

The Treatment Effectiveness of Top-down Approaches
for Children with Developmental Coordination
Disorder: A Meta-analysis

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由上而下的治療模式對發展性協
調障礙兒童的療效：後設分析

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The Treatment Effectiveness of Top-down Approaches for Children with Developmental Coordination Disorder: A Meta-analysis

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Abstract

The purpose of this meta-analysis was to address whether existing studies of top-down treatment approaches support the effectiveness of motor skill acquisition and skill transfer for children with developmental coordination disorder (DCD). Based on a review of literature from 1987 to 2002, six studies of top-down approaches for children with DCD were identified and examined using a meta-analysis. A large and statistically significant relationship between top-down approaches and motor skill acquisition ($r_w = .91$) was found. The Cognitive Orientation to daily Occupational Performance (CO-OP) approach was superior to other top-down approaches ($g = .92$). The meta-analysis also suggests that children with DCD benefited from top-down approaches in skill transfer ($r_w = .52$). Future studies of top-down approaches need to include a control group, examine the long term effects of skill training, and compare effects between top-down approaches and bottom-up approaches, such as sensory integration and kinesthetic training.

Key words: evidence-based practice, effect size, intervention

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Introduction

Developmental coordination disorder (DCD) has been described as difficulty in movement skills experienced by children that is not primarily due to general intellectual, primary sensory, or motor neurological impairment (Cermak, Gubbay, & Larkin, 2001). The term, DCD, was introduced in the DSM-III-R in 1987 (American Psychiatric Association [APA], 1987) and the criteria were revised in the DSM-IV (APA, 1994). DCD has four criteria: 1) a marked impairment in the development of motor coordination; 2) this impairment interferes with academic achievement or activities of daily living; 3) the coordination difficulties are not due to a medical condition (e.g., cerebral palsy, hemiplegia, or muscular dystrophy) and the criteria are not met for Pervasive Development Disorder; 4) if mental retardation is present, the motor difficulties are in excess of those usually associated with it (APA, 1994, p. 53).

Children with motor coordination problems are often referred to occupational therapists because of their difficulties in daily activities at school (e.g. handwriting, participation in sporting activities, social interaction) and at home (e.g., self-care activities) (Dewey & Wilson, 2001; Missiuna & Polatajko, 1995). In order to provide evidence-based practice, it is important to evaluate the published research on treatment effectiveness for children with DCD (Mandich, Polatajko, Macnab, & Miller, 2001). Mandich and colleagues (2001) conducted a literature search for intervention and treatment studies of children with DCD, covering the period of 1985-2000. They identified 32 studies in their search. They reviewed and organized the underlying assump-

tions of the treatment approaches, and categorized the studies into "bottom-up" approaches and "top-down" approaches. Bottom-up approaches often were based on hierarchical theories, and focused on remediating underlying sensory-motor deficits to improve functional motor performance. These approaches included sensory integration (SI), process-oriented kinesthetic training, perceptual motor training, and the combination of these. For example, the sensory integration approach emphasizes provision of enhanced sensory input for use, facilitates adaptive responses to challenges imposed by the environment, and enables meaningful and purposeful participation in daily occupations (Ayres, 1979; Spitzer & Smith Riley, 2001). Based on their review of bottom-up intervention studies (Kaplan, Polatajko, Wilson, & Faris, 1993; Kavale & Mattson, 1983; Pless & Carlsson, 2000; Polatajko, Macnab, Anslett, Malloy-Miller, Murphy, & Noh, 1995; Vargas & Camilli, 1999), Mandich and colleagues (2001) concluded that the evidence supporting the efficacy of the bottom-up approaches in improving functional performance of children with DCD is limited, and the relationship between underlying processes and functional performance is still unclear.

The other intervention categorized by Mandich and colleagues (2001) was the top-down approach. Unlike the traditional and hierarchical approach, top-down approaches primarily address the child's problems in occupational performance: the child's role participation in home, school, and community contexts. In order to engage in their roles satisfactorily, children need to do well in the tasks and activities that constitute their expected roles. The top-down approaches

focus on direct skill training and use task specific intervention and cognitive strategies (Mandich, et al., 2001). Task specific intervention involves direct teaching of targeted tasks and includes strategies such as breaking a task into several steps, teaching the task step by step, and linking the whole task together. Cognitive strategies focus on teaching the child problem solving techniques related to performing specific motor tasks (Bouffard & Wall, 1990; Henderson & Sugden, 1992; Polatajko, Mandich, Miller, & Macnab, 2001a).

A new cognitive approach, Cognitive Orientation to daily Occupational Performance (CO-OP), proposed by Polatajko and her colleagues (2001a; 2001b) is an individualized, client-centered approach focused on strategy-based skill acquisition. The therapy sessions use a structured format with twelve, one-to-one sessions, each of approximately one hour in length. This child-centered approach helps to achieve child-chosen goals (Polatajko, et al., 2001b). The CO-OP uses a dynamic performance analysis (Polatajko, Mandich, & Martini, 2000) to help children understand task requirements, find where their performance breaks down, solve the problems with possible strategies, and practice them. Tasks are accomplished by using two cognitive strategies: a global strategy [Goal-Plan-Do-Check (GPDC)] and domain-specific strategies. The CO-OP is different from the other top-down approaches because it uses child chosen tasks rather than therapist-chosen tasks or the tasks from an assessment such as the Movement Assessment Battery for Children (M-ABC) (Henderson & Sugden, 1992). The CO-OP incorporates guided discovery and verbal self-guidance rather than therapist given feedback, and the CO-OP has parent/caregiver involvement.

In every treatment session, the therapist and the child work together to identify the problems and solutions in a dynamic interaction.

Pless and Carlsson (2000) conducted a meta-analysis to examine the effects of motor skill intervention on children with DCD and included 13 studies from 1970 to 1996. They found that specific skill training approaches had better effectiveness than other approaches (sensory integration-SI, neurodevelopmental treatment-NDT, and perceptual-motor training). However, the specific skill training studies selected by Pless and Carlsson also included kinesthetic training which was defined as a bottom-up approach by Mandich and colleagues (2001). Moreover, Pless and Carlsson (2000) did not include studies using the CO-OP approach and only examined one top-down approach-Revie and Larkin's (1993) study of skill specific training. There has not been meta-analytic evidence for other top-down approaches, especially for the new cognitive approach- CO-OP. Thus, the purpose of this meta-analysis was to examine the effects of top-down approaches for improving motor skills of children with DCD. It was hypothesized that top-down approaches would significantly improve motor skill acquisition and skill transfer in children with DCD.

Methods

Selection of Studies

A literature search for treatment studies was conducted using MEDLINE, PsycINFO, ERIC, and CINAHL, covering the period from 1987 to 2002. The beginning date of 1987 was selected because the diagnosis of DCD was introduced in the DSM system in 1987. A broad range of key words was used for the target population such as

"developmental coordination disorder", "physically awkward", "clumsy child syndrome", "sensory integration disorder", "dyspraxia", and "motor coordination problems". We also used the key words: treatment, intervention, occupational therapy, rehabilitation, effectiveness, and occupational performance. In addition to the literature search, we contacted one of the primary authors who conducted the research in this area (C. Mis-siuna, personal communication, January 16, 2002) and asked her whether there were any unpublished studies on this topic. Studies also had to meet the following criteria to be included: 1) include children with DCD, sensory integration disorder, clumsiness or dyspraxia, 2) report means and standard deviations of the outcome measures for the experimental and control groups, 3) use a top-down treatment approach, including task-specific intervention or cognitive

strategies, and 4) measure motor outcomes. Six studies met the criteria and were included in the meta-analysis. Table 1 describes these studies. Five studies were published in journal articles and one was a master's thesis. The earliest study (Revie & Larkin, 1993) was in 1993, and the studies of the CO-OP approach were all in the stage of pilot investigation. Each of these six studies was a within-subject design with pretest and posttest; none of the studies included a control group without intervention. The dependent variables were separated into two categories: motor skill acquisition and motor skill transfer. The variables in the motor skill acquisition category were the motor skills that the therapist taught the child directly. For motor skill acquisition, the outcome measures included the M-ABC Test (Henderson & Sugden, 1992), the Canadian Occupational Performance Measure (COPM) (Law,

Table 1. A Summary of All Studies Selected for Analysis (1987-2002)

Author	Sample size	Age / gender	Duration	Intervention	Dependent Variable Category
Revie & Larkin 1993	21	5.9 yr to 9.3 yr 11 boys, 9 girls	8 sessions/ 4 weeks	Task specific training	SA: distance throw, distance hop, target kick, ball bounce and catch
Wright & Sugden, 1998	18	6 yr to 9 yr 10 boys, 8 girls	5 weeks	Cognitive-motor	SA: M-ABC test, M-ABC checklist
Wilcox, 1994	10	7 yr to 12 yr 6 boys, 4 girls	10 sessions	CO-OP	SA: COPM, PQRS ST: TOMI, VMI, Handwriting Evaluation Scale
Martini & Polatajko, 1998	4	7 yr to 12 yr 3 boys, 1 girl	10 sessions	CO-OP	SA: COPM, PQRS
Miller, et al., 2001	10	7 yr to 12 yr 7 boys, 3 girls	10 sessions	CO-OP	SA: COPM, PQRS ST: BOTMP, VABS-motor, VMI, SPPC-motor
Polatajko, et al., 2001a	25	7 yr to 12 yr	10 sessions	CO-OP	SA: COPM ST: M-ABC test, VABS-motor, VMI

Notes. CO-OP= Cognitive Orientation to daily Occupational Performance Approach; SA=skill acquisition; ST= skill transfer; M-ABC= Movement Assessment Battery for Children; COPM= Canadian Occupational Performance Measure; PQRS= Performance Quality Rating Scale; TOMI= Test of Motor Impairment; BOTMP= Bruininks-Oserestsky Test of Motor Proficiency; VABS= Vineland Adaptive Behavior Scale; SPPC= Self-Perception Profile for Children.

et al., 1991), and the Performance Quality Rating Scale (PQRS) (Martini & Polatajko, 1998). The M-ABC Test, which includes a number of motor tasks, was used to measure skill acquisition (Wright & Sugden, 1998) and was also used as a measure of skill transfer (Polatajko, et al., 2001a). The CO-OP studies used the COPM and the PQRS to measure skill acquisition. The COPM measures three child-chosen motor tasks rated by the child himself/herself. The PQRS measures the quality of children's motor performance rated by therapists. In addition to measuring motor skill acquisition, the CO-OP studies examined whether the child could use the strategies of the top-down approach in performing other motor skills. The measurements of motor skills that the therapist did not teach the child were categorized as measures of motor skill transfer. These outcome measures of motor skill transfer included the M-ABC Test (Henderson & Sugden, 1992), the Vineland Adaptive Behavior Scales-motor (VABS) (Sparrow, Balla, & Cichetti, 1984), the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) (Bruininks, 1978), the Developmental Test of Visual-Motor Integration (VMI) (Berry & Buktenica, 1989), Test of Motor Impairment (TOMI) (Stott, Moyes, & Henderson, 1984), the Handwriting Evaluation Scale (Malloy-Miller, 1985), and the Self-Perception Profile for Children (SPPC) (Harter, 1985). Non-motor outcome variables (i.e. social and communication skills)

were not included in the meta-analysis because the research hypothesis only addressed motor skill learning.

Conducting the Meta-analysis

This meta-analysis was performed using the effect size r as an estimate of the degree to which treatment was related to outcome. Using the procedure described by Rosenthal (1994), the effect size r of each individual study was calculated directly from the researcher's t statistics or F statistics. If a t value or an appropriate F (1 df in the numerator) was not provided in the study, appropriate means and standard deviations were entered into a formula for a paired t -test. If an exact p value was provided in the study, the p value was converted to a Z statistic by using a table of standard normal deviates, and then the effect size r was calculated. These formulas are presented in Table 2. The r values were coded with a positive sign to indicate a positive intervention effect, and a negative sign to indicate a negative effect. This was done because a higher score in some measurements indicated improvement, eg. the BOTMP (Bruininks, 1978), but in some tests such as the M-ABC Test (Henderson & Sugden, 1992), a higher score indicated poorer performance. In addition to the effect size r , the 90% confidence interval (CI) of the effect size r for each study or the weighted mean effect size r was calculated (Shadish & Haddock, 1994, p. 266,

Table 2. Formulas Used To Calculate Effect Size r

Effect Size r Formula
$r = [t^2 / (t^2 + df)]^{1/2}$
$r = [F / (F + df)]^{1/2}$
$r = Z / (N)^{1/2}$

Notes. t = test of significance for comparing the scores of two conditions, calculated from a paired t -test; F = test of significance for comparing the scores of 2 or more conditions, calculated from an analysis of variance (ANOVA); Z = test of significance for demonstrating the probability of a set of scores occurring; df = degrees of freedom; N = sample size. Only F 's with 1 df in the numerator could be used to calculate r . The df from the error term (denominator) is the one used in calculation from F to r .

equations 18-2, 18-3, 18-4). The Z statistic of the effect size r was also calculated (Shadish & Haddock, 1994, p. 266, equation 18-5), then converted to the p value, a statistically significant effect size r was at $p < .05$ (one-tailed, directional test of $p < .05$).

Within one study, a separate effect size r for each motor outcome was calculated. The effect size r for each outcome measure was transformed into Fisher's Z_r for calculating the average effect sizes Z_r for each individual study. The effect sizes Z_r were averaged to compute one effect size for each category (motor skill acquisition and motor skill transfer). For the six studies, the unweighted mean effect size was the average of these studies' Z_r . Then, the effect sizes Z_r were converted back to an effect size r . In addition, a weighted mean effect size (r_w) was calculated using a fixed effects model. procedure described by Shadish and Haddock (1994, p. 265, equation 18-1), studies with larger sample sizes were weighted more heavily than studies with smaller sample sizes.

The homogeneity of the individual study's effect sizes was tested using a Q statistic. (Shadish & Haddock, 1994, p266, the convenient form of equation 18-6). The test of homogeneity is used to determine whether a moderator analysis should be conducted. A rejection of homogeneity suggests that a set of effect sizes may not be from the same population of effect sizes.

Moderator analyses, also called sensitivity analyses, were performed to compare the different types of top-down approaches and the different outcome measures. The estimated contrast g was calculated from a linear combination of the

contrast group means (Hedges, 1994, p.292, equation 19-15). The contrast coefficients were chosen to reflect a particular comparison (i.e. group 1=-1, group 2=+1), so that the contrast g was the difference between the mean effect sizes of group 1 and group 2. In addition to the estimated contrast g , the p value was also reported. The first moderator analysis tested the hypothesis that the CO-OP approach was superior to the other top-down approaches. The second moderator analysis tested the hypothesis that the improvement in skill acquisition was greater than in skill transfer. This second moderator analysis was conducted within each of the three studies that measured both skill acquisition and skill transfer. The results of the analyses of the three studies were combined.

Results

Table 1 shows a summary of the attributes of the six studies that met the criteria for inclusion. Four studies used the CO-OP approach, one study used task-specific training, and one study used a cognitive-motor approach that combined task-specific training and problem-solving strategies. Only three studies measured skill transfer.

Effectiveness in Skill Acquisition

Table 3 shows the meta-analysis results of skill acquisition. The top-down approaches showed a positive association with motor skill acquisition for children with DCD. The unweighted mean effect size was .95, and the weighted mean effect size r_w was .91. Both the unweighted and weighted effect sizes were large and statistically significant ($p < .001$). Based on the weighted effect size, it can be stated with a 90% confidence level that the true effect size fell within the range

Table 3. A Summary of the Meta-analytic Results

Author	N	Intervention	ES r (90% CI)	
			Skill Acquisition	Skill Transfer
Revie & Larkin, 1993	21	Task specific training	.74 (.50 to .87)	
Wright & Sugden, 1998	18	Cognitive-motor	.82 (.63 to .92)	
Wilcox, 1994	10	CO-OP	.98 (.93 to .99)	.25 (-.35 to .70)
Martini & Polatajko, 1998	4	CO-OP	.99 (.67 to 1.0)	
Miller, et al., 2001	10	CO-OP	.96 (.87 to .99)	.39 (-.21 to .77)
Polatajko, et al., 2001a	25	CO-OP	.95 (.93 to .98)	.62 (.34 to .79)
Unweighted ES			$r = .95$	$r = .44$
Weighted ES			$r_w = .91$ (.87 to .94)	$r_w = .52$ (.30 to .79)

Notes. ES= effect size; CI= confidence interval; CO-OP= Cognitive Orientation to daily Occupational Performance approach.

of .87 and .94. Using the Binomial Effect Size explanation (Rosenthal & Rubin, 1982; Tickle-Degnen, 1998), the meta-analytical r can be explained as: *At pre-treatment, there were only 4.5% of the children with DCD scoring at a high level of motor skills (relative to the average of the entire set of pre and post scores); whereas after the top-down intervention, 95.5% of the children with DCD were scored at a high level.* A weighted mean effect size of .91 means that there was a 91% increase of high scores on motor skills from pre-treatment and post-treatment.

Effectiveness in Skill Transfer

Table 3 shows that for the three CO-OP studies that included outcome measures related to skill transfer, the unweighted mean effect size r was .44, and the weighted mean effect size r_w was .52. Both the unweighted and weighted effect sizes were statistically significant ($p < .001$). Based on the weighted effect size, the meta-analytical r for skill transfer can be interpreted as: *At pre-treatment, there were only 24% of the children with DCD scoring at a high level of their*

skill transfer (relative to the average of the entire set of pre and post scores); whereas after the top-down intervention, 76% of the children with DCD were scored at a high level. A weighted mean effect size of .52 means that there was a 52% increase of high scores on motor skill transfer from pre-treatment and post-treatment.

Results of Moderator Analyses

The test of the homogeneity of the set of study effect sizes provided statistically significant evidence that the effect sizes for skill acquisition of the six studies were not from the same population ($Q=17.01$, $df= 5$, $p < .05$). This finding suggests that there may have been systematic differences among these studies. Thus, further moderator analyses were warranted. One important moderator was the type of top-down intervention. Four studies used the standard CO-OP approach and all were from the same research team, whereas the other two studies were conducted by different researchers and used other approaches. Based on this consideration, a moderator analysis tested whether the studies that did

not use CO-OP approach had a significantly lower effect size than the CO-OP studies. The result of this moderator analysis showed that there was a statistically significantly lower effect size for non-CO-OP studies compared to the CO-OP studies ($g = .92, p = .00005$).

The type of outcome measures was another important moderator variable. The second moderator analysis tested whether improvement in skill transfer had a statistically significantly lower effect size than skill acquisition. If the skills in the transfer tasks were not the skills that therapists taught the children, then it was possible that these untrained skills would improve less than skills directly taught to children. The combined result of the moderator analyses of the three studies that measured both skill acquisition and skill transfer showed that there was a significantly lower effect size for improvement in skill transfer compared to improvement in skill acquisition ($g = 1.55, p = .0007$).

Discussion

The hypothesis of this present meta-analysis that top-down approaches would improve motor skill acquisition in children with DCD was supported. The results of this meta-analysis replicated the previous evidence (Pless & Carlsson, 2000). It shows a strong relationship between top-down approaches and motor skill acquisition, and provides support for the beneficial effect of top-down approaches in motor skill acquisition. Because the majority of studies are at an early stage of research development, the results are suggestive rather than confirmatory. This meta-analysis suggests that the top-down approach is effective; however, future studies are needed to

confirm this conclusion. The results for different dependent variables (skill transfer) and for the moderator analysis provide guidance for the direction of future studies.

The effectiveness of a top-down approach, specifically CO-OP, on skill transfer was also significant, but less than that observed with skill acquisition. One reason may be the difference between the tasks selected for training and the tasks chosen to study transfer. The CO-OP studies emphasized the importance of child-chosen tasks and used child-chosen tasks when assessing the effectiveness of CO-OP for skill acquisition. However, they did not measure child-selected activities for evaluating transfer of skill. Rather they used standardized assessments (i.e. VABS, BOTMP, VMI) of non-selected activities. Children might have lower motivation on these therapist-chosen tasks and find them less meaningful than their self-selected tasks. Moreover, the skills demanded by these tests would be classified as "very far transfer" by Toglia (1998) because they shared few characteristics with the tasks on which the children were trained. Toglia suggested that near and intermediate transfers should be evaluated before far transfer. Thus, in the future, based on Toglia, we would recommend that in measuring skill transfer the CO-OP approach use child-selected tasks but change 1-2 task parameters (near transfer) or 3-6 task parameters (intermediate transfer) before they use a comprehensive assessment such as the VABS that changed all or nearly all task parameters (very far transfer). Although the magnitude of the effect in skill transfer ranged from moderate to large, only three studies measured skill transfer. In addition, these studies consisted of small sample sizes.

Consequently, the skill transfer result should be generalized with caution.

The moderator analysis provided evidence that the CO-OP approach yields a significantly larger improvement in skill acquisition than the other two top-down approaches, which were the task specific training (Revie & Larkin, 1993) and the cognitive motor approach (Wright & Sugden, 1998). Some differences in mediating factors between the CO-OP and non CO-OP approaches might explain this result:

- (1) The CO-OP approach used self-selected tasks that could raise children's motivation and understanding of their goals.
- (2) Children's verbal self-guidance used in the CO-OP approach could become inner speech to direct and regulate their performance (Miller, Polatajko, Missiuna, Mandich, & Macnab, 2001).
- (3) The CO-OP creates a playful dynamic interaction when the therapist guides children to discover problems and solutions.
- (4) Before and after treatment, children rated satisfaction and performance for each their chosen tasks, ranging from 1 to 10. The self-evaluation process helped children perceive improvement and established confidence needed to solve other motor difficulties.

None of the six studies in this meta-analysis included a control group. Rather they looked at change from pre to post intervention. Future studies need to incorporate a control group without treatment. An even more rigorous comparison would involve a control group in which subjects repeatedly practiced the tasks without top-down strategies since repeated practice itself may produce a treatment effect.

Another comparison would involve an alternate treatment approach. In this meta-analysis, effect sizes in all six studies were calculated from within-subject designs (i.e. pre versus post-test). One study compared the CO-OP approach with the contemporary treatment approach (CTA) which combined neuromuscular, multi-sensory, and biomechanical approaches (Miller, et al., 2001). The results showed that there was a statistically significantly larger effect size on skill acquisition ($r = .54$, 90% CI= .21- .77, $p = .006$) for the CO-OP approach compared to the CTA approach, whereas the effect size ($r = .21$, 90% CI= -.19- .55, $p = .19$) on skill transfer was not significant. But the study by Miller and colleagues (2001) had a small sample size (CTA group $n = 10$; CO-OP group $n = 10$) and it is unknown whether this is a replicable effect. Future studies involving larger sample sizes should be conducted to compare the short-term and long-term treatment effects of CO-OP with other approaches.

In the top-down studies of the present meta-analysis, the outcome measures focused on task performance, mostly at an activity level. The authors in the CO-OP studies used the COPM to measure participation in only three tasks. However, there has not been a comprehensive assessment yet developed to address the overall role participation for children with DCD. This kind of assessment should include children's satisfaction for the activities that they want and need to do as in COPM, and also include other possible related factors (e.g., parents' perception, teacher and peer's attitude, support systems) and children's actual performance. Researchers should study whether the CO-OP approach can improve the overall occupational performance and role participation for children with DCD.

In order to assess the treatment effects on skill maintenance, one CO-OP study (Wilcox, 1994) had examined the treatment effect of 12 weeks after treatment. Two CO-OP studies (Miller, et al., 2001; Polatajko, Mandich & Martini, 1997) used a telephone interview to ask parents whether their child had maintained the skills acquired during treatment, and the extent to which the child applied any strategies acquired in treatment. Researchers of top-down approaches should use formal standardized evaluation, as they used in pre and post treatment measurement, to examine the long-term (six months and one year) effects of skill maintenance.

Conclusion

This article provides evidence that top-down approaches are beneficial for children with DCD in motor skill acquisition and skill transfer. The difference in children's motor performance from before to after treatment is large, and provides preliminary support for the use of this approach in occupational therapy clinical practice for children with DCD. It is entirely possible, however, that the size of this effect would be considerably smaller when tested against an appropriate control group. Since only three studies with small sample sizes provided evidence of effectiveness in skill transfer, we have to be cautious interpreting the results for generalization or transfer of training. In addition, top-down approaches for children with DCD are beginning to emerge, more research should be done to support the effectiveness of the top-down approaches.

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由上而下的治療模式對發展性協調障礙兒童的療效：後設分析

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摘要

本研究的目的，是使用後設分析，來驗證由上而下的治療模式對於發展性協調障礙兒童是否有療效。根據自1987年至2002年的文獻搜尋，發現有六篇研究是用此治療模式來治療發展性協調障礙兒童，本研究運用後設分析，來驗證此治療模式，是否可改善發展性協調障礙兒童的動作技巧獲得及技巧轉移。結果發現，由上而下的治療模式和動作技巧獲得之間，有極大且顯著的相關。其中發現，針對日常職能表現的認知取向治療，比其它由上而下的治療模式有療效；此後設分析並且發現，此治療模式對發展性協調障礙兒童在技巧轉移上也同樣有療效。經由文獻回顧，建議未來這樣的治療模式研究應有對照組，並評估技巧訓練的長期療效，且比較由上而下與由下而上的治療模式(例如：感覺統合治療和運動感覺訓練)療效是否有差益異。

關鍵詞：證據醫學，有效程度，介入處置

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