Listening and Speaking Ability of Thai Deaf Children in Preschool Aural Rehabilitation Program

Krisna Lertsukprasert MA*, Nittaya Kasemkosin MA*,
Wichit Cheewareungroj MD*, Lalida Kasemsuwan MD*

** Department of Otolaryngology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*

Background: *An auditory-oral approach can help deaf children achieve success in oral communication. Many studies confirm that deaf children with access to sound through high-powered and appropriate hearing aids at the youngest age possible have the capability to acquire communication skills similar to their hearing peers.*

Objective: *Evaluate the listening and speaking progress made by 27 Thai hearing-impaired children who attended a preschool aural rehabilitation program, which was established at Audiology and Speech clinic. After hearing aids fitting, deaf children were enrolled to the preschool aural rehabilitation program after receiving their parents consent.*

Material and Method: *Hearing impaired children were divided into groups of 4-6 children with approximately the same level of performance. The listening and speaking performance at the initial period were recorded. Each group participated in the 3-hour-program once a week, included auditory training, conversation (maternal reflexive method), and speech stimulation. The improvements and problems of each child were recorded at the end of session. Listening and speaking performance evaluation were recorded at six months intervals.*

Results: *There were 12 boys and 15 girls. The average hearing loss in the better ear was 104 dBHL, range from 83-117 dBHL, SD = 8.33. The mean age of enrollment was 2 years and 10 months. The majority gradually developed listening skills and speaking ability. There was no relationship between age of enrollment and the listening and speaking ability ($p > 0.05$). However, listening skills had positive relationship with length of speech ($r = 0.685$), number of spoken vocabulary ($r = 0.665$), and speech character ($r = 0.598$); $p < 0.01$.*

Conclusion: *Auditory training is an important task to develop listening skills and improve length of speech, speaking vocabulary, and speech character. Other benefits from the aural rehabilitation program included monitoring the auditory progression after hearing aid fitting, parents meeting, and promotion a better quality of life by enabling hearing impaired children to participate in hearing society.*

Keywords: *Preschool aural rehabilitation program, Hearing-impaired children, Listening and speaking ability*

J Med Assoc Thai 2010; 93 (4): 474-80
Full text. e-Journal: *http://www.mat.or.th/journal*

It is well known that many deaf children can develop their listening skills and spoken language by the use of amplifications. Most deaf children have some residual hearing, even a minimal amount of residual hearing, if stimulated, could lead to the development of spontaneous speech and oral communication[1]. In order to achieve this, deaf children must be identified earlier, fitted with appropriate hearing aids that are properly monitored and maintained. It is also essential to have a consistent and well-formed training program to support the children's current and changing needs[2]. With an auditory-oral approach, deaf children are trained how to use their residual hearing so that they access to spoken language, which is called auditory training[3]. Additionally, there is also focus on speech reading and contextual cues to give deaf children better understanding and use spoken language. If deaf children were trained orally, they will do well in life and permit earlier adjustment to a world in which speech is the chief means of communication[4].

In Thailand, the educational system for hearing impaired children was formerly based on degree of hearing loss. If it exceeded 90 dBHL, deaf children were referred to deaf schools to study total communication, which mostly focus on signs, thus

Correspondence to: Lertsukprasert K, Audiology Clinic, Department of Otolaryngology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, 270 Rama VI Rd, Bangkok 10400, Thailand. Phone: 0-2201-2425, Fax: 0-2201-2208. E-mail: krisna44@hotmail.com

inhibiting the opportunity to learn listening, speaking and participate in the hearing society. At present, hearing loss is easily diagnosed soon after birth[5-7] with updated audiological technology. After proper medical evaluation and appropriate hearing aid fitting, aural rehabilitation should be started immediately in accordance with normal development models. Preschool aural rehabilitation program, Ramathibodi Hospital, Mahidol University was established in 2001 to provide an early intervention program for very young deaf children who were diagnosed at Ramathibodi Hospital. It is also available for referral children whose parents are willing to participate in the program. The purpose of the present study was to examine listening and speaking performances of deaf children who enrolled in the preschool aural rehabilitation program for hearing-impaired children at our clinic.

Material and Method

Twenty-seven hearing-impaired children enrolled in the present study. Inclusion criteria were:

1. Less than six years of age with no other handicaps.

2. Bilateral sensorineural hearing loss that was diagnosed by otolaryngologist(s) and appropriate hearing aids fitted by audiologists.

3. Parent and the child must be able to attend the program regularly.

After the children enrolled into the program, listening and speaking ability were evaluated by a team comprising of an audiologist, a speech pathologist, and a teacher in the program. Hearing-impaired children were enrolled into rehabilitation program at various ages and different time, so the children were classified into small groups of 4-6 children based on their performance level at the evaluation process, according to the rating scale in Table 1. Each group attended the program once a week for approximately 3 hours per session. While the children were trained in the program, one parent of each child had to participate in the class and to observe the training in order to continue their training at home. The training session started with group auditory training for 45 minutes, the difficulty level of activities depending on the child's ability, followed by 50 minutes of group conversation (Maternal Reflexive Method)[8]. The final phase of training was for individual training, *i.e.*, one child was trained individually by the teacher for approximately 15 minutes while the rest of the group (3-5 children) spent the time in arts and crafts with an assistant. The training session was concluded with a 10-minute parent's counseling. The teacher and assistant filled

Table 1. Categories of evaluation for hearing impaired-children

	Rating				
Category	0	1	2	3	4
Listening skills	None	Detection	Discrimination	Identification	Comprehension
Speaking skills	None	Imitation	Prompt speech	Spontaneous speech	-
Length of speech	None	1 syllable	2-3 syllables/phrase	Sentence	-

The listening skills were determined by 5 level rating scale as follow:
0 = No awareness of sounds
1 = Demonstrates conditioned respond to sounds
2 = Discriminates various auditory pattern
3 = Identifies words without lip reading
4 = Understands and respond to common phrases, everyday conversation
The speaking skills were determined by 4 level rating scale as follow:
0 = None (no speech)
1 = Imitates varying numbers of syllables or words (imitation)
2 = Naming words after stimulating with pictures or models (prompted production)
3 = Says the words with his own appropriately (spontaneous production)
The length of speech production was determined as follow:
0 = None (no speech)
1 = one-syllable words
2 = 2-3 syllable words and phrase
3 = sentence with at least 3 words

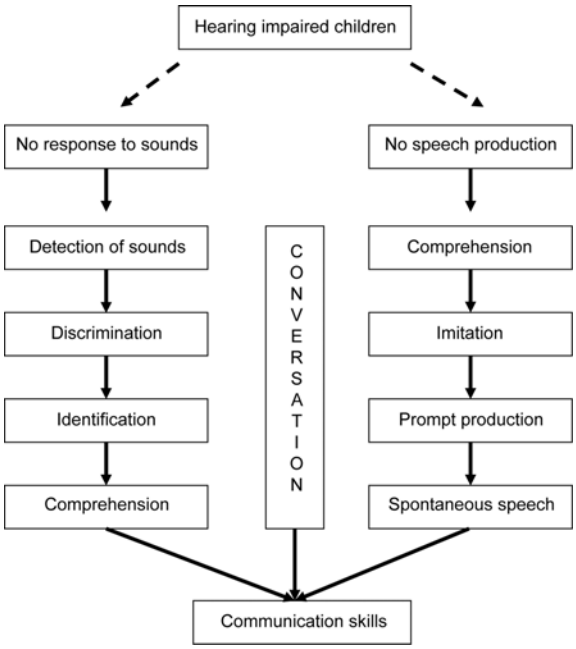

Fig. 1 Diagram showing plan of training program for hearing-impaired children

in the records of all the improvements and problems for each child's progress note and plan for the next session by following the rehabilitation process shown in Fig. 1. Evaluations of each child were done every 6 months[9].

Statistical analysis

Descriptive statistics was used for analysis of the data. Correlation coefficient was used to assess the relation between age of enrollment, listening skills speech character, number of spoken vocabulary and length of speech, statistical significance at $p < 0.05$.

Results

Twenty-seven children (12 boys and 15 girls) have been trained regularly for more than 1.5 year and included 14 children who were diagnosed at our clinic and 13 children who were referred from other clinics. The average hearing loss in the better ear was 104 dBHL with SD = 8.33 (range 83-117 dBHL). The mean age of enrollment was 34 months with SD = 14.5 (range 11-60 months). The median hearing age (duration of hearing aid fitting and age of enrollment) was 3 months (range 0-15 months). The progression of listening ability is shown in Fig. 2. At the initial period, most of the children's hearing ability (twenty children) was very poor. They were not aware to sound. Only seven children were at the level of sound detection. After the first six-month of the training period, the twenty children were able to detect sounds consistently, two children were at the level of detection, and five children improved to the level of sound discrimination. At eighteen months, fourteen children were able to identify speech sounds and six children were in the level of comprehension.

For speech production, there were three categories of evaluation including type of speech production, length of speech production, and number of spoken vocabulary. As shown in Fig. 3, at initial evaluation, twenty-one children could not produce any speech. After six months, these twenty-one children were able to imitate speech sounds. Two children did not improve, while four children improved to the level of prompted production. After eighteen months, sixteen children were able to produce spontaneous

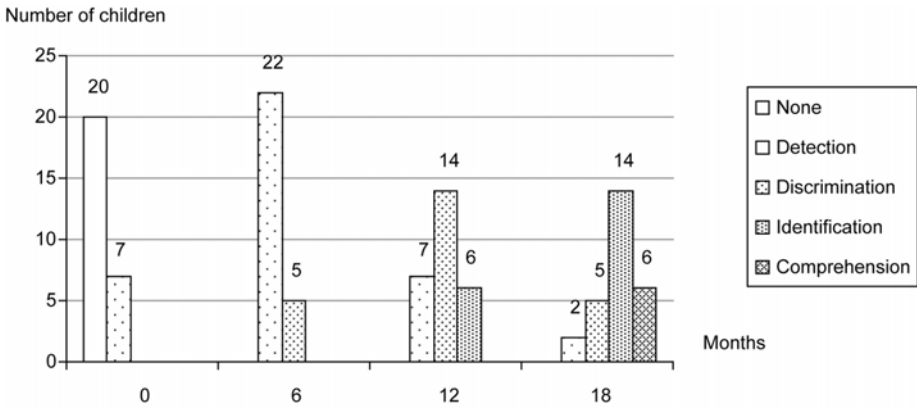

Fig. 2 Progression of listening ability of 27 hearing impaired children from initial evaluation to 18 months of training

speech and the remaining eleven children could produce prompted speech. In Fig. 4, at initial evaluation, only four children could produce single words but after six months of training, eighteen children improved their ability to produce single words and gradually improved to phrases (eleven children) and sentences (twelve children) at eighteen months. Finally, in Fig. 5, there was a gradual increase in the number of spoken vocabulary to more than 100 words at the completion of eighteen months of training.

The age of enrollment did not correlate with listening skill, speaking skill, and number of spoken vocabulary ($p > 0.05$). However, listening skill had positive relationships with length of speech ($r = 0.685$),

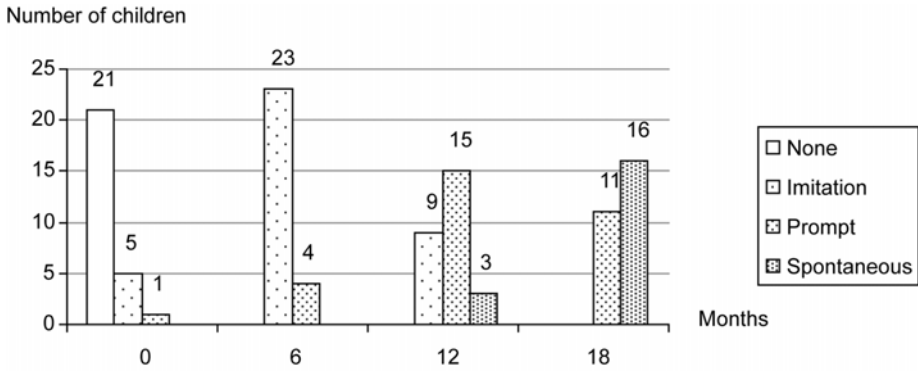

Fig. 3 Progression of type of speech production from initial evaluation to 18 months of training

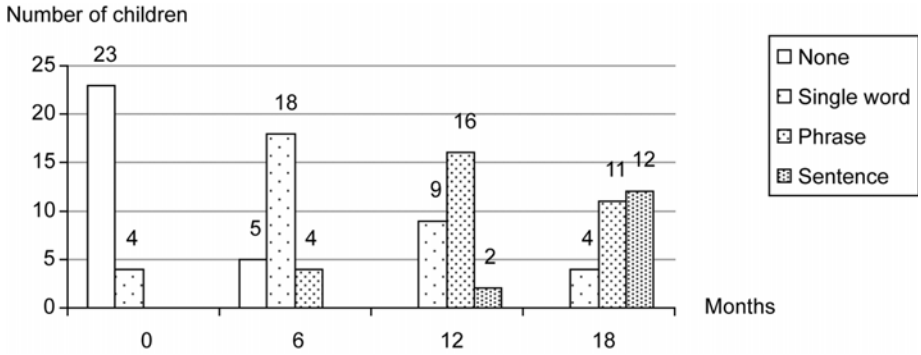

Fig. 4 Progression of speech length from the initial evaluation to 18 months of training

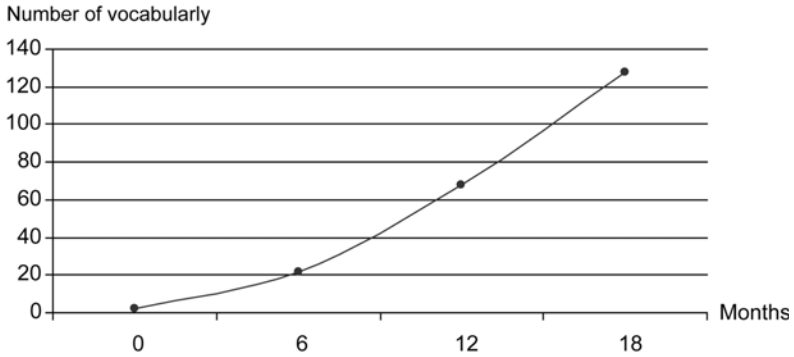

Fig. 5 Average number of speaking vocabulary acqusition of 27 hearing impaired children from initial evaluation to 18 months of training

Table 2. Correlation coefficient between age of enrollment, listening skills, speech character, number of spoken vocabulary and length of speech

	Age of enrollment	Listening skills
Listening skills	-0.019	-
Speech character	0.005	0.598*(a)
Number of spoken vocabulary	0.047	0.665*(b)
Length of speech	0.099	0.685*(b)

(a) Significant at $p = 0.01$
(b) Significant at $p < 0.01$

number of spoken vocabulary ($r = 0.665$), and speaking ability ($r = 0.598$); $p < 0.01$ (Table 2).

Discussion

The preschool training program for hearing impaired children aims to provide aural rehabilitation, especially for deaf children who have limited in speech understanding, even with amplification[10]. Following aural rehabilitation, there was evidence of development of listening and speaking ability in all participants. Twenty-seven children with severe to profound hearing loss who had attended the program regularly once a week for more than one and a half years showed progression in listening skills, speech acquisition, language development, comprehension, and capability to respond to everyday conversation. They were able to participate in daily living activities with hearing people without using signs. This is in agreement with the study of Geers[11] who found that deaf children were able to approach the achievement of hearing children with improved teaching method. Study of Yoshinaga-Itano C et al[12] reported that enrollment in an intervention program by nine months of age compared with later intervention program was associated with improvements of speaking ability. In the present study, there was no relationship between age of enrollment and the speech performance because the average age of enrollment of children in the present study was rather late. The children came from our clinic and referral from outside. Most of the referral children have been fitted with hearing aids and started to train at other centers before enrollment to the program. Some children needed re-hearing aids evaluation because they were not fitted with appropriate hearing aids; therefore, they could not derive maximum benefit from amplification[13]. Some referral children were older than children from our clinic. The result of our study was the same as the study of Calderon and Naidu[14] who compared the vocabulary scores of children enrolled in the intervention program before 24 months of age. They were not different from those enrolled later ($p > 0.05$). The present study shows a positive relationship between listening skills and speech length, number of spoken vocabulary, and speech character. This means that children who have better hearing will develop longer speech, better speech character, and more spoken vocabulary acquisition. The presented program applied the maternal reflexive method, which focus on maximizing the residual hearing combined with speech reading and early introduction of written words during training[8]. Thus, auditory training is important in development of auditory skills. When children hear words and sounds in combination with written words, it helps the children's ability to produce longer words. If the child hears more speech, the child can easily learn spoken language. No matter how deaf the children are, listening and speaking may be accessed when they are properly fitted with hearing aids and given appropriate and intensive auditory training[15].

However, many factors influence successful aural rehabilitation for deaf children as in the authors' experience. Firstly, this rehabilitation program was supported by donations. The program could not be managed like an ordinary kindergarten due to limited personnel, place, and budget. There was only one teacher and one assistant to teach all the children. The children could not attend daily training. They participated in the program only once a week. Parents were required to participate with the training program, because parent are the primary rehabilitative agent for maintaining the child's hearing aids and structuring an auditory learning environment rich with listening experiences[16]. Secondly, reliable and valid outcome measurement for infants and young children are limited for several reasons such as lack of co-operation during audiologic testing, physical differences, and limited speech perception ability in infants and young children[17]. For this reason, one benefit of the presented program was monitoring of children's progress, especially after hearing aid fitting. The children will receive training, re-evaluation of hearing capacity, and hearing aid using if there is no progress in auditory development. Thirdly, children who had severely profound hearing loss, even with powerful hearing aids, showed less auditory progress after an extended period of consistent hearing aids use with rehabilitation program. These children are candidates for cochlear implantation, but most parents could not afford the

expensive devices. Other common problems inhibiting the child's progress include over-protected child, unable to be trained at home, and extended time period of hearing aid repair without replacement.

Conclusion

Preschool aural rehabilitation was found to be useful for deaf children. Auditory training is a meaningful component of aural rehabilitation for hearing impaired children. Following rehabilitation process, a majority of the children demonstrated progression in listening and speaking ability. Moreover, there are other benefits from the program such as the audiologist can monitor the auditory progression after hearing aid fitting, group training provides the opportunity for children to play and learn from each other, and parents have a chance to observe other children's performance and share ideas together.

Acknowledgement

The authors wish to thank Mr. Jan van der Heijden, the former Director of De Horst, the Netherlands for his great support to our project. We also wish to thank Dr. Thawat Jayaneeyayothin who initiated the project fund for the presented program. The authors also wish to thank Mrs. Umaporn Udomsubpayakul, from Research center, Ramathibodi Hospital for her assistance in statistical analysis.

References

1. Beebe H. Deaf children can learn to hear. J Commun Disord 1978; 11: 193-200.
2. Johnson CE, Danhauer JL. Outcomes measurement in aural rehabilitation. In: Johnson CE, Danhauer JL, editors. Handbook of outcomes measurement in audiology. New York: Thomson Delmar Learning; 2002: 217-75.
3. Tye-Murray N. Auditory training. In: Tye-Murray N, editor. Foundations of aural rehabilitation: children, adults, and their family members. San Diego, CA: Singular Publishing Group; 1998: 159-92.
4. Silverman SR, Lane HS. Deaf children. In: David H, Silverman SR, editors. Hearing and deafness. 3rd ed. New York: Holt, Rinehart & Winston; 1970: 101-9.
5. Finitzo T, Albright K, O'Neal J. The newborn with hearing loss: detection in the nursery. Pediatrics 1998; 102: 1452-60.
6. Vohr BR, Carty LM, Moore PE, Letourneau K. The Rhode Island Hearing Assessment Program: experience with statewide hearing screening (1993-1996). J Pediatr 1998; 133: 353-7.
7. Vohr BR, Maxon AB. Screening infants for hearing impairment. J Pediatr 1996; 128: 710-4.
8. Van Uden A. A world of language for deaf child. Part I. Basic principles: a maternal reflexive method. 3rd ed. Amsterdam: Swets & Zeitlinger; 1977: 138-49.
9. Yoshinaga-Itano C. Assessment and intervention with preschool children who are deaf and hard-of-hearing. In: Alpiner JG, McCarthy PA, editors. Rehabilitative audiology: children and adults. 3rd ed. Baltimore, MD: Williams & Wilkins; 2000: 140-77.
10. Katz J, White TP. Introduction to the handicap of hearing impairment. In: Hull RH, editor. Aural rehabilitation: serving children and adults. 4th ed. San Diego, CA: Singular Thomson Learning; 2001: 21-40.
11. Geers A. Assessment of hearing impaired children: determining typical and optimal levels of performance. In: Powell F, Finitzo-Heiber T, Friel-Patti S, Henderson D, editors. Education of the hearing impaired child. San Diego, CA: College-Hill Press, 1985: 57-82.
12. Yoshinaga-Itano C, Sedey AL, Coulter DK, Mehl AL. Language of early- and later-identified children with hearing loss. Pediatrics 1998; 102: 1161-71.
13. Johnson CE. Enhancing the conversational skills of children with hearing impairment. Language, Speech, and Hearing Services in Schools 1997; 28; 137-45.
14. Calderon R, Naidu S. Further support for the benefits of early identification and intervention for children with hearing loss. In: Yoshinaga-Itano C, Sedley AL, editors. Language, speech and social-emotional development of children who are deaf or hard of hearing. Washington, D.C.: Alexander Graham Bell Association; 2000: 53-84.
15. Moog JS. Auditory-oral education: teaching deaf children to talk [database on the Internet]. St. Louis, MO: Moog center for deaf education; 2008 [cited 2008 Feb 19]. Available from: http://www.audiologyonline.com/articles/article_detail.asp?article_id=266
16. Atkins DV. Family involvement and counseling in serving children who are hearing impaired. In: Hull RH, editor. Aural rehabilitation: serving children and adults. 4th ed. San-Diego, CA: Singular Thomson Learning, 2001: 79-96.
17. Stelmachowicz PG. Hearing aid outcome measures for children. J Am Acad Audiol 1999; 10: 14-25.

ความสามารถทางการได้ยิน และการพูดของเด็กหูหนวกไทยในโครงการฟื้นฟูสมรรถภาพเด็กหูพิการก่อนวัยเรียน

กฤษณา เลิศสุขประเสริฐ, นิตยา เกษมโกสินทร์, วิชิต ชีวเรืองโรจน์, ลลิดา เกษมสุวรรณ

ภูมิหลัง: *การฟื้นฟูสมรรถภาพการฟังและการพูดของเด็กหูหนวก จะช่วยให้เด็กรับรู้เสียง และสื่อความหมายด้วยการพูด การศึกษาเป็นจำนวนมากได้ยืนยันถึงการใช้เครื่องช่วยฟังที่มีกำลังขยายสูง และเหมาะสมในเด็กหูพิการตั้งแต่อายุน้อย ๆ ก็มีโอกาสที่จะเรียนรู้การฟัง และการพูดได้เช่นเดียวกับเด็กทั่วไป*

วัตถุประสงค์: *เพื่อศึกษาความสามารถการฟัง และการพูดของเด็กหูหนวก 27 ราย ที่ใส่เครื่องช่วยฟัง และเข้ารับการฝึกในโครงการฟื้นฟูสมรรถภาพเด็กหูพิการก่อนวัยเรียน คลินิกโสตสัมผัส และการพูดโรงพยาบาลรามาธิบดี*

วัสดุและวิธีการ: *ผู้นิพนธ์แบ่งเด็กหูพิการที่มีความสามารถใกล้เคียงกันเป็นกลุ่ม ๆ ละ 4-6 คน ทำการบันทึกความสามารถการฟัง และการพูดก่อนเข้าโปรแกรมการฟื้นฟูสัปดาห์ละ 1 ครั้ง ๆ ละ 3 ชั่วโมง ซึ่งประกอบด้วยการฝึกฟัง การสนทนาโดยใช้ maternal reflexive method และการกระตุ้นพัฒนาการทางภาษา และการพูด ความสามารถและปัญหาของเด็กแต่ละคนจะถูกบันทึกไว้ทุกครั้ง เมื่อเสร็จสิ้นการฝึก เด็กจะได้รับการประเมินความสามารถเป็นระยะทุก 6 เดือน อย่างน้อย 3 ครั้ง*

ผลการศึกษา: *เด็กหูหนวกเพศชาย 12 คน เพศหญิง 15 คน ระดับการสูญเสียการได้ยินเฉลี่ย (ข้างที่ดี) เท่ากับ 104 เดซิเบล (83-117 เดซิเบล) ค่าเบี่ยงเบนมาตรฐาน 8.33 อายุเฉลี่ยที่เด็กเริ่มเข้าสู่โปรแกรมการฟื้นฟู 2 ปี 10 เดือน เด็กส่วนมากมีความก้าวหน้าในการฟังและการพูด ไม่พบความสัมพันธ์ระหว่างความสามารถของเด็กกับอายุที่เข้าโปรแกรม อย่างไรก็ตามพบความสัมพันธ์เชิงบวกระหว่างความสามารถการฟังกับความยาวของคำพูด ($r = 0.685$) จำนวนคำศัพท์ ($r = 0.665$) และลักษณะของการพูด ($r = 0.598$); $p < 0.01$*

สรุป: *การฝึกฟังเป็นกิจกรรมอย่างหนึ่งในโปรแกรมการฟื้นฟูสมรรถภาพ ที่มีความสำคัญในการพัฒนาทักษะในการฟัง ความยาวของคำพูด จำนวนคำศัพท์ และลักษณะของการพูด นอกจากนั้นโปรแกรมการฝึกฟังยังมีประโยชน์ในการติดตามความสามารถทางการได้ยินสำหรับเด็กที่เพิ่งใส่เครื่องช่วยฟัง สามารถดูแลเด็กหูพิการให้มีคุณภาพชีวิตที่ดีในสังคมที่ใช้การฟังและการพูด*