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Original Article

Cognitive motor therapy: description and clinical analysis of children with Developmental Coordination Disorder (DCD)

Terapia motora cognitiva: descrição e análise clínica de crianças com Transtorno do Desenvolvimento da Coordenação (TDC)[1,2]

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Abstract

Introduction: It is estimated that 6% of school-age children have Developmental Coordination Disorder (DCD), characterized by motor difficulties that restrict participation at home, in the community and at school. The Cognitive Orientation to Daily Occupational Performance Approach (CO-OP) is effective in improving the functional performance of these children, but there is little clinical data on variations in the response to the intervention. **Objective:** To identify and describe the most relevant characteristics of children with DCD that influence their response to CO-OP. **Method:** Case study conducted with four children with DCD who underwent CO-OP: the two who had the highest gain and the two who had the lowest gain with the intervention. The data obtained in this study were categorized and synthesized to compose a clinical description of the participants' characteristics. **Results:** Parents of children with better performance showed better parenting style. Unstructured observation of the researchers during the collections showed that the families of the children with greater progress attended the collections more often and were more engaged. Greater family support seems to provide children with more confidence, as well as increase motivation to achieve goals in therapy. **Conclusion:** The support offered by parents is a relevant factor for the good performance of children with DCD in the intervention using the CO-OP. The clinical description of children with DCD assists in the reasoning during professional practice because it identifies characteristics that can influence progress in the intervention.

Keywords: Occupational Therapy, Psychomotor Performance, Child Development.

[1]This is a secondary analysis of data from a randomized clinical trial approved by the Research Ethics Committee - COEP (CAAE 54543216.3.0000.5149, opinion 1.520.296 of April 20 of 2016) of the Universidade Federal de Minas Gerais (UFMG). The clinical trial was registered on the ClinicalTrials.gov platform.

[2]The work was presented at the X Brazilian Congress of Motor Behavior in 2020.

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Resumo

Introdução: Estima-se que 6% das crianças em idade escolar apresentam Transtorno do Desenvolvimento da Coordenação (TDC), caracterizado por dificuldades motoras que restringem a participação em casa, na comunidade e na escola. A *Cognitive Orientation to Daily Occupational Performance Approach* (CO-OP) é efetiva para melhorar o desempenho funcional dessas crianças, mas há poucos dados clínicos sobre variações na resposta à intervenção. **Objetivo:** Identificar e descrever as características mais relevantes de crianças com TDC que influenciam sua resposta à CO-OP. **Método:** Estudo de caso conduzido com quatro crianças com TDC submetidas à CO-OP: as duas que obtiveram maior e menor ganho com a intervenção. Os dados obtidos no estudo foram categorizados e sintetizados para compor uma descrição clínica das características dos participantes. **Resultados:** Os pais das crianças com melhor desempenho apresentaram melhor estilo parental. A observação não estruturada das pesquisadoras durante as coletas identificou que as famílias das crianças com maior progresso compareceram mais vezes às coletas e eram mais engajadas. Maior apoio familiar parece proporcionar mais confiança às crianças, além de aumentar a motivação para alcançar os objetivos em terapia. **Conclusão:** O apoio oferecido pelos pais é fator relevante para o bom desempenho de crianças com TDC na intervenção usando a CO-OP. A descrição clínica de crianças com TDC auxilia o raciocínio durante a prática profissional por identificar características que podem influenciar o progresso na intervenção.

Palavras-chave: Terapia Ocupacional, Desempenho Psicomotor, Desenvolvimento Infantil.

Introduction

Among school-age children, 5 to 6% have motor difficulties that restrict their participation at home, in the community and at school (American Psychiatric Association, 2014). These children have Developmental Coordination Disorder (DCD) which, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), is diagnosed according to the following criteria: (A) acquisition and execution of coordinated motor skills (reaching, running and jumping, for example) lower than expected for age; (B) the deficit in motor skills interferes with the performance of daily activities expected for age; (C) symptoms are noticed at the beginning of development; (D) deficits cannot be explained by other health conditions (American Psychiatric Association, 2014).

"Clumsy", "uncoordinated" and "disorganized" are some of the adjectives often directed at children with DCD, which often leads to their exclusion from group activities, especially in school and sports. Thus, begins a vicious cycle in which, due to motor difficulties, the child is excluded from recreational and social activities that would stimulate their motor skills (Hendrix et al., 2014; Lingam et al., 2012; Yu et al., 2016; Poulsen et al., 2007). Problems performing typical childhood activities, such as getting dressed, playing ball and riding a bicycle, can lead to isolation and even generate anxiety and depressive symptoms in childhood and adolescence (Missiuna & Campbell, 2014). Because of motor issues and their secondary consequences, these children need specialized intervention to help them face difficulties.

It should be noted that DCD is not usually an isolated condition, it often occurs in association with Attention Deficit Hyperactivity Disorder (ADHD) and Specific Learning,

Speech and Language Disorders. There are, therefore, very varied clinical pictures, in which, in addition to the motor deficit, one can observe varying degrees of inattention, difficulties in reading and writing, numerical sense, logical reasoning and in the production and expression of speech (American Psychiatric Association, 2014). Behavior problems, with difficulties in controlling emotions, may also be present. The combination of these conditions, with greater or lesser degree of motor impairment, has an effect on functional performance, restricting participation in different contexts, including school, in childhood and throughout life (Blank et al., 2019).

Children with DCD need specialized intervention, especially when the motor deficit is severe, limiting performance in activities of daily living, school performance and socialization, generating psychosocial consequences (Blank et al., 2019). Currently, the main intervention approaches are classified into two large groups, according to the International Classification of Functioning, Disability and Health (ICF) (Organização Mundial da Saúde, 2003): approaches oriented towards activity and/or participation and those oriented towards body structure and function (Blank et al., 2019). The former have the following characteristics: (1) being customer-oriented, (2) achieving goals, (3) being focused on specific tasks and contexts, (4) encouraging active customer participation, (5) functionality and non-normativeness and (6) the active involvement of parents or caregivers to promote generalization and transfer. Generalization is the ability to perform the activity learned in other contexts, while transfer refers to the use of acquired strategies to learn similar activities that were not the focus of therapy (Houldin et al., 2018). Body structure and function-oriented approaches are aimed at reducing underlying impairments to the motor frame, based on the hypothesis that improving body structure and function automatically leads to better activity performance and participation (Novak & Honan, 2019).

According to the European Academy of Childhood Disability guidelines for the diagnosis and management of DCD (Blank et al., 2019), both activity-oriented and/or participation-oriented approaches and body structure and function-oriented approaches can be beneficial for individuals with DCD. However, approaches centered on body structure and function are generally more used with younger children, to promote improved motor functions, and obtain better results in occupational performance when combined with task training. However, alone, these approaches do not demonstrate positive results for the transfer of acquired skills to other tasks not addressed in therapy. On the other hand, activity and/or participation-oriented approaches have shown favorable results in improving performance in Activities of Daily Living (ADLs), in addition to enabling transfer (Blank et al., 2019).

Among activity-oriented and/or participation-oriented approaches, the Cognitive Orientation to Daily Occupational Performance Approach (CO-OP) (Polatajko & Mandich, 2004) is a client-centered approach created by Canadian occupational therapists to improve occupational performance and participation in different contexts. It is a brief therapy that can be conducted in any setting, such as the clinic or at home, and has robust evidence of efficacy (Smits-Engelsman et al., 2018; Novak & Honan, 2019). Children choose goals and the therapist supports their learning, guiding them to select appropriate strategies and stimulating problem-solving skills, always with the active involvement of parents. Initially, the therapist teaches a global cognitive strategy – Meta-Plan-Do-Czech – that will be used to approach all activities chosen by the child. This strategy helps the child to focus attention and manage behaviors and attitudes so that, with the therapist's

support, they can effectively discover and learn other more specific strategies, until the child is able to satisfactorily perform the activities chosen as goals (Araújo et al., 2019).

Although there are many studies on the effectiveness of CO-OP in children with DCD, most of them were performed with groups and report mean pre and post-intervention performance, but there are generally no detailed clinical descriptions of participants that reveal the characteristics of children. who respond better or worse to the intervention (Scammell et al., 2016). Portney & Watkins (2015) emphasize the importance of descriptive studies to contribute to clinical practice. The collection of detailed information about a specific individual or group, as well as their responses to treatments and risk factors, helps to identify aspects that can be investigated in future studies, in addition to attracting the clinician's attention, helping them in the dissemination of information among professionals (Portney & Watkins, 2015).

A better understanding of the characteristics of children with DCD who respond or not to a given intervention guides the clinician in identifying the most efficient type of approach for each case, which contributes to optimizing the results obtained with the therapy. This information favors the clinical reasoning process of the occupational therapist, indicating paths for decision-making according to the particularities of each child (Araújo et al., 2019). The aim of this study was to identify the most relevant characteristics of children with DCD with different response patterns to CO-OP. This descriptive case study presents the clinical characteristics of four children with DCD who underwent CO-OP: both obtained greater and lesser gains from the intervention. It was investigated whether it is possible to identify common characteristics in the performance of these children that could guide future research and interventions with this public, contributing to greater effectiveness of this type of intervention.

Method

Design and ethical aspects

Descriptive case study analyzing the clinical characteristics of children with DCD who achieved greater and lesser progress after intervention using the CO-OP. This is a secondary analysis of data from a randomized clinical trial on the effectiveness of CO-OP approved by the Research Ethics Committee - COEP (CAAE 54543216.3.0000.5149, opinion 1.520.296 of April 20, 2016) of the Universidade Federal de Minas Gerais (UFMG) and registered on the ClinicalTrials.gov platform under number NCT02893852. Participants signed a Free and Informed Consent Form (TCLE).

Original study

The original intervention project, started in October 2016, included evaluation, intervention and follow-up three months after the intervention. Recruitment details available in Araújo et al. (2019).

The four participants in this study were children aged 7 to 11 years old. These children were selected according to the following inclusion criteria: 1) score lower than expected for their age in a standardized test of motor coordination (Movement ABC2 percentile - MABC-2 <16); (2) performance in activities of daily living (ADLs) that require motor coordination

below expectations for the child's chronological age, considering learning opportunities; (3) children enrolled in regular education and without evidence of marked delay (more than one year) in relation to their peers; (4) cognitive development as expected for chronological age (total quotient on the Wechsler Intelligence Scale for Children - WISC-IV ≥70); (5) age between seven and 12 years; (6) no diagnosis of autism spectrum disorder or signs of neurological damage or neuromuscular disorders that affect movement. Twenty-one children completed the intervention phase and 19 completed the follow-up phase.

The intervention was based on the original CO-OP protocol (Polatajko & Mandich, 2004) of 12 sessions, involving active parental participation in at least eight sessions. A booklet on DCD and CO-OP was prepared, explaining what cognitive strategies are and how to use them to support the child's occupational performance in different contexts. According to the CO-OP protocol, in the 1st therapy session, each child selected four goals or intervention objectives, in the 2nd session, the puppet was presented, whose name refers to the global cognitive strategy "Meta-Plano-Faz-Checa". Continuing the intervention, guided mediation and discovery techniques were used to acquire skills and improve the performance of goals (Polatajko & Mandich, 2004). At the end of therapy, children were assessed for motor skills, goal achievement, and participation at home, school, and community. Three months after the end of the intervention, the children were evaluated at follow-up.

For the case study, a clinical description and detailed analysis of four children participating in the intervention were performed.

Instrumentation

To characterize the participants, data on the history of growth and development of each child were obtained from the Development Questionnaire prepared by the researchers. Economic data were obtained using the Brazilian Economic Classification Criteria (CCEB) of the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa, 2014). This questionnaire, based on the education of the head of the family and ownership of assets, divides families into six economic classes: A - around R$20,272.56; B1 - around BRL 8,695.88; B2 - around R$4,427.36; C1 - around R$2,409.01; C2 - around BRL 1,446.24; D-E - around R$639.78.

The Parenting Styles Inventory (PSI) (Gomide, 2006) was used to identify parenting practices that may influence the development of antisocial and prosocial behaviors in children and adolescents. These practices are associated with the support given to the child at home by the parents, which is relevant to the CO-OP. The PSI score is transformed into percentiles: 75-99 – great parenting style, with a marked presence of positive parenting practices and absence of negative parenting practices; 55-70 – good parenting style, above average; 30-50 – good parenting style, but below average; <25 – risky parenting style (Gomide, 2006).

To identify signs of DCD and confirm a deficit in functional performance, the Parents' Developmental Coordination Disorder Questionnaire (DCDQ) (Wilson et al., 2000) Brazilian version – DCDQ-Brasil (Prado et al., 2009) was used. This questionnaire consists of 15 items about the child's motor performance, scored on a scale of 1 to 5 points, with a total score ranging from 15 to 75. The DCD indicator is given according to age: from five years to seven years and 11 months, total score ≤46; from eight years to nine years and 11 months, total score ≤55; from 10 years to 15 years and six months, total score ≤57 (Prado et al., 2009).

To assess children's motor performance, the MABC-2 (Henderson et al., 2007) was used, which contains activities involving manual dexterity, ball skills and dynamic and static balance. The test's raw data are converted into percentiles, which allow identifying the levels of motor difficulty: percentile ≤5 = motor deficit, percentile 6-15 = possible motor deficit and percentile >15 = motor performance appropriate for age. Combining the DCD-Brazil score below the cutoff point and the MABC-2 score, it is possible to classify children into severe DCD, scores less than or equal to the fifth percentile, and moderate DCD, scores between the sixth and 15th percentiles on the MABC-2 (Smits-Engelsman et al., 2015).

To assess intellectual capacity, the Wechsler Intelligence Scale for Children WISC-IV (Weschler, 2013) was used, and only children with intelligence quotient (IQ) ≥70 were included in the original study. The Swanson, Nolan and Phelham SNAP-IV parent questionnaire - Brazilian version (Mattos et al., 2006) was applied to identify signs of ADHD, which may be associated with DCD. From the SNAP-IV total scores, children were classified as: 1 = signs of inattention, 2 = signs of hyperactivity/impulsivity, 3 = signs of combined ADHD, and 4 = no signs of ADHD.

The Self Perception Profile for Children (SPPC) – Brazilian version (Harter, 1985; Valentini et al., 2010) was used to assess self-concept in the areas of academic competence, social acceptance, athletic competence, physical appearance, behavioral conduct and overall self-concept. The questionnaire has 36 questions, scored on a Likert scale of 1-4 points, in which each item is scored as really true or partially true, according to the child's perception (Valentini et al., 2010).

To define the intervention goals, the Perceived Efficacy and Goal Setting System (PEGS) (Missiuna et al., 2004) was used, a questionnaire that uses 24 pictures of motor activities in the areas of self-care, school work and common childhood play (Ruggio et al., 2018), which allow the child to identify areas of difficulty and define intervention goals. The PEGS is scored on a scale of 1-4, with a total score ranging from 24 to 96, with the higher the score, the greater the perceived effectiveness in performing the activities indicated on the cards. Using PEGS, children selected four activities/goals they would like to learn from the intervention. Each of these activities was scored for quality of performance and satisfaction with performance, using the scale from 1 to 10 (1 = dissatisfied; 10 = completely satisfied) proposed in the Canadian Occupational Performance Measure (COPM) (Law et al., 2009). Gain of two points or more in COPM score signals clinically significant change (Law et al., 2009). In this study, we will deal only with three of these four activities, which were the goals trained with the children. The fourth goal was for the generalization of the structure learned with the three goals trained together with the child.

Finally, the Performance Quality Rating Scale – Generic Rating System (PQRS-G) (Polatajko & Mandich, 2004; Martini et al., 2015) was used, a scale from 1 to 10, developed by Polatajko & Mandich (2004) for use with the CO-OP. Using videos of the child doing at least five repetitions of the activities they chose as therapy goals, their performance in each of the activities was scored — pre, post-intervention and at follow-up — by four external examiners previously trained to achieve good performance. reliability index (≥0.80). A positive difference ≥3 points is considered a clinically significant change (Martini et al., 2015).

Case study

For this case study, the two children who made the most progress and the two children who made the least progress, as scored in the assessment shortly after the end of the intervention using the CO-OP in the clinical trial, were selected. Only four children were selected with the intention of allowing a more detailed analysis of the data. The following criteria were defined to identify progress:

1) Difference in mean performance score on goals before and after the intervention, scored on a 1-10 point scale by the PQRS-G. The children who obtained the highest value for this difference were classified as those with the greatest progress, and those with the lowest value, as those with the least progress.

2) As a tiebreaker, the total PQRS-G scores obtained at follow-up were considered. The use of this criterion was necessary to differentiate the two children with greater progress, since both had obtained the same improvement value by the PQRS-G.

Data analysis

Data were gathered, categorized into tables and analyzed according to the following aspects: personal characteristics, socioeconomic data, parenting style, presence or absence of ADHD signs, motor performance, cognitive performance, behavioral profile and perceived efficacy. In addition, the characteristics of the activities chosen as goals were analyzed, as well as the children's performance in these activities, according to the perspectives of the child, parents and external evaluators.

The data of the four selected children were organized in an Excel® spreadsheet. Initially, the data were summarized and the values of each evaluation compared, aiming to identify possible relevant aspects between the children's characteristics, test scores and intervention results. Then, these characteristics were discussed by the researchers to carry out the clinical synthesis and identify the patterns or characteristics that may have influenced the performance of these children.

Results

The four children analyzed were between 9 and 11 years old, one girl and three boys. The children were identified as: C1, C2, C3 and C4, with C1 and C2 being the ones that made the most progress and C3 and C4 the ones with the least progress. All were born weighing more than 2,500 g, but two were characterized as borderline premature, with one in each group using medication to treat ADHD. The children's families were classified in economic levels A and B according to the CCEB (Brazil Economic Classification Criteria) (Table 1). Parents' education level ranged from Complete Elementary School to Complete Higher Education. Families of children with greater progress in performance had higher scores on the PSI (70), which indicates a good parenting style, with the presence of above average positive parenting practices; and those with less progress, obtained lower scores: 15 and 45, which means, respectively, risky parenting style and good parenting style, but below average.

Table 1. Characterization of children and their families.

	Best performance				Worst performance			
	C1		**C2**		**C3**		**C4**	
Age (years)	10		9		9		11	
Sex	Female		Male		Male		Male	
Birth weight	2,380 g		3,500 g		2,500 g		-	
Gestational weight	38 weeks		36 weeks		36 weeks		-	
Use of medication	No		Ritalin		No		Ritalin	
WISC-IV	70		99		120		95	
SNAP-IV	1		2		2		3	
Economic classification	B1		B1		A		B1	
Mother's scholarity	Complete high school		Incomplete high school		Complete higher education		Complete high school	
Father's scholarity	Complete primary education		Complete primary school		Complete higher education		Incomplete higher education	
Parenting style	70		70		15		45	
	Child	**Mom**	**Child**	**Mom**	**Child**	**Mom**	**Child**	**Mom**
PEGS	68	49	73	53	78	54	77	73

Note: SNAP-IV = Swanson, Nolan and Pelham IV Scale (1 = signs of inattention, 2 = signs of hyperactivity/impulsivity, 3 = combined ADHD signs, and 4 = no signs of ADHD); WISC-IV = Wechsler Intelligence Scale for Children Fourth Edition; PEGS = Perceived Efficacy and Goal Setting System.

Tables 2 and 3 present the results of the pre- and post-CO-OP and follow-up evaluations of the four participants. Child C1, with the lowest cognitive level (WISC-IV = 70), made the most progress with the intervention, gaining 6.3 points on the PQRS-G post-CO-OP (Table 3). In the DCDQ-Brazil total score, she went from 18 to 41, but this increase in the score was not enough to change her classification in the questionnaire, having remained as possible-TDC. In MABC-2, there was little change, but it persisted in the motor deficit range. C1 showed small gains in self-perception (SPPC) post-CO-OP (Table 2) and obtained clinically relevant changes, by COPM, in all goals, considering both the child's and parents' scores (Table 3).

Table 2. Pre and post-intervention performance in the motor questionnaire and test, in the self-concept and perceived efficacy questionnaires.

	DCDQ		MABC-2		SPPC - Global	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
C1	18	41	1	0.5	3.7	4
C2	29	37	0.5	0.5	2.5	3
C3	54	51	5	25	4	4
C4	49	53	2	5	2.5	1.8

Note: DCDQ = Developmental Coordination Disorder Questionnaire; MABC-2 = Movement Assessment Battery for Children 2° Edition; SPPC = Self Perception Profile for Children.

Table 3. Pre and post-intervention and follow-up performance on intervention goals scored by external examiners (PQRS-G) and by children and their parents (COPM).

Child	PQRS-G				COPM-child				COPM-Parents			
	Pre	Post	Difference	Follow-up	Pre	Post	Difference	Follow-up	Pre	Post	Difference	Follow-up
C1	2.7	9	6.3*	9.7	3.3	8.0	4.7*	10.0	3.7	5.7	2.0*	10
C2	2.7	9	6.3*	9.3	3.3	9.7	6.4*	8.7	1.7	8.0	6.3*	8.7
C3	7.7	8.7	1.0	8.3	4.3	9.0	4.7*	9.0	5.0	7.7	2.7*	9
C4	7.3	8	0.7	7.3	5.0	8.3	3.3*	9.3	6.0	6.3	0.3*	9,3

Note: PQRS = Performance Quality Rating Scale; COPM = Canadian Occupational Performance Measure. *Clinically relevant.

Child C2 showed an improvement equal to that of C1, 6.3 points on the PQRS-G, but had a lower performance score at follow-up, ranking as the second child with the greatest progress (Table 3). His total DCDQ-Brazil score went from 29 to 37, which was also insufficient for a change in classification, remaining as possible-TDC. With a constant percentile of 0.5 in the MABC-2, C2 remained in the severe motor deficit classification. The WISC-IV indicated an IQ of 99, which is average for cognitive abilities (Table 1). Like C1, he showed small gains in self-perception (SPPC) post-intervention (Table 2), achieving clinically relevant change in COPM in all goals, from his perspective and that of his parents (Table 3).

Considering the children with the lowest response, C3 was the child with the highest cognitive level (WISC-IV = 120) (Table 1); however, they obtained an increase in the PQRS-G score of only 1 point post-CO-OP, ranking as the second child with the lowest progress (Table 2). Their DCDQ-Brazil score reduced from 54 to 51 post-CO-OP, remaining in the possible-TDC classification; however, in the MABC-2, there was an increase in the score, going from the 5th percentile in the pre-intervention to the 25th in the post-CO-OP. Their SPPC score remained constant pre and post-intervention (Table 2). C3 achieved clinically relevant gains in total COPM means (Table 3) and clinically significant gains in all goals alone, both from his perspective and that of his parents (Table 4).

Child C4, with average intelligence (IQ=95) (Table 1), was the one who made the least progress among the 21 who completed the study, with an increase in the PQRS-G score of only 0.7 points (Table 3). His DCDQ score increased from 49 to 53 and, on the MABC-2, the percentile increased from 2 to 5, which did not change his classification as a severe DCD. In terms of self-concept, their global score (SPPC) decreased by 0.7 points (Table 3). C4 showed clinically relevant improvement in only two goals, as scored by the child, but did not show clinically relevant improvement in any of the therapy goals, from the parents' perspective (Table 4). When considering the total average in COPM (Table 3), C4 showed clinically significant improvement only according to his perspective.

As for the goals chosen by the children for therapy (Table 4), it is possible to observe that C1, C2 and C3 selected Activities of Daily Living (ADLs) such as, “Tying shoelaces” and “cutting food with a fork and knife”, this being last chosen by C1 and C3. On the other hand, C1, C3 and C4 chose goals with the ball, such as “grabbing”, “kicking” and “throwing harder and aiming for the dodge ball”, and “grabbing the ball” was a common goal between C1 and C4. Children C2, C3 and C4 chose goals typical of the school environment, such as “making/assembling things with their hands”, “improving their writing” and “finishing homework on time”. Finally, C1 and C2 chose activities involving

gross motor skills, different from activities with a ball, namely "jumping rope" and "riding a bicycle".

Table 4. Occupational performance in pre and post-intervention in each selected goal.

	Goals	COPM - Desempenho			
		Children		Parents	
		Pre	Post	Pre	Post
C1	1. Cutting food with knife and fork.	1	9*	4	6*
	2. Jumping rope.	4	7*	3	5*
	3. Grabbing the ball.	5	8*	4	6*
C2	1. Tying shoelaces.	2	10*	1	9*
	2. Cycling.	3	10*	3	10*
	3. Making/Assembling things with your hands.	5	9*	1	6*
C3	1. Throwing the ball harder and aim for the dodge ball.	5	9*	6	9*
	2. Cutting food with knife and fork.	4	10*	6	8*
	3. Improve writing.	4	8*	3	7*
C4	1. First schoolwork on time.	6	7	5	6
	2. Kicking the ball.	4	8*	6	6
	3. Grabbing the ball.	5	10*	7	7

Note: COPM = Canadian Measure of Occupational Performance. *Clinically relevant change.

The researchers' unstructured observation during the collections identified that the families of children with greater progress attended the collections more often and were more engaged.

Families with better parenting styles (families from C1 and C2: good parenting styles) correspond to those who participated in almost all sessions. Regarding the families with the worst/most precarious parenting styles (families from C3 and C4: risky parenting style and good parenting style, but below average, respectively), conflicting family situations were perceived during the sessions. The parents of these children were not very engaged in the activities and, in some situations, the presence of conflicts made it necessary for the child to remain alone in the session.

Discussion

Analysis of individual cases identified that children with DCD with better parenting styles and self-concept scores had better results after the CO-OP intervention. In general, the post-intervention DCDQ-Brazil and MABC2 measurements did not significantly change the children's ratings, with them remaining as possible-DCD and motor deficit. A surprising finding was that the child with the lowest cognitive ability obtained the greatest clinically significant gains in occupational performance with cognitive motor therapy.

In this study, the presence of one girl for three boys corroborates most studies on the prevalence of DCD, between 1:2 and 1:7 (girl:boy), and only in the study by Girish et al. (2016) found more girls than boys, in a ratio of 1:2 (boy:girl) (Blank et al., 2019).

Consistent with data suggesting that ADHD is the most common disorder associated with DCD, with frequency ≥50% (Blank et al., 2019), all children investigated had some type of attention deficit disorder. Child C1 had signs of inattention, C2 had a diagnosis of

ADHD and, together with C3, showed signs of hyperactivity/impulsivity, while C4 showed signs of combined ADHD, with medication use. The fact that the child most affected by attention deficit was the one with the worst post-intervention performance suggests the need to use specific strategies to control attention along with the CO-OP.

The socioeconomic level did not seem to influence the greater or lesser progress, since, in this study, the child with the highest socioeconomic level (A) showed little progress after the intervention. Blank et al. (2019) state that, although DCD occurs regardless of culture, race and socioeconomic conditions, the engagement of children with DCD in activities can be influenced by social, cultural and physical factors, as well as by individual characteristics. Contrary to expectations, it was curious to observe that children with a higher cognitive level and with parents with a higher educational level had worse post-intervention performance. This fact may have been influenced by parenting styles and practices in the children's context, and it was also observed that parental involvement during therapy was greater among children who showed better post-intervention progress. Parents with a good parenting style attended most of the sessions, in addition to following the therapist's guidelines regarding tasks to be done at home. On the other hand, the parents of C3 and C4 did not show the same engagement and participation in therapy, although they had more education. It is noted, therefore, that parental participation and parenting style are factors that can act as facilitators or barriers in the intervention process, influencing the results of therapy.

Parents of C1 and C2, with good parenting style, participated in almost all sessions. C1 was often accompanied by her mother and two younger sisters, which was sometimes a facilitator and, at other times, a barrier to the child's engagement in therapy. Strategies used by the therapist varied between requesting the presence of only the mother, when possible, and using behavior management techniques with C1 and her sisters to avoid conflicts and performance comparisons. The child often performed the activities oriented to do at home, to stimulate the generalization and transfer of skills and cognitive strategies learned during therapy.

C2 came to the sessions accompanied by their mother and younger brother. The child is diagnosed with ADHD and had impulsive behavior. The mother was actively engaged in the intervention, but in agreement with the therapist, she was absent from the sessions at times – a strategy used by the therapist to manage the child's behavior. The engagement of the families of C1 and C2 in the therapy process was a facilitator, with guidance on carrying out, at home and in other contexts, the activities that the child chose as a goal.

The therapy with C3 had the participation of their mother and younger sister, who often did not stay during the entire session, as C3 preferred that both were out of the therapy environment. The strategy used by the therapist to engage the family was, at the end of the sessions, together with C3, to describe the progress of each session. Furthermore, although home activities were oriented, the child was not always interested in completing them with his mother and sister. With a risky parenting style, the mother reported conflicts in the relationship with C3, and that the child preferred to do the activities in the therapy itself. The mother and child were referred for psychological follow-up.

Most of the time, C4 attended the consultations with his father, but, although he was present and apparently attentive during the sessions, he was not very participative. The father was away from work by accident and showed signs of depression, which may have influenced his engagement in his son's therapy. Homework was rarely done and, when C4 did it, it was

with the help of his mother, grandmother and younger brother. According to the child's reports and videos recorded at home, the dynamics were often confusing, representing a barrier to C4's performance. The child reported frequent bullying at school due to his short stature, which possibly reflected in the overall self-concept assessed by the SPPC.

In this study, children whose parents scored higher on the parenting styles questionnaire made greater post-therapy progress. Good parenting style means the presence above average of positive or democratic parenting practices that provide social support, which is associated with more confident behaviors and greater capacity for reflective critical thinking in children (Cassoni, 2013). These children had more opportunities to practice activities at home and in other environments. On the other hand, children who presented risky or below average parenting styles (15 and 45), approaching the classification of negligent, permissive or authoritarian practices, respectively, showed less progress. This suggests that poor or absent social support may have led to greater insecurity and, consequently, less progress in therapy.

Comparison of PSI values with self-concept scores (SPPC) shows that children with better parenting styles also improved their post-intervention SPPC scores, while those with lower PSI scores had lower post-intervention SPPC scores (Harter, 1985; Valentini et al., 2010). Such comparisons, added to the fact that children with better parenting styles were the ones that made the most progress, suggest that better parenting styles provide greater self-confidence/self-concept in the child, helping them in the process of improving occupational performance (Zimmerman, 2000).

Interestingly, the children who made the most progress had lower COPM scores before the intervention; while those with less progress either perceived themselves as performing well before the intervention or perceived only small changes in post-intervention performance. As children with less progress had slightly higher performance scores initially, the perceived change in score seems to have been smaller.

According to Blank et al. (2019), the minimum IQ criterion required for the diagnosis of DCD has been much discussed regarding its validity. According to these authors, a score of 71 does not seem to be sufficient to distinguish between children with DCD and those with intellectual disorders, in which motor coordination problems are common. In the present clinical description, C1 had borderline IQ for intellectual disability, but was the child with the greatest progress in therapy. Children C3 and C4, with less progress, had higher IQ values, and C3, who obtained the highest global intelligence index, did not show clinically significant progress in occupational performance according to external evaluation, but obtained gains in motor and occupational performance from your perspective and that of your mother.

The children who showed the greatest progress in therapy were those with the worst motor results. C1 and C2 showed small changes in motor outcomes, which were not enough to change their classifications regarding motor difficulties and possible DCD. C3 and C4 also showed changes in their motor scores; however, only C3 showed sufficient motor improvement to change his motor deficit classification. Such findings reinforce the fundamental characteristic of CO-OP of encouraging improvement in occupational goals and the fact that all motor alterations are secondary results, not being the main objective of the intervention. Motor performance does not yet seem to be decisive for greater or lesser progress after CO-OP therapy, which is influenced by multiple factors.

It was observed that the targets selected for intervention ranged from Activities of Daily Living, activities in the school context, play and leisure activities. There is, however, an interest

in improving performance in popular activities typical of childhood. Most goals involved activities with great potential for socialization in the child's frequent environments, especially those involving play and leisure. It is interesting to note that, although these children have reduced participation in collective activities because of motor deficits, the choice of goals reveals an interest in being successful, possibly for greater socialization with peers.

Despite the descriptive type of study being one of the limitations of this study, the data contribute to professional practice by identifying characteristics that can influence progress in occupational therapy. A specific cognitive-based approach to intervention was investigated, which values parental participation, and it is important to analyze other types of intervention. It should be emphasized that all children, with worse or better performance, showed some gain with the use of CO-OP, being necessary to investigate cases in which there was no clinically significant gain.

Conclusion

The individualized clinical analysis of children with DCD who underwent CO-OP in this study identified that parenting style and self-concept seem to influence children's performance, which may have overlapped with factors such as socioeconomic class and parental education level. One hypothesis is that greater family support gives children more confidence and, therefore, they feel more supported and motivated to achieve their goals during therapy. In addition, motor outcome findings do not seem to be decisive for progress in occupational goals. Progress, in turn, is influenced by the dynamic interaction between several factors. The data discussed are useful to guide occupational therapists who work with this public to prioritize the use of CO-OP with more present and engaged families. The results suggest the use of CO-OP in clinical practice with children with lower cognitive abilities, since children with lower cognitive and motor performance showed good results with the therapy.

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Beatriz Couto Fortuna was responsible for organization of sources and/or analyses, conception and writing of the text. Mylena Oliveira Machado was responsible for organization of sources and/or analyses, conception and writing of the text. Clarice Ribeiro Soares Araújo was responsible for data collection, organization of sources and/or analyses, writing and text revision. Ana Amélia Cardoso was responsible for monitoring the intervention and text revision. Lívia de Castro Magalhães was responsible for conception of the study, organization of sources and/or analyses, conception, writing and revision of the text. All authors approved the final version of the text.

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