Management of upper limb dysfunction in children with cerebral palsy: a systematic review

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Authors' objectives
To evaluate the efficacy of different treatments for the management of upper limb dysfunction in children with cerebral palsy (CP).

Searching
The following databases were searched: MEDLINE from 1966 to December 2000; CINAHL from 1982 to December 2000; CinPsyc from 1989 to December 2000; DARE (September 2000); PEDro; EBM Reviews: Best Evidence from 1991 to December 2000; the Cochrane Database of Systematic Reviews (Issue 4, 2000); and the Cochrane Controlled Trials Register (CENTRAL/CCTR). The exploded search terms used were 'cerebral palsy', 'upper limb', 'spasticity', 'physical therapy or physiotherapy', 'occupational therapy', 'neurodevelopmental therapy', 'conductive education', 'constraint induced therapy', 'botulinum toxin A', 'casting' and 'upper limb surgery'. In addition, abstracts from major meetings including the European Society of Movement Analysis in Adults and Children, European Academy of Childhood Disability, the Gait and Clinical Movement Analysis Society, and the American Academy for Cerebral Palsy and Developmental Medicine, were obtained and handsearched. Only full publications written in the English language were included.

Study selection
Study designs of evaluations included in the review
Prospective studies of any design where eligible for inclusion in the review. The studies were graded according to Sackett's levels of evidence (see Other Publications of Related Interest no.1).

Specific interventions included in the review
Studies were eligible for inclusion if they included the following treatments: physiotherapy or occupational therapy including neurodevelopmental therapy or contemporary movement training based on the movement sciences; conductive education; constraint-induced therapy; serial casting; splinting; neuromuscular electrical stimulation; intramuscular injections of botulinum type A (BTX-A); and upper limb orthopaedic surgery.

The following treatments were assessed in the included studies: physiotherapy; occupational therapy; neurodevelopmental therapy; conductive education; motor learning; strength training; constraint-induced training; orthoses and splints; seating; serial plaster casting; BTX-A; electrical stimulation; upper limb surgery; intrathecal baclofen; and selective dorsal rhizotomy.

Participants included in the review
Studies that included children with CP, who were treated for spasticity in the upper limbs, were eligible for inclusion.

Outcomes assessed in the review
The inclusion and exclusion criteria were not defined in terms of the outcomes. The outcomes were categorised according to the International Classification of Impairment, Disability and Handicaps (ICIDH-2) categories. These categories included measures of impairment, activity scales, participation and contextual factors.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
Randomised controlled trials (RCTs) were assessed for methodological quality according to criteria specified on the PEDro website (seehttp://www.pedro.fhs.usyd.edu.au/) (accessed 11/03/2003). The following criteria were addressed:
specification of eligibility criteria; random allocation; concealed allocation; prognostic similarity at baseline; participant, therapist and assessor blinding; greater than 85% follow-up of at least one key outcome; intention to treat analysis; between-group statistical comparison for at least one key outcome; and point estimates and measures of variability provided for at least one key outcome. The studies were given a score up to a maximum of 11. The authors report a method for assessing validity but do not state how many of the reviewers performed the assessment.

**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 data were extracted into tables under the following headings: study design, number of groups, patient numbers, age range, motor types, severity at baseline, length of follow-up, loss to follow-up, interventions, outcome measures, complications, main result, treatment effect, and size of treatment effect. Where possible, the effect size was calculated for each of the RCTs.

**Methods of synthesis**
How were the studies combined?
The studies were combined statistically. For continuous data, both the observed differences in means and the standardised differences in means (effect sizes) were used. A fixed-effect model was used to combine the data, and the treatment effect between groups was reported as a mean difference (see Other Publications of Related Interest no.2). Tests of overall effect for all of the studies were computed using a Z-score as the ratio of overall effect to its standard error, and this was compared with the normal distribution.

How were differences between studies investigated?
Heterogeneity was investigated using chi-squared analyses.

**Results of the review**
Sixty-one prospective studies were eligible for inclusion. Of these, 5 were RCTs and the design of the remaining studies was unclear.

Methodological quality of the 5 RCTs: 4 of the 5 studies were of moderate to high quality (PEDro scale: greater than 6 out of 11).

Three RCTs that used the same primary outcome measure, the Quality of Upper Extremity Skills Test, were analysed for treatment effects between groups using mean difference scores with 95% confidence intervals (CIs). A meta-analysis of the 3 studies was not undertaken, as they had sufficiently different treatment comparisons and did not incorporate untreated control groups. The following treatment comparisons were made.

Casting versus no casting: the standardised mean difference (SMD) was 0.17 (95% CI: -0.48, 0.81).

Intensive versus regular occupational therapy: the SMD was -0.02 (95% CI: -0.67, 0.63).

Intensive neurodevelopmental therapy and cast versus regular occupational therapy alone: the SMD was -0.15 (95% CI: -0.71, 0.40).

BTX-A and occupational therapy alone versus occupational therapy alone at 6 months: the SMD was 0.40 (95% CI: -0.33, 1.12).

BTX-A and occupational therapy alone versus occupational therapy alone at 1 month: the SMD was 1.02 (95% CI: 0.25, 1.78).

One RCT, of BTX-A versus placebo, was not used as the authors could not calculate the treatment effect size.
Authors' conclusions
Currently, the interventions with the best evidence are occupational therapy and serial casting, although the outcomes of these remain similar, with only small treatment effects. There is also growing evidence to support the use of BTX-A for reducing upper limb spasticity and improving function in children with CP. The effective use of the upper limb impacts on educational outcomes, independence in activities of daily living and vocational options for many children with CP. Therefore, the development of effective therapy regimens and the evaluation of their efficacy with RCTs require immediate attention.

CRD commentary
The methodological quality of this review was fair, but the method of reporting the results was extremely poor. The authors reported a clear review question and appropriate inclusion criteria. The search strategy was comprehensive and included many sources. However, no assessment of publication bias was undertaken. The authors did not report how the studies were selected and the data extracted, nor the number of reviewers who carried out these processes. In addition, although a satisfactory quality assessment of the included RCTs was undertaken, the number of reviewers who carried out the assessment was not specified. The authors did not report a method for assessing the methodological quality of the other prospective studies.

The studies were appropriately combined in a narrative. Only the details of selected studies were tabulated in full. The table presenting all of the included studies was overcomplicated and confusing. It was, therefore, unclear which studies had been included in the review. In addition, the total number of included studies was unclear.

The authors' conclusions should be viewed with great caution, given the limitations outlined and the poor standard of reporting.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors state that further research is required to evaluate the effects of combinations of treatment over longer time intervals. This should utilise a broader range of outcome measures.

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Other publications of related interest

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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.