



Hear here: Children with hearing loss learn words by listening



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ABSTRACT

Objectives: Early use of hearing devices and family participation in auditory-verbal therapy has been associated with age-appropriate verbal communication outcomes for children with hearing loss. However, there continues to be great variability in outcomes across different oral intervention programmes and little consensus on how therapists should prioritise goals at each therapy session for positive clinical outcomes. This pilot intervention study aimed to determine whether therapy goals that concentrate on teaching preschool children with hearing loss how to distinguish between words in a structured listening programme is effective, and whether gains in speech perception skills impact on vocabulary and speech development without them having to be worked on directly in therapy.

Method: A multiple baseline across subjects design was used in this within-subject controlled study. 3 children aged between 2:6 and 3:1 with moderate–severe to severe-profound hearing loss were recruited for a 6-week intervention programme. Each participant commenced at different stages of the 10-staged listening programme depending on their individual listening skills at recruitment. Speech development and vocabulary assessments were conducted before and after the training programme in addition to speech perception assessments and probes conducted throughout the intervention programme.

Results: All participants made gains in speech perception skills as well as vocabulary and speech development. Speech perception skills acquired were noted to be maintained a week after intervention. In addition, all participants were able to generalise speech perception skills learnt to words that had not been used in the intervention programme.

Conclusions: This pilot study found that therapy directed at listening alone is promising and that it may have positive impact on speech and vocabulary development without these goals having to be incorporated into a therapy programme. Although a larger study is necessary for more conclusive findings, the results from this preliminary study are promising in support of emphasise on listening skills within auditory-verbal therapy programmes.

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1. Introduction

Hearing loss (HL) is the most common birth anomaly, affecting 1–3 of every 1000 newborns in developed societies [1–4]. Congenital hearing loss impacts language learning [5,6], speech development [5,7], psychosocial development [8–10], literacy [6,11,12], academic success [13] and employment outcomes

[13–16]. As a result, hearing loss is identified as one of the most costly lifelong conditions [16]. The sequelae of lifelong events affected by hearing loss seem to begin in-utero [17,18]. Babies with typical hearing are born with skills that facilitate language development from the first moments of life [19,20]. At birth, infants have preferential attention to their own mother's voices [21], human speech sounds over nonspeech sounds [19], as well as an ability to recognise their own native language spoken over other languages [22]. Newborns with typical hearing are also able to perceive fine acoustic differences between individual speech sounds [21,23,24]. Where children are born with hearing loss, their ability to access speech acoustic information for detecting and discriminating between speech sounds is diminished. A recent cortical study on the auditory pathways of children born with

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hearing loss report correlation between increased length in auditory deprivation and decreased likelihood in achieving normal cortical responses to sound through the use of assistive hearing devices [25].

1.1. The importance of early intervention

The need to minimise the lifelong impact of permanent sensorineural hearing loss has resulted in a number of important changes to the management of young children with hearing loss. Increasingly widespread implementation of newborn hearing screening has enabled the early detection of hearing loss whilst advances in amplification devices have enabled most children born with hearing loss to have auditory access to speech sounds. Best practice for newborns with permanent hearing loss currently involves the detection of hearing loss by one month of age, amplification by 3 months and attendance at early intervention by 6 months [26–28]. This is frequently referred to as the 1-3-6 guidelines.

There is a spectrum of early intervention choices available to parents, from programmes that aim to teach children how to communicate manually to programmes that teach children how to communicate orally (refer to Schwartz [29] for a description of the main options). For parents who would like their child with hearing loss to learn to speak, an early intervention choice that has been gaining in popularity is Auditory-Verbal Therapy (AVT) [30]. With an emphasis on the use of appropriate hearing technology for auditory stimulation, the fundamental goal in AVT is for children to use hearing as the primary sensory modality in developing spoken language [31]. AVT focuses on creating listening experiences so that the child's newly acquired auditory potential is optimally used as they learn to process verbal language and speak [32].

Children enrolled in AVT have been reported to be successful at achieving age-appropriate verbal communication outcomes [33–35]. A longitudinal outcome study of children enrolled in an AVT programme by Dornan et al. [33,36] has shown that language growth with each year of therapy was comparable with that of normal hearing peers matched for language age, gender and socioeconomic status. These findings were supported by a more recent longitudinal study that examined the language development of children who received intervention in accordance with 1-3-6 guidelines [35]. In this study, Fulcher et al. found that 90% of children born with hearing loss achieved age-appropriate speech and language outcomes by 3 years of age [35]. Outcome studies of AVT have been important in supporting the overall efficacy of AVT programmes in the current drive towards evidence-based practice.

In order for such positive outcomes to be achieved across all AVT programmes, it is important to have evidence to support practitioners in the use of clinical techniques as well as prioritising goals that drive each therapy session. Rhoades [30] raised concerns regarding the lack of research evidence in supporting the process of AVT; and noted the need for data to answer critical questions such as which clinical strategies used in AVT programmes are more efficient than others. The current guiding principle for goal setting in AVT indicates that practitioners are to follow the developmental patterns of typical children covering the areas of audition, speech, language, cognition and communication [31]. With respect to audition, there are a number of published developmental hierarchies used by AV practitioners to develop and refine a child's listening skills. Some examples include the 'Listening Skills Scale for Auditory-Verbal Therapy (LSSAVT)' [32], 'Targets for Auditory/Linguistic Learning' [17], the 'St. Gabriel's Curriculum' [37] and the 'Listen Learn and Talk' [38]. While these audition hierarchies are widely used and central to therapy planning, no known outcome study has been published on the efficacy of designing a therapy programme based on these hierarchies.

Speech perception is a significant component of many widely used audition hierarchies, yet little is known regarding the efficacy of speech perception intervention with infants and preschool children with hearing loss. Research evidence is available only for the efficacy of speech perception intervention with adults and school-aged children. Although these intervention studies reported positive outcomes [39–42], their applicability to preschool children is limited because all of these programmes require participants to have prior linguistic and letter-to-sound knowledge in addition to being literate. Moreover, the programmes tracked the development of speech perception skills without measuring the development of other aspects of verbal communication skills such as vocabulary development and speech intelligibility, thereby failing to demonstrate any improvement in functional skills as a result of improved speech perception or auditory development.

It is important to understand the essential role that speech perception intervention plays in AVT as teaching listening is one of its key elements. Several studies have found correlation between development of early speech perception and later vocabulary skills in young children with normal hearing [43–45]. In addition, prospective studies of typically developing infant speech perception and early language abilities report that infant speech perception skills accurately predict low vs normal language function up to 8 years of age [46–48]. These findings are exciting for children with hearing loss. If speech perception skills during infancy can predict language status in later childhood, perhaps early intervention of poor speech perception skills can intercept the course of delayed or impaired language development. In order to determine whether there is positive correlation between speech perception skills and vocabulary in pre-schoolers with hearing loss, Desjardin et al. [49] designed a speech perception test that is based on the repetition of nonsense syllables. This cross-sectional study found significant correlation between speech perception and vocabulary skills, thereby supporting the hypothesis that speech perception intervention may have a positive impact on the vocabulary of preschool children with hearing loss who are learning spoken language. An intervention study with school-aged children by Paatsch et al. [50] analysed the effects of speech production intervention as well as vocabulary intervention and found a causal impact on speech perception and reading development [50]. Although the impact of speech perception intervention on speech production and vocabulary skills cannot be ascertained from this study, it seems there is a relationship between development in speech production and/or vocabulary skills with development in speech perception in older children with hearing loss.

Recent studies have found discontinuity between development in speech perception skills and early word learning for young preschool children with normal hearing [51–53]. These studies suggest that the processing demands of linking words to meaning are so great for the novice word-learner that they have difficulty in attending closely to the fine phonetic detail that is available in the speech signal. If children with normal hearing who are born ready for speech perception have difficulty attending to fine acoustic detail when they first begin learning words, what is the course of word learning in children with hearing loss who are still in the process of learning speech perception? A recent study on word learning processes in preschool children using cochlear implants who were enrolled in auditory-verbal programmes by Walker and McGregor [54] found that the children demonstrated delay in word learning despite early cochlear implantation. In comparison with typically developing peers, the children with hearing loss had difficulty with fast-mapping which is the word learning process of linking a word to its referents after only a few exposures [54]. Inferential fast-mapping whereby novel words were not directly marked by social or linguistic cues were particularly difficult for

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