

Brief Research Communication

Efficacy of PASS Reading Enhancement Programme on Neuropsychological Functions of a Child with Mild Vascular Neurocognitive Disorder and Comorbid Attention Deficit Hyperactivity Disorder: A Case Study

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ABSTRACT

Background: PASS Reading Enhancement Programme (PREP), a reading enhancement tool focusing on successive and simultaneous processing tasks, has been used successfully to improve the information processing strategies that underlie reading. The study explored the effects of training with successive processing task of PREP on various cognitive and neuropsychological functioning of an 8-year-old child with mild vascular neurocognitive disorder with comorbid attention deficit hyperactivity disorder. **Materials and Methods:** A pre–post intervention single case design was used. AIIMS Comprehensive Neuropsychological Battery in Hindi, Children's Form was used to assess the baseline performance on various neuropsychological domains. After 25 sessions of weekly outpatient-based training with PREP, reassessment was done using the same test battery. **Results:** Results indicated posttraining global improvement in the neuropsychological functioning like receptive and expressive speech, intellectual processes, memory, and reading and writing abilities. **Conclusion:** Cognitive remediation programs focusing on training in successive processing could be used in the enhancement of overall neuropsychological functioning in children with neurocognitive disorder.

Key words: Cognitive remediation, neuropsychological functions, PASS Reading Enhancement Programme
Key messages: The case study shows application of PASS Reading Enhancement Programme in Mild Vascular Neurocognitive Disorder with comorbid ADHD. It enhances several neuropsychological functioning and academic performance.


PASS Reading Enhancement Programme (PREP), a cognitive intervention program, is based on the PASS (planning, attention, simultaneous, and successive processing) model.^[1] Through its various tasks, PREP helps improve all the four areas – planning, attention,

simultaneous, and successive processing, though it mainly focuses on successive and simultaneous processing. The

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concept of three functional units (arousal unit of the reticular activating system; sensory input unit of the occipital, parietal, and temporal lobes; and the planning unit of the frontal and prefrontal areas) is used as the basis of the PASS model.^[2]

In a study, researchers suggested that a specific cognitive processing deficit called successive processing deficit is involved in word reading difficulty.^[3] They also suggested that the ability for language and comprehension is primarily related to simultaneous processing. Attention deficit hyperactivity disorder (ADHD) has also been found to be associated with planning deficit.^[4]

Studies also found significant improvement by PREP on a standard word-decoding test in children with decoding difficulties.^[5,6] Another study has shown significant improvement in reading tasks involving word reading and word decoding as well as passage comprehension following intervention using PREP in children identified as poor readers.^[7] Despite having ample of evidence in favor of PREP as a cognitive training program to improve reading ability, its efficacy in other academic functions like arithmetic, writing, and global neuropsychological functions, including motor, visual, tactile, and intellectual abilities; memory; receptive-expressive language and so on; have been less explored. In addition, it might be interesting to examine the usefulness of PREP in neurocognitive disorder, another less investigated area. In this study, an attempt was made to explore the effects of training in primarily successive processing tasks following PREP^[8] on neuropsychological functioning of a child with mild vascular neurocognitive disorder with comorbid ADHD, combined presentation. Since PREP is based on the three functional units,^[2] which encompass the major neuropsychological domains, it was selected for the present case to evaluate its effects on neuropsychological functioning.

MATERIALS AND METHODS

Study design

A pre–post intervention single case design was used to evaluate the effects of training.

Case history

Ms. S.R., an 8-year-old, Hindu, Bengali female, studying in class 2, with 4 years of formal education, belongs to an urban, nuclear family of middle socioeconomic status. Parents reported excessive restlessness, fidgeting, and a tendency to irritate others since around 2 years of age; poor concentration, a deficit in organized speech, and difficulty in reading and writing since around 4 years of age; and significant difficulty in academics since around 6 years of age. The child had an acute nonhemorrhagic infarct in the left basal ganglia at 3 years 2 months of age, due to which

there was a weakness in the right side of the body (right hemiparesis), deviation in the angle of the mouth, and impairment of speech for around 2–3 weeks. However, she recovered with the help of medication (aspirin) and physiotherapy, and within around 6 months, she was able to resume her previous functioning. Following this, difficulty in sustaining attention, organized speech, reading, and writing was observed, and restlessness was continuing. She had difficulty in remembering the sounds of all alphabets, particularly the vowels, and in combining the sounds of the alphabets to read the word. She had difficulty pronouncing words and remembering spellings, had a tendency to reverse letters like b and d while writing, and used to say one letter and write another, like saying c and writing k. She used to add or omit letters and take a long time and hesitate while reading or writing. She also had difficulty constructing sentences and made grammatical errors. The difficulties were found in both English and Bengali. The child had deficits in expressing in an organized manner, particularly while narrating any incidents. None of these deficits, except the hyperactivity symptoms, was present before the episode of the cerebrovascular attack (CVA), and the symptoms started after acute CVA. From 6 years of age, her academic performance other than in maths started deteriorating significantly. The restlessness has been improving for around 6 years, although no medical management was taken. However, the academic difficulties were showing a deteriorating progress.

There was no history suggestive of delayed motor or speech milestones, deficit in social interactions, or persistently defiant or disruptive behavior. The child was under aspirin from 3–6 years of age. However, no medical or psychological management for hyperactivity, inattention, or learning difficulty was taken. She had a family history of migraine in father and hypertension in mother. Personal history revealed that she had few friends of the same age level. She had an easy general temperament. She had a medical history of respiratory distress at 3 years 8 months of age. Birth and developmental history indicated the presence of maternal hypertension in the prenatal stage, a child born of full-term normal delivery, and the presence of perinatal jaundice. Current developmental status was age-appropriate.

Mental status examination revealed well-kempt and tidy appearance, good eye contact, and easily established rapport. Motor behavior was indicative of hyperactivity, with adequate receptive and expressive speech. Attention was easily aroused but difficult to sustain. Remote and recent memory were intact, but immediate memory was impaired. Her general intellectual functioning was average. Affect was stable, with normal thought and perception.

On psychological assessment, she had average intelligence (IQ = 95), with a significant deficit in reading and writing (as assessed on NIMHANS Index of Specific Learning Disabilities).^[9] Significant inattention and hyperactive features were evident in Abbreviated Conners' Rating Scale for parent (score = 20).^[10]

The child was diagnosed as 331.83 mild vascular neurocognitive disorder with 314.01 ADHD, combined presentation according to DSM-5.^[11] Additional diagnosis of specific learning disorder was not considered due to the presence of organic brain damage.

Psychopathology formulation

Figure 1 shows that features of difficulty in sustaining attention, getting easily distracted, and not seeming to listen when spoken to, which are indicative of inattention, may be due to dysfunction in Unit 1 – arousal unit, which is associated with the brain stem, diencephalon, and medial regions of the cortex. Features of difficulty in following instructions and in reading, making spelling mistake, and difficulty in understanding meaning of sentences, which are indicative of learning difficulties, may be due to dysfunction in Unit 2 – sensory input unit, which is associated with the parietal, occipital, and temporal lobe.

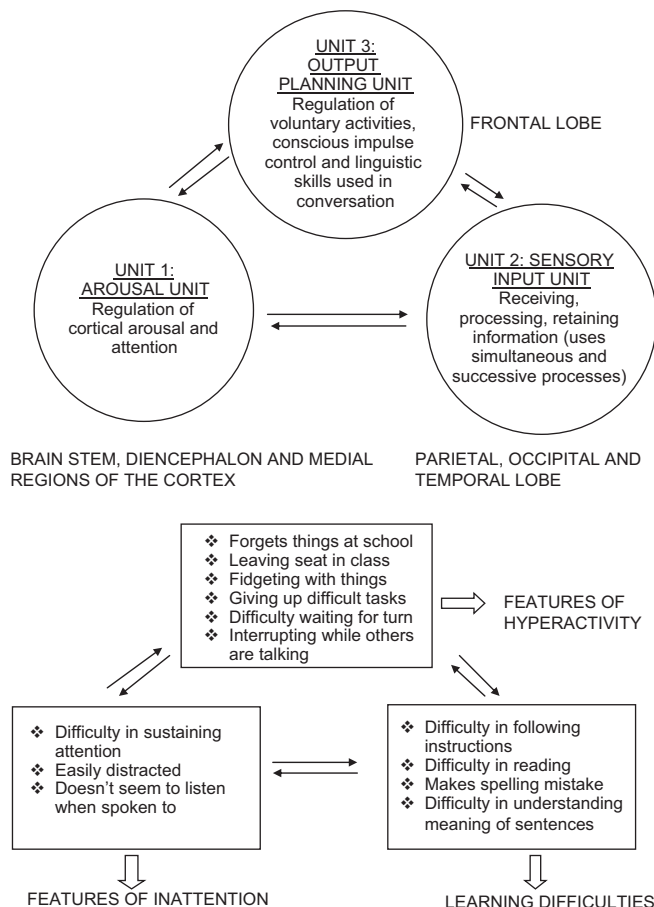


Figure 1: Etiological explanation of the case

and temporal lobes. Finally, the features of forgetting things at school, leaving the seat in the class, fidgeting with things, giving up difficult tasks, difficulty waiting for the turn, and interrupting while others are talking, which are indicative of hyperactivity, may be due to dysfunction in Unit 3 – output planning unit, which is associated with the frontal lobe.

Pre-intervention assessment (baseline assessment)

AIIMS Comprehensive Neuropsychological Battery in Hindi, Children's Form,^[12] which is applicable for children having a minimum of 8 years of age and 3 years of education, was administered as a baseline measure. This battery is based on Luria's concept of three functional units, with various neuropsychological domains assessing the functioning of these units. The cognitive intervention program selected for the present case is based on the PASS model whose basis is again Luria's concept, and it focuses on improving the cognitive processes involved in the functioning of these units. Although the tool demands 3 years of education and the child was studying in class 2, it was still considered, as the child had 4 years of formal educational exposure including nursery and there is no equivalent test available for the given age. Only raw scores were calculated to assess the baseline level of functioning.

Intervention

Pass Reading Enhancement Programme

PREP involves a global training component, which consists of structured nonreading tasks based on successive and simultaneous strategies, and a curriculum-related bridging component, which involves simultaneous and successive processing strategies that are closely linked to reading and writing. There are four successive and four simultaneous processing tasks as per the 2005 revised research edition.^[8] The successive processing tasks include joining shapes, connecting letters, related memory, and window sequencing. The simultaneous processing tasks include tracking, shapes and objects, shape design, and sentence verification. The tasks are further divided into three difficulty levels that allow the child to progress in strategy development.

Attention and planning are important aspects of the tasks in the programme as attention is required to perform each task, and planning skill is developed by encouraging the children to discuss their strategies and solutions both during and following each task.

Sessions

In all, 25 sessions were conducted which focused on successive processing tasks. The sessions were held once a week in the hospital outpatient department in a government setup. The sessions consisted of tasks

namely joining shapes, connecting letters, related memory, and window sequencing. Each task had a global and a curriculum-based bridging component and three prompt levels to attain mastery. If the child gained mastery in the first prompt level, training moved on to the next task. No retraining at home was advised. The sessions lasted for approximately 45 minutes.

Post-intervention assessment

AIIMS Comprehensive Neuropsychological Battery in Hindi, Children's Form^[12] was again administered after 25 sessions of cognitive intervention on successive processing tasks.

RESULTS

Table 1 and Figure 2 indicate that after the training, there was an improvement in the functioning in the neuropsychological domains. The raw scores in the post-intervention assessment were considerably lower than the scores before intervention, indicating lesser dysfunction and thus an improvement in functioning. Distinct improvement was seen in the domains of receptive and expressive speech, reading, writing, arithmetic, memory, and intellectual processes along with the motor and tactile domains and the total score. Improvement was also observed in the school performance as reported by the parents, and significant improvement was noticed in examination grade too. Parents also reported enhancement in reading and writing skills of the child.

DISCUSSION

The purpose of this case study was to explore the effects of training, primarily in successive processing tasks

Table 1: AIIMS Comprehensive Neuropsychological Battery in Hindi, Children's Form: profile of scores

Function scales	Raw score		Percentage of improvement in dysfunction
	Preintervention assessment	Postintervention assessment	
Motor	39	16	59
Tactile	11	5	55
Visual	7	4	43
Receptive speech	4	0	100
Expressive speech	12	1	92
Reading	35	10	71
Writing	34	5	85
Arithmetic	19	7	63
Memory	23	2	91
Intellectual process	20	2	90
Left hemisphere	41	16	61
Right hemisphere	32	13	59
Pathognomonic	22	9	59
Total scale	207	53	74

following PREP, on neuropsychological functions of an 8-year-old child with mild vascular neurocognitive disorder with comorbid ADHD, combined presentation. Pre and post-intervention scores showed positive effects of PREP on the neuropsychological functioning of the child, indicating improvement in the various neuropsychological domains after training. From these findings, it can be said that the cognitive processes underlying the tasks included in the management programme (i.e., successive processing, attention, and planning) work on facilitating the functioning of the three functional units of Luria's model in cases of mild neurocognitive disorders as well. Thus, it helps improve neuropsychological functioning following vascular impairment. Various studies have shown improvement in word reading, word decoding, and comprehension following training in PREP in children with reading deficits.^[5-7] This not only may show involvement of cognitive processes in learning problems as indicated by improvement in reading, writing, and arithmetic domains in AIIMS Comprehensive Neuropsychological Battery but also may indicate the applicability of the program in other neurocognitive conditions including speech.

However, this case study has some limitations. Simultaneous processing task could not be tried due to time limitation. NIMHANS Index of SLD and Abbreviated Conner's Rating Scale for parents could have been used during the post-intervention assessment. Moreover, this is a single case study and hence it has limited generalizability. A controlled trial of PREP module on similar cases might lead to more conclusive findings as changes in the post-intervention scores owing to normal development could not be eliminated.

CONCLUSION

Cognitive remediation programs focusing on training in successive processing are useful in improving deficits

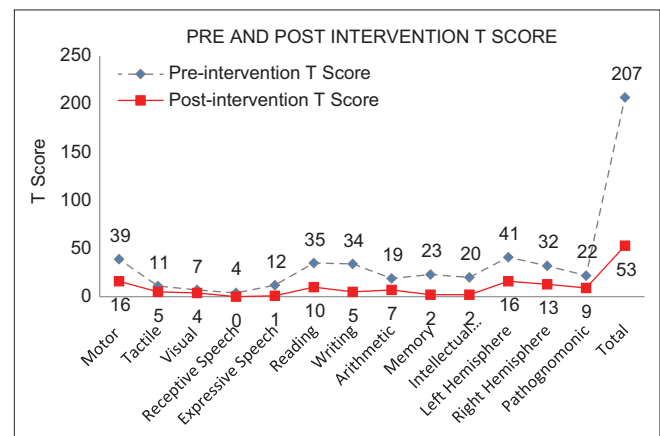


Figure 2: Pre and post intervention scores AIIMS Comprehensive Neuropsychological Battery in Hindi, Children's Form

in neuropsychological functioning following vascular impairment. Hence, the underlying cognitive factors may be responsible for the learning difficulties. Thus, PREP is beneficial and can be effectively used as a remediation program in neuropsychological dysfunction following vascular impairment.

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Conflicts of interest

There are no conflicts of interest.

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