The Developmental Coordination Project: A First Look at Findings

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P3DEO
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Diagnostic Criteria for Developmental Coordination Disorder

- Marked impairment in development of motor coordination
- Impairment interferes with academic achievement or activities of daily living
- Coordination difficulties not due to general medical condition or PDD
- If IQ below normal, motor difficulties in excess of those usually associated with IQ level

(DSM IV TR, 2000)
DCD is what we call the 5 C’s…

Common
Clumsy children
Chronic health condition
Co-morbid with
Consequences
DCD is . . .

Common
- Affects 5-6% of school aged children
  (DSM IV TR, 2000)
- Gender differences
- One child in every classroom
Children with DCD….

- Are **CLUMSY**, but show heterogeneous profiles
  - Low muscle tone (tin man/scarecrow) plus difficulty with co-contraction and joint stabilization
  - More reliant on vision to guide motor behaviour
  - Remain at the new learning stage much longer
  - Fail to see links (transfer and generalization)

- Range in **SEVERITY** from moderate to severely affected
  - Safety issues (balance, fractures, injuries)
DCD is a chronic health condition

- “Missed and misunderstood”
  
  (Missiuna, Moll, King, King & Law, 2006)

- Pervasive
  
  - strong evidence that DCD persists into adolescence and adulthood
    
    (Losse, et al., 1991; Rasmussen & Gillberg, 2000; Cantell & Kooistra, 2002; Cousins & Smyth, 2003)
  
  - evidence that adults are still affected by DCD during activities of daily living
    
    (Cousins & Smyth, 2003; Drew, 2005; Fitzpatrick & Watkinson, 2003; Missiuna et al., in preparation)
DCD is …

COMORBID with:

- **Attention deficit hyperactivity disorder (50%)**
  
  *(e.g., Piek et al, 2004; Tervo, Azuma, Fogas & Fiechtner, 2002)*

- **Language based learning disabilities (+50%)**
  
  *(e.g., Dewey et al, 2002; Jongmans, et al, 2003)*

- **Specific language impairment (40-90%)**
  
  *(Gaines & Missiuna, in press; Hill, 2001; Webster, Majnemer, Platt & Shevell, 2005)*
DCD is …

**COMORBID** with:

- Non-verbal learning disabilities (NLD)?
  - DCD and NLD are not the same thing
  - High verbal/low performance IQ may also be due to motor-based problems

*New section on DCD in Maggie Mamen’s NLD book*
Preschool Speech-Language Difficulties and DCD
School Age
DCD and Co-Morbidities

DCD

ADHD

LD
DCD has . . . .

Social and emotional CONSEQUENCES . .

- Behavioural and academic problems (school refusal, task avoidance)
  
  (Elliott & Place, 2004; Losse et al., 1991)

- Social and emotional problems (victimized, decreased self-esteem and self-efficacy)
  
  (e.g., Chen & Cohn, 2003; Maeland, 1992; Piek, Dworcan, Barrett & Coleman, 2000; Piek et al., 2005; Skinner & Piek, 2001; Smyth & Anderson, 2001)
DCD has . . . .

Mental health CONSEQUENCES . . .

- Increased risk for development of mental health problems (depression, anxiety)
  
  (e.g., Hellgren, Gillberg, Bagenholm & Gillberg, 1994; Missiuna et al., in press; Rasmussen & Gillberg, 2000)

- Worse outcomes, if both DCD and ADHD are present
  
  (Rasmussen & Gillberg, 2000; Tervo et al, 2002)
DCD has . . . .

Physical Consequences . . .

- Reduced participation in physical activities . . .
  - decreased strength over time
  - low endurance
  - deteriorating physical fitness

  (e.g., Cantell, Ahonen & Smyth, 1994; Larkin & Parker, 1998; Poulsen & Ziviani, 2004; Raynor, 2001; Wakinson et al., 2001)

- Increased risk for obesity, cardiovascular problems

  (e.g., Faught, Hay, Flouris, Cairney, & Hawes, 2002; Hay, Hawes & Faught, 2004; O’Beirne, Larkin & Cable, 1994)
Taking a closer look…
Diagnosing DCD

Why diagnose?
Developmental Coordination Disorder
A New Look at the Physically Awkward Child

Missiuna, Moll, Law, King & King, 2006
Positive Outcomes

Emotional Health
Self Perception
Peer Relations
Participation
Academic Performance
Self Care Activities
Play Differences
Coordination Differences

Negative Outcomes

Missiuna, Moll, King, King & Law, in press
Goals of the Project

- Knowledge exchange (interdisciplinary service providers → physicians)
- Support primary health care providers in learning about earlier identification and diagnosis of an under-recognized chronic health condition
- Facilitate knowledge about, and referral to, most appropriate interdisciplinary service provider
- Provide evidence-based materials that support families and increase self-management by families
Participants

- Family physicians and community pediatricians practicing in the Ottawa region
- Families of children who have concerns about their child’s motor coordination abilities
- Children 4-12 years old who, based on their performance on screening activities and on information from a parental questionnaire, are suspected by their physician of having DCD
Pre-Study Survey of Physicians’ Knowledge of DCD (September 2004)

- 747 Family Physicians and Community Pediatricians in Ottawa (Return Rate, RR=26%; n=191)
  - 91% didn’t know what DCD was
We have used . . . traditional methods of knowledge transfer

- Manual, Binder
- Workshops
- Chart Audits
Grassroots Education

- Psychologists
- SLPs
- PTs
- OTs
- Psychiatrists
- Spec Ed Teachers
- Phys Ed Teachers
- Early Childhood Eds
- Parents
- Medical Specialists
- Nurse Practitioners
- Medical Residents
... and newer, more interactive approaches ...
Recruitment

- Recruitment Began: October 20, 2004

- Physicians/Nurses signed on until: End of February 2006

- Child Referrals Accepted until: End of February 2006
Physician & OT Collaborate in the Identification of Children with DCD

- Physician: Differential Diagnosis
- OT: Provides assessment of motor function
- Together: Provide Feedback which educates, supports and assists with management
Evaluation of the Impact of the DCD Project...

Some Preliminary Findings.....
Key Indices of Knowledge Transfer

- Quantitative Evaluations:
  - # of physicians recruited to project
  - # of child referrals to project
  - Accuracy of the referrals
    - # of children with motor problems
    - # of children diagnosed
Figure 1. Cumulative number of physicians enrolled in the DCD Project

Total Recruitment:  
30 Pediatricians  
117 Family Physicians
Child Results

- 117 referrals accepted
- 117 tested
  - 14/117 normal on motor testing
  - 103/117 had motor issues (88%)
    - 90 have been diagnosed with DCD by doctor (77% - HIT!)
    - 13 have other explanations for motor problems
      - 8-global developmental delay
      - 2-PDD
      - 2-neurological reasons
      - 1-skeletal alignment issues
Qualitative Evaluations

- Questionnaires and Focus Groups Designed to….
  - Describe any changes/impact on Physician practice
  - Inform the Ministry about the needs for service change in primary health care
Post-Study Survey of Physician Knowledge (15% RR-so far!)

- **Study Physicians**
  - Have knowledge to identify DCD 18/49 (37%)

- **Non-Study Physicians**
  - Have knowledge to identify DCD 0/63 (0%)
  - Little or no knowledge of DCD 51/63 (81%)

- Pre-study: 91%-little or no knowledge of DCD
Focus Groups

- Pediatricians
- Family Physicians
- Parents
- Service Providers
Pediatrician Focus Group Findings

- Changes made to practices:
  - Use of parent interview guide to screen
  - Addition of balls for exam
  - Look for co-morbidities
  - Know where to go for resources

“It seems that all these kids are in my practice, I just didn’t identify them before”
Pediatrician Focus Group Findings

- Benefits for the child/family
  - Diagnosis is comforting and validating for parents
  - Children’s participation will improve because of understanding
  - Canchild website resources give strategies

“The family was thrilled at the diagnosis, finally, it made the world of difference to them because they knew there was something wrong, but we couldn’t put a name on it”
Parent Questionnaires

- Materials, Knowledge and Use of Information about DCD
Parent Questionnaire (49% RR)

- Parents read the educational materials, requested a school meeting, shared materials with teacher and others 17/25 (68%)
- 8 other parents reported having done this AND intend to share materials with next teacher and accessed the Canchild website in the last month 8/25 (32%)
- Parents report they understand DCD from a moderate to a great extent 25/25 (100%)
Inter-Professional Teams Needed for Children with DCD

DCD Project Model…
DCD Diagnosis Given

Intake Decision

Psychology

OT

PT

SLP
Inter-Professional Team Assessments

- 30 children – team assessments
  - 19 additional OT
  - 12 PT
  - 17 Psychology
  - 18 SLP
- 12/30 (40%) – minimum of 3 disciplines
What will an SLP see?

- Needs hand over hand help?
- Difficulty with two-handed tasks?
- Difficulty getting in and out of chairs?
- Low frustration tolerance?
- Avoidance of some activities?
- Clumsiness?
- Uses wrong amount of force with toys, puzzles, crayons?
What do SLPs do to help?

- Assist children in/out of chairs?
- Tie shoes, do up zippers?
- Hold paper?
- Open juice boxes?
- Assist with glue and scissors?
- Stabilize toys?
- Give verbal or physical prompts?

Hoggan, Dawson, & Missiuna, 2001
An opportunity arose...

- Speech/language Impaired toddlers received a parent-child intervention called “Toddler Talk” at 2 years of age
- Invited back at the end of kindergarten for assessment
- 40 children participated (5:3 to 6:8)
Speech Language Outcomes

- 12 children (30%) had significant persistent speech/language difficulties
- 28 children (70%) – now within normal limits for speech/language
Motor Coordination Outcomes (M-ABC)

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Definite (&lt;5%ile)</th>
<th>Borderline (6-15%ile)</th>
<th>Non-DCD (no motor impairment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6 years</td>
<td>40</td>
<td>10</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(25%)</td>
<td>(20%)</td>
<td>(55%)</td>
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Developmental speech and motor problems?

In a group of children who were identified as having speech/language difficulties as toddlers:

- 12 (75%) children who had continuing S/L problems had significant motor impairment at age 5-6 years.
A word about Psychology

- Co-morbidities:
  - ADHDs
  - LDs
  - Mental Health Issues
    - Anxiety
    - Depression
Physiotherapy

- Test of Gross Motor Skills may under identify milder expressions of DCD
- Standardized testing needs to be coupled with clinical observations:
  - tone across proximal and distal joints
  - speed and reaction time (especially with new learning)
  - force production
  - agonist and antagonist timing (‘fixing’ and degrees of freedom)
  - anticipatory motor control
  - error correction ability
Physiotherapy

- Over reliance on visual feedback and less on proprioceptive information, difficulties with sequencing more complex skills and dealing with multiple sources of information
- Secondary sequelae of decreased strength and power, reduced physical fitness
- Over representation of flat feet, tight heel cords, toe walking, leg and knee pain as well as injuries
Occupational Therapy

- Diagnosis by exclusion for a Physician
- No “Gold” standard for assessment but we are getting there
- Standardized Motor Skill Testing + Functional Measures
  - Multiple sources of Data and qualitative observations

(Missiuna and Pollock, 1995)
Occupational Therapy

- Standardized Motor Skill Testing + Functional Measures

  Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)
  SS<42 but will likely under-identify
  *fine motor score is questionable (poor agreement with other tests)

  Movement Assessment Battery for Children (M-ABC)
  *<15\textsuperscript{th} percentile + clinical observations + reports on functional performance may give a truer picture
  *<5\textsuperscript{th} percentile is a definite motor impairment

(Crawford, Wilson and Dewey, 2001)
Occupational Therapy

- Developmental Coordination Disorder Questionnaire (DCDQ) 1SD below the mean—a screen to rule out DCD
- Developmental Test of Visual Motor Integration (VMI) including supplementary tests
- Structured parent interview is essential
- Task Observation
- Perceived Efficacy and Goal Setting (PEGS) for the parent, teacher and child or the Paediatric Activity Card Sort (PACS)
A Few Insights

- Standardized approach
  - Clinical measurement and practical guidelines for service providers (*Canchild, 2005*)
- Occupation-based assessment
  - (*Coster, 1998*)
- Report Writing
  - (*Donaldson et al, 2004*)
- Reassessment Strategies
Identification of Issues

- Stay focused on:
  - **Occupation**
    - What specific tasks are difficult for this child?
  - **Environment**
    - What features of each setting provide supports/barriers to this child’s performance?
  - **Participation**
    - Is this child participating in the typical activities of childhood?
    - How much and what type of assistance is required for this child to participate in each setting?
What are ‘our consumers’ telling us?
DCD: Impact on the Family

- Parental concerns often not heard or acknowledged
- Frustration with health care and educational systems
- Overprotective - “world as a hostile place”
- Stress regarding daily activities around the home
- Relieved once diagnosis is made
Life experiences of resilient young adults with DCD

- Coordination difficulties are context-specific
- They struggle, as children, with issues of social isolation and lack of participation.
- They remember ‘pull-out therapy’ and ‘being made to work on handwriting’ very negatively
- Social/emotional health and life course improve when kids enter high school
- Accommodations and support are critical factors

Missiuna, Moll, King, Stewart & Macdonald, in preparation
Intervention
Impairment–focused Intervention

Corrective gymnastics 1926
Special help from teachers 1969
Sensory integration 1972
Knowledge-based approach 1985
Process-oriented 1985
Perceptual motor 1980s
Activity-based Intervention

Task specific 1990s
Cognitive motor 1992
Verbal self-guidance 1998
CO-OP 2000s
Neuromotor task training 2000s
Imagery training 2002
If you need a quick summary of the evidence....

- Practitioner Review: Approaches to assessment and treatment of children with DCD: an evaluative review
  
  (Wilson, 2005)

- CanChild Website
Models of Intervention should not necessarily create change in the child

*but rather*

improve the child’s participation in his environment
PREPARE THE CHILD
NOT
REPAIR THE CHILD
Intervention = Education
Children with DCD:
What can we do about it?

- EDUCATE
  - Parents, teachers, support personnel
  - Health professionals
  - Community coaches and instructors
  - Child!

Parental questions about DCD: A synopsis of current evidence (accepted). *Paediatrics and Child Health*
ACCOMMODATE: MATCH the activity to the child

- **M**odify the task
- **A**lter your expectations
- **T**each strategies
- **C**hange the environment
- **H**elp by understanding
Children with DCD: What can we do about it?

- **MONITOR**
  - Social and emotional problems
  - Physical and mental health consequences

- **CONSIDER COMORBIDITIES**
  - Refer to interdisciplinary team members, as appropriate
What is a DCD profile?

- A Case Study- David
DCD profile - David

- 7 year 10 month boy
  - early (< 1 y.o.) medical problems
    - gastrointestinal problems
    - blood clotting disorder
  - height and weight concerns (lower %iles)
  - dev motor milestones WNL
    - but hx of being “clumsy”, falling often
    - speech delayed
    - hx of expressive language therapy
  - ++ school difficulties in reading and math
  - parental concerns = academics (~ social)
Early speech/language delay in expressive language and articulation. Treatment received in preschool.

History of school therapy services for the last 3 years (OT, SLP) as well as private SLP services (Lidcombe)

Family is ‘burned out’ on therapy and feels ‘nobody understands their child’

Interdisciplinary assessment
  • PT, OT, SLP, and Psych.
DCD profile - David

Motor-sensory profile

- Standardized Motor Measures
- Normal Sensory Processing
  - 1st percentile on MABC (total score of 22.5)
    - All subtests below 5th percentile
    - Low tone, errors in grasp, force control, speed, reaction time, targeting, over recruitment of muscles, poor bilateral coordination
  - 4th percentile on the TGMS

- Significant Functional Issues
  - Problems with top button of pants, shoelaces, messy eater, poor use of utensils, can’t open packages and has trouble blowing his nose, problems with all areas of school fine motor activities, frequent falls in the playground and during gym, preference for sedentary activities, falls out of his desk
DCD profile - David

- **Cognitive profile**
  - IQ within normal limits (WNL)
    - even distribution
  - most speech & language skills WNL
    - delayed phonological awareness
  - ↓↓↓↓ academics
    - reading, spelling, and math
DCD profile - David

- Behavioural profile
  - friendly & cooperative
  - (Q) social functioning
  - no attention issues
Intervention

- **Recommendations**
  - +++ school supports for LD
  - IPRC includes diagnoses of LD and DCD
  - IEP reflects both diagnoses (motor and learning needs)
  - OT identifies the activities and conditions that support occupational engagement in the environment
  - Education of child, teacher and parent on functional issues
Previous Goals and Outcomes

- Previous Goals
  - To improve ability to cross midline
  - To improve muscle tone
  - To be able to stand on one foot on a balance beam
  - To improve visual motor skills
  - To limit falling in the playground

- Previous Outcomes
  - By June, 2006, David will transfer an object from left to right using only his right hand
  - David will sit up straight at his desk
  - David will be able to stand on the balance beam for 20 seconds
  - David will score in the average range of the VMI
  - David will not need to make his weekly office visit for an ice pack or band aid
New Goals and Outcomes

Functional Goals (SMART)

- David will independently open and eat all of his prepared lunch within the lunch time period (1 week)
- David will independently dress/change for recess, gym and for bathroom breaks (1 week)
- David will safely participate (no falls or injuries) in specific school playground and gym activities (1 week)

Outcomes

COPM
Performance Quality Rating Scale (PQRS) *(Polatajko and Mandich, 2005)*
Goal attainment Scaling
Putting research into practice

- A new service delivery model for CHEO Rehab PSU to begin soon
  - DCD Clinic
    - early identification (in JK year, accepted up until March 31st)
  - based on DCD study model
    - OT assessment
    - physician feedback
    - interdisciplinary
www.dcdpack.ca
User name: dcdpack
Password: dcdchild

Physician Allied health Collaboration Kit