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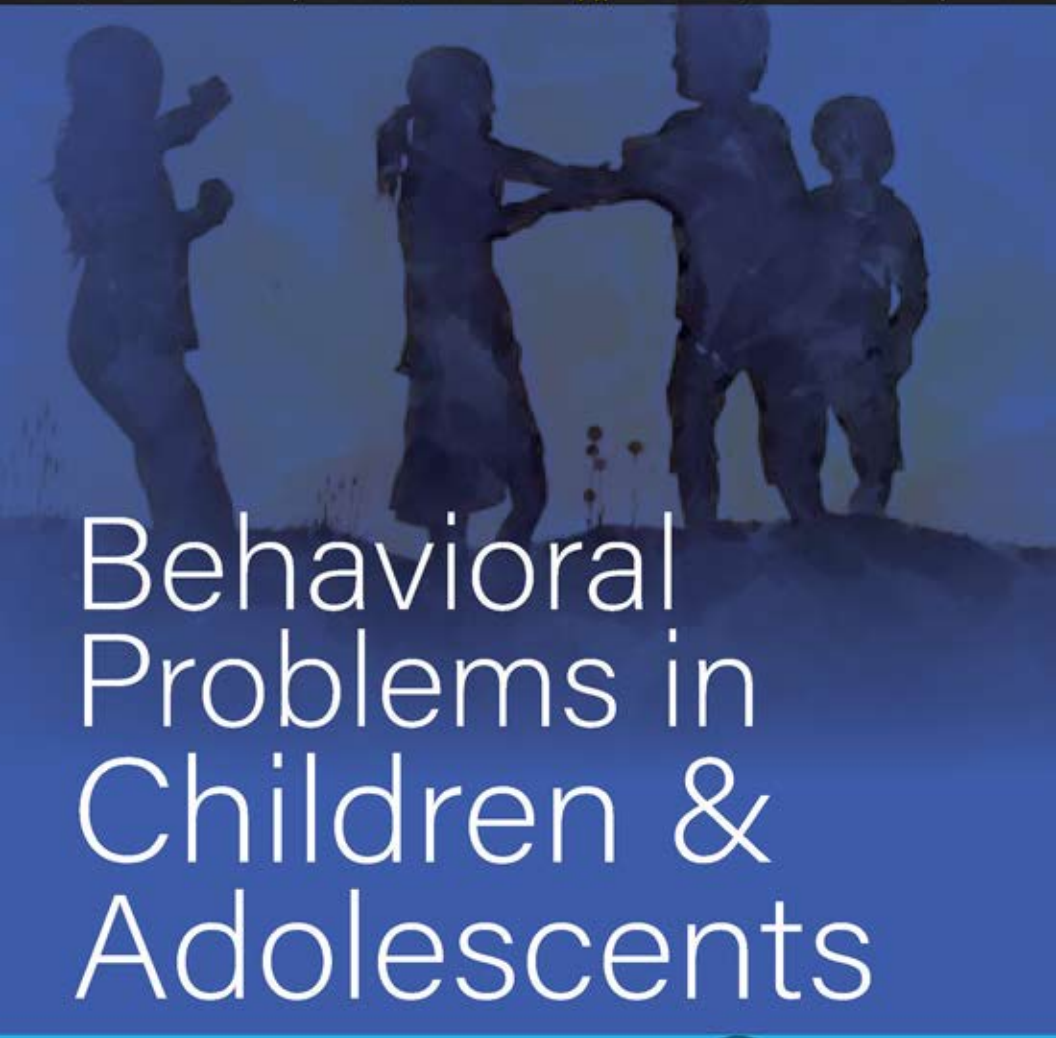

Behavioral Problems in Children & Adolescents



2nd Edition

Editor
Jaydeep Choudhury

JAYPEE

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CHAPTER 4

Developmental Coordination Disorder

Anjan Bhattacharya, Jewel Chakraborty

INTRODUCTION

Some children fail to perform the usual fine and gross motor tasks of daily living; they are casually branded as "clumsy," "lazy," "odd," or even "silly." These children are often victims of bullying and insults of all sorts. Even their parents, teachers, and near and dear can abuse them without realizing that these terms are detrimental. Many of them suffer from the malady of developmental coordination disorder (DCD). Developmental coordination difficulties are thought to affect between 5 and 10% of school-aged children. In the UK, these difficulties are often referred to as dyspraxia.

DEFINITION

Developmental coordination disorder is diagnosed when children do not develop normal motor coordination (coordination of movements involving the voluntary muscles) in keeping with their general developmental level.

Developmental coordination disorder is a common disorder affecting fine or gross motor coordination in children. DCD is distinct from other motor disorders such as cerebral palsy and occurs across the range of intellectual abilities. These may change over time depending on environmental demands and life experience. Children suffering from DCD often struggle with various physical activities and sports. Due to their limitations, they may appear somewhat awkward and clumsy. Their progression is slow when compared to other children. Children having dyspraxia or DCD encounter difficulty learning new movements. They also have limitations in transferring learned skills in different situations.

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EPIDEMIOLOGY

The exact causes of DCD in children are not known. It is thought to be caused by a disruption in the way messages from the brain are transmitted to the body. DCD is characterized by difficulty in planning smooth, coordinated movements. This leads to clumsiness and lack of coordination. Often, it can lead to problems with language, perception, and thought. DCD is a universal problem. Current estimates quote that as many as 6% of children between the ages of 5 and 11 years have DCD. Males and females are equally affected. But it is often seen that males are more commonly detected. It is also known to run in families.

In typically developing populations, the most frequently reported prevalence of DCD is 5–6%, and in preterm populations, the reported prevalence has varied between <10 and >50% depending on the definition of DCD, the sample size, and the sample composition. Prevalence rates are mostly based on cohorts born in the 1980s and 1990s and may not reflect outcomes after the advent of active perinatal care of the most immature children. In addition, there are very few recent studies that have reported associations between DCD and other comorbidities in children born extremely preterm.

DIAGNOSIS

The following are the diagnostic criteria as per the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM 5):

- The accusation and execution of coordinated motor skills are substantially below than expected given the individual's chronological age and opportunity for skill learning and use. Difficulties are manifested as clumsiness (e.g., dropping or bumping into objects) as well as slowness and inaccuracy of performance of motor skills (e.g., catching an object, using scissors and cutlery, handwriting, riding a bike, or participating in sports).
- The motor skill deficit in criterion A significantly and persistently interferes with activities of daily living appropriate to chronological age (e.g., self-care and self-maintenance) and impacts academic/school productivity, prevocational and vocational activities, leisure, and play.

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- The onset of symptoms is in the early developmental period.
- The motor skill deficits are not better explained by intellectual disability (intellectual developmental disorder) or visual impairment and are not attributable to a neurological condition affecting movements (e.g., cerebral palsy, muscular dystrophy, degenerative disorder).

CLINICAL FEATURES

There are great variations in symptoms and signs. So the presentations vary widely. In some, this manifests as an inability to catch a ball or fashion a lace, while in others, DCD may present as an inability to draw objects or properly form printed letters.

There are six general groups of symptoms as follows:

1. General unsteadiness and slight shaking
2. Low muscular tone at rest (basal tone)
3. Consistently high muscle tone than normal
4. Inability to put subunits of the whole movement together (jerkiness)
5. Inability to produce written symbols
6. Nonsmooth movement associated with comorbidities

Comorbidities

Co-occurrence of various disease entities is well recognized for DCD:

- *Speech difficulties:* Dysarthria or subtler varieties and speech, language, and communication needs (SLCN)
- *Specific learning disabilities:* Dyslexia, dysgraphia, or dyscalculia
- *Attention and motor planning disorders:* Attention-deficit hyperactivity disorder (ADHD)/attention-deficit disorder (ADD)/hyperactivity disorder (HD) or deficits in attention, motor control, and perception (DAMP)
- *Eye–hand coordination disorders:* Visuospatial difficulties or orthoptic/optometric difficulties
- *Neurological diseases:* Epilepsy, cerebral palsy, or kernicterus
- *Genetic diseases:* Dysmorphisms, syndromes, or chromosomal abnormalities
- *Health conditions:* Obesity or atopy
- *Other:* Medication effects or nervous tics.

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Secondary Morbidities or Impact

Although some children with milder variety can grow out of their DCD, about 9 out of 10 children are known to suffer throughout their life from the disease and/or its impact on their life, some of which are as follows:

- *Mental health problems:*
  - Low self-esteem
  - Chronic anguish
  - Depression
  - Miscellaneous, e.g., phobias, suicidal tendencies
- *Educational impact:*
  - Writing, reading, or spelling difficulties
  - Backbencher position
  - Bullying
  - Truancy, delinquency, school failure
  - Miscellaneous
- *Employment impairment:*
  - Avoid professions involving fine precision or visual discrimination, e.g., driving heavy vehicles or airplanes, fine machinery.
  - Occupational hazards, e.g., accident proneness
  - Miscellaneous
- *Social impairment:*
  - Stigmatization
  - Poor peer group acceptance
  - Behavioral problems, e.g., antisocial, substance abuse, criminality
  - Miscellaneous, e.g., leisure and recreational activities.

TREATMENT

As common to all developmental disorders, the management of the condition depends on the precise developmental diagnostic workup.

Screening

The Developmental Coordination Disorder Questionnaire (DCDQ) is a brief parent questionnaire designed to screen for coordination disorders in children aged 5–15 years. It was originally developed

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in the late 90s at the Alberta Children's Hospital, Calgary, Alberta, Canada. Through further study with a population-based sample of children, a revision has been developed, the DCDQ'07. It can be considered a valid clinical screening tool for children who have coordination challenges.

Role of Sensory Integration and Praxis Tests in Diagnosis of Developmental Dyspraxia

The condition *developmental dyspraxia* was first described by *A Jean Ayres*. He pioneered the theory of sensory integration (SI). Ayres interpreted that children with developmental dyspraxia often face challenges coping with various life situations, which may include normal childhood activities such as play, educational learning, and daily social behavior. The limitations of this disorder have a deep impact on these children and their daily life activities.

Developmental dyspraxia was first identified with a measuring instrument developed by Ayres in 1972 as the *Southern California Sensory Integration Test (SCSIT)* and then the *Sensory Integration and Praxis Tests (SIPT)* in 1989. Through the development of SCSIT and SIPT, initially Ayres and later Mulligan were able to correlate poor discrimination of tactile, vestibular, and proprioceptive input with dyspraxia. This confirmed association between developmental dyspraxia and sensory discrimination contributed to the development of management protocols for developmental dyspraxia.

Sensory integration is one of the key factors to approach developmental dyspraxia. To understand developmental dyspraxia, the three processes of praxis have to be approached from an SI perspective. Ideation, motor planning, and motor execution are processes which are usually implicated when praxis is deficient. Ayres and Mulligan identified the four types of dyspraxia: *Visiodyspraxia, somatodyspraxia, bilateral integration and sequencing deficits,* and *dyspraxia on verbal command*.

The SIPT measures visual, tactile, and kinesthetic perception as well as motor performance. It is composed of the following 17 tests. A prototype case with a low average score is represented in **Figure 1**.

1. Space visualizations
2. Figure-ground perception

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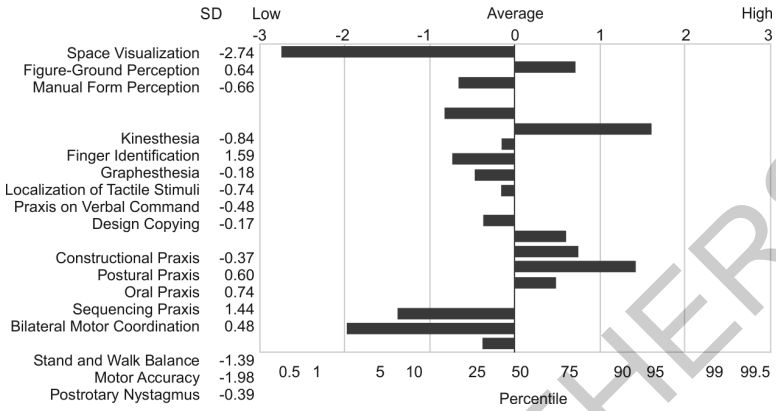

Fig. 1: Bar graph score shows the child has *low average scores* in the area of Figure-ground perception, Manual form perception, Kinesthesia, Graphesthesia, Localization of tactile stimuli, Praxis on verbal command, Design copying, Constructional praxis, Oral praxis, Bilateral motor coordination, Postrotary nystagmus, and Postural praxis.

3. Standing/walking balance
4. Design copying
5. Postural praxis
6. Bilateral motor coordination
7. Praxis on verbal command
8. Constructional praxis
9. Postrotary nystagmus
10. Motor accuracy
11. Sequencing praxis
12. Oral praxis
13. Manual form perception
14. Kinesthesia
15. Finger identification
16. Graphesthesia
17. Localization of tactile stimuli

The assessment is scored and interpreted through computerized scoring. The subject's raw scores are entered into the SIPT scoring program, which are converted to standard deviation (SD) scores. SIPT test results are expressed in SD scores. Scores between –1.0 and +1.0 SD are considered average, score of –2 to –1.0 suggests mild

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difficulties, score of –2.5 to –2 indicates definite dysfunction, and score of –3 to –2.5 indicates severe dysfunction. A score of +1.0 to +2.0 indicates above-average functioning and a score of +2.0 to +3.0 indicates advanced functioning. The computer-generated report describes each test and also the obtained standard score. It has a summary bar graph that depicts the major results and lists various scores such as the Standard Error of Measurement (SEM), SD scores, measurements of lateral function, and also an audit of test data. It also shows a summary graph comparing the child's SD scores to that of the significant cluster group mean scores.

The child has *definite dysfunction* in the areas of standing/walking balance and motor accuracy and *severe dysfunction* in the area of space visualization.

Six prototypic groups have been identified to describe the child's condition including dysfunctional, average, and superior patterns of SI. These six groups are as follows:

1. Low average bilateral integration and sequencing
2. Low average SI and praxis
3. Dyspraxia on verbal command
4. Generalized SI dysfunction
5. Visuo-and somatodyspraxia
6. High average SI and praxis

D-squared value of the SIPT scores indicates similarity to these six prototypic groups. A small D-squared value indicates a close fit and a large D-squared value indicates a poor fit with these six prototypic groups.

D-squared value of the below-mentioned scores in **Figure 2** indicates that the child has *low average bilateral integration and sequencing dysfunction*.

Precise tools like SIPT thus help pinpoint the functional barrier, which helps clinicians to target management precisely and accurately. Wherever properly *trained* professionals are employed to identify and treat these conditions, the results are rewarding to a surprising extent.

International Classification of Functioning (ICF) is another tool from the World Health Organization (WHO) that helps planning holistically in managing the child's all necessary aspects of management. A competent coordinating professional, like

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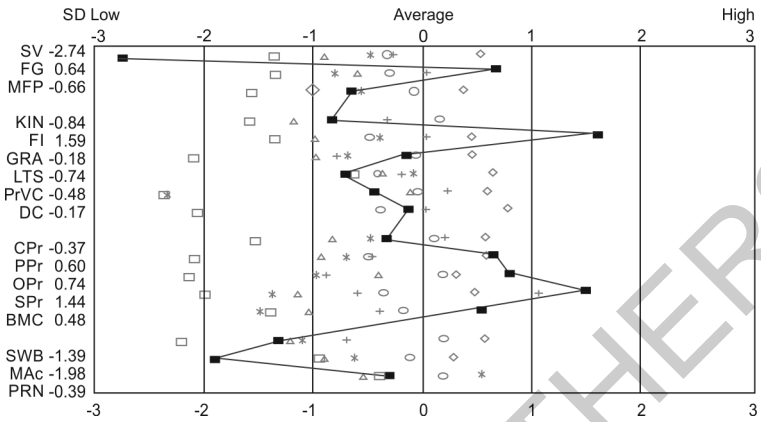

Fig. 2: D-squared value compared to diagnostic prototypes. (BMC: bilateral motor coordination; CPr: constructional praxis; DC: design copying; FG: figure-ground perception; FI: finger identification; GRA: graphethesia; KIN: kinesthesia; LTS: localized tactile stimuli; MAc: motor accuracy; MFP: manual form perception; OPr: oral praxis; PPr: postural praxis; PRN: postrotary nystagmus; PrVC: praxis verbal command; SPr: sequencing praxis; SWB: stand and walk balance)

a developmental pediatrician of quality, can ensure complex multidisciplinary care coordination in a simple and deliverable manner compared to incompetent handling, which is both cost-intensive and suboptimally effective.

Management

Primary care: Doctors, child health doctors, school nurses, school-based school health professionals such as special educational need coordinator (SENCO), teachers, social workers, and parents have a statutory (legal) obligation to refer the child "at risk" to school health team or community child health clinic.

Secondary care: Screening and referral to Child Development Centre (CDC), if concern persists with local advice and support until definitive management is instituted.

Tertiary care: Every borough (equivalent to Zilla or Talukas in the Indian system) in the UK has a Child Development Centre or

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equivalent to rule out other developmental disorders and institute early intervention (EI) to remediate if a definitive diagnosis is made.

Components of Management

Management involves EI involving a multidisciplinary team (MDT). The management modalities involve the following:

Therapeutic management: Remediation

School-based management: School health team

Resourced information and advice: Health education and information

Medical management: Primarily regular health promotional and preventative work and secondarily medication for comorbidities, advice and training for disability limitation, care coordination, transitional care modules, etc.

It is important to encourage children with DCD to actively participate in and get involved in physical activities. Swimming is a simple activity which is particularly good for children with DCD. It is basically repetitive sequential movements. Most importantly, it is not complicated and unpredictable as any team and ball games. Sometimes, it is difficult to learn the early skills but children should be encouraged to persevere as he or she will eventually become quite proficient. Swimming can also aid in the development of balance, physical strength, body flexibility, endurance, and coordination along with the enhancement of self-esteem and social skills. These children need constant encouragement and individual-focused attention to prevent them from quickly becoming dissatisfied and disillusioned.

GUIDELINES FOR PARENTS

- Reward the efforts.
- Participation and imbibing fun should be encouraged in all activities rather than competition.
- To start with, skills in smaller, more manageable parts should be taught.
- Give clear, concise instructions and repeat these for the child if necessary.
- It may be helpful to use pictures to illustrate the required action if the child has real difficulty focusing on verbal instructions.
- Swimming is particularly beneficial for children with DCD as it is made up of repetitive sequences of movements and it is not as complicated and unpredictable as team and ball games.

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Behavioral Problems in Children & Adolescents

Salient Features

- All the chapters in the second edition have been updated considering the latest developments
- Current and relevant topics such as Digital Media and Children, Fussy Child, Mental Health of Children during Pandemic, and Study Skills have been added
- Practicing pediatricians will find this useful for dealing with various behavioral problems in day-to-day practice
- Postgraduate students in pediatrics will find common topics for examinations
- Students in psychiatry may utilize it for some important aspects of child behavior, which is unique and different from adult psychiatry
- Undergraduate students can refer to some topics on developmental pediatrics and childhood psychiatry
- DSM 5 guidelines have been followed
- Each chapter contains guidelines for parents.

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