AUDITORY TRAINING BENEFITS TO THE HEARING AIDS USERS– A SYSTEMATIC REVIEW

Benefícios do treinamento auditivo em usuários de aparelho de amplificação sonora individual – revisão sistemática

Lizandra Oliveira Beier [1], Fleming Pedroso [1], Maria Inês Dornelles da Costa-Ferreira [1]

ABSTRACT

The present study consists of a systematic review with the purpose of verifying the benefits of the auditory training for the hearing aids users. The studies were selected according to previously defined inclusion criteria and, from this selection, data of interest were extracted. Only studies with title, summary or part of the article connected to the object of this study were evaluated and selected. The researched articles demonstrate that the auditory training, carried out within its different conceptions, being formal, informal, with lip reading, or communication strategies, analytic or synthetic, benefits the hearing aids users, mainly when in combination with cognitive tasks.

KEYWORDS: Hearing Aids; Hearing Loss; Rehabilitation; Systematic Review

INTRODUCTION

The sense of hearing is very important for human communication. The hearing loss may have consequences for the individuals, hindering their oral communication and understanding, interfering with their quality of life. The hearing impairment makes the individual limited or unable to play its role in society[1].

One of the instruments used for the auditory rehabilitation is the hearing aid (AASI) whose microphones pick up the sound from the environment the amplifiers increase the intensity of the sound which is sent into the individual ear amplified by the receiver.[2]

Individuals with sensorineural hearing loss have more difficulties in perceiving the speech in noisy environments than individuals with normal hearing or with conductive or mixed hearing loss. The understanding of speech in competitive or noisy environments is still an aspect not provided by the hearing aids, despite the constant efforts of manufacturers in relation to the noise reduction systems[3].

To minimize the difficulties of speech understanding, especially in noisy environments, it is necessary to perform auditory training with patients who make use of hearing aids, with the objective of minimizing the deficiencies in processing information that are related to the difficulties in understanding speech in noisy and reverberating environments, and of maximizing the identification and discrimination of sound patterns.

Thus, the auditory training will exercise the auditory abilities in the attempt to minimize the functional deficits presented by the individual. It consists of listening tasks, in which the patient will perform the functions of auditory detection, auditory discrimination, auditory recognition and auditory understanding[4].

One of the principles of the auditory training is to develop the Central Nervous System neuroplasticity in order to generate changes in morphology and in auditory performance after the training and the auditory stimulation, allowing the patient to give a new significance- to re-signify- to each sound that he hears[4].

According to the literature, the auditory training has not been yet a practice of the user after the acquisition of the hearing aid. So, the proposal of researches on the subject is imperative in order to check the benefit and satisfaction with hearing

[1] Centro Universitário Metodista do Sul – IPA, Porto Alegre, RS, Brasil.

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aids in the light of scientific evidence. The study is justified on the ground that it checks, by means of a systematic review of the literature, if the auditory training produces beneficial outcomes for users of hearing aids. This way, the objective of this study is to check the benefits of auditory training to users of hearing aids.

METHODS

The method chosen for this study is a systematic review of auditory training post-adaptation of the hearing aid in which the studies were selected according to the inclusion criteria, previously established and, from this selection the data of interest were extracted. In the search, the only evaluated and selected studies were those whose title, or summary, or body of article had relation with the objective of this study, namely to determine whether the auditory training produces beneficial outcomes for the hearing aid users.

For the survey of descriptors it was used the structured vocabulary of the Descriptors in Health Sciences created for indexing articles in scientific journals and other publications, as well as, for the use in bibliographic databases.

The collection of articles was performed from the Scielo, Medline, Lilacs and Direct Science database between 2000 and 2013. They used the following descriptors: Auditory Rehabilitation; Hearing Aids; Auditory Training; Hearing Aids; Hearing Loss; Hearing Loss; Speech Perception; Hearing Aids; Elderly; Neural Plasticity; Hearing Tests; Adults; Auditory Training, Aural Rehabilitation; Communication Skills; Presbyacusis; Lip Reading; Cognition; Aging; Auditory Handicap.

The articles were analyzed qualitatively, in accordance with the inclusion criteria and with the question to be answered.

After the descriptors selection, another utilized criterion was the inclusion of articles in which the target audience was composed only of adults and of elderly. According to the exclusion criteria, the articles including samples and populations with normal hearing thresholds that had undergone therapy for auditory processing were dismissed. After the selection of abstracts relevant to the issue, the recovery of full-text articles was performed.

LITERATURE REVIEW

At the end of the survey of this study, 29 articles were found in the searched databases. However, only 17 were consistent with the inclusion criteria classified in accordance with the subject proposed in the study.

It is worth noting that a systematic review requires the inclusion of studies with high levels of evidence, that is, systematic reviews or meta-analyzes and randomized clinical trials. If exclusively this criterion were considered, the number of scientific articles would be reduced and other relevant information would not be considered, given the small number of published studies that focus on auditory training both in the international and mainly in the national literature. Therefore, other studies that do not fall exclusively into the mentioned categories were included such as clinical trials not randomized, studies of randomized clinical-cohort, quasi-experimental, quasi-experimental series of cases and descriptive and cross-sectional study.

In relation to the method used in the articles included in this study, three systematic reviews may be highlighted: two of them focused on the effectiveness of auditory training [5,6] and one on the use of software for the auditory training of adults and elderly users of hearing aids[7]. In addition to these, we also included two non- systematic literature reviews, being one about formal auditory training[8] and the other about factors associated with auditory training[9]. Regarding the prospective studies, eight are clinical trials that developed auditory training programs[10-17]; another one that has mixed design (clinical-cohort) [4]. In addition to these, three studies are characterized as randomized quasi-experimental[18], quasi-experimental series of cases[19] and cross-sectional and descriptive[20].

Based on the selected articles, it is possible to observe that the majority refers to the auditory training as a strong ally for the auditory rehabilitation of users of hearing aids. In the analysis, 12 out of 17 articles included in the present review aim to check the effectiveness of an auditory training program for elderly users of hearing aids. The studies involved from 7 to 100 participants with ages ranging from 60 to 90 years old, in their great majority. Such work focused on the formal, informal, analytical or synthetic Auditory Training, and involved communication strategies for such users [4,5,10,11,13-17]. Two studies also mentioned the need to reduce the auditory handicap using techniques such as the training of lip reading [18,19]. Another study examined the contribution of the family in the rehabilitation process of hearing aids users[11]. The effects of an auditory rehabilitation program regarding to the abilities of temporal resolution and ordering were also approached in one study[12]. Moreover, one study approached the profile of users of hearing aids treated at a health center with views to amplification, cognition and auditory processing, indicating that the amplification should not be considered in isolation[20]. Two studies review and discuss the software used

for the auditory training, pointing to the existence of available resources in the market [7,8].

On the other hand, another review pointed out the need to consider the negative factors that can affect the overall process of audiological rehabilitation such as changes in temporal resolution, deterioration of cognitive abilities (decline of auditory memory) and lower processing speed associated with aging. To minimize such occurrences, the study also examined the reasons for the lack of compliance with the therapeutic options, such as social and psychological factors that may come out throughout the process of the audiological rehabilitation. Among these factors it is possible to mention the denial of the problem, the difficulties encountered during the rehabilitation due to changes in the patterns of daily life among the family and friends, in addition to the lack of confidence toward the qualified professionals[9].

Several studies deal with different types of auditory training. In the selected articles 6 studies investigated the formal auditory training, carried out in a soundproof booth, basically using central auditory processing tasks [4,8,10,12-14]. However, 2 articles reported the use of informal auditory training, with evaluation materials containing words, sentences, and recording of sentences [11,16]. One systematic review article approached the type of training that may be analytical (bottom-up), which includes just the auditory tasks, or synthetic (top-down), which consists of communication strategies associated with the cognitive functions of attention, language, memory, and with the executive functions. The same article also mentions the possibility of combining both approaches[6]. Recently, such approaches have been referred to by scholars of auditory processing as guided by stimulus (bottom-up) and guided by task (top d Top-down), which consists of the communication strategies associated with cognitive functions of attention, language, memory and executive functions.The first represents the hemispheric specialization for processing a stimulus under the free listening conditions. The second concerns the alternation of attentive focus[21.]

One of the studies involving the informal auditory training included the practice of LOF together with the use of strategies of comunication[11]. Similar studies indicate that the LOF and the strategies of communication benefit the individuals in the use of visual clue, taking part of the speech perception, facilitating the communication and improving the quality of life of these indivíduals [18,19]. Two articles also combined the cognitive tasks with the formal auditory training in adults and the elderly, and concluded that the auditory training may, partially restore brain deficits related to age, promoting greater cognition and perceptive ability [15,16].

Other studies show different kinds of software created for the formal auditory training use, offering opportunities for audio-visual learning at the levels of vowels, consonants and sentenças[8]. Among the mentioned kinds of software, there are some national kinds focused on the auditory processing therapy, and some international ones that are particular for the auditory training. However, there is a need for more research on the use of software created for auditory training, since with its use it might be possible to develop proactive and updated strategies for the rehabilitation of the hearing aid users[7].

As for the frequency, number of sessions and duration of auditory training, the majority of the articles presented 7 to 8-week programs, once or twice a week, and with duration of 1h to 1h and 30min.[4,10-14,16-19].

Some studies on formal auditory training involved the following skills: figure-ground, auditory closure, temporal auditory processing (temporal resolution and ordering), binaural separation and integration and dichotic listening. The auditory training program was structured according to the number of sessions. In general, 7 sessions a week as follows: 1st session: Figure-background for verbal sounds (sentences) – Test of synthetic sentence identification (SSI)- right ear; 2nd session: Figure- ground for verbal sounds (sentences) – Test of synthetic sentence identification (SSI) – left ear; 3rd session: Figure-ground for verbal sounds (digits) – Dichotic Digits test (DD) – right ear; 4th session: Figure-ground for verbal sounds (digits) -Dichotic Digits test (DD) – left ear; 5th session: Figure-ground for non-verbal sounds – Non-Verbal Dichotic test – left ear and Figure-ground for verbal sounds (digits) – Dichotic Digits test- right ear; 6th session: Figure-ground for non-verbal sounds – Non-Verbal Dichotic test – right ear and Figure-ground for verbal sounds (digits) – Dichotic Digits test – left ear; 7th session: Binaural Integration – for verbal sounds (digits) – Dichotic Digits test and for non-verbal sounds – Non-verbal Dichotic Test [4,10,13].

The studies concerning the LOF and communication strategies were carried out along an average of 5 sessions that consisted in the presentation of labial phonemes (/p, /b/), in the first session; denti-alveolar (/t, /d/), in the second session; palatal alveolar (/f, /v/), in the third session; palatal (/m, /n, /l/), in the fourth session, and velar (/k /g, /r, /s, /S/), in the 5th session, in dissyllabic and in three-syllable words, as well as in sentences. In each session, three different communication strategies were used, namely: “Pay attention to the speaker, not only to

the lips, but also to the gestures and expressions", "The face of the speaker must be always ahead", "Try to relax, the tension interferes with the lips reading ability", "Learn to look at the ideas, not only at the isolated words" among others [18,19].

The auditory training associated with cognitive tasks was also presented by other studies, with a duration of 8 weeks, in which the speech discrimination, figure-ground and auditory closure tasks started to be performed by means of an auditory memory activity and communication strategies in which the participants received useful tips to adapt to different situations of daily life[15,16].

The study involving the skills of temporal resolution and ordering cited the following tasks: musical auditory training (MAT), which included the auditory abilities of temporal processing, selective attention through figure-ground of instrumental sounds, frequency and duration of sounds, directed listening, rhythm and auditory closure[12].

As already mentioned, the majority of studies had a clinical delineation design in which some kind of measurement is forecasted, before and after the completion of the experiment, compared to a control group that performed the same measures, but without any treatment. Thus, the assessments consisted, essentially, of the self-assessment questionnaires: Hearing Handicap Inventory for the Elderly (HHI-E) and Abbreviated Profile of Hearing Aid Benefit (APHAB); tonal audiometry; research of the signal-to-noise ratio; Test of recognition of sentences in noise; search the index of speech recognition not sensitized; sequential frequency and duration pattern tests; tests of directed listening, monothic of speech in noise test and speech perception test with monosyllables and disyllables, in addition to electrophysiological evaluation through the long-latency evoked potentials [4,10,12-14,18,19].

The majority of these articles mention that there was a significant improvement in the speech perception in monosyllables and disyllables test, as well as in the frequency and duration pattern tests and in naming tasks.

In accordance with the literature and with the clinical evidence, an effective program of auditory training might involve binaural interaction tasks, auditory closure and figure-ground, temporal resolution, temporal ordering and dichotic stimuli, associated with the cognitive functions of attention, language, memory and executive functions, involving the guided by stimulus (bottom-up) and the guided by the task (top-down) approaches. In addition, the communication strategies and LOF may be strong allies during this process. The process of rehabilitation could consist of at least 8 sessions a week, lasting from 45 minutes to 1 hour each session.

Although some studies prove the effectiveness of formal auditory training, the use of standardized testing in rehabilitation has been criticized because they exclude the possibility of a new evaluation by means of behavioral measures. Therefore, there is a strong need of specific resources for the formal auditory training for the hearing aid users, as well as of software and other audio visual resources.

As measuring instruments, it is proposed the use of tests of auditory processing and speech in noise, tests of temporal resolution as Randon Gap Detection Test (RGDT) and Gaps in Noise (GIN) and Dichotic Digits. The first three provide information about the process of decoding, commonly changed in users of hearing aids, and the latter has proven to be useful to identify the existence or not of binaural interference. In addition to these, the measures pre- and post-auditory training could involve Evoked potentials of long latency, as well as the use of questionnaires of satisfaction.

CONCLUSION

The articles mentioned in this study show that the auditory training applied in their different conceptions, being formal, informal, with LOF or communication strategies, analytical or synthetic, benefits the users of hearing aids, especially when it involves tasks with cognitive demand.

RESUMO

O presente estudo consiste em uma revisão sistemática de literatura com o objetivo de verificar se o treinamento auditivo produz benefícios aos pacientes usuários de aparelho de amplificação sonora individual. Os estudos foram selecionados a partir de critérios de inclusão previamente estabelecidos e a partir deste, os dados de interesse foram extraídos. Na busca, foram avaliados e selecionados apenas os estudos cujo título, resumo ou corpo do artigo tivesse relação com o objeto do presente estudo. Os artigos pesquisados demonstraram que o treinamento auditivo aplicado nas suas diferentes concepções, sendo formal, informal, com leitura orofacial ou estratégias de comunicação, analítico ou sintético, beneficia os usuários de aparelho de amplificação sonora individual, principalmente quando associado às tarefas com demanda cognitiva.

DESCRITORES: Auxiliares de Audição; Perda Auditiva; Reabilitação; Revisão Sistemática

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Mailing Address:
Maria Inês Dornelles da Costa Ferreira
Rua Luis Afonso 158 Apartamento 702,
Cidade Baixa
Porto Alegre – RS – Brasil
CEP: 90050-310
E-mail: costa.ferreira@terra.com.br