Evaluation of patient satisfaction with different hearing aids: A study of 107 patients

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Abstract

We retrospectively investigated patient satisfaction with different types of hearing aids in 107 patients—60 males and 47 females, aged 8 to 84 years (mean: 53.8)—with unilateral or bilateral hearing loss, each of whom used two different hearing devices for at least 3 years per device. The International Outcome Inventory for Hearing Aids, Turkish edition (IOI-HA-TR) was used to evaluate satisfaction levels; we also calculated our own total individual subjective satisfaction (TISS) scores. We divided 16 different hearing devices into two types: device 1 and device 2; on average, device 2 had more channels, a lower minimum frequency, and a higher maximum frequency. We found that the IOI-HA-TR scores and TISS scores were higher and usage time was greater during device 2 use, and that there was a positive correlation between IOI-HA-TR and TISS scores. A total of 69 patients (64.5%) used device 2 for more than 8 hours per day, while 38 patients (35.5%) used it for 4 to 8 hours per day during the final 2 weeks of the trial. In contrast, 40 patients (37.4%) used device 1 for more than 8 hours, 50 (46.7%) used it for 4 to 8 hours, and the remaining 17 (15.9%) used it for less than 4 hours; the difference in the duration of use of the two devices was statistically significant ($p < 0.001$). Younger patients and patients with more education were more satisfied with their devices than were older patients and those who were not as well educated. We conclude that devices with good technologic features such as more channels, a lower minimum frequency, and a higher maximum frequency result in better hearing. Also, based on the age difference that we observed, we recommend that psychological support be provided to older patients with aided hearing to enhance their mental health and quality of life.

Introduction

Hearing loss not only causes a deficiency in a person's capacity to perceive sounds, but it also brings about psychosocial compromises.[1] These compromises can prevent people from enjoying a healthy social life and playing an active role in society, which greatly impacts their quality of life.[1]

Novaes et al reported that in children diagnosed with hearing loss during the first 3 years of life, family involvement, the quality of parental participation in the intervention program, and expectations about the future are important considerations in their child's ability to cope with their loss.[2] These factors can aid therapists and researchers in the assessment of the effectiveness of interventions for infants with hearing loss.

Aurélio et al found no relationship between age and satisfaction with hearing aid use.[3] This is not in agreement with the findings of a study by Korkmaz et al, who concluded that there was a negative correlation between age and satisfaction; in other words, younger patients were happier.[4]

The use of hearing aids is low compared with the prevalence of hearing impairment.[5] According to studies, 12% of those who could benefit from hearing aids do not use theirs, only 58% of regular users report satisfaction, and hearing-related problems remain in 62% of these patients.[6-8] People who seek help can take part

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in hearing aid rehabilitation programs in several ways. A patient-centered approach that involves a patient's active participation has been found to improve clinical dispensing, fitting, and counseling practices with the goal of increasing the benefits of and satisfaction with the use of hearing aids.[5]

In this article, we describe our investigation of patients' satisfaction with two different types of hearing aid devices.

Patients and methods

This retrospective study was conducted at the ENT Clinic at Çorlu State Hospital in accordance with the Helsinki Declaration.[9]

Statistical analysis. The SPSS (v. 16.0) software package was used for statistical evaluation. The Kruskal-Wallis variance analysis, Wilcoxon signed rank test, Mann-Whitney *U* test with Bonferroni correction, and the chi-square (χ^2) test were used to analyze differences between devices. Relationships among questionnaire scores, the type of device, age, sex, education level, the number of device channels, and the minimum and maximum frequencies were analyzed by calculating the Spearman correlation coefficient. A p value of <0.05 was considered statistically significant.

Patients. The study population included 107 patients—60 males and 47 females, aged 8 to 84 years (mean: 53.8 ± 18.8)—who had sought treatment for unilateral or bilateral hearing loss.[10] All patients were classified as being of middle socioeconomic status for conditions in Çorlu, Turkey.

In addition to demographic data, we compiled information on each patient's amount of education. Among the 60 males, 24 (22.4% of the entire study group) had attended primary school for 5 years and 15 (14.0%) for 8 years, 18 (16.8%) had gone to secondary school for 11 years, and 3 (2.8%) were university-educated. Among the 47 females, 1 (0.9%) was illiterate, 18 (16.8%) had attended primary school for 5 years and 9 (8.4%) for 8 years, 17 (15.9%) had gone to secondary school for 11 years, and 2 (1.9%) had been university-educated. There was no significant difference in education levels between the males and females ($p = 0.911$, $\chi^2 = 0.013$).

Hearing aid devices. All patients were recommended digital-type hearing aids appropriate for their hearing level. Patients used two different types of hearing aid device (classified as device 1 and device 2) for at least 3 years each.

Device features. Patients used two of the following devices:

- 1 channel: Phoenix 113-213-313;
- 2 channels: Music, Infiniti, Lotus;
- 4 channels Intuis;
- 6 channels Cielo, Motion 100-101;
- 8 channels: Motion 300-301, Nitro 300-301;
- 12 channels: Artis, Motion 500-501, Explorer 500; and
- 16 channels: Acuris, Centra, Motion 700-701, Nitro 700-701.

These devices were combined into two different groups (device 1 and device 2) based on the number of channels and the minimum and maximum frequencies.

Device 1. In the group of hearing aids designated as device 1, the number of channels ranged from 1 to 16 (mean: 3.2 ± 2.5). The minimum frequency ranged from 100 to 240 Hz (mean: 117.2 ± 24.4), and the maximum frequency from 4,000 to 7,100 Hz (mean: 6,050.5 ± 475.5).

Device 2. In the device 2 group, the number of channels ranged from 2 to 16 (mean: 5.2 ± 3.7). The minimum frequency ranged from 100 to 160 Hz (mean: 113.9 ± 21.1), and the maximum from 5,800 to 7,600 Hz (mean: 6,497.2 ± 398.4).

According to the Mann-Whitney *U* test, the device 2 hearing aids had significantly more channels on average ($p < 0.001$, $z = -5.799$), a lower mean minimum frequency ($p = 0.014$, $z = -2.445$), and a higher mean maximum frequency ($p < 0.001$, $z = -6.939$) than the device 1 hearing aids.

Measurement of patient satisfaction. We used two instruments to determine patient satisfaction: the International Outcome Inventory for Hearing Aids, Turkish edition (IOI-HA-TR)[11-14] and our own total individual subjective satisfaction (TISS) scores.

IOI-HA-TR scores. IOI-HA-TR scores were determined for each of the devices according to each patient's amount of use during the final 2 weeks of each trial. This inventory consists of seven questions, with five possible answers to each (figure 1). Scores for each question range from 1 to 5—with 5 indicating the greatest level of satisfaction—and the possible total scores range from 7 to 35.

TISS scores. TISS scores were based on patients' self-assessments. They ranged from 0 to 100, with 100 representing maximum satisfaction. Patients' opinions of each of the devices were obtained at 1, 6, and 12 months after they began using the device.

Ethical considerations. Approval for the study was granted by the Clinical Research Ethics Committee of Bakırköy Dr. Sadi Konuk Training and Research Hospital.

The International Outcome Inventory for Hearing Aids, Turkish edition

1. Think about how much you used your present hearing aid(s) over the past 2 weeks. On an average day, for how many hours did you use the hearing aid(s)?

None (1)
Less than 1 hour a day (2)
1 to 4 hours a day (3)
4 to 8 hours a day (4)
More than 8 hours a day (5)

2.Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past 2 weeks, how much has the hearing aid helped in those situations?

Helped not at all (1)
Helped slightly (2)
Helped moderately (3)
Helped quite a lot (4)
Helped very much (5)

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

Very much difficulty (1)
Quite a lot of difficulty (2)
Moderate difficulty (3)
Slight difficulty (4)
No difficulty (5)

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?

Not at all worth it (1)
Slightly worth it (2)
Moderately worth it (3)
Quite a lot worth it (4)
Very much worth it (5)

5. Over the past 2 weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

Affected very much (1)
Affected quite a lot (2)
Affected moderately (3)
Affected slightly (4)
Affected not at al (5)

6. Over the past 2 weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

Bothered very much (1)
Bothered quite a lot (2)
Bothered moderately (3)
Bothered slightly (4)
Bothered not at all (5)

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

Worse (1)
No change (2)
Slightly better (3)
Quite a lot better (4)
Very much better (5)

Figure 1. Scores for these questions were used to rate patient satisfaction.

Results

IOI-HA-TR scores. Responses to IOI-HA-TR were analyzed with the χ^2 test.

Question 1: How much did you use the device during the final 2 weeks? Usage time was significantly greater with device 2 than with device 1 ($p < 0.001$, $\chi^2 = 24.348$). More than half of the patients (n = 69 [64.5%]) used device 2 for more than 8 hours per day, while 38 patients (35.5%) used it for just 4 to 8 hours. In contrast, 40 patients (37.4%) used device 1 for more than 8 hours, 50 (46.7%) used it for 4 to 8 hours, and the remaining 17 (15.9%) used it for less than 4 hours; the difference in the duration of use of the two devices was statistically significant ($p < 0.001$) (figure 2).

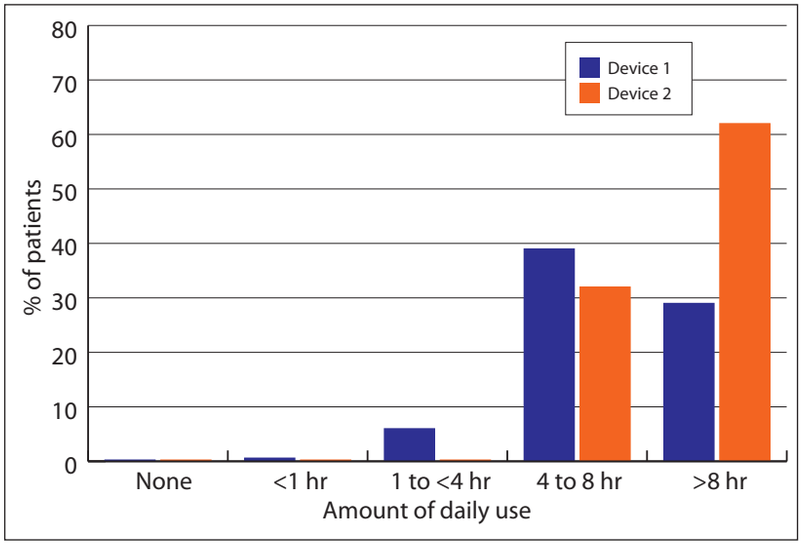

Figure 2. Chart compares the duration of daily use of devices 1 and 2.

Question 2: Did the device help with hearing well in certain situations? Device 2 was significantly more helpful than device 1 ($p < 0.001$, $\chi^2 = 25.515$). A total of 24 patients (22.4%) said device 2 helped them "very much" and 81 (75.7%) said it helped them "quite a lot." The corresponding figures for device 1 were only 10 (9.3%) and 69 (64.5%).

Question 3: How difficult was hearing well when using the device? Hearing was significantly less difficult with device 2 than with device 1 ($p < 0.001$, $\chi^2 = 33.094$). During device 2 use, 35 patients (32.7%) reported "no difficulty" and 55 (51.4 %) reported only "slight difficulty." For device 1, these figures were 8 (7.5%) and 51 (47.7%), respectively.

Question 4: Is a hearing aid worth the trouble? Significantly more patients found device 2 worth the trouble, compared with device 1 ($p < 0.001$, $\chi^2 = 35.743$). During device 2 use, 27 patients (25.2%) said that the device was "very much worth" the trouble and 75 (70.1%) said it was "quite a lot worth" it. For device 1, users, these percentages were 5 (4.7%) and 69 (64.5%), respectively.

Question 5: How much have your hearing difficulties affected you while wearing the device? Significantly fewer patients reported negative effects during device 2 use ($p < 0.001$, $\chi^2 = 29.832$); 26 (24.3%) said they were "not at all" affected, compared with 10 patients (9.3%) during device 1 use.

Question 6: How does your hearing loss bother others? Hearing loss was significantly less bothersome to others with device 2 ($p < 0.001$, $\chi^2 = 22.821$). During device 2 use, 26 patients (24.3%) said others were "bothered not at all," compared with only 6 patients (5.6%) who answered the same during device 1 use.

Question 7: How much has your hearing aid changed your enjoyment of life? Enjoyment of life was significantly higher with device 2 ($p < 0.001$, $\chi^2 = 30.336$). During device 2 use, 38 patients (35.5%) said their enjoyment was "very much better" and 67 (62.6%) said it was "quite a lot better." During device 1 use, the corresponding figures were 17 (15.9%) and 58 (54.2%).

Total IOI-HA-TR score. The difference between the total IOI-HA-TR scores during device 1 and device 2 use was analyzed by the Mann-Whitney *U* test. Device 2 was associated with a higher score (mean: 29.8 ± 2.6) than device 1 (mean: 26.2 ± 4.0); the difference was statistically significant ($p < 0.001$).

TISS scores. TISS scores were significantly higher with device 2 than device 1 at 1, 6, and 12 months of use according to both the Kruskal-Wallis variance analysis and the Wilcoxon signed rank test ($p < 0.001$) (table). To identify the reasons for these differences, pairwise comparisons were performed using the Mann-Whitney *U* test with Bonferroni correction. For both devices, the TISS score at 12 months was significantly greater than the TISS score at 6 months, which in turn was greater than the TISS score at 1 month ($p < 0.0175$).

IOI-HA-TR vis-à-vis TISS scores. The relationship between total IOI-HA-TR scores at 12 months and TISS scores at 1, 6, and 12 months was analyzed according to the Spearman correlation coefficient. Significant positive correlations among these scores were identified in all comparisons ($p < 0.05$ for all).

Subgroup analyses. The relationships of IOI-HA-TR and TISS scores to the type of device, age, sex, education level, the number of device channels, and the minimum and maximum frequencies were analyzed by calculating the Spearman correlation coefficient.

Type of device. During device 2 use, each individual IOI-HA-TR score and the total IOI-HA-TR score and each TISS score at 1, 6, and 12 months were significantly higher than the corresponding scores during device 1 use ($p < 0.05$ for all).

Age. The total IOI-HA-TR score was significantly lower in older patients than in younger patients, as were TISS scores, especially at 6 and 12 months ($p < 0.05$ for all). In addition, more older patients than younger patients

Table. TISS scores at 1, 6, and 12 months

	TISS score			
	1 mo	**6 mo**	**12 mo**	***p* Value***
Device 1, median (range)	50 (20 to 80)	60 (20 to 80	65 (25 to 90)	<0.001
Device 2, median (range)	60 (30 to 85)	70 (50 to 85)	75 (55 to 90)	<0.001
p Value†	<0.001	<0.001	<0.001	
z Score	–7.808	–7.808	–8.174	

** Kruskal-Wallis variance analysis.*
† Wilcoxon signed rank test.

($p^{Dev\ 1:\ 1\text{-}6}$ <0.001, z = –3.695; $p^{Dev\ 1:\ 1\text{-}12}$ <0.001, z = –7.796; $p^{Dev1:\ 6\text{-}12}$ <0.001, z = –4.954).
($p^{Dev2:\ 1\text{-}6}$ <0.001, z = –5.931; $p^{Dev\ 2:\ 1\text{-}12}$ <0.001, z = –9.938; $p^{Dev2:\ 6\text{-}12}$ <0.001, z = –6.481).

reported that others were significantly bothered by their hearing difficulties ($p < 0.05$).

Sex. We used the Spearman test to analyze the correlation between sex and each of the IOI-HA-TR test results and total IOI-HA-TR score at 12 months, as well as the TISS scores, and found no significant correlation ($p > 0.05$).

Education level. Total IOI-HA-TR scores and TISS scores at 12 months were significantly higher in the more highly educated patients than in those with less education ($p < 0.05$ for both). On the other hand, the highly educated patients were affected more negatively by their hearing loss while performing their jobs.

Number of channels. With both devices, IOI-HA-TR and the TISS scores increased significantly as the number of channels increased ($p < 0.05$).

Minimum frequency. As the minimum frequency decreased, the total IOI-HA-TR score and the TISS scores at 1, 6, and 12 months increased significantly ($p < 0.05$) with both devices. Moreover, the devices became more effective in helping to hear well, and other persons were less bothered.

Maximum frequency. For both devices, as the maximum frequency increased, all IOI-HA-TR scores and TISS scores increased significantly ($p < 0.05$).

Discussion

Hearing loss has long been considered a disabling condition, as it is associated with a decline in quality of life, an increase in depressive symptoms, and a decrease in functional capacity.[15] In recent years, much has been done to mitigate these effects and to improve the quality of life of hearing-impaired patients.[16]

Despite advances in miniaturization of hearing-assistance devices and the development of sophisticated digital signal processing, obstacles remain. Some patients cannot tolerate these devices for technical reasons, such as feedback, the occlusion effect, and insufficient high-frequency gain. Other patients face limiting personal issues, such as difficulty in using the device, stigma, pathology, a reduction in the caliber of the external auditory canal, ear mold allergies, and inability to use these devices during water contact, physical activities, and overnight while sleeping.[17]

The process of selecting and fitting hearing aid devices is effective and produces good outcomes only if patients make effective use of the device.[3] Hearing stimulation after amplification causes a neural plasticity that enables the central pathways to reorganize and enhance hearing skills.[18] The improvement in hearing brought about by this stimulation is known as the *acclimatization phenomenon.* This can occur within 3 months after fitting a hearing aid,[19] between 6 and 12 weeks after using the amplification[20] and, according to some authors, after the second month of use.[21]

In the study by Aurélio et al,[3] most patients reported using their hearing aid for more than 8 hours, which is consistent with other reports.[1,22] Hearing aids then are an integral part of day-to-day living for many patients. Aurélio et al found that patients who used hearing aids the most were happier than expected because the longer they are used, the more patients adapt to them.[3]

The ability to help patients hear well in certain situations (Q2, Q3) was greater during the use of device 2. Likewise, patients found that device 2 was more worth the trouble than device 1 (Q4), and patients experienced fewer negative effects of hearing loss while wearing device 2 (Q5). Finally, patients felt that their hearing loss was less bothersome to other people while they were wearing device 2 (Q6) and that enjoyment of life was better with device 2. The mean total IOI-HA-TR score was significantly higher during device 2 use than during device 1 use.

The study by Aurélio et al was a descriptive cross-sectional study in which 60 patients were evaluated by oral questioning during one-on-one interviews with the Satisfaction with Amplification in Daily Life instrument.[3] This instrument contains four domains: *positive effects, service and costs, negative factors,* and *personal image.* Patients reported that they were generally very happy with their hearing aids and that their satisfaction level was not related to age, sex, the time of day they used their device, and device type. Patients who used their hearing aids every day were even happier with them.

In our study, satisfaction with hearing aids was not related to sex, but as mentioned, it was correlated with age, as older patients expressed less satisfaction with their devices than did younger patients. In addition, older patients said their hearing difficulties were more bothersome to others.

In terms of education, our study found that more than half of our patients had completed at least 8 years of school, and greater education was correlated with greater satisfaction. Likewise, Hamurcu et al reported that education was significantly and positively correlated with hearing aid satisfaction.[15]

Ataş et al reported that in 19 adults with conductive or mixed hearing loss, the total IOI-HA score was significantly higher with the Vibrant SoundBridge (VSB) than with conventional hearing aids.[23] However, no statistically significant differences between the VSB and hearing aids were found with respect to daily use, residual activity limitations, patient satisfaction, impact on others, and quality of life. Nevertheless, the researchers concluded that VSB was superior in terms of benefit and residual participation restrictions.

Kırkım et al found that patients with lower speech discrimination scores had lower scores on questions 3, 5, and 6 of the IOI-HA-TR.[11] They concluded that speech discrimination scores were an effective means of evaluating patients' satisfaction with their hearing aids, particularly with respect to questions related to verbal communication.

In a study by Kießling and Kreikemeier, the benefit of modern hearing aids in everyday life was assessed by asking patients to complete a questionnaire.[24] The questionnaire consisted of 20 items, 10 of which were taken from two validated international inventories (the IOI-HA and the Speech, Spatial, and Qualities of Hearing scale); the other 10 items were formulated specifically for their study. The authors pointed out that modern hearing aid system technology provides significant extra benefits at the 5% level relative to the previous generation of hearing aids for all variables tested. Then they concluded that although the amount of gain in terms of user benefit may be overestimated secondary to the placebo effect, a net effect was evident in their study. They could not identify any correlations among the level of hearing aid benefit and possible influencing factors such as age, sex, differences in individual hearing aids, the duration of hearing loss, and the duration of hearing aid use.

Hearing aid technology is developing rapidly, providing new benefits to users.[24] In our study, the greater patient satisfaction during device 2 use might have been related to the better technologic features of device 2, such as more channels, a lower minimum frequency, and a higher maximum frequency. Moreover, since our older patients expressed less satisfaction with their devices, we recommend that psychological support be provided to older patients with aided hearing to enhance their mental health and quality of life.

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