Undertreatment of Motor Problems in Children with ADHD


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Background: Motor problems occur in 30% to 50% of children with ADHD, and have a severe impact on daily life. In clinical practice there seems to be little attention for this comorbidity with the possible consequence that these motor problems go undertreated. Method: Clinical interview and questionnaire survey of treatment by physiotherapy and factors predicting treatment of motor problems in 235 children with ADHD and 108 controls. Results: Half of motor-affected children had received physiotherapy. Treated children had more severe motor problems, and less frequently presented with comorbid anxiety and conduct disorder. Treated and untreated children were similar in age, and rated similarly on ADHD inattentive and hyperactive-impulsive scales and parental socio-economic status. Conclusion: Currently, undertreatment of motor problems in ADHD occurs. Behavioural factors play a role in referral and intervention.

Key Practitioner Message:
- ADHD and motor problems are frequently co-occurring
- Only half of children with ADHD receive physiotherapy treatment
- Health workers should be aware of the impact of motor problems on the daily life of children with ADHD

Keywords: ADHD; motor problems; children; developmental coordination disorder questionnaire; comorbidity; physiotherapy

Introduction

The frequent co-occurrence of both motor problems and Attention Deficit Hyperactivity Disorder (ADHD) has received relatively little attention in research, compared to the attention for psychiatric comorbidities like depression, autism, ODD and conduct disorder. Also in clinical practice there seems to be less attention for motor problems. Motor problems are usually not part of assessments for ADHD and are typically not included in intervention programs (Gillberg et al., 2004; Gillberg & Kadesjo, 2003; Sergeant, Piek, & Oosterlaan, 2006). Motor problems, often referred to as Developmental Coordination Disorder (DCD), occur in 30% to 50% of children with ADHD (Fliers et al., 2008; Magalhaes, Missiuna, & Wong, 2006; Polatajko & Cantin, 2005;
Visser, 2003). Motor problems have a severe impact on children's daily life, and are a strong predictor of a child's popularity and self-esteem (Skinner & Piek, 2001). Because of their core symptoms of inattention, impulsivity and hyperactivity, children with ADHD usually are among the least popular children in their class (Hoza, 2007; Mrug et al., 2007). Motor problems causing difficulties in, for example, riding a bicycle, dressing, tying shoelaces or causing poor handwriting and sports abilities, further reduce their social participation and make them even more disadvantaged.

Many studies have conclusively shown that physiotherapy of motor problems, especially child-centred, task-oriented approaches, can ameliorate motor disability and thus quality of life (Sangster et al., 2005; Schoemaker et al., 2003; Sugden & Chambers, 2007; Watemberg et al., 2007; Wilson, 2005). Interventions can be delivered by physical therapists (which is usual in The Netherlands), or occupational therapists. Also, parents and teachers can be instructed to manage motor problems, which may be helpful in case of limited professional resources (Sugden & Chambers, 2003). However, since the presence of motor problems often goes unassessed, children may not get access to any of these treatment options.

In the current study, we examined if we could substantiate the clinical impression that motor problems receive too little attention in the treatment of ADHD comorbid disorders. Our main goal was to investigate in a well-diagnosed sample of children with combined subtype ADHD how many and which children were treated for motor problems, currently or in the past. We investigated as secondary goals if treated and untreated children differed in age, gender, motor scores, ADHD inattentive and hyperactive-impulsive symptoms scores, comorbidity with other conditions (anxiety disorder, mood disorders, oppositional defiant disorder, conduct disorder) and socio-economic status of parents, in order to predict actual treatment administration.

### Methods

**Participants**

Participants with ADHD were recruited as part of the International Multicenter ADHD Genetics (IMAGE) study (Brookes et al., 2006; Kuntsi et al., 2006). Children came from paediatric and child psychiatric services, and through advertisements in the magazine and on the website of the Dutch Parents Association of children with ADHD. Participants, all of them previously evaluated by a paediatrician, neurologist or child psychiatrist, were reassessed for ADHD. Probands had to fulfill clinical criteria for DSM-IV combined subtype of ADHD, be 5 to 18 years old, live at home, and attend primary or high school. Exclusion criteria were IQ < 70, known genetic syndromes (Down, Turner, Fragile-X), autism, neurological conditions such as brain disorders and epilepsy currently or in the past.

Control children were recruited from elementary schools and high schools in The Netherlands. Principals were contacted by mail seeking permission to ask the parents to participate. Parents who gave permission received questionnaires by mail. Control children had to obtain non-clinical scores on both the parent and teacher version of the Conners' long version rating scales (Conners’-N-scale: T-score ≤ 62) to rule out ADHD.

In 235 Dutch ADHD families additional information was gathered regarding motor performance and from these families one child with ADHD was included in the study, as were 108 unrelated control children (see Table 1 for demographics). Regional Ethics Review Boards in The Netherlands approved the study. Parents provided written informed consent for their children under 12 years old; children aged 12 and older gave written informed consent themselves in addition to their parents.

**Instruments**

Screening questionnaires (parent and teacher Conners' long version rating scales (Conners, 2003) and parent and teacher Strengths and Difficulties Questionnaires (SDQ (Goodman, 1997)) were used to reassess children with ADHD. T-scores ≥ 63 on the Conners ADHD-sub-scales, inattentive (L), hyperactive-impulsive (M) and total scores (N), and scores >90th percentile on the SDQ-hyperactivity scale were considered as clinically significant. The Parental Account of Children’s Symptoms (PACS), a semi-structured, standardised, investigator-based interview (Taylor et al., 1986), was administered to all children scoring clinically on any of the questionnaires at a subsequent hospital visit for further assessment. A standardised algorithm was applied to the PACS to derive each of the 18 DSM-IV ADHD symptoms, providing operational definitions for each behavioural symptom. These were combined with items that were scored 2 ('pretty much true') or 3 ('very much true') in the teacher-rated Conners ADHD sub-scales (L, M and N) to generate the total number of hyperactive-impulsive and inattentive symptoms of the DSM-IV symptom list. Comorbidities were diagnosed according to the PACS interview, which covers DSM-IV

| Table 1. Summary statistics of children with ADHD and control children |
|-----------------|-----------------|-----------------|
|                 | Children with ADHD | Control children |
|                 | N or mean + SD    | N or mean + SD  |
| **Boys**        |                  |                 |
|                 | 204              | 45              |
| **Girls**       |                  |                 |
|                 | 31               | 63              |
| **Total**       | 235              | 108             |
| **Age (years)** |                  |                 |
|                 | 11.6 ± 2.7       | 11.5 ± 3.2      |
| **Conners (clinical cut-off >62)** |                  |                 |
| **Conners parents total score** | 75.9 ± 9.0       | 46.0 ± 4.6      |
| **Conners teachers total score** | 68.9 ± 9.9       | 46.9 ± 5.1      |
| **Motor affected** |                  |                 |
| **According to parents (DCD-O)** | 82 (34.9%)       | 4 (3.7%)        |
| **According to teachers (GMO)** | 85 (38.5%)       | 9 (9.5%)        |
| **Comorbidities** |                  |                 |
| **Mood disorder** | 45               |                 |
| **Anxiety disorder** | 126              |                 |
| **Oppositional defiant disorder** | 128              |                 |
| **Conduct disorder** | 46               |                 |
symptoms of mood disorder, anxiety disorder, oppositional defiant disorder and conduct disorder. A more elaborate description of the instruments used can be found elsewhere (Fliers et al., 2008; Kuntsi et al., 2006; Schoemaker et al., 2003).

To detect possible motor difficulties the Developmental Coordination Disorder Questionnaire (DCD-Q), was completed by parents, and the ‘Groningen Motoriek Observatieschaal’ (Groningen Motor Observation scale, GMO), was completed by teachers. The DCD-Q, developed in Canada by Wilson et al. identifies children with motor problems in daily life and was recently translated and validated (Schoemaker et al., 2006; Wilson et al., 2000). The internal consistency of the questionnaire is high (alpha = .88). It contains 17 items. The summary score varies from 17 to 85, with low scores representing poor performance. For each item, parents are asked to compare the degree of coordination of their child with that of other children of the same age, and to rate it on a five-point scale, ranging from ‘not at all like this child,’ to ‘extremely like this child’. There are four subscales: motor control in motion, fine motor control/handwriting, gross motor control/planning and general coordination. Cut-offs indicate the presence of motor problems, suspected motor problems and no motor problems, for scores lower than the 10th percentile, between the 10th to the 25th percentile and above the 25th percentile of normal controls, respectively. In this study, the cut-off at the 10th percentile was used to indicate motor impairment. The GMO, developed in the Netherlands, is an observation checklist to be completed by teachers (van Dellen, Vaessen, & Schoemaker, 1990). It contains 18 items to be scored on a 4-point scale, ranging from ‘not at all like this child’ to ‘extremely like this child’. The total score varies from 18 to 72. High scores on the GMO indicate poor performance. The cut-off scores indicating the presence of motor problems, suspected motor problems or no motor problems are age and gender dependent. A score below the 15th percentile was used as the cut-off in this study to indicate motor impairment.

The parental socio-economic status was based on information concerning parents’ professions, gathered during the PACS interview. Professions were categorised into five levels, from manual labor to academic work.

A questionnaire concerning physical domains was designed for this study. This questionnaire was completed by parents and contains 36 questions concerning development, motor milestones, sleep habits, infections, hospital admissions, medication and use of facilities like physiotherapy. The question evaluated in this study was posed as follows: ‘was your child ever treated for motor problems by physiotherapy, now or in the past?’

**Statistics**

Imputation using the mean of the list was performed in case a questionnaire (DCD-Q or GMO) had missing items, with the restriction of five missing items. This was done for 7% of the children with ADHD and 3% of the control children for the DCD-Q and for 16% of the children with ADHD and 10% of the control children for the GMO. Exploratory analysis was used to classify children as having motor problems. In children with motor problems, the frequency of treatment by physiotherapy was computed. The two groups (ADHD receiving physiotherapy versus ADHD without receiving physiotherapy) were compared using a MANOVA. Total motor scores on DCD-Q and its motor subscales, GMO motor scores, ADHD inattentive and hyperactive-impulsive scores were dependent variables and age was entered into the model as a covariate. Comparison of proportions was performed using Chi square regarding dichotomous comorbidity (anxiety disorder, mood disorder, oppositional defiant disorder, conduct disorder) and socio-economic status of parents. Outcomes were calculated separately for parents and teacher reports of motor problems. Logistic regression analysis was used to examine which variables predicted treatment in a multivariate model. A p-value of < .05 was used to indicate statistical significance. All statistical analyses were carried out with SPSS (version 14.0; SPSS, Inc. 2005).

**Results**

Table 1 presents the demographic and clinical characteristics of the 235 ADHD affected children and 108 control children included in the study. Teacher’s GMO data were available for 221 (94%) of children with ADHD, and for all control children. Data on treatment were available for all children with ADHD and all control children. As reported previously, 38.5% and 34.9% of ADHD affected children had motor problems according to teachers and parents, respectively (for more details regarding prevalence see Fliers (2008)). Forty-five children showed mood disorder, 126 children anxiety disorder, 128 children oppositional defiant disorder and 46 children conduct disorder as comorbidities of ADHD.

**Analyses in children with ADHD**

The overall MANOVA showed a significant difference between groups ($F = 3.19$, $df = 194$, $p = .001$). Table 2 presents a comparison of children with ADHD who did and who did not receive physiotherapy with p-values. All motor scores except for gross motor control differed significantly, with poorer scores in treated children. Other characteristics of treated and untreated children did not differ: age, gender, ADHD inattentive and hyperactive-impulsive scores, comorbidity (anxiety disorder, mood disorders, oppositional defiant disorder, conduct disorder) and socio-economic status of parents were comparable.

**Analyses in children with ADHD and motor affection**

Children who had a motor disorder, according to the parent-rated DCD-Q, received physiotherapy more often than children who were rated motor affected by their teachers (59.8% and 45.6%, respectively, $p < .001$, data not shown). In parent-rated motor affected children comorbid conduct disorder (CD) reduced the treatment percentage: 43/66 children without CD were treated, versus 6/16 with CD ($p = .043$). For anxiety disorder 23/32 children without anxiety were treated versus 26/50 with anxiety ($p = .073$). In a logistic regression model of parent-rated motor affected children with physiotherapy as
dependent variable and DCD-Q and GMO motor scores, anxiety and conduct disorder as predictors, only GMO scores predicted treatment (OR 2.21, \( p = .014 \), CI-95% = 1.18–4.14). This was similar for the teacher-rated motor affected children, here also only the GMO predicted treatment (OR 1.09, \( p = .457 \)) but was true for the teacher ratings (\( p = .010 \)). In this group anxiety played a significant role: 17/20 children without anxiety received physiotherapy compared to 3/26 with anxiety (\( p = .013 \)). Logistic regression with physiotherapy as dependent variable and GMO motor scores, anxiety and age as predictors showed that only the absence of comorbid anxiety disorder predicted treatment in this group of children (OR 6.32, \( p = .025 \), CI-95% = 1.26–31.86).

**Discussion**

Our study confirms the impression that motor problems of children with ADHD are a neglected area of clinical attention. Roughly only half of the children with ADHD and motor problems in our study had received physiotherapy.

To our knowledge, the finding that especially behavioural factors play a role in referral and intervention is new. The presence of anxiety disorder and conduct disorder in motor affected ADHD children was associated with a lower likelihood of receiving treatment by physiotherapy. This conforms to our expectation. If a child is extremely disruptive, or very afraid, parents are probably less likely to expose them to physiotherapy. Treatment will then be focussed more on behavioural interventions.

We did not find any effects of severity of ADHD symptoms, age, or parental socioeconomic status on motor treatment status. Possibly, the severity of ADHD was not predictive as all of the children suffered from the most severe subtype of ADHD, due to strict inclusion criteria of the study. The finding of socioeconomic status not predicting treatment could be due to the fact that in The Netherlands, every citizen is insured for physiotherapy by means of National Health Insurance, which means that parents do not have to pay extra to use this service.

Children rated by their parents as motor affected were treated more often than children rated motor affected by their teachers. It seems plausible that parents seek help earlier, if they themselves notice problems in their children. Still, teachers can be expected to detect motor problems accurately, since they can compare children to a larger reference group than parents. This finding may point to a lack of communication on this subject between teacher and parents.

An interesting issue is whether motor problems are also undertreated in children without ADHD. It could be that this is a general problem rather than being specific for comorbidity with ADHD. More research is needed to answer this question, preferably in a large non-clinical sample.

A limitation of our study is the use of questionnaire data only, in the absence of objective motor tests or assessments of motor functioning by experienced clinicians necessary for a clinical diagnosis of developmental coordination disorder (Polatajko & Cantin, 2005; Wilson, 2005; Green & Wilson, 2008). We are aware of the fact that questionnaires have been found to be less reliable in assessing motor ability than objective motor tests. Other studies have found higher proportions of motor affected children when using motor performance tests rather than questionnaires. However, also lower percentages (30%) of affected children have been found. This discrepancy partly depends on the specific motor test or questionnaire, and also on the chosen cut-off scores that are chosen to indicate affected status (Polatajko & Cantin, 2005). The questionnaires used, however, have been validated (van Dellen et al., 1990; Schoemaker et al., 2006) and we also used two different informants, the parents and the teacher, to detect motor difficulties. Furthermore, only through the use of the questionnaire approach it was possible in the setting of the IMAGE-study to evaluate the large number of subjects necessary to get a representative picture of intervention use for motor problems in children with ADHD.

Our study has clinical implications. Physiotherapy or occupational therapy has been proven effective for treating motor problems, especially the task-oriented and the cognitive-based approaches like neuro motor...
task training (NMTt) and cognitive orientation to daily occupational performance (CO-OP) (Niemeyer, Smits-Engelsman, & Schoemaker, 2007; Sangster et al., 2005; Sugden & Chambers, 2007). These modern intervention methods are child-focused and help children to acquire important skills for daily activities, which can increase their quality of life.

All health specialists treating children with ADHD should be aware of the high frequency of co-occurring motor problems. Referrers need more training and guidance in the field of DCD (Gaines et al., 2008; Dunford et al., 2004). Children with ADHD should be assessed for motor problems in a standardised manner, either by interviewing parents and children or by use of questionnaires. A physical examination should be part of the assessment. However, it is known that the physical and neurological examination as performed by doctors does not always detect motor coordination problems (de Kleine et al., 2003). Therefore we suggest that healthcare workers use a screening questionnaire such as the DCD-Q, a valid and reliable questionnaire (Cairney et al., 2008; Schoemaker et al., 2006; Wilson et al., 2000). If necessary, a child should then be referred to a paediatric physical therapist for a standardised test like the Movement ABC to confirm or reject a diagnosis of DCD, and to make a detailed inventory of problems in daily activities as basis for treatment. The social-emotional benefits of movement training cannot be underestimated. Withholding therapy from these children is a missed opportunity to really help them cope with the challenges of daily life.

Acknowledgements

We thank the families and teachers who participated in the study. We also wish to thank Marina Schoemaker for enabling us to use the Dutch version of the DCD-Q while the validation study was still in progress. This study was funded by NIH grant no: R01 MH62873-01A1 to Stephen Faraone.

References


