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EARLY CHILDHOOD HEARING REHABILITATION (PART II): HOW TO ENHANCE HEARING AND LINGUISTIC DEVELOPMENT DURING THE EARLY YEARS

Milaine Dominici Sanfins, Dayane Domeneghini Didoné,
Piotr Henryk Skarzynski e Daniela Gil



ŚWIATOWE CENTRUM SŁUCHU
INSTYTUTU FIZJOLOGII I PATOLOGII SŁUCHU

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This month's newsletter discusses the key factors surrounding hearing rehabilitation. We will look at the factors that affect the development of hearing and language in children with hearing impairment, and how it is possible to enhance these skills at an early stage in order to minimize potential damage.

In the May newsletter we discussed what guidance parents and caregivers should give to support rehabilitation. If you haven't read this material, it probably helps if you do.



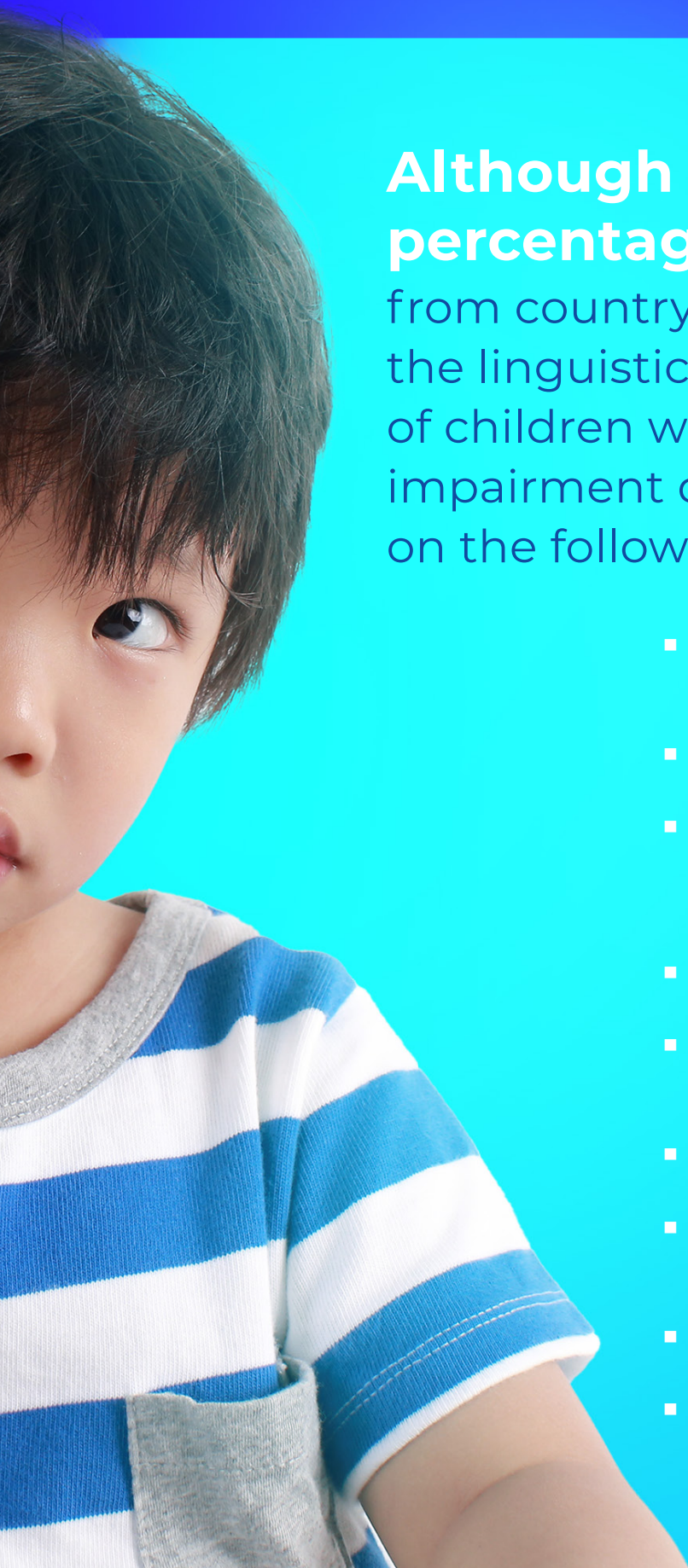


Hearing loss is known to significantly affect the development of a child's hearing and language skills, especially in the early years. This is because a lack of hearing stimuli causes atypical organization of the auditory cortex. If there is no early rehabilitation, the hearing areas of the cortex will be underutilized and will likely become sensitive to other sensory modalities, such as vision, a process called cross-modal plasticity. There will be a direct impact on linguistic development, and in fact speech delay or disorder is one of the main developmental impairments in such children. It is closely associated with severe to profound sensory hearing loss, in which access to the sounds of speech is impossible without the use of electronic aids.



Language and communication issues are important for both family members and hearing rehabilitation professionals, as the issues directly affect the social inclusion and independence of impaired children.

When it comes to hearing enablement and rehabilitation, about 90% of parents and caregivers of children with severe hearing loss choose to develop their child's oral language, and only 10% choose to use sign language. Most parents and guardians use speech, so there is a natural desire to have their children use the same communication mode.



Although the percentage varies from country to country, the linguistic success rate of children with hearing impairment depends on the following factors:

- Early detection and admission of a child into a specialized program;
- Type and degree of hearing loss;
- Age of installation, constant use of sound amplification devices and/or cochlear implants;
- Qualified therapists;
- Active and well-advised parents and guardians;
- Contact with school staff;
- Exposure of the child to oral language;
- Interaction with listening peers;
- Absence or presence of comorbidities.

EARLY DETECTION AND ADMISSION OF THE CHILD IN A SPECIALIZED PROGRAM

According to international criteria (JCIH, 2019) the stages of identification, diagnosis, and intervention should occur at the 1st, 2nd, and 3rd months of life, respectively. In order for these age targets to be achieved it is necessary that the multi-professional team work together so that all the steps are fulfilled efficiently.

In cases where there are indications for receiving a cochlear implant, it is necessary to carry out experiments with hearing prostheses to establish hearing levels for speech sounds. It is also necessary to perform complementary imaging to confirm that the anatomical conditions are suitable for the operation. After surgery it is necessary to wait about 30 days for the implant to be activated.



However, even before activation of the implant itself, a language-speech-hearing intervention can be carried out aimed at establishing good interactions with the family and the child. Currently, the guidance and advice of family members is extremely important. Aspects such as milestones in speech and language development, and operation and care of the implant can be addressed. It is also a good time to highlight the importance of rehabilitation, aimed at the acquisition and development of hearing skills, as well as adjusting and aligning expectations.

TYPE AND DEGREE OF HEARING LOSS

The degree of hearing loss has a considerable impact on language development, i.e. the higher the degree, the greater the hearing and linguistic damage. A study conducted by Tomblin et al. (2014) assessed the influence of hearing aids on the language development of children aged 3 to 5 years with varying degrees of auditory loss. It was found that the smaller the degree of hearing loss and the longer the time of use of prosthetics, the better oral language skills will be.

In cases of severe or profound hearing loss, when there are no benefits with the use of hearing aids, a cochlear implant should be considered, with the indication based on audiological and medical criteria.

Although the impact on speech and language development is greater and more evident in children with more pronounced hearing loss, it is necessary to emphasize the importance of care and intervention in cases of hearing losses with lower degrees of impairment or unilateral hearing damage.

A UK study of 1638 children with mild to moderate degree of bilateral hearing loss showed that these children have greater difficulties in understanding speech in noisy environments compared to their listening peers. Children with moderate degree of hearing loss also showed difficulties in short-term memory and reading tasks, demonstrating the existence of communication difficulties in these children.

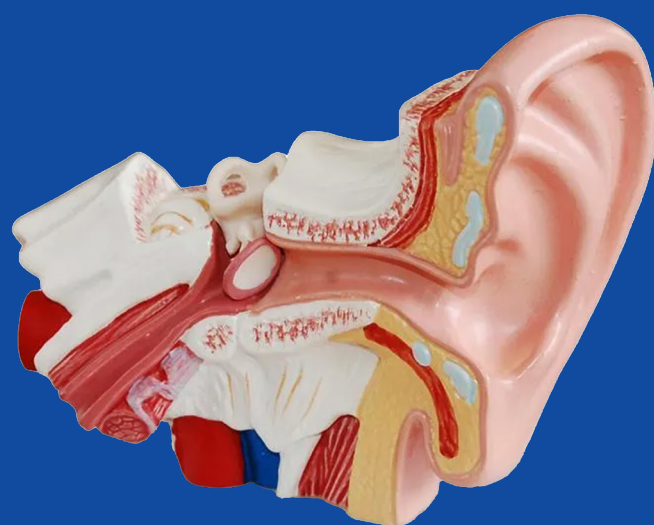
Therefore, regardless of the degree and type of hearing loss and the indication for an electronic device, there is a need for language-speech-hearing monitoring to monitor the development of the child's hearing and communication skills.

UNILATERAL HEARING LOSS

Unilateral hearing loss also negatively impacts the organization of the central auditory nervous system during the early years. Such children tend to have difficulties in figure-to-face skills, auditory closure, and spatial hearing, all of which compromise the mastery of complex linguistic skills, especially metalingual and metacognitive skills.

Longitudinal research has shown that the cognitive and linguistic skills of these children improve over time. However, sometimes school performance rates do not improve. Parents or guardians and teachers sometimes find behavioral and academic problems in some of the children evaluated.

A metaanalysis found that children with unilateral hearing loss have lower IQ scores than those without hearing losses. Verbal competence was also poorer in cases of unilateral hearing loss. Binaural hearing favours sound localization, a basic hearing skill which is acquired in the first months of life and provides better conditions for speech recognition in noisy environments. Therefore, intervention here is also worthwhile, and early intervention can restore binaural hearing and promote auditory skills, and, consequently, cognitive and linguistic skills.



IMPLANTATION AGE, CONSTANT USE OF HEARING AIDS AND/OR COCHLEAR IMPLANTS

Electronic and/or implantable devices, together with language-speech-hearing therapy, have the potential to improve the development of language skills and promote the social independence of affected children. In cases of neurosensory hearing loss, hearing prosthetics are the first step towards rehabilitation.

Implantation age is crucial to the success of therapy. Research has shown that children with congenital and acquired hearing

loss up to the age of 3 years and 5 months have a greater potential to develop hearing abilities similar to their hearing peers due to higher brain plasticity during this period. If implantation is carried out after 7 years, plasticity is drastically reduced.

Other factors such as the previous use of hearing aids, residual hearing, the time of sensory deprivation, and the etiology of the hearing loss also contribute to the success of this intervention.



However, implantation during the optimal period is the best predictor of therapeutic success. Constant and systematic use of the device is essential for incidental language learning. In addition, reducing visual cues will help maximize hearing inputs.

QUALIFIED THERAPISTS

Although hearing aids and/or cochlear implants are important, we know that by themselves they are not enough. In order to stimulate the development of hearing skills, language-speech-hearing therapy should be introduced early, since it is the basis for development of oral language. Two hearing aids as well as language-speech-hearing therapy also guarantees greater participation of children in social contexts, and allows constant exposure to oral language. Studies have shown that exposure to rich linguistic environments facilitates the development of a child's vocabulary, making them good communicators.

During therapy, the skills of detection, localization, discrimination, recognition, and understanding should be stimulated, following this hierarchy of acquisition, which is permeated by the cognitive skills of attention and memory. Phased hearing skills compromise linguistic development and are a factor in reducing the social involvement of children with hearing impairment, since such skills directly influence the development of oral language. In the case of adequate hearing gains with the use of two audio devices, programs of auditive/oral stimulation are encouraged, which promotes the development of receptive and expressive language, and improves speech intelligibility and social interaction. Studies have pointed out important benefits with this therapeutic model, as long as the intervention is early.

Cognitive factors also directly influence the acquisition and development of language and must be considered. Therefore, promoting language-speech-hearing therapy and everyday situations that involve tasks of attention, memory and visual stimuli, guarantees a better development of these children. In addition, the kinesthetic capacity helps children in the exploration and manipulation of objects or indirectly promotes cognitive development and, consequently, language.



ACTIVE AND WELL-ORIENTED PARENTS AND CAREGIVERS

The effectiveness of language-speech-hearing therapy is maximized when the therapeutic approach is family-centred. Thus, the therapist should know how to welcome and advise relatives on the technical, emotional, and cultural issues of each family.

The linguistic success of these children also depends on the stimulation provided by parents/caregivers. Interventions focused on improving communication between parents and children are essential. Promoting an environment rich in meaningful language experiences enables the child to succeed in linguistic acquisition and development.

Therefore, the active involvement of the family in the whole rehabilitation process is extremely relevant since it is the family who knows the child, its potentialities and needs, and will experience the consequences of the decisions taken on the development of the child.

A study by Monshizadeh et al. (2021) demonstrated that children with cochlear implants who participated in a program of auditive and cognitive stimulation performed better in language tests compared to those who were subjected only to auditory activities. This shows that cognitive factors should be part of the language-speech-hearing and encouraged therapy of the parents or caregivers.

A language-speech-hearing therapy in the first years must involve activities that can be easily reproduced outside the family or social and academic context, because it will have more chances of being successful, since the redundancy and the presentation and the reinforcement of the two aspects addressed will be guaranteed.

CONTACT WITH SCHOOL

Another key aspect of a successful intervention program, especially when involving children, is contact with the school in which the patient is inserted. As evidenced by various studies, the development of hearing and language skills in the early years also has an impact on the academic performance of these children. Therefore, every effort of the professionals and family is essential for the child to be able to accompany his listening peers in school tasks, as language skills directly influence the skills of reading, writing, and calculation.

Partnership with the educational team provides for regular contact with the teachers involved with the child. Visits to get to know the physical spaces of the school will help in order to decide on auxiliary hearing equipment such as an FM system, which will help improve the signal/noise ratio, giving better access to the teacher's speech. Knowing the academic demands of the child and performing integrated work with the team increases the chances of success in the therapeutic process. Alignment, whenever possible, of the therapeutic objectives with the academic goals promotes greater redundancy of the contents, facilitating the acquisition of new concepts.

Instructing the staff on the hearing conditions of the child and also on the operation of the electronic device will ensure its constant use in school activities, which will promote better interaction of children with hearing impairment with their listening colleagues, promoting better social inclusion.

EXPOSURE OF THE CHILD TO ORAL LANGUAGE

When compared to their typical peers, children with hearing loss have deficits in areas of oral language, especially if they have severe and profound losses and make use of electronic devices. Studies show that they will have difficulties with vocabulary and learning new words. These difficulties can result in impairment of literacy, since a poor vocabulary is linked to greater difficulties in reading. Even more evident is the fact that children of preschool age who have hearing loss show a slower pace in their ability to learn new words when compared to their typical peers. However, new findings show that an appropriate choice of electronic device during early exposure to oral language makes it possible for them to achieve a very similar vocabulary.



An interesting study by Werfel et al (2022) suggested that children with hearing loss who make use of electronic devices show lower performance when compared to listening children in terms of measurements of vocabulary and morphosyntax at the age of 4. The authors warn that standardized measures of vocabulary showed values within the limits of normality, which highlights the information from other researchers that these measures do not provide data that there is an equal performance between listeners and those with hearing loss. With regard

to morphosyntax, children with hearing loss continue to show lower performance, about a standard deviation below the values obtained in their hearing peers.

These findings show that care and access to oral language in the first years of life are vital for new brain connections to form, and that there is a harmony between the development of communication of children with hearing loss with their listening peers, since communication is essential for participation and social integration.



PRESENCE OF OTHER DISORDERS/ COMORBIDITIES

Many children have deficits other than hearing loss. In these cases, hearing rehabilitation using hearing aids and/or cochlear implants should also be considered, given the importance of hearing for overall development.

Currently the indications for the use of the cochlear implant in these cases have been expanded, and the understanding of the importance of hearing in the presence of other deficiencies has also been broadened. However, when it comes to children with multiple disabilities the results of using cochlear implants are variable. Therefore, these children should be monitored more frequently, since the pace of development of speech and language perception may be slower when compared to their peers with only hearing impairment.

Lammninmäki and colleagues (2023) conducted an intensive language training program in children with other hearing loss-related disabilities and found that when the therapeutic intervention program is intensive and well planned, and if there are no associated serious neurological and psychiatric deficiencies, it is possible that these children have

significant improvements in language development.

Furthermore, non-verbal cognitive skills are predictive for the development of receptive and expressive oral language in children with other disabilities. In these cases, the involvement of a multidisciplinary team and family counselling are extremely important in favour of overall development and communication skills.

Regarding family counselling in these cases, studies have shown that parents and caregivers of children with hearing loss and multiple disabilities showed greater satisfaction with the combined use of the telehealth procedures, possibly due to greater difficulties and movement to the intervention environment.

Thus, the absence of other disorders can definitely facilitate the process of hearing and linguistic development in the early years. Parents and professionals should learn from each other and thus explore options that are beneficial to the children.



Finally, a challenging and extremely important issue is that the intervention process of a child with hearing loss will have greater gains when the participation and contribution of different specialists occurs.

A multi-professional approach allows the child to be seen as a complex and unique human being. Thus, care and intervention are directed at the needs of each child taking into account their peculiarities and specific circumstances.



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Authors:



PROF. DR. MILAINE DOMINICI SANFINS

- Professor of the Audiology da Universidade Federal de São Paulo (UNIFESP);
- Research group member, Institute of Physiology and Pathology of Hearing, Kajetany, Poland.
- Professor of the post-graduate program in Clinical Audiology at the Albert Einstein Israelite Institute of research and teaching;
- Postdoc at the World Hearing Center, Warsaw, Poland;
- Sandwich Doctorate by School of Medical Sciences, Universidade Estadual de Campinas (FCM-UNICAMP) and by Università degli Studi di Ferrara/Italy;
- Expertise in Audiology by Federal Council of Speech Therapy and Audiology;
- Speech Therapist and Audiologist, Master by Medical School of University of São Paulo (FMUSP);
- Member of the Teaching and Research Commission of the Brazilian Academy of Audiology (2024-2026);
- Reviewer of scientific articles in the area of Neuroaudiology, Neuroscience, Electrophysiology and Audiology;
- Instagram @misanfins / email: msanfins@uol.com.br and msanfins@unifesp.br



PROF. DR. DAYANE DOMENECHINI DIDONÉ

- Assistant Professor of Curso de Fonoaudiologia da Universidade Federal de Santa Maria (UFSM);
- Professor of the Postgraduate Program in Human Communication Disorders of the Universidade Federal de Santa Maria (UFSM);
- Master's degree in Human Communication Disorders from the Universidade Federal de Santa Maria (UFSM);
- Doctorate in Child and Adolescent Health from the Universidade Federal do Rio Grande do Sul (UFRGS);
- Coordinator of GERA – Study Group on Hearing Rehabilitation.
- Reviewer of scientific articles in the field of Audiology.



PROF. DR. PIOTR HENRYK SKARZYŃSKI

- Professor, ENT, Master and Doctorate by Medical University of Warsaw;
- Research, didactic, clinical, and organizational work in World Hearing Center of Institute of Physiology and Pathology of Hearing, Institute of Sensory Organs and Medical University of Warsaw;
- Specialist in ENT, pediatric ENT, audiology and phoniatics, and public health. Participated in the 3rd Stakeholders Consultation meeting during which the World Hearing Forum of WHO was announced;
- Member of the Roster of Experts on Digital Health of WHO, Vice-President and Institutional Representative of ISfTeH;
- President-elect of International Advisory Board of AAO-HNS, member of Congress and Meeting Department of EAONO, Regional Representative of Europe of ISA, Vice-President of HearRing Group, Auditor of EFAS, member of the Facial Nerve Stimulation Steering Committee;

- Board Secretary of the Polish Society of Otorhinolaryngologists, Phoniatrists and Audiologists. Member of Hearing Committee (2018–19);
- Goodwill Ambassador representing Poland at the AAO-HNSF 2021 Annual Meeting & OTO Experience, and since 2021 a member of Implantable Hearing Devices Committee and Otology & Neurotology Education Committee of AAO-HNS;
- Consultant Committee of International Experts of CPAM-VBMS (by special invitation), honorary member of ORL Danube Society, and honorary member of Société Française d'Oto-Rhino-Laryngologie;
- Member of the Council of National Science Center;
- Expert and member of numerous national organizations.



PROF. DR. DANIELA GIL

- Fonoaudióloga Especialista em Audiologia pelo Conselho Federal de Fonoaudiologia
- Doutora em Ciências pela UNIFESP
- Professora Associada do Departamento de Fonoaudiologia da Universidade Federal de Sao Paulo

- Preceptora da Liga de Audição e Equilíbrio da UNIFESP
- Revisora de artigos nas áreas de Audiologia, Eletrofisiologia, Processamento Auditivo Central e Reabilitação Auditiva.