

Supporting Communicative Development of Infants and Toddlers with Hearing Loss

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ABSTRACT

Newborn hearing screening has increased the number of families enrolled in early intervention during a sensitive period of communication development. The primary role of the speech-language pathologist in early intervention is to facilitate natural parent-infant interactions and support parents' feelings of confidence in communicating with their child. Feelings of self-efficacy can be increased when parents understand how hearing loss impacts their child's communication development, understand how to monitor hearing technology and hearing status, and receive consistent feedback related to their child's progress. This article reviews the evidence behind benefits of early parent-child interactions and outlines strategies and resources for speech-language pathologists to use in supporting communication development with infants and toddlers with hearing loss.

KEYWORDS: Infants, toddlers, hearing loss, language development

Learning Outcomes: As a result of this activity, the reader will be able to (1) describe the developmental benefits of early parent-infant interactions; (2) identify tools for assessing early communication development of children who are deaf/hard of hearing, and (3) name two ways to identify a young child's response to sound.

The Joint Committee on Infant Hearing recommends early intervention services begin no later than 6 months of age.¹ In the past 20 years, the average age of identification has decreased

from ~2½ to 3 years of age to 2 to 3 months of age.² Because of newborn screening, early intervention services are often initiated during a sensitive time period for communication

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development. Speech-language pathologists working in early intervention settings need to be aware of how and why to support early interactions between parents and their infants. It is also important to understand how these interactions can be impacted by the diagnosis of a hearing loss. This article will (1) outline evidence supporting how early parent-infant interactions support a framework for language development, (2) review ways for speech-language pathologists to support and enhance natural interactions between families, and (3) discuss specific methods speech-language pathologists can utilize to maximize early intervention with children with hearing loss, including strategies for increasing parents' understanding of hearing loss, technology, and development.

RELATIONSHIP BETWEEN PARENT-INFANT INTERACTIONS AND LANGUAGE DEVELOPMENT

Parent-child interactions with infants and toddlers with normal hearing have been studied in relation to the quality^{3,4} and the quantity⁵ of input. In these early interactions, parents inherently utilize techniques that offer numerous neurological, linguistic, and social benefits to the infant's ability to develop a framework for spoken language. In turn, the infant reinforces (i.e., through smiles and vocalizations) the parents' use of these early communication techniques. One of the "tools" that parents use with their hearing infants is *infant-directed speech*. In contrast to adult-directed speech, infant-directed speech uses a higher average pitch, increased pitch range, shorter utterances, longer pauses, and vowel hyperarticulations, or expansions in the first and second formants of vowels.^{3,4} This increased vowel space has been found in infant-directed speech across languages and is linked with increased speech discrimination skills in infants with normal hearing.⁵

In addition, early parent-child interactions provide hearing infants with a neural framework for speech perception that is linked to later language outcomes.⁶ As children are exposed to their parent's language, they acquire knowledge about the distributional properties of the phonemes of that language. This, in turn, helps them to segment the speech stream and make meaning

out of the language.⁷ In a study examining speech segmentation skills of 8-month-olds, Saffran et al⁷ found that hearing infants were able to recognize "words" given a small sample (i.e., 2 minutes) of auditory experience. This suggests that infants are "primed" to learn language from the experience of their early interactions.

Although infants have the potential to learn from small amounts of input, greater input has been associated with improved vocabulary and language outcomes.⁵ It has been suggested that children need over 20,000 hours of listening experience in the first 5 years of life to create a neural framework for literacy.^{8,9} Therefore, it is important for parents to understand that exposure to language (both quality and quantity) is critical as it provides infants with the opportunity to decipher the configurations of their language. This development of efficient pathways for language learning is dependent on the experience gained through early parent-child interactions.

IMPACT OF HEARING LOSS

Even with the advances in early identification and hearing technology, infants with hearing loss come to the task of early language learning with challenges. Hearing infants start perceiving sound around 20 weeks' gestation^{9,10} and at birth have ~20 more weeks of experience listening and learning prosodic cues than their peers with hearing loss. For example, infants are born with a preference for their mother's voice over other female voices.¹⁰

In addition, the quality of early parent-infant interactions can be impacted by the diagnosis of hearing loss. Slower speaking rates¹¹ and decreases in vowel hyperarticulation¹² have been found in studies examining parent vocalizations to infants with hearing loss. The quantity (i.e., mean length of utterance and number of total words) can also be impacted by hearing loss and a parent's feelings of self-efficacy.¹³

SPEECH-LANGUAGE PATHOLOGISTS' ROLE IN SUPPORTING PARENT-CHILD COMMUNICATION

A critical aspect of working with families in early intervention is to support the early

interactions that occur naturally between parents and their infants. Speech-language pathologists can help parents to recognize and reinforce their child's early vocalizations and responses to sound. They can also help parents to model the expectation of verbal turn-taking with their infants. Parents can expect vocalizations from their child through pausing, leaning toward the child, and looking expectantly. When infants are given these cues, they typically will respond with a move, vocalization, or smile, which encourages the parent to move and talk again. This expectation helps the child to establish early interactions that lead to the communication dyads essential to conversation.

Clinicians can also provide models to encourage multiple opportunities for language input, such as teaching parents to narrate everyday activities, describe scenery, and read books. Families can be introduced to songs to sing with their child. Singing increases infants' exposure to signals rich in acoustic and prosodic information through songs' range of pitches, variations in duration and intensity, and use of repetition. The inclusion of extended family members, such as siblings, grandparents, aunts, and uncles, in therapy sessions also increases the likelihood of repetition and the infants' exposure to language.

In addition, it is important to address parents' feelings of self-efficacy or confidence in relating to their child and his or her development. Parents' self-efficacy has been related to the quantity of language parents use with their child.¹³ Speech-language pathologists can identify parents' goals and expectations, answer questions, and coach parents to be the primary facilitator of their child's communicative development. Feelings of self-efficacy can be increased when parents understand how hearing loss impacts their child's communication development, understand how to monitor hearing technology and hearing status, and receive consistent feedback related to their child's progress.

SKILLS NEEDED RELATED TO WORKING WITH INFANTS AND TODDLERS WITH HEARING LOSS

Although parents have the inherent skills needed to support communication development in

their infants and toddlers, many parents are unfamiliar with hearing loss. In fact, ~90% of infants with hearing loss are born to two hearing parents.¹⁴ Professionals must understand and help parents learn how hearing impacts communication, how to monitor their child's early responses to sound, and the need for consistent hearing technology.

Monitoring Hearing Equipment

Speech-language pathologists can help parents to understand the speech spectrum and the sounds that occur at different frequencies. Speech carries not only information for the development of speech production, but also information that is needed for successful developmental use of grammatical morphemes, syntax, semantics, and pragmatics.¹⁵ It is important for professionals (e.g., audiologists, early intervention providers, speech-language pathologists) to work together to teach parents to monitor their child's hearing devices in the home. Audiologists will explain hearing technology with parents, but it is important for speech-language pathologists to review and coach parents with troubleshooting and monitoring of equipment. Parents can be taught to perform the Ling 6 test (also called the Ling 7 test) daily to ensure that children are hearing across frequencies. This test consists of the parents presenting six sounds (/m/, /oo/, /ah/, /ee/, /sh/, and /ss/) and a "nothing" response (for full description and a video description of the Ling Sound Test, see http://www.infantheating.org/videos/featured/hearing_aid_listening_check.html).

The Ling test will help parents detect changes in the child's hearing and communicate these changes to professionals. An ongoing dialogue between the parent, the early intervention provider, and the audiologist will assure that the child's hearing technology is optimized to provide access to frequencies across the speech spectrum. The speech-language pathologist and parents should understand that a child's hearing loss has the potential to change due to growth, presence of fluid, and/or physiological changes. Better understanding of the reason for the hearing loss and how to monitor hearing status is critical for ensuring that the

appropriate hearing technology is selected and optimized. This requires an ongoing, collaborative dialogue about the child's responses to sound and any potential changes that occur.

Understanding Responses to Sound

Integral to this communication is the monitoring of a child's hearing status through understanding of how infants and toddlers respond to sound. Speech-language pathologists must help parents to become "detectives" to their infant's early responses to sound. It is important to be aware of what potential responses to sound look like and to track these over time.

The sucking reflex is one of the first reflexes that a child develops. This reflex has been used in studies examining speech perception in children as young as a few hours after birth.¹⁰ As environmental and speech sounds are produced, speech-language pathologists and parents can watch an infant's sucking responses to see if they quicken, stop, or change as a way of monitoring early responses to sound. This information can help parents and professionals to be more aware of an infant's preliminary patterns in their response to sound.

As children age, it is possible to train a head turn response to demonstrate early awareness of sound. Head turn responses start at ~6 to 10 months of age^{16,17} and are commonly used in early audiology sessions. Speech-language pathologists work with parents to train head turn responses with noisemakers and the Ling sounds. Typically, one person (speech-language pathologist) is in front of the child and engages the child in mildly entertaining visual stimulus (moving a toy or a block). The other person (parent) presents a sound from behind the child. Initially, the speech-language pathologist can cue the child to turn his or her head to look for the sound and the parent provides some type of reinforcement (hug, smile, bubbles). As head turn responses become more established, the speech-language pathologist discontinues any cuing of the presence or absence of sound to determine the child's spontaneous and independent responses. The advantage to training a head turn response is that this type of physical movement provides increased training for a similar activity that will be used with an audi-

ologist in a testing/sound booth environment. In addition, these clear movements provide early reinforcements and encouragement for the parent that the child is detecting and responding to sound.

Detection is the first of the auditory skills that develop in infants. Speech-language pathologists must also understand the process of auditory skill development and how this can be supported and monitored in early intervention. Cole and Flexer's book, *Children with Hearing Loss Developing Listening and Talking*,⁹ includes a comprehensive list of auditory assessments that are commonly used with infants and young children. These assessments can serve as a guide for speech-language pathologists and families to ensure that the child is aware of sound, connecting it with meaning, and using listening as the foundation for linguistic development.

Supporting Consistent Hearing Aid Use

A majority of parents are unfamiliar with hearing aids, how they work, and the benefits of consistent use. Many families are only exposed to hearing aids through older family members and their experiences. These experiences may include squealing (i.e., feedback), difficulty in noise, and reports that the hearing aids are "too loud." This may give parents the perception that the hearing aids are uncomfortable or will give their child a distorted sense of speech. Speech-language pathologists can help parents to understand the differences between hearing aid use in infants and hearing aid use in adults. Because many children can detect sound without their hearing aids, parents may not understand why the child needs to use them during all waking hours. Speech-language pathologists can help parents to understand that adults have established language and so are able to understand much of the conversational speech in their environment and are able to "fill in the gaps" cognitively when they don't have a clear acoustic signal. In contrast, infants rely on the information they hear to develop phonological, semantic, syntactic, and pragmatic information needed to be successful communicators. Speech-language pathologists can provide parents with simulations of what is

audible with different levels of hearing loss to demonstrate how even a mild hearing loss can impact speech and language development. One example of a hearing loss simulation can be found at: http://www.phonak.com/us/b2c/en/hearing/understanding_hearingloss/how_hearing_loss_sounds.html. When parents have increased understanding of how full-time consistent use of hearing aids impacts their child's language, they are often more likely to commit to full-time use of hearing aids. *Learn to Talk Around the Clock*¹⁸ is one resource that provides early intervention providers with a "Signature Behavior Checklist" specific to increasing listening behaviors in the home. This checklist is particularly helpful in working with families to create objective, practical steps to increasing hearing aid use. In addition, the *Learn to Talk Around the Clock* curriculum includes information and activities to support this development.

Understanding Developmental Milestones

It is important for speech-language pathologists to help parents recognize communication milestones and understand how they can be impacted by hearing loss. With increases in newborn hearing screening, children with hearing loss now are often identified prior to 3 months of age and receive hearing technology within approximately 2 months of diagnosis.¹⁹ With these changes, the communication development of children with hearing loss does not need to be delayed and many children can develop speech and language within developmentally appropriate milestones, or *developmental synchrony*.^{9,20}

Reduplicative babble is one of the first developmental milestones that can be impacted by hearing loss. Infants with normal hearing typically develop reduplicative babble around 6 to 9 months of age; children with hearing loss who have not been identified or received proper hearing technology are delayed in their development of these babbling behaviors.²¹ Speech-language pathologists can anticipate babbling behavior and present toys and routines that support reduplicative babble through use of early developed phonemes. The "learning to listen" sounds²² can be used in activities and

suggestions can be provided for linking vocalizations to objects in varying patterns. Speech-language pathologists should monitor early vocalizations not only from a developmental perspective, but also with the understanding of the frequency allocation of the various phonemes to ensure that the child is hearing and producing sounds across the speech spectrum.

Parent-completed inventories such as the *MacArthur-Bates Communicative Development Inventories*²³ can be used to track a child's early vocabulary development. First words typically occur around 12 months of age and first word combinations occur between 18 to 24 months. As the child begins to combine words, the speech-language pathologist can monitor the types of combinations to ensure syntactic variations and the child's ability to use a variety of parts of speech (i.e., nouns, verbs, and adjectives). Inventories provide a common communication context between parent and clinician in determining if the child is developing as expected, and, if not, to develop an action plan.

Assessment

Regular assessment is part of the Joint Committee on Infant Hearing recommendations.¹ These recommendations outline that assessments should be every 6 months and compare a child to his or her hearing peers.¹ Standardized assessments evaluating communication development, such as The *Preschool Language Scale-4*,²⁴ or criterion-referenced assessments, such as the *Rossetti*,²⁵ can supplement the previously mentioned vocabulary checklists. In addition, the child's progress should be monitored across developmental domains. The *Minnesota Child Development Inventory*²⁶ and the *Battelle*²⁷ are assessments that can be used to measure a child's cognitive, physical, fine motor, social, self-help, and preacademic growth over time. It is important for parents and speech-language pathologists to know that although hearing loss may be the first condition detected, it may be not the only condition present. It is critical that speech-language pathologists monitor developmental milestones across domains and work with a team of professionals for potential referrals (e.g.,

occupational therapists, physical therapists, vision specialists, and special educators).

Speech-language pathologists need to understand that, although it is important to use standardized assessments to compare the speech and language development of children with hearing loss to their age-matched hearing peers, it is also important to be aware of how to identify errors that might be more specific to hearing loss. For example, if a child with hearing loss does not produce plural /s/, it may be that the child does not have access to high-frequency information. Therefore, it is also important that the speech-language pathologists are aware of, and utilize, criterion-referenced assessments specific to children with hearing loss to supplement standardized assessments. The Infant Monitor of Vocal Production (<http://www.ridbcrenwickcentre.com/imp>) is one tool that can be used to assess early child productions. The *Cottage Acquisition Scales for Listening, Language, and Speech*²⁸ has several checklists that can be used to evaluate a child's language from very early productions (presentence level) to the use of more complex language (complex sentence level). The *Auditory Learning Guide*²⁹ (<http://www.firstyears.org/c4/alg/alg.pdf>) can also be used as an ongoing tool to examine a child's awareness to sound as well as their phonemic, vocabulary, and language development.

Collaboration

The success of early intervention services relies on regular communication from each of the team members: parent, speech-language pathologist, early intervention provider, and audiologist. Each team member has a unique perspective in determining how the child is developing across communication domains and environments. Through collaborative efforts, parents and professionals can monitor progress and make the modifications in hearing technology and/or intervention services to ensure that a child is meeting his or her full potential.

CONCLUSION

One of the biggest impacts of newborn hearing screening is initiation of early intervention at

younger ages. The speech-language pathologist should be prepared to understand parent-infant communication, developmental milestones, and how these are impacted by hearing loss. Many of the interactions that occur between parent and child may be impacted with the diagnosis of a hearing loss. It is important that speech-language pathologists have the skills and knowledge needed to support parents as the primary facilitators of their child's communicative development.

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