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# A Case History of a Child with Articulo-Graphic Dyslexia (AGD): A Brief Investigation and Intervention

Chia Kok Hwee, M.Ed

Articulo-graphic dyslexia (or AGD in short) is one particularly rare dyslexic subtype. According to Chia (2000), it belongs to the category of developmental dysnemiaphonesia (a secondary developmental dyslexic subtype) with dyspraxic problems in speech and graphomotor control. It comprises a small group (16%) of all the dyslexic cases (Westman, 1996). Because it is rare, children with AGD are often left unnoticed or it is mistaken for some other learning problems.

AGD has been identified and classified by Westman (1990, 1996) as the fourth dyslexic subtype in his proposed paradigm of the developmental dyslexia, which comprises four subtypes: (1) vestibulo-cerebellar dyslexia (VCD), with motor difficulty in visually tracking words; (2) visuo-spatial dyslexia (VSD), with cognitive difficulty in recognizing words; (3) auditory-linguistic dyslexia (ALD), with language difficulty in comprehending the meaning of words; and (4) articulo-graphic dyslexia (AGD), with motor difficulty in spelling and writing accurately.

However, AGD is not new, nor has it been just recently discovered. In fact, it has been known by a different name—developmental articulatory dyspraxia (Brian, 1961; Williams, 1970, 1974). Children with AGD manifest symptoms of dyspraxia. AGD is also known as articulo-graphic dyspraxia (Westman, 1996). Dyspraxia is an immaturity or impairment in the organization and planning of controlled movements with associated problems of visual perception, and, occasionally, communication (Teodorescu & Addy, 1996; Westman, 1996). There is a slippage between intention and execution.

## Symptoms of AGD

Westman (1996) has identified two key neurological defects in children with AGD. First, there are lesions found in the frontal lobe of the brain, and such lesions cause dyspraxic speech errors. For instance, an AGD child may mispronounce words, omit initial consonants or syllables, such as saying *air* instead of *pair*, and simplify consonant clusters, such as saying *ee* instead of *see*, *seep* instead of *sleep*. Second, the lesions on the temporal lobe of the brain cause transposition of the order of sounds and syllables in the AGD child's speech. For example, the AGD child may say "tragedy" instead of "tragedy."

There are also other neurological symptoms. One is a lack of rhythm, which may interfere with reading and speaking. The child may adopt certain coping strategies or

what Davis (1994) described as *compulsive solutions* to help in his reading, such as rushing through a given text or reading very slowly. Hence, there is often a loss of comprehension of what is read. Another neurological symptom concerns the jerky tremors that are related to basal ganglia dysfunctions (Westman, 1996). They are found to interfere with muscle movements throughout the body. These erratic movements affect reading when they involve the eye muscles and handwriting when they involve the hand and arm muscles. When they affect both, the result is poor eye-hand coordination.

Emotional symptoms are often caused by, and can mimic the symptoms of, AGD. Anxiety is the most common emotional problem experienced from continued frustration with learning failure. The child grows to develop a fear of encountering new situations because he anticipates failure. This leads to another problem: error phobias. As a result, the child will avoid tasks he thinks are difficult for him to perform or accomplish. He may choose to avoid performing certain tasks and be labeled incorrectly by his teachers as lazy or stupid.

Another emotional factor is low self-esteem. This often results from learning failure, and may make the child vulnerable to depression.

## A Case History

While previously working at the Lexington Learning Clinic, Singapore, as a senior educational therapist, I came across two cases of children with AGD. Both were boys, one aged 9 and the other, 7. They were assessed by a clinical psychologist at the National University Hospital, Singapore, and referred to the clinic for educational therapy. I shall discuss one of them, whom I refer to by the initials TKH.

TKH, age seven, has been described as a child who failed to make a start in reading despite being read to by his mother at an early age. The urge for further diagnosis of the child's learning disability came from his supportive but anxious parents and grandparents. The kindergarten teachers who had taught TKH were worried that a bright boy like him displayed such difficulty.

In class, although TKH's visuospatial perceptual skills are intact, he continues to display difficulty or trouble copying shapes or designs correctly despite recognizing the errors. Hence his penmanship legibility is impaired. Although his handwriting might have proper line orientation, it is illegible and there are numerous spelling errors. These errors are often letter omissions and perseveration resulting from fragmented, incomplete, and misplaced letters and syllables. TKH miswrites and misspells words because his hands do not faithfully carry out his intention. He also has difficulty copying accurately because of errors in transposing what he imagines into what he writes. In spite of this, TKH can recognize his errors when checking his written work.

In reading, TKH is unable to pronounce familiar words or to sound out unfamiliar ones. His phonological coding ability is impaired. Reading errors include omission and perseveration of letters and syllables. He also manifests

difficulty in the articulation and blending of word sounds when reading orally, but not when silently. However, when read to or with, TKH can recognize and comprehend meanings of words. TKH has difficulty writing spontaneously and to dictation; he displays problems putting ideas accurately down on paper.

### Results of Psychoeducational Assessment

A clinical psychologist administered the WISC-III. TKH's Verbal IQ (VIQ) was 131 and his Performance IQ (PIQ) was 127. The Full-Scale IQ (FSIQ) was 132. Although his PIQ was above average, it was lower than his VIQ, in spite of the fact that his highest score on the entire test was in block design (score = 19). TKH's performance score was lowered, mainly by his poorer achievement on object assembly (score = 10). His poor performance on the object assembly test suggests that he encountered some difficulty in visuo-spatial perception, severe enough to account for his reading difficulty. His competence on the block design test was indeed remarkable. According to his psychological report, TKH's execution of the Bender Visual Motor Gestalt Test was appropriate for his age of 7 years. He manifested some difficulty drawing a self-portrait.

A reading specialist from the School Psychological Service, Ministry of Education, Singapore, administered the Neale Analysis of Reading Ability. TKH's reading accuracy was 5 years 10 months, but his age-equivalent comprehension was age 8 years 5 months.

According to his mother, TKH is the only child in the family. His birth weight was 3500g. He was born after a prolonged labor, but the delivery was normal with Apgar scores of 9 (first 1 minute) and 10 (next 5 minutes). TKH crawled at 1 year 2 months and walked at about 20 months. His mother recalled that he began to talk rather late and could not feed himself with a spoon. TKH is now a noticeably clumsy child. He tends to knock things over and is unable to run as fast as his classmates. His peers often tease him when he is unable to keep up with them at play. When he was attending a Montessori play-school, his teachers noticed that he was slow to fasten the buttons on his shirt and was unable to tie his shoelaces. He felt awkward and frustrated when using a knife and a fork to eat and would avoid using them. He still prefers to be fed than to eat on his own.

A vision specialist at the National Eye Clinic assessed TKH's vision and found it normal. His hearing acuity, assessed by an audiologist in private practice, is also normal. However, TKH's articulation is notably weak. He mispronounces and misspeaks words, and it appears that his muscles involved in speech are not harmoniously coordinated. When speaking in moments of thrill or frustration, he becomes tongue-tied or has difficulty getting out words. He still shows many consonant substitutions and omissions. A neurological examination revealed mild left hemiparesis.

TKH belongs to the group of so-called "clumsy" children. His motor disability is most evident in speech, putting him into the category of children described by Brian (1961) and Williams (1974) as having developmental

articulatory dyspraxia. In other words, he displays symptoms of AGD. Although TKH continues to display difficulty in executing the movements needed for buttoning shirts and tying shoelaces, his visuo-spatial ability is within the range of normal development. His reading difficulty appears to be directly related to his poor articulation. The clinical psychologist has recommended a remedial reading intervention program linked with educational therapy, that stresses phonics training.

### Intervention Programs for Children with AGD

Several commercially produced language intervention programs are available on the market. One is the highly structured *Alpha-to-Omega* teaching program for dyslexic children (Hornsby and Shear, 1980). It follows the normal pattern of phonological and language acquisition. Every step progresses to the next. The child is not expected to read or write spelling patterns or language structures that have not yet been taught.

A similar language instruction program for dyslexic children is the *Language Tool Kit* (Rome and Osman, 1993), which I used to teach TKH. This intervention program is based on the principles of the Orton-Gillingham method. Each lesson begins with flash card drills on letter sounds/phonograms. There are 122 cards. Colored cards (blue, orange, and yellow) are guides for the teacher, not to be used with the child. The white cards—each with a letter sound/phonogram printed on one side and rules on the other—are used in drill work with the child. Spelling rules and patterns are covered in this program.

Another intervention program that I found to be highly effective in reducing TKH's dyspraxic problem was the *Teodorescu Perceptuo-Motor Programme* (Teodorescu and Addy, 1996). This program, originated in Romania, was developed by Professor Ion Teodorescu. It develops the intrinsic muscles in the AGD child's hand to help him gain the control required to form necessary letter shapes and to create appropriate spaces between words. It also develops perceptual skills required to orientate letters and organize them on the page. The program also consists of a carefully graded series of 410 graphic exercises to develop hand-eye coordination, form constancy, spatial organization, figure-ground discrimination, orientation, and laterality. This program is the only one of its kind available in Singapore. It is quite effective and helpful in teaching AGD children. Occupational therapists who use the program have found it helpful with dyspraxic children. The program will be described further in the next section.

### The Teodorescu Perceptuo-Motor Programme

The *Teodorescu Perceptuo-Motor Programme* is easy to use and does not require much preparation other than photocopying the worksheets. It contains eight booklets, divided into two books, containing a total number of 410 carefully graded graphic exercises. Each booklet deals with a number of specific skill areas. Book 1 is made up of four booklets that provide an introduction to aspects of percep-

tion including hand-eye coordination, figure-ground discrimination, form constancy, spatial relationships, and visual closure, all in a simple form. For instance, exercises on form constancy assist AGD children to experience the form of a circle, square, or triangle by repeatedly following dotted outlines. Other activities involve touch and movement necessary to establish the understanding of form, such as feeling the shape of a plate, or the outline of a ball or a steering wheel.

Book 2 expands on these areas by introducing combinations of graphic and perceptual exercises which include elements of fluency, rhythm, position in space,

orientation, symmetry, and laterality. A strong emphasis is placed on spatial organization, which involves aspects of sequence, space, orientation, size, and form. For instance, exercises in spatial organization provide a framework in which to develop visual organization. They begin with two points to be joined, and progress with an increasing number of points to be joined in an organized manner. This encourages scanning, hand-eye coordination, pencil control, and spatial organization.

The exercises in the *Teodorescu Perceptuo-Motor Programme* are carefully graded and progress in difficulty.

**An Informal Checklist for Identification of Articulo-Graphic Dyslexia (AGD)**

Symptoms	Observed (check)	Not Observed (check)
Shows more generalized motor coordination problems		
Verbal and performance IQs are equivalent		
Has intact visuo-spatial perceptual skills, but displays difficulty copying shapes and designs correctly even though recognizes the errors		
Cannot pronounce familiar words		
Cannot sound out unfamiliar words		
Mispronounces and misspeaks words because the muscles involved in speech are not harmoniously coordinated		
Has difficulty in articulation and blending of sounds of words when reading orally but not silently		
Recognizes and comprehends meanings of words when read to or with		
Reading errors include omission and perseveration of letters and syllables		
Handwriting has proper line orientations but tends to be illegible and contain spelling errors		
May not dot <i>i</i> 's and cross <i>t</i> 's		
Has difficulty copying accurately because of errors in transposing what he/she imagines into what he/she writes.		
Has difficulty writing to dictation		
Has difficulty writing spontaneously		
Has difficulty putting ideas down on paper accurately		
Recognizes errors when checking written work		
Miswrites or misspells words because the hands do not faithfully carry out intention		
Makes spelling errors resulting from fragmented, incomplete, or misplaced letters and syllables		
Total number of checks in each column:		

Comments:

This checklist has been completed by:

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Date: \_\_\_\_\_

*Note: The symptoms listed above are adapted from Westman's (1996) paradigm of developmental dyslexic subtypes.*

Each section relies on the skills acquired in previous exercises. Ideally part of the program should be done each day for about 15 minutes. Children should be closely supervised to ensure that the exercises are done correctly, observing the diagnostic aspects of the program. By observing a child's attempts at an exercise set, weaknesses of perception, control, and comprehension can be noted.

#### Conclusion

The hallmarks of AGD can be detected in oral reading, in spontaneous writing or writing from dictation, and from copied sentences. It can also be evaluated from skin-writing recognition, directional orientation, fine and gross motor coordination, and the presence of tremors. Early intervention using one of the programs mentioned above is important to minimize the problems caused by AGD and helps those with AGD cope better with learning. However, it cannot eradicate the learning disability, nor does it attempt to.

The checklist above [Table 1] has been prepared as a guideline for the identification of children with AGD. Teachers and parents should find it helpful; however, I must stress that the AGD checklist serves only to contribute toward further understanding of a subject's learning difficulties, not as a definitive diagnosis.

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Chia Kok Hwee, M.Ed, is the Senior Consultant-Educational Therapy at the Inamen Center for Educational Therapy and Counseling in Singapore. He is a Professional Member of the Association of Educational Therapists

# Neuropsychological Applications to Remediation Planning in Children

Karen L. Schiltz, Ph.D.  
Lorie A. Humphrey, Ph.D.  
Kristina B. Pappas, Ph.D.

#### Introduction

Neuropsychological assessment is being used increasingly in the diagnostic assessment of children with cognitive issues stemming from brain-based problems. Traditional applications of neuropsychological assessment (e.g., forensics, hospital inpatient) are being expanded to include the evaluation of children with learning disorders. Neuropsychological assessment offers a more comprehensive approach than does traditional psychoeducational assessment. Through examining all domains involved in cognitive processing, the neuropsychologist is able to identify not only the child's profile of learning difficulties but also his or her strengths. Additionally, rather than just reporting the impact of the learning difference on specific academic tasks (e.g., reading, writing, and arithmetic), the comprehensive nature of the neuropsychological assessment offers information on how children process information, including their use of language, visual perceptual skills, and executive functioning in managing and completing academic task demands.

Pediatric neuropsychologists are in a unique position to assist educational and treatment teams because of their thorough knowledge of intellectual, cognitive, social-emotional, adaptive, and achievement functioning levels. This broad approach to assessment creates an integrated blueprint for treatment, allowing for the design of an appropriate treatment team, as well as the prioritization of services.

In this paper, we will outline the specific guidelines for the training of the neuropsychologist. Second, we will present the domains that are typically assessed during a neuropsychological assessment. The analysis and integration of these areas will also be discussed using specific case examples. Finally, the application of the neuropsychological assessment to overall treatment and educational planning will be discussed.

#### Definition of a Clinical Neuropsychologist

The definition of a clinical neuropsychologist has been approved by Division 40 (Neuropsychology Division) of the American Psychological Association (1989). It reads:

A Clinical Neuropsychologist is a professional psychologist who applies principles of assessment and intervention based upon the scientific study of human behavior as it relates to normal and abnormal functioning of the central nervous system. The Clinical Neuropsychologist is a doctoral-level psychology provider of diagnostic and