

Problems encountered with hearing aids in adult population

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Abstract

Language and speech are natural tools for communication. Loss of hearing causes multiple problems, results in a decrease in life quality and psychosocial regression, depressive symptoms and communication failures. For situations when medical and/or surgical approaches to eliminate or reduce the effects of hearing loss do not succeed, hearing aid devices are an option. The aim of this paper is to determine the problems with usage of hearing aids by adults and to offer possible solutions. The selection of the type and model of a hearing aid device in a way to meet individual requirements is a critical step. An efficient hearing aid application is expected to be more beneficial when supported by an audiological rehabilitation. The problems encountered in usage of hearing devices in adult stage are not only physical factors but can also be individual factors. Lately the digital hearing devices are gaining popularity and utilisation problems are encountered quite less but still many problems are waiting to be solved. To minimise the problems encountered with usage of hearing aids in society, healthcare professionals advising hearing aids should have a better training and equipment, number of disciplines focusing on hearing devices should be increased and all related parties (government agencies, healthcare workers advising hearing aid devices, device suppliers) should follow developments in the field closely. It is expected for all the parties to find a common ground and aim for maximum benefit from the audiological rehabilitation of individuals with hearing loss.

Keywords: Hearing aid device, hearing loss, audiological rehabilitation, adult.

Özet: Erişkin popülasyonda işitme cihazı kullanımında karşılaşılan sorunlar

Dil ve konuşma, iletişim için gerekli doğal araçlardır. İşitme kaybı birçok işitsel probleme yol açarken, aynı zamanda yaşam kalitesinin düşmesine, psikososyal gerilemeye, depresif semptomlara ve iletişim bozukluğuna da neden olmaktadır. İşitme kaybını ortadan kaldırmaya veya olumsuz etkilerini azaltmaya yönelik çeşitli medikal ve/veya cerrahi yaklaşımların sonuç vermediği durumlarda işitme cihazı bir seçenektir. Bu derlemede, erişkin çağda işitme cihazı kullanımında karşılaşılan sorunların tespiti ve bunlara yönelik olası çözüm önerilerinin oluşturulması amaçlanmıştır. Bireysel beklentileri karşılayan işitme cihazı tipinin ve modelinin seçilmesi kritik öneme sahiptir. Etkin bir işitme cihazı uygulamasının odyolojik rehabilitasyon ile desteklendiğinde daha faydalı olması beklenir. Erişkin dönemde işitme cihazı kullanımında karşılaşılan sorunlar cihaza ait fiziksel faktörler olabileceği gibi, kullanıcıya ait bireysel faktörler de olabilir. Son dönemde popülerite kazanan dijital işitme cihazlarıyla kullanım sorunları oldukça azaltılsa da, işitme cihazı kullanımında hala birçok sorun çözülmeyi beklemektedir. Toplumda işitme cihazı kullanımında karşılaşılan sorunları en aza indirmek için işitme cihazı öneren sağlık çalışanlarının bu konudaki donanımlarının artırılması, işitme cihazı alanında çalışan disiplin sayısının artırılması ve konuyla ilgilenen tüm tarafların (ilgili devlet kurumları, cihaz öneren sağlık çalışanları, cihaz satıcıları) gelişmeleri yakından takibi büyük önem taşımaktadır. Konunun paydaşlarının ortak bir paydada buluşup işitme kaybı olan bireylerin odyolojik rehabilitasyonunda maksimum fayda sağlamayı amaçlaması beklenmektedir.

Anahtar sözcükler: İşitme cihazı, işitme kaybı, odyolojik rehabilitasyon, erişkin.

Hearing Loss and its Effects

Role of Hearing in Human Life

The ear works from birth to death without a pause and has the capability to produce its own energy. It is the first fully

developed and functioning organ in the intrauterine period and it is also the last organ to die in death. The role of hearing in the physical and psychological development of a human being who starts interacting with his environment

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right after birth and later on continuing to communicate as a social entity cannot be overlooked. Language and speech are necessary natural tools for communication. The loss of these partially or completely during any period in life affects life quality drastically. In the beginning, when people only worked for their needs in life, hearing loss was a secondary problem. Today, together with the increase in life expectancy and quality, the effort toward quality of life (music, arts etc.) is also gaining momentum. Similarly, the expectations from hearing aids have increased and people with hearing loss not only expect to be able to hear and understand spoken words in a quiet environment but also in different environments like a concert or a crowded place.^[1,2]

Results of Hearing Loss

Hearing loss results in a reduction of social skills due to communication problems, in a lack of confidence and isolation. In certain cases, disabilities may develop in patients who do not receive medical help or hearing rehabilitation. A hearing device utilised for ease of communication can minimise the effects of hearing loss and improves life quality perceivably.^[3,4]

Psychosocial Effects of Hearing Loss

Hearing loss results in a reduced life quality, depressive symptoms and reduction in functional capacity.^[5] Hearing loss can cause many auditory problems such as the reduction in hearing sensitivity, distortion in speech signals, reduced frequency sensitivity, reduced tolerance for noise and loud sounds, deterioration of temporal resolution, problems with binaural hearing, but also it can cause many communication problems; creates a reduction in social relation levels, can affect mental health and cognitive skills, can cause loss of attention and concentration and continuity of hearing loss. In medical literature, a lot of work is focused on psychosocial results of hearing loss. Trychin et al. classified the reactions an individual develops toward a hearing loss as following: emotional reactions such as stigmatisation, shame, guilt, anxiety, rage and disillusionment and depression, cognitive reactions such as lack of concentration, carelessness, difficulty in listening and reduced self esteem, interpersonal reactions such as social withdrawal, dominant speech or loss of sincerity in personal relations, behavioural reactions such as restricting social activities, or physical reactions such as fatigue, muscle tension, headaches, stomach and sleep problems.^[6]

Stigmatisation can be seen in many subjects and situations but since the early ages, it is mostly related to people

with a mental disorder. We now know that in all cultures and in all levels of society, people with a mental disorder are stigmatised and isolated and patients are concerned by this situation and carry the stigmatisation feeling within themselves.^[7] Coming from the depths of history and probably being one of the first common reactions of humanity, stigmatisation is also valid for stigmatisation dynamic after hearing loss and hearing aid usage. Many studies are reported from different countries, cultures and geographies about the subjects to overcome these and social education, social campaigns and audiological rehabilitation solutions are proposed.^[6,8-10]

Hearing Loss in Elderly

Aging can hinder communication by causing presbycusis, actually hearing loss has become one of the most frequently encountered chronic diseases in the elderly. In USA, hearing loss is the 3rd most common chronic disease afflicting the elderly.^[11] With the increasing life quality, the elderly population and presbycusis incidences are increasing in numbers and proportion. Some of the elderly are also suffering from conductive or mixed hearing loss. Hearing loss is important in older adults since it can cause insufficient social activity due to communication problems, worsening of depressive symptoms, lack of self-esteem and solitude. Acar et al. reported that a mini-mental state examination (MMSE) resulted in a statistically meaningful improvement in cognitive functions, geriatric depression scales and depressive symptoms 3 months after utilising hearing aids on 34 patients older than 65 years, who never used a hearing device.^[12]

Numerous problems in geriatrics can be solved with the advances in medical technology which are occurring at a breakneck speed, the small amount of problems causing hearing loss can be minimized; however, causes of hearing loss are still waiting to be eliminated. That is why hearing devices minimizing the effects of hearing loss are still largely used and continuously improved.

Audiological Rehabilitation

During audiological rehabilitation, the selection of the device in accordance with the hearing loss and technical specifications of the device determines the success of the rehabilitation. The device type and model should be capable of meeting personal requirements. A device will not satisfy the user if it does not meet the user's expectations and does not improve life quality sufficiently. Each device

has its own separate acoustic characteristic; moreover, the accompanying mold can cause variations in the acoustic power of the device. When comparing hearing devices, it can be seen that each have their own indications, advantages and disadvantages.

It is known that hearing devices have a positive effect on quality of life. Supplementary audiological rehabilitation programs are more effective on psychosocial results. Major factors contributing to these results are age, sex, duration of device use, economic status and communication strategies. Abram et al., who first shown the benefits of audiological rehabilitation, report that effectiveness of a hearing device increases with supplementary audiological rehabilitation.^[13] Brewer et al. also reported similar results.^[14] In these studies, the audiological rehabilitation program is described as a consultancy-based program designed to reduce psychosocial problems related hearing loss and includes study sessions covering ear anatomy, hearing losses, hearing devices, auxiliary hearing devices, speech, reading and communication strategies. Gil and Iorio have shown in their study carried out on 7 adults using hearing devices who received an auditory training and 7 adults who did not receive any training that the auditory training results in a reduction of P3 latency, improved voice localization, improved memory for communication sounds and figure-ground for linguistic voices and more utilisation in noisy environments or in the presence of echo sounds.^[15] Still there is no consensus on the contents and standards of an audiological rehabilitation program.^[1]

Numerous questionnaires have been developed to evaluate the effectiveness of hearing devices. The International Outcome Inventory for Hearing Aids (IOI-HA) is based on 7 parameters, daily use, utilisation, residual activity limitations, satisfaction, residual participation restrictions, impact on others and life quality. Hearing Handicap Inventory for the Elderly (HHIE) is developed to assess hearing loss and life quality and includes 13 questions with social elements and 12 questions with emotional elements. Social Hearing Handicap Index (SHHI) is used to evaluate hearing in social environments. The first 10 questions are for hearing environment where there is little to none environmental noise, the other 10 questions are for the case when environmental sounds are present. However, SHHI is not applicable in some cases, for instance on patients with very advanced stages of hearing loss or psychological problems.^[1,16]

In their study on 232 patients, by utilising the Turkish version of IOI-HA, Kirkim et al. reported that the type of

hearing device and the level of hearing loss is not effective on patients' satisfaction but the level of hearing loss influences daily device usage duration.^[17]

In their study on 179 patients conducted to investigate device usage and patient satisfaction rate, Kahveci et al. reported that that hearing loss type and level, hearing device type, whether if the patient is self-sustaining or requires external care, education level of the patient, device usage duration and ease of device usage, device vendor and device price have no effect on customer satisfaction.^[18] However, patients below 70 years compared to ones above 70 years, patients who received training on device properties and device usage compared to the ones who did not have training, and patients whose device vendor has an audiometrist on site compared to patients whose vendors were without an audiometrist show a statistically significant higher rate of satisfaction.

Problems Encountered in Hearing Device Usage Factors Restricting Usage of Conventional Hearing Devices

On selected patients with a proper hearing device utilisation and rehabilitation, a meaningful improvement in communication occurs; however, many candidates for hearing device treatment either could not get their devices or the devices remain unused. A study shows that roughly 59% of all the hearing devices are sold to elderly with restricted financial incomes.^[19] Similarly, Franks and Beckmann remarked the high costs as one of the main reasons among elderly against the usage of hearing devices in addition to concerns of stigmatisation and quality of sound amplified, sales techniques of hearing device vendors, lack of skills to use the device and insufficient information about alternative financial sources to obtain hearing devices.^[20] In another study, 39% of hearing device users reported problems which were disturbing acoustic feedback due to improper ear molds, amplified background noise, distortion of voices etc.^[21] To reach a complete satisfaction with the device a patient may have to visit a hearing device application centre for numerous times. Correct training is one of the most important factors in hearing device usage.

Of the individuals with a hearing device, 12% of them never used their devices and only 58% of individuals who use their devices regularly reported that their devices were efficient enough. This situation may result from individuals themselves (cosmetics, psychological reasons etc.) or from deficiencies of hearing devices but may also result from removal of normal energy transfer paths (radical

mastoidectomy) or modification of said paths (ossiculoplasty, modified radical mastoidectomy).

Application problems such as improper selection of hearing devices and earmolds with regards to audiological and clinical properties are other frequently encountered disadvantages. Sometimes, special cases such as irritations on external ear canal or repeating infections or cavity problems due to surgical operations for chronic otitis media or middle ear diseases or situations where the convection arc is distorted may cause problems in hearing device usage. Especially motor skill deficiencies due to advanced age and recession in cognitive skills are frequently encountered disadvantages among the elderly.^[22]

Restrictions on Audiological Rehabilitation During Usage of Conventional Hearing Devices

The latest developments in signal processing and miniaturization resulted in an increasing acceptance of hearing devices; however, cost, complications of external ear canal occlusion, cosmetic concerns and an insufficient lack of understanding of the merits of hearing devices makes the selection of a hearing device still a difficult one. Conventional (analogue) hearing devices have some inherent disadvantages due to their design and the path they operate in, the air of the external ear canal.

Physical Factors

- **Insufficient gain:** Primary purpose for patients with heavy hearing loss is the amplification of sound. Since the gain is usually dependent on the size of the hearing device, cosmetically pleasing devices have less gain. The necessity of a hearing device according to the level of hearing loss is shown in Table 1, maximum gains for some hearing device types are shown in Table 2.
- **Acoustic feedback:** Part of the acoustic waves emitted from the hearing device speaker reflects back from the eardrum and leaks back through the air gap between hearing device body and external ear canal wall. These waves enter the microphone as additional noise and are again amplified. The resulting positive feedback is disturbing shrill sound. Potential feedback is worse in the channel devices where microphone is close to the speaker and in ears with large mastoid cavities.
- **Insufficient acoustic quality and sound distortion (Non-linear harmonic distortion):** Conventional hearing devices are limited to the frequency interval they amplify. Most of them give their best performances in speech band (500–2000 Hz), since they cannot homoge-

nously amplify the sound in low frequencies (Meniere disease) or high frequencies (presbycusis, autotoxicity) an artificial character is induced to voice reception due to losses in low and high frequencies. Additionally, even in speech frequencies, the vertical changes in the amplification gain creates typical phase shifts.

- **Effects of external ear canal occlusion:** It causes a feeling of discomfort due to the pressure on canal skin. Due to continuous irritation, secondary otitis externa risk increases. Patients with chronic otitis media cannot tolerate their hearing loss due to frequent otorrhea. It results in a worsening autophony in case of external pressure variations and a sense of fullness in ears. External ear canal resonator effect is lost. Canal hygiene problems may occur.
- **Negative image:** Many patients refuse the usage of hearing devices to avoid getting stigmatised as old, weak or handicapped.
- **Frequent change of batteries**
- **Frequently repeating technical problems**

Human Factors

- **Recruitment and reduction in dynamic field:** Sensorineural hearing loss results in a reduction in dynamic field, dependent on the increase on sound amplitude results in the abnormal recruitment occurrence; this creates problems while using hearing devices in noisy environments.

Table 1. Benefits of a hearing device based on the level of hearing loss.

| Level of hearing loss | Benefits of hearing device |
|-----------------------|-----------------------------|
| 0-25 dB HL | No need |
| 26-40 dB HL | Optional, needed |
| 41-55 dB HL | Needed |
| 55-80 dB HL | Highest utilisation |
| 80-90 dB HL | Low utilisation |
| ≥91 dB HL | Cochlear implant indication |

Table 2. Maximum gains of some hearing device types.

| Type of hearing device | Maximum gain (dB) |
|------------------------|-------------------|
| Behind the ear | 75-82 |
| In the ear | 55-65 |
| In the channel | 45-55 |
| Completely in channel | 35-50 |

Sound Localization and Distortion in Sound Tone Resolution

When only one ear functions or if there is a big variation in hearing thresholds between ears, the localization of sound source becomes problematic and sound tone resolution is distorted. The air filled external ear canal has different mechanical impedance than the cochlea, which is filled with liquid. The inequality in impedance and loss of energy due to lack of harmony is another shortcoming of conventional hearing devices. Even the majority of the state of the art hearing devices cannot replicate the complex, non-linear response of healthy cochlea and can barely imitate selectivity of the cochlea while organising sound tone information.^[23] Factors above may increase the rate of incompatibility for device users. In addition to all that many device users still think that the device is not satisfying their needs sufficiently and feel bad about it.^[24]

Digital Hearing Devices

After supplementing conventional, manually controlled analogue hearing devices with frequency control, gain, limiting, output power maximizing and voice processor circuits and enabling digital control resulted in digital hearing devices. Digital hearing devices are open to further development since through different software its functions can be improved.

Advantages of Digital Hearing Devices

Digital hearing devices produced in the recent years have a lot of advantages compared to analogue hearing devices:

- Smaller size but stronger output.
- Longer battery life due to small size and less energy consumption.
- Lightweight, aesthetically pleasing design.
- Remote control option.
- Better sound quality through suppression of internal noise and feedback.
- More flexible usage for fluctuating and progressive hearing loss due to the possibility of running different algorithms in signal processor.
- Availability of automatic selection of different operating programs for maximized hearing performance in different environments (concerts, in car, cocktails).
- Best performance when ears have different levels of hearing loss since it can be programmed to compensate for differences.
- Ease of maintenance and repair due to reduced number of mechanical parts.^[25]

Cost Efficiency of Hearing Devices in Health Economics

Worldwide data suggests that approximately 300 million people are suffering from hearing problems. Annually 10 million hearing devices are sold worldwide and it has been estimated that only 3% of all the people with hearing loss are utilising a hearing device. In Turkey, 130,000 devices were sold in 2012 but the size of the market is estimated to be around 400,000 people. However, it is thought that the number of people with a hearing problem who actually use a hearing device is in the order of one-thousandth.

It can be seen that hearing devices form a big portion of all healthcare costs in the world and Turkey considering patients pay extra in addition to budgets of insurance companies. In a country like Finland with a population of 5 million, annually more than 13 million Euros are spent for hearing devices.^[26] In Turkey, accessing to reliable cost information is problematic.

Results and Suggestions

Modern hearing technology makes fine-tuning available and hearing device users are mostly satisfied with features such as multi-channel compression, feedback and environmental noise suppression, multi-directionality, wind effect suppression, and speech recognition. Hearing industry is reducing current problems but due to the lack of qualified personnel in hearing device sale points, actual applications are still problematic and developed technologies do not always reach the end user. In short, users' demands and expectations can be mostly met with current acoustic technology, the real problem lies with applications and marketing and adaptation of new technologies.^[27]

Checking market share information it can be seen that the hearing device market share is growing but not in a consistent and healthy manner. The number of new audiometrist graduates is lacking and the demands of public and private hospitals prevent new centres from opening. Also the number of audiologists employed in private sector is negligibly small. However, in the last few years, public and private universities launched new audiology departments and new postgraduate programs on audiology. All these new programs should be based on actual employment data and should be aligned to the needs of the country. Otherwise, launching new departments without a control can result in market saturation and unemployment in near future in as close as 5 years. The deficiencies in numbers of instructors and laboratories may reduce the quality of the education. Curriculum should be re-evaluated with regard

to the needs of the sector and technological developments. Practical applications during the education should be deemed mandatory to give new graduates necessary skills. It may even be necessary to found more specific departments to train hearing device acoustic technicians.

In Turkey, audiological clinics are not inclined to share their experience and know-how, audiological experts are not sensitive enough to the problems of the sector and function in an isolated manner from the sector. Ear-Nose-Throat doctors do not show sufficient interest into the subject and due to their heavy working conditions, they cannot inform patients sufficiently on advantages of hearing devices or encourage them to use hearing devices.

Hearing device sector had no regulation for years and this also shifted public opinion to negative when it comes to hearing devices. Since hearing devices take a very small percentage in total health costs, related institutions and individuals are not involved in the sector sufficiently. Frequent changes of responsible authorities, lack of clarity of regulations and unnecessary bureaucracy makes obtaining hearing devices very hard.

Along with these sectoral problems, Minister of Health has disciplined the sector with regulations and some changes in the last few years. Hearing devices are now sold in audio centres, there is an increase in equipment in hearing centres, sale of unregistered products are prevented with National Data Bank system and social security payments are partially increased compared to before. Competition is increasing quality and co-operation of state authorities with non-governmental organizations increases public awareness in public regarding hearing device usage.

Kahveci et al. reported that ear-nose-throat doctors are quite active while hearing device need is diagnosed and related health report is prepared, but remain passive in later stages like device selection, device adjustments and patient's training, so the case is not tracked sufficiently and it results in a patient group with an un-determinable percentage of success.^[18] They also suggest that the problems while purchasing a hearing device and their solutions should be examined from a social security viewpoint and ENT doctors should take more responsibility while introducing the patients to the hearing device and explaining its properties.

Rapid changes in technology and chaos and lack of regulation regarding hearing devices may result in our country becoming a technological dump. Developing countries like Turkey cannot free themselves from external dependencies without developing their own technology. To over-

come these problems, the number of device advising health personnel and their skills must be increased, more disciplines should be founded which work on hearing devices and all related parties should follow latest developments closely for cost efficiency and better results.^[2]

To minimise hearing device usage problems in society shareholders of the subject, device importers and vendors first should reach a consensus and then universities and later on the scope of this consensus should be enlarged with the addition of institutes such as the Turkish Council of Higher Education (YÖK), the Scientific and Technological Research Council of Turkey (TÜBİTAK) etc. to find a common ground toward the maximum audiological rehabilitation of individuals with hearing loss.

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References

1. Karabulut H, Karaşen RM. Yaşlılarda işitme cihazı uygulamaları ve sonuçlarının psiko-sosyal yansımaları. *Türkiye Klinikleri Journal of ENT Special Topics* 2012;5:75–9.
2. Belgin E, Ataş A. İşitme cihazları. In: Çelik O, editor. *Kulak burun boğaz hastalıkları ve baş boyun cerrahisi*. 2nd ed. İzmir: Asya Tıp Kitabevi; 2007. p. 324–37.
3. Joore MA, Van Der Stel H, Peters HJ, Boas GM, Anteunis LJ. The cost-effectiveness of hearing aid fitting in the Netherlands. *Arch Otolaryngol Head Neck Surg* 2003;129:297–304.
4. Seniors Research Group. The consequences of untreated hearing loss in older patients (summary). Washington: The National Council on the Aging; 1999.
5. Lupsakko TA, Kautiainen HJ, Sulkava R. The non-use of hearing aids in people aged 75 years and over in the city of Kuopio in Finland. *Eur Arch Otorhinolaryngol* 2005;262:165–9.
6. Trychin S. Guidelines for providing mental health services to people who are hard of hearing. San Diego: California Univ.; 2002.
7. Taşkın EO. Ruhsal hastalıklarda damgalama ve ayrımcılık. In: Taşkın EO, editor. *Stigma ruhsal hastalıklara yönelik tutumlar ve damgalama*. İzmir: Meta Basım; 2007. p. 17–30.
8. Héту R. The stigma attached to hearing impairment. *Scand Audiol Suppl* 1996;43:12–24.
9. Hogan A. Hearing rehabilitation for deafened adults: a psychosocial approach. London: Whurr Publishers; 2001.
10. Wu HY, Chin JJ, Tong HM. Screening for hearing impairment in a cohort of elderly patients attending a hospital geriatric medicine service. *Singapore Med J* 2004;45:79–84.
11. Bogardus ST Jr, Yueh B, Shekelle PG. Screening and management of adult hearing loss in primary care: clinical applications. *JAMA* 2003;289:1986–90.
12. Acar B, Yurekli MF, Babademez MA, Karabulut H, Karasen RM. Effects of hearing aids on cognitive functions and depressive signs in elderly people. *Arch Gerontol Geriatr* 2011;52:250–2.

13. Abrams HB, Hnath-Chisolm T, Guerreiro SM, Ritterman SI. The effects of intervention strategy on self-perception of hearing handicap. *Ear Hear* 1992;13:371-7.
14. Brewer DM. Considerations in measuring effectiveness of group audiologic rehabilitation classes. *J Acad Rehab Audiol* 2001;34: 53-60.
15. Gil D, Iorio MC. Formal auditory training in adult hearing aid users. *Clinics (Sao Paulo)* 2010;65:165-74.
16. Ağaç ME. İşitme cihazları uyarlama metotları. İstanbul: Mega Basım Yayın: 2013.
17. Kırkım G, Şerbetçioğlu MB, Mutlu B. Uluslar arası işitme cihazları değerlendirme envanteri Türkçe versiyonu kullanılarak hastalardaki işitme cihazı memnuniyetinin değerlendirilmesi. *KBB ve BBC Dergisi*, 2008;16:101-7.
18. Kahveci OK, Miman MC, Okur E, Ayçiçek A, Sevinç S, Altuntaş A. Hearing aid use and patient satisfaction. *Kulak Burun Bogaz Ihtis Derg* 2011;21:117-21.
19. Pappas JJ, Bailey HA Jr, Graham SS. Clinical hearing aid dispensing: a five year review. *Laryngoscope* 1980;90:1475-80.
20. Franks JR, Beckmann NJ. Rejection of hearing aids: attitudes of a geriatric sample. *Ear Hear* 1985;6:161-6.
21. Tyler RS, Baker LJ, Armstrong-Bednall G. Difficulties experienced by hearing-aid candidates and hearing-aid users. *Br J Audiol* 1983;17:191-201.
22. Gündüz B, Cevizci R, Bayazıt YA. Orta kulağa implante edilebilen cihazlar. In: Koç C, editor. *Kulak burun boğaz hastalıkları ve baş-boyun cerrahisi*, 2nd ed. Ankara: Güneş Tıp Kitabevleri; 2013. p. 333-44.
23. Maniglia AJ, Murray G, Arnold JE, Ko WH. Bioelectronic options for a totally implantable hearing device for partial and total hearing loss. *Otolaryngol Clin North Am* 2001;34:469-83.
24. Santina CCD, Lustig LR. Surgically Implantable Hearing Aids. In: Cummings CW, Haughey BH, Thomas JR, editors. *Cummings otolaryngology - head & neck surgery*. 4th ed. Philadelphia, Elsevier-Mosby; 2005. p. 3575-600.
25. Ataş A, Polat Z. Dijital ve dijital olarak programlanabilen işitme cihazları. In: Koç C, editor. *Kulak burun boğaz hastalıkları ve baş-boyun cerrahisi*, 2nd ed. Ankara: Güneş Tıp Kitabevleri; 2013. p. 345-56.
26. Vuorialho A, Karinen P, Sorri M. Counselling of hearing aid users is highly cost-effective. *Eur Arch Otorhinolaryngol* 2006;263: 988-95.
27. Ağaç ME. İşitme cihazları uyarlama metotları. İstanbul: Mega Basım Yayın: 2013. p. 80-6.

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