

Motor abilities and coping in children with and without developmental coordination disorder

Renate Ruckser-Scherb,¹ Roswith Roth,² Harald Lothaller,³ and Christian Endler⁴



Key words:

Coping strategies, motor competences, differences, relationship.

Introduction: This study was conducted in order to identify differences in motor abilities and coping in children with and without developmental coordination disorder. The study also discusses the relationship between coping and motor abilities.

Method: A cross-sectional design with two independent groups was chosen to identify the differences. The Movement Assessment Battery for Children — second edition (Henderson et al 2007) was used to assess motor skills. Coping was evaluated with the Coping Inventory observation form (Adaptive Behaviour Index) (Zeitlin 1985).

Results: Univariate analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) showed significant differences between the motor abilities and coping efforts of children with and without developmental coordination disorder. Calculations using Pearson's correlation coefficient showed a significant correlation between coping and motor competences. In the overall model, boys and children with lower coping efforts were found more likely to be participants in the group with developmental coordination disorder.

Conclusion: Children with coordination problems differ from typically developing children in their motor and coping abilities when rated by their parents. This highlights the importance of paying attention to the coping strategies and resources of children with developmental coordination disorder during therapy.

¹Senior Lecturer, University of Applied Sciences for Health Professions Upper Austria; Interuniversity College Graz, Castle of Seggau, Graz, Styria, Austria.

²Professor, Interuniversity College Graz, Castle of Seggau, Graz, Styria, Austria.

³Lecturer, Interuniversity College Graz, Castle of Seggau, Graz, Styria, Austria.

⁴Professor and Head of College, Interuniversity College Graz, Castle of Seggau, Graz, Styria, Austria.

Corresponding author:

Dr Renate Ruckser-Scherb, Senior Lecturer, Niedernharterstr 20, 4020 Linz, Austria.
Email: renae.ruckser@fhgooe.ac.at

Reference: Ruckser-Scherb R, Roth R, Lothaller H, Endler C (2013) Motor abilities and coping in children with and without developmental coordination disorder. *British Journal of Occupational Therapy*, 76(12), 548–555.

DOI: 10.4276/030802213X13861576675286

© The College of Occupational Therapists Ltd.

Submitted: 18 November 2012.

Accepted: 19 August 2013.

Introduction

Motor competency is important to both self-esteem and social inclusion. Children between 4 and 8 years of age enjoy jumping, running, and climbing. They love to play, draw, sing, and dance. The children in this age group learn to dress themselves, eat on their own, and perform other activities of daily living (Largo 2009). Children with motor coordination difficulties, however, struggle with zippers, putting toothpaste on a toothbrush, or using a knife during meals. They cannot jump or ride a bike as well as their friends; they experience failures every day, and must find ways of coping with them. Their difficulties often reduce their participation in games with their peers, and sometimes even leads to psychosocial problems (Missiuna et al 2007).

But are there any differences in the way these children cope with their feelings and everyday situations? Is there interdependency between the constructs of motor competency and coping? How do the motor abilities of typically developing children and children with developmental coordination disorder (DCD) differ?

Literature review

DCD has a prevalence of 1.8–6 per cent in children from 5 to 11 years of age (Lingham et al 2009, American Psychiatric Association 2000). It is a motor impairment with unknown aetiology and has significant impact on the participation of children in activities. Yet, those affected are not a homogeneous group because specific impact on the individual child differs (Miller et al 2001).

Diagnostic criteria for DCD according to *Diagnostic and statistical manual of mental disorders, 4th edition, DSM-IV (DSM-IV-TR)* (American Psychiatric Association 2000, p55) are as follows:

- A) Performance in daily activities that require motor coordination is substantially below the level expected given the person's chronological age and measured intelligence ...
- B) ... this interferes with academic achievement or activities of daily living.
- C) The disturbance is not due to a general medical condition or ... a Pervasive Developmental Disorder.
- D) If mental retardation is present, the motor difficulties are in excess of those usually associated with it.

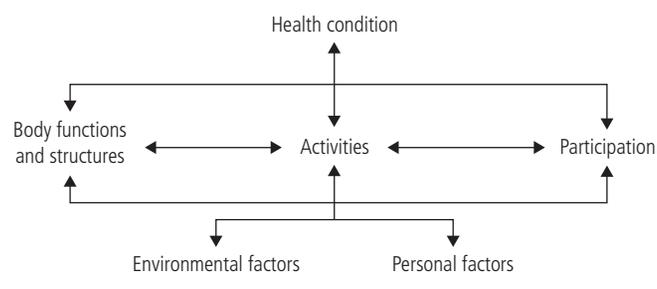
The diagnosis of DCD is found about twice as often in boys than in girls (Sugden and Chambers 1998, Kirby and Sugden 2007), with children frequently diagnosed between 5 and 6 years of age; before that age, motor development is reported to vary widely (Schoemaker 2008).

Gross motor signs of DCD include delayed motor milestones, falling over frequently, difficulties in jumping, running, skipping, climbing, and playing with a ball, also being late in learning to ride a bike, and fatiguing easily. Fine motor signs are difficulties in manipulating small objects, using utensils such as a pencil, and bimanual activities (Schoemaker 2008). These children often exhibit abnormal muscle tone and poor body awareness, have difficulties with gross motor sequencing, and deficits in timing and perceptual processing (Piek et al 2006). Some children exhibit problems in fine motor activities such as drawing, colouring, writing, or using a knife and fork (Polatajko and Cantin 2006); others have problems with all motor activities (Miller et al 2001, Polatajko and Cantin 2006). Typical childhood activities are often reduced, as children with DCD experience problems when it comes to dressing, personal hygiene, and eating skills (Dunford et al 2005, Summers et al 2008). This can lead to secondary psychosocial issues such as low self-esteem, social exclusion and isolation, victimization, anxiety and depression (Dewey et al 2002). Children with DCD have difficulties participating in or successfully completing everyday tasks, which can influence their wellbeing and quality of life (Christiansen and Townsend 2010, Ruckser-Scherb et al 2013).

The World Health Organization (WHO 2007) *International Classification of Functioning, Disability and Health: Children and Youth Version — Children and Youth (ICF-CY)* provides a framework to understand the condition of children with DCD in a holistic manner. The framework considers the body structures and functions affected by DCD (impairment in gross and fine motor skills) as well as the impact on children's activities and participation in school, home and leisure pursuits. Barriers and facilitators stemming from environmental and personal factors are also considered (WHO 2007) (see Fig. 1).

Motor performance deficits can be seen as a considerable source of stress for children with DCD. They are forced to find a response to these stressful circumstances and to solve problems arising in everyday activities. Coping is 'a general

Fig. 1. Interactions between components of ICF (World Health Organization 2007).



term for the learned behaviours one uses to meet personal needs and to adapt to the demands of one's environment' (Zeitlin 1985, p2) and, as such, is a response to stress that challenges the individual to search through a repertoire of adaptive behaviours and choose effective strategies (Christiansen 1991), representing the efforts of an individual to manage specific internal and/or external demands (Lazarus 1999). The effectiveness of coping ranges on a continuum from adaptive to maladaptive:

- Adaptive coping behaviour allows one to react adequately, care for oneself, and meet the demands of the environment (for example, other people). The higher the effectiveness of coping behaviour, the more resources the child has for further adaptive coping, enabling them to cope with more demands, and to generate new strategies for coping with unknown situations, as new patterns of behaviour are tried and learned.
- Maladaptive coping behaviour may help the child to master a stressful situation, but does not allow new learning, in result leading potentially to more stress, and increased vulnerability.
- The level of effectiveness for coping behaviour indicates whether a child's coping resources are either a source of strength or a source of concern that requires intervention (Lazarus 1993, Zeitlin 1985).

Personality disposition and environmental factors each influence coping efforts (Christiansen 1991), and Zeitlin also differentiates between coping with 'self' and coping with the 'environment'.

Coping with self refers to how the child meets personal needs, is able to care for herself/himself and fulfil personal demands, and includes the child's self-image or self-concept. It considers whether a child uses self-protecting behaviours to control the impact of the environment, is able to handle anxiety, uses language to communicate needs, finds a way of handling a difficult situation, asks for help when needed, and can shift plans or change behaviour to achieve a goal (Brown et al 2005).

Coping with 'the environment' refers to how the child adapts to the requirements of others, and to his or her surroundings: that is, if the child plays with others, is liked and accepted by others, and is empathetic to other people, and able to give and accept support (Zeitlin 1985).

Previous studies have examined how the effectiveness of coping relates to gender and age. In a longitudinal study of the

children of Kauai, Werner and Smith (1982) found that females coped more adaptively on the whole than males; Zeitlin, also, observed gender differences in coping, with females tending to cope more adaptively than males (Zeitlin 1985). Surprisingly, there is some evidence that effectiveness in coping decreases as children get older. In children between the ages of 3 and 10 years, Zeitlin observed a slight drop in Adaptive Behaviour Index (ABI) scores (Zeitlin 1985), and adolescents were found to show a decrease in adaptive, and an increase in maladaptive coping (Hampel and Petermann 2005). Related findings have been reported in studies for motor ability, where girls display slightly better motor abilities than boys, and older children show higher skills than younger ones (Starker et al 2007). There are a few studies on low motor competency and its relationship to coping. Watson and Knott (2006) found out that children with DCD apply fewer different types of coping strategies, are more passive, and adopt more avoidance strategies than children without diagnosis.

The aims of this study were twofold: (1) to examine how coping relates to motor ability in children with DCD compared with children without it (it was hypothesized that children with DCD would demonstrate lower coping efforts); and (2) to study differences in motor abilities and coping, as well as evaluating the extent to which these, along with socio-demographic variables, could predict to which of the two groups the child belonged.

Method

Design

A cross-sectional study was conducted, including a group of children with DCD (DCDG) and a control group comprised of children who showed no developmental deviations in motor skills (CG).

Procedure

Ethics approval for this study was obtained from the Ethics Committee of Interuniversity College Graz/Castle of Seggau, Austria. Questionnaire packages consisted of (1) a cover letter to parents; (2) the Coping Inventory; (3) questions on children's abilities; and (4) a consent form. Two hundred questionnaire packages were handed out to parents in Linz, Upper Austria, and surrounding urban and rural areas; 106 of these were filled in by parents and returned with a signed consent form, with a response rate of 53 per cent.

Participants

The DCDG comprised 32 children who were identified by experienced occupational therapists in clinics and independent practices in Upper Austria. The children fulfilled all diagnostic criteria of the DSM-IV-TR:

- Movement Assessment Battery for Children – Second Edition (MABC-2) (Henderson et al 2007) percentile of 9 or less (Criterion A) (Gesellschaft für Neuropädiatrie 2011)
- Difficulties with activities of daily life (Criterion B)

- No other diagnoses, such as attention deficit hyperactivity disorder (ADHD), autistic spectrum disorders (ASD), or cerebral palsy (Criterion C)
- No mental retardation (Criterion D)

The CG comprised 74 potentially typically developing children who were recruited in schools and kindergartens in Upper Austria, and were scheduled for testing with the MABC-2 by the first author, who is an occupational therapist. Ten children had to be excluded from the sample: five were absent on the day of the MABC-2 test, and five had an MABC-2 percentile less than 26 but higher than 9. Sixty-four children with an MABC-2 percentile of more than 25 were assigned to the control group.

To fulfil Criterion B of the diagnostic criteria in the DSM-IV-TR, the first author designed questions concerning the impact of DCD on daily life and academic activities. At this time there was no standardized questionnaire available in German. Parents' reports on their children's skills and deficits have been shown to be a sensitive, reliable, and valid source of information (Faraone et al 1995, Glasco 2000). Thus, five activities were selected, based on a review of literature (Cairney et al 2008, Schoemaker et al 2008, Wilson et al 2000): parents rated their children's ability to perform handwriting or drawing/colouring, handicraft, eating with a knife and fork, dressing, and physical exercise (in a classroom, or a gym hall) on a five-point Likert scale (from 1 = 'very good' to 5 = 'really bad').

Measures

MABC-2

This standardized assessment (Henderson et al 2007) is a revision of the Movement Assessment Battery for Children (Henderson and Sugden 1992). The aim of MABC-2 is to identify children with movement difficulties. The test is divided into three age bands: (1) Age Band 1: 3–6 years, (2) Age Band 2: 7–9 years, (3) Age Band 3: 10–16 years. Children are asked to perform a series of eight motor tasks appropriate to their band. The main items assessed in this instrument are manual dexterity (MD), aiming/catching (AC), and static and dynamic balance (BL) (Henderson et al 2007).

MABC-2 is widely accepted as a test for identifying motor coordination problems, and satisfies Criterion A of the DSM-IV-TR guideline (American Psychiatric Association 2000, Brown and Lalor 2009, Crawford et al 2001, Rodger et al 2007). A validated German version of the MABC-2 is available (Petermann et al 2008), and was used in this investigation. Studies prove criterion-related validity, discriminative validity, and high inter-rater reliability for the MABC-2 (ICC = 0.94–1.0) (Henderson et al 2007).

Coping Inventory — a measure of adaptive behaviour

This observation form (Zeitlin 1985) is used for children between 3 and 16 years of age and includes 48 observation items, each rated on a five-point Likert scale (from 1 = 'never' to 5 = 'always'). It consists of two categories of coping

behaviours, Self and Environment, and the theoretical concept considers three additional dimensions in each of these: 'productive', 'active', and 'flexible'. Each item of the Coping Inventory describes behaviours that are observable. For example, in the Self category, 'Child does not get frustrated easily' is a behaviour for Coping with Self — productive; 'Child asks for help when needed (either from adults or peers)' for Self — active; and 'Child can shift plans or change behaviour to achieve a goal' for Self — flexible. In the Environment category, 'Child knows what is expected and behaves accordingly' is an example for Coping with Environment — productive; 'Child is stimulating to others (gets others started, enthused, involved)' for Environment — active; and 'Child, when necessary, accepts new ideas' for Environment — flexible (Zeitlin 1985). Scores could be provided for each category in the two categories of Self and Environment, and a total calculated to provide the ABI.

Internal consistency reliability coefficients reported in the Coping Inventory manual ranged from 0.84 to 0.98 across the six rated dimensions. All inter-rater reliability coefficients were significant, ranging from 0.781 to 0.895 ($p < 0.001$) (Zeitlin 1985). This measurement was translated from English to German by the first author with permission from Scholastic Testing Service (personal communication, November 2008). The author followed three out of the six steps of the cross-cultural adaptation process (Beaton et al 2000): forward translations by two translators, synthesis of the two translations, and pretesting with 27 parents — to get a revised instrument. After this, a factor analysis was performed ($n = 96$; 48 items), which verified the internal validity (the existence of two dominant factors, Self and Environment). The results of the reliability analysis also confirmed these categories of Self (Cronbach's alpha = 0.918) and Environment (Cronbach's alpha = 0.923) in the German version, and showed high Cronbach's alpha values for all items within these categories.

Results

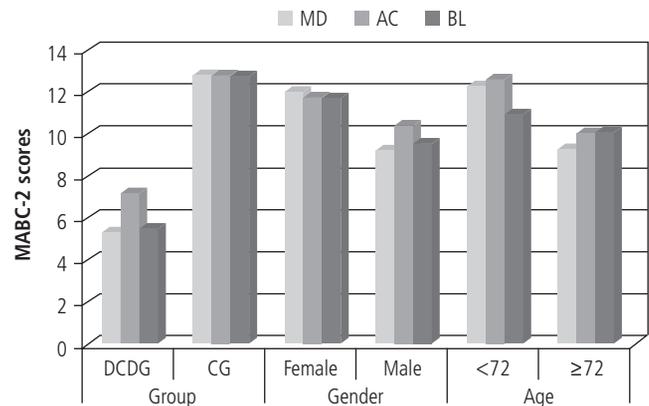
Sample

Ninety-six participants between 48 and 95 months of age (mean age 72 months, SD 13.05) were included. The DCDG consisted of 32 children (8 girls, 24 boys) and the CG of 64 children (29 girls, 35 boys). Usually, more boys than girls are diagnosed with DCD, and this was reflected in the DCDG (group (DCDG, CG) x gender (f, m): $\chi^2 = 3.71599$; $p = 0.054$). DCD is often identified at the age of 60 to 72 months and this was reflected in there being slightly more children of this age group in the DCDG (group (DCDG, CG) x age (<72, ≥72 months): $\chi^2 = 3.04762$; $p = 0.081$). Additionally, girls and boys differed in age, with girls being older than boys (gender x age: $\chi^2 = 7.34587$; $p = 0.007$).

Data analysis

The relationship between coping and motor ability was investigated using Pearson's correlation coefficient. An overall model

Fig. 2. MABC-2 scales: MD (manual dexterity), AC (aiming/catching), and BL (dynamic balance) in relation to diagnosis (DCDG, CG), gender (f, m) and age in months (<72 and ≥72).



was calculated by logistic regression, predicting the affiliation to the DCDG or CG using gender, age and ABI as predictors.

Further analyses examined differences in motor abilities and coping between groups, considering age, gender and type of location. This was done by univariate analyses of variance (ANOVA) and multivariate analyses of variance (MANOVA). The latter were used to examine effects of the independent variables — group (DCDG, CG), Age (<72, ≥72 month) and gender (m/f) — on a set of related dependent variables (ABI as Coping Inventory total score, Coping Inventory subscales, MABC-2 total score, MABC-2 subscales).

Motor ability

The children in the DCDG and CG differed significantly in the MABC-2 total and three subscale scores, as this measure had been used as a diagnosis group allocation. We also expected age and gender differences in the MABC-2 scores in general. In the ANOVA of the total score we found gender ($F_{1,92} = 6.726$; $p = 0.011$) and age ($F_{1,92} = 7.60$; $p = 0.007$) differences, indicating that girls had higher scores ($M = 12.57$, $SD = 4.72$) than boys ($M = 9.73$; $SD = 4.59$) and younger children had higher scores (<72 months: $M = 12.82$; $SD = 4.23$) than older ones (≥72 months: $M = 9.70$; $SD = 4.83$).

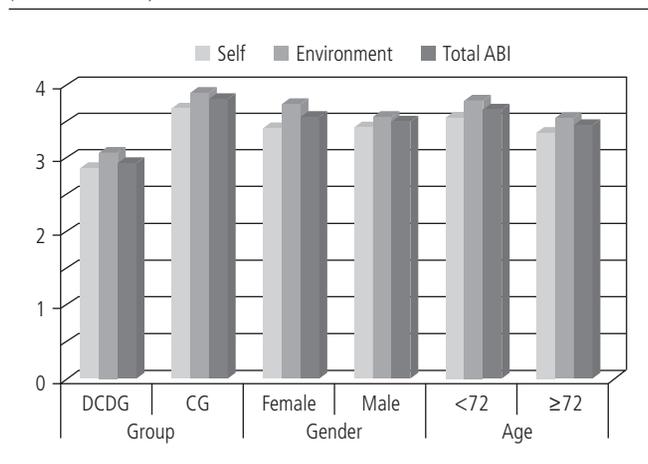
Taking the three MABC-2 subscales into account, MANOVA provided significant main effects in age ($F_{3,90} = 6.24$, $p = 0.001$) and gender ($F_{3,90} = 3.363$, $p = 0.022$). Gender differed in MD ($p = 0.003$) and BL ($p = 0.019$), in both aspects girls were better, whereas age differences appeared in MD ($p = 0.002$) and AC ($p = 0.002$) showing lower scores in the age group ≥72 months. The fact that older children seemed less skilled in motor activities might result from the norms in the age bands: the younger group fell into the higher age of the 3–6 years age band, whereas the older children were among the youngest in the 7–10 years age band, and so might have found the tasks relatively difficult.

Typically developing children reached nearly the same scores in all three MABC-2 subscales, with children with DCD showing more difficulties in MD ($M 5.34$; $SD 2.27$) and BL ($M 5.63$; $SD 1.79$) than in AC ($M 7.22$; $SD 2.21$) (see Fig. 2).

Coping

ANOVA was calculated with the total coping score (ABI) and the independent variables 'group' (DCDG, CG) and 'gender' (f, m). Highly significant group differences were obtained between DCDG and CG in ABI ($F_{1,92} = 13.19, p < 0.001$). The same held true for the two coping categories (multivariate: $F_{2,91} = 45.851; p < 0.001$) of Self ($p < 0.001$) and Environment ($p < 0.001$). For the subscales, gender also showed multivariate significance ($F_{2,91} = 3.838$), but only Self scores differed between genders, with girls obtaining lower scores ($p = 0.024$). No significant interactions of 'group x gender' were found. Children in the CG used more effective coping strategies than DCDG children. (See Fig. 3)

Fig. 3. Coping scales (Self, Environment) and total score (ABI) in relation to diagnosis (DCDG, CG), gender (f, m) and age in months (<72 and ≥ 72).



Relationship between coping and motor ability

Highly significant correlations were obtained between the Coping Inventory total score and the MABC-2 total score ($r = 0.602; p < 0.001$) and subscale scores (MD $r = 0.593$; AC $r = 0.469$; BL $r = 0.540$). The same also applies to the two subscales of the Coping Inventory (highly significant correlation, $p < 0.001$, of Self, $r = 0.529$, and Environment, $r = 0.614$, to the MABC-2 total score).

Affiliation to group

An overall model was calculated by a logistic regression predicting the affiliation to the DCDG or CG using gender, age, location, and ABI as predictors. Children with lower coping efforts (ABI) (OR = 82.940; $p < 0.001$) were more likely to be DCDG participants than those with higher coping efforts. Girls were less likely to be DCDG participants than boys (OR = 0.162; $p = 0.024$). Age was not significant, and 89.6% of the children could be placed in the appropriate group.

Discussion and implications

Relationship between coping and motor abilities

Our results indicated that coping in children with DCD differed significantly from coping in children without motor

problems, supporting the fact that children with DCD have more problems in 'coping with self' and are not always able to fulfil their personal needs; they also experience difficulty in 'coping with environment', being less likely to succeed in adapting to the requirements of others and their surroundings.

The ICF-CY framework (WHO 2007) provides guidance for understanding the interaction between personal factors and environment, and the impact of impaired body functions on activity and participation. Difficulties in motor abilities may be associated with difficulties in activities and problems in participation: that is, activities of daily living (ADLs) at school, home, and in leisure pursuits. Environmental and personal factors interact with activities and participation: for example, when a child needs support from another individual (environmental factors) in order to get dressed, or when a child applies problem-solving strategies (personal factors) in order to participate in a game. Performance deficits lead to constantly challenging situations.

Children have a desire for mastery, and their environment demands mastery of them. The interaction of these two elements creates a pressure to gain mastery, in the form of an occupational challenge in particular situations, triggering the need to develop an adaptive response. The child has to involve sensorimotor, cognitive, and psychosocial features in finding a response to meet the challenging situation. If the response is adaptive and results in success, it is remembered for future use, so enhancing the child's coping skills (Schkade and McClung 2001). Difficulties in motor abilities are related to coping: the better a child's motor abilities, the better he or she is able to cope. Children with poor motor competency are confronted with more stressful situations as a result of their condition, and experience low self-efficacy and low self-esteem (Engel-Yeger and Hanna-Kasis 2010). Their lack of self-belief also means that they have not developed a realistic self-image. As a result, they often ask for help, especially in problem solving, and avoid being confronted by challenging situations (Missiuna et al 2007); rather than creatively seek out new solutions, they stick to what they know, which makes their coping style inflexible, and therefore less effective. Their coping abilities are reduced, yet they are confronted with situations that are more challenging and in need of coping than for typically developing children (Watson and Knott 2006).

Children learn by doing and participating in occupations of daily life. They become competent, independent, and build an occupational and coping repertoire (Zilberbrant and Mandich 2005). Children with DCD experience failure in motor activities as well as in their ability to engage in self-care and play activities (Morgan and Long 2012), interfering with successful participation in ADLs (American Psychiatric Association 2000). Occupational participation (in self-care and play) is associated with coping strategies (Roche and Taylor 2005), and these children have to use strategies to facilitate occupational performance: they have to solve problems. The problem-solving process includes steps such as 'exploring options' and 'planning action' (Polatajko et al 2001). When 'exploring options', children have to appraise

the demands associated with the activity and identify limitations and resources, whereas for 'planning action' they need to find solutions, overcome limitations, and use available resources (Roche and Taylor 2005). But children with DCD are known to have problems with problem solving (Garraalda and Rangel 2004), and tend to use less active coping strategies and more passive coping strategies (Ruckser-Scherb et al 2013). Out of a lowered sense of confidence (Missiuna et al 2007) and competence in dealing with problems, they show an increased use of resignation coping strategies, which are known to be less effective (Garraalda and Rangel 2004). Intervention approaches should, therefore, facilitate problem solving and finding useful strategies, as described in interventionist approaches such as cognitive orientation to occupational performance and occupational coaching with parents (as discussed further in Implications, below).

Differences in coping and motor abilities in children with and without DCD

The study saw no significant differences between girls and boys, with respect to the total coping score: Zeitlin's findings (1985) regarding a difference in gender were, therefore, not confirmed, and it was only in the Self category that girls showed less adaptive behaviour and received lower ratings for coping behaviour. Similarly, age was not associated with coping; this was remarkable, since one might expect that older children would be better at coping with everyday demands.

This study also showed that motor ability differed significantly between the two groups. Compared to typically developing children, those with DCD displayed more difficulties in manual dexterity and balance than they did in aiming and catching. This was consistent with results obtained by Wright and Sugden (1996), who identified two groups: one that performed poorly in manual dexterity and balance, and another that performed poorly in aiming and catching. Gender was not related to motor ability, but in the manual dexterity and balance subscales, girls tend to perform better. These findings are consistent with Starker et al's (2007) research indicating that girls in general display slightly better motor abilities than boys.

Analysis of motor abilities showed that none of the children in the sample demonstrated only fine or gross motor impairment, with all in the diagnosis group having deficiencies in both areas. This distribution did not correspond to findings by Polatajko and Cantin (2006), which identified children with just one of the two categories of impairments.

Implications

For therapists, this study highlighted the need for effective intervention to have an awareness of coping abilities. Performance deficits require coping skills because diminished functional performance leads to stressful sequences or constantly challenging situations. Individuals' coping abilities are challenged by the multiple stressful situations that result from their conditions (Christiansen 1991). The present study suggests that these implications apply equally to children with DCD. Understanding the way in which coping is created

in children with DCD will help therapists to support these children in finding, developing, and using effective coping strategies. Feedback from the therapist can help these children to identify limitations, resources, and solutions, as well as reduce unrealistic expectations (Roche and Taylor 2005). This improves the child's ability to master goals, become more confident, and more willing to persist in difficult tasks (Mandich et al 2003).

Occupational therapy is directed at improving an individual's ability to adapt, addressing the patient's internal processes and how such processes are facilitated, in order to improve occupational functioning. The individual's occupational environment is as important as their experience of personal limitations and potential (Schkade and McClung 2001)

Several intervention approaches can be applied. The child can be given the opportunity to participate in activities that challenge appropriately and lead to a sense of competence or mastery (Larson 2000). Cognitive Orientation for daily Occupational Performance (CO-OP) helps to enhance children's skill acquisition in order to enable engagement in relevant occupations, and promote participation in the activities of daily life. The child is assisted in identifying the most useful cognitive strategies to support successful performance. This may include global problem-solving strategies as well as domain-specific strategies, with the therapist and child working together to find out what works best (Rodger and Polatajko 2010).

When the child's performance is highly dependent on the context, occupational therapists often use 'Occupational Performance Coaching', which enables parents to support their child's performance and leads to successful practice, improved occupational performance, and transferable skills (Graham and Rodger 2010).

Effective intervention requires knowledge of a child's coping strategies and resources; it is important for occupational therapists and parents to know whether the child has problems with meeting personal needs and fulfilling personal demands, or has difficulties in adapting to the requirements of others. It is important to know what is most helpful to the child; interventions should be planned to improve coping skills, enhance resources for coping, and overcome the child's difficulties in establishing self-esteem and self-efficacy.

The challenge of the ICF-CY framework is the move from a focus on impairment to an emphasis on improving participation as the result of intervention (Missiuna 2005). To achieve this, therapists often choose everyday occupations that are meaningful to the child, focusing interventions on areas such as:

- Task-specific intervention: to enhance skill acquisition.
- Cognitive approaches: to discover strategies that address motor problems and involve active problem solving.
- Accommodation of the task and the environment: to encourage the child's participation and to prevent deterioration in academic performance.
- Education of people in the child's environment: to empower the child and family to manage throughout life.

All four types of intervention may be required at some point in time (Missiuna 2005).

The aim of occupational therapy intervention is that children with DCD are able:

... to live more productive and enjoyable lives and become independent in the things that they need and want to do. This includes their ability to look after themselves (self care), enjoy themselves (leisure) and perform to their full potential (learning) (College of Occupational Therapists 2012).

Limitations of the study and future research

The results of this study are limited by several factors. No information on parents' social status was gathered. The Coping Inventory observation form by Zeitlin (1985) was translated from English to German, and omitted three steps of the cross-cultural adaptation process: there was no back-translation, no expert committee review, and no submission to developers for appraisal (Beaton et al 2000, Gjersing et al 2010). In order to answer the Coping Inventory, parents required very good German reading and comprehension ability, which may explain why few children from families of other ethnicities were included in the sample.

The authors collected the data from a convenience sample that included more boys than girls in the DCD group, in order to coincide with natural occurrence of the condition, but boys and girls occurred in equal distribution of CG. For this reason, the effects and interactions of gender should be interpreted with caution.

Finally, it would be important in future studies to investigate the strategies used by children and their families in coping. It would also be interesting to study the impact of DCD on overall wellbeing and quality of life.

Conclusion

These results show a strong relationship between coping and motor abilities. Children with DCD require occupation-centred intervention in order to overcome their difficulties in creating coping strategies, establishing self-esteem, and experiencing self-efficacy. It is important for therapists to facilitate a better match between the demands and abilities of the child, and to take into account the relationship between coping, successful adaptation, and wellbeing. The impact of DCD on overall wellbeing and quality of life will be investigated in a further study.

Conflict of interest: None declared.

Funding: This research received no specific grant support from any funding agency in the public, commercial, or not-for-profit sectors.

Research ethics: Ethics approval was obtained from the Ethics Committee of Interuniversity College Graz/Castle of Seggau, Austria.

References

American Psychiatric Association (2000) *Diagnostic and statistical manual of mental disorders, 4th edition, DSM-IV*. Washington, DC: American Psychiatric Association.

Key findings

- Coping in children with DCD differs from that of typically developing children.
- There is mutual influence between motor competences and coping. This leads not only to differences in motor abilities but also to coping differences; it is suggested that both have long-term effects on development in children with DCD.

What the study has added

This study expands our current knowledge of the relationship between coordination difficulties and coping. It suggests that, for children with DCD, both motor abilities and coping behaviour should be considered in the intervention plan.

- Beaton DE, Bombardier C, Guillemin F, Ferraz MB (2000) Guidelines for the process of cross-cultural adaptation of self-reported measures. *Spine*, 25(24), 3186–3191.
- Brown T, Lalor A (2009) The Movement Assessment Battery for children, second edition: A review and critique. *Physical and Occupational Therapy in Pediatrics*, 29(1), 86–103.
- Brown SP, Westbrook RA, Challagalla G (2005) Good cope, bad cope: Adaptive and maladaptive coping strategies following a critical negative work event. *Journal of Applied Psychology*, 90(4), 792–798.
- Cairney J, Missiuna C, Veldhuizen S, Wilson B (2008) Evaluation of the psychometric properties of the Developmental Coordination Disorder Questionnaire for parents (DCD-Q): results from a community based study of school-aged children. *Human Movement Science*, 27(6), 932–40.
- Christiansen C (1991) Performance deficits as sources of stress. Coping theory and occupational therapy. In: C Christiansen, C Baum, eds. *Occupational Therapy: Overcoming human performance deficits*. Thorofare: Slack Incorporated.
- Christiansen C, Townsend E (2010) *Introduction to occupation: The art of science and living*. 2nd ed. Upper Saddle River, NJ: Pearson.
- College of Occupational Therapists (2012) *Access to occupational therapy for children and young people with developmental coordination disorder (position statement)*. Available at: <http://www.cot.co.uk/position-statements/access-ot-children-and-young-people-developmental-co-ordination-disorder> Accessed 19.11.13.
- Crawford SG, Wilson BN, Dewey D (2001) Identifying developmental coordination disorder: consistency between tests. *Physical and Occupational Therapy in Pediatrics*, 20(2–3), 29–50.
- Dewey D, Kaplan BJ, Crawford SG, Wilson BN (2002) Developmental coordination disorder: Associated problems in attention, learning, and psychosocial adjustment. *Human Movement Science*, 21(5–6), 905–918.
- Dunford C, Missiuna C, Street E, Silbert J (2005) Children's perception of the impact of developmental coordination disorder on activities of daily living. *British Journal of Occupational Therapy*, 68(5), 207–214.
- Engel-Yeger B, Hanna-Kasis A (2010) The relationship between Developmental Coordination Disorders, child's perceived self-efficacy and preference to participate in daily activities. *Child Care, Health and Development*, 36(5), 670–677.
- Faraone SV, Biederman J, Milberger S (1995) How reliable are maternal reports of their children's psychopathology? One-year recall of psychiatric diagnoses of ADHD children. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34(8), 1001–1008.

- Garralda M, Rangel L (2004) Impairment and coping in children and adolescents with chronic fatigue syndrome: A comparative study with other paediatric disorders. *Journal of Child Psychology and Psychiatry*, 45(3), 543–552.
- Gesellschaft für Neuropädiatrie (2011) *Deutsch-Schweizerische Versorgungsleitlinie basierend auf internationalen Empfehlungen (EACD-Consensus) zu Definition, Diagnose, Untersuchung und Behandlung bei Umschriebenen Entwicklungsstörungen motorischer Funktionen (UEMF)*. Version Juli 2011. Available at: <http://www.awmf.org/leitlinien/detail/III/022-017.html> Accessed 12.11.13.
- Gjersing L, Caplehorn J, Clausen T (2010) Cross-cultural adaptation of research instruments: language, setting, time and statistical considerations. *BMC Medical Research Methodology* 2010, 10(13) doi:10.1186/1471-2288-10-13
- Glascoe FP (2000) Early detection of developmental and behavioural problems. *Pediatrics in Review*, 21(8), 272–280.
- Graham F, Rodger S (2010) Occupational performance coaching: Enabling parents' and children's occupational performance. In: Rodger S, ed. *Occupation-centred practice with children*. Chichester: Wiley-Blackwell.
- Hampel P, Petermann F (2005) Age and gender effects on coping in children and adolescents. *Journal of Youth and Adolescence*, 34(2), 73–83.
- Henderson S, Sugden D (1992) *The Movement Assessment Battery for Children*. London: Psychological Corporation, Harcourt Brace Jovanovich.
- Henderson S, Sugden D, Barnett A (2007) *The Movement Assessment Battery for Children – second edition (Movement ABC-2)*. London: Harcourt Assessment.
- Kirby A, Sugden DA (2007) Children with developmental coordination disorders. *Journal of the Royal Society of Medicine*, 100(4), 182–186.
- Largo RH (2009) *Kinderjahre. Die Individualität des Kindes als erzieherische Herausforderung*, 18th ed. München: Piper Verlag.
- Larson R (2000) Toward a psychology of positive youth development. *American Psychologist*, 55(1), 170–183.
- Lazarus RS (1993) Coping theory and research: Past, present, and future. *Psychosomatic Medicine*, 55, 234–247.
- Lazarus RS (1999) *Stress and emotion: A new synthesis*. New York: Springer.
- Lingham R, Hunt L, Golding J, Jongmans M, Edmond A (2009) Prevalence of developmental coordination disorder using the DSM-IV at 7 years of age: A UK population-based study. *Pediatrics*, 123(4), 693–700.
- Mandich AD, Polatajko HJ, Rodger S (2003) Rites of passage: Understanding participation of children with developmental coordination disorder. *Human Movement Science*, 22(4–5), 583–595.
- Miller LT, Missiuna CA, Macnab JJ, Malloy-Miller T, Polatajko HJ (2001) Clinical description of children with developmental coordination disorder. *Canadian Journal of Occupational Therapy*, 68(1), 5–15.
- Missiuna C (2005) *Economic & Social Research Council – Seminar Series, seminar 4: New models for changing the environment, not the child*. Available at: <http://www.dcd-uk.org/seminar4c.html> Accessed 23.11.13.
- Missiuna C, Moll S, King S, King G, Law M (2007) A trajectory of troubles: Parents' impression of the impact of developmental coordination disorder. *Physical and Occupational Therapy in Pediatrics*, 27(1), 81–101.
- Morgan R, Long T (2012) The effectiveness of occupational therapy for children with developmental coordination disorder: A review of the qualitative literature. *British Journal of Occupational Therapy*, 75(1), 10–18.
- Petermann F, Bös K, Kastner J (2008) *Movement Assessment Battery for Children – 2 (Movement ABC-2): Deutschsprachige Adaptation nach SE Henderson, DA Sugden und AL Barnett* (German-language adaptation of Henderson, Sugden and Barnett's *Movement Assessment Battery for Children 2*). London: Pearson.
- Piek JP, Baynam GB, Barrett NC (2006) The relationship between fine and gross motor ability, self-perceptions and self-worth in children and adolescents. *Human Movement Science*, 25(1), 65–750.
- Polatajko HJ, Cantin N (2006) Developmental Coordination Disorder (DCD): An overview of the state of the art. *Seminars in Pediatric Neurology*, 12(4), 250–258.
- Polatajko HJ, Mandich AD, Miller LT, Macnab JJ (2001) CO-OP: Part II – the evidence. *Physical and Occupational Therapy in Pediatrics*, 20(2–3), 83–106.
- Roche R, Taylor RR (2005) Coping and occupational participation in chronic fatigue syndrome. *OTJR: Occupation, Participation and Health*, 25(2), 75–83.
- Rodger S, Polatajko HJ (2010) cognitive orientation for daily occupational performance (CO-OP): a uniquely occupation-centred intervention created for children. In: Rodger S. *Occupation-centred practice with children*. Chichester: Wiley-Blackwell.
- Rodger S, Watter P, Marinac J, Woodyatt G, Ziviani J, Ozanne A (2007) Assessment of children with developmental coordination disorder (DCD): Motor functional, self-efficacy and communication abilities. *New Zealand Journal of Physiotherapy*, 35(3), 99–109.
- Ruckser-Scherb R, Roth R, Fridrich A (2013) Coping and quality of life in children with developmental coordination disorder aged four to seven years. *Ergoscience*, 8(2), 65–74.
- Schkade J, McClung M (2001) *Occupational adaptation in practice. Concepts and cases*. Thorofare: Slack Incorporated.
- Schoemaker M (2008) *Identification of developmental coordination disorder*. Centre of Human Movement Sciences, University of Groningen. Available at: http://www.ergoterapiforbarn.nl/pdf/Marina_identification.pdf Accessed 16.04.12.
- Starker A, Lampert F, Worth A, Oberger J, Kahl H, Bös K (2007) Motorische Leistungsfähigkeit. Ergebnisse des Kinder- und Jugendgesundheits surveys (KiGGS). *Bundesgesundheitsblatt*, 50, 775–783.
- Sugden DA, Chambers ME (1998) Intervention approaches and children with development coordination disorder. *Pediatric Rehabilitation*, 2(4), 139–147.
- Summers J, Larkin D, Dewey D (2008) Activities of daily living in children with developmental coordination disorder: Dressing, personal hygiene, and eating skills. *Human Movement Science*, 27(2), 215–229.
- Watson L, Knott F (2006) Self-esteem and coping in children with developmental coordination disorder. *British Journal of Occupational Therapy*, 69(10), 450–456.
- Werner E, Smith R (1982) *Vulnerable but invincible: A study of resilient children*. New York: Mc Graw-Hill.
- Wilson BN, Kaplan BJ, Crawford S, Campbell A, Dewey D (2000) Reliability and Validity of a Parent Questionnaire on Childhood Motor Skills. *American Journal of Occupational Therapy*, 54(5), 484–493.
- World Health Organization (2007) *International Classification of Functioning, Disability and Health: Children and Youth Version*. Geneva: World Health Organization.
- Wright HC, Sugden DA (1996) A two-step procedure for the identification of children with developmental co-ordination disorder in Singapore. *Developmental Medicine Child Neurology*, 38(12), 1099–1105.
- Zeitlin S (1985) *Coping Inventory – a measure of adaptive behavior*. Bensenville, Illinois: Scholastic Testing Service, Inc.
- Zilberbrant A, Mandich A (2005) Enabling a sense of doing in children. *Occupational Therapy – Now*, 7(2), 19–21. Available at: http://www.caot.ca/otnow/March05/OTNowMarch05_Sense.pdf Accessed 18.11.13.