Integrating Phonological Component Analysis with Language Therapy for Pediatric Acquired Aphasia

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Abstract: *This case study presents a 7-year-old girl diagnosed with Acquired Childhood Aphasia (ACA) post-stroke, resulting in severe language and cognitive impairments. Treatment with Phonological Component Analysis (PCA) and language therapy led to significant improvements, suggesting PCA as a promising intervention for ACA, where established treatments for ACA are still lacking.*

Keywords: Stroke, Childhood aphasia, Language Impairment, Phonology-based intervention, and Language therapy.

1. Introduction

Acquired childhood aphasia (ACA) refers to language impairment that arises after normal language development, often resulting from brain injury due to epilepsy, stroke, infections, or head trauma (1,3). Children typically develop speech and language skills by the age of two, but ACA can manifest as difficulties in word retrieval, syntax, and comprehension following neurological events (2). The severity of these impairments depends on the location and extent of brain injury (3). ACA can be focal, affecting specific language domains, or generalized, impacting multiple areas of communication. Factors such as underlying causes, pre-existing language skills, and disrupted language development also play a role in symptom severity (2).

While aphasia in adults has been well studied, there is a notable gap in research on ACA, making its diagnosis and treatment more challenging. Childhood aphasia can have significant repercussions on a child's academic performance, social interactions, and overall quality of life (4). Early intervention is critical for improving outcomes, yet many children remain undiagnosed or are misdiagnosed. This study aims to bridge these gaps by examining a detailed case study of ACA, focusing on effective diagnostic strategies and therapeutic interventions. Through this research, we hope to provide valuable insights to advance clinical practices in pediatric speech and language pathology.

2. Case Report

A 7-year-old girl was referred to the Department of Speech and Hearing with concerns regarding reduced speech output following her second episode of stroke. Her parents observed diminished verbal communication, with the child primarily using single-word responses and struggling to recall object names. There was no significant prenatal history, and the perinatal period was unremarkable, with a normal birth cry, absence of cyanosis, and appropriate birth weight. Her postnatal history included recurrent colds and fevers monthly, but there were no known hereditary conditions or disabilities in her family. Developmentally, the child met all motor and speech milestones appropriate for her age. She had positive social interactions and was enrolled in a regular school where she performed satisfactorily in English.

The child initially experienced a transient ischemic stroke in early August 2023, with no lasting speech or language difficulties. However, her second episode, an acute ischemic stroke in the third week of August 2023, led to a 4-day ICU admission and a period of mutism, followed by reduced speech output. Magnetic resonance imaging (MRI) revealed a chronic infarct affecting the left fronto-parieto-temporal lobe, left basal ganglia, and left insula in the MCA territory, with encephalomalacic changes in the basal ganglia and corona radiata, as well as critical stenosis of the left M1 branch of the MCA. Poststroke, she exhibited right hemiplegia and started receiving physiotherapy and occupational therapy.

An oral peripheral mechanism examination (OPME) revealed slight deviation and facial drooping on the right side, where the other articulators were structurally and functionally normal. Language evaluation revealed stronger comprehension abilities than expressive abilities. The child could follow simple instructions, recognize relationships, and identify common lexical categories. In terms of expression, she often communicates nonverbally through actions but can express basic needs, names, and simple vocabulary.

Standardized language assessments using the Assessment of Language Development (ALD) (5) indicated a receptive language age of 6- 7 years but an expressive language age of 24- 30 months. The Development of Cognitive Linguistic Assessment Protocol for Children (CLAP-C) (6) and the Children Acquired Aphasia Screening Test in Kannada (CAAST-K) (7) were used to assess cognition and provide a definitive diagnosis. The provisional diagnosis was acquired childhood aphasia, a condition where cognitive, motor, and language impairments often overlap. Therefore, a multidomain approach was employed: (1) profiling the child across various domains, (2) setting goals within each domain,

and (3) executing these goals by integrating multiple target skills into functional activities.

The child underwent intensive speech therapy for 30 sessions over two months, focusing on cognitive skills, word retrieval, syntax, and pragmatics. The phonological component analysis (PCA) approach was used to enhance the child's word retrieval through auditory analysis. The therapy involved breaking down words into their phonological components, including initial sounds, rhyming words, syllables, and final sounds.
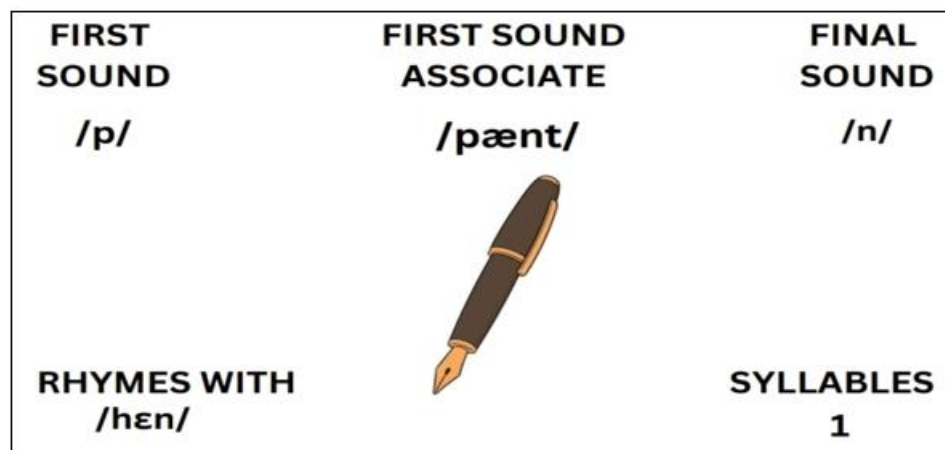

Figure 1: Example of the phonological component analysis chart

The skills and goals worked on during the therapy sessions are mentioned in Table 1.

Table 1: Language therapeutic skills, goals, and progress

S. No	Domains	Skill	Goal	Progress
1	Cognitive	Working Memory, Decision Making	Improve word recall and decision-making accuracy.	Able to memorize 2-3 words with 40% accuracy. Decision-making improved with 50% accuracy.
2	Word Retrieval	Awareness of phonological properties of words	Enhance word retrieval by focusing on phonological features.	Word retrieval improved by 30%.
3	Syntactic	Use of possessive markers, plurals, and correct word order	Improve the use of possessive markers, plurals, and sentence structure.	Able to form 3–4-word sentences using possessive markers and plurals with 50% accuracy.
4	Pragmatic	Narration (describing daily routine)	Improve ability to narrate daily routines in simple sentences.	Able to narrate 3-4 sentences of daily routine with 30% accuracy.

The ethical considerations were maintained, and the patient's parents granted informed consent for the report's publication.

3. Discussion

Despite numerous efforts over the years to categorize Acquired Childhood Aphasia using the adult classification system, these attempts have not yielded successful results. (8) This case study highlights the significant impact of phonological component analysis (PCA) in improving language and cognitive skills in a child with acquired childhood aphasia (ACA). Unlike adult aphasia, the recovery process in children tends to be more rapid and complete,

which makes them more responsive to intensive language interventions. (9) Despite PCA being originally designed for adult aphasia, it was successfully adapted for this young patient, demonstrating notable improvements in cognitive, word retrieval, syntactic, and pragmatic skills.

The prognosis was meticulously evaluated through pretherapy assessment and posttherapy assessment via the standardized assessment tools ALD (5), CLAP-C (6), and CAAST-K (7) all of which indicated a notable improvement across the assessed domains. The personalized tailor-made intervention approach led to a clear progression in the child's abilities, particularly in word retrieval and sentence formation, within just two months of therapy.
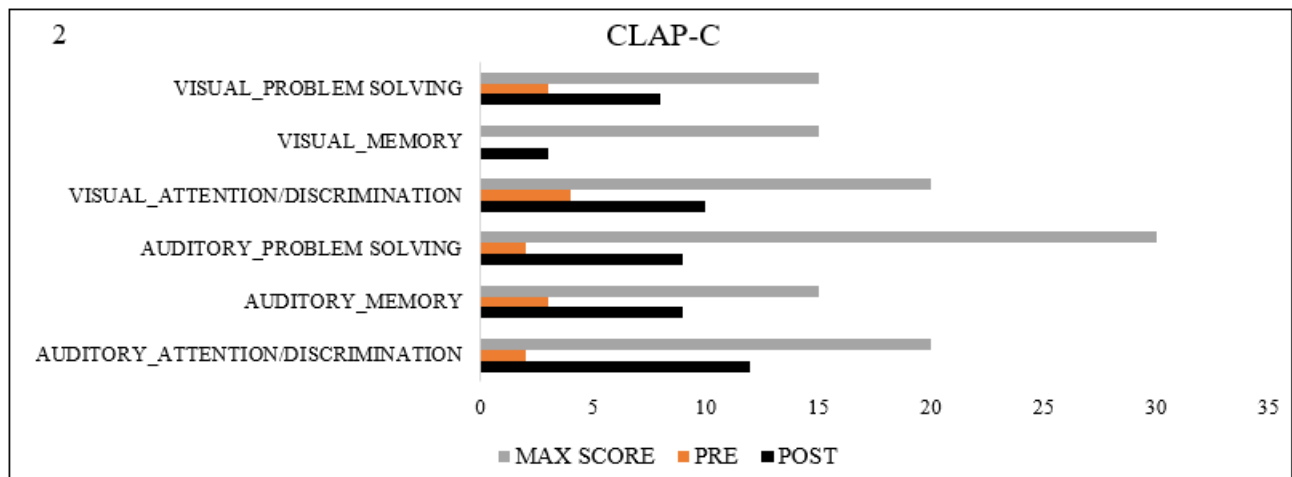
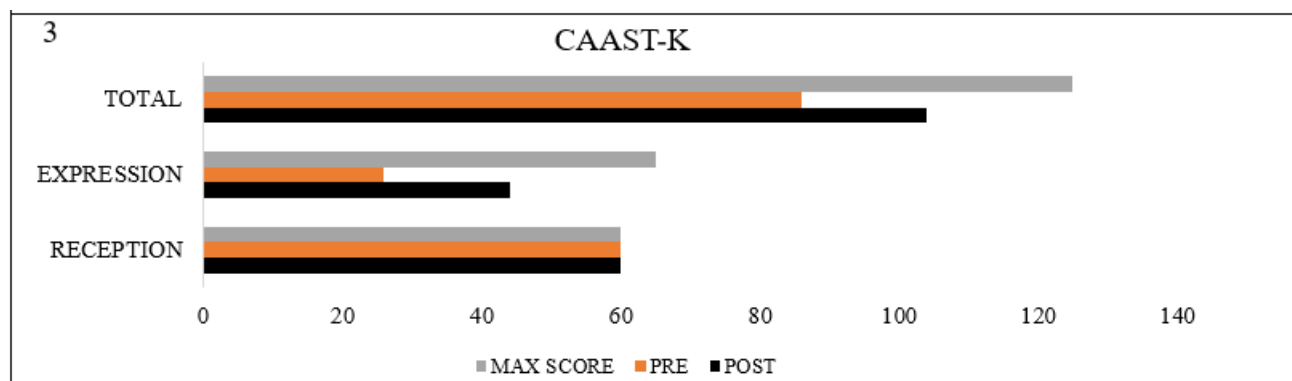**Figure 2:** Pre- and Post- scores of the CLAP-C

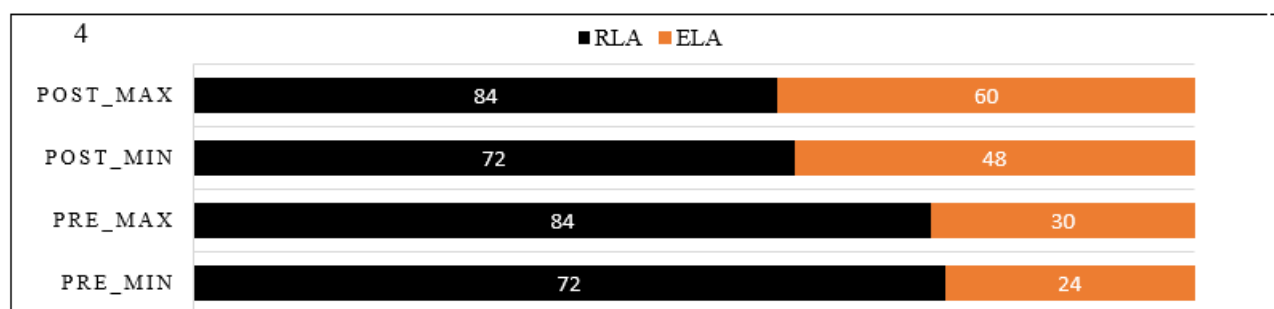

Figure 3: Pre- and post- CAAST-K scores

Figure 4: Pre- and post- ALD scores

In conclusion, the application of PCA in this case proves to be an effective treatment for ACA, highlighting its versatility and adaptability beyond its initial design for adult aphasia. Additionally, the success of the therapy underscores the importance of a multidisciplinary approach as well as family involvement to support the child's recovery.

However, the study's short duration of therapy and limited follow-up represent its main limitations. Future research should focus on further refining PCA for pediatric use, and exploring the long-term effects of personalized therapy methods. Larger-scale studies would provide valuable insights into the efficacy of PCA and similar treatments for children with ACA.

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Consent to Publish: Informed consent from the child's mother was obtained for case report submission.

Ethics declarations: The study received ethical clearance from Father Muller Charitable Institutions (FMCI) (FMMCIEC/CCM/057/2025)

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