Auditory Exercises in Children with Hearing Loss: A Single Case Study

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eISSN: 2986-8068

pISSN: 2656-4335

https://doi.org/10.59898/jawara.v2i1.17

Published date: 11 September 2023

Jurnal Terapi Wicara. 2023 Vol.1 Issue. 2 :1-16

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Abstract

Background: verbal communication is studied primarily through the auditory modality. Adverse impact on language development, cognition, academics, including verbal communication when there is a decrease in hearing sensitivity.

Objective: this study aims to provide initial evidence of changes in ability to identify speech sounds after intervention with auditory training.

Method: The research method used is a single- subject experiment. Data were collected through interviews with the client's parents, direct, observations of the client, test and a document study of the client's medical record.

Result: After 10 sessions of speech therapy using auditory training, the client's ability to detect sounds increased by 83.3%.

Conclusion: providing auditory training to identify sounds is important for children with hearing loss.

Key words: verbal communication, speech sounds, auditory training, hearing loss

INTRODUCTION

Deaf children are children with hearing loss so they cannot hear sounds perfectly or even can not hear at all. According to Andreas Dwidjosumarto suggested that someone who cannot hear or is less able to hear sounds is said to be deaf. Meanwhile, according to Tin Suharmini, deaf people are someone with hearing impairment that affects the non-capture of sounds or other stimuli through the ear (1).

Children with hearing loss will experience obstacles in speech, language, education, social functioning, thus interfering with quality of life. Hearing loss can be congenital or acquired with possible causes including congenital, genetic, and traumatic infections.(2) It is not uncommon for the cause of hearing loss not to be found with certainty (idiopathic) and never identified. Hearing loss can occur at birth, occur suddenly or gradually over time it can also occur repeatedly, steadily or change. Hearing loss is classified by audiogram into several grades, namely mild, moderate, severe, and very severe (3). According to the Hearing Loss Association of America (HLLA) hearing loss is divided into 3 types, namely Sensorineural Hearing Loss (SNHL) because there is a problem in the inner ear caused by damage to hair cells in the cochlea or auditory nerve, Conductive Hearing Loss caused by blockage, injury, or malformation of the ear canal, eardrum, or small bones of the middle ear that prevent sound waves from reaching Cochlea, Type Mixed hearing loss is damage that occurs in the outer or middle ear and inner ear or/as well as auditory nerve disorders (4). Hearing loss problems that occur are important to detect as early as possible, because hearing function plays an important role in the development of children's speech. If there is a delay in diagnosis, it will also be too late in intervening and will have a serious impact on further development. Because it is difficult to detect hearing loss in infants makes parents with children who have hearing disorders consider children as autistic or hyperactive because the child's attitude is difficult to manage. Parents notice hearing loss when the child has no response to loud noises or speech delays. So from these problems, early detection of hearing loss in children is important (5). According to Van Uden, communication

skills in deaf children who are trained from infancy or early age such as hearing children can reduce lag in language development in children (6). Detecting and intervening as early as possible will improve children's ability to speak and speak. Because at the beginning of the life years (0-3 years), the stage of language development in children occurs very intensively. Research shows that in this period, the quality of auditory stimulation influences anatomical, physiological, and behavioral changes caused by the development of the auditory system. Hearing loss in infants should be ensured before the age of 3 months, so that if a deaf child is found, habilitation efforts can begin at 6 months of age (5).

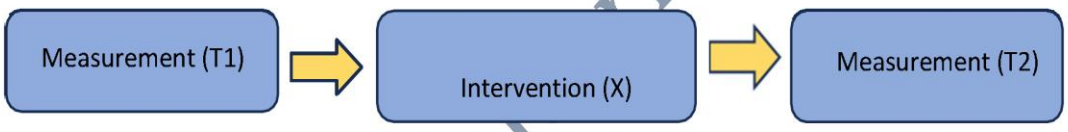
For children with hearing loss, communication is a major problem that often becomes an obstacle. Children with communication disorders find it difficult to understand and understand others. Communication that can be performed by children with hearing loss includes sign language, bilingualism, Cued Speech, Total Communication, speech & spoken language therapy, and Auditory Verbal therapy.

In deaf children, skills that can still be developed and used are sound perception skills or residual hearing skills that they still have when using hearing aids or without hearing aids. The use of hearing residue of deaf children, especially after the child uses hearing aids, will greatly affect the child's daily life. For example, in deaf children who are classified as hearing less, hearing still plays an important role in helping them absorb speech in the surrounding environment. While deaf children with severe or even total levels are only able to receive vibrations and then pass them on to the hearing center. Building communication, sound perception and rhythm aims to increase the remaining sensitivity of hearing and vibration to sounds so that children can understand the meaning of different sounds, especially language sounds that greatly determine the success of children's communication with their environment (7).

RESEARCH METHODOLOGY

This study used a quantitative approach with Single Subject Research (SSR) research. According to Prahmana, Single Subject Research (SSR) is an experiment designed to test behavior and evaluate certain interventions or treatments on the behavior of a subject with assessments carried out repeatedly at certain specified time points. Meanwhile, according to Gast and Ledford, Single Subject Research (SSR) is a type of quantitative research that studies the behavior of each in detail from a small number of subjects (8). The single subject in this study was a seven-year-old boy client in Cengkareng sub-district, West Jakarta. The experimental design used in this study was one group pretest-posttest design, which used one subject (single case) and measured ability before treatment or therapy (pretest) and after therapy treatment (posttest). The design can be seen as follows:

Figure 1. One Group Pretest-Posttest Design



Information:

T1: experimental group before being given auditory exercise treatment (pretest)

X: application of auditory exercises

T2: experimental group after being given auditory exercise treatment (posttest)

Research instruments in the form of tools selected and used by researchers in collecting data so that research becomes systematic. Data collection techniques used in this study were interviews with clients' parents, observation of clients' speech, motor, and sensory language skills, various tests and document studies. Data collection techniques can be seen in the table below.

Table 1. Techniques, Respondent Instruments and Research Indicators

No	Collection Techniques Data	Instruments	Respond	Indicator
1	Interview	Form Interview and Inform Consent	Client's parents	Obtain data on: client identity, causal factors, medical history before and after illness, family history.
2	Observation	Observation form	Client	Knowing: physical condition, language skills, motor skills, sensory abilities.
3	Articulation Tests	Articulation Test Form	Client	Knowing: articulation ability at the word level, and to assess the presence or absence of articulation errors of substitution, omission, distortion, and addition (SODA).
4	Auditory Language Comprehension Test (PBSA)	PBSA test form	Client	Knowing: the client's word-level language comprehension ability through auditory stimuli
5	Communication Skills Test Verbal Phoneme Awareness	Test form Phoneme Awareness	Client	Knowing: the client's ability to identify sounds
6	Early Detection Test for Communication and Language Disorders (DDGKB)	DDGKB Form	Client	Knowing: the client's ability to communicate whether it is age appropriate for the calendar or not
7	Document Study	Results of the doctor's examination	Doctor	Supporting data needed by researchers in strengthening the data obtained
8	Initial Test and Final Test	Initial Test Form and Final Test	Client	Know the success of the therapy achieved

After the data is obtained, data analysis is carried out to determine the diagnosis with the syndrome contained in the client for further preparation of a therapy program. The therapy program is divided into long-term therapy programs, and short-term therapy programs. The established short-term therapy program aims to improve the client's ability to detect ling six sound at a loudness level of 80 dB at a distance of 1 meter. Therapy is given to clients as many as 10 sessions of speech therapy meetings, with the duration of each session for 45 minutes. During the therapy sessions, researchers

used the WCC Ling Sound app version 1.0 by Venkata Tetali and Sound Meter Level version 3.4.5 by Abc Apps.

A. Client Description

At the time of the study, the client was seven years old and was the only child of a 28-year-old mother and a 34-year-old father. Based on the results of the interview, the client's mother conceived the client at the age of 20. At the age of 3 months, the client's mother had a fever and there was a red rash on the client's mother's skin. The client's mother gave birth at 38 weeks gestation with normal delivery and the baby's condition immediately cried, birth weight 2000 grams, the baby's skin color was red. Based on the doctor's statement, the client's mother was infected with the rubella virus and the client's mother only found out after giving birth to the client. The doctor also explained that this is what causes the client to experience hearing loss.The client was diagnosed with hearing loss at the age of 12 months after BERA and ASSR tests at RSCM. From the test results stated that the client's right ear had 80dB hearing loss and in the left ear

60dB degree of interference. Since it is known to have hearing loss until now the client does not use hearing aids. The client started doing speech therapy in the clinic at the age of five.

B. Therapeutic Goals

In order for clients to be able to maximize their remaining hearing and be able to improve receptive and expressive language skills at the level of words, phrases and sentences.

C. Therapy Program

Train to maximize the remaining hearing possessed and train receptive and expressive language skills at the level of words, phrases and sentences.

D. Therapy Materials

The therapeutic material in this study is Ling six sound which is a rapid test that can be used clinically to determine the ability of children's speech and language development in

recognizing speech sounds in the required frequency range (7). Ling six sound can also be used for sound detection, discrimination, and identification.

In this study, Ling Six Sound was used to detect a hardness level of 80 dB by raising the hand at a distance of 30 cm on 3 occasions. Researchers took a hardness level of 80 dB because 80 dB is the threshold level of hearing from clients. Researchers used therapeutic tools such as Ling six sound cards, Mobile phones with the WCC Ling Sound application version 1.0 by Venkata Tetali and Sound Meter version 3.4.5 by Abc Apps as well as speakers as therapeutic aids for loudspeakers from Ling Six Sound sound sources

The material detects sound using ling six sound which is used as follows:

a. /a/ with high frequency
b. /ee/ (ii) with low frequency
c. /m/ with low frequency
d. /sh/ with high frequency
e. /s/ with high frequency
f. /oo/ (uu) with low frequency

E. Therapy Methods

The method in this study is Auditory Training which is one small part of all components of the rehabilitation process in children with hearing loss. It is common to classify auditory skills into stages based on stimuli given and responses required. These stages include detecting sounds, distinguishing sounds, identifying sounds, recognizing sounds in a wider context (open circuit), and understanding the meaning of speech (9).

The auditory training / learning method is used for clients with the aim of training hearing skills by

maximizing the use of residual hearing and making 6 ling six sounds as therapeutic material.

This method is used because seeing the client's hearing ability to detect sound is still very limited. From the stages of the Auditory Training method, researchers only use the detection

or awareness stage of sound. At this stage, it is expected that the client can be aware of the presence or absence of sound and learn to pay attention to sounds.

F. Therapeutic Steps (Detection Stage)

Detection can be done through conditioned play responses or spontaneous responses.

1. Give instructions to the client if the client hears a voice, the client can respond by looking for a voice, turning his eyes or head towards the sound, making a sound. or head in the direction of the sound, or vocalize. The client's knee-jerk response includes behaviors such as: looking for a voice, looking away or raising a hand
2. The ultimate goal of the detection stage is for the child to use his hearing ability to detect sounds that are around him

G. Judging Criteria

a. Response criteria

1. Rated 1 if the client raises his hand or turns his head when there is a ling six sound stimulus.

2. Rated 0 if the client does not raise his hand or turn his head when there is a ling six sound stimulus.

b. Success criteria

1. Successful if the client gets a final test score of 3-5 points.

2. It is quite successful if the client gets a final test score of 2-3 points.

3. It does not work if the client gets a final nilat test of 0-1 point.

From the table above, researchers calculate quantitative and qualitative assessments as follows:

Quantitatively

From the results of the comparison of the initial test and the final test, the client experienced an increase in ability by 5 points. Therapist obtained these results from the difference formula between:

Final test – Initial test = Number of

Qualitatively

Qualitatively, researchers concluded that the success criteria for client therapy outcomes fall into the category of successful.

RESULTS AND DISCUSSION

Based on the results of interviews with the client's mother, information was obtained that the client's mother was pregnant at the age of 20 years, at the age of 3 months the client's mother had a fever and there was a red rash on the client's mother's skin, this was in accordance with the statements of Usonis V and Anca I which mentioned the symptoms of someone who had rubella, namely headaches, red patches, enlarged lymph nodes and joint pain (10). Based on the doctor's statement, the client's mother was infected with the Rubella virus and the client's mother only found out after giving birth to the client. The doctor also conveyed to the client's mother that the cause of the client's hearing loss was due to being infected with the Rubella virus. Children with congenital rubella syndrome (CRS) can suffer from hearing loss, eye and heart defects, and other lifelong disabilities, including autism, diabetes mellitus, and thyroid dysfunction(11). This is also reinforced by the statements of Lieu and Kenna M, congenital infections can cause children to experience hearing loss and the most common cases are infected with the TORCHES virus (toxoplasmosis, other, rubella, CMV, herpes virus, syphilis) (2).

After hearing examination tests in the form of BERA and ASSR at the age of 12 months, data were obtained that the client experienced hearing loss in the severe category with a degree of deafness of 80 dB in the right ear and a mild category with a degree of deafness of 60 dB in the left ear which can inhibit the development of speech, language, cognitive and social communication of clients.
The classification of hearing loss and the effects of interference on communication described by Kenneth is as follows (12):

Table 2. Effects of Hearing Loss on Communication and Types of Habilitative Intervention with Children

Very mild hearing loss (16-to 25-dB HL)	at 15 dB one can lose 10% of the speech signal, when a teacher is 3ft away (1ft = ±30cm) away and the class is in noisy conditions.
Mild hearing loss (26- to 40-dB HL)	With a hearing loss of 30 dB, a learner can lose 25-40% of the speech signal. Without the aid of tools, children with hearing loss of 35-40 dB can miss at least 50% of class discussions.
Moderate hearing loss (41- to 55-dB HL)	The child understands speech at a distance of 3 to 5 feet (face to face) only if the structure and vocabulary are mastered. Without aids, the amount of speech signal loss can reach 50-75%, with a loss of 40 dB loss of 80-100% and loss at 50 dB.
Moderate to severe hearing loss (56- to 70-dB HL)	Without tools, the conversation must be very loud in order to be understood. A loss of 55 dB can cause a child to lose 100% of information in speech.
Severe hearing loss (71- to 90-dB HL)	Without assistive devices, the child may hear loud sounds at a distance of about 1 foot from the ear. When maximally amplified, children with hearing ability of 90 dB or more are able to recognize environmental sounds and detect all sounds in speech.
Very severe hearing loss (>90-dB HL)	Being aware of vibrations is better than tone patterns. It may rely more on sight than listening as the primary way for communication and learning.
hearing loss on one side (normal hearing in one ear with the other at least mild impairment	May have difficulty hearing low voices or distant speech. It usually has difficulty finding the source of the sound and even more difficult to understand speech in noisy places.

(Sumber: Shipley KG, McAfee JG. Assessment Pathology in Speech-Language Pathology, A Resource Manual Sixth Edition. 2021. 1–713 p.)

The client did not use a hearing aid from the time he was diagnosed with hearing loss at the age of 12 months until now. The client only took up speech therapy when the client was five years old. Seeing the client's condition and the handling obtained by the client is very late so that it affects the client's language skills. Stiles and Tomblin say that recent studies of children with mild to severe hearing loss support the idea that hearing aids are associated with language outcomes. Stiles examined the vocabulary skills of deaf children aged six to nine years and using hearing aids with hearing aids was a better predictor of performance than the severity of hearing loss. Consistent and early use of hearing aids will have a useful influence on children's language development (13). PBSA test results, obtained the correct score result is 37 items while the number of items on the PBSA test is 101 which means the client's language ability does not match his age ability. The ability of clients under the age of children under 3 years. This is due to impaired function in his hearing and lack of information

acquisition through his hearing. As Widia points out, the stage of language acquisition in deaf children cannot take place in the same way as in normal children, children with hearing loss cannot connect language experiences and symbols through hearing. However, this does not rule out the possibility of maximizing hearing function in children with hearing loss (14). According to Hernawati, the beginning of language acquisition of children who hear is derived from experiences or shared situations between babies and the environment and people around them. From the experience gained, children are able to connect language experiences and symbols through hearing. This process became the basis for the development of inner language (14). From the results of the client's phoneme awareness ability test is currently absent or not yet visible. According to researchers, the client's ability to produce words at the age of 6 years and 11 months is late, compared to other normal children.

DDGKB test results aged 6-7 years on the test understand the value of the concept (concept of quality) and add and subtract to a value of 10, the client has not been able to. Based on the observation of receptive verbal communication skills in the sub-test, understanding simple words and phrases in interactions in the environment and understanding simple words and phrases in interactions in the environment get 2 points, meaning that client abilities occasionally begin to be seen. After the assessment, information about the client's speech, articulation, cognitive, language and motor skills is obtained. Based on speech development, it is known that the client's speech language development is as follows: Vocalization reflex at the age of 0 months, babbling 24 months, lalling 36 months, echolalia 48 months and true speech 60 months. For the client's motor development as follows: The client does not go through the crawling phase. Clients are just starting to be prone at 12 months of age; sitting age 24 months; stand 30 months; and runs 36 months. Based on the results of observations of articulation abilities that include vowels, and consonants when researchers ask clients to imitate vowel and consonant sounds /a/, /i/, /u/, /e/, /o/, /p/, /b/, /m/, /w/, /s/, /sh/ clients are only able to say /a/, /i/, /e/, /o/, /p/, /m/. This is caused by hearing obstruction, causing the sound to sound imperfect and the repronunciation of the sound that has been heard becomes less perfect. Children with hearing

loss often omit speech sounds such as "s", "sh", "f", "t", and "k" because they cannot hear the sounds so they do not include them in their speech (15).

Based on the articulation test, researchers obtained data, there were articulation errors in total, there were 38 total articulation errors out of a total of 71 consonants in the form of 20-item substitutions, 26 client omissions, and 3 items of distortion. Fellenddorf and Black reveal that the most common speaking errors in deaf children are errors due to poor breathing, pronunciation associated with sound disturbances, and speed associated with producing sounds (16). The three elements are interrelated, if one of the three is disturbed, the speech issued will become chaotic and difficult for the interlocutor to understand. A person with sensorineural hearing loss has more difficulty understanding speech in a noisy environment compared to someone with normal hearing or someone with conductive or mixed hearing loss. To minimize this, researchers use the Auditory Training method, this method to maximize the client's residual hearing. The success of Auditory Training can be assessed from (i) increased ability for the material being trained (on-task learning); (ii) improvement of ability in off-task; generalized; or transfer of learning; (iii) retention of learning during the therapy period or after therapy stops; and (iv) client adherence to therapy (17).

Auditory Training has 4 stages, namely, Detection to respond to the presence or absence of sound, Discrimination to equalize / distinguish, Identification to respond by repeating, pointing or writing the stimulus of speech heard and Comprehension to understand the meaning of speech by answering questions (18). Auditory Training can help clients maximize their remaining hearing because according to D.Moore and S.Amitay because listening exercises consist of cognitive components from top to bottom and sensory components from bottom to top, Auditory Training can improve hearing ability both in the short and long term. and Auditory Training It also has a good impact on the perception of more complex client speech such as words and sentences. The ultimate goal of Auditory Training is to assist clients in recognizing messages spoken during everyday conversation (19).

Researchers only use the first stage, namely detection, to train the ability to respond to the presence or absence of sounds around the client. The purpose of using this method is to practice listening by simulating the use of the rest of the hearing that the client has.

The therapy material given and selected by the researchers is to detect sounds using 6 Ling Six Sound sounds that represent phonemes of low frequency and some high frequency. The reason why peliti took the material to detect sounds using ling six sound was because at the time of the test, the client was not able to hear the sound of ling six sound which represents variations ranging from low to high frequencies in speech sounds. If the client cannot hear the frequency variation, the client will not get enough information to develop his speaking skills. For clients with severe hearing loss, it is usually difficult to make good use of their residual hearing due to difficulty controlling the suprasegmental associated with the long and short duration of sound, as well as the importance of pressure. According to Most and Frank, children with severe, very severe hearing loss have more difficulty understanding yes/no questions, which are characterized by changes in intonation that rise, when compared to comprehension of statements characterized by changes in intonation that go down (9).

Table 3. Implementation of therapy

Meeting	Stimulus	Responds
1-10	Opening : a. Invite clients to pray b. Have conversations with clients to increase familiarity with clients. **Core activities :** Therapist sounds ling six sound /ah/ Therapist sounds ling six sound /ee/(ii) Therapist sounds ling six sound /m/ Therapist sounds ling six sound /sh/ Therapist sounds ling six sound /s/ Therapist sounds ling six sound /oo/(uu) Closing activity: Therapist closes today's meeting by inviting clients to pray, then shake hands.	Opening : a. Clients pray alone or are assisted by Therapist b. The client participates in the conversation that Therapist has. The client notices the author, then the client detects the ling six sound by turning his head. The client notices the author, then the client detects the ling six sound by turning his head. The client notices the author, then the client detects the ling six sound by turning his head. The client notices the author, then the client detects the ling six sound by turning his head.

		The client notices the author, then the client detects the ling six sound by turning his head. The client notices the author, then the client detects the ling six sound by turning his head. The client responds by moving his mouth but making no sound.
11	Evaluation	Evaluation

Table 4. Pre and Post Test Results

	Mean	N	SD	t	df	p-value
Pre Test	.17	6	.408	-5.000	5	.004
Post Test	1.00	6	.000			

Paired sampel t-test

Significant difference p≤ 0.05

After speech therapy with Auditory Training as many as 10 therapy sessions, with a duration of 45 minutes each session, there was an increase in skills in detecting ling six sounds as many as 6 items with an increase percentage of 83.3%.

Ertmer and Wei cite several studies reporting the use of the Ling test to confirm speech sound detection in children with severe hearing loss using implanted cochleas. In addition, Ertmer et al also noted an improvement in sound detection using Auditory Training after several test sessions (20).

CONCLUSION

Children with hearing impairments will benefit from improved sound recognition skills. The Auditory Training therapy method can improve the ability to detect ling six sounds as many as 6 items in this case.

SUGGESTION

Further research is needed to obtain data and information on the effectiveness of using the Auditory Training method in children with hearing loss

THANK YOU

Therapist would like to thank the campus of the Academy of Speech Therapy, the Speech Therapy Study Program and all parties who have supported and assisted in this research.

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