International Journal of Pediatric Otorhinolaryngology 83 (2016) 16–21

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Language skills and phonological awareness in children with cochlear implants and normal hearing

Zahra Soleymani [a,*], Najmeh Mahmoodabadi [b], Mina Mohammadi Nouri [c]

[a] School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran
[b] Iranian Research Center on Healthy Aging, Sabzevar University of Medical Sciences, Sabzevar, Iran
[c] School of Mathematics, Statistics and Computer Science, University of Tehran, Tehran, Iran

ARTICLE INFO

Article history:
Received 28 August 2015
Received in revised form 2 January 2016
Accepted 15 January 2016
Available online 25 January 2016

Keywords:
Phonological awareness
Language skills
Cochlear implant
Farsi-speaking children

ABSTRACT

Objectives: Early auditory experience plays a major role in language acquisition. Linguistic and metalinguistic abilities of children aged 5–5.5 years with cochlear implants (CIs) were compared to age-matched children with normal hearing (NH) to investigate the effect of hearing on development of these two skills.

Methods: Eighteen children with NH and 18 children with CIs took part in the study. The Test of Language Development-Primary, third edition, was used to assess language and metalinguistic skills by assessment of phonological awareness (PA). Language skills and PA were then compared between groups. Hierarchical linear regression was conducted to determine whether the language skills explained the unique variance in PA.

Results: There were significant differences between children with NH and those with CIs for language skills and PA ($p \leq 0.001$). All language skills (semantics, syntax, listening, spoken language, organizing, and speaking) were uniquely predictive of PA outcome in the CI children. Linear combinations of listening and semantics and listening, semantics, and syntax correlated significantly with PA.

Conclusion: The results show that children with CIs may have trouble with language skills and PA. Listening, semantics, and syntax, among other skills, are significant indicators of the variance in PA for children with CIs.

1. Introduction

It has been demonstrated that oral language skills and their phonological representations influence the path of reading development in children with normal hearing (NH) [1]. Phonological representation is a repository for speech sound information and forms the foundation of spoken words. It is saved as either complete (words) or segmental (syllables and phonemes). As lexical items are collected in a more segmented manner, phonological awareness (PA) skills develop [2].

PA is a wide-ranging ability to discover and manipulate units of oral language such as words, syllables, onsets and rimes. The order in which children first develop PA begins with awareness of larger speech parts (words, syllables), which leads to awareness of smaller parts (onset-rimes, phonemes) [3]. The developmental sequence of PA begins with awareness of words as units of speech and is followed sequentially by awareness of syllables, onset–rime units, and phonemes [4]. Semantics and syntax reflect language awareness of large segments, vocabulary, and sentence-level language structure. The development of these skills paves the way for PA [3].

It has been shown that code-related skills in the preschool years, including print concepts and PA, are connected in oral language [5]. Studies have shown that some levels of PA, such as rhyme detection tasks and an awareness of nursery rhyme tasks, can be assessed in children as young as three years of age. It is in the early steps that PA is associated with oral language [3]. Prekindergarten speech perception abilities and the extent of receptive vocabulary are also associated with PA in NH children [6,7]. As vocabulary increases, sensitivity to phonological structure (PA) increases to avoid confusion between similar-sounding lexical items [8]. Beyond vocabulary, however, there is little knowledge about other oral language skills that support the development of PA in the early years. Moreover, the relationship between PA and

* Corresponding author at: Department of Speech Therapy, School of Rehabilitation, Tehran University of Medical Sciences, Enghelab Avenue, Pitch-e-shemiran, Tehran 11489, Iran. Tel.: +98 9122036683; fax: +98 2177636042.
E-mail address: Soleymaniz@sina.tums.ac.ir (Z. Soleymani).

http://dx.doi.org/10.1016/j.ijporl.2016.01.013
0165-5876/

different aspects of oral language skills in preschool-age children has not been clearly detected.

Speech is the most useful method of communication within the families and local society. It has been proven that exposure to speech and language throughout the first years of life has a lasting effect on auditory, speech, language, and literacy development in children. The present study investigated language skills and PA in children with cochlear implants (CIs). Deaf children who have benefited from early implantation remain at risk for difficulties in language acquisition. The acquisition of sensitivity to phonological structure and language skills on a typical time-table is impaired in deaf children who have received CIs; thus, these children experience language and literacy difficulties [9,10].

Profoundly deaf children lack knowledge of the semantics and syntax of spoken language [11]. Early auditory experience promotes spoken language competence in children with CIs. Although wide individual variability exists in CI children, the implants decrease delays in language development for pre-linguistically deaf children [12]. Studies have reported that the persistence of language delays in CI children differs according to the language domain and controversy exists about the results reported for receptive vocabulary. Some children with CI develop receptive vocabulary skills that are similar to those in NH children [13]. Other researchers have reported below-average receptive vocabulary development in comparison with chronological age of the CI children [14]. Analysis of other linguistic skills of CI children reveals that expressive vocabulary and narrative production improves, but receptive and expressive morphology and syntax continue to be weak [15].

CI provides children with the auditory sensations that are important for development of phonological representations [16]; however, CI children still experience inadequately specified phonological representations of speech. Children with CIs have stronger phonological systems than those of their deaf peers without CIs, although they are weaker than those of their hearing peers [17]. Children with CIs function significantly worse than NH children on PA as a metalinguistic skill; they demonstrate decreased ability to differentiate and manipulate syllables and phonemes [18].

Spencer and Tomblin [17] reported that their CI group performed differently in different PA tasks. The CI group scored best on rhyming and scored similarly to the NH group in the blending task, but functioning on the elision task varied widely. Even literate adults with CI with at least 12 months of listening experience with the implant face trouble with tasks of explicit phonological representations such as the rhyme-judgment task [19].

Recently, the relation between oral language and literacy skills has been studied in CI children. It was found that PA skills as a prerequisite for literacy predicated receptive vocabulary abilities in CI children [18]. Word reading and reading comprehension are strongly related to syllabic structure and broad narrative ability in children with CIs. On the other hand, reading comprehension varied according to the size of children's expressive vocabularies [20].

There is a little overall knowledge of developmental trends in the relationships between PA tasks at various levels of linguistic complexity. The gap in the literature about the relationship between PA and language skills in preschool-age children motivated us to investigate whether specific preschool oral language competency (i.e., syntax) predicted concurrent PA outcomes. The present study sought to develop a comprehensive profile of the language skills of CI children and investigate the relationship between language skills and PA. This study used CI children an appropriate model for examining what occurs when the hearing experience is unavailable pre-acquisition and during early language acquisition.

Without hearing experience, it is extremely difficult to prepare understanding of language acquisition and phonemic categories. The current study assessed the language skills of semantics (vocabulary), syntax (syntactic understanding, sentence imitation, and morphological completion), listening, spoken language, organizing, and speaking. It also examined PA to estimate higher-order language processing in such children. These topics have not been widely reported in literature on children with CIs. This study is relevant because it has been found that the development in PA is linked to the development of vocabulary in kindergarten children [21]; however relatively little is known about the role of certain oral language skills on the increase in PA in preschool years. Recognition of the possible interaction between particular domains of oral language skill and PA in the early years could allow the rapid development of recommendations for primary childhood educational and clinical practice.

2. Methods

2.1. Participants

Speech and language therapy services at three hospitals in the city of Tehran that perform CI surgery were asked to refer CI children aged 5.0–5.5 years for participation in the study. Eighteen children (11 girls and 7 boys) having the following inclusion criteria were recruited: are native speakers of Farsi; profound congenital bilateral sensorineural hearing loss; usage of the Nucleus Freedom System with 22 channels for at least two years; no obvious structural or motor speech problems on oral assessment; and normal performance on intelligence quotient assessment. All children with CIs used auditory-oral communication modes. The CI children were assessed in a quiet room in the relevant hospital.

The NH participants were recruited using a list of all NH children aged 5.0–5.5 years who resided in married-student housing at Tehran University. Eighteen NH children (11 girls and 7 boys) aged 5.0–5.5 years having the following inclusion criteria were recruited: hearing, speech, and language were measured to be within normal range; are native speakers of Farsi. The children were tested in a quiet room in the married-student housing. The children were matched according to parental education and incoming level to equalize the social economic status of CI and NH children.

All the procedures were approved by the Ethics Review Committee of Tehran University of Medical Sciences (study number p/26/d4/243). The study was carried out after written informed consent had been obtained from the parents of the children.

2.2. Materials

The language skills were assessed using the standardized Farsi version of the Test of Language Development-Primary, third edition (TOLD-P:3) [22]. The main TOLD-P:3 subtests were picture vocabulary, relational vocabulary, oral vocabulary, syntactic understanding, sentence imitation, and morphological completion. Various subtests were combined to obtain composite language quotients for assessment of language skills. This comprehensive measure of verbal ability assessed the skills for semantics, syntax, listening, organizing, speaking, and spoken language. This test uses standard scores having a mean of 100 and standard deviation of 15.

The tasks for assessment of PA were developed based on the developmental stages of PA. To decrease the memory load and tap only PA skills, the tasks were presented visually [4]. Images of