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Practice Point

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Practice Point

Assessment, diagnosis, and management of developmental coordination disorder

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Abstract

Developmental coordination disorder (DCD) is a neurodevelopmental condition that affects 5% to 6% of school-aged children. DCD can significantly impact early development and life-long functioning. Evidence supports promising interventions for DCD, but the disorder continues to be under-recognized and under-diagnosed. Paediatricians play an important role in the identification and management of DCD. This practice point, with accompanying tables, assists and supports paediatricians in diagnosing and managing uncomplicated cases of DCD.

Keywords: *Community paediatrics; Developmental coordination disorder; Diagnosis*

BACKGROUND

Developmental coordination disorder (DCD) is a common neurodevelopmental disorder characterized by difficulties with learning gross or fine motor skills, leading to functional impairment in academic achievement or activities of daily living. A diagnosis of DCD can only be confirmed when motor difficulties are not the result of a medical condition or disease, such as cerebral palsy (CP) or visual impairment, yet the individual has low scores on standardized motor testing and a history of motor problems from the early developmental period (1). A recent survey of paediatricians in the Canadian Paediatric Society (n=152) found that most reported having little knowledge of DCD diagnostic criteria, with 86% being unaware of the international guidelines for DCD (Kubow and Zwicker, unpublished data).

This practice point defines DCD, describes the diagnosis and management of uncomplicated cases, discusses differential diagnoses, and indicates when further investigations or referrals are needed.

DCD impacts early development significantly, often with life-long impacts on social functioning, physical and mental health, academic and vocational success, and health-related quality of life (2,3). Evidence supports promising rehabilitation interventions for DCD and, thus, it is important that paediatricians are equipped to recognize and diagnose DCD as early as possible. Table 1 describes the four diagnostic criteria that must be met for a DCD diagnosis (4), along with recommended assessment tools (2). The presentation of DCD varies among individuals, such that fine, gross, and oral motor systems may not all be affected, or are affected to varying degrees.

RISK FACTORS AND ASSOCIATED CO-OCCURRING CONDITIONS

DCD prevalence is higher in males than in females (2:1 to 7:1) (4). Preterm birth is a significant risk factor (7), with the odds of DCD increasing with decreasing gestational age (GA)

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Table 1. Diagnostic criteria for developmental coordination disorder

DSM-5 diagnostic criteria	How is this criterion assessed?
A. Acquisition and execution of coordinated motor skills are substantially below expectations for a child's chronological age and opportunities for motor skill learning. Difficulties may include 'clumsy', slow, or inaccurate motor skill performance (e.g., when catching an object, using scissors, handwriting, bike riding, or participating in sports).	An occupational or physical therapist administers a standardized motor assessment, usually the Movement Assessment Battery for Children-2 (MABC-2)(5)*
B. Motor skills deficit significantly and persistently interferes with activities of daily living appropriate for age, and impacts school work, prevocational and vocational activities, leisure, and play.	In addition to history-taking, parent questionnaires such as the DCDQ (5–15 years) or Little DCDQ (3–4 years) (6) can help determine the functional impact of motor difficulties. Scores are interpreted as 'indicative of DCD', 'suspect DCD', or 'probably not DCD'.
C. Onset of symptoms in the early developmental period.	Conduct developmental history. Motor milestones are often attained by the age expected, but listen for difficulty in *learning* motor skills.
D. Motor skills deficit is not better explained by intellectual disability, visual impairment, or a neurological condition affecting movement (e.g., cerebral palsy, muscular dystrophy).	Ensure that vision has been assessed. Conduct a neurological exam. Standardized IQ testing by a psychologist is required in some cases (1).

Adapted with permission from reference (2).

*MABC-2 total score ≤16th percentile may be indicative of DCD (≥6 years). However, a child of this age scoring ≤5th percentile on one of the sub-domains (e.g., manual dexterity, balance), regardless of the total score, also meets Criterion A (1,10). For children ages 3–5 years old, an MABC-2 total score of ≤5th percentile is required to meet Criterion A, with two assessments administered at least 3 months apart (1,10).

(8). Common co-occurring conditions associated with DCD include attention-deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), specific learning disabilities, and language impairments (9,10). Children with DCD are also more likely to have symptoms of anxiety and depression (1,2).

THE PAEDIATRICIAN'S ROLE IN DIAGNOSIS

While diagnosing DCD requires a team approach, physicians have an integral role as the only health care professionals who can evaluate Criterion D (4). Paediatricians should (ideally) have results for Criteria A (motor skill testing), B (impact on function), and C (symptom onset in early development) to integrate at the time of the consultation. Even after completing the consultation and receiving the motor testing results from an occupational or physical therapist, many physicians report discomfort in making a diagnosis of DCD (11). To help bridge this gap, a DCD Toolkit for Pediatricians—a free online resource—was developed to summarize the evidence for diagnosis (10).

To make a diagnosis of DCD, a child's motor skill deficits cannot be better explained by an underlying neurological or medical condition affecting movement, visual or vestibular impairments, or motor skills commensurate with an intellectual disability. The paediatrician's consult is key for ruling out medical conditions that might better explain a child's motor deficits. For children with mild intellectual disability, an additional diagnosis of DCD can be made when motor skills are found on assessment to fall below a child's cognitive ability. This uncommon scenario often requires additional assessment by a child psychologist.

After completing a standard medical and developmental history targeting symptoms of DCD (Criteria B and C), the physician conducts a physical and neurological examination to assess both 'soft' and 'hard' neurological signs (Criterion D). Soft signs are nonspecific markers of performance difference when a child executes motor tasks that persist beyond a typical age range but do not necessarily indicate an underlying etiology. Soft signs fade in most children by age 6 but may persist in children with DCD (12). They include overflow movements (e.g., hand posturing when walking on heels or toes), mirror movements (e.g., one hand 'copying' the other when imitating a finger pattern), or finger agnosia (e.g., visual monitoring to copy a finger pattern when proprioceptive feedback is insufficient). Children with DCD may struggle with coordination (e.g., during the finger-nose test and rapid alternating movement), but other cerebellar findings, such as Romberg testing, should be negative.

In contrast, hard neurological signs, such as hypertonia or hypotonia, abnormal reflexes, or cerebellar signs (e.g., ataxia) are suggestive of nervous system pathology and require further diagnostic workup. Specifically, the presence of hyperreflexia, spasticity, asymmetry on neurological exam, or upper motor neuron signs raises a question of CNS involvement as seen in

CP or traumatic brain injury. A neurocutaneous examination may be required to rule out neurofibromatosis 1 or tuberous sclerosis. It is not uncommon to find low normal tone in children with DCD, and a 4 or 5 strength rating, but true hypotonia, hyperreflexia, or muscle weakness warrants further evaluation. Table 2 outlines key elements of the physical exam when assessing for possible DCD.

Children with DCD can have joint hypermobility, especially in the small joints of the hands and feet. However, joint pain is not associated with DCD and this finding raises concern for Ehler's Danlos syndrome (13,14), joint hypermobility syndrome, or arthritis. Less commonly, progressive restriction in activity could reflect an autoimmune process or, rarely, a tethered spinal cord. One common sequela of DCD is obesity, as children become less active due to motor challenges (15).

During the neurological exam, the child may act silly, say they are tired, or resist doing motor tasks. Such behaviours may indicate motor difficulties. Observing the child who is challenged in dressing and undressing, tying shoelaces, or who has difficulty getting on and off the examining bed may indicate motor impairment. A cranial nerve exam and history (i.e., for oromotor difficulties such as excessive drooling, difficulty chewing or swallowing, or motor speech problems) may indicate a CP versus DCD profile.

Atypical findings based on history, physical examination, and behavioural observation can generally be grouped into three categories: neurological, genetic, and musculoskeletal. Table 3 outlines common medical conditions to rule out when considering a DCD diagnosis. Investigations may include assessing hearing and vision, creatine phosphokinase, metabolic investigations, thyroid function, peripheral nerve conduction, and/or neuroimaging (e.g., cranial MRI), depending on the neurological exam findings. When concerns arise regarding an underlying genetic disorder, consider chromosomal microarray, karyotype, or fragile X testing, with possible referral to a neurologist or geneticist. Evaluate for common co-occurring conditions, such as ADHD, specific learning disorders, anxiety, or depression, which require further management or involvement of mental health supports (16).

While both CP and DCD are disorders of movement, current evidence suggests that the disorders are separate entities and present differently on neurological exam (17). See the CPS practice point entitled Comprehensive care of the ambulatory child with CP GMFCS I and II.

Table 2. Physical and neurological exam for DCD

General exam
Growth
Dysmorphology
Neurocutaneous examination, skin elasticity
Musculoskeletal exam
Joint hypermobility
Joint swelling
Joint pain
Posture
Spine exam, sacral dimple
Neurological exam
Cranial nerves
Tone (low normal tone*)
Strength
Deep tendon reflexes
Upper motor neuron signs: plantar reflex, clonus, adductor reflex
Coordination: finger-nose*, rapid alternating movements*
Romberg test
Static balance: single foot balance ≥30 seconds*
Dynamic balance: jumping on one foot*
Stair climbing*
Gait: walking, running*, toe-walking, heel-walking, forward and backward tandem*
Minor neurological signs (13): visual monitoring*, mirror movement*, finger agnosia* during imitative finger movements
Presence or absence of overflow movements*

DCD Developmental coordination disorder.

*Children with DCD often show one or more of these signs or have difficulties with these tasks (13).

Table 3. Common differential diagnoses for DCD

Neurological
Cerebral palsy (GMFCS I)
Muscular or myotonic dystrophy
Peripheral neuropathy
Traumatic brain injury with new onset motor impairment
Neurocutaneous conditions
Arnold-Chiari malformation
Tethered spinal cord
Musculoskeletal
Joint hypermobility syndrome
Ehlers-Danlos syndrome (14)
Juvenile arthritis
Genetic
Microdeletion/microduplication syndromes
Neurofibromatosis 1
Tuberous sclerosis
Sotos syndrome
Fragile X syndrome

DCD Developmental coordination disorder.

MANAGEMENT

Key steps in the medical management of DCD include diagnosing and demystifying the condition, identifying and addressing common co-occurring conditions (e.g., ADHD, learning disorders), and ongoing monitoring for secondary consequences of the disorder (e.g., sedentary behaviour, overweight or obesity, poor self-esteem, and mental health).

Additional management involves referral to a paediatric occupational or physical therapist to provide practical recommendations to support the child's successful participation in home, school, and community activities. Direct intervention may also be required. Evidence favours task-specific interventions, such as the 'Cognitive Orientation to Occupational Performance' (CO-OP) approach over sensory-based interventions (1). Encourage participation in individual-based and noncompetitive sports, such as tae kwon doe or swimming. Families should be directed to evidence-based and supportive resources (e.g., the CanChild website).

RECOMMENDED RESOURCES

1. Sunny Hill Health Centre at BC Children's Hospital. Child Development & Rehabilitation Website. DCD Toolkit for Pediatricians. DCD Assessment Information Sheet, November 2018: http://www.childdevelopment.ca/DCDAdvocacyToolkit/DCDAdvocacyToolkitIntro.aspx
2. McMaster University/Machealth. Developmental Coordination Disorder (DCD) Course: https://machealth.ca/programs/developmental_coordination_disorder/
3. CanChild. Diagnoses: Developmental Coordination Disorder: https://www.canchild.ca/en/diagnoses/developmental-coordination-disorder

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