

The Hearing Aid Use and Its Efficiency in Geriatric Population

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Abstract

Objective: The hearing aid is an important method of rehabilitation for hearing loss. This study aims to determine if the Turkish geriatric population were recommended the proper hearing aid for their hearing loss, if patients use hearing aids, and how much they benefit from hearing aids.

Methods: 3126 participants were divided into 6 groups by age; [59, 64], [65, 69], [70, 74], [75, 79], [80, 84] and 85 and older. PTA, SDS, SRT values, and hearing aid usage data were gathered from their audiograms. Additionally, changes in SRT and SDS percentages of 240 individuals using a hearing aid were statistically determined with and without hearing aids.

Results: 84.48% of all individuals included in the study needed a hearing aid, however only 12.57% of them were hearing aid users. Best SRT and SDS values were found as 58.6 dB HL and 61.1% without hearing aids, and they improved to 39 dB HL and 74.6% respectively with hearing aids. A statistical significance was observed between SRT and SDS values with and without hearing aid use for each group.

Conclusions: The hearing aid usage rate in the geriatric population was found to be quite low. Despite improvements in SRT and SDS with hearing aid usage, the best SRT value was still high and would impair daily communication

Keywords: Hearing aid; Hearing loss; Geriatric population; Speech discrimination score; Speech reception threshold

Introduction

Aging of the population is one of the most prominent demographic phenomena of the 21st century. According to the Department of Economic and Social Affairs of the United Nations Secretariat, the global population that was aged 60 years or over was 962 million in 2017. The number of older persons is expected to double by 2050,

when it is projected to reach nearly 2.1 billion [1]. In Turkey, the population above 65 years of age was 9.1% of the total population in 2019. This ratio is expected to reach 16.3% in 2040 and 25.6% in 2080 [2]. Hearing loss that develops with age (presbycusis) has become a serious social and health problem. The rate at which hearing loss is seen between the ages 65-74 is 24%-40%. After the age of 75, this rate reaches 40%-66% [3]. The most prominent symptoms of presbycusis are difficulty in speech discrimination and perception. Since presbycusis is not a curable condition, the goal is to increase the life quality of patients and to minimize their communication problems. Hearing aids are of utmost importance in the rehabilitation of patients with sensorineural hearing loss. In previous studies, it was shown that only 20% of people who could benefit from amplification utilize it, while 25%-40% don't use hearing aids or have discontinued their use of hearing aids after some time [4]. The choice of hearing aid depends on the hearing loss and the correct choice of hearing aid is critical. With a hearing aid, it is possible for patients to hear sounds below their hearing threshold. For patients with presbycusis, bilateral use of hearing aids is recommended. However, the study conducted by Şenkal reports that due to economic and aesthetic reasons, most patients prefer to use unilaterally. Compared to bilateral hearing aid use, unilateral use may have fewer benefits for the patient [5]. Since the number of older persons is increasing throughout the world and hearing problems are growing, studies should be performed to protect the hearing of elderly people. The hearing aid is an important method of rehabilitation for hearing loss, therefore, studies to improve hearing aid usage should also be done. Hence, this study aims to analyse the ratio of hearing aid use in the Turkish geriatric population. It also aims to determine if patients above 59 years of age were recommended the proper hearing aid for their hearing loss, if the patients use these hearing aids, and how much they benefit from these hearing aids.

Materials and Methods

This work was designed and conducted in accordance with the ethical standards of the Helsinki Declaration. Approval was given for this work by the Institutional Ethics Committee. This retrospective study was conducted by examining the audiograms of 21,500 patients who were referred to the Audiology and Speech Pathology Unit at the Department of Otolaryngology in a public hospital in the last four years. Cochlear implant users, participants with total hearing loss, and individuals who younger than 59 years were excluded. Therefore, a total of 3,126 individuals (1,577 males, 1,549 females) were included in this study. Hence, 6,252 ears (3,126 right and 3,126 left ears) were assessed. Included participants were divided into six groups according to their age. The age groups were selected as 59–64, 65–69, 70–74, 75–79, 80–84, and 85+ years. The groups were named as group 1, group 2, group 3, group 4, group 5, and group 6, respectively. The Pure Tone Average (PTA), Speech Reception Threshold (SRT), Speech Discrimination Score (SDS), and hearing aid use information given in the audiograms were used for statistical analysis. It was accepted that those with a PTA (500 - 4000 Hz) greater than 25 dB could benefit from hearing aid usage. 2641 participants were determined to need hearing aids, but only 332 participants were noted as hearing aid users in their audiograms. Since the hearing aid use suggestion information was not given in the audiograms, the number of individuals who should use hearing aid was calculated for each group by using PTA values given in the audiograms. On the contrary, the hearing aid usage information was given in audiograms, hence the number of hearing aid users given in this study were counted from their audiograms for each group. As this is a retrospective study, the hearing aid usage information and SRT, SDS data were obtained from the existing audiograms of the patients. There were 240 audiograms including both SRT and SDS values measured with and without hearing aids. Therefore, SRT values and SDS

percentages of hearing aid users (240 participants) measured with and without hearing aids were compared with each other. SPSS 25.0 was used for statistical analysis. All of the data was subjected to power analysis. Paired-Samples t-test was used for the analysis of the difference in SRT values and SDS percentages with and without hearing aids.

Results

The individuals included in this study were grouped according to their age. The number of participants and the minimum, maximum, and average ages of each group are given in **Table 1**. The minimum age was determined as 59.07 years and the maximum age was determined to be 96.11 years. There were a total of 1577 males and 1549 females included in this study.

Table 1: Minimum, maximum, and mean ages within each group.

Group No	MALE				FEMALE			
	N	Min	Max	Mean \pm SD	N	Min	Max	Mean \pm SD
1	514	59,07	64,96	62,35 \pm 1,5	503	59,1	64,99	62,30 \pm 1,5
2	384	65,01	69,97	67,46 \pm 1,5	377	65,01	69,99	67,31 \pm 1,4
3	290	70	74,95	72,27 \pm 1,4	261	70	74,98	72,52 \pm 1,5
4	196	75	79,95	77,28 \pm 1,5	207	75,01	79,99	77,15 \pm 1,4
5	131	80	84,98	82,56 \pm 1,5	117	80,01	84,95	82,15 \pm 1,4
6	62	85,02	96,11	87,91 \pm 2,4	84	85,13	96,11	88,70 \pm 2,9
TOTAL	1577				1549			

SD: Standard Deviation

The mean PTA and SRT values and SDS percentages of the individuals included in each group were calculated and are shown in **Table 2**. The values given in the table had been measured without hearing aids. As seen from the table the mean values of right and left ears were similar within each group.

Table 2: Mean PTA, SRT, and SDS values for each group.

Group No	Ears	N_ears	Mean PTA (dB)	Mean SRT (dB)	Mean SDS (%)
1	Right	1017	37,1	35,8	82,8
	Left	1017	37,9	36,5	81,1
2	Right	761	39,8	37,9	78,4
	Left	761	41,1	38,6	78,3
3	Right	551	45,3	42,6	70,9
	Left	551	45,5	42,7	70,2
4	Right	403	49,1	46,7	65,4
	Left	403	49,1	46,7	66,4
5	Right	248	54,4	53,4	54,6

	Left	248	54,4	53,1	55,3
6	Right	146	59,4	57,1	48,1
	Left	146	60,1	57,5	47,8
Total	-	6252	-	-	-

PTA: Pure Tone Average, SDS: Speech Discrimination Score, SRT: Speech Reception Threshold

Table 3 shows the number of hearing aid candidates for each group. A speech-frequency pure-tone average (average of hearing thresholds at 0.5, 1, 2, and 4 kHz) of greater than 25 dB HL (hearing level) was defined as hearing loss per World Health Organization criteria [6]. Therefore, the participants with PTA values greater than 25 dB were accepted as a candidate to use hearing aids.

Table 3: Hearing aid suggestions based on the PTA values of participants.

Group No	Ears	N	PTA≤25dB	%N	PTA>25dB	%N
1	Right	1017	352	35	665	65
	Left	1017	331	33	686	67
	Bilateral		235	23	569	56
2	Right	761	218	29	543	71
	Left	761	193	25	568	75
	Bilateral		152	20	503	66
3	Right	551	87	16	464	84
	Left	551	84	15	467	85
	Bilateral		55	10	435	79
4	Right	403	37	9	366	91
	Left	403	44	11	359	89
	Bilateral		27	7	349	87
5	Right	248	16	6	232	94
	Left	248	18	7	230	93
	Bilateral		14	6	228	92
6	Right	146	4	3	142	97
	Left	146	4	3	142	97
	Bilateral		2	1	140	96

%N: Percent of total number, PTA: Pure Ton Average

As seen from **Table 3**, some individuals have exhibited PTA values lower than 25 dB bilaterally. Those individuals were not accepted as hearing aid use candidates. Secondly, there were some individuals with PTA values greater than 25 dB bilaterally, and those participants were accepted as suitable to use bilateral hearing aids. Using these numbers, it was also possible to calculate the number of individuals who would be unilateral hearing aid candidates. The calculated number of hearing aid candidates and the number of users according to the information given in the audiograms of the participants within each group are given in **Table 4**. It can be seen from **Table 4** that although 2641 participants could benefit from hearing aid use, there were only 332 users.

Table 4: Hearing aid suggestion and usage information of participants.

Group No	# of Participants	# of not suggested	# of suggested	Needed %	Total HA usage	Usage %	UL usage	BL usage
1	1017	235	782	76.89	61	7.8	44	17
2	761	152	609	80.02	68	11.16	45	23
3	551	55	496	90.01	59	11.89	37	22
4	403	27	376	93.3	61	16.22	32	29
5	248	14	234	94.35	51	21.79	28	23
6	146	2	144	98.63	32	22.22	21	11
Total	3126	485	2641	84.48	332	12.57	207	125

HA: Hearing aid, UL: Unilateral, BL: Bilateral

The SRT values and SDS percentages of hearing aid users determined with and without hearing aids were given in **Table 5**. For every group, the SRT values and SDS percentages without hearing aids and with hearing aids were compared with each other. A significant decrease in SRT values and a slight but significant increase in SDS values were observed in measurements with hearing aids and is portrayed in **Table 5**.

Table 5: The maximum, minimum and average SRT values and SDS scores of participants with and without HA.

Group No	N	W/O HA SRT (dBHL) (Mean±SD)	W HA SRT (dBHL) (Mean±SD)	p	W/O HA SDS (%) (Mean±SD)	W HA SDS (%) (Mean±SD)	p
1	43	65.2±18.1	41.2±13.0	<0.001	61.4±26.4	76±20.0	<0.001 ^a
2	52	58.6±17.3	39.0±12.6	<0.001	61.1±22.5	74.6±22.6	<0.001 ^a
3	41	61.6±16.8	42.0±11.6	<0.001	52.9±18.3	62.8±18.6	<0.001 ^a
4	46	65.4±19.6	42.5±10.2	<0.001	52.6±19.1	68±2.54	<0.001 ^a
5	39	64.7±13.8	46.7±13.0	<0.001	38.2±22.1	53.83±20.3	<0.001 ^a
6	20	68.0±15.8	45.8±11.3	<0.001	39.6±22.7	53±19.9	<0.001 ^a

a: statistically significant, W HA: with hearing aid, W/O HA: without hearing aid, SRT: Speech reception threshold, SDS: Speech discrimination score, SD: Standard deviation

Discussion

Many studies have shown that untreated hearing loss leads to a decrease in the patient's quality of life, an increase in social struggles and depression, and a loss in cognitive functions [7]. Hearing aids may be effective in increasing audibility and enhance their communicative experiences, yet, a small percentage of the adults who could benefit from hearing aids use them, according to some studies done in different countries [8-10]. In this study, the analysis of hearing aid usage in the Turkish geriatric population aged above 59 years and having hearing loss greater than 25 dB at any ear was made. Mean PTA, SRT, and SDS values for each group are

presented in **Table 2**. Statistical analysis showed that there is not a statistically significant difference between right and left ears for all groups. **Table 3** shows the number of participants that have bilateral hearing loss and those who do not have hearing loss in each group. As seen from the table, the percentage of the patients having bilateral hearing loss increases as age increases. That is an expected situation, but there is another result that should be discussed. Most of the participants included in this study have bilateral hearing loss and should use hearing aids bilaterally. This result shows that patients apply to a clinic when their hearing loss has progressed. As seen from **Table 4**, the minimum hearing aid usage percentage was seen in the 1st group with 7,8% while the maximum was seen in the 6th group with 22.2%. Additionally, it's seen that the total hearing aid use percentage of all participants is only 12,6%. Similar results were found in the literature. A study conducted by Chien and Lin in the USA, based on the measured thresholds of 2,605 adults, examined the reasons why patients above the age of 50 and with a hearing loss greater than 25 dB did not use hearing aids. The 2,605 patients included in the study were divided into 4 groups according to age (50-59, 60-69, 70-79, 80 and above). They calculated a ratio of the number of hearing aid users to the number of persons that need hearing aids. The percentage of usage in the first group was 4.3%, 7.3% in the second group, 17.0% in the third group, and 22.1% in the fourth group [11]. It was seen that many people did not use hearing aids despite their need. When compared with this study, it is seen that the percentages of hearing aid users in each age group are similar. However, these ratios are below the number of hearing aids needed by the geriatric population. There is no agreed definition for the success of hearing aids. However, a patient with hearing loss who regularly uses a hearing aid and is reporting its benefits may describe that a successful outcome has been achieved [12]. There may be many reasons why elderly people do not use hearing aids. A study conducted by Kochkin in the United States of America explored the reasons why the 348 patients included in the study were not using their hearing aids. When the 348 individuals were asked the reasons for not using hearing aids, 29.6% (n=103) answered that they did not see sufficient benefits, 25.3% (n=88) reported that they stopped using hearing aids due to background noise, 18.7% (n=65) said that their hearing aids were ill-matched and uncomfortable. The remainder of the patients stated that they discontinued hearing aid use due to the cost, low quality of sound, faults in hearing aid, and having no need for hearing aid use [13]. Another study, conducted by Lupsakko inspected 601 cases of individuals above the age of 75. Only 100 of the 601 patients owned hearing aids and it was determined that 24 of these 100 patients had never used their hearing aids. When the 24 patients were asked about their reasons for not using their hearing aids, 10 of them responded with a lack of need, 5 of the patients stated that hearing aid use was difficult, while the remainder of the patients attributed their lack of hearing aid use to hearing aid breakdown and cost [14]. The SRT values of the patients included in this study with/without hearing aids are given in **Table 5**. A significant difference was found in the SRT values for each age group. A study conducted in the Netherlands by Duquesnoy and Plomp examined the SRT values of 50 patients with various types of hearing loss with and without hearing aids. When the patients were grouped by their hearing loss type or PTA value, a 15-20 dB improvement was detected in the SRT values with hearing aids compared to SRT values without hearing aids for each group. Within the groups, the best average SRT value with hearing aids was found to be 30 dB while the worst was found to be 45.9 dB [15]. In this study, the best average SRT value with hearing aids was 39 dB HL while the worst was 46.7 dB HL. Regardless of the improvement found for each group, the average of the SRT values was below the SRT values expected from an efficient hearing aid and SRT values obtained demonstrate that the patients have difficulty in hearing despite being in a quiet environment. The studies in the literature state that if

the adjustment of the hearing aid was not done with accordance to the hearing loss of the person, the user gets fewer benefit from the hearing aid and is dissatisfied [16]. Kochkin stated in this study that, if hearing aids are programmed by using the ear canal responses (external ear canal resonances) of individuals, there would be significant changes in the Satisfaction with Amplification in Daily Life (SADL) subscale scores. As seen in **Table 5**, SRT values without hearing aids in all groups are approximately 60 dB HL. This SRT value represents a moderately severe hearing loss. In other words, people start to use hearing aids when hearing loss progresses and causes communication difficulties. If a loss of hearing at this level is not rehabilitated for a long time, the deterioration of SDS values is inevitable. Glick and Sharma studied the effect of hearing aid usage on Cortical Visual Evoked Potentials (CVEPs), cognitive function, and speech perception abilities. They measured these parameters on 28 adults with untreated mild-moderate age-related hearing loss and 13 age-matched normal hearing controls. The group of adults with presbycusis were then fit with bilateral hearing aids and re-evaluated after 6 months of amplification use. It was stated in this study that clinical intervention with well-fit amplification may promote more typical cortical organization and functioning and provide cognitive benefit. **Table 5** also shows the SDS percentages of the participants with and without hearing aids. In this study, significant differences were observed for each age group's SDS percentages with and without hearing aid use. Within the groups, the best average SDS value was 76% (Group 1) while the worst average SDS value was found to be 53.83% (Group 6). A 2005 study by Reber and Kompis in Switzerland observed the changes in the SDS percentages of 23 patients between the ages 40-76 who were using hearing aids for the first time over a period of 6 months. At the end of the 6 months, a change of more than 20% was detected in the patients' SDS percentages. Both in the study carried by Reber and Kompis and in this study, it was stated that there were significant differences in SDS values measured with and without hearing aids.

Conclusion

In conclusion, this study determines that hearing aids usage and awareness is low in the geriatric population. The use of hearing aids in patients with mild hearing loss is less than hearing aid use in patients with severe hearing loss. Leading causes for limited hearing aid use may be low awareness, hearing aid prices, fitting inaccuracies, inadequate post-hearing aid sale services, and insufficient rehabilitative support. Furthermore, it is believed that the lack of a hearing screening for the geriatric population leads to delays in acquiring hearing aids and a low percentage of hearing aid use. It is thought that an awareness program regarding the hardships of hearing loss and the benefits of hearing aid use through media and television will be beneficial. Hearing screening and rehabilitation programs should be developed for the geriatric population. The speech in noise tests should also be included in the audiometric test battery, especially for the geriatric population. In future studies the reasons for the low amount of hearing aid use should be evaluated and these results should be reported to pave the way for new legal regulations and supportive policies.

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