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RESEARCH

EFFECTS OF HEARING AIDS ON TINNITUS IN GERIATRIC PATIENTS WITH AGE-RELATED HEARING LOSS

Aydın ACAR[1]
Hasan ŞAHİN[2]
Rauf Oğuzhan KUM[1]
Zeynel ÖZTÜRK[3]
Melih ÇAYÖNÜ[4]
Fulya EKER[1]
Celil GÖÇER[5]

ABSTRACT

Introduction: The aim of this study was to evaluate the effects of hearing aids on tinnitus in elderly patients with presbycusis using the Tinnitus Handicap Inventory.

Materials and Method: Twenty-four elderly patients who were diagnosed with presbycusis and subjective tinnitus between September 2013 and January 2014 were included in this study. The tinnitus handicap inventory questionnaire was completed before a hearing aid was prescribed and then 3 months after using the hearing aid. The effects of the use of hearing aid on tinnitus were assessed by comparing the scores.

Results: A total of 24 patients, 10 females and 14 males were included in the study. Their ages ranged from 65 to 74 years, with a mean of 67.04±2.95. With respect to tinnitus handicap inventory scores, before using hearing aid the mean score was 60.08±11.86, and after 3 months it decreased to 42.33±13.48. This difference was found to be highly significant (p=0.001). For all degrees of hearing loss, the decrease in patients' tinnitus handicap inventory scores after the use of hearing aid was found to be statistically significant (26-40 dB; p=0.007, 41-55 dB; p = 0.018, ≥56 dB; p=0.011).

Conclusion: Among elderly patients with tinnitus and presbycusis, a significant difference was observed in the severity of tinnitus after 3 months of hearing aid use. The results of this study confirm the effectiveness and benefit of fitting hearing aids for tinnitus in elderly patients with presbycusis.

Key Words: Aged; Hearing Aids; Tinnitus; Presbycusis.

ARAŞTIRMA

YAŞA BAĞLI İŞİTME KAYBI OLAN GERİATRİK HASTALARDA İŞİTME CİHAZI KULLANIMININ TİNNİTUS ÜZERİNE OLAN ETKİLERİ

ÖZ

Giriş: Bu çalışmanın amacı yaşa bağlı işitme kaybı olan geriatrik hastalarda işitme cihazı kullanımının tinnitus üzerine olan etkilerini tinnitus engellilik anketi ile araştırmaktır.

Gereç ve Yöntem: Çalışmaya Eylül 2013 Ocak 2014 tarihleri arasında presbiakuzi ve subjektif tinnitus tanısı alan 24 yaşlı hasta alındı. Çalışma prospektif olarak tasarlandı. İşitme cihazı verilmeden önce ve cihaz verildikten 3 ay sonra tinnitus engellilik anketi uygulandı ve sonuçlar karşılaştırıldı. İşitme cihazının tinnitus üzerine olan etkileri araştırıldı.

Bulgular: Çalışmaya katılan hasta sayısı, 10'u kadın ve 14'ü erkek olmak üzere toplam 24 kişidir. Hastaların ortalama yaşı 65-74 aralığında olmak üzere 67,04±2,95 yıldı. İşitme cihazı kullanmadan önce tinnitus engellilik anketi skor ortalaması 60,08±11,86 (aralık 40-80) idi ve işitme cihazı kullandıktan sonra tinnitus engellilik anketi skor ortalaması 42,33±13,48 (aralık 20-66) ye düştü. Tinnitus engellilik anketi skorundaki 17,75 birimlik düşüş, diğer bir ifadeyle düzelme istatiksel olarak ileri derecede anlamlı bulundu (p=0,001). İşitme kaybı derecesine göre işitme cihazı kullandıktan sonra tinnitus engellilik anketi skorlarındaki düşüş istatiksel olarak anlamlı bulundu (26-40 dB; p=0,007, 41-55 dB; p=0,018, ≥ 56 dB; p=0,011).

Sonuç: Tinnitus ve presbiakuzisi olan yaşlı hastalarda 3 ay işitme cihazı kullanımı sonrası tinnitusun olumsuz etkilerinde belirgin azalma izlendi. Bu çalışmanın sonuçları presbiakuzisi olan yaşlı hastalarda işitme cihazı kullanımının tinnitus üzerine etkinliğini kanıtlamıştır. Tinnitus ve işitme kaybı şikayeti olan yaşlı hastalar işitme cihazından fayda görebilir.

Anahtar Sözcükler: Yaşlı; İşitme Cihazı; Tinnitus; Presbiakuzi.

İletişim *(Correspondance)*

Aydın ACAR
Ankara Numune Eğitim ve Araştırma Hastanesi, Kulak Burun Boğaz Kliniği ANKARA

Tlf: 0532 431 36 21
e-posta: acaraydin66@gmail.com

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[1] Ankara Numune Eğitim ve Araştırma Hastanesi, Kulak Burun Boğaz Kliniği ANKARA
[2] Ankara Numune Eğitim ve Araştırma Hastanesi, Odyoloji, Kliniği ANKARA
[3] Nişantaşı Üniversitesi Meslek Yüksekokulu, Odyoloji Kliniği İSTANBUL
[4] Amasya Üniversitesi Tıp Fakültesi, Kulak Burun Boğaz Anabilim Dalı AMASYA
[5] Lokman Hekim Sincan Hastanesi, Kulak Burun Boğaz Kliniği ANKARA

Introduction

Tinnitus describes the perception of an auditory sensation in the absence of a corresponding external stimulus; it is experienced by approximately 10% of adults in various countries (1). There are several causes of tinnitus, and presbycusis underlies the majority of tinnitus cases (2). Presbycusis can be defined as the hearing loss associated with aging, reflecting the loss of auditory sensitivity.

With improvements in quality of life (QoL) and health care, aging of the population has become a worldwide reality, and therefore presbycusis is increasing and is quite common in the elderly population. Presbycusis and tinnitus not only cause auditory problems, but also affect QoL. Due to the frequent co-existence of tinnitus and hearing loss in the elderly population, there is a need to understand its causes in order to improve prevention and develop appropriate treatments (3,4).

Surgical or medical treatment may be an option for some patients, but there is no certain treatment modality for an individual with hearing loss and tinnitus, so hearing aids (HA) are commonly used for tinnitus management and to help these patients increase their QoL (5).

Several health questionnaires are available that assess the effects of tinnitus, of which the Tinnitus Handicap Inventory (THI) is the most commonly used (6).

The aim of the present study was to evaluate the effects of hearing aids on tinnitus in elderly patients with presbycusis, using the THI.

Materials and Method

Between September 2013 and January 2014, a total of 24 patients who were diagnosed with tinnitus and bilateral symmetrical or asymmetrical sensorineural hearing loss, or mixed hearing loss with sensorineural dominance, through audiometric tests were included in this study. This study was designed prospectively. All patients in this study had sufficient hearing loss to warrant the use of HA, but their primary presenting complaint was tinnitus, rather than hearing loss. All of the patients had had subjective tinnitus for at least 1 year. Patients were not allowed to begin any new medication or other treatments during the study that might have altered progress in either a positive or negative direction. None of the patients had used an HA before. All of the participants were over the age of 65 years. All of them were otherwise healthy and were examined by the same audiologist, and similar hearing aids were recommended to all. The HA was given to the ear with a better speech discrimination score (SDS). In cases of the same SDS scores with both ears, the HA was given to the ear that had a greater conductive hearing loss component. Patients who were diagnosed with Ménière's disease or otosclerosis, or who had objective tinnitus or any mental, neurological, or psychological pathology, were excluded from the study. Twenty-seven patients were enrolled, with 24 completing the study. One patient died during the study, one patient lost his HA and the other patient did not want to continue the study. These patients were excluded from the data analysis.

Patients with average hearing loss had more than a 30 dB loss. Pure-tone audiometric (PTA) evaluation was performed using an AC-40 clinical audiometer (Inter acoustics, Denmark). The SDS test was done using monosyllable phonetically balanced word lists (FD-300). In the audiometric tests, PTA thresholds at 500, 1000, 2000 and 4000 Hz frequencies, and an HA fitting process were applied. The patients were divided into 3 groups (26-40 dB, 41-55 dB and ≥ 56 dB) according to degree of hearing loss (7).

Subjective tinnitus severity was assessed using a standardized outcome measure, the validated Turkish version of the THI (8). The THI is a scale consisting of 25 items requiring an answer of yes (4 points), sometimes (2 points), or no (0 point). Thus, scoring can range from 0 to 100 points. In the original definition, THI scores of 18–36 correspond to "mild handicap", THI scores of 38–56 correspond to "moderate handicap", THI scores of 58–76 correspond to "severe handicap", and THI scores of 78–100 correspond to "catastrophic handicap"(9). The THI questionnaire was completed before an HA was prescribed and also 3 months after using the hearing aid, and the scores were compared to assess the effects of use of HA on tinnitus.

The study was approved by the Local Ethical Committee, No: 2013/691. All participants gave their informed consent prior to their inclusion in the study.

For the statistical analysis, NCSS (Number Cruncher Statistical System) 2007&PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) programs were used. Descriptive statistical used were mean, standard deviation, median, frequency, ratio, minimum, and maximum. To compare quantitative data and two groups of parameters that did not show a normal distribution, the Mann Whitney U test was used; to compare three or more groups the Kruskal-Wallis test was used, and to detect the source of differences between groups the Mann Whitney U test was used. The Paired Sample T test was used for within-group comparisons of

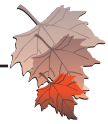

Table 1— Demographic and Descriptive Characteristics of the Patients.

	Min-Max	Mean±sd
Age (years)	65-74	67.04 ± 2.95
Level of Hearing Loss (dB)	34-64	46.79 ± 8.85
		n
Gender	Male	14
	Female	10
Degree of Hearing Loss (dB)	26-40	9
	41-55	7
	≥ 56	8

normally distributed variables, and the Wilcoxon Signed Ranks test for parameters that do not show a normal distribution. The significance level was set at $p<0.01$ for the Wilcoxon Signed Ranks test and paired sample t tests, and at $p<0.05$ for the Mann Whitney U test.

Results

A total of 24 patients, 10 females and 14 males were included in the study. Their age ranged from 65 to 74 years, with a mean of 67.04±2.95 years. General group characteristics and demographic results are given in Table 1. The patients were divided into 3 groups according to their degree of hearing loss: for 26-40 dB, n=9; for 41-55 dB, n=7; for ≥56 dB, n=8. The average degree of hearing loss, averaged over both ears, was 46.79±8.85 dB (range 34-64). With respect to THI scores, before using HA the mean score was 60.08±11.86 (range 40-80), and after 3 months it decreased to 42.33±13.48 (range 20-66). The decrease in THI scores after the use of HA was 17.75 units, which was highly statistically significant (p=0.001) (Table 2).

Though many of the patients localized their tinnitus bilaterally (20 patients), it was localized on the left side in 2 patients and on the right side in 2 patients.

Differences in THI scores before the use of HA varied significantly according to the degree of hearing loss ($p = 0.002$) (Table 3). According to the paired comparisons, the THI scores of patients with a hearing loss ≥ 56 dB were significantly higher than those of patients with a hearing loss of 26-40 dB and 41-55 dB ($p = 0.001$, $p = 0.019$, respectively). There was no significant difference in THI scores between patients with hearing losses of 26-40 dB and 41-55 dB before the use of HA ($p = 0.099$).

Differences in THI scores after the use of HA varied significantly according to the degree of hearing loss ($p=0.001$) (Table 3). According to the paired comparisons, the THI scores of patients with a hearing loss ≥ 56 dB were significantly higher than those of patients with a hearing loss 26-40 dB and 41-55 dB ($p=0.001$, $p = 0.015$, respectively). There was no significant difference in THI scores between patients with hearing losses 26-40 dB and 41-55 dB, after the use of HA ($p = 0.210$).

According to the degree of hearing loss, the decrease in THI scores of patients after the use of HA was found to be statistically significant (26-40 dB, $p=0.007$; 41-55 dB, $p=0.018$; ≥ 56 dB, $p=0.011$) (Table 3).

There was no statistically significant difference between the degree of hearing loss groups (26-40 dB, 41-55 dB, ≥ 56 dB) in THI score changes after the use of HA ($p=0.538$) (Table 3).

There was no statistically significant difference between male and female patients with respect to THI score changes after the use of HA ($p=0.461$).

Discussion

The main findings of this study were that use of HAs for three months led to a significant reduction in tinnitus handicap as measured by the THI, and that HAs can significantly reduce the negative impact of tinnitus on QoL.

Table 2— Assessment of Tinnitus Handicap Inventory (THI) Scores.

		Before Hearing Aid (n=24)	After Hearing Aid (n=24)	p
THI Scores	**18-36 (Mild handicap)**	–	11	
	38-56 (Moderate handicap)	9	8	
	58-100 (Severe handicap)	15	5	
	Min-Max	40-80	20-66	**0.001****
	Mean±sd	60.08 ± 11.86	42.33 ± 13.48	

Paired Sample t Test, **p<0.01.

Table 3— Assessment of Tinnitus Handicap Inventory (THI) Scores According to Degree of Hearing Loss.

		Degree of Hearing Loss			
		26-40 dB (n=9) Mean±sd (Median)	41-55 dB (n=7) Mean±sd (Median)	≥56 dB (n=8) Mean±sd (Median)	[a]p
THI Scores	Before Hearing Aid	50.89±8.55 (48.0)	58.86±9.99 (64.0)	71.50±5.83 (72.0)	**0.002****
	After Hearing Aid	32.22±4.94 (34.0)	39.71±13.03 (44.0)	56.00±8.48 (58.0)	**0.001****
	[b]p	**0.007****	**0.018***	**0.011***	
THI Scores Changes		18.67±7.42 (24.0)	19.14±7.47 (22.0)	15.50±7.15 (14.0)	**0.538**

[a]Kruskal Wallis Test, [b]Wilcoxon Signed Ranks Test, **p<0.01, *p<0.05.

Sensorineural hearing loss and tinnitus in elderly patients result from similar pathological processes (degeneration of nerve fibers in the cochlear ganglion and the cochlear nuclei, atrophy of hair cells in the organ of Corti, impaired blood supply of the spiral ligament and the vascular stripe, atrophy of the spiral ligament and rupture of the cochlear duct) (10). The relationship between tinnitus and hearing loss has been previously demonstrated (11). Some 11% of patients with presbycusis complain of annoying tinnitus (12) and many patients with chronic tinnitus show at least some degree of hearing loss (13). Tinnitus and presbycusis are considered to begin at age 45-55 years, reaching a peak in the mid-60s (14). Tinnitus and presbycusis are difficult therapeutic problems for patients. Tinnitus usually occurs in the poorer hearing ear, and these patients have a significant reduction in communication skills (14). Tinnitus symptoms create distress and negatively affect the quality of life in approximately 4% of the population (15).

Several management procedures have demonstrated relief for tinnitus sufferers, such as HAs (16), tinnitus retraining therapy (17), masking with acoustic stimulation (15) and neuromonics acoustic desensitization (18).

A number of studies have demonstrated relief provided by amplification, and HAs are widely used as part of the clinical treatment of tinnitus (4,11,19). HAs may affect tinnitus audibility through many mechanisms such as auditory signals that can mask or mingle with tinnitus, making it less perceptible, reducing attention towards hearing loss and tinnitus which in turn reduces associated stress and down-regulating central gain by increasing auditory nerve activity (20).

The THI is a reliable test, used to determine the severity of symptoms in patients with tinnitus and for patient follow-up (17). In a recent review of the role of HAs for tinnitus, measures used in the studies included the THI, Tinnitus Handicap Questionnaire and others. The analysis found that a large number of studies support the use of HAs although many of them provide a low level of evidence for the benefits of HA use for tinnitus (4). Surr et al. administered the THI prior to and after the HA fitting and demonstrated a statistically significant reduction in THI scores six weeks post-fitting, stating that some 90% of tinnitus patients may benefit from HA amplification (21). A recent study compared HA use to sound generator use, and the estimated effect on change in tinnitus loudness or severity as measured by the THI score was compatible with benefits for both HAs and sound generators, but no significant difference was found between the two treatments (22). In our study, the mean THI score decreased (improved) from 60.08 to 42.33 after 3 months of using an HA (Table 2). Although a recent study reported that if an HA is programmed for tinnitus it is more beneficial for patients who suffer from tinnitus (23), in our study, HAs were programmed for presbycusis rather than tinnitus and an appropriate improvement was detected in tinnitus with elderly patients who had presbycusis. In addition, some authors have reported that in patients with unilateral sensorineural hearing loss and tinnitus, fitting the impaired ear exclusively was effective, and individuals with bilateral complaints required bilateral fitting (11). However, in our study the patients were fitted only with a unilateral HA. In our study benefit was observed after 3 months of HA use, unlike many other studies which observed maximum benefit after 6 to 12 months of HA use (19).

One of the major risk factors for tinnitus is high-frequency hearing loss (2). Tinnitus usually occurs in the poorer hearing ear, and these patients have a significant reduction in communication skills (14). Some authors reported no correlation between the degree of hearing loss and tinnitus (24). We found a correlation between the degree of hearing loss, as me-

asured with audiometry, and tinnitus. Patients whose level of hearing loss was ≥56 dB, had higher THI scores than patients whose hearing loss was 26-40 dB or 41-55 dB. However, improvement in THI scores at all hearing loss levels was similar, and no significant differences were observed (Table 3). This indicates that with an increase in hearing loss, the QoL of elderly patients with tinnitus decreases, and HAs have similar effects on tinnitus for all levels of hearing loss.

In conclusion, among elderly patients with tinnitus and hearing loss, a significant difference was observed in the severity of tinnitus after 3 months of HA use. Tinnitus sufferers could benefit from HA, and the results of this study confirm the effectiveness of fitting HAs for tinnitus in elderly patients with presbycusis.

Conflict of Interest: The authors declare that they have no conflict of interest.

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