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FACTORS AFFECTING HEARING AID USE

Abstract:

Hearing aids improve the communication and quality of life of persons with hearing loss. Despite this, today substantial number of hearing aid users reject to use hearing aids regularly. The aim of the study was to determine the side effects and complaints associated with the hearing aids as factors affecting hearing aid use.

Majority of patients reported acoustic feedback (unpleasant sound from the device) as a main side effect associated with hearing aid use. Second important complaint was poor benefit from the hearing aid. The patients had feeling that their hearing aids did not help sufficiently. Other side effects and complaints associated with hearing aid use have also been reported: background noise is uncomfortably loud, short battery life, poor sound quality, bad fitting, ear pain, fullness sensation in the ears, hearing aid users cannot operate the device themselves, stigmatization, and feeling nervous.

Degree of hearing loss is also a factor contributing to use or rejection of hearing aid. Patients with a higher degree of hearing loss wear their hearing aids longer in a day.

Keywords: *hearing aid, use, side effects*

Introduction

Hearing aids are devices that amplify sounds so the person with hearing loss can hear them. The selection and fitting of hearing aids is a key component to the overall treatment and rehabilitative audiology program for many patients with permanent hearing loss (Mueller, 2019). Hearing aids have several basic components. The hearing aid's microphone picks up sounds and converts them into an electrical signal. The microphone is one of the hearing aid's transducers. A transducer converts one form of energy to another. The microphone contains a diaphragm that is set into vibration by the pressure variation of sound waves that enter the opening of the microphone, a port. The motion of the diaphragm transduces the acoustical energy (sound) to electrical energy (Groth and Christensen, 2015). Once the sound has been changed into an electrical signal it can be manipulated by electronic circuits. The principal manipulation is to boost its intensity, that is, to amplify it. This is done by the amplifier. The amplified electrical signal is then converted back into sound by an electrical-to-acoustic transducer or loudspeaker. The hearing aid's loudspeaker is called a receiver. The amplified sound from the receiver is directed into the patient's ear. A main component of the hearing aid is also the earmold, which is inserted into the patient's ear. Some hearing aids are completely contained within the earmold itself (Gelfand, 2016).

The most common styles of hearing aids are known as behind-the-ear (BTE) and in-the-ear (ITE) hearing aids. A BTE hearing aid's microphone, amplifier, and loudspeaker are housed in a case that is worn behind the ear. Amplified sound is delivered to the ear canal through a tube that leads either to a custom-fitted earmold, or some form of open-fit eartip (Stach, 2010). There is a smaller variation of the BTE style, called mini-BTE. One type of mini-BTE hearing aid has all the hearing aid components housed within the hearing aid casing, the same as for a traditional BTE, but the casing is smaller. This type is called receiver-in-the-aid (RITA). The sound from the receiver is sent to the ear through a much thinner and smaller diameter tube (nearly invisible) than that used with traditional BTEs. A second type of mini-BTE has the receiver in the earmold, which is connected to the casing via an electrical wire encased in thin tubing. This type of mini-BTE is usually called a receiver-in-the-canal or RIC (Mueller, 2019). Another term for the hearing aids with a receiver that fits inside the ear canal instead of in the hearing aid shell is receiver-in-the-ear (RITE). An ITE hearing aid has all of the components contained in a custom-fitted case that fits into the concha. One variation is a smaller device that fits into the ear canal, known as an in-the-canal (ITC) hearing aid. A device that is an even smaller version that fits deeply in the canal is called a completely-in-the-canal (CIC) hearing aid (Stach, 2010).

Hearing loss is associated with significant health outcomes including social isolation. Hearing aid use improves communication and quality of life

(Assi et al., 2021). Indications based on current guidelines of hearing aid prescription in Germany are the following:

- surgical hearing improvement should not be possible,
- the tone audiometric hearing loss in the better hearing ear should be at least 30 dB in at least one of the test frequencies between 500 and 4000 Hz,
- speech audiometry should reveal an understanding in the better hearing ear with headphones in the Freiburg monosyllabic test of not more than 80% at 65 dB,
- the patient should be sufficiently cooperative.

The same criteria apply for hearing loss and speech understanding for unilateral hearing loss (Hoppe and Hesse, 2017).

Despite improvement of quality of life with hearing aids, a small percent of adults with hearing loss use hearing aids. In the United States, overall, the prevalence of hearing aid use in individuals with mild hearing loss or worse increases with every age decade, from 4.3% in individuals aged 50 to 59 years, 7.3% in individuals aged 60 to 69 years, 17.0% in individuals aged 70 to 79 years, and 22.1% in individuals 80 years and older (Chien and Lin, 2012). A research has shown that a key barrier to accessing hearing aids is affordability (Assi et al., 2021). However, in the United Kingdom, where the full cost of hearing aids is covered by the National Health Service, a third of patients fit with hearing aids do not use them regularly (Aazh et al., 2015).

Studies have shown that a significant proportion of patients (38%) do not use their hearing aid devices. The most common causes for positive adherence to hearing aid use were identified as follows: a higher degree of hearing loss: individuals with a more severe degree of hearing loss were more likely to adhere to the use of hearing aids; awareness of their condition and daily necessity; having a sufficient financial resources and greater experience using the device. The most common causes for rejection of hearing aids were: lack of perceived benefits or improvements in their hearing or communication abilities and discomfort with the device (Marcos-Alonso et al., 2023). Löhler et al. (2019) reported results from the study estimating the prevalence of hearing loss in Northern and Southern Germany. The study showed that 1.4% (age 18-29 years), 0.8% (age 30-39 years), 2.3% (age 40-49 years), 1.2% (age 50-59 years), 5.8% (age 60-69 years), 18.3% (age 70-79 years), and 32.6% (age $\geq$ 80 years) of patients with hearing impairments use a unilateral or bilateral hearing aid. Overall, 6.5% of the included study population used hearing aids.

A review of hearing aid use for mild to moderate hearing loss in adults showed that hearing aids improve the ability of adults with mild to moderate hearing loss to take part in everyday life, their general quality of life and their ability to listen to other people. The evidence is compatible with the widespread provision of hearing aids as the first-line clinical management in those who seek help for hearing difficulties (Fergusson et al., 2017).

Manchaiah et al. (2019) grouped the side effects and complaints associated with hearing aid use as Physical effects (Feedback noise, poor sound

quality, sounds are uncomfortably loud, sounds are too soft, bad fitting, ear pain, too much pressure, plugged or fullness sensation in the ears, itching and/or rashes in the ears, sweating or moisture in the ears, wax build up, problems chewing or swallowing, hairs getting caught in the hearing aid, headache, tinnitus, and dizziness); Psychological effects (when the patients wear their hearing aids do they feel: nervous, isolated, old, reduced self-confidence, financial stress, afraid of missing out in conversations, afraid of being more responsible for listening in conversations, afraid of becoming dependent on the device, afraid that your hearing aids will stop working and/or batteries will run out, or fear of losing or destroying your hearing aids); and Social effects (when the patients wear their hearing aids do they notice that other people treating them with less respect, people avoiding them, people staring at them, people talking louder when they see their hearing aids, or people talking softer when they see their hearing aids).

Rawool (2018) reported the following reasons for rejection of hearing aids: perception that hearing loss is not serious enough (individuals with mild to moderate hearing loss have perception that they hear well enough in most situations); ambivalence about the effectiveness of hearing aids (some individuals report minimal benefit from hearing aids in noisy surroundings, which restricts their participation in social gatherings, some individuals believe that hearing aids do not work and others consider hearing aids are not worth bothering about) and lack of trust in hearing health care providers (some patients may believe that hearing health care services are commercially oriented). Knudsen et al. (2010) found different factors for help seeking, hearing aid uptake, use, and satisfaction with hearing aids: personal factors (e.g., source of motivation, expectation, attitude, hearing sensitivity), demographic factors (e.g., age, gender), or external factors (e.g., cost, counseling).

The aim of the present study was to examine the side effects and complaints associated with hearing aid use in adults with hearing loss as factors impacting the use or rejection of hearing aids.

Methods

This retrospective study included a sample of 74 patients that use hearing aids, 42 males (56.8%) and 32 females (43.2%), aged 19 to 82 years (mean age of 67.2 ± 11.1 years). Audiologic assessment was performed at the Department of Audiology, City General Hospital "8th September" – Skopje. Inclusion criteria were: unilateral or bilateral hearing loss, hearing aid use at least one year and available data on side effects or patient's complaints associated with hearing aid use. For the statistical data analysis we used Chi-square test with the level of significance $p < 0.05$.

Results

A total of 74 hearing aid users were included in the study. Because 10 patients had binaural hearing aid fitting, data on satisfaction from using of 84 devices were analyzed. We displayed demographic and clinical characteristics of patients (Table 1). Most of the patients had bilateral hearing loss. In terms of the degree and type of hearing loss, majority of them had severe sensorineural hearing loss.

Table 1. Demographic and clinical characteristics of patients

Variables	No (%)
Age (years)	19-82 (mean age of 67.2±11.1)
Gender	
Male	42 (56.8)
Female	32 (43.2)
Side of hearing loss	
Bilateral	70 (94.6)
Unilateral	4 (5.4)
Degree of hearing loss (84 ears)	
Moderate	24 (28.6)
Severe	50 (59.5)
Profound	10 (11.9)
Type of hearing loss (84 ears)	
Sensorineural	51 (60.7)
Mixed	33 (39.3)
Duration of hearing aid use (years)	
1-5	15 (20.3)
6-10	38 (51.4)
> 10	21 (28.4)

In Table 2 we displayed the main side effect or complaint reported by the patients with monoaural or binaural fitting configuration.

Table 2. Main side effect/complaint in different fitting configuration

Main side effect/ complaint	Monoaural		Binaural		Total		p*
	No	%	No	%	No	%	
Acoustic feedback	51	68.9	5	6.8	56	75.7	
Poor benefit	13	17.6	5	6.8	18	24.3	
Total	64	86.5	10	13.5	74	100	0.042

*Chi-square test

Majority of patients reported acoustic feedback (an unpleasant sound from the device) as a main side effect associated with hearing aid use. There was statistically significant difference between reported side effect and fitting configuration. A second important complaint was poor benefit. The patients had feeling that their hearing aids do not help sufficiently. Patients had also reported other side effects and complaints associated with hearing aid use: background noise is uncomfortably loud, short battery life, poor sound quality, bad fitting, ear pain, fullness sensation in the ears, they cannot operate the device themselves, stigmatization, and feeling nervous.

Table 3 contains hearing aid style distribution in terms of the satisfaction with the hearing aids. A total of 84 ears were included because 10 patients had binaural fitting.

Table 3. Hearing aid style in terms of the satisfaction with the hearing aids

Hearing aid style	Satisfied		Non-satisfied		Total	
	No	%	No	%	No	%
BTE	16	19	6	7.1	22	26.2
Mini-BTE	27	32.1	14	16.7	41	48.8
ITE	5	6	2	2.4	7	8.3
ITC	6	7.1	4	4.8	10	11.9
CIC	2	2.4	2	2.4	4	4.8
Total	56	66.7	28	33.3	84	100

We displayed hearing aid styles commonly used in the sample: mini-BTE, ITC and CIC (Figure 1). Types of earmold/eartip/dome used in BTE hearing aids was the following: 29 custom (46%) and 34 eartips for open-fitting (54%).



Figure 1. Hearing aid styles commonly used in the sample

In Table 4 we displayed distribution of the patients in terms of the duration of daily use of hearing aids and degree of hearing loss. It is assumed that degree of hearing loss is a factor contributing to use or rejection of hearing aid.

Table 4. Duration of daily use of hearing aids in terms of the degree of hearing loss

Duration of use (hours)	Moderate		Severe		Profound		Total		p*
	No	%	No	%	No	%	No	%	
More than 5	15	17.9	34	40.5	5	6	54	64.3	
Less than 5	9	10.7	16	19	5	6	30	35.7	
Total	24	28.6	50	59.5	10	11.9	84	100	0.543

*Chi-square test

Patients with a higher degree of hearing loss wear their hearing aids longer in a day, but there is no statistically significant difference in duration of daily use of hearing aids and degree of hearing loss.

Discussion

The aim of the present study was to determine the side effects and complaints associated with the hearing aids as factors contributing to use or rejection of hearing aids in patients with hearing loss. Majority of patients reported acoustic feedback (unpleasant sound from the device) as a main side effect associated with hearing aid use. Other studies also showed that feedback is one of the most frequent complaints of hearing aid users. The most common type is acoustic feedback, which is often referred to as high-frequency tonal sounds

emitted by hearing aids. In a more general sense, it is the output of the receiver escaping from the ear canal, tubing wall, and the sides of earmold/shell/vent being picked up by the hearing aid microphone, whether or not a whistling sound is heard. A whistling or ringing feedback is heard only when the hearing aid goes into "oscillation". This happens when the amplification from the microphone to the receiver is greater than the attenuation of the amplified sounds from the receiver to the microphone. The frequency range of acoustic feedback is usually 2 to 5 kHz. Feedback limits the amount of maximum gain that can be provided by a hearing aid and limits the style of the hearing aid that can be fitted to users with a particular degree of hearing loss (Chung, 2004).

Second important complaint in our study was poor benefit. The patients had feeling that their hearing aids do not help sufficiently. Other side effects and complaints associated with hearing aid use have also been reported: background noise is uncomfortably loud, short battery life, poor sound quality, bad fitting, ear pain, and fullness sensation in the ears. McCormack and Fortnum (2013) classified the reasons for non-use of hearing aid (HA) in the following way: Hearing aid value/speech clarity (noisy situations/background noise, does not help/poor benefit, poor sound quality and not suitable for type of hearing loss); Fit and comfort of the hearing aid(need help putting HA in, need help taking HA off, uncomfortable and side effects: rashes, itching); Care and maintenance of hearing aid(need help changing batteries, handling problems/ manual dexterity, volume control adjustment, attitude and no need/hear well enough without HA); Device factors (not working properly/broken, disappointed with HA, feedback/whistling, device requires service, battery life too short, makes voice sound funny and poor directivity); Situational factors (no opportunity/ lack of situations necessary for HA, only used for specific situations, only works in limited situations, and does not work on the phone); Financial factors (cost of repairs and cost of batteries); Psycho-social factors (nuisance/hassle, forget to use it and lost it); Health care professionals(poor service from dispenser and oversold expectations); Appearance (stigma of wearing HA, do not like the appearance and cosmetic concerns); Infection/ear problems(have tinnitus, cannot use due to external otitis and ear wax problem) and Recommendations (family pressure to get HA). Solheim et al. (2012) examined four factors related to hearing-aid use in older adults: "accepted need" defined as the acknowledgement of a need for hearing aids; "follow-up support" defined as organized check-ups and accessibility to professionals; "social assessment" and "consciousness". The use of hearing aids was significantly associated with "accepted need" and "follow-up support", suggesting that these factors are important and should be emphasized in rehabilitation programs. Gahlon et al. (2024) identified patterns of hearing aid usage among U.S. National Health & Aging Trends Study (NHATS) participants. There were three utilization group patterns: continued use (76.6%), interrupted use (18.2%), and ceased use (5.2%). Nearly a quarter of hearing aid users experience interrupted or ceased use of hearing aids. Socioeconomic factors, such as age, income, and education, may be relevant for how individuals

use assistive medical devices over time. A study that investigated the efficiency of the Swiss hearing aid dispensing system and factors contributing to successful hearing aid provision showed that 85% used their device(s) regularly, 12% only occasionally and 3% never. Eighty percent were satisfied with their aids. Non-regular use of hearing aids was significantly associated with age, gender, regional language, total duration of use, type of amplification, hearing aid category, hearing loss, and dissatisfaction with and difficulties in managing the aid. Dissatisfaction was associated with regional language, total duration of use, difficulties in managing the aid, and non-regular use. It was concluded that rates of regular hearing aid use and satisfaction are high in Switzerland (Bertoli et al., 2009). Knoetze et al. (2023) presented the conclusions of the review that investigated the factors influencing hearing help-seeking and hearing aid uptake in adults. Age and gender were not predictive of hearing help-seeking or hearing aid uptake in most studies. However, a few reports indicated that older people and males were more likely to seek help or to take up hearing aids. Social factors like social pressure appear important for hearing help-seeking. The perceived potential benefit of amplification was linked to hearing help-seeking and positive attitudes to hearing aids and an understanding of their function were predictive of hearing aid uptake. Access to financial support was a strong predictor of hearing aid uptake but not of hearing help-seeking. The severity of hearing loss and greater self-reported hearing disability were two of the most important predictors of hearing aid uptake. Franks and Timmer (2024) investigating the reasons for the non-use of hearing aids concluded that for the past-user group, device related issues were the largest contributing factor to non-use. Past users stated the following: "the hearing aids didn't feel comfortable in my ears", "I didn't like wearing hearing aids" and that the hearing aids did not help them.

In our study some patients reported that they cannot operate the device themselves. Desjardins and Doherty (2009) investigated the experienced hearing aid users' ability to manipulate their hearing aids correctly. Individuals who wear hearing aids without fully understanding how to use them correctly may not be receiving maximum benefit from the devices. In the worst case scenario, this could result in the hearing aid user rejecting amplification altogether.

In present study patients also reported stigmatization and feeling nervous as factors contributing to use of hearing aids. Ritter, Barker and Scharp (2020) explored the reasons for hearing aid non-use in the United States. Four reasons were internally motivated: non-necessity, stigmatization, lack of integration into daily living, and unreadiness due to lack of education. There are also device-centric reasons (e.g., sound quality is poor, feedback, short battery life, etc.). The stigmatization still keeps hearing impaired people from accepting an adequate treatment of hearing loss. Some estimation showed that only 15% of hearing impaired persons (only in Germany those are 15 million candidates) wear hearing aids. Hearing aids should be recommended and prescribed as early as possible in order to prevent deprivation of the hearing pathway and especially of the auditory cortex. A large epidemiologic study in the

USA showed that only 22.5% of the people with moderate to severe hearing loss wore hearing aids (Hoppe and Hesse, 2017).

However, despite side effects, in general, about one third of the patients in our sample were satisfied with the hearing aids. Mahmutovic, Hasanbegovic and Tomic (2023) investigated the satisfaction with the use of hearing aids in everyday life in Bosnia and Herzegovina. They concluded that the majority of hearing aid users regularly wear a hearing aid, that they benefit significantly from the hearing aid, and that it helps them communicate. They have no significant problems when using and handling the hearing aid. A smaller percentage of users have no problems with telephone calls and have better functionality of hearing aids in a closed room and have no problems with sound orientation. According to Mustafa and Krishnamurthy (2025), despite advancement in hearing aid technology has enhanced user satisfaction but challenges with understanding speech in noise still persist. The actual usefulness of hearing aids in real-life situations is uncertain. While noise management, directionality, and signal processing may somewhat improve the situation, they generally do not meet the expectations of users of premium devices.

Our study showed that except side effects and complaints related to hearing aid use, degree of hearing loss is also an important factor for use or rejection of hearing aid. Patients with a higher degree of hearing loss wear their hearing aid more regularly. A study that assessed the benefit of hearing aids among patients with different degrees of hearing loss and determined the profiles of patients who have the least benefit from hearing aids showed that hearing aids improved communication in everyday life situations among 91.6% of hearing aid users. This is a very important conclusion that helps to raise awareness among patients who have doubts about whether to choose a hearing aid. Patients with severe hearing loss benefited the most from hearing aids (Ziemska-Gorczyca, Dzaman and Kantor, 2024).

Conclusion

The main side effect of hearing aid use is an acoustic feedback as an unpleasant sound from the device. The second important complaint is poor benefit from the hearing aid. The patients have feeling that their hearing aids do not help sufficiently. Other side effects and complaints associated with hearing aid use are the following: background noise is uncomfortably loud, short battery life, poor sound quality, bad fitting, ear pain, fullness sensation in the ears, hearing-aid users cannot operate the device themselves, stigmatization, and feeling nervous. Degree of hearing loss is also a factor contributing to use or rejection of hearing aid. Patients with a higher degree of hearing loss wear their hearing aids longer in a day.

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