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The Use of SUVAG technique to Reduce Articulation Disorders in Hearing Impaired Children

استخدام تقنية "سوفاج" (SUVAG) للحد من اضطرابات النطق لدى الأطفال ضعاف السمع

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Abstract (English): The aim of this literature review is to document relevant aspects of rehabilitation methods for people with hearing impairment using the SUVAG technique. This is by presenting the "verbotonal method", rooted in Guberina's theory in 1961, which was established by the Yugoslav scholar Petar Guberina. It is a structural linguistic theory based on audio, visual, and tonal approaches, and it is also called the "tonalized pronunciation" method, according to which speech can be rehabilitated for the hard of hearing by stimulating the remaining auditory abilities, after accurately determining the site and type of weakness. Rehabilitation of the residual auditory capacity (residual hearing) is achieved by stimulating all response systems. This is through intensive intervention based on the development and creation of a good rhythm and tone of voice in hearing using sound amplifiers (Suvag device) and focusing on low vibrations (less than 500 Hz) as well as using body movements to help in the production and perception of speech.

Keywords: Articulation disorders, hearing impaired, SUVAG technique; verbotonal method.

ملخص باللغة العربية : الهدف من هذه المراجعة النظرية هو توثيق الجوانب ذات الصلة بطرق إعادة تأهيل المصابين بضعف السمع باستخدام تقنية سوفاج (SUVAG) من خلال عرض الطريقة " السمعية اللفظية النغمية تأصيلا لنظرية Guberina سنة 1961، والتي أنشأها العالم اليوغسلافي Petar Guberina، وهي نظرية لسانية بنيوية تقوم على هاهو سمعي، بصري، نغمي، ويطلق عليها أيضا طريقة "اللفظ المنغم"، والتي بموجبها يمكن إعادة تأهيل الكلام لدى ضعاف السمع عن طريق تحفيز القدرات السمعية المتبقية، بعد التحديد الدقيق لموقع الضعف ونوعه، يتم تحقيق إعادة تأهيل القدرة السمعية المتبقية(بقايا السمع) من خلال تحفيز جميع أنظمة الاستجابة عن طريق التدخل المكثف القائم على تطوير وخلق إيقاع جيد ونغمة صوت جيدة في السمع باستعمال أدوات مضخمة للصوت (جهازSuvag) والتركيز على الذبذبات المنخفضة(أقل من 500هرتز)وكذا استغلال حركات الجسم لتكون مساعدة على إنتاج وإدراك الكلام.

كلمات مفتاحية: اضطرابات النطق ؛ ضعاف السمع ؛ تقنية سوفاج SUVAG ؛اللفظ المنغم.

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1- Introduction:

The ability to hear and speak is one of the most important abilities that allow a person to form concepts and ideas as well as purposes. These abilities enable a person to communicate with the other through the transmission and exchange of these ideas, i.e. communicating about complex content and interacting using speech. The sense of hearing plays a prominent role in this regard, as it allows a person to hear the sounds and words uttered by others around him, so he begins to imitate them, which thus helps him to learn the dominant language in his group, as well as the dialect that distinguishes this group from others. From this point of view, any impairment that affects the sense of hearing naturally affects its functional performance, which depends on sensitivity to sound, whether this represents a loss of hearing or complete loss of it (Fathi Jarwan, Al-Amayriyah Moussasa, 2013, p. 298).

Hearing disability is one of the most important problems that children may face in their life. Through the sense of hearing, children can perceive the world around them, as well as obtain information about their external reality. Both Hallhan and Kauffman confirm that communication is the most developmental aspect affected by hearing impairment, as it negatively affects all aspects of language development. If the hearing-impaired children are not trained effectively, systematically and intensively, they will not develop the natural manifestations of language development. Therefore, the hearing impaired suffers from a clear delay in the development of language and reading, and the degree of this delay becomes clear whenever the degree of hearing disability is severe. As a result of the hearing impairment, the child does not receive appropriate auditory input (Muhammad Zaid Al-Arabi, 2010, pg. 07). Ibrahim Al Zureikat (2003, p. 180) indicates that children with hearing loss have fewer opportunities to hear from a variety of sources, which leads to a lack of experiences that negatively affects the formation of grammar, words, and vocabulary growth. This is an indication that language is an acquired process that depends on sound simulation, and this means that the shortcomings in the auditory aspects result in speech disturbances. Articulation disorders are considered one of the most prevalent speech disorders among children with hearing disabilities and hard of hearing.

Children who suffer from severe hearing loss cannot pronounce words or correct the sounds that reach them, because they do not hear others clearly. Thus, the circle is incomplete between them and the others. They also suffer from inconsistency in the tone of the voice, and the formation of letters appears unnaturally on the mouth and lips sometimes (Al-Qaryouti, 1995, p. 157). Therefore, they need auditory rehabilitation programs and correct pronunciation and speech in ways of communication appropriate to the degree and type of their disability, in order to enable them to

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express themselves, interact with others, and integrate into social life. On the other hand, hearing-impaired children are among the first persons with special needs who have been provided with educational and rehabilitation services. In the eighteenth-century AD, two schools of thought prevailed in Europe in teaching communication to the hard of hearing individuals. The first school focused on sign language, while the second school emphasized the need to use the oral method and speech in teaching children with hearing loss or children with hard of hearing (Alala, 2008, p. 211). Many rehabilitation and treatment programs have adopted the oral and speech method in teaching children with hearing loss or children with hard of hearing. The verbal method was considered effective in evaluating pronunciation and improving communication, which is part of the so-called *oral communication*, a method that combines the use of speech and the remains of hearing, reading speech and enunciation.

Among the modern and authentic methods, we find the Verbotonal Method. It is based on the principle of sound perception through vibrations that reach the brain directly through the nerves of the hand or any other bony part of the body. Thus, helping a child with hearing loss or children with a hearing impairment to perceive and understand speech, and this method needs special devices such as the infrared *SUVAG* device, filters to purify the sound, and so on (Aroussi Derradji, 2018, pg. 74).

Several studies have proven the importance of using the Suvag technique in the rehabilitation of hearing and speech and the correction of speech disorders. Many schools and auditory rehabilitation centers and services to provide care for deaf and hard of hearing children around the world have dedicated intervention programs based on the use of this technology according to the theory of the Yugoslav scholar "Guberina". The Western Pennsylvania School for the Deaf, a boarding school, has adopted the Verbotonal Method using the Suvag technique for all children of all levels from kindergarten to high school. It was noted that these children improved in their adaptation to the program and their vitality to acquire expressive communication skills. Professionals of this method have developed an interesting integrated program that benefits all deaf and hard of hearing children, where in general, the results were positive (Petar Guberina and Carl W. ASP, 1981).During all these years, a number of programs implemented in North America proved that deaf children have benefited from rehabilitation services using the Verbotonal method and Suvag devices, and they stated that the method showed many advantages that the traditional systems lack (Black1971).A program at the Alexander Graham Bell School in Columbus, Ohio reported that patterns of rhythm and intonation improved children's speech intelligibility. Moreover, children of The Metropolitan School for the Deaf in Toronto also made progress in all Verbotonal classes. (Guberina, 1981)

Thanks to research grants independently funded by the World Rehabilitation Fund, Santore (1980) and Asp (1981) were able to monitor and evaluate the major centers in Europe of Verbo-Tonal, which was used in various languages and in different cultural contexts. Over the past twenty-five years, the SUVAG Zegreb Center, Croatia has grown and is currently the largest center in the world providing services for children who have many types of communication problems, speech and speech disorders, hearing impairment and deafness. In an early US government-sponsored study, the SUVAG Center evaluated the progression of 100 hearing-impaired children over a five-year period. The results showed that 44% of the children were integrated into the classrooms of regular government schools, and 30% of the children improved significantly in distinguishing speech when presented in the optimal hearing field, and the ability of 23% of them to understand speech improved. More recent statistics showed that 75% to 90% of the hard of hearing were integrated from this center.

The Arabic studies dealt with treatment programs for Verbo-Tonal using the SUVAG technique. After it was designed and conducted on 3 hearing-impaired students at the Special Education Services Center in Dammam, Saudi Arabia (Al-Omari, 2017, pp. 124,135),Talae Abdullah Al-Omari's study confirmed that the training program for students with hearing impairments to reduce their speech disorders using the "SUVAG" technique is of good effectiveness with different degrees of hearing loss and different ages.Mahmoud Helmy Gouda's study (2021) also aimed at reducing speech disorders in hearing-impaired children by using Verbo-Tonal technique. The study sample consisted of 20 hearing-impaired children, whose ages ranged between (9-12) years. They were divided into two groups, one the control group and the other experimental group. The results showed a clear improvement in the experimental group in reducing speech disorders after applying the program (Mahmoud Helmy Gouda, 2021, pp. 565,596).

Based on the foregoing, it is clear that the use of the SUVAG technology and the Verbo-Tonal technique is one of the most important rehabilitation programs for the hearing impaired around the world. This is what can be presented in this literature review by studying the Verbotonal theory, its philosophy, its most important principles and methods of use, and exposure to the most important characteristics of hearing-impaired children, and their widespread speech disorders.

2- The Verbotonal theory:

The verbotonal theory originated from the study of spoken language by the world-famous linguist Petar Guberina. He is the founder of Zagreb Phonetics, Zagreb Polyclinic, Suvag and then the Suvag Center. Professor Petar Guberina (1913-2005) obtained a doctorate in linguistics in Paris. He also worked as a permanent professor at Zegreb University in Croatia, and a member of the Croatian

Academy of Arts. Among the rich scientific contributions of Professor Guberina is the Verbotonal Theory, which is considered one of his important achievements. This is reflected in the size of the global distribution of his theory, which touched 60 countries. Such a wide spread of the verbotonal theory is due to Guberina's innovative thought that transcends traditional linguistic contexts. Guberina, in his definition of the word or articulation, refers to the consideration that speech is a structural global linguistic phenomenon that includes both sound and movement and emanates from the human being in its entirety. At the heart of the Verbotonal Theory, the human being is the actor in the communication process, whether in his perception and reception of the spoken discourse, that is, when receiving the communicative message or reproducing it. (Mildner, 2018, p22)

Verbotonal Theory is the result of a multidisciplinary approach by Petar Guberina, incorporating knowledge inspired by general linguistics theory, auditory theory, and neuropsychological theory of cognition. The philosophy and applications of the "verbotonal" system put the human being at the center of its attention, his need to express himself through speech, his human brain and creative abilities, the human body and its way of expression and emotion as the engine of everything. Guberina believes that speech is a structure consisting of sound and movement, i.e. the body is the source of language, the brain processes it, speech is a form of language, and expression is the unit of language, i.e. linguistic expression related to the thought and values of spoken language. Guberina asserts that thought originates within speech. In addition, speech allows the formation of a relationship with other members of society to achieve the basic function, which is the function of communication through the transmission of various information (sensory, vocal, emotional).

The verbotonal theory emphasizes the importance of the simultaneous development of all senses (touch, proprioception, sense of balance, hearing and sight). This theory is a multisensory approach that focuses on spoken language and is an indispensable tool in improving and developing good communication skills. Furthermore, the verbotonal method supports the articulation of vocalizations with the help of bodily movements and is based on the belief that sound information can be improved by using visual, kinesthetic and sensory clues. The purpose was to help the deaf and hard of hearing develop normal speech patterns by providing access to the phonemic variables of speech including rhythm and tone. It uses auditory, visual, tactile and kinesthetic methods, through the use of body movements that help the child perceive how sound is felt and perceived inside his body through multi-sensory inputs.

Acoustic rhythms are another important form of assisting people with hearing impairments. Rhythm is a guide to acquiring good speaking skills. The Verbotonal System develops a program of rhythmic body movements and music values, which are based on the physical properties of speech sounds

and encourage speech production. Verbotonal theory emphasizes the importance of the human body in transmitting speech to individuals with hearing impairments.

The verbotonal theory has developed in two directions. The first was aimed at rehabilitating the hearing and speech of children who could not develop the ability to speak well due to organic or functional damage. The primary goal of this theory is to develop a well-spoken and understandable language for children and adults with hearing impairments to be able to communicate with people of good hearing. The second direction was aimed at teaching foreign languages, through phonemic correction, considering that learning a foreign language occurs through the awareness of the sounds of this language and thus its acquisition. All human beings are subject to the sound system of the mother tongue acquired at an early age, and the sounds of a foreign language are perceived only by distinguishing and filtering them. The theory stems from the idea that the foreign language learners are already deaf to foreign sounds that do not exist in their mother tongue, which do not link them to meaning and therefore cannot be accurately reproduced. The verbotonal hypothesis states that improving an individual's listening skills is the key to improving their speaking skills, by highlighting the linguistic forms of speech sounds. It is possible to train the ear to recognize and integrate new sounds and then produce them, and through time, the brain eventually creates this new class of sounds.

The Verbotonal System establishes its theory about the tone of speech in the optimal field for sound reception. Considering the components of sound are: frequency, intensity, duration, and body as a receiver, it is necessary to study the structural composition of sounds in order to form the optimal field that will serve as the basis for the auditory rehabilitation of the hearing impaired or deaf child. It is a method aimed at teaching speech and pronunciation training through auditory discrimination using special devices for loudspeakers, filters for sound purification such as the oscillating SUVAG and the Mini SUVAG.

3 The use of the SUVAG device:

SUVAG1 is an auditory training unit with a wide frequency response (0.5 to 20,000 Hz, electrically). The device is used during most group activities and during initial individual therapy sessions when the child learns rhythm and intonation patterns via a high-quality electric microphone that produces low frequencies (flat up to 10 Hz and down 6 dB at 5 Hz). This is without distortion of the speech sample (flat up to 10 Hz and down 6 dB at 5 Hz). The SUVAG I is guided by a specially designed bone vibrator (SUVAG VIBAR) that has an excellent low frequency response (0 to 1000 Hz), or through headphones (Koss K6) that have a wide frequency response that delivers maximum resonance at low frequencies.The intensity produced in a headset is usually intense between 60 and 90 dB HTL

when we use the wide frequency range. The SUVAG I audio training unit is used for all group activities; the teacher's microphone is positioned to provide a good signal ratio. Children naturally receive visual clues and yet do not receive any lip-reading instructions. They receive vibrotactile stimulation through the sound board, or a bone vibrator attached to each child's wrist, alerting the child to speech, helping to develop good sound quality and facilitating the perception and natural production of rhythm patterns. Moreover, vibrational stimulation prepares the child to perceive speech through the auditory mechanism.

The group lessons that occupy 80% of a child's time in the first stage of treatment focus on developing the rhythm and intonation patterns of spoken language. With normal sound quality, children learn the social aspect of speech through structured play situations that promote spontaneous physical and emotional reactions, where they learn to play with each other in a group and participate in activities that provide adequate stimulation

4- Hearing impaired and their characteristics:

In order to develop the sense of hearing, it is necessary that all parts of the auditory pathway are healthy and functional. The failure of one of its parts leads to hearing damage and is one of the most common natural damages. It can be defined as the impossibility or reduced ability to receive and record auditory stimuli due to congenital reasons or that the damage is acquired during development or impairment of the functions of the auditory system, central auditory nerve, or auditory centers in the brain. (Dulcic, &Kondic 2002, p47).

5- The concept of hearing impairment:

Both Ysseldyk and Algozzine (1995) define the hard of hearing as a person whose hearing loss ranges between (35-69 decibels) to the extent that s/he is compelled to use a hearing aid (a certain means). In other words, s/he finds it difficult to understand the speech of others by ear without using a specific means (Ysseldyke&Algozzine, 1995, p38).

Muhammad al-Nubi (2000) indicates that the hard of hearing are people whose sense of hearing is disturbed as a result of a partial disruption of it due to a disorder that occurs in the outer, middle or inner ear, in the auditory nerve or in the auditory center of the brain, which impedes social relations. (Mohammed Al-Nubi, 2009 p. 4)

Ibrahim Al-Qaryouti (2001) defines the hard of hearing as those who have a hearing impairment or have a residual hearing. However, their sense of hearing is functional to some degree and they can learn speech and language with or without hearing aids.

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6- Psychological and behavioral characteristics of hearing-impaired children:

There is no doubt that hearing impairment leaves multiple effects on various aspects of the development of the individual who suffers from it, and this effect appears clear in several aspects. The most important of them are physical and motor development, psychological and emotional development, academic achievement, social, and cognitive development. However, it is worth noting that disability does not affect all individuals who suffer from it to the same degree, rather this effect varies from one individual to another depending on the nature of the individual and the nature and degree of disability (Muhammad Zaid Al-Arabi, 2017, p. 49).

The effects of hearing impairment appear to be evident on many of the personal and behavioral characteristics that distinguish an individual with a hearing impairment from other normal individuals. (Al Rousan, 2001, pp. 145, 146)

The most prominent characteristics that distinguish hearing-impaired children are those related to physical, emotional, social, and language development. With regard to physical growth, it was found that they develop wrong physical conditions. As for the motor development of these children, it is late compared to the normal ones. (Al-Qamsh2000, p. 69) About 30% of the hearing-impaired children suffer from Dyspraxia. This disorder is the opposite of the motor coordination consistency. It can be described as a behavior that is carried out according to systematic and planned movements (Muhammad Zaid Al-Arabi, 2017, p. 50). Hearing-impaired children have problems with the ability to move and generally lose the auditory sense required for movement.

In terms of emotional development, hearing-impaired children usually suffer from emotional imbalance and are more introverted. Their level of social maturity is usually 20% to 40% lower than the average child, due to the obvious deficiencies in their communication, expression and language skills.

One of the most important factors affecting the life of a hearing-impaired child is the development of language and speech. For this reason, the lack of verbal language and the delay in linguistic development are the most serious consequences of hearing impairment, as the understanding of language, its output, and the clarity of speech are, of course, linked to the degree of hearing loss. Accordingly, the problems facing the hearing impaired in this context are less in quantity and quality than the problems facing deaf children. As for the written language and the abilities of hearing-impaired children, they show simple and uncomplicated writing.

Speech and language disorders usually spread among the hard of hearing, as they face many difficulties in learning the sounds of words because they do not hear them normally.

As for mental and cognitive development, there is an ongoing debate about the impact of hearing impairment on mental and cognitive abilities. Some researchers believe that cognitive development does not necessarily depend on language. Therefore, they assert that only the concepts related to language are weak among the hearing impaired. Some even see the sign language used by the hearing impaired as a real language. They believe that if there is a difference between the hearing impaired and other people in terms of performance on intelligence tests, this does not necessarily mean that the hearing impaired are less intelligent than others. Rather, this is due to the lack of effective teaching methods and the failure to provide them with the appropriate stimuli from those around them. As for others, they believe that cognitive development depends on language, and since language is the most vulnerable among the various aspects of development for the hearing impaired, they believe that cognitive development will necessarily be affected accordingly. (Al-Khatib, 2002, p. 87).

7- Articulation disorders in the hard of hearing:

The American Speech-Language-Hearing Association (ASHA) defines language as a complex and dynamic system of agreed-upon symbols used in various forms of thought and communication. Articulation is an important aspect of the speech process, as pronunciation uses speech sounds to form words that carry meanings and key information to be communicated to others. Articulation, like any aspect of a person, can be disturbed and deviate from performing the required function. The word articulation refers to the motor processes in the planning and execution of the sequence of gestures and movements to produce speech. Articulation is defined as the process of generating speech sounds. It is caused by the modification of the vocal passage that consists of the nasal, oral, and pharyngeal cavities. For example, any change in the place, style, or member of the speech organs leads to the production of a specific sound. Articulation disorders are defined as a defect in the individual's ability to pronounce sounds correctly, which affects the clarity of the meaning to be conveyed, especially if the defect includes many important sounds in speech. (Zainab Hussein Saadan, 2016, p. 23)

Articulation disorder occurs as a result of hearing impairment, and the hard of hearing lacks verbal language and his/her pronunciation does not develop normally, because the speech and language process is an acquired process that depends heavily on imitation and onomatopoeia. This means that the defect in the auditory aspects results in speech disturbances (Faisal Khair Al-Zarrad, 1990, p. 256).

The articulation disorders, or the so-called enunciation disorders, spread clearly among the hearing-impaired children, and the following disorders in the pronunciation of the sounds are usually prevalent among them:

1- The number of substitutions in vowel sounds is as large as replacing tense vowels with soft vowels.

2- Replacing diphthongs with vowel sounds, and vowel sounds with diphthongs.

3- Occurrence of deletion in the vowel sounds or diphthongs.

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Substitution appears as the most common manifestation of the articulation disorders, and the hearing impaired suffer from a disorder of sounds deletion at the beginning, middle, or end of words. The disorders also appear in their inability to pronounce the first and second consonant and vowel in some words. Moreover, they do not give the moving sound its full required movement during pronunciation, in addition to the fact that they may pronounce some words and sounds with a force less than or more than what is required, which shows the voice in a distorted and not completely clear manner. Some hard of hearing children add a new sound or syllable to the uttered word and thus his words are incomprehensible and this aspect is called addition.

8- Some strategies used in the treatment of articulation disorders in the hard of hearing:

Hearing impaired people need extensive training to speak, because they may produce irregular and unacceptable sounds. The fact that they do not make any sounds maylead to the annoyance and alienation of others. Controlling the occurrence of letters from the correct places and placing the tongue, whether the voice is whispered or loud or explosive, all contribute to the weak of hearing's acquisition abilities that qualify them to be close to the ordinary in controlling their voice and facilitating interaction with them.

Here are several strategies that can be used to develop the speech skills of a hearing-impaired children, including the following:

1- Education based on audiogram: Speech therapy for children with weak to moderate hearing impairment differs from speech therapy for children with normal hearing in several aspects. While people with normal hearing rely on auditory feedback to correct their speech, the hard of hearing needs to use visual, sensory and motor cues to compensate for their hearing loss. Here, the speech and language therapist has to look at the audiogram to identify the level of hearing with the presence of the hearing aid, in order to identify sounds that may not be present in the child's auditory perceptions.

2- Learning based on auditory discrimination: sounds affect and are affected by the sounds surrounding them in the same word or sentence. It is difficult to isolate the sounds from each other, as it may pose a problem, especially for the hearing impaired. Thus, it must be taken into account in any intervention, so that the speech-language pathologist trains the sounds by putting them in sentences and phrases instead of teaching them as single sounds, as happens with a normal child.

3- Rehabilitation of the speech apparatus: among the pronunciation elements that the specialist focuses on with hearing-impaired children are reducing the speed of the voice, working on distorted vowels, using the appropriate sound frequency, focusing on the problems of replacing whispered sounds with loud sounds, and increasing the level of speech intensity. Moreover, taking into account the elements of intonation, word weight and speech rate is a critical component of working with the hearing impaired.

Curricula for enhancing speech training for the hard of hearing focus on the optimal use of auditory residuals. They use pictorial and anatomical observation, as well as visual stimuli, audio-visual retrieval tools, and hearing aids such as the FM system.

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9-Conclusion:

Through the foregoing, it is important that language rehabilitation programs for the hard of hearing child be based on the principles of auditory education by following the verbal-tonal method and using the SUVAG technique. This is in order to enable hearing-impaired children to overcome the rhythmic difficulties of speech by training them to produce any sound unit in any phonological situation on the basis of movement, tone, and rhythm.

The main idea of the verbotonal theory and its practices lies in the premise that the ear alone does not allow listening, but that the whole body participates in listening as a medium that receives information from the various sensory modalities. The human being is the center of the verbal system. The verbal system provides the possibility of a very deep study of the human being and we get to know it through speech in the entire communication process. In addition, the expression of thought through speech presupposes a nervous and muscular activity, meaning that the whole human body participates in the thought and speech processes. The structure of speech is biological, physiological, neuropsychological, psychological, and speech is perceived in a global multidimensional structure.

The verbotonal method, through its principles, can be considered the method that adopts educational positivity. Given the broad spectrum of its modalities and its knowledge of auditory frequency and multisensory function, the Verbo-Tonal method remains more important than ever for the rehabilitation of a hearing-impaired child. This method has not lost its originality and has been able to adapt to technical developments through its humanistic philosophy and how it considers the importance of the body and auditory signals in the development of speech and discourse. It turns out that language development is based on emotional investment with it, and this is what Professor P. Guberina realized since then, a very long time ago. The primary goal of rehabilitation is to help children exercise optimally and use their remaining auditory abilities and skills in the service of their speech and oral language.

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