

RESEARCH ARTICLE

Comparison of children with hearing loss using hearing aids and normal-hearing children through Persian version of the parents' evaluation of aural/oral performance of children questionnaire

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Abstract

Background and Aim: Hearing loss is one of the most prevalent disabilities. Children with severe-to-profound sensorineural hearing loss (SNHL) normally experience numerous problems. However, the extents of educational and communicational problems are not usually diagnosed in these children. Therefore, the aim of the current study was to compare children with hearing loss using hearing aids with normal children through the Persian version of parents' evaluation of aural/oral performance of children (PEACH).

Methods: This study was conducted on 56 children with mild to severe hearing loss using hearing aids and 56 children with normal-hearing ability by utilizing the PEACH questionnaire for a week.

Results: The mean score in quiet showed a significant difference between the two groups ($p=0.006$), although there was no significant between-group difference in terms of mean score in noise places ($p=0.100$). The mean overall score also showed a significant difference between the two groups ($p=0.012$).

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Conclusion: The results indicated that the PEACH questionnaire is a useful tool in the study of performance and effectiveness of hearing aid in children and its adjustment.

Keywords: Hearing-impaired child; hearing aid; parents' evaluation of aural/oral performance of children

Introduction

Hearing loss is one of the most common sensory disabilities in the world. According to the World Health Organization (WHO) in 2011, the incidence of severe and profound hearing loss is 1 to 3 per 1000 newborns [1]. Understanding the needs of hearing impaired children who suffer from hearing disabilities is of great importance in the process of language development [2]. Hearing disability affects learning, attention, and communication of children and can cause delays in their speech and language development compared to their peers.

Language acquisition process is reduced by increasing the hearing problem. Children with severe-to-profound sensorineural hearing loss (SNHL) have many problems in the spoken language, literacy, academic achievement, and psychological functions. Hearing loss, especially in the prelingual stage is more destructive in children and can make significant problems in the

process of learning and listening as well as communication skills [2,3]. Children afflicted with severe-to-profound SNHL encounter serious challenges in language acquisition [4]. Also, children with permanent hearing loss must use amplification devices such as cochlear implant and hearing aids to prevent the communication and spoken problems [5]. Even children fitted with hearing aids are unable to discover acoustic-phonetic cues which are necessary to recognize the speech [6]. Studies have shown that hearing and speaking are considerably more efficient in children with cochlear implants than children using hearing aids [7]. Newborn hearing screening can lead to early detection of hearing impairments. As a result, rehabilitation interventions can make the hearing ability more efficient at an early age. There are regular monitoring methods such as speech perception tests for children but these methods cannot be used for infants and young children [8]. On the other hand, there is evidence to suggest that the results of speech tests are not indicative of children's performance in real life [9].

Hearing problems and deficits are identified in children after parents' diagnosis and regular hearing tests. However, educational, communicational and attention problems in these children are not usually recognized; thus, there is a pressing need to arrange a plan for evaluating the above-mentioned problems. Questionnaire is one of the valid and appropriate tools for evaluating this type of disability [5].

Auditory and communication behaviors of children can be evaluated based on questionnaire. Several questionnaires have been designed and developed up to now. These questionnaires are non-audiometric, available, and valuable. One of these questionnaires is parents' evaluation of aural/oral performance of children (PEACH). This questionnaire can be used for children of all ages at all levels of hearing loss from mild to profound. PEACH questionnaire was designed in 2007 by Ching and Hill to evaluate the aural/oral performance in actual life. To fill out the questionnaire, parents should monitor their children for at least a week and record their observations for 13 situations. The questionnaire is

designed as a booklet for the parents to record the auditory behaviors and responses of children in different situations of hearing during a week. It is also used to record how the child is hearing and communicating when using hearing aids or cochlear implants. This questionnaire includes 13 questions, which are completed by the audiologist in a meeting in the presence of parents or baby sitter [10]. Ching et al. in 2010 evaluated daily aural performance and language ability of 133 hearing impaired children who were fitted hearing aids at age three. Their daily language ability and aural/oral performance were evaluated using pre-school language tests and PEACH, respectively. There was a significant correlation between the assessments of language and PEACH. Averagely, children who had language problem faced also difficulties in daily aural/oral performance. In addition, a substantial compliance was observed between language measures and standardized PEACH. Finally, they recommended PEACH to evaluate the oral/aural performance in daily life. It was also considered as a valid tool to assess the effectiveness of the amplifier for children in real life. Completing this questionnaire requires the active cooperation of parents. The parents are free to note their observations in real situations instead of being only limited to response to the choices [10]. The advantages of this questionnaire are: a) it is applicable to children aged from one month up to school age, b) it is applicable to different levels of hearing loss from mild to profound and c) its scoring is irrespective of gender [11]. This questionnaire is completed at both baseline/beginning and end of the rehabilitation program so that the aural/oral performance of child can be evaluated before and after the rehabilitation. The questionnaire is also used in the form of interview. It means that, a clinician can read each question to parents or baby sitter and record their answers. However, this process is efficient when the parents or baby sitter are illiterate. This questionnaire has been translated into different languages such as Malaysian [10], Indian [12], Arabic, Chinese, Vietnamese, Italian, Norwegian, Swedish, and Turkish [13,14].

Table 1. Scoring parents' evaluation of aural/oral performance of children

	Raw score	% Score
Quiet	(Q's 3+4+7+8+11+12) A	(A/24) x 100
Noise	(Q's 5+6+9+10+13) B	(B/20) x 100
Overall	(A + B) C	(C/44) x 100

Most similar questionnaires translated into Persian are allocated for adults, while the PEACH questionnaire is an effective tool to gather information on aural performance of child with amplification system in real life. The reliability and validity of the Persian questionnaire were investigated in the study of Naghibirad et al. among normal and cochlear implanted children. The results showed that the scale has high internal consistency and high repeatability coefficient [15]. However, this questionnaire has not been administered to Iranian hearing impaired children who use hearing aids. Therefore, the aim of the current study was to compare children with hearing loss who use hearing aids with normal children based on the scores of Persian PEACH scale.

Methods

This cross-sectional study was conducted on 56 children with mild, moderate, and severe hearing loss who used hearing aids and 56 children with normal-hearing aged 3 to 7 years. Inclusion criteria were: a) willingness to participate in the study for parents, b) being literate and having ability to read and write and speak in Persian for parents, c) using pediatric hearing aids for children who aged from 3 to 7 years and suffered from mild, moderate, or severe SNHL, d) using the hearing aids for at least 6 months for the hearing loss children, e) undergoing the rehabilitation program for the hearing loss children, f) being at age of 3 to 7 years with no history of ear infection, pain, or ear discharge for normal-hearing children, and g) lack of neurological disorders such as epilepsy, multiple sclerosis, skull fractures and head trauma for all children.

Domains of the PEACH questionnaire are: a) using undesirable amplification and loudness (composed of two questions only in hearing loss children b) hearing and communication in a quiet environment c) hearing and communication in noisy environment d) using a telephone and, e) responding to sounds in the environment. Each question scoring from zero to four has five choices. Each score includes a number and a percentage (from 0 to 100%). The score of 0 describes children who have no response or there is no example; the score 1 describes those who have one or two examples for responding or have a response in 25% of cases; the score 2 describes children who have three or four examples for responding or have a response in 50% of cases; the score 3 describes those who have five or six examples for responding or have a response in 75% of cases; and the score 4 describes children who have more than six examples for responding or have a response in more than 75% of cases in which parents observe auditory behaviors.

The questionnaire comprises three sections. The first section is composed of two questions related to hearing aids. The second section contains six questions about quiet situations and the third section includes five questions on noisy situations. The first two questions are related to hearing loss children regarding their hearing aids. The scores obtained in the quiet and noisy places comprise sections A and B, respectively. The section C is the overall score of responses (A+B=C) (Table 1).

Following the coordination with private medical centers and kindergartens in Mazandaran province, the written consent was obtained from parents of children who would like to participate in the study. First, the children were examined using audiometry test with ASA84 (Pajvak Ava Co., Iran) tympanometry (type A) in order to rule out middle ear problems. The thresholds of normal-hearing and mild to severe SNHL were the average of hearing thresholds at octave frequencies (500, 1000, and 2000 Hz), the thresholds were between 0 to 70 dB, and type A tympanogram.

The PEACH questionnaire and its manual were

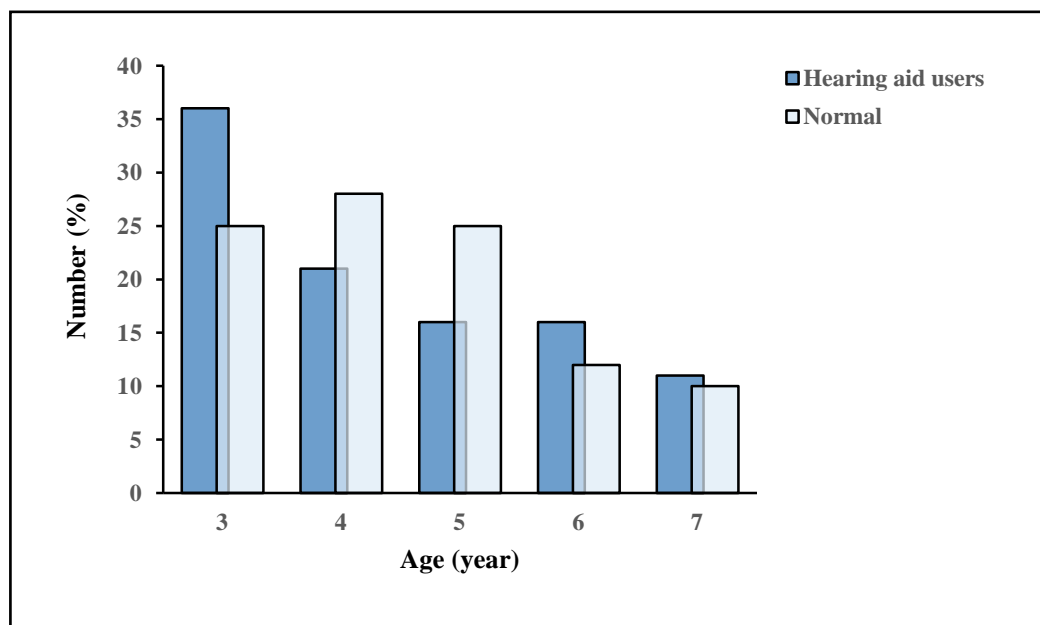


Fig. 1. Percentage distribution of normal-hearing children and hearing aid users by age.

given to the parents. They were also instructed verbally on how to fill out the questionnaire. The parents were asked to monitor their children in various aural environments for a week and record their behaviors, but fill out the questionnaire only in the presence of the audiologist. The data were analyzed using SPSS16 at the significant level of 0.05. Independent t-test was used to compare the obtained data between the groups.

Results

The most and the least frequencies in both groups belonged to 3-year-old and 7-year-old children, respectively (Fig. 1).

Table 2 shows the mean value and percentage of scores on the PEACH questionnaire. By comparing the data, it was found that there were significant differences between the two groups in terms of the mean score in quiet and the mean overall score ($p=0.006$, $p=0.012$ respectively), whereas it we observed no difference in the mean score of noise between-groups.

Discussion

The results of the study indicated that the mean scores in quiet and noise were

22.46 ± 2.64 ($92.23 \pm 11.10\%$) and 18.26 ± 2.35 ($90.45 \pm 12.25\%$), respectively in normal-hearing children, indicating the mean overall score of 40.73 ± 5.84 ($91.80 \pm 11.19\%$). These data are consistent with those of normal children [21.86 ± 1.28 , 18.07 ± 1.84 , and 38.66 ± 1.28 , respectively] obtained by Naghibirad et al. investigating normal vs. cochlear implanted children using the Persian version of PEACH [15].

In the present study, the mean overall score and the mean scores in noise and quiet in the normal group was higher compared to the original version of the questionnaire (i.e. the scores of 62.9, 62.5 and 63.3, respectively) [14]. The reason may be related to the higher age range of normal group in our study. It shows the increased efficacy of questionnaire by increasing the age. This is in accordance with the findings of Naghibirad et al. on cochlear implanted users and normal children showing the significant correlation between age and overall score. Our study also is consistent with the studies conducted by Kumar et al. [13], Bagatto et al. [12], and Quar et al. [11].

According to the findings, in hearing aids users the mean overall score and the mean scores in quiet and noise were 30.58 ± 7.62

Table 2. Mean (standard deviation) parents' evaluation of aural/oral performance of children scores in normal-hearing children and hearing aid users

Situation	Raw mean score (SD)		Mean percent score (SD)		p
	Normal-hearing	Hearing aid	Normal-hearing	Hearing aid	
Quiet	22.46 (2.64)	17.42 (4.05)	92.23 (11.10)	70.09 (19.77)	0.006
Noise	18.26 (2.35)	13.16 (5.12)	90.45 (12.25)	65.80 (19.06)	0.100
Overall	40.73 (15.84)	30.58 (7.62)	91.80 (11.19)	68.26 (19.02)	0.012

(68.28 ± 19.02%), 17.42 ± 4.05 (70.09±19.77%) and 13.16±5.12 (65.80±19.06%), respectively. These scores are higher than the scores reported by Naghibirad et al. (32.20±8.38, 16.80±2.14, 18.07±1.84, respectively). The reason may be attributed to the wider age range of children participated in this study and the different type of hearing aid devices.

The comparison of the two groups in the present study showed a significant difference in the mean overall score and the mean score in quiet which is consistent with the findings of Naghibirad et al. [15]. This indicates a difference in oral/aural ability between normal and hearing-impaired children.

Comparison of the mean score in noise indicated no significant difference between the groups, a finding that is in agreement with [15].

Quar et al. conducted a study on 74 Malaysian normal-hearing children aged between 3 months and 13 years to evaluate the effect of reinforcing the auditory behaviors in children's daily life based on observation using the PEACH questionnaire. The overall score (64.5 ±14.7) was close to the original score (62.9±14.9). It was also found that there is a significant difference in the overall score of Malay version of the questionnaire based on participants' gender [10]. Kumar et al. [12] administered the PEACH questionnaire to 30 Indian CI users divided into two groups of 15. The first group received CI under age 2 years (earlier implanted group=EIG), while the other group received CI between ages 3-4 years (later implanted group=LIG). Overall score was 30.8±0.98 in EIG and 21.13±0.27 in LIG. Despite of language difficulties, the first

group showed better linguistic performance than the second group. Moreover, there was a significant correlation between onset age and obtained score in PEACH. Thus, we can conclude that the questionnaire is useful as a clinical tool to obtain significant information about auditory functioning in real life of children. In the present study, the overall score in hearing aids users was 30.58±7.62 that was close to the score of EIG in the Kumar's study, indicating the effectiveness of HA prescribed in early age.

Bagatto et al. [11] compared normalized data of PEACH daily booklet in Ching study with data obtained from a different group of children using the categorized section of PEACH. In this study, 95 normal-hearing children (age range 2 to 83 months) participated while accompanied by their parents. They observed a close agreement between both findings. Also, no significant difference was observed based on gender, and data had a good internal consistency. It was also revealed that by an increase in age, the PEACH scores increased; a result that was consistent with the finding of the present study, indicating the increased effectiveness of the questionnaire with increasing age.

Ching and Hill compared auditory behavior in 180 children, comprising 90 with normal-hearing aged 1 week to 46 months (mean age 13.4 and SD=11.4 months) and 90 with hearing loss aged 4 months to 19 years (mean age 95.6 and SD=64 months) using the PEACH questionnaire. The overall score and the scores in quiet and noise were 62.9, 62.5, and 63.3, respectively; the scores were ascending from age 6 months and the full score was obtained in 40

months [14], which also confirms our results.

Conclusion

The results indicated a significant difference in the mean overall score and the mean scores in quiet between normal children and hearing aids users, whereas there was no significant difference in noise between the two groups. According to these findings, it seems that the PEACH questionnaire can be used to evaluate the performance and effectiveness of hearing aids in children. This questionnaire can be filled out by parents at the beginning of rehabilitation programs to evaluate the process of program implementation, estimate the time it takes to run the program, and adjustment formulas for hearing aids.

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REFERENCES

- World Health Organization. World report on disability. Geneva, Switzerland: WHO Press; 2011.
- Ching TY, Crowe K, Martin V, Day J, Mahler N, Youn S, et al. Language development and everyday functioning of children with hearing loss assessed at 3 years of age. *Int J Speech Lang Pathol*. 2010;12(2):124-31.
- Nelson HD, Bougatsos C, Nygren P; 2001 US Preventive Services Task Force. Universal newborn hearing screening: systematic review to update the 2001 US Preventive Services Task Force Recommendation. *Pediatrics*. 2008;122(1):e266-76.
- Duchesne L, Sutton A, Bergeron F. Language achievement in children who received cochlear implants between 1 and 2 years of age: group trends and individual patterns. *J Deaf Stud Deaf Educ*. 2009;14(4):465-85.
- King AM. The national protocol for paediatric amplification in Australia. *Int J Audiol*. 2010;49 Suppl 1:S64-9.
- Niparko JK, Tobey EA, Thal DJ, Eisenberg LS, Wang NY, Quittner AL, et al. Spoken language development in children following cochlear implantation. *JAMA*. 2010;303(15):1498-506.
- Serry TA, Blamey PJ. A 4-year investigation into phonetic inventory development in young cochlear implant users. *J Speech Lang Hear Res*. 1999;42(1):141-54.
- Ching TY, Hill M, Birtles G, Beecham L. Clinical use of paired comparisons to evaluate hearing aid fitting of severely/profoundly hearing impaired children. *Australian and New Zealand Journal of Audiology*. 1999;21(2):51-63.
- Crais ER. Expanding the repertoire of tools and techniques for assessing the communication skills of infants and toddlers. *Am J Speech Lang Pathol*. 1995;4(3):47-59.
- Quar TK, Ching TY, Mukari SZ, Newall P. Parents' evaluation of aural/oral performance of children (PEACH) scale in the Malay language: data for normal-hearing children. *Int J Audiol*. 2012;51(4):326-33.
- Bagatto MP, Scollie SD. Validation of the parents' evaluation of aural/oral performance of children (PEACH) rating scale. *J Am Acad Audiol*. 2013;24(2):121-5.
- Kumar S, Rout N, Kumar N, Chatterjee I, Selvakumaran H. Performance of Indian children with cochlear implant on PEACH scale. *ISRN Otolaryngol*. 2013;2013:565096.
- Brännström KJ, Ludvigsson J, Morris D, Ibertsson T. Clinical note: validation of the Swedish version of the parents' evaluation of aural/oral performance of children (PEACH) rating scale for normal hearing infants and children. *Hearing Balance Commun*. 2014;12(2):88-93.
- Ching TY, Hill M. The parents' evaluation of aural/oral performance of children (PEACH) scale: normative data. *J Am Acad Audiol*. 2007;18(3):220-35.
- Naqibirad F, Fatahi J, Hajiabolfassan F, Faghizadeh E, Emamdjomeh H. Cultural adaptation and determination of validity and reliability of the Persian version of the parents' evaluation of aural/oral performance of children questionnaire. *Aud Vest Res*. 2016;25(2):111-18.