The efficacy of neurodevelopmental treatments in children: a systematic review

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Authors' objectives
To determine the efficacy of neurodevelopmental treatment (NDT) for paediatric patients diagnosed with a neurological dysfunction.

Searching
The following databases were searched to 1998: Best Evidence, CINAHL, the Cochrane Library, EMBASE, ERIC, HealthSTAR, PsycINFO, MEDLINE, and Sociofile. Full details of the keywords used were provided under the headings of population, diagnosis, and intervention. The reference lists of eligible papers were examined and fourteen named journals were handsearched (full details were given). Experts were contacted for details of any additional research papers. Unpublished research and foreign research without an English translation were excluded.

Study selection
Study designs of evaluations included in the review
The selection criteria appear to state that randomised controlled trials (RCTs) published after 1975 were eligible for inclusion. However, studies without control groups were also included.

Specific interventions included in the review
NDTs were eligible. However, one included study did not specifically examine the effects of NDT, whilst another examined a facilitation and functional intervention. The cointerventions included short-leg casting, sensory integration, Rood and proprioceptive neuromuscular facilitation strategy, and selective posterior rhizotomy. The control interventions included regular occupational therapy sessions and an infant stimulation programme. However, it was not always clear what interventions had been compared. The duration of the interventions ranged from 7 days to 12 months, whilst the frequency of therapy varied considerably from a total of 2 visits to daily sessions. Some interventions were carried out in the home.

Participants included in the review
Children and adolescents aged from 0 to 18 years with a diagnosis of neurological dysfunction were eligible for inclusion. The included children had been diagnosed or suspected of cerebral palsy, or were considered to be high-risk infants. Their ages ranged from 3 months to 14 years.

Outcomes assessed in the review
Studies that assessed clinical outcomes were eligible for inclusion. The following outcomes were assessed: gait measurements; Denver Development Screening Test; Neo-Natal Behavioural Assessment Scale; Griffith's Mental Development; Modified Milani-Comarpetri; Gidoni Scale of Gross Motor Development; Bayley Scale of Mental Development; Maternal Observation Interview; Hollingshead Four-Factor Index of Social Position; videotape, clinical observation and goniometry; Peabody Fine Motor Scale; Quality of Upper Extremity Skills Test; Canadian Occupational Performance Measure; Fine Motor Skills; Bayley Scale of Infant Development; Vineland Social Maturity Scale; Stanford-Binet Intelligence Scale; Prechtl Neurological Examination of the Full-Term Infant; Wolanski Gross Motor Evaluation; Wilson Developmental Reflex Profile; Neurological Examination of the Collaborative Perinatal Project; Vanguard Spirometer; Meunchener Funktionell Entwicklungs Diagnostik; Bayley Scales for 2-year olds; Raynell Developmental Language Scales; Gesell Development Schedules; Gross Motor Function Scale; Physiological Cost Index; modified Ashworth Scale; clinical measurements; and a variety of scales defined by the authors of the studies.

How were decisions on the relevance of primary studies made?
Two authors independently reviewed the identified studies using a standard relevance form, and agreement between the reviewers was assessed using the kappa statistic. Any disagreements were resolved by reaching consensus after discussion. The kappa statistic was 0.583, indicating a moderate level of agreement.
Assessment of study quality
The validity of the studies was assessed and scored using the 3-item, 5-point scale described by Jadad et al. (see Other Publications of Related Interest no.1). This assessed the following criteria: adequacy of randomisation; adequacy of double-blinding; and description of withdrawal by treatment group. In addition, the Concealment of Treatment Allocation scale (see Other Publications of Related Interest no.2) was used to classify the method of randomisation as adequate, inadequate, or unclear.

The level of evidence was rated from I (highest) to V (lowest) using guidelines described by Sackett and Cook et al. (see Other Publications of Related Interest nos.3-4). Level I evidence was offered by RCTs demonstrating a significant benefit of experimental treatment, or by RCTs demonstrating no effect of therapy and excluding the possibility of a clinically important effect. Level V evidence came from case series with no control groups. Two reviewers assessed and scored validity. Inter-rater consistency on scoring validity and grading the level of evidence was assessed using the kappa statistic. Consensus was reached when disagreements occurred.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.

The following information were tabulated: author and year of study; country and language; sample size; intervention type, duration, and frequency; diagnostic group and age of the participants; details of the study design; findings; and outcome measures used.

Methods of synthesis
How were the studies combined?
A narrative synthesis was undertaken.

How were differences between studies investigated?
Differences were discussed in the text of the review. The results from studies for children with cerebral palsy and high-risk or low-birth weight infants were discussed separately.

Results of the review
Seventeen studies (818 children) were included, of which 11 had a control group.

Study quality.

The Jadad scores ranged from 0 to 5. The inter-rater correlation for scoring the validity criteria was high (kappa 0.932). Only one study was described as double-blind. In 13 studies, the assessor of the outcome was blinded to the treatment allocation. The studies demonstrated methodological deficiencies including the following: it was unclear whether the patients were aware of which group they had been assigned to; the means of concealing treatment allocation were unclear or inadequate; many sample sizes were small; a definitive overall treatment effect was not always reported; and a wide range of standardised and non-standardised assessment tools were used.

Level of evidence.

Four studies provided level 1 evidence (statistically significant or non significant effect). Twelve studies provided level 2 evidence (beneficial positive trends without statistical significance or little effect of treatment). The inter-rater correlation for grading the level of evidence was substantial (kappa 0.678).

Treatment effect.

Results were inconsistent with 7 out of the 17 studies reporting a benefit from NDT. Some studies reported statistical significance in some components of the study. Conflicting results were also found for studies involving only children.
with cerebral palsy (6 of the 10 studies reported a benefit) and for high-risk or low-birth weight infants (1 of the 6 controlled studies reported a benefit).

**Authors' conclusions**
Overall, results of the efficacy of NDT were largely inconclusive. The results from studies of children with cerebral palsy were inconsistent, and studies examining the use of NDT in high-risk or low-birth weight infants did not support the usefulness of NDT.

**CRD commentary**
The aims were stated, and the inclusion criteria were defined in terms of the participants and interventions. The initial impression was that only RCTs were eligible for inclusion. However, the inclusion of uncontrolled studies indicates that the stated inclusion criteria were not followed. Many relevant sources were searched, and full details of the search strategy were given. The methods used to select the studies were described, and the level of agreement between the study selectors was estimated. Restricting the included studies to those published in the English language may have resulted in the omission of other relevant studies. In addition, the exclusion of unpublished studies raises the possibility of publication bias.

The quality of the studies was assessed and scored using validated criteria, and the results were presented. The assessment methods were also reported. Relevant data were tabulated but the methods used to extract the data were not described. A narrative synthesis was appropriate given the differences between the studies. A more detailed presentation of the results would have been helpful, e.g. discussing the results in relation to the quality of the evidence.

The evidence presented supports the authors' conclusions.

**Implications of the review for practice and research**
Practice: The authors state that current research does not clearly demonstrate the efficacy or inefficacy of NDT.

Research: The authors strongly recommend a multicentre double-blind RCT be performed to examine the efficacy of NDT.

**Bibliographic details**

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by CRD

**MeSH**
Brain Damage, Chronic /rehabilitation; Brain Injuries /rehabilitation; Cerebral Palsy /therapy; Child; Neurologic Examination; Physical Therapy Modalities /methods; Psychomotor Disorders /rehabilitation

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**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.