A meta-analysis of research on sensory integration treatment

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Authors' objectives
To find whether existing studies of treatment using sensory integration approaches support the efficacy of these approaches, in different behavioural domains and for different diagnostic and age groups, compared with other intervention strategies.

Searching
Published literature was sought from 1972 to 1994 with computer search systems (ERIC, PsycLIT, MEDLINE, Dissertation Abstracts), manual searches through article bibliographies, personal contacts with authors and consultation with the Sensory Integration International Association. The key terms used for the search are reported.

Study selection

Study designs of evaluations included in the review
All designs except case studies, single group-design studies, and laboratory-type stimulation studies were eligible for inclusion. At least 2 interventions had to be compared.

Specific interventions included in the review
Sensory Integration (SI) treatment versus no treatment or an alternative treatment. SI treatment was operationally defined as a treatment that aimed to enhance development of basic sensory integration processes with activities that provide vestibular, proprioceptive, tactile, or other somatosensory inputs as modalities to elicit adaptive body responses.

Participants included in the review
Patients with learning disabilities, mental retardation, minor brain dysfunction, aphasia, motor delay and adult psychiatric patients, as well as patients at risk. The female-male ratio was approximately 1 to 6 for children and about 1 to 1 for adults. The majority of studies were of children with learning disabilities.

Outcomes assessed in the review
Outcome measures were classified into five categories: psychosocial, behaviour, language, motor, and sensorimotor function. The classification of outcomes was submitted to five expert judges and agreement rates are reported.

How were decisions on the relevance of primary studies made?
Inclusion criteria were that the studies:

1. Investigated the effect of treatment using SI approaches.
2. Reported a comparison of at least 2 conditions.
3. Reported findings and results in a manner that allowed quantitative analysis.
4. Reported the outcome measures in the broad categories of academic skills, motor function, behaviour, language function, and sensorimotor function.

The authors do not state how many of the authors performed the selection.

Assessment of study quality
The variations of implementation and quality of the treatment using SI approaches were coded, and their effects were investigated (Kimball, 1988; see Other Publications of Related Interest no.3). Treatment-related variables were quality...
of treatment using SI approaches, total treatment hours, diagnosis and age and children's age. Design-related variables were design quality, sampling method, number of outcome measures, number of measurement categories, professional affiliation of the researchers, geographic location, and publication year. The authors do not state how the papers were assessed for validity, or how many of the reviewers performed the validity assessment.

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

Methods of synthesis
How were the studies combined?
Effect sizes were calculated from the pretest and posttest means and standard deviations, chi-square statistics, gain scores extracted from graphs and t or F statistics with the formulas presented by (Hedges and Olkin (1985) see Other Publications of Related Interest no.1 and Cooper (1989) see Other Publications of Related Interest no.2). The value of effect size was multiplied by a correction factor for sample size bias to obtain an unbiased estimator (Hedges and Olkin, 1985). A single composite weight was constructed for effect sizes by multiplying three individual weights: variance weight (inversely proportional to the variance of each effect size), measurement weight (the inverse of the number of effect sizes used in one study) and study weight (the inverse of the number of comparisons made with the same experimental group).

How were differences between studies investigated?
Hedges' homogeneity statistic was used to investigate within and between variances among the levels of each independent variable (Hedges and Olkin, 1985). The pattern of moderator variable confounding was examined with hierarchical cluster analysis.

Results of the review
The literature selection resulted in 14 articles contributing 16 studies comparing SI with no treatment (SI/NT), and 11 articles contributing 16 studies comparing SI with an alternative treatment (SI/ALT). For the SI/NT studies, the total numbers of participants were 341 in the experimental groups and 237 in the control groups, whereas the corresponding sample sizes in SI/ALT comparisons were 250 in the experimental groups and 191 in the control groups.

The weighted average effect size of SI/NT studies was 0.29 (95% CI: 0.12,0.48, heterogeneity was present). There was a significant difference between the average effect sizes of the earlier studies (0.60; 95% CI: 0.33,0.86) and the more recent studies (0.03; 95% CI: -0.20,0.26). Of the outcome measures, larger effect sizes were found in the psychoeducational category (0.39) and motor category (0.40).

Of SI/ALT studies, the average effect size was 0.09 (95% CI: -0.11,0.28), not significantly different from zero. Heterogeneity was not present.

Authors' conclusions
The authors make three central conclusions. First, in the SI/NT comparison, a significant effect was replicated for SI treatment effects in earlier studies, but more recent studies did not show overall positive effects. Second, larger effect sizes were found in psychoeducational and motor categories. Third, SI treatment methods were found to be as effective as various alternative treatment methods.

CRD commentary
The search strategy and inclusion criteria are clear and well specified. Authors did not report the way how decisions on inclusion or exclusion of studies were taken, how methodological quality was assessed and how data extraction was done.
The synthesis of results is presented clearly and completely and heterogeneity of studies has been taken into account. The authors' conclusions seem to follow from the evidence presented.

**Implications of the review for practice and research**
The authors state that there is a need to investigate more rigorously the effect of alternative activities as part of sensory integration treatment strategies.

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