Korean Tinnitus Study Group). The first-round questionnaire of the online Delphi survey was sent to experts who agreed to participate. Only participants who completed Round 1 qualified to participate in Round 2.

The Delphi survey

A 2-round, modified Delphi survey was conducted via email. The survey questions comprised 6 categories: candidates for treatment, medication, TRT/CBT, auditory rehabilitation, neuromodulation, and miscellaneous treatment. The questions were affirmative statements, except for several questions in the miscellaneous treatment category, which were negative. The specific values in the questions were based on the references. Demographic information of the participants, including sex, age range at 10-year intervals, position, and affiliation, was collected. The responses were presented anonymously.

In the first-round survey, 28 experts participated and scored each statement on a scale of 1–9 for the level of agreement on tinnitus treatment based on the Grades of Recommendation, Assessment, Development, and Evaluation guidelines.⁹ Additional explanation of categories for scoring were presented with the survey: 1–3 indicated high disagreement, 4–6 indicated

important but not critical, and 7–9 indicated high agreement. All the participants could provide additional comments or opinions on each statement.

The results of the first-round survey were presented to all participants at an online meeting, and the questions were discussed with additional suggestions and comments from the participants. The questions were modified after discussion and utilized in a second-round survey among the 28 experts who participated in the first-round survey.

Consensus criterion

Consensus criteria were established after an online meeting. Recommendations for the inclusion of statements were defined when 75% or more of the participants scored 7–9 (indicating agreement), and 15% or less scored 1–3 (indicating disagreement). In contrast, a recommendation for the exclusion of statements was defined when 75% or more of the participants scored 1–3, and 15% or less scored 7–9.

Level of agreement

To ensure that the responses to the 2-round modified Delphi survey were reliable, the content validity ratio (CVR) and Kendall's coefficient of concordance (W) were evaluated. A significant level of agreement was obtained when the CVR was ≥ 0.37 ($P < 0.05$). The value of W ranges from 0 to 1, and an approximation of a value closer to 1 indicates greater convergence in opinion. W of 0.9 indicates unusually strong agreement; 0.7 indicates strong agreement; 0.5 indicates moderate agreement; 0.3 indicates weak agreement; and 0.1 indicates very weak agreement with no confidence in ranks.¹⁰

RESULTS

A Delphi survey was conducted from January 2022 to March 2022 with 28 experts. Participants included 2 otologists from primary clinics and 26 from secondary or tertiary institutions. All participants had completed a fellowship in otology and had at least 10 years of experience in their expertise. The first round of the online survey included 38 statements regarding tinnitus treatment candidates and methods for tinnitus treatment. After the first-round online survey, the participants attended an online meeting to discuss and modify their statements. Similar statements were combined, and duplicated or unnecessary statements were removed, resulting in 31 statements being used for the second-round survey (Table 1).

In the second-round Delphi survey, 19 of the 31 statements reached a consensus. Regarding the candidates for treatment, Statement 1-1, *Patients with tinnitus lasting 5 min or more on most days are candidates for treatment*; Statement 1-2, *Patients with unilateral tinnitus accompanied by ipsilesional hearing loss are candidates for treatment*; and Statement 1-3, *Patients with tinnitus accompanied by dizziness are candidates for treatment*, met the criteria of consensus. Regarding treatment with medication, Statement 2-3, *Steroids are effective for acute tinnitus with sudden hearing loss*; Statement 2-6, *Antidepressants and anxiolytics are effective for depression and anxiety in patients with subjective chronic tinnitus*; and Statement 2-8, *Carbamazepines are effective for typewriter's tinnitus*, met the criteria of consensus. Regarding TRT and CBT, Statement 3-1, *Tinnitus retraining therapy is effective for subjective chronic tinnitus*; and Statement 3-2, *Cognitive behavioral therapy is effective for subjective chronic tinnitus*, satisfied the criteria of consensus. Regarding auditory rehabilitation, Statement 4-1, *Hearing aids are effective for subjective chronic tinnitus with hearing loss*; Statement 4-2, *Sound therapy with sound generator is effective for subjective chronic tinnitus*;

Table 1. Results of the second-round Delphi survey for tinnitus treatment

Number		Statement	Reference	Degree of agreement (percent)		
				7–9 (agreement)	4–6	1–3 (disagreement)
Candidate for treatment						
1-1	Patients with tinnitus lasting 5 minutes or more on most days are candidates for treatment ^b	1,2	92.8	3.6	3.6	
1-2	Patients with unilateral tinnitus accompanied by ipsilesional hearing loss are candidates for treatment ^b	1	96.4	3.6	0	
1-3	Patients with tinnitus accompanied by dizziness are candidates for treatment ^b	1	89.3	10.7	0	
Medication						
2-1	Oral steroids are effective for acute tinnitus within 4 weeks	13	57.1 (46.4) ^a	35.7	7.1	
2-2	Intratympanic steroid injection is effective for acute tinnitus within 4 weeks	11,14,15	60.7 (42.9) ^a	32.1	7.1	
2-3	Steroids are effective for acute tinnitus with sudden hearing loss ^b	12	100.0	0	0	
2-4	Ginkgo biloba is effective for subjective chronic tinnitus	15,16,19	17.9	57.1	25.0	
2-5	Acamprosate, which is a glutamate antagonist, is effective for subjective chronic tinnitus	15,16	7.1	57.1	35.7	
2-6	Antidepressants and anxiolytics are effective for depression and anxiety in patients with subjective chronic tinnitus ^b	1,7,16	100.0	0	0	
2-7	Carbamazepines are effective for myoclonal tinnitus	18	67.9	32.1	0	
2-8	Carbamazepines are effective for typewriter's tinnitus ^b	7,17	100.0 (96.4) ^a	0	0	
Tinnitus retraining therapy and cognitive behavioral therapy						
3-1	Tinnitus retraining therapy is effective for subjective chronic tinnitus ^b	5	92.9	7.1	0	
3-2	Cognitive behavioral therapy is effective for subjective chronic tinnitus ^b	1,16	89.3	10.7	0	
Auditory rehabilitation						
4-1	Hearing aids are effective for subjective chronic tinnitus with hearing loss ^b	1,21	100.0	0	0	
4-2	Sound therapy with sound generator is effective for subjective chronic tinnitus ^b	20	85.7	14.3	0	
4-3	Cochlear implantation is effective for subjective chronic tinnitus in patients with severe-to-profound hearing loss ^b	22	96.4	3.6	0	
4-4	Middle ear implantation is effective for subjective chronic tinnitus in patients with moderate-to-moderately severe hearing loss ^b	23	78.6 (75.0) ^a	21.4	0	
4-5	Bone anchored hearing aids implantation is effective for subjective chronic tinnitus in patients with ipsilesional severe-to-profound hearing loss	26,27	39.3 (35.7) ^a	53.6	7.1	
4-6	Contralateral routing of signal hearing aids is effective for subjective chronic tinnitus in patients with ipsilesional severe-to-profound hearing loss	28	35.7	46.4	17.9	
4-7	Sound therapy with sound generator is effective for tinnitus with hyperacusis ^b	24,25	75.0	25.0	0	
Neuromodulation						
5-1	Repetitive transcranial magnetic stimulation is effective for tinnitus	1	46.4	50.0	3.5	
5-2	Transcutaneous electrical nerve stimulation is effective for tinnitus	31	17.9	75.0	7.1	
5-3	Transcutaneous vagus nerve stimulation is effective for tinnitus	29	21.4	75.0	3.6	
5-4	Transcranial direct current stimulation is effective for tinnitus	30	28.6	67.9	3.6	
5-5	Transcranial random noise stimulation is effective for tinnitus	32	25.0	64.3	10.7	
Miscellaneous treatment						
6-1	Hyperbaric oxygen therapy is ineffective for chronic tinnitus ^b	15	85.7	10.7	3.6	
6-2	Acupuncture is ineffective for tinnitus ^b	1,15,16,33	96.4	0	3.6	
6-3	Device using sound conditioning is ineffective ^b	34	85.7	14.3	0	
6-4	Moxibustion in the ear is ineffective ^b	35	96.4	0	3.6	
6-5	Smartphone applications and internet-based platforms for sound therapy, counselling, and education are effective for chronic tinnitus ^b	36,37	82.1	17.9	0	
6-6	Physical therapy of cervical spine or temporomandibular joint is effective for somatic tinnitus caused by cervical spine or temporomandibular joint disorders ^b	15	89.3	10.7	0	

^aThe percent of agreement after excluding participants who were authors of the respective references.

^bStatements that reached a consensus.

Statement 4-3, *Cochlear implantation is effective for subjective chronic tinnitus in patients with severe-to-profound hearing loss*; Statement 4-4, *Middle ear implantation is effective for subjective chronic tinnitus in patients with moderate-to-moderately severe hearing loss*; and Statement 4-7, *Sound therapy with sound generator is effective for tinnitus with hyperacusis*, fulfilled the criteria of consensus. No statement regarding neuromodulation met the consensus criteria. Regarding miscellaneous treatment, Statement 6-1, *Hyperbaric oxygen therapy is ineffective for chronic tinnitus*; Statement 6-2, *Acupuncture is ineffective for tinnitus*; Statement 6-3, *Device using sound conditioning is ineffective*; Statement 6-4, *Moxibustion in the ear is ineffective*; Statement 6-5, *Smartphone applications and internet-based*

Table 2. Statements of inclusion criteria for treatment of tinnitus

Number	Statement	Mean $\pm$ SD	CVR
Candidate for treatment			
1-1	Patients with tinnitus lasting 5 minutes or more on most days are candidates for treatment	7.9 $\pm$ 1.5	0.857
1-2	Patients with unilateral tinnitus accompanied by ipsilesional hearing loss are candidates for treatment	8.4 $\pm$ 0.8	0.929
1-3	Patients with tinnitus accompanied by dizziness are candidates for treatment	8.0 $\pm$ 1.4	0.786
Medication			
2-3	Steroids are effective for acute tinnitus with sudden hearing loss	8.2 $\pm$ 0.8	1.000
2-6	Antidepressants and anxiolytics are effective for depression and anxiety in patients with subjective chronic tinnitus	7.7 $\pm$ 0.7	1.000
2-8	Carbamazepines are effective for typewriter's tinnitus	8.1 $\pm$ 0.8	1.000
Tinnitus retraining therapy and cognitive behavioral therapy			
3-1	Tinnitus retraining therapy is effective for subjective chronic tinnitus	7.9 $\pm$ 1.0	0.857
3-2	Cognitive behavioral therapy is effective for subjective chronic tinnitus	7.7 $\pm$ 1.2	0.786
Auditory rehabilitation			
4-1	Hearing aids are effective for subjective chronic tinnitus with hearing loss	8.4 $\pm$ 0.7	1.000
4-2	Sound therapy with sound generator is effective for subjective chronic tinnitus	7.5 $\pm$ 1.0	0.714
4-3	Cochlear implantation is effective for subjective chronic tinnitus in patients with severe-to-profound hearing loss	8.0 $\pm$ 0.9	0.929
4-4	Middle ear implantation is effective for subjective chronic tinnitus in patients with moderate-to-moderately severe hearing loss	7.3 $\pm$ 1.2	0.571
4-7	Sound therapy with sound generator is effective for tinnitus with hyperacusis	7.1 $\pm$ 1.2	0.500
Miscellaneous treatment			
6-1	Hyperbaric oxygen therapy is ineffective for chronic tinnitus	7.4 $\pm$ 1.5	0.714
6-2	Acupuncture is ineffective for tinnitus	8.2 $\pm$ 1.6	0.929
6-3	Device using sound conditioning is ineffective	8.1 $\pm$ 1.3	0.714
6-4	Moxibustion in the ear is ineffective	8.5 $\pm$ 1.6	0.929
6-5	Smartphone applications and internet-based platforms for sound therapy, counselling, and education are effective for chronic tinnitus	7.2 $\pm$ 1.0	0.643
6-6	Physical therapy of cervical spine or temporomandibular joint is effective for somatic tinnitus caused by cervical spine or temporomandibular joint disorders	7.2 $\pm$ 1.1	0.786

SD = standard deviation, CVR = content validity ratio.

platforms for sound therapy, counselling, and education are effective for chronic tinnitus; and Statement 6-6, *Physical therapy of cervical spine or temporomandibular joint is effective for somatic tinnitus caused by cervical spine or temporomandibular joint disorders*, met the criteria of consensus (Table 2).

The overall value of the W was 0.476, which indicated weak agreement among the participants and was the highest in the statements regarding medication ($W = 0.635$) and lowest in the statements regarding neuromodulation ($W = 0.094$) (Table 3).

DISCUSSION

In this study, more than half of the statements regarding tinnitus treatment were agreed upon by experts in Korea. In particular, most statements belonging to the categories of candidates for treatment, TRT/CBT, and auditory rehabilitation were positively agreed upon. Moreover, those belonging to the categories of miscellaneous treatment were negatively correlated.

Table 3. Level of agreement on the statements about treatment of tinnitus using W

Category	W
Overall	0.476
Candidate for treatment	0.107
Medication	0.635
Tinnitus retraining therapy and cognitive behavioral therapy	0.107
Auditory rehabilitation	0.534
Neuromodulation	0.094
Miscellaneous treatment	0.373

W = Kendall's coefficient of concordance.

Clinicians should decide which patients with tinnitus are suitable candidates for tinnitus treatment. The AAO-HNSF recommends that patients with tinnitus that is unilateral and persistent for 6 months or longer or associated with hearing loss should be assessed with prompt and comprehensive audiologic examination. Unilateral tinnitus may indicate vascular lesion or vestibular schwannoma, except in patients with a known history of trauma or surgery involving the affected ear.¹ The etiology and pathology of acute subjective idiopathic tinnitus are often associated with sudden sensorineural hearing loss.¹¹ Patients with tinnitus and a history of vertigo or other balance malfunction may have cochlear, retrocochlear, or other central nervous system disorder, such as Meniere's disease, superior canal dehiscence, or vestibular schwannoma.¹

Several experts agree that steroids are effective in treating acute tinnitus with sudden hearing loss. However, regarding the effectiveness of oral or intratympanic steroids for acute tinnitus, significant agreement was not obtained among experts. In the AAO-HNSF clinical practice guidelines for sudden hearing loss (2019), corticosteroids are an option as initial therapy to patients with sudden sensorineural hearing loss within 2 weeks of symptom onset.¹² Furthermore, low dose oral steroids and ginkgo biloba have been reported to provide early subjective improvement of tinnitus up to 12 weeks in patients with acute idiopathic tinnitus with normal hearing.¹³ Intratympanic dexamethasone injections combined with oral alprazolam have shown greater efficacy in treating subjective idiopathic tinnitus within 3 months compared to alprazolam alone.¹¹ However, a prospective randomized controlled study found that intratympanic dexamethasone injections were not more effective than intratympanic normal saline injection was.¹⁴ Furthermore, there was no significant change in the severity of tinnitus distress in patients treated intratympanically with either methylprednisolone or dexamethasone compared with controls treated intratympanically with saline.¹⁵

For depression and anxiety in patients with subjective chronic tinnitus, evidence is insufficient to support the effectiveness of benzodiazepines and antidepressants.¹⁶ The AAO-HNSF clinical practice guidelines advise against the routine use of antidepressants and anxiolytics for the primary treatment of persistent bothersome tinnitus.¹ However, while antidepressants may not directly affect tinnitus, they may help alleviate comorbid depressive or anxiety disorders.⁷ In several randomized controlled trials included in the AAO-HNSF clinical practice guidelines, tricyclic antidepressants showed modest improvement of tinnitus. However, these effects may be linked to alleviating depression and anxiety rather than with altering the characteristics or intensity of tinnitus.¹ Although benzodiazepines may have some benefits for tinnitus, their routine use is not recommended for tinnitus treatment due to adverse effects.⁷ In the present survey, experts agreed that antidepressants and anxiolytics are effective for managing depression and anxiety in patients with subjective chronic tinnitus. This agreement pertains to the impact of medications on depression and anxiety symptoms, not on tinnitus itself.

Typewriter's tinnitus is characterized by unilateral paroxysmal attacks of tinnitus, which sounds like a typewriter with intermittent tinnitus-free intervals. Neurovascular compression of the cochlear nerve by the loop of the anterior inferior cerebellar artery causes typewriter's tinnitus.¹⁷ Carbamazepine may be effective in patients with typewriter's tinnitus.⁷ Reportedly, carbamazepine, clonazepam, and baclofen were effective in more than 75% of patients with middle ear myoclonus.¹⁸ However, experts agreed on the effectiveness of carbamazepine for typewriter's tinnitus but not for myoclonal tinnitus in the present study.

For other medications, limited evidence supports the effectiveness of Ginkgo biloba for tinnitus as a primary complaint.¹⁹ Although several studies reported improvements in tinnitus with acamprosate, which is a glutamate antagonist, these studies lack adequate evidence due to low methodological quality and insufficient sample sizes.¹⁵

In a meta-analysis and systematic review, TRT was effective for the treatment of tinnitus, improving response rates and decreasing the tinnitus handicapped index scale, despite limited studies with low-quality evidence and a high risk of bias.⁵ Although CBT may not be more effective than placebo in improving tinnitus loudness, it can improve overall tinnitus symptoms at 12 months. CBT may be more effective in improving depression, anxiety, quality of life, and annoyance scores in patients with tinnitus.¹⁶ The AAO-HNSF clinical practice guidelines recommend CBT for patients with persistent bothersome tinnitus.¹

In a Cochrane review of sound therapy for tinnitus, there was no evidence for the superiority of sound therapy compared with waiting, placebo, or education with no device for tinnitus. In addition, there was insufficient evidence of the superiority or inferiority of sound therapy options, such as hearing aids, sound generators, or a combination of both, over each other.²⁰ In contrast, acoustic therapy using hearing aids was reported to be effective for patients with both hearing loss and tinnitus.²¹ In the clinical practice guidelines by AAO-HNSF, hearing aid evaluation for patients with hearing loss and persistent bothersome tinnitus was recommended, whereas sound therapy for patients with persistent bothersome tinnitus was an option.¹ In the present study, experts agreed on the effect of hearing aids for subjective chronic tinnitus with hearing loss and that of sound therapy with sound generator for subjective chronic tinnitus.

In a meta-analysis of the effect of cochlear implantation on tinnitus, patients with preoperative tinnitus showed improvement after either unilateral or bilateral cochlear implantation.²² Reportedly, patients with unilateral tinnitus who had moderate to severe hearing loss may have improved tinnitus after middle ear implantation as cochlear implantation.²³ Few patients with tinnitus and hyperacusis have complete remission unless the underlying hearing loss is treated with hearing aids or implants. The treatment of hearing loss increases the treatment success rate of tinnitus and hyperacusis.²⁴ Certain forms of sound therapy can reduce auditory gain and increase loudness tolerance in hyperacusis and tinnitus.²⁵

The effects of bone anchored hearing aids (BAHA) on tinnitus reduction remain controversial. There was no significant difference in tinnitus reduction before and after BAHA implantation.²⁶ In contrast, BAHA had an effect on tinnitus in patients with unilateral sensorineural hearing loss.²⁷ Bilateral contralateral routing of signal (biCROS) with the amplification of the poorer ear, which was StereoBiCROS or TriCROS, was reported to reduce tinnitus handicap and loudness in tinnitus patients with asymmetrical hearing loss or single-sided deafness.²⁸ However, studies on the effect of BAHA or CROS have been insufficient.

The effects of treatment with neuromodulation, including repetitive transcranial magnetic stimulation (rTMS), transcutaneous electrical nerve stimulation (TENS), transcutaneous vagus nerve stimulation (tVNS), transcranial direct current stimulation (tDCS), and transcranial random noise stimulation (tRNS), were not agreed upon by experts in the present study. In the clinical practice guidelines by AAO-HNSF, the routine treatment using rTMS was not recommended in patients with persistent bothersome tinnitus.¹ The effect of tVNS on tinnitus was reportedly unclear, considering the methodological limitations and

low quality of previous studies in a systematic review.²⁹ The effect of tDCS on tinnitus is variable depending on the methods and has not been verified.³⁰ In contrast, several studies have reported the effect of neuromodulation on tinnitus. As reported in a systematic review and meta-analysis, TENS is a safe and feasible treatment option.³¹ Both single session and repetitive tRNSs have a significant effect on tinnitus.³² Studies on the effect of these new treatments have been reported recently. However, these treatments are not administered commonly. Thus, it seems that the participants in this study did not confidently agree on their effects.

The benefit of hyperbaric oxygen for chronic tinnitus treatment was not verified in a systematic review.¹⁵ As per another systematic review, the number and quality of the randomized controlled studies on the effectiveness of acupuncture for the treatment of tinnitus were insufficient for definitive conclusions.³³ Acupuncture was not recommended in patients with persistent bothersome tinnitus in the clinical practice guidelines of AAO-HNSF.¹ Cochlea can actively adapt to certain high-level sounds by exposure-experience training or sound conditioning, thereby allowing pre-exposure training using a moderate-level sound stimulus and eventually exceeding exposure stimulus.³⁴ Reportedly, moxibustion acupuncture may be a better treatment among different acupuncture methods.³⁵ However, the effect of these alternative treatments for tinnitus has not been verified through randomized controlled trials. Thus, in the present survey, the effectiveness of these treatments was not confirmed.

A systematic review reported that both internet- or smartphone-based treatment and traditional treatment such as TRT, CBT, and acceptance and commitment therapy showed similar improvements of tinnitus distress and quality of life.³⁶ Internet-based CBT for tinnitus was reported to have effects on tinnitus distress and symptoms.³⁷ When the tinnitus is induced by head or neck movements, physical therapy of the cervical spine may be considered although relevant large controlled studies are insufficient.¹⁵ In the era of internet and smartphones, many experts agreed on the effectiveness of treatments based on these. In addition, experts agree on physical therapy for tinnitus induced by cervical spine or temporomandibular joint disorders.

This study used the Delphi technique to collect expert opinions on the treatment of tinnitus. Mainly, this study aimed to develop a reliable consensus on tinnitus treatment among Korean professional experts. Some agreed that statements about specific treatments may not be in accordance with the results of previous studies. However, the present study reflected the experts' confidence and feasibility of the treatments in the clinical field rather than the evidence of the treatments in this Delphi study. A consensus was reached only among the members of a single research group in Korea, and it may have been influenced by the country's healthcare system or the study group's guidelines. However, since there are no restrictions on tinnitus treatment in Korea, nor established guidelines for such treatment to date, the impact of these factors was minimal. Therefore, the fact that the participants were members of a single study group is not a limitation.

Several statements regarding the treatment of tinnitus were agreed upon with a high level of consensus among experts in Korea in a modified Delphi study. These agreements can provide valuable data for further studies on tinnitus treatment and the development of clinical practice guidelines. The results of this study can provide beneficial and practical information for clinicians regarding the treatment of tinnitus.

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