

Application of Motor Sensory Approach to Improve Articulation Skills in Children with Intellectual Disabilities: A Single Case Study

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Abstract

Background: Several studies have shown that speech sound disorders in children with intellectual disabilities impact communication with their environment. They have more difficulty with expressive language and speech intelligibility than receptive. Interventions are needed to improve speech skills, especially in articulation skills.

Purpose: This study aims to determine the effect of sensory motor methods in improving articulation skills.

Method: using a single subject experiment, using a one group pretest-posttest design. The participant is a girl aged 7:6 years old with articulation disorder on consonants /p/, /b/, /m/, /n/, /w/, /t/, /d/, /k/, /g/, /ŋ/, /j/, /c/, /f/, /w/, /v/, /h/, /r/, /y/, /z/, /fr/, /br/, /dw/, /gr/, /kl/, /pr/, /sk/, /sp/, /st/, /sw/. Data collection was done through interviews with the client's parents, direct observation of the client, and tests. Speech therapy was conducted for 10 sessions with an emphasis on sensory-motor integration. Perceptual assessment was carried out by comparing the ability to produce the phoneme /p/ in the initial position of the word with a combination of vowels /a/ before and after therapy.

Results: in the post speech therapy assessment, there was an increase of 40%.

Conclusion: from the therapy activities for 10 session with the Sensory Motor Approach, the client was quite successful in producing /p/ in the initial position of the word with a combination of vowels /a/.

Suggestion: this study suggests designing a therapy cycle in order to find out the effectiveness of the Sensory Motor Approach more deeply.

Keywords: articulation, intellectual disability, sensory motor approach.

INTRODUCTION

Down syndrome or an excess disorder of chromosome 21 is known for its distinctive physical and developmental characteristics. According to the results of Basic Health Research in 2013, Down Syndrome in Indonesia tends to increase by 0.13% in children aged 24-59 months (1). Individuals with Down syndrome often face challenges in language development and communication. Dyslogia is a speech disorder caused by mental retardation(2). Due to the addition of this genetic material causes various physical and cognitive characteristics to emerge including articulation disorders.

The causes of articulation disorders in Down syndrome are multifactor consisting of structural and functional factors. Structurally, Down syndrome exhibits several characteristics such as short and high palate, microgenia, macroglossia, microdontia of permanent teeth, and so on. These structural differences affect the coordination and movement of articulator structures, causing difficulties in producing speech sounds accurately (3). Functionally, generally individuals with Down syndrome have weaker muscle tone (hypotonia). This affects the muscles involved in producing articulation because muscle control and coordination are reduced(4). Individuals with Down syndrome also experience sensory processing problems that affect articulation problems making it difficult for individuals to understand and distinguish speech accurately (5).

Articulation is a description of a person's speech production that refers to the motor aspects of planning and executing a series of movements that will result in speech production. There are articulation errors according to the child's chronological age, with characteristics including substitution, omission, distortion, and addition abbreviated as SODA(6) and most articulation errors in Down Syndrome are omission errors or omission of language sounds(7).

Relating to sensory processing disorders in Down Syndrome is one of the causes of articulation disorders, the integration of Sensory Motor is the main topic in this study. Motor Sensory Integration is a process in which environmental sensory feedback is integrated with motor commands generated by the central nervous system, allowing planning, execution, and control of movements(8). Sensory-Motor integration plays an important role in regulating articulator movements and producing

language sounds. This aspect includes the integration of auditory, proprioceptive, and somatosensory feedback with motor commands to produce accurate and clear speech (9). This study focuses on the integration of Sensory Motor methods in improving speech ability in individuals with Down Syndrome who experience articulation disorders. This therapy emphasizes the important role of sensory-motor in helping individuals understand, control, and improve their speech articulation.

METHOD

This study used Single Subject Research (SSR) research with a quantitative approach. According to Prahmana 2021, SSR research is subject research using experimental design to obtain information on the effect of treatment on behavior change (10). The sole subject in this study was a seven-year-old girl client in Sukoharjo sub-district, Central Java. 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.

Table 1. Research Instruments

Assessment Method	Respondents	Instruments	Purpose
Interview	Client's parents	General Child Interview Format and Inform Consent	To obtain data regarding the client's medical history, communication skills, behavior history, and family history.
Observation	Client	Format of observation and general examination of developmental cases	Observe the client to determine the client's general condition, motor and sensory skills, language skills, speech, voice, fluency rhythm, swallowing, speech organs, breathing and see the behavior and effects of intelligence
Test	Client	Articulation test format	To find out the client's ability to teach consonant sounds according to his age. Know whether or not there are articulation errors that occur to the client.
		DDGKB Format (Early Detection of Language Impairment)	The aim is to find out how the development of children's speech and language, this test obtains data on the presence of language disorders in terms of oral comprehension and oral ability.

Assessment Method	Respondents	Instruments	Purpose
		PBSA (Auditory Language Comprehension) Test Format	To find out the client's comprehension ability by being given a verbal stimulus. Researchers tested as many as 101 test items available by sitting opposite the client. give stimulus commands pointing at images. Each test item, the client is shown 3 pictures then must choose according to what the client hears.
		Speech Tool Inspection Format (PAW)	The purpose is to find out the function of the speech organs. The test is done by observing the client's speech organs and commanding the client such as sticking out the tongue, lip sling, opening the mouth, phonating /a/, and others.
Evaluation of Initial Test and Final Test	Client	Initial test format and Final test	To know the development and progress of the client.

Case Description

The client (NZ) is a 7 years and 6 months old girl. The client is the second of 2 children. The client's mother conceived at the age of 36. The client's body size is quite small compared to his age, his back is slightly bent, has distinctive eye characteristics, namely narrow eye tips, client's ears tend to be low, tongue occasionally comes out and the size is quite large. The nose is small, the neck seems short, the size of the head is small with the skull of the back of the head tends to be flat.

The condition of the feet and hands is quite wide and the fingers are short. Having difficulty chasing the consonants /p/, /b/, /m/, /n/, /w/, /t/, /d/, /k/, /g/, /ŋ/, /j/, /c/, /f/, /w/, /v/, /h/, /r/, /y/, /z/, /fr/, /br/, /dw/, /gr/, /kl/, /pr/, /sk/, /sp/, /st/, /sw/. The client's language skills are not appropriate for his age, in general the client is at the stage of being able to combine words, understand and be able to use simple sentences. The client has been in speech therapy since the age of 4 until now.

Intervention

Therapeutic Goals

In therapy with 10 meetings, it is expected that clients are able to improve articulation skills by imitating word-level phonemes in the consonant /p/ initial position of words with a combination of

vowels /a/ without omission or omission according to the stimulus of 5 phonemes using picture cards.

Therapy Program

Train articulation skills by imitating word-level phonemes in the consonant /p/ at the beginning of the word with a combination of vowels /a/ without omission or omission according to the stimulus of 5 phonemes using picture cards.

Therapy Materials

Train articulation skills by imitating the unvoiced plosive bilabial consonant /p/ the initial position of the word with a combination of vowels /a/ using picture cards: papa, rice, nails, hammers, and nutmeg.

Therapy Methods

Therapy using the Sensory Motor Approach method, the purpose of this method is to increase the ability to capture patterns of auditory sensations, proprioceptive sensations and tactile sensations of articulated movements ballistic overlapping (11). This method has 2 variations of exercises, two syllables and trisilabel. In this case, applying bilislabel training first because the client's modality is not yet able to at the trisyllable stage and there is inconsistency in sound production so that it has not been able to vary various vowel and consonant sounds.

Therapeutic Steps

This therapeutic step is based on Hedge(12), the focus of the exercise is to vary the sounds that the client has been able to master. Here are the steps of two syllables exercise therapy:

1. Use sounds that children have mastered correctly by giving KV+KV patterns
2. The child must be able to describe what is heard and felt articulatory movements
3. Put pressure on speech and ask the child to repeat
4. Vary with various vowels and consonants

Judging Criteria

Formulate assessment indicators in the form of norms or standards that will be used to assess client response and therapy success.

Response Criteria

- a. Given a value of 1: if the client is able to imitate speech in accordance with the expected respons.
- b. Given a value of 0: if the client is unable to imitate speech according to the expected response

Success Criteria

Success criteria are used to assess the extent of therapeutic success rates. In this study using a rating scale to measure the ability of clients after the implementation of therapy with the following steps and formulas:

- a. Conduct initial tests
- b. Conducting therapeutic activities
- c. Perform the final test
- d. Compare the number of final tests and initial tests
- e. Then the difference is used as a success criterion

Table 2. Research Step Formula

Pretest	Treatment	Posttest
T0	X	T1

Based on the steps above, it is formulated to determine the amount of increase as below:

$$T1 - T0 = \text{Number of Increases}$$

Figure 1. Determine The Amount Of Increase

Information:

T0: before therapy

X: treatment or therapeutic activity

T1: after therapy

To see the criteria for client success after therapy, this study used 3 assessment numbers, namely successful, quite successful, and unsuccessful. That is by calculating the difference between the final test and the initial test.

Success: if the client gets a score of 4 – 5

Quite successful: if the client gets a value of 2 – 3

Unsuccessful: if client gets value 0 –1

RESULTS AND DISCUSSION

Based on the results of interviews with the client's parents, it is known that the client has Down Syndrome. The age of the mother when pregnant 36 years will be at risk of giving birth to a child with Down Syndrome. The cause of Down Syndrome is due to drug intake factors or incorrect intake during pregnancy, exposure to radiation, chromosomal abnormalities when conception occurs, and the age of the mother over the age of 30 years (13).

Irwanto, et al said that women over the age of 35 years are more at risk of giving birth to babies with down syndrome by 1 in 400 births compared to young (less) mothers (14). In addition, logical aging of the ovaries is characterized by a decrease in the total oocyte pool, a decrease in the number of antral follicles that mature per cycle and incoming reproductive hormonal changes. Ovulged oocytes are overmature and thus more susceptible to chromosomal malsegregation (15).

Language Skills

The results of the client's DDGKB test of oral language comprehension at the level of 6-7 years, the client's oral language comprehension ability does not match his age. Receptive language comprehension seems poor because the client is unable to answer commands (distinguish his own limbs). The client is also unable to follow the beats that therapist does correctly, does not understand the value of money and does not understand addition and subtraction to the value of 10. The client's oral comprehension and oral ability are in children aged 2.5 – 3 years. The pattern of language acceptance through auditory and visual aspects in Down syndrome children has limitations in receiving language at the cognitive level and producing and pronouncing their first words at an early age (16).

As for the results of PBSA tests on clients, it is known that clients are able to respond correctly as many as 45 out of 101 items. The results of this test state that the client's ability is at the level of a three-year-old. The client's language skills are not appropriate for his age and this is one of the characteristics found in Down Syndrome. Children with Down syndrome have difficulty processing information auditorily and affect their receptive ability (17).

Articulation Ability

From the results of tests and observations on the Speech Tool Examination (PAW), it can be seen that the structure of the lips does not touch each other, seems not to be docked during rest posture. The structure of the tongue looks long and fills the mouth space so that the function of the tongue to bend up and down is not optimal. Such a characteristic as hypotonia is the main characteristic of trisomy 21. Macroglossia, malocclusion, and tongue thrusting are symptoms of down syndrome (18). This affects speech, prosody and voice in the clarity of speech.

Based on the results of the articulation test conducted to determine the client's articulation ability using the articulation format of 69 test items, it is known that the client has a substitution error (substitution) of 16 test items in the consonants /d/, /n/, /g/, /c/, /f/ in the initial position, /g/, /c/, /f/, /v/, /z/, /h/, /r/, /y/ in the middle position, /g/, /f/ in the final position and the /fr/ cluster. As for Omission (omission) as many as 34 test items on the consonants /p/, /b/, /m/, /t/, /w/, /k/, /ŋ/, /j/, /ny/, /v/, /z/, /r/, /w/, /y/, in the initial position, /m/, /ŋ/, /j/ in the middle position, /b/, /d/, /k/, /ŋ/, /j/, /w/, /y/ in the final position and the clearers /br/, /dw/, /gr/, /kl/, /pr/, /sk/, /sp/, /st/, /sw/. Looking at the client's articulation modality, based on the results of the articulation test, data was obtained that the client had many substitutions and emissions.

According to Libby Kumin, the most common phonological process in down syndrome children is the final consonant removal (omission), this omission usually occurs at the last consonant sound in words (19). The most common mistake in mentally retarded children is omission, but not only omission but accompanied by other errors such as substitution, and distortion (7). Therefore, by improving the child's response using auditory, proprioceptive and tactile sensations to ballistic overlapping

articulation movement patterns can reduce client articulation errors.

In this case study, researchers developed communication skills for down syndrome using the Sensory Motor Approach method. This method aims at improving the client's Motor Sensory Integration function. Sensori Motor Integration is a combination of motor programs and acoustic signals that play an important role in speech production and perception (20). What is meant by sensory integration here is a part of the body sending signals related to sensation contact and the surrounding environment through one or more sensory systems (i.e., vision, hearing, tactile, taste, smell, vestibular, and proprioceptive) to the brain to be integrated, then the brain relays signals to the motor system to react.

The role of sensory feedback is to coordinate and control speech production. Sensory feedback such as auditory and proprioceptive play an important role in monitoring and commanding speech production to be accurate and clear output (9). Somatosensory feedback such as tactile also plays a major role in the integration of Sensory-Motor Speech. Information is provided usually through contact and pressure between articulator organs such as the tongue and lips. In addition, studies have shown that motor stimulation can alter perceptual responses to tasks related to speech perception. It has been shown that stimulation of certain motor areas involved in speech production affects reaction and accuracy in speech production requiring identification or discrimination of language sounds (21).

Therefore, researchers planned therapy in clients with a focus on practicing articulation skills by imitating word-level phonemes in the consonant /p/ initial position of the word. The selection of the consonant sound /p/ is one of the first sounds that can be produced by children, namely at the age of 2 – 3 years (22) and uses a combination of vowels /a/ which are low, back, and not round (23) so that the material prepared is the words: papa, rice, nails, hammer, and nutmeg. Therapy is carried out for 10 meetings with the implementation as the following table:

Table 3. Implementation of Therapy

Meeting to-	Stimulus	Response
1 & 6	Opening :	Opening :
	1. Theraphist and clients sit opposite each other	1. The client follows theraphist direction and sits opposite theraphist
	2. Theraphist invites clients to pray	

	3. Therapist conducts conversations about the client's activities today so that the client feels comfortable and familiar to therapist while the therapy takes place. Core activities: 1. Therapist asks the client to pay attention to therapist lip movements When introducing the consonant /p/ 2. Therapist Bring the hand closer to the mouth by saying the consonant /p/ with air coming out towards the hand (therapist and client feel the air respectively) 3. Have the client follow therapist on 2 occasions 4. Therapist asks the client to pay attention to the movement of the therapist 's lips when saying the syllable /pa/ 5. Have clients follow therapist with 3x the chance 6. Therapist asks clients to pay attention to the therapist 's lip movements when teaching the word /papa/ with 3x chances Cover: 1. Therapist invites clients to pray 2. Therapist records daily evaluations	2. Clients are able to pray 3. The client is able to interact with therapist . Core activities: 1. The client wants to pay attention to the therapist 's lip movements, feels the air coming out of the hand when pronouncing the consonant /p/, wants to pronounce syllables and pronounce words according to the stimulus 2. The client gets great praise and therapist gives a thumbs up to the client Cover: The client follows therapist in prayer
2 & 7	Opening : 1. Therapist and clients sit opposite each other 2. Therapist invites clients to pray 3. Therapist have a conversation about the client's activities today so that the client feels comfortable and familiar to therapist while the therapy takes place Core activities: 1. Therapist asks the client to pay attention to therapist lip movements When introducing the consonant /p/ 2. Therapist Bring the hand closer to the mouth of the consonant /p/ with air coming out towards the hand (therapist and client feel the air respectively) 3. Have the client follow therapist on 2 occasions 4. Therapist Ask the client to pay	Opening : 1. The client follows therapist direction and sits opposite therapist 2. Clients are able to pray 3. The client is able to interact with therapist Core activities: 1. The client wants to pay attention to the therapist 's lip movements, feels the air coming out of the hand when pronouncing the consonant /p/, wants to pronounce syllables and pronounce words according to the stimulus 2. The client gets great praise and therapist gives a thumbs up to the client

	attention to the syllable /pa/ - Have clients follow therapist with 3x the chance - Therapist asks clients to pay attention to the therapist's lip movements when teaching the word /rice/ with 3x chances Closing: - Therapist invites clients to pray - Therapist records daily evaluations	Closing: The client follows therapist in prayer
3 & 8	Opening : - Therapist and clients sit opposite each other - Therapist invites clients to pray - Therapist have a conversation about the client's activities today so that the client feels comfortable and familiar to therapist while the therapy takes place Core activities: - Therapist asks the client to pay attention to therapist lip movements - Therapist Bring your hand closer to your mouth by saying there is air coming out towards your hand (therapist and client feel each other's air) - Have the client follow therapist on 2 occasions - Therapist asks the client to pay attention to the movement of the therapist's lips when saying the syllable /pa/ - Have clients follow therapist with 3x the chance - Therapist asks clients to pay attention to the therapist's lip movements when teaching the word /nail/ with 3x chances Closing: - Therapist invites clients to pray - Therapist records daily evaluations	Opening: - The client follows therapist direction and sits opposite therapist - Clients are able to pray - The client is able to interact with therapist Core activities: - The client wants to pay attention to the therapist's lip movements, feels the air coming out of the hand when pronouncing the consonant /p/, wants to pronounce syllables and pronounce words according to the stimulus - The client gets great praise and therapist gives a thumbs up to the client Closing: The client follows therapist in prayer
4 & 9	Opening: - Therapist and clients sit opposite each other - Therapist invites clients to pray - Therapist have a conversation about the client's activities today so that the	Opening: - The client follows therapist direction and the sit confronts therapist - Clients are able to pray - The client is able to interact with

	client feels comfortable and familiar to therapist while the therapy takes place therapist Core activities: 1. Therapist asks the client to pay attention to therapist lip movements When introducing the consonant /p/ 2. Therapist Bring the hand closer to the mouth by saying the consonant /p/ with air coming out towards the hand (therapist and client feel the air respectively) 3. Have the client follow therapist on 2 occasions 4. Therapist asks the client to pay attention to the movement of the therapist 's lips when saying the syllable /pa/ 5. Have clients follow therapist with 3x the chance 6. Therapist asks clients to pay attention to the therapist 's lip movements when teaching the word /hammer/ with 3x chances. Closing: 1. Therapist invites clients to pray 2. Therapist records daily evaluations	therapist Core activities: 1. The client wants to pay attention to the movement of the therapist 's lips, feels the air coming out of the hand when pronouncing the consonant /p/, wants to pronounce syllables and pronounce words according to the stimulus. 2. The client gets great praise and therapist gives a thumbs up to the client Closing: The client follows therapist in prayer
5 & 10	Opening: 1. Therapist and clients sit opposite each other 2. Therapist invites clients to pray 3. Therapist conducts conversations about the client's activities today so that the client feels comfortable and familiar to therapist while the therapy takes place Core Activities: 1. Therapist asks the client to pay attention to the motion of therapist lips when introducing the consonant /p/ 2. Therapist Bring the hand closer to the mouth by saying the consonant /p/ with air coming out towards the hand (therapist and client feel the air respectively) 3. Have the client follow therapist on 2 occasions 4. Therapist asks the client to pay attention to the movement of the therapist 's lips when saying the syllable /pa/	Opening: 1. The client follows therapist direction and the duduk confronts therapist 2. Clients are able to pray 3. The client is able to interact with therapist Core activities: 1. The client wants to pay attention to the therapist 's lip movements, feels the air coming out of the hand when pronouncing the consonant /p/, wants to pronounce syllables and pronounce words according to the stimulus 2. Clients get compliments 3. great and author 4. give a thumbs up to a client Closing:

	5. Have clients follow therapist with 3x the chance	The client follows therapist in prayer
	6. Therapist asks clients to pay attention to the therapist 's lip movements when teaching the word /nutmeg/ with 3x chances.	
	Closing: 1. Therapist invites clients to pray Therapist records daily evaluations	
11	Evaluation	Evaluation

After 10 meetings and one evaluation, the comparison results of the initial test and the final test were obtained as follows:

Table 4. Pre and Post Test Results

	Mean	N	SD	Do	p-value
Pre test	.00	5	.000	4	.178
Post test	.40	5	.548		

Paired Samples T-Test

From the results of speech therapy interventions as many as 10 sessions of meetings with a duration of 40 minutes each session, information was obtained to increase articulation production ability at the /p/ word level by 40%. The client was proven to correct his omission articulation error after undergoing sensory motor method therapy for 10 meetings. The final test results are known that the client is sufficiently achieved on short-term goals. In terms of variations in therapeutic material, therapeutic activities have increased.

As in the initial test using five stimulus cards in the form of /papa/, /rice/, /nails/, /hammer/, /nutmeg/. Then at the time of the final test, the client responds to all the stimuli given, namely /papa/, /rice/, /palu/, /nutmeg/. It can be concluded that this therapy can be declared successful based on the short-term goals set. This is in line with the opinion of marchant et al, that the application of articulation therapy results in a significant increase in producing sounds with observable precision and clarity (24).

CONCLUSION

Therapy activities for 10 sessions with the Sensory-Motor Method in this case showed success in producing /p/ the initial position of the word with a vowel combination of /a/ as much as 40%. Although the frequency of therapeutic activities is limited, the results are promising for improvement in 10 sessions. The motivation, enthusiasm for learning and support of the client's family also influence the success of therapy.

SUGGESTION

Achieving results in 10 sessions is a proud first step, but broader research and longer frequency will be very good to provide an understanding of the extent to which this therapy can provide more consistent and sustainable success. For future research, this study suggests designing a therapeutic cycle in order to determine the effectiveness of the Sensory-Motor Method more deeply.

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