

## Assessment of benefit of sound amplification in teens hearing impaired

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### ABSTRACT

**Purpose:** To evaluate the benefit provided by the use of electronic devices to improve hearing in adolescents through self-assessment instruments.

**Methods:** The study looked at 13 adolescents. Questionnaires for assessing the effective use of listening devices and evaluate the benefit of Boscolo et al (2006) were applied. The data were related in order to analyze the observed benefit and factors related to it.

**Results:** 76.9 % adolescents perceive the benefit provided by the devices in situations experienced at the home environment, 61.54 % at the school environment and 76.92 % at the social environment, demonstrating good understanding of the users benefit. Aspects such as journaling and effective use of the devices, early adaptation and maintenance of devices and attendance in rehabilitation were related with indices of perceived benefit obtained.

**Conclusion:** There was a benefit provided by hearing aid devices used by adolescents studied.

**Keywords:** Hearing, Hearing Aids, Hearing Loss, Adolescent, Self-Assessment.

## **1. INTRODUCTION**

Hearing is one of the fundamental meanings of life and an important way in society, since it is the basis of the development of human oral communication (Danieli, Castiquini, Zambonato and Bevilacqua, 2011). The auditory integrity is important to the process of acquisition and development of oral language because it plays a role in the perceptual organization and structuring of the information on process of learning and social interaction of the human being. Therefore, it can be said that the development of hearing and oral language is correlated.

Hearing loss is defined as a decrease in hearing, which may appear accompanied by speech unintelligibility and, in childhood, is an important public health problem, both for frequency, linguistic, educational and psychosocial consequences. Thus, for these reasons, hearing impairment as a disease is considered the third most common disability in the population (Kunh, 2000).

In order to minimize the negative effects of hearing impairment, electronic hearing aid devices were developed, namely hearing aids and cochlear implants, which are considered important components of auditory rehabilitation due to they enable not only the perception of speech sounds, but also environmental sounds, danger and alert signals, and other sounds present in the life of the user of these devices (Torres, Lessa, Aurélio, Santos and Costa, 2013).

The use of hearing aids (HA) and/or cochlear implant (CI) may represent a great opportunity to modify the course of the relationship of the hearing impaired with the environment in which they live. For this, it is important that effective strategies of adaptation, effective use and effective maintenance practices have been adopted, providing benefits to the user and guaranteeing real possibilities of hearing development and, consequently, oral language.

Any strategy adopted that allows both the follow-up of the adaptation process in the hearing devices, as well as the effective use of them, and such practice should be adopted by rehabilitation programs for hearing impaired patients. These strategies, called benefit monitoring, should include the assessment of the patient's auditory performance through standardized clinical procedures, as well as the careful monitoring of the evolution of the auditory rehabilitation process that aims to solve or alleviate the psychosocial situations unfavorable to development (Lessa, Costa, Becker and Vaucher, 2010).

One cannot predict with certainty how the user will react to the amplification until he has had the opportunity to use it in everyday situations. For this reason, the speech-language pathologist may use procedures that analyze direct measures, such as observing user behavior in response to the amplified signal provided by the device, quantifying behavioral responses using functional gain assessment and speech perception tests; as well as indirect measures of performance obtained in interviews with the parents or with the users themselves through questionnaires developed for this purpose (Boscolo, Costa, Domingos, & Perez, 2006). For this reason, self-assessment questionnaires have been strongly considered in the clinic in order to obtain measurements of the individual's performance or perception of changes that may occur over time in the activities involving communication (Bess, Hedley-Williams and Lichtenstein, 2001).

In order to verify the benefit of amplification in patients with hearing aids in the 10 to 14 age group, Boscolo et al (2006) developed a self-assessment questionnaire composed of closed questions and illustrative pictures that aim to know the improvement of performance provided by the amplification considering the domestic, school and social environments. Based on these discussed objectives, the objective of this study was to evaluate the benefit provided by the use of electronic hearing aid devices in adolescents attending public hearing services in the audiology area of the city of João Pessoa/Brazil.

## **2. METHODS**

The study was initiated after approval by the local Research Ethics Committee with protocol number: 23673713.8.0000.5188. This was a cross-sectional, observational, descriptive study. It was performed in three auditory rehabilitation reference services in the city of João Pessoa/Brazil between December 2013 and February 2014.

It considered 13 adolescents, where they were considered as inclusion criteria: the age group of 12 to 18 years, the use of HA and/or CI for at least 06 months (considering that this time of use already allows the adolescent perception) and frequency regular (At least once a week) in the auditory rehabilitation service. Adolescents who did not want to participate voluntarily, who did not have time available, who had an aggravation of their general health and, finally, those whose parents and/or guardians did not allow it were excluded from this study.

The data collection procedure consisted of two steps. The first step consisted in the application to the parents of a questionnaire developed specifically for this study, here called the evaluation questionnaire on the effective use of electronic hearing aid devices (Figure 1). The data obtained at this stage were those related to the characterization of the population, type and degree of hearing loss, unilateral or bilateral adaptation of hearing devices, age of users at the time of adaptation of devices, age of users at the time of initiation of rehabilitation, frequency of the users in the rehabilitation, periodicity of accomplishment of functional gain, frequency and effectiveness of use of hearing devices. From these data it was possible to identify which factors could later be associated with the perceived benefit not only of adolescents, but also of their parents. It is important to clarify that in this study we considered a satisfactory frequency of the devices use when users used them every day throughout the day, as well as considering effective use of the devices when users perceive that the devices do not work, advising the parents to do so the exchange or themselves replace the batteries of the devices and when they perceive the difference between being with and without the devices.

**Figure 1**

**Questionnaire evaluating the effective use of electronic hearing aid devices**

Initials: \_\_\_\_\_ Birth: \_\_\_\_\_ Age: \_\_\_\_\_ Sex: \_\_\_\_\_

Education: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

Sound Amplification: \_\_\_\_\_ Institution of rehabilitation: \_\_\_\_\_

( ) HA Mark: \_\_\_\_\_

( ) CI Type: \_\_\_\_\_

**Audiological Information**

1. Type of loss: \_\_\_\_\_
2. Degree of loss: \_\_\_\_\_

**Intervention information**

3. Age of adaptation HA/CI activation: \_\_\_\_\_
4. Start of rehabilitation: \_\_\_\_\_
5. Rehabilitation frequency: ( ) Good (weekly) ( ) Bad (monthly)

**Follow-up information**

6. Last evaluation of functional gain: ( ) there is 6m ( ) there is 1y ( ) more than 1y ( ) did not perform ( ) other: \_\_\_\_\_

**Usage Information**

7. Uses all day, every day? ( ) yes ( ) no  
Obs.: \_\_\_\_\_
8. Do you really use it? Do you miss when you're not wearing it? ( ) yes ( ) no  
Obs.: \_\_\_\_\_
9. Do you notice when you need to replace the batteries? ( ) yes ( ) no  
Obs.: \_\_\_\_\_
10. Do you see difference between being with and without HÁ/CI? ( ) yes ( ) no  
Obs.: \_\_\_\_\_

The second stage of the collection procedure consisted of interviewing and applying the Benefit Assessment Questionnaire by Boscolo et al. (2006) with adolescents. This questionnaire contains closed questions accompanied by illustrative pictures of the benefit of hearing aids/cochlear implants in the residential, school and social setting (Please check the original questionnaire in the quoted article). In some cases where they did not understand the issues, it was necessary to use sign language and gestures used by the relatives or guardians who followed the procedure, thus ensuring an understanding of the issues applied.

The data were submitted to statistical analysis using the Statistical Package for the Social Sciences - SPSS, in order to associate dependent and independent variables. The Chi-Square test was used, with significance value  $\leq 0.05$ . However, because of the small number of the sample, no significant responses were found, although differences between them are visible. Given the above, the results will be presented in descriptive form with relative and absolute frequency.

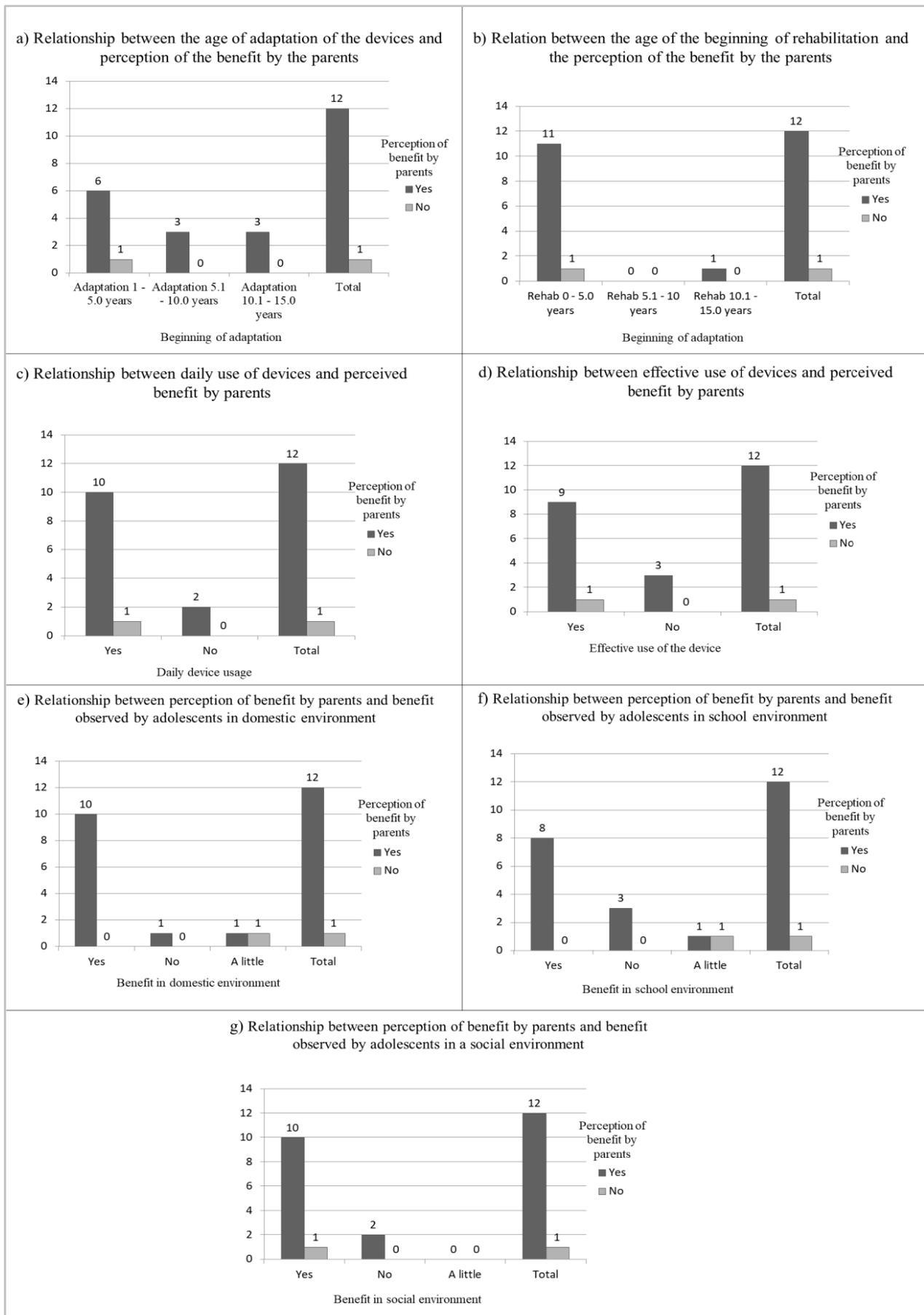
### **3. RESULTS**

Of the 13 adolescents who used electronic hearing aid devices, six (46.2%) used HA and seven (53.8%) used CI. Of these, eight are female adolescents and five are male adolescents. As for the schooling of the participants, the majority, seven users (53.8%) are in the sixth year of elementary school. As to the age group, eleven (84.6%) were in the age group of 12 to 14 years and two (15.4%) were between 14 and 16 years old, the sample did not include any adolescent in the age group from 16 to 18 years. As to the type and degree of hearing loss in the studied population, 12 (92.3%) presented hearing loss of the sensorimotor type, mostly of a profound degree, and one (7.7%) presented moderate hearing loss. All HA users, six (46.2%) have bilateral adaptation; whereas the CI users, seven (53.8%) use the implant unilaterally.

The mean age at which device adaptations occurred was from one to five years of age, when rehab was also initiated in the majority of the adolescents participating in the study,  $n = 11$  (84.6%). The frequency of the users in the rehabilitation was considered good when they attended the services at least once a week, totalizing 12 (92.3%) adolescents in this condition. Regarding the achievement of the functional gain by the population, we have as a result that four (30.8%) adolescents did it six months ago, four (30.8%) a year ago, one (7.7%) two years and four (30.8%) never performed the functional gain test in order to objectively verify the gain of the device used. In relation to the electroacoustic maintenance of the devices, two (15.4%) performed bimonthly revisions, one (7.7%) quarterly, four (30.8%) semiannually, two (15.4%) annually and four (30.8%) never performed.

According to the information provided by the parents, the results were that of the 13 adolescents, ten (76.9%) perceive when the devices do not work, advising the parents to make the switch or they replace the batteries of the devices themselves. Regarding the perception of the difference of being with the device connected and without the device connected, 12 (92.3%) report perceiving this difference and one report perceives certain situations, not describing them. When questioned about the daily use of the devices, parents report that ten (76.9%) of adolescents use their devices daily. These data were then related to the answers provided by them to the Benefit Assessment Questionnaire developed by Boscolo et al (2006). These relationships can be seen in Figure 2 below.

Figure 2



#### 4. DISCUSSION

The results show that the daily and effective use of the devices by this group has ensured the parents' perception that the devices make a difference for their users, that is, they bring general benefit to their children. When we analyze this perception of the benefit of the parents in relation to the use of the devices and the ages in which they have been adapted, we see that the earlier (from zero to five years) the adaptation occurred, the more visible is the observation of that they bring benefits to adolescents. It was also observed that the earlier the rehabilitation process started, the higher the parental benefit index. These data corroborate with the Joint Committee on Infant Hearing - JCIH (1995); Evelyn (2000) and JCIH (2007) statement when it recommends that not only early diagnosis but also and primarily intervention measures adopted in the early years of life are major factors in the successful development of children with hearing impairment.

The literature proposed by Affonso (2011) also indicates that, in fact, the speech-language intervention in the first years of life has been the promising way in the treatment of hearing loss and in the reduction of the diseases caused by this condition. According to the oral approach, the hearing impaired child should be exposed to spoken language and sounds, always using electronic hearing aids and undergoing auditory training, and should have continuity at home, through the involvement of the whole family (Moura, Lodi and Harrison, 1997).

Other aspects favor this perception of parental benefit. It should be noted that the majority of the patients present good rehabilitation (12 adolescents), careful electroacoustic maintenance of their devices (nine performed maintenance on times ranging from quarterly to recently) and direct measurements of benefit HA and CI as functional gain (eight adolescents in less than one year), factors that, in fact, guarantee an adequate use of the devices used and respond to the high level of benefit observed by the parents of this group of adolescents. Authors state that the effectiveness of the use of hearing aids does not only depend on an adequate adaptation, but also on the user's follow-up, focusing on the way the device is being used (Boscolo et al., 2006; Bevilacqua and Gardenal, 2001; Rossino, Blasca and Motti, 2002). The success of prosthesis adaptation, therefore, depends on patient follow-up so that the effective use of sound amplification can be guaranteed (Lanzetta, 2008).

Once the parents' perception about the general benefit of the devices used by the adolescents was known, their relationship with the answers obtained to the questionnaire applied to adolescents was analyzed. With regard to the benefit of the devices in routine situations experienced in the domestic environment, ten adolescents (76.92%) reported that the devices assist in the day to day, results that agree with findings found by other studies (Boscolo et al., 2006; Aurélio, Torres, Lopes and Costa, 2012).

As for the benefit provided in the school environment, it was reported by eight (61.5%) adolescents that the devices help in school activities. Regarding the four that did not benefit from the devices completely in this environment, it is advisable to adopt measures of school orientation regarding the positioning of the same ones next to the teacher, since this favors the perception of the speech signal and reduces the interference of the environmental noise (Marriage, Moore, Stone and Baer, 2005). Satisfactory results were found in 10 (76.9%) adolescents who reported that the devices coexist better in social situations, corroborating with findings also found in other studies (Boscolo et al., 2006; Aurélio et al, 2012).

#### 5. FINAL CONSIDERATIONS

The benefit provided by hearing aids used by the group of adolescents studied in different life situations was verified, both from the users' perspective and from their parents. And that the use of

hearing devices is essential for the maintenance of the domestic, school and social life of adolescents. In this population, the factors that can be attributed to the perception of this benefit by the investigated group were: effective and daily use of HA and/or CI, adaptation and initiation of the rehabilitation process before age five, good frequency in the rehabilitation sessions, care in the electroacoustic maintenance of the devices and direct measures to evaluate the benefit of the devices through the achievement of functional gain.

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**Author contributions:** All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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