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Weak evidence supports intensive, task-oriented, early intervention with parent support for infants with, or at high risk of, cerebral palsy

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Weak evidence supports intensive, task oriented, early intervention with parent support for infants with, or at high risk of, cerebral palsy.

Synopsis

Hadders-Algra, M., Boxum, A. G., Hielkema, T., & Hamer, E. G. (2017). Effect of early intervention in infants at very high risk of cerebral palsy: A systematic review. *Developmental Medicine and Child Neurology, 59*(3), 246-258. doi:10.1111/dmcn.13331

Objective: Review the evidence for early intervention with infants with, or at risk of, cerebral palsy.

Design: Systematic review

Methods: PubMed, CINAHL, Embase, reference lists, review articles and *Developmental Medicine and Child Neurology* were searched to January 2016. Inclusion criteria: peer-reviewed research of moderate to high methodological quality; written in English; a prospective group design with comparison group or period; mean age of the infants at study entry less than 12 months corrected age and individual infants younger than 18 months; and intervention intended to influence neurodevelopmental outcome. Exclusion was severe co-morbidity unrelated to cerebral palsy. Outcomes of interest were motor, cognitive and family and parental well-being, and their relationship to brain lesion and type and dose of intervention. Three reviewers independently extracted data, completed quality appraisal and reached consensus through discussion.

Main findings: Seven randomised trials (high (n=1) and moderate (n=6) methodological quality) of 299 infants (groups sizes 6 to 54) with brain lesion, “neurological deviancy”, “high suspicion” of cerebral palsy or abnormal general movements were included. Heterogeneity of intervention type and intensity precluded pooling of results and drawing firm conclusions. Weak evidence suggests that developmental stimulation may improve cognitive outcomes (2 of 3 studies showed a positive effect) and parent support improves family wellbeing (3 out of 3 studies). No convincing evidence that neurodevelopmental therapy (1 of 2 studies suggested positive effect) or developmental stimulation (1 of 4 studies) improves motor outcomes. Insufficient evidence to draw conclusions about the impact of sensory input (1 study). Insufficient information was available to identify a relationship between type of brain lesion and intervention effectiveness. Several flaws in the evidence base were noted including small sample size, ill-defined brain lesions, short follow up, inadequate comparison group description, and adherence to intervention fidelity not addressed.

Authors’ conclusions: Weak evidence in the included studies leads to the suggestion that intensive early intervention and multifaceted intervention may be required to optimise outcomes for infants with, or at risk of, cerebral palsy. Substantial high-quality research is required to advance the field.

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Synopsis

Morgan, C., Darrah, J., Gordon, A. M, Harbourne, R., Spittle, A., Johnson, R., & Fetters, L. (2016). Effectiveness of motor interventions in infants with cerebral palsy: A systematic review. *Developmental Medicine and Child Neurology, 58*(9), 900-909. doi:10.1111/dmcn.13105

Objective: To review the evidence for effectiveness of interventions to improve motor outcomes for children with cerebral palsy aged 0 – 2 years.

Design: Systematic review

Methods: Systematic searches of six databases (PubMed, Embase, CINAHL, Cochrane, Web of Knowledge, PEDro) were undertaken in 2014 and updated in 2015. Inclusion criteria: all research designs with participants aged birth-2 years diagnosed with, or at high risk of, cerebral palsy; motor intervention implemented and motor outcomes assessed. Motor intervention defined as "therapeutic intervention with motor development or skills as one primary outcome" (p.901). Studies were excluded if not written in English or if the intervention was medical, pharmaceutical or surgical. Reviewers independently selected studies for inclusion. Interventions were classified by reviewer consensus using the International Classification of Functioning Disability and Health framework. Risk of bias was assessed using American Academy of Cerebral Palsy and Developmental Medicine guidelines. Effect sizes assessed according to Cohens *d* and quality and strength of evidence ranked using the Grading of Recommendations Assessment, Development and Evaluation system. Meta-analysis was not possible due to heterogeneity.

Main findings: Thirty-six included papers reported 34 studies published 1984-2015; 10 randomised controlled trials (RCT), 4 cohort, 10 single-subject design and 10 case studies or case series designs. Methodological quality collectively assessed as low. The median sample size of the RCTs and the cohort study with a control group was 26. Confirmed diagnosis at study exit ranged from 22%-77%. Activity level outcomes were most commonly measured. Only 4 (of 10) RCTs reported statistically significant findings with “effect sizes ranging from 0.14 (small) to 0.75 (moderate-high)” (p.906). The single-subject and case series designs all showed positive findings. Duration and intensity of intervention varied from 6-days/week for 6 weeks to monthly for 12 months. Interventions included neurodevelopmental therapy, Vojta (passive application of reciprocal limb movements), environmental enrichment and constraint induced movement therapy. Interventions were complex; the most common component was parent education. The commonly included intervention elements in the two RCTs with largest effect sizes were child initiated movement, task specific training and environmental modifications.

Authors' conclusions: Low quality evidence was ‘weakly positive.’ Recommendations were to implement early, intensive motor intervention with infants with, or at high risk of, cerebral palsy consistent with contemporary practice around neuroplasticity and motor learning principles, and positive outcomes identified in studies of older children - that is, interventions which elicit active movement in task-oriented activities in a high intensity program.

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COMMENTARY

Premature birth, brain lesions and abnormalities place infants at higher risk of cerebral palsy (CP). Recently, the increased use of magnetic resonance imaging (MRI), combined with prognostic tools such as the General Movements Assessment (GMs) and the Hammersmith Infant Neurological Examination (HINE), has made detection of infants with, or at risk of, CP possible during the first half-year of life (McIntyre, Morgan, Walker, & Novak, 2011; Romeo, Ricci, Brogna, & Mercuri, 2016). Early detection is crucial, as animal studies show that the *timing* of intervention is the most critical factor for maximising treatment outcomes (Friel, Chakrabarty, Kuo, & Martin, 2012). Further to this, is evidence that most gross motor and bimanual performance potential in children with CP is experienced in the first 2 years of development (Nordstrand, Eliasson, & Holmefur, 2016; Rosenbaum et al., 2002). Early detection should trigger immediate referral to infant specific intervention programs. But what is the evidence for these programs? Two recent papers aimed to systematically review the evidence for early intervention for infants with, or at high risk of CP (Hadders-Algra, Boxum, Hielkema, & Hamer, 2017; Morgan et al., 2016).

These two reviews fill an important knowledge gap by focussing specifically on children younger than 2 years of age when intervention can drive neural circuit development during the most dynamic phase of plasticity. Hadders-Algra et al. (2017) made special effort to highlight differences in methodology compared to the earlier review by Morgan et al. (2016). These include a focus on children <1 years old, methods used for rating the quality of included studies, inclusion of family outcomes, the effect of disease state on intervention response and the dose and type of intervention provided. These differences led to inclusion of significantly fewer studies in Hadders-Algra et al. (2017) (n=7) compared with Morgan et al. (2017) (n=34). Despite this, outcomes for each review are similar. Evidence for intervention remains weak. Studies are mostly small with low methodological quality. There is considerable heterogeneity across studies including participants, interventions and outcome measures. As a result, meta-analysis of data for pooled effect, the ability to make definitive conclusions on the effect of disease state on treatment response, or on the dose and type of intervention provided, are not possible. Both reviews concluded that trends in the data support intervention models based on motor learning theory (e.g., child-initiated movement), environmental enrichment and parent education underpinned by ecological and family-centred frameworks.

One point of difference between the reviews relates to Neurodevelopmental Therapy (NDT). Hadders-Algra et al. suggested that minimal *hands on* postural support techniques may be useful for infants with CP. Morgan et al. suggested that trends in data do not support neuro-maturational approaches such as NDT. Despite these differences, we agree with comments by Morgan et al. (2016) that whatever the intervention type, a comprehensive description of the key ingredients is essential, especially where there is a diversity of interpretation (Mayston, 2016).

While evidence remains weak, the consistent outcomes and emerging evidence described by both reviews, have important implications for occupational therapists. Working with infants with CP means focusing on occupation, rather than using neuro-maturational approaches that seek to *normalise* movement. The core philosophies of our occupation-based profession are entirely consistent with the key ingredients of evidence-based models of early intervention proposed in these reviews including child-initiated movement, task specificity, environmental modification and parent support and education.

Paediatric occupational therapists should abandon generalised, low intensity models of intervention. Alongside a specific, targeted, therapist-guided program, interventions should include a goal-directed home program as a pragmatic solution to achieving optimal intensity and to ensure generalisation of skills (Novak et al. 2009). Evidence based occupational therapy with infants at high risk of CP includes collaborating with medical professionals in the early detection of CP by using diagnostic tools such as the GMs and HINE; confident application of evidence-based early intervention models including COPing with and CAring for Infants with Special Needs (COPCA) (Dirks, Blauw-Hospers, Hulshof, & Hadders-Algra, 2011), Goals, Activity and Motor Enrichment (GAME) (Morgan, Novak, Dale, Guzzetta, & Badawi, 2014), baby constraint-induced movement therapy (Eliasson, Sjostrand, Ek, Krumlinde-Sundholm, & Tedroff, 2014) and bimanual therapy (Hoare & Greaves, 2017). New measures such as the Hand Assessment for Infants (HAI) (Krumlinde-Sundholm et al., 2015) and the Mini-Assisting Hand Assessment (Greaves, Imms, Dodd, & Krumlinde-Sundholm, 2013) are available and enable targeting of upper limb interventions to the just right challenge, and objective evaluation of outcomes of early intervention.

In Australia, the introduction of the National Disability Insurance Scheme (NDIS) provides great opportunity for families of children with CP to access occupational therapy. For children older than 2 years of age with CP, there are effective interventions supported by strong evidence (Novak et al., 2013). Evidence-based interventions implemented with strong treatment fidelity in clinical practice, including for younger infants, are required. Current evidence-based interventions are not transdisciplinary approaches, but are highly specific and targeted interventions provided by skilled therapists who have gained experience in, and knowledge about, working with very young infants. Organisations need to ensure specialist training opportunities for staff, adapt services based on the evolving evidence, and foster and recognise clinical expertise.

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