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**Introduction**

Speech production is the process of converting one's thoughts and ideas into meaningful speech. It is governed by many factors, of which motor control of speech forms an important aspect. A developmental trend in speech motor control is supported by the concept of "speech motor age" proposed by some investigators. Speech motor age defines the early expressive speech of children as a sequentially acquired motor event consequent to neuronal maturation. 'Praxis' is a Greek word, which is used to describe the learned ability to plan, and carryout sequences of coordinated movements in order to achieve an objective, which could be a speech or a non-speech act. Praxis control is very important for speech production in terms of generation of articulatory postures and seriation of speech gestures.

In children with childhood apraxia of speech (CAS), the deficits in verbal praxis are primarily due to the inability to sequence or seriate muscle contractions, thereby leading to inaccurate control of skilled speech action sequences. The disruption of speech in apraxia is attributed to the disintegration of temporal schemata that aid in control of movement sequences, and spatial targets defined by a space coordination system of vocal tract. Because of these deficits/ disruptions, children with CAS exhibit various speech sound errors like metathetic, perseverative and anticipatory errors that may be related to the sequencing of sound elements and to reductions in the complexity of word shapes. A particular difficulty in the sequencing of phoneme elements is also present.

There is a paucity of tools available to identify and assess children with/at risk for non-verbal and verbal praxis breakdown, particularly in the Indian context. Banumathy (2008) developed a protocol for assessing oral motor, oral praxis and verbal praxis skills in Kannada speaking children with CAS and suspected apraxia of speech (sAOS) in the age group of ≥4 to ≤14 years. Based on this tool, Radhika (2008) developed a protocol for appraisal of verbal praxis in typically developing Kannada speaking children in the age range of ≥2.6 to ≤4.0 years. In this study, the protocol by Banumathy (2008) was adapted for assessment of oral motor, oral praxis and verbal praxis skills in children with CAS and sAOS in Malayalam language.

**Description of the Protocol**

The study was carried out in 7 phases with sub stages under each phase, which was as follows:

*Phase I:* Compilation and development of the protocol

*Phase II:* Checking for item validity of the protocol developed

*Phase III:* Modification based on the feedback from phase II

*Phase IV:* Administration of the protocol on 60 typically developing Malayalam speaking children in the age group of ≥ 2.6 to ≤ 4.6 years

*Phase V:* Modification based on the feedback from Phase IV

*Phase VI:* Testing the sensitivity of the protocol by administering it on children with CAS and sAOS (ELD, Autism & DCD).

*Phase VII:* Modification based on the feedback from Phase VI and finalizing the protocol.

The **Assessment Protocol for Oral Motor, Oral Praxis and Verbal Praxis Skills in Malayalam Speaking Children with Childhood Apraxia of Speech and Suspected Apraxia of Speech (APOOV-M)** is developed in Malayalam language for children with CAS and sAOS in the age group of ≥2.6 to ≤4.6 years. The sensitivity of the test was tested on the following clinical groups with CAS and sAOS:

1. Clinical group I: 4 Malayalam speaking participants with CAS
2. Clinical group II: 14 Malayalam speaking participants with sAOS associated with disorders as follows:
3. Clinical Group II-A: Expressive Language Delay (ELD) (N =4)
4. Clinical Group II-B: Autism (N =6)
5. Clinical Group II-C: Developmental Coordination Disorder (DCD) (N =4)

Participants in the clinical group II were further screened for sAOS using the Screening checklist for apraxia (given in Appendix A). All the participants in this group received scores greater than the cutoff score of 60% in the checklist and thus were selected as participants with sAOS.

The protocol included three major domains namely, Oral motor assessment tool, Oral praxis assessment tool and Verbal praxis assessment tool with several sub domains under each. The test stimuli in the first two domains were adapted from the protocol by Banumathy (2008) as these domains were not language specific. However, the instructions and description of the scoring procedure were translated to Malayalam language. The third domain on ‘Verbal praxis assessment tool’ was language sensitive and has been compiled and developed based on the linguistic structure of Malayalam language, taking into account the phonemic, semantic and phonetic constraints of the language. The hierarchy of sub domains in Malayalam was indentified in line with the protocol in Kannada by Banumathy (2008). The sub domains in the verbal praxis assessment tool are given in the table below and described in the following section.

|  |  |  |  |
| --- | --- | --- | --- |
| Sl. No. | Sub domains of Verbal Praxis assessment tool | No. of items/tasks | Analysis/Scoring Pattern |
| A | Isolated verbal movements | 25 | Rating scale |
| B | Sequential verbal movements | 7 | Rating scale |
| C | Diadochokinetic (DDK) tasks | 2 | Rate, number of attempts, accuracy, & consistency |
| D | Word level praxis assessment | 44 | * Phonological process analysis * Sequence maintenance score * Analysis for specific praxis errors |
| E | Sentence level praxis assessment | 8 | * Percentage of consonants correct (PCC) & Percentage of Vowels Correct (PVC) * Sequence maintenance score * Sentence length |
| F | Analysis of spontaneous speech | 10-150 utterances | * Phonotactic assessment * PCC & PVC * Analysis for specific praxis errors |

**A. Isolated verbal movements**

25 vowels, consonants and CV syllables with consonants that occur in the initial position in Malayalam (Kumari, 1972) constituted the stimuli in this sub domain. They were selected based on the use of jaw, lip and tongue movements as praxis deficits, if present, are evident in the movements of these structures.

**B. Sequential verbal movements**

The stimuli in this section included seven double and triple speech movements comprising vowels and continuant /m/.

**C. Diadochokinetc (DDK) tasks**

This task required the participants to repeat syllables /pa/, /ta/, /ka/ independently (AMR-Alternating Motion Rate) and /pa/-/ta/-/ka/ sequentially (SMR-Sequential Motion Rate) after the examiner. If the participants had difficulty in understanding the instructions, they were given cues by tapping a finger with every syllable. Ten continuous iterations were considered as the best response.

**D. Word level praxis assessment**

The stimuli comprised of 44 words arranged in a hierarchy of increasing length and presence of clusters as follows:

* + Disyllabic words with no clusters (DNC - 5 words)
  + Disyllabic words with geminate clusters (DGC - 5 words)
  + Disyllabic words with non-geminate clusters (DNGC- 3 words)
  + Trisyllabic words with no clusters (TNC - 5 words)
  + Trisyllabic words with geminate clusters (TGC - 5 words)
  + Trisyllabic words with non-geminate clusters (TNGC - 3 words)
  + Multisyllabic words with no clusters (MNC - 5 words)
  + Multisyllabic words with geminate clusters (MGC - 5 words)
  + Multisyllabic words with non-geminate clusters (MNGC - 3 words)
  + Complex words (CW - 5 words)

**E. Sentence level praxis assessment**

The stimuli included eight sentences with length varying from 3 syllables to 10 syllables presented for a repetition task**.**

**F. Spontaneous speech**

Spontaneous speech samples should include a minimum of 10 utterances to a maximum of 150 utterances recorded from the participants by engaging them in general conversation about home, routine activities and school using age appropriate toys and pictures. Utterances can involve request for toys, names or description of toys, etc.

Refer to Appendix B for the assessment protocol including stimuli, details of analysis and scoring patterns. A sample protocol for a participant with CAS is given in Appendix C.

**Summary**

The findings indicated deficits related to praxis failure in both children with CAS and sAOS in all the three domains including oral motor, oral praxis and verbal praxis skills. Even though each participant exhibited a unique profile, all of them exhibited deficits in all the domains and sub domains of the protocol proving the usefulness and sensitivity of the protocol in identifying the praxis breakdown at different levels in different domains. The demographic details and scores obtained by the participants of the study on the assessment protocol are presented in Appendix D.

**Clinical implications of the Study**

* The protocol developed is one of the first attempts in Malayalam language for the assessment of children with CAS and sAOS.
* It will facilitate the identification of the breakdown in different domains or distribution of the symptoms in CAS and sAOS.
* The protocol can facilitate the selection of speech therapy goals for children with CAS and sAOS.
* The protocol can be used for periodic re-evaluation of children with CAS and sAOS.

**APPENDIX A**

**SCREENING CHECKLIST (Banumathy, 2008)**

*Note: Information with respect to items 1 to 10 to be obtained from parent of the child. The rest of the items are to be scored by the Speech-Language Pathologist. The items are to be recorded as ‘Yes’ or ‘No’(Score 1 is offered for ‘Yes’ and ‘0’ for ‘No’).*

|  |  |  |
| --- | --- | --- |
| **Sl.No.** | **Information from Parents** | **Yes/No** |
|  | Is there any family history of speech, language, hearing or learning deficits? |  |
|  | Psycho social history: Does your child show high frustration levels, behavioral problems, and excessive shyness especially in unfamiliar social settings? |  |
|  | History of feeding:   1. Does your child show poor co-ordination of suck-swallow-breathe process resulting in mild but frequent coughing/choking or spillage? 2. Does your child exhibit excessive drooling, especially when talking or engaged in other motor activities? |  |
|  | Was your child a quiet baby, that is, he/she did not show much of vocalization/verbalizations especially between 4-12 months of age? |  |
|  | Prebabble vocalizations:  Did your child present the following:   1. There was no or little babbling except vowel like vocalizations? 2. The babble consisted of few or no consonants? |  |
|  | *Intelligibility:* Did the intelligibility of your speech of your child vary from situation to situation? E.g.: Speech was more intelligible with closest family members when compared to that with strangers. |  |
|  | *Rate of Speech:* Does your child use a slow rate of speech? |  |
|  | *Development of Speech:*  Did the child show delayed development of speech (i.e., the development of speech occurred at a slower rate when compared with his/her counterparts?) |  |
|  | *Use of non – verbal modes:*  Did your child show increased use of gestures to communicate his needs (E.g., leading parents to desired objects)? Or use mime, conventional or idiosyncratic signs (natural gesture system invented by child) or both? |  |
|  | *Play:*  Did your child exhibit age-appropriate, single action pretend play, but showed delay in developing sequences of pretend play? |  |
| **Observations by the Speech-Language Pathologist** | | |
|  | Are there any indications of soft neurological signs (immature reflexes, mild low muscle tone, sensory hypersensitivity, or hyposensitivity)? |  |
|  | Does the child show difficulty in voluntary use of oral structures? |  |
|  | Does the child have difficulty in moving the tongue independently of jaw? |  |
|  | Does the child show any evident silent posturing/ Groping (searching of the articulators) or effort at initiation of speech? |  |
|  | Does the child show difficulty in learning sequenced movements (E.g., learning sequenced speech movements to utter a particular word)? |  |
|  | Does the child show incoordination while shifting from one motor activity to another? |  |
|  | Does the child experience difficulty with initial consonants in words? |  |
|  | Does the child omit or distort vowel sounds? |  |
|  | Does the child show word or morpheme sequencing errors (E.g., “he’s go” for “he goes”)? |  |
|  | Does the child tend to produce a word once and never utter the same word again in a same or different context? In other words, are the responses of the child inconsistent? |  |
|  | Does the child demonstrate multiple consistent misarticulations? |  |
|  | Does the child producesome words involuntarily and is unable to reproduce or imitate the same on request? |  |
|  | Does the child demonstrate prolongations and syllable additions in speech frequently? |  |
|  | Does the child repeat sounds and syllables in multi syllabic words? |  |
|  | Does the child transpose sounds within words (E.g., naba:na/banana)? |  |
|  | Does the child use more of signs/gestures, vocal noises, and/or idiosyncratic words than meaningful intelligible words? |  |
|  | Does the child use more of signs/gestures along with a few words while attempting to speak in sentences? |  |
|  | Does the child omit, mis-select or mis-place pronouns (E.g., /adu/-meaning ‘that/it’, /aval/-meaning ‘she’, /nja:n/-meaning ‘I’) and PNG markers (structures referring to person, number and gender)? |  |
|  | Does the child exhibit difficulty in organizing and sequencing segments (speech sounds) while speaking or when indulged in conversations? |  |
|  | Does the child show poor accuracy for words as and when the length or phonetic complexity of the utterance increases? |  |
|  | Does the child show poor accuracy for words as and when the length or phonetic complexity of the utterance increases? |  |
|  | Does the quality and quantity of speech reduce in unfamiliar contexts (situations, location, interlocutors, topic, etc)? or when a task is altered or when a new task is introduced (E.g., child seems to have mastered /s/ sound but begins mispronouncing it when /ʃ/ is introduced)? |  |
|  | Does the child exhibit jargon speech (“speaking gibberish”; varied consonant and vowel patterns with appropriate intonation patterns, but no apparent meaning) in his/her speech? |  |
|  | Does the child demonstrate difficulty with rate, rhythm, stress or intonation? Or Is the child monotonous in his/her speech? |  |
|  | Does the child show significantly higher receptive language skills than expressive language skills? |  |
|  | Did the child show unusually slow progress in spite of intensive speech-language treatment in the past? |  |
|  | Does the child show mildly low muscle tone? (Exclude extreme tone differences which are typical of CP)? |  |
|  | Does the child exhibit limb apraxia: Fine and gross motor-planning difficulties, especially for action sequences (hands, whole body)? |  |
|  | Does the child show mild to moderate sensory hypersensitivity, hyposensitivity, or both in different areas of the face and/or body? |  |

**Total score: \_\_\_\_\_\_**

**Clinical Impression:**

**APPENDIX B**

**ASSESSMENT PROTOCOL FOR ORAL MOTOR, ORAL PRAXIS AND VERBAL PRAXIS SKILLS IN MALAYALAM SPEAKING CHILDREN WITH CHILDHOOD APRAXIA OF SPEECH AND SUSPECTED APRAXIA OF SPEECH**

**(APOOV-M)**

NAME: DATE:

REGISTRATION NUMBER:

AGE/GENDER:

EDUCATION:

CRECHE/NURSERY:

OTHER RELEVENT INFORMATION:

1. **ORAL MOTOR ASSESSMENT**
2. **Oral structures at rest**

*The clinician should score for the following based on his/her observation. Score 2 for ‘a’, 1 for ‘b’ and 0 for ‘c’*

|  |  |  |
| --- | --- | --- |
| ***Sl. No.*** | ***At Rest*** | ***Score*** |
| 1 | The child’s jaw is:   1. In normal alignment 2. Slightly protracted or retracted 3. Noticeably protracted or retracted |  |
| 2 | The child’s jaw at rest is:   1. Closed 2. Slightly open 3. Noticeably open |  |
| 3 | The child’s lips are:   1. In a normal position 2. Slightly protracted or retracted 3. Obviously protracted or retracted |  |
| 4 | The child:   1. Does not drool 2. Drools, but tries to swallow it 3. Drools and does not use any strategy to clear it |  |
| 5 | The child’s tongue is:   1. Placed appropriately inside the mouth 2. On the bottom of the lower lip 3. Outside the mouth |  |
| 6 | Based on the interpretation from the five items above, the oral structures seems to show:   1. Normal tone 2. Mildly abnormal tone 3. Moderately abnormal tone |  |
| 7 | Involuntary movements are:   1. Absent 2. Present but barely noticeable 3. Apparently present |  |
| 8 | When the child moves his/her oral structures:   1. Other parts of the body do not move 2. Other parts of the body move minimally 3. Other parts of the body move noticeably (and hinder in speech production) |  |
| ***Total score =*** | | |

1. **Functions of the oral mechanism for speech**

*The clinician should score for the following based on his/her observation. Score 1 for ‘adequate’ and 0 for ‘inadequate’.*

|  |  |  |
| --- | --- | --- |
| ***Sl.No.*** | ***Functions*** | ***Score*** |
| 1 | The intra-oral air build-up for stops |  |
| 2 | Air build up and precision of fricatives |  |
| 3 | Oral-nasal distinction |  |
| 4 | The range of movement of lips when the child spreads his lips |  |
| 5 | The range of movement of jaw when the child opens and closes his/her mouth |  |
| 6 | The range of movement of the tongue when the child moves the tongue from side to side |  |
| ***Total score*** = | | |

**II. ORAL PRAXIS ASSESSMENT**

1. **Isolated oral movements**

*The clinician should ask the child to imitate the following movements. A maximum of three repetitions should be given if needed. The clinician should comment regarding the accuracy & rate of movement, the number of repetitions required and then provide a score accordingly.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Action*** | ***Accuracy*** | ***Rate*** | ***Repetitions*** | ***Score*** | ***Sub scores*** |
| *Jaw movement* | | | | | | |
| 1 | Click teeth together once |  |  |  |  |  |
| 2 | Open your mouth |  |  |  |  |
| 3 | Close your mouth |  |  |  |  |
| 4 | Hold your mouth open at mid range |  |  |  |  |
| *Lip movement* | | | | | | |
| 5 | Smile |  |  |  |  |  |
| 6 | Pucker lips |  |  |  |  |
| 7 | Bite lower lip |  |  |  |  |
| 8 | Blow |  |  |  |  |
| 9 | Pretend to kiss |  |  |  |  |
| *Tongue movement* | | | | | | |
| 10 | Stick out your tongue |  |  |  |  |  |
| 11 | Lick your lips with tongue |  |  |  |  |
| 12 | Touch the nose with tip of tongue |  |  |  |  |
| 13 | Move your tongue in and out |  |  |  |  |
| 14 | Move your tongue to the right |  |  |  |  |
| 15 | Move your tongue to the left |  |  |  |  |
| 16 | Click your tongue |  |  |  |  |
| 17 | Wiggle your tongue from side to side |  |  |  |  |
| *Others* | | | | | | |
| 18 | Clear your throat |  |  |  |  |  |
| 19 | Puff up your cheeks |  |  |  |  |
| ***Total score =*** | | | | | | |

***Scoring:***

The accuracy and rate are evaluated based on the number of repetitions provided. All responses are scored based on rate, accuracy and repetitions used as follows:

|  |  |
| --- | --- |
| 4 - | Movement/action is accurate and rate is appropriate. |
| 3 - | Movement/action is accurate and rate is appropriate with one or more repetitions. |
| 2 - | Either movement/action or rate is inappropriate with more than one repetition. |
| 1 - | Both are inappropriate with more than one repetition. |
| 0 - | Child is unable to perform even with repetitions. |

1. **Sequential oral movements**

*The clinician should ask the child to imitate the sequential oral movements given in the table. A maximum of three repetitions should be given if needed. The clinician should comment regarding the response and provide appropriate scoring as given below.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Sl.***  ***No.*** | ***Stimulus*** | ***Response*** | ***MCS*** | ***SMS*** |
| 1 | Bite and blow |  |  |  |
| 2 | Smile and kiss |  |  |  |
| 3 | Blow and smile |  |  |  |
| 4 | Kiss and stick out your tongue |  |  |  |
| 5 | Bite and open your mouth |  |  |  |
| ***Total score*** | | |  |  |

***Scoring:***

***Motor Control Score (MCS):***

|  |  |
| --- | --- |
| 2 - | Both movements are precise |
| 1 - | One of the movements is imprecise |
| 0 - | Both movements are imprecise |

***Sequence Maintenance Score (SMS):***

|  |  |
| --- | --- |
| 2 - | Completes both movements in the order stated (correct sequence) |
| 1 - | Completes both movements in the reverse order (incorrect sequence) or adds an extra movement |
| 0 - | Completes only one movement or completes the same movement twice. |

**III. VERBAL PRAXIS ASSESSMENT**

1. **Isolated verbal movements**

*The clinician should ask the child to imitate the following syllables, consonants and vowels. A maximum of three repetitions should be given if needed.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Sl.No.*** | ***Action*** | ***Response*** | ***Accuracy*** | ***Repetitions*** | ***Score*** |
| *Jaw movement* | | | | | |
| 1 | Open your mouth & say /a/ (അ) |  |  |  |  |
| 2 | Close your mouth & say /m…/(മ്…) |  |  |  |  |
| 3 | Say /ja/ (യ) |  |  |  |  |
| 4 | Say /ai/ (ഐ) |  |  |  |  |
| 5 | Say /au/ (ഔ) |  |  |  |  |
| *Lip movement* | | | | | |
| 6 | Say /pa/ (പ) |  |  |  |  |
| 7 | Say /o/ (ഒ) |  |  |  |  |
| 8 | Say /u/ (ഉ) |  |  |  |  |
| 9 | Say /i/ (ഇ) |  |  |  |  |
| 10 | Say /e/ (എ) |  |  |  |  |
| *Tongue movement* | | | | | |
| 11 | Say /ʈa/ (ട) |  |  |  |  |
| 12 | Say /ɖa/ (ഡ) |  |  |  |  |
| 13 | Say /n…/ (ന്…) alveolar |  |  |  |  |
| 14 | Say /n.../ (ന്…) dental |  |  |  |  |
| 15 | Say /l.../ (ല്…) |  |  |  |  |
| 16 | Say /ka/ (ക) |  |  |  |  |
| 17 | Say /ɡa/ (ഗ) |  |  |  |  |
| 18 | Say /ta/ (ത) |  |  |  |  |
| 19 | Say /da/ (ദ) |  |  |  |  |
| 20 | Say /ʧa/ (ച) |  |  |  |  |
| 21 | Say /ʤa/ (ജ) |  |  |  |  |
| 22 | Say /ra/ (റ) |  |  |  |  |
| 23 | Say /ra/ (ര) |  |  |  |  |
| 24 | Say /s…/ (സ്....) |  |  |  |  |
| 25 | Say /ʃ…/ (ശ്....) |  |  |  |  |
| ***Total score =*** | | | | | |

***Scoring:***

The speech movements are scored based on the accuracy and repetition used as follows:

|  |  |
| --- | --- |
| 3 - | Movement/action is accurate. |
| 2 - | Movement/action is accurate with one or more repetition. |
| 1 - | Movement/action is inappropriate with more than one repetition. |
| 0 - | Child is unable to perform even with repetitions. |

1. **Sequential verbal movements**

*The clinician should ask the child to imitate the following sequential verbal utterances. A maximum of three repetitions should be given if needed.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Stimulus*** | ***Transcribed response*** | ***MCS*** | ***SMS*** |
| 1 | a-u (അ-ഉ) |  |  |  |
| 2 | o-i (ഒ-ഇ) |  |  |  |
| 3 | m-u (മ്-ഉ) |  |  |  |
| 4 | a-m-u (അ-മ്-ഉ) |  |  |  |
| 5 | u-i-a (ഉ-ഇ-അ) |  |  |  |
| 6 | i-u-a (ഇ-ഉ-അ) |  |  |  |
| 7 | m-o-i (മ്-ഒ-ഇ) |  |  |  |
| ***Total score=*** | | |  |  |

***Scoring:***

Two types of scores are given as follows:

***Motor Control Score (MCS):***

*For two phoneme sequences:*

|  |  |
| --- | --- |
| 2 - | All movements are precise |
| 1 - | One of the movements is imprecise |
| 0 - | All movements are imprecise or child does not say all phonemes |

*For three phoneme sequences:*

|  |  |
| --- | --- |
| 2 - | All movements are precise |
| 1 - | One or two of the movements are imprecise |
| 0 - | All movements are imprecise or child does not say all phonemes |

***Sequence Maintenance Score (SMS):***

*For two phoneme sequences:*

|  |  |
| --- | --- |
| 2 - | Repeats both phonemes in the correct order |
| 1 - | Repeats both phonemes in reverse order or repeat a phoneme or add a phoneme |
| 0 - | Repeats only one phoneme or does not repeat any phoneme |

*For three phoneme sequences:*

|  |  |
| --- | --- |
| 2 - | Repeats all phonemes correctly |
| 1 - | Repeats 2 out of 3 phoneme sequences correctly or repeats the phonemes 5 or 6 times |
| 0 - | Repeats one out of 3 phoneme sequences correctly or repeats the phoneme sequence more than 6 times |

If the child does not respond, mark NR and score 0.

1. **Diadochokinetic rate (DDK)**

*The clinician should demonstrate SMR (/pa/-/ʈa/-/ka/) and AMR (/pa/,/ʈa/,/ka/ independently) and ask the child to imitate as fast and as clearly as possible. A maximum of three trials should be given for the child to produce a minimum of ten iterations per trial. Analysis is in terms of the attempts, accuracy and consistency of production.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***DDK*** | ***Stimuli*** | ***Attempt*** | ***Accuracy*** | ***Consistency*** | ***DDK rate*** |
| ***AMR*** | /pa-pa-pa…/  പ..പ..പ |  |  |  |  |
| /ʈa-ʈa-ʈa.../  ട..ട..ട |  |  |  |  |
| /ka-ka-ka.../  ക..ക..ക |  |  |  |  |
| ***SMR*** | /paʈaka.../  പടക.. |  |  |  |  |

***Scoring:***

1. *Attempts:*

A maximum of three attempts should be given to each child and the best attempt with atleast ten iterations should be considered for calculation of DDK.

1. *Accuracy:*

Responses of the child should be rated for accuracy with respect to articulation. If the first four repetitions are accurately produced, a score of 1 should be given and 0 if the repetitions are inaccurate.

1. *Consistency:*

The initial four repetitions should be considered for scoring.

|  |  |
| --- | --- |
| 3 - | Consistent repetitions; no change from one repetition to the next. |
| 2 - | Three of the four repetitions are consistently repeated. |
| 1 - | Two of the four repetitions are consistently repeated. |
| 0 - | All repetitions are different from one another. |

1. *DDK rate:*

DDK rate is calculated using the following formula:

DDK rate = Total number if iterations

Duration of trial (in sec)

1. **Word level praxis assessment**

*The clinician should ask the child to repeat the following words after him/her. Three trials should be provided if the child is unable to repeat with one. Words 1-36 are appropriate for* > 2.6 to < 3.6 *years and words 1-44 for* > 3.6 to < 4.6 *years.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Target*** | ***Transcribed response*** | | | ***PE*** | | | ***G*** | ***D*** | ***WP*** | ***SMS*** |
| ***SE*** | ***TE*** | ***WWE*** |
| **DNC:** Disyllabic words with no clusters | | | | | | | | | | | |
| 1 | /a:na/  ആന |  | | |  |  |  |  |  |  |  |
| 2 | /ila/  ഇല |  | | |  |  |  |  |  |  |  |
| 3 | /pu:vɅ/  പൂവ് |  | | |  |  |  |  |  |  |  |
| 4 | /katha/  കഥ |  | | |  |  |  |  |  |  |  |
| 5 | /vaɖi/  വടി |  | | |  |  |  |  |  |  |  |
| **DGC:** Disyllabic words with geminate clusters | | | | | | | | | | | |
| 6 | /toppi/  തൊപ്പി |  | | |  |  |  |  |  |  |  |
| 7 | /laittɅ/  ലൈറ്റ് |  | | |  |  |  |  |  |  |  |
| 8 | /kaɳɳɅ/  കണ്ണ് |  | | |  |  |  |  |  |  |  |
| 9 | /veɭɭam/  വെള്ളം |  | | |  |  |  |  |  |  |  |
| 10 | /u:ɲa:l/  ഊഞ്ഞാല്‍ |  | | |  |  |  |  |  |  |  |
| **DNGC:** Disyllabic words with non-geminate clusters | | | | | | | | | | | |
| 11 | /su:rjan/  സൂര്യന്‍ |  | | |  |  |  |  |  |  |  |
| 12 | /raɳɖɅ/  രണ്ട് |  | | |  |  |  |  |  |  |  |
| 13 | /vaɳɖi/  വണ്ടി |  | | |  |  |  |  |  |  |  |
| **TNC:** Trisyllabic words with no clusters | | | | | | | | | | | |
| 14 | /kutira/  കുതിര |  | | |  |  |  |  |  |  |  |
| 15 | /mo:tiram/  മോതിരം |  | | |  |  |  |  |  |  |  |
| 16 | /vajaṛɅ/  വയറ് |  | | |  |  |  |  |  |  |  |
| 17 | /miʈha:ji/  മിഠായി |  | | |  |  |  |  |  |  |  |
| 18 | /vima:nam/  വിമാനം |  | | |  |  |  |  |  |  |  |
| **TGC:**Trisyllabic words with geminate clusters | | | | | | | | | | | |
| 19 | /marunɅ/  മരുന്ന് |  | | |  |  |  |  |  |  |  |
| 20 | /kaɳɳa:ɖi/  കണ്ണാടി |  | | |  |  |  |  |  |  |  |
| 21 | /ʧeruppɅ/  ചെരുപ്പ് |  | | |  |  |  |  |  |  |  |
| 22 | /takka:ɭi/  തക്കാളി |  | | |  |  |  |  |  |  |  |
| 23 | /uɖuppɅ/  ഉടുപ്പ് |  | | |  |  |  |  |  |  |  |
| **TNGC:** Trisyllabic words with non-geminate clusters | | | | | | | | | | | |
| 24 | /uṛumbɅ/  Dl¡Ì§ |  | | |  |  |  |  |  |  |  |
| 25 | /ti:vaɳɖi/  തീവണ്ടി |  | | |  |  |  |  |  |  |  |
| 26 | /paruntɅ/  പരുന്ത് |  | | |  |  |  |  |  |  |  |
| **MNC:** Multisyllabic words with no clusters | | | | | | | | | | | |
| 27 | /talamuɖi/  തലമുടി |  | | |  |  |  |  |  |  |  |
| 28 | /alama:ri/  അലമാരി |  | | |  |  |  |  |  |  |  |
| 29 | /birijani/  ബിരിയാണി |  | | |  |  |  |  |  |  |  |
| 30 | /talajaɳa/  തലയണ |  | | |  |  |  |  |  |  |  |
| 31 | /kuɭimuṛi/  കുളിമുറി |  | | |  |  |  |  |  |  |  |
| **MGC:** Multisyllabic words with geminate clusters | | | | | | | | | | | |
| 32 | /ʧu:ɖuveɭɭam/  ചൂടുവെള്ളം | |  | |  |  |  |  |  |  |  |
| 33 | /aɖukaɭa/  അടുക്കള | |  | |  |  |  |  |  |  |  |
| 34 | /so:ppupoɖi/  സോപ്പുപൊടി | |  | |  |  |  |  |  |  |  |
| 35 | /kuɲɲuva:va/  കുഞ്ഞുവാവ | |  | |  |  |  |  |  |  |  |
| 36 | /kuppivaɭa/  കുപ്പിവള | |  | |  |  |  |  |  |  |  |
| **MNGC:** Multisyllabic words with non-geminate clusters | | | | | | | | | | | |
| 37 | /paɲʤasa:ra/  പഞ്ചസാര | | |  |  |  |  |  |  |  |  |
| 38 | /ambiɭima:man/  AÌynyixi© | | |  |  |  |  |  |  |  |  |
| 39 | /ʧilantivala/  ചിലന്തിവല | | |  |  |  |  |  |  |  |  |
| **CW:**Complex words | | | | | | | | | | | |
| 40 | /paʧʧakkaṛi/  പച്ചക്കറി | |  | |  |  |  |  |  |  |  |
| 41 | /moʈʈattala/  മൊട്ടത്തല | |  | |  |  |  |  |  |  |  |
| 42 | /uɳɳijappam/  ഉണ്ണിയപ്പം | |  | |  |  |  |  |  |  |  |
| 43 | /kaɭippa:ʈʈam/  കളിപ്പാട്ടം | |  | |  |  |  |  |  |  |  |
| 44 | /pu:mba:tta/  e¢Ìxl÷ | |  | |  |  |  |  |  |  |  |
| ***Total Scores*** | | | | |  |  |  |  |  |  |  |

***Note:*** *PE- Phonological errors, G- Groping errors, D- Disfluencies, WP- Weak precision, Di – Distortion, SMS- Sequence maintenance score.*

The errors should be transcribed and the total number of errors counted.

**Key for scoring errors:**

1. ***Phonological errors***

*Space errors (SE):* fronting, backing, palatalization, depalatalization, deretroflexion, and vowel deviations including vowel prolongation, vowel shortening, vowel centralization, vowel decentralization, monothongization, diphthongization, vowel raising, vowel lowering, vowel fronting, vowel backing.

*Timing errors (TE):* voicing errors, affrication, deaffrication, denasalization, nasalisation, deaspiration, gemination and degemination of consonants.

*Whole word errors (WWE):* cluster reduction, cluster deletion, reduplication, consonant harmony, migration, metathesis, epenthesis, initial consonant deletion, medial consonant deletion, vowel deletion, substitution of geminates for non-geminates and vice versa, initial, medial and final syllable deletions.

A score of ‘1’ is given for each error.

1. ***Groping errors:*** Self corrections that are silent or audible should be considered as groping errors. A score of ‘1’ should be given if it is observed in a word.
2. ***Disfluencies****:* Repetitive production of speech sounds, hesitations and pauses should be considered as disfluencies. A score of ‘1’ should be given if one or more of it is observed in a word.
3. ***Weak precision:*** Every occurrence of weak precision with respect to the consonants produced should be given a score of ‘1’.
4. ***Sequence maintenance score (SMS):***

*For Disyllabic words:*

|  |  |
| --- | --- |
| 2 - | Repeats both syllables in the correct order. |
| 1 - | Repeats both syllables in reverse order or repeats a syllable or adds/substitutes a syllable. |
| 0 - | Repeats only one syllable or does not repeat any syllable. |

*For Trisyllabic and multisyllabic words:*

|  |  |
| --- | --- |
| 2 - | Repeats all syllables in the correct sequence. |
| 1 - | Repeats all syllables except one in the correct sequence or any one syllable in reverse order or addition/deletion of a syllable. |
| 0 - | Repeats one syllable correctly or does not repeat any syllable in the correct order. |

If the child does not respond, mark NR (No response) and score 0.

1. **Sentence level assessment**

*The clinician should ask the child to repeat the following sentences after him/her. Three trials should be provided if the child is unable to repeat with one. Sentences 1-6 are appropriate for* >2.6 to <3.6 *years and sentences 1-8 for* >3.6 to <4.6 *years.*

|  |  |  |  |
| --- | --- | --- | --- |
| ***Sl. No.*** | ***Target*** | ***Transcribed response*** | ***SMS*** |
| 1 | /pa:lɅ ta:/  പാല് താ |  |  |
| 2 | /ka:rɅ po:ji/  കാറ് പോയി |  |  |
| 3 | /miʈha:ji ve:ɳam/  മിഠായി വേണം |  |  |
| 4 | /ʧe:ʧi veɭɭam tannu/  ചേച്ചി വെള്ളം തന്നു |  |  |
| 5 | /pu:ʧʧa pa:lɅ kuɖiʧʧu/  പൂച്ച പാല് കുടിച്ചു |  |  |
| 6 | /kiɭi marattil irunnu/  കിളി മരത്തില്‍ ഇരുന്നു |  |  |
| 7 | /kuʈʈi puṛattɅ uɲɲaalaaɖi/  കുട്ടി പുറത്ത് ഊഞ്ഞാലാടി |  |  |
| 8 | /aɳɳa:n ʧa:ɖi marattil kajaṛi/  അണ്ണാന്‍ ചാടി മരത്തില്‍ കയറി |  |  |
| ***SMS =*** | | | |

***Scoring:***

The following calculations should be done:

1. ***Sequence maintenance score (SMS):***

|  |  |
| --- | --- |
| 2 - | All words are in the exact order or position |
| 1 - | Sentences with <3 words- at least 1 word is in order  Sentences with > 3 words- at least 3 of the key words are in order |
| 0 - | Sentences with < 3 words-no words in order  Sentences with > 3 words-2, 1 or no key words are in order |

If the child does not respond, mark NR (No response) and score 0.

1. ***Percentages of consonants correct (PCC) & Percentages of vowels correct (PVC):***

For the calculation of these measures, the following data should be excluded from the analysis:

* + All unintelligible and partially intelligible utterances.
  + All consonants in the third or greater repetition of the same word if the pronunciation does not change.

The errors in the remaining data should be identified using the following criteria:

* + Dialectal changes, casual speech pronunciations and allophonic variations were not scored as incorrect.
  + Any doubt about the correctness of the consonant was scored as incorrect.
  + Consonant deletions were scored as incorrect.
  + Consonant substitutions were scored as incorrect.
  + Partial voicing was scored as incorrect.
  + Additions of consonants were scored as incorrect.

*Percentage of consonants correct (PCC):*

PCC= Total number of consonants produced correctly X 100

Total number of consonants attempted

*Percentage of vowels correct (PVC):*

PVC= Total number of vowels produced correctly X 100

Total number of vowels attempted

|  |
| --- |
| ***PCC :*** |
| ***PVC :*** |

1. ***Sentence length:***

Calculate the number of syllables imitated appropriately by the participants in the sentences with increasing lengths. The clinician should write in the columns regarding the presence or absence of errors in the respective sentences.

|  |  |  |
| --- | --- | --- |
| ***Sl.No.*** | ***Sentence length*** | ***Errors*** |
| 1 | 3 |  |
| 2 | 4 |  |
| 3 | 5 |  |
| 4 | 6 |  |
| 5 | 7 |  |
| 6 | 8 |  |
| 7 | 9 |  |
| 8 | 10 |  |

1. **Analysis of spontaneous speech sample**

*Record a spontaneous speech sample of the child by eliciting speech using age appropriate toys and pictures and conversations with family members. Write the transcription in the space given below.*

***Transcribed sample:***

***Scoring:***

The following calculations should be done:

1. ***PCC & PVC:***

*Percentage of consonants correct (PCC):*

PCC=

*Percentage of vowels correct (PVC):*

PVC=

|  |
| --- |
| ***Percent intelligible words:*** |
| ***PCC:*** |
| ***PVC:*** |

1. ***Phonotactic analysis (Vellemen, 1998):***

* *Percentage occurrences of different types of syllables:*

% V syllables =

% VC syllables =

% CV syllables =

% CVC syllables =

*Fill in the types of syllables shapes occurring in the sample with the respective percentage of occurrences of each in the table given below.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Types of syllables*** | | ***Percentage occurrences*** | ***Types of syllables*** | ***Percentage occurrences*** | ***Types of syllables*** | ***Percentage occurrences*** |
|  |  | |  |  |  |  |
|  |  | |  |  |  |  |
|  |  | |  |  |  |  |
|  |  | |  |  |  |  |
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|  |  | |  |  |  |  |
|  |  | |  |  |  |  |
|  |  | |  |  |  |  |

* *Percentage occurrences of different types of words:*

% monosyllabic words =

% disyllabic words =

% trisyllabic words =

% multisyllabic words =

*Fill in the word shapes occurring in the sample with the respective percentage of occurrences of each in the table given below.*

|  |  |
| --- | --- |
| ***Types of words*** | ***Percentage occurrences*** |
| monosyllabic words |  |
| disyllabic words |  |
| trisyllabic words |  |
| multisyllabic words |  |

* *Percentage occurrences of different types of clusters:*

% initial geminate clusters =

% initial non-geminate clusters =

% medial geminate clusters =

% medial non-geminate clusters =

% final geminate clusters =

% final non-geminate clusters =

*Fill in the types of clusters occurring in the sample with the respective percentage of occurrences of each in the table given below.*

|  |  |
| --- | --- |
| ***Types of clusters*** | ***Percentage occurrences*** |
| Initial geminate clusters |  |
| Initial non-geminate clusters |  |
| Medial geminate clusters |  |
| Medial non-geminate clusters |  |
| Final geminate clusters |  |
| Final non-geminate clusters |  |

1. ***Specific praxis errors***

|  |  |
| --- | --- |
| ***Praxis errors*** | ***Frequency*** |
| Groping |  |
| Disfluencies |  |
| Weak precision |  |

***FINDINGS:***

***DIAGNOSTIC FORMULATION:***

##### **APPENDIX C**

**ASSESSMENT PROTOCOL FOR ORAL MOTOR, ORAL PRAXIS AND VERBAL PRAXIS SKILLS IN MALAYALAM SPEAKING CHILDREN WITH CHILDHOOD APRAXIA OF SPEECH AND SUSPECTED APRAXIA OF SPEECH**

**(APOOV-M)**

NAME: XXX DATE: YYY

REGISTRATION NUMBER: ZZZ

AGE/GENDER: 4 years/Male

EDUCATION:

CRECHE/NURSERY:

OTHER RELEVENT INFORMATION: The child’s expressive vocabulary consists of simple disyllabic and monosyllabic utterances.

**I. ORAL MOTOR ASSESSMENT**

1. **Oral structures at rest**

|  |  |  |
| --- | --- | --- |
| ***Sl. No.*** | ***At Rest*** | ***Score*** |
| 1 | The child’s jaw is:   1. In normal alignment 2. Slightly protracted or retracted 3. Noticeably protracted or retracted | 2 |
| 2 | The child’s jaw at rest is:   1. Closed 2. Slightly open 3. Noticeably open | 1 |
| 3 | The child’s lips are:   1. In a normal position 2. Slightly protracted or retracted 3. Obviously protracted or retracted | 1 |
| 4 | The child:   1. Does not drool 2. Drools, but tries to swallow it 3. Drools and does not use any strategy to clear it | 0 |
| 5 | The child’s tongue is:   1. Placed appropriately inside the mouth 2. On the bottom of the lower lip 3. Outside the mouth | 2 |
| 6 | Based on the interpretation from the five items above, the oral structures seems to show:   1. Normal tone 2. Mildly abnormal tone 3. Moderately abnormal tone | 1 |
| 7 | Involuntary movements are:   1. Absent 2. Present but barely noticeable 3. Apparently present | 2 |
| 8 | When the child moves his/her oral structures:   1. Other parts of the body do not move 2. Other parts of the body move minimally 3. Other parts of the body move noticeably (and hinder in speech production) | 2 |
| ***Total score = 11/16*** | | |

1. **Functions of the oral mechanism for speech**

|  |  |  |
| --- | --- | --- |
| ***Sl. No.*** | ***Functions*** | ***Score*** |
| 1 | The intra-oral air build-up for stops | 0 |
| 2 | Air build up and precision of fricatives | 0 |
| 3 | Oral-nasal distinction | 0 |
| 4 | The range of movement of lips when the child spreads his lips | 0 |
| 5 | The range of movement of jaw when the child opens and closes his/her mouth | 0 |
| 6 | The range of movement of the tongue when the child moves the tongue from side to side | 0 |
| ***Total score*** = 0/6 | | |

**II. ORAL PRAXIS ASSESSMENT**

1. **Isolated oral movements**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Action*** | ***Accuracy*** | ***Rate*** | ***Repetitions*** | ***Score*** | ***Sub scores*** |
| *Jaw movement* | | | | | | |
| 1 | Click teeth together once | NR | - | 3 | 0 | 4 |
| 2 | Open your mouth | inaccurate | adequate | 3 | 2 |
| 3 | Close your mouth | inaccurate | adequate | 3 | 2 |
| 4 | Hold your mouth open at mid range | NR | - | 3 | 0 |
| *Lip movement* | | | | | | |
| 5 | Smile | inaccurate | inadequate | 3 | 1 | 3 |
| 6 | Pucker lips | inaccurate | inadequate | 3 | 1 |
| 7 | Bite lower lip | NR | - | 3 | 0 |
| 8 | Blow | inaccurate | inadequate | 3 | 1 |
| 9 | Pretend to kiss | NR | - | 3 | 0 |
| *Tongue movement* | | | | | | |
| 10 | Stick out your tongue | inaccurate | inadequate | 3 | 1 | 1 |
| 11 | Lick your lips with tongue | NR | - | 3 | 0 |
| 12 | Touch the nose with tip of tongue | NR | - | 3 | 0 |
| 13 | Move your tongue in and out | NR | - | 3 | 0 |
| 14 | Move your tongue to the right | NR | - | 3 | 0 |
| 15 | Move your tongue to the left | NR | - | 3 | 0 |
| 16 | Click your tongue | NR | - | 3 | 0 |
| 17 | Wiggle your tongue from side to side | NR | - | 3 | 0 |
| *Others* | | | | | | |
| 18 | Clear your throat | NR | - | 3 | 0 | 1 |
| 19 | Puff up your cheeks | inaccurate | inadequate | 3 | 1 |
| ***Total score =***  9/76 | | | | | | |

1. **Sequential oral movements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Sl.***  ***No.*** | ***Stimulus*** | ***Response*** | ***MCS*** | ***SMS*** |
| 1 | Bite and blow | NR | 0 | 0 |
| 2 | Smile and kiss | NR | 0 | 0 |
| 3 | Blow and smile | NR | 0 | 0 |
| 4 | Kiss and stick out your tongue | NR | 0 | 0 |
| 5 | Bite and open your mouth | NR | 0 | 0 |
| ***Total score*** | | | 0 | 0 |

**III. VERBAL PRAXIS ASSESSMENT**

1. **Isolated verbal movements**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Sl.No.*** | ***Action*** | ***Response*** | ***Accuracy*** | ***Repetitions*** | ***Score*** |
| *Jaw movement* | | | | | |
| 1 | Open your mouth & say /a/ (അ) | /a/ | accurate | 0 | 3 |
| 2 | Close your mouth & say /m…/ (മ്…) | M… | accurate | 1 | 2 |
| 3 | Say /ja/ (യ) | NR | - | 3 | 0 |
| 4 | Say /ai/ (ഐ) | /ai/ | accurate | 1 | 2 |
| 5 | Say /au/ (ഔ) | /av/ | inaccurate | 3 | 1 |
| *Lip movement* | | | | | |
| 6 | Say /pə/ (പ) | /pə/ | inaccurate | 3 | 1 |
| 7 | Say /o/ (ഒ) | /ə/ | inaccurate | 3 | 1 |
| 8 | Say /u/ (ഉ) | /u/ | accurate | 2 | 2 |
| 9 | Say /i/ (ഇ) | /i/ | accurate | 1 | 2 |
| 10 | Say /e/ (എ) | /ai/ | inaccurate | 3 | 1 |
| *Tongue movement* | | | | | |
| 11 | Say /ʈa/ (ട) | /ʈa/ | inaccurate | 3 | 1 |
| 12 | Say /ɖa/ (ഡ) | NR | - | 3 | 0 |
| 13 | Say /n…/ (ന്…) alveolar | NR | - | 3 | 0 |
| 14 | Say /n.../ (ന്…) dental | NR | - | 3 | 0 |
| 15 | Say /l.../ (ല് …) | /ʈa/ | inaccurate | 3 | 1 |
| 16 | Say /ka/ (ക) | /ka/ | accurate | 2 | 2 |
| 217 | Say /ɡa/ (ഗ) | NR | - | 3 | 0 |
| 18 | Say /ta/ (ത) | /ta/ | accurate | 1 | 2 |
| 19 | Say /da/ (ദ) | /ta/ | inaccurate | 3 | 1 |
| 20 | Say /ʧa/ (ച) | /a/ | inaccurate | 3 | 1 |
| 21 | Say /ʤa/ (ജ) | /ə/ | inaccurate | 3 | 1 |
| 22 | Say /ra/ (റ) | NR | - | 3 | 0 |
| 23 | Say /ra/ (ര) | NR | - | 3 | 0 |
| 24 | Say /s…/ (സ്....) | /tə/ | inaccurate | 3 | 1 |
| 25 | Say /ʃ…/ (ശ്....) | NR | - | 3 | 0 |
| ***Total score = 26/76*** | | | | | |

1. **Sequential verbal movements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Stimulus*** | ***Transcribed response*** | ***MCS*** | ***SMS*** |
| 1 | a-u (അ-ഉ) | NR | 0 | 0 |
| 2 | o-i (ഒ-ഇ) | NR | 0 | 0 |
| 3 | m-u (മ്-ഉ) | NR | 0 | 0 |
| 4 | a-m-u (അ-മ്-ഉ) | NR | 0 | 0 |
| 5 | u-i-a (ഉ-ഇ-അ) | NR | 0 | 0 |
| 6 | i-u-a (ഇ-ഉ-അ) | NR | 0 | 0 |
| 7 | m-o-i (മ്-ഒ-ഇ) | NR | 0 | 0 |
| ***Total score*** | | | 0 | 0 |

1. **Diadochokinetic rate (DDK)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***DDK*** | ***Stimuli*** | ***Attempt*** | ***Accuracy*** | ***Consistency*** | ***DDK rate*** |
| ***AMR*** | /pa-pa-pa…/  പ..പ..പ |  |  |  |  |
| /ʈa-ʈa-ʈa.../  ട..ട..ട |  |  |  |  |
| /ka-ka-ka.../  ക..ക..ക |  |  |  |  |
| ***SMR*** | /paʈaka.../  പടക.. |  |  |  |  |

*Note: The child couldn’t produce 10 iterations and therefore scoring was not done.*

1. **Word level praxis assessment**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Sl. No.*** | ***Target*** | ***Transcribed response*** | | | ***PE*** | | | ***G*** | ***D*** | ***WP*** | ***SMS*** |
| ***SE*** | ***TE*** | ***WWE*** |
| **DNC:** Disyllabic words with no clusters | | | | | | | | | | | |
| 1 | /a:na/  ആന | /a:na/ | | | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2 | /ila/  ഇല | /ilɅ/ | | | 3 | 0 | 0 | 0 | 0 | 0 | 2 |
| 3 | /pu:vɅ/  പൂവ് | /u:vɅ/ | | | 0 | 0 | 1 | 0 | 0 | 2 | 1 |
| 4 | /katha/  കഥ | /kɅkɅ/ | | | 7 | 1 | 2 | 1 | 0 | 2 | 1 |
| 5 | /vaɖi/  വടി | /əkə/ | | | 6 | 1 | 2 | 0 | 0 | 1 | 0 |
| **DGC:** Disyllabic words with geminate clusters | | | | | | | | | | | |
| 6 | /toppi/  തൊപ്പി | /oppi/  /appaa/ | | | 4 | 0 | 2 | 0 | 0 | 0 | 1 |
| 7 | /laittɅ/  ലൈറ്റ് | /airrɅ/ | | | 1 | 0 | 1 | 0 | 0 | 2 | 1 |
| 8 | /kaɳɳɅ/  കണ്ണ് | /i..inɡa/  /i..iɲa/ | | | 11 | 1 | 3 | 0 | 2 | 4 | 0 |
| 9 | /veɭɭam/  വെള്ളം | /mba/ | | | 4 | 1 | 3 | 0 | 0 | 4 | 0 |
| 10 | /u:ɲa:l/  ഊഞ്ഞാല്‍ | /ɲa:/ | | | 0 | 1 | 2 | 1 | 0 | 1 | 0 |
| **DNGC:** Disyllabic words with non-geminate clusters | | | | | | | | | | | |
| 11 | /su:rjan/  സൂര്യന്‍ | NR | | | - | - | - | - | - | - | 0 |
| 12 | /raɳɖɅ/  രണ്ട് | NR | | | - | - | - | - | - | - | 0 |
| 13 | /vaɳɖi/  വണ്ടി | /aappa/ | | | 5 | 0 | 2 | 1 | 0 | 2 | 0 |
| **TNC:** Trisyllabic words with no clusters | | | | | | | | | | | |
| 14 | /kutira/  കുതിര | /kaka/  /aa/  /aaɡa/ | | | 8 | 1 | 7 | 1 | 0 | 2 | 0 |
| 15 | /mo:tiram/  മോതിരം | NR | | | - | - | - | - | - | - | 0 |
| 16 | /vajarɅ/  വയറ് | /aaʈaa/ | | | 4 | 1 | 2 | 0 | 0 | 1 | 0 |
| 17 | /miʈha:ji/  മിഠായി | /aʈaaʈa/ | | | 6 | 2 | 1 | 0 | 0 | 2 | 0 |
| 18 | /vima:nam/  വിമാനം | /ai/ | | | 1 | 0 | 3 | 0 | 0 | 1 | 0 |
| **TGC:**Trisyllabic words with geminate clusters | | | | | | | | | | | |
| 19 | /marunɅ/  മരുന്ന് | NR | | | - | - | - | - | - | - | 0 |
| 20 | /kaɳɳa:ɖi/  കണ്ണാടി | /ka:/ | | | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| 21 | /ʧeruppɅ/  ചെരുപ്പ് | /taappaa/ | | | 9 | 1 | 1 | 0 | 0 | 1 | 0 |
| 22 | /takka:ɭi/  തക്കാളി | NR | | | - | - | - | - | - | - | 0 |
| 23 | /uɖuppɅ/  ഉടുപ്പ് | /uuʈɅ/ | | | 4 | 0 | 1 | 0 | 0 | 0 | 0 |
| **TNGC:** Trisyllabic words with non-geminate clusters | | | | | | | | | | | |
| 24 | /uṛumbɅ/  Dl¡Ì§ | /uuvaa/  /aka/ | | | 7 | 2 | 2 | 1 | 1 | 2 | 0 |
| 25 | /ti:vaɳɖi/  തീവണ്ടി | /taata/ | | | 2 | 0 | 3 | 0 | 0 | 1 | 0 |
| 26 | /paruntɅ/  പരുന്ത് | NR | | | - | - | - | - | - | - | 0 |
| **MNC:** Multisyllabic words with no clusters | | | | | | | | | | | |
| 27 | /talamuɖi/  തലമുടി | /aa/ | | | 1 | 0 | 4 | 0 | 0 | 0 | 0 |
| 28 | /alama:ri/  അലമാരി | NR | | | - | - | - | - | - | - | 0 |
| 29 | /birijani/  ബിരിയാണി | NR | | | - | - | - | - | - | - | 0 |
| 30 | /talajaɳa/  തലയണ | NR | | | - | - | - | - | - | - | 0 |
| 31 | /kuɭimuṛi/  കുളിമുറി | NR | | | - | - | - | - | - | - | 0 |
| **MGC:** Multisyllabic words with geminate clusters | | | | | | | | | | | |
| 32 | /ʧu:ɖuveɭɭam/  ചൂടുവെള്ളം | | /aa/  /uua/ | | 2 | 0 | 8 | 0 | 0 | 0 | 0 |
| 33 | /aɖukaɭa/  അടുക്കള | | NR | | - | - | - | - | - | - | 0 |
| 34 | /so:ppupoɖi/  സോപ്പുപൊടി | | NR | | - | - | - | - | - | - | 0 |
| 35 | /kuɲɲuva:va/  കുഞ്ഞുവാവ | | /aadaa/  /uɲɅ-aappa/ | | 5 | 3 | 5 | 0 | 0 | 0 | 0 |
| 36 | /kuppivaɭa/  കുപ്പിവള | | NR | | - | - | - | - | - | - | 0 |
| **MNGC:** Multisyllabic words with non-geminate clusters | | | | | | | | | | | |
| 37 | /paɲʤasa:ra/  പഞ്ചസാര | | | /ənɡə-ada/ | 7 | 1 | 2 | 0 | 0 | 0 | 0 |
| 38 | /ambiɭima:man/  AÌynyixi© | | | NR | - | - | - | - | - | - | 0 |
| 39 | /ʧilantivala/  ചിലന്തിവല | | | NR | - | - | - | - | - | - | 0 |
| **CW:**Complex words | | | | | | | | | | | |
| 40 | /paʧʧakkaṛi/  പച്ചക്കറി | | | NR | - | - | - | - | - | - | 0 |
| 41 | /moʈʈattala/  മൊട്ടത്തല | | | /aʈaaʈaaa/ | 4 | 3 | 2 | 0 | 0 | 0 | 0 |
| 42 | /uɳɳijappam/  ഉണ്ണിയപ്പം | | | NR | - | - | - | - | - | - | 0 |
| 43 | /kaɭippa:ʈʈam/  കളിപ്പാട്ടം | | | /aʈaaʈa/ | 5 | 2 | 2 | 0 | 0 | 0 | 0 |
| 44 | /pu:mba:tta/  e¢Ìxl÷ | | | /aa-aa-aa/ | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| ***Total Scores*** | | | | | 101 | 21 | 65 | 6 | 3 | 28 | 8/88 |

***Note:*** *PE- Phonological errors, G- Groping errors, D- Disfluencies, WP- Weak precision, Di – Distortion, SMS- Sequence maintenance score.*

1. **Sentence level assessment**

|  |  |  |  |
| --- | --- | --- | --- |
| ***Sl. No.*** | ***Target*** | ***Transcribed response*** | ***SMS*** |
| 1 | /pa:lɅ ta:/  പാല് താ | /aataa taa/ | 1 |
| 2 | /ka:rɅ po:ji/  കാറ് പോയി | /u-u-aa/ | 0 |
| 3 | /miʈha:ji ve:ɳam/  മിഠായി വേണം | /aa/ | 0 |
| 4 | /ʧe:ʧi veɭɭam tannu/  ചേച്ചി വെള്ളം തന്നു | NR | 0 |
| 5 | /pu:ʧʧa pa:lɅ kuɖiʧʧu/  പൂച്ച പാല് കുടിച്ചു | NR | 0 |
| 6 | /kiɭi marattil irunnu/  കിളി മരത്തില്‍ ഇരുന്നു | NR | 0 |
| 7 | /kuʈʈi puṛattɅ uɲɲaalaaɖi/  കുട്ടി പുറത്ത് ഊഞ്ഞാലാടി | NR | 0 |
| 8 | /aɳɳa:n ʧa:ɖi marattil kajaṛi/  അണ്ണാന്‍ ചാടി മരത്തില്‍ കയറി | NR | 0 |
| ***SMS =1/16*** | | | |

***Scoring:***

1. ***Sequence maintenance score (SMS):1/16***
2. ***PCC & PVC***

*Note: Sentences produced were unintelligible and therefore scoring was not done*

|  |  |
| --- | --- |
| ***PCC*** | ***-*** |
| ***PVC*** | ***-*** |

1. ***Sentence length:***

|  |  |  |
| --- | --- | --- |
| ***Sl.No.*** | ***Sentence length*** | ***Errors*** |
| 1 | 3 | Present |
| 2 | 4 | Present |
| 3 | 5 | Present |
| 4 | 6 | NR |
| 5 | 7 | NR |
| 6 | 8 | NR |
| 7 | 9 | NR |
| 8 | 10 | NR |

1. **Analysis of spontaneous speech sample**

***Transcribed sample:***

/ila a-ə-a a intə a taa taa I ə ija aappa ppaa aappa taa taa aaɲɲa aaja a aappa ta aataappa ambaa ambaa amba amba ila ammaa i-i-I ila m… a əkəkən ə-ə-kkə ammə ammə enɡə ta a m… inda inda a in-ta-inta amme intaa indaa inta iium taa inda inda ija ammaa m… k-ikka va va po pa inɡa inɡa i…ɲa imam əmba əmba vaa ppa aaja a ala ila ila ila ila sssi…ka la a in ve ə ha a… ija ija ija aka ila pa po pa po po po popo inɡa appə u-a-u-akkə iɲe inɡa ʈa ila ija ila/

|  |  |
| --- | --- |
| ***Percent intelligible words*** | *60.19* |
| ***PCC*** | *47.37* |
| ***PVC*** | *41.49* |

1. ***Phonotactic analysis (Vellemen, 1998):***

* *Percentage occurrences of different types of syllables:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Types of syllables*** | | ***Percentage occurrences*** | ***Types of syllables*** | ***Percentage occurrences*** | ***Types of syllables*** | ***Percentage occurrences*** |
| V | 10.68 | | VVCVVCCV | 0.97 |  |  |
| VCV | 19.42 | | VCCVV | 5.83 |  |  |
| VVV | 1.94 | | CCV | 1.94 |  |  |
| VCCV | 22.33 | | VC | 0.97 |  |  |
| CVV | 8.74 | | CVCV | 0.97 |  |  |
| VCVV | 0.97 | |  |  |  |  |
| VCVCVC | 0.97 | |  |  |  |  |
| VVCCV | 3.88 | |  |  |  |  |
| CCVV | 0.97 | |  |  |  |  |
| VVCV | 1.94 | |  |  |  |  |
| CV | 14.56 | |  |  |  |  |
| C | 2.91 | |  |  |  |  |

* *Percentage occurrences of different types of words:*

|  |  |
| --- | --- |
| ***Types of words*** | ***Percentage occurrences*** |
| monosyllabic words | 37.62 |
| disyllabic words | 59.41 |
| trisyllabic words | 2.97 |
| multisyllabic words | 0.00 |

* *Percentage occurrences of different types of clusters:*

|  |  |
| --- | --- |
| ***Types of clusters*** | ***Percentage occurrences*** |
| Initial geminate clusters | 5.41 |
| Initial non-geminate clusters | - |
| Medial geminate clusters | 43.24 |
| Medial non-geminate clusters | 51.35 |
| Final geminate clusters | - |
| Final non-geminate clusters | - |

1. ***Specific praxis errors***

|  |  |
| --- | --- |
| ***Praxis errors*** | ***Frequency*** |
| Groping | 12 |
| Disfluencies | 08 |
| Weak precision | 55 |

***FINDINGS:***

***DIAGNOSTIC FORMULATION:***  Childhood Apraxia of Speech

**APPENDIX D**

**Demographic details and scores obtained by the participants on the assessment protocol**

Demographic details:

|  |  |  |
| --- | --- | --- |
| Participant code | Age (years)/ Gender | Baseline |
| ***Participants with CAS*** | | |
| A | 3.6/Male | Client’s expression was restricted to monosyllabic utterances which is inconsistent. |
| B | 3.6/Male | Client’s expression was restricted to disyllabic to trisyllabic utterances, which were inconsistent. |
| C | 4/Male | Client’s expressive vocabulary consists of simple disyllabic and monosyllabic common utterances. |
| D | 4/Female | Client’s expression was restricted to simple monosyllabic and disyllabic words. |
| ***Participants with sAOS associated with ELD*** | | |
| E | 2.6/Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected  Difficulty increases with complexity and length of utterances  Inconsistency and Variability  Limited improvement noted even after therapy.  *Screening checklist results:*25/39 (Interpretation: sAOS) |
| F | 3/ Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected  Difficulty increases with complexity and length of utterances  Inconsistency and Variability  Unintelligibility varies across situations  *Screening checklist results:*27/39 (Interpretation: sAOS) |
| G | 3.6/ Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected  Difficulty increases with complexity and length of utterances  Inconsistent errors  *Screening checklist results:*24/39 (Interpretation: sAOS) |
| H | 3.6/ Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected  Difficulty increases with complexity and length of utterances  Inconsistency and Variability  Difficulty in correct production even on immediate production after a model  *Screening checklist results:*28/39 (Interpretation: sAOS) |
| ***Participants with sAOS associated with Autism*** | | | |
| I | 4.5/  Male | *Significant features of suspected AOS (according to the therapist):*  Limited verbal output  Lack of significant progress even after therapy  Volitional speech affected  Groping on attempting to speak  *Screening checklist results:*33/39 (Interpretation: sAOS) |
| J | 4.5/ Male | *Significant features of suspected AOS (according to the therapist):*  Limited verbal output  Correct production of words occasionally  Groping on attempting to speak  Easier initiation of words when given a tactile cue  *Screening checklist results:* 30/39 (Interpretation: sAOS) |
| K | 3/ Male | *Significant features of suspected AOS (according to the therapist):*  Limited verbal output  Unable to produce although attempts to produce (struggle)  Inconsistent production of certain monosyllabic utterances  *Screening checklist results:35/39* (Interpretation: sAOS) |
| L | 4.5/ Male | *Significant features of suspected AOS (according to the therapist):*  Limited verbal output  Unable to produce although attempts to produce  Sequencing difficulty  Inconsistent errors  *Screening checklist results:30/39* (Interpretation: sAOS) |
| M | 4.5/ Male | *Significant features of suspected AOS (according to the therapist):*  Slow progress rate even after intensive stimulation  Groping behaviour on voluntary production  Sequencing difficulty  *Screening checklist results:28/39* (Interpretation: sAOS) |
| N | 4.5/ Male | *Significant features of suspected AOS (according to the therapist):*  Limited verbal output  Lack of significant progress even after therapy  Volitional speech affected  Groping on attempting to speak  Speech repertoire restricted to more of monosyllablic, reduplicated disyllabic and trisyllabic utterances  Difficulty in imitating longer utterances  *Screening checklist results:29/39* (Interpretation: sAOS) |
| ***Participants with sAOS associated with DCD*** | | |
| O | 4/ Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected.  Difficulty increases with complexity and length of utterances.  Inconsistency and variability.  Groping on attempting to speak.  Whispered speech occasionally.  *Screening checklist results:*32/39 (Interpretation: sAOS) |
| P | 2.6/ Female | *Significant features of suspected AOS (according to the therapist):*  Noticeable groping behavior.  Volitional speech and sequencing skills affected.  Sound repertoire restricted to vowels and bilabials.  *Screening checklist results:34/39* (Interpretation: sAOS) |
| Q | 3.6/ Male | *Significant features of suspected AOS (according to the therapist):*  Groping on speaking on request  Volitional speech affected  Difficulty increases with complexity and length of utterances  Productions include more of repetitive sound sequences  *Screening checklist results:29/30* (Interpretation: sAOS) |
| R | 4/ Male | *Significant features of suspected AOS (according to the therapist):*  Volitional speech affected  Limited sound repertoire  Productions include more of repetitive sound sequences for everything  Groping on attempting to speak  Difficulty increases with complexity and length of utterances  *Screening checklist results:*31/39 (Interpretation: sAOS) |

*Scores obtained by the participants with CAS:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Domains & sub domains* | *Participant code* | | | |
| *A* | *B* | *C* | *D* |
| I. Oral motor skills | | | | |
| A. Oral structures at rest (Max: 16) | 13.00 | 16.00 | 11.00 | 12.00 |
| B. Function of the oral mechanism for speech (Max: 6) | 1.00 | 3.00 | 0.00 | 1.00 |
| II. Oral praxis skills | | | | |
| A. Isolated oral movements (Max: 76) | 30.00 | 11.00 | 9.00 | 5.00 |
| B. Sequential oral movements | | | | |
| MCS (Max: 10) | 4.00 | 0.00 | 0.00 | 0.00 |
| SMS (Max: 10) | 0.00 | 0.00 | 0.00 | 0.00 |
| III.Verbal praxis skills | | | | |
| A. Isolated verbal movements | 42.00 | 15.00 | 26.00 | 9.00 |
| B. Sequential verbal movements | | | | |
| MCS (Max: 14) | 7.00 | 4.00 | 0.00 | 0.00 |
| SMS (Max: 14) | 3.00 | 2.00 | 0.00 | 0.00 |
| C. Diadochokinetic (DDK) tasks | - | - | - | - |
| D. Word Level praxis assessment | | | | |
| Number of words attempted | 19.00 | 24.00 | 27.00 | 5.00 |
| Phonological process assessment | | | | |
| 1. Frequency | 126.00 | 160.00 | 187.00 | 13.00 |
| 1. Space Errors | 82.00 | 105.00 | 101.00 | 5.00 |
| 1. Timing Errors | 9.00 | 10.00 | 21.00 | 0.00 |
| 1. Whole Word Errors | 35.00 | 45.00 | 65.00 | 8.00 |
| SMS - words (Max: 88) | 5.00 | 6.00 | 8.00 | 5.00 |
| Groping | 7.00 | 4.00 | 6.00 | 1.00 |
| Disfluencies | 2.00 | 2.00 | 3.00 | 0.00 |
| Weak precision | 28.00 | 42.00 | 28.00 | 0.00 |
| E. Sentence level praxis assessment | | | | |
| SMS - sentence (Max: 16) | 2.00 | 0.00 | 1.00 | 0.00 |
| PCC | 33.30 | - | 33.33 | - |
| PVC | 40.00 | - | 66.67 | - |
| Sentence length | 1.00 | NR | 1.00 | NR |
| F. Analysis of Spontaneous speech | | | | |
| Phonotactic assessment | | | | |
| 1. Number of utterances | 88.00 | 147.00 | 103.00 | 25.00 |
| 1. Number of different syllable shapes | 17.00 | 28.00 | 17.00 | 11.00 |
| 1. Monosyllables | 61.90 | 67.35 | 37.62 | 52.00 |
| 1. Disyllables | 36.90 | 27.89 | 59.41 | 44.00 |
| 1. Trisyllables | 1.19 | 4.76 | 2.97 | 4.00 |
| 1. Initial geminate | 6.25 | 0 | 5.41 | 0.00 |
| 1. Initial non-geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| 1. Medial geminate | 68.75 | 81.82 | 43.24 | 100.00 |
| 1. Medial non-geminate | 25.00 | 9.09 | 51.35 | 0.00 |
| 1. Final geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| 1. Final non-geminate | 0.00 | 9.09 | 0.00 | 0.00 |
| PCC | 75.00 | 47.13 | 47.37 | - |
| PVC | 55.74 | 38.71 | 41.49 | - |
| Groping | 4.00 | 9.00 | 12.00 | 4.00 |
| Disfluencies | 3.00 | 4.00 | 8.00 | 1.00 |
| Weak precision | 39.00 | 63.00 | 55.00 | 8.00 |

*Scores obtained by the participants with sAOS associated with ELD:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Domains & sub domains | Participant code | | | |
| E | F | G | H |
| I. Oral motor skills | | | | |
| A. Oral structures at rest (Max: 16) | 16.00 | 16.00 | 14.00 | 16.00 |
| B. Function of the oral mechanism for speech (Max:6) | 4.00 | 2.00 | 2.00 | 4.00 |
| II. Oral praxis skills | | | | |
| A. Isolated oral movements | 40.00 | 42.00 | 42.00 | 49.00 |
| B. Sequential oral movements | | | | |
| MCS (Max: 10) | 0.00 | 1.00 | 0.00 | 6.00 |
| SMS (Max: 10) | 0.00 | 0.00 | 0.00 | 2.00 |
| III. Verbal praxis skills | | | | |
| A. Isolated verbal movements | 36.00 | 42.00 | 36.00 | 44.00 |
| B. Sequential verbal movements | | | | |
| MCS (Max: 14) | 0.00 | 7.00 | 7.00 | 4.00 |
| SMS (Max: 14) | 0.00 | 2.00 | 3.00 | 3.00 |
| C. Diadochokinetic (DDK) tasks | - | - | - | - |
| D. Word Level praxis assessment | | | | |
| Number of words attempted | 20.00 | 44.00 | 38.00 | 41.00 |
| Phonological process assessment | | | | |
| 1. Frequency | 94.00 | 205.00 | 168.00 | 308.00 |
| 1. Space Errors | 47.00 | 100.00 | 87.00 | 161.00 |
| 1. Timing Errors | 9.00 | 15.00 | 9.00 | 38.00 |
| 1. Whole Word Errors | 38.00 | 90.00 | 72.00 | 109.00 |
| SMS - words (Max: 88) | 8.00 | 6.00 | 9.00 | 3.00 |
| Groping | 3.00 | 6.00 | 3.00 | 9.00 |
| Disfluencies | 0.00 | 3.00 | 2.00 | 2.00 |
| Weak precision | 25.00 | 37.00 | 29.00 | 57.00 |
| E. Sentence level praxis assessment | | | | |
| SMS - sentence (Max: 16) | 0.00 | 0.00 | 2.00 | 2.00 |
| PCC | - | - | 39.13 | 53.85 |
| PVC | - | - | 50 | 41.67 |
| Sentence length | 1-2 | 1-6 | 1-4 | 1-6 |
| F. Analysis of Spontaneous speech | | | | |
| Phonotactic assessment | | | | |
| 1. Number of utterances | 82.00 | 52.00 | 51.00 | 79.00 |
| 1. Number of different syllable shapes | 21.00 | 12.00 | 22.00 | 23.00 |
| 1. Monosyllables | 39.02 | 34.62 | 41.18 | 58.97 |
| 1. Disyllables | 57.32 | 59.62 | 50.98 | 37.18 |
| 1. Trisyllables | 3.66 | 5.77 | 7.84 | 3.85 |
| 1. Initial geminate | 20.00 | 0.00 | 0.00 | 15.00 |
| 1. Initial non-geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| 1. Medial geminate | 80.00 | 100.00 | 77.78 | 65.00 |
| 1. Medial non-geminate | 0.00 | 0.00 | 22.22 | 5.00 |
| 1. Final geminate | 0.00 | 0.00 | 0.00 | 15.00 |
| 1. Final non-geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| PCC | 52.17 | 20.00 | 55.81 | 52.00 |
| PVC | 63.21 | 49.18 | 46.48 | 68.6 |
| Groping | 0.00 | 2.00 | 1.00 | 0.00 |
| Disfluencies | 2.00 | 0.00 | 0.00 | 1.00 |
| Weak precision | 24.00 | 35.00 | 26.00 | 42.00 |

*Scores obtained by the participants with sAOS associated with Autism:*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Domains & sub domains | Participant code | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I | J | | | | | | | | | | K | | | | | | | | | | L | | | | | M | | | | | | | N | | | |
| I. Oral motor skills | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A. Oral structures at rest (Max: 16) | 9.00 | | 13.00 | | | | | | | | | | 12.00 | | | | | | | | | | 16.00 | | | | | 15.00 | | | | | | | | | 13.00 |
| B. Function of the oral mechanism (Max: 6) | 1.00 | | 0.00 | | | | | | | | | | 1.00 | | | | | | | | | | 1.00 | | | | | 1.00 | | | | | | | | | 0.00 |
| II. Oral praxis skills | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A. Isolated oral movements | 3.00 | | 6.00 | | | | | | | | | | 7.00 | | | | | | | | | | 8.00 | | | | | 14.00 | | | | | | | | | 12.00 |
| B. Sequential oral movements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCS (Max: 10) | 0.00 | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | | | | | | | 0.00 |
| SMS (Max: 10) | 0.00 | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | | | | | | | 0.00 |
| III. Verbal praxis skills | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A. Isolated verbal movements | 26.00 | | 28.00 | | | | | | | | | | 19.00 | | | | | | | | | | 25.00 | | | | | 33.00 | | | | | | | | | 30.00 |
| B. Sequential verbal movements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCS (Max:14) | 1.00 | | 2.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 5.00 | | | | | | | | | 8.00 |
| SMS (Max:14) | 0.00 | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | | | | | | | 2.00 |
| C. Diadochokinetic (DDK) tasks | - | | - | | | | | | | | | | - | | | | | | | | | | - | | | | | - | | | | | | | | | - |
| D. Word Level praxis assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of words attempted | 9.00 | | | 44.00 | | | | | | | | | | 11.00 | | | | | | | | | | 15.00 | | | | | | | | | 44.00 | | | | 12.00 |
| Phonological process assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Frequency | 23.00 | | | | 286.00 | | | | | | | | | | 56.00 | | | | | | | | | | | 46.00 | | | | | | | 239.00 | | | | 42.00 |
| 1. Space Errors | 6.00 | | | | 194.00 | | | | | | | | | | 39.00 | | | | | | | | | | | 17.00 | | | | | | | 124.00 | | | | 22.00 |
| 1. Timing Errors | 0.00 | | | | 33.00 | | | | | | | | | | 5.00 | | | | | | | | | | | 2.00 | | | | | | | 12.00 | | | | 2.00 |
| 1. Whole Word Errors | 17.00 | | | | 59.00 | | | | | | | | | | 12.00 | | | | | | | | | | | 27.00 | | | | | | | 103.00 | | | | 18.00 |
| SMS - words (Max: 88) | 0.00 | | | | | 6.00 | | | | | | | | | | 7.00 | | | | | | | | | | 3.00 | | | | | | 9.00 | | | | 2.00 | |
| Groping | 2.00 | | | | | 19.00 | | | | | | | | | | 4.00 | | | | | | | | | | 7.00 | | | | | | 7.00 | | | | 6.00 | |
| Disfluencies | 0.00 | | | | | 5.00 | | | | | | | | | | 0.00 | | | | | | | | | | 2.00 | | | | | | 0.00 | | | | 1.00 | |
| Weak precision | 0.00 | | | | | 66.00 | | | | | | | | | | 7.00 | | | | | | | | | | 2.00 | | | | | | 16.00 | | | | 5.00 | |
| E. Sentence level praxis assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SMS - sentence (Max: 16) | 0.00 | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | 0.00 | | | | | 1.00 | | | | | 3.00 | |
| PCC | - | | | | | | 30.00 | | | | | | | | | | - | | | | | | | | | - | | | | | 66.67 | | | | | - | |
| PVC | - | | | | | | 0.00 | | | | | | | | | | - | | | | | | | | | - | | | | | 66.67 | | | | | - | |
| Sentence length | NR | | | | | | 1-3 | | | | | | | | | | NR | | | | | | | | | NR | | | | | 1-6 | | | | | 1-3 | |
| F. Analysis of Spontaneous speech | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Phonotactic assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Number of utterances | 17.00 | | | | | | | 28.00 | | | | | | | | | | 25.00 | | | | | | | | 20.00 | | | | | 37.00 | | | | | 20.00 | |
| 1. Number of different syllable shapes | 7.00 | | | | | | | 10.00 | | | | | | | | | | 8.00 | | | | | | | | 9.00 | | | | | 15.00 | | | | | 10.00 | |
| 1. Monosyllables | 52.94 | | | | | | | 60.71 | | | | | | | | | | 44.00 | | | | | | | | 65.00 | | | | | 27.03 | | | | | 25.00 | |
| 1. Disyllables | 35.29 | | | | | | | 35.71 | | | | | | | | | | 56.00 | | | | | | | | 35.00 | | | | | 67.57 | | | | | 55.00 | |
| 1. Trisyllables | 11.76 | | | | | | | 3.57 | | | | | | | | | | 0.00 | | | | | | | | 0.00 | | | | | 5.41 | | | | | 15.00 | |
| 1. Initial geminate | 0.00 | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | 0.00 | | | | | 0.00 | | | | | 0.00 | |
| 1. Initial non-geminate | 0.00 | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | | | | 0.00 | | | | | 0.00 | | | | | 0.00 | |
| 1. Medial geminate | 0.00 | | | | | | | | 100.00 | | | | | | | | | | 0.00 | | | | | | | 0.00 | | | | 100.00 | | | | | | 100.00 | |
| 1. Medial non-geminate | 0.00 | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | | 0.00 | | | | | | 0.00 | | |
| 1. Final geminate | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | 0.00 | | | | | | 0.00 | | |
| 1. Final non-geminate | 0.00 | | | | | | | | | | 0.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | 0.00 | | | | | | 0.00 | | |
| PCC | - | | | | | | | | | | - | | | | | | | | | | - | | | | | - | | | - | | | | | | - | | |
| PVC | - | | | | | | | | | | - | | | | | | | | | | - | | | | | - | | | - | | | | | | - | | |
| Groping | 0.00 | | | | | | | | | | 2.00 | | | | | | | | | | 4.00 | | | | | 2.00 | | | 2.00 | | | | | | 2.00 | | |
| Disfluencies | 0.00 | | | | | | | | | | 2.00 | | | | | | | | | | 0.00 | | | | | 0.00 | | | 0.00 | | | | | | 0.00 | | |
| Weak precision | 12.00 | | | | | | | | | | 18.00 | | | | | | | | | | 5.00 | | | | | 3.00 | | | 19.00 | | | | | | 15.00 | | |

*Scores obtained by the participants with sAOS associated with DCD:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Domains & sub domains | Participant code | | | |
| O | P | Q | R |
| I. Oral motor skills | | | | |
| A. Oral structures at rest (Max: 16) | 9.00 | 1.00 | 13.00 | 11.00 |
| B. Function of the oral mechanism for speech (Max: 6) | 1.00 | 0.00 | 1.00 | 0.00 |
| II. Oral praxis skills | | | | |
| A. Isolated oral movements | 26.00 | 10.00 | 9.00 | 9.00 |
| B. Sequential oral movements | | | | |
| MCS (Max: 10) | 2.00 | 0.00 | 0.00 | 0.00 |
| SMS (Max: 10) | 0.00 | 0.00 | 0.00 | 2.00 |
| III. Verbal praxis skills | | | | |
| A. Isolated verbal movements | 57.00 | 27.00 | 9.00 | 10.00 |
| B. Sequential verbal movements | | | | |
| MCS (Max: 14) | 7.00 | 2.00 | 0.00 | 0.00 |
| SMS (Max: 14) | 5.00 | 0.00 | 0.00 | 0.00 |
| C. Diadochokinetic (DDK) tasks | - | - | - | - |
| D. Word Level praxis assessment | | | | |
| Number of words attempted | 33.00 | 12.00 | 12.00 | 5.00 |
| Phonological process assessment | | | | |
| 1. Frequency | 127.00 | 57.00 | 57.00 | 20.00 |
| 1. Space Errors | 73.00 | 34.00 | 40.00 | 13.00 |
| 1. Timing Errors | 12.00 | 2.00 | 4.00 | 0.00 |
| 1. Whole Word Errors | 42.00 | 21.00 | 13.00 | 7.00 |
| SMS - words (Max: 88) | 25.00 | 1.00 | 4.00 | 0.00 |
| Groping | 3.00 | 10.00 | 4.00 | 5.00 |
| Disfluencies | 1.00 | 1.00 | 2.00 | 0.00 |
| Weak precision | 25.00 | 5.00 | 12.00 | 0.00 |
| E. Sentence level praxis assessment | | | | |
| SMS - sentence (Max: 16) | 1.00 | 0.00 | 0.00 | 1.00 |
| PCC | 47.06 | 33.33 | - | - |
| PVC | 46.15 | 0.00 | - | - |
| Sentence length | 1-4 | 1 | NR | NR |
| F. Analysis of Spontaneous speech | | | | |
| Phonotactic assessment | | | | |
| 1. Number of utterances | 100.00 | 51.00 | 45.00 | 64.00 |
| 1. Number of different syllable shapes | 28.00 | 13.00 | 16.00 | 11.00 |
| 1. Monosyllables | 48.00 | 64.71 | 19.00 | 62.5 |
| 1. Disyllables | 47.00 | 35.29 | 21.00 | 32.81 |
| 1. Trisyllables | 5.00 | 0.00 | 3.00 | 4.69 |
| 1. Initial geminate | 7.89 | 14.29 | 0.00 | 0.00 |
| 1. Initial non-geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| 1. Medial geminate | 84.21 | 71.43 | 81.25 | 75.00 |
| 1. Medial non-geminate | 5.26 | 14.29 | 18.75 | 25.00 |
| 1. Final geminate | 2.63 | 0.00 | 0.00 | 0.00 |
| 1. Final non-geminate | 0.00 | 0.00 | 0.00 | 0.00 |
| PCC | 67.58 | 19.35 | - | 49.09 |
| PVC | 75.00 | 43.75 | - | 36.36 |
| Groping | 10.00 | 15.00 | 4.00 | 7.00 |
| Disfluencies | 4.00 | 3.00 | 1.00 | 1.00 |
| Weak precision | 35.00 | 29.00 | 13.00 | 35.00 |