

What is the effectiveness of sensory integration to improve occupational performance in children?

Prepared by: Hayley Treweek

Date: 3 June 2011

Review date: 3 June 2013

Clinical Scenario

Sensory integration (SI) was pioneered by Dr. Anna Jean Ayres in the 1950's, it is a therapy which is used to assist the brain to organise different sensations (Ayres & Robbins, 2005). SI is very popular among occupational therapists (OT's) in the paediatric setting. SI is most commonly used to support children with difficulty processing sensory information to achieve in their environment.

A critique of the application of SI by Hoehn and Baumeister (1994) raised serious doubts about the effectiveness of SI and the assumption that it is an effective treatment for children labelled as experiencing 'sensory integrative dysfunction'. Questions were also raised as to the validity and reliability of current research.

<p>Focused Clinical Question: What is the effectiveness of sensory integration on improving occupational performance in children with difficulty processing sensory information?</p>

Summary of search, 'best' evidence appraised, and key findings

There is very little literature available exploring the effectiveness of SI in children with sensory processing disorders. Despite using a vast range of search strategies among a number of different databases and also conducting a hand search of internet sites relevant to the subject area, it was very difficult to locate evidence specific to the clinical question. The majority of studies were quantitative single subject in design and suggest that SI can have positive outcomes in children, but are often no more effective than other forms of intervention.

The key finding was that the use of SI as an effective intervention in children with sensory processing disorders can have positive outcomes, but has not been proven to be

any more effective than other interventions (May-Benson & Koomar, 2010; Roberts, King-Thomas & Boccia, 2007; Schaaf & Nightlinger, 2007). Further research at higher levels is also required to confirm this (Pfeiffer, Koenig, Kinnealey, Sheppard & Henderson, 2011).

Clinical Bottom line: There is evidence to support the use of SI with children who experience difficulty in processing sensory information to improve occupation performance and engagement.

Limitation of this CAT

This critical appraisal has been peer reviewed by one lecturer as part of an assignment for Otago Polytechnic, School of Occupational Therapy. The breadth of the review has also been limited by the assignment requirements (ie. 2 articles only were reviewed).

Search Strategy

An electronic search of four relevant databases was conducted; data bases and search terms are as follows:

Database searched	Search terms	Limits used	Results
Cochrane library	“sensory integration” OR “sensory interventions” AND effectiveness	None	4
CINAL	“sensory integration” AND “engagement”	None	6
OT seeker	“sensory integration” AND engagement	None	0 hits 247 near matches
Pro Quest	“sensory integration” AND (engagement OR “occupational performance”)	Peer reviewed and scholarly articles only	0 hits 462 near matches

In addition a hand search was conducted of relevant websites relating to SI and relevant studies noted in the reference section of retrieved articles.

Inclusion and Exclusion Criteria

Inclusion:

- Age of participants ≥ 21 years old.
- Participants had to have difficulty processing sensory information.

- The study had to measure some form of function that affects occupational performance, for example behaviour, motor performance, sensory processing or social interactions.
- Aim of the study was to assess or compare the effectiveness of SI.

Exclusion:

- Studies not in English.
- Studies where the 'full text' option was not available electronically through the Otago Polytechnic libraries or online.
- Studies where SI was not a main intervention.

Results of Search

Study design	Year
Quantitative - single-subject ABAB design	Roberts, King-Thomas & Boccia, (2007).
Quantitative – pilot study	Pfeiffer, Koenig, Kinnealey, Sheppard & Henderson, (2011).
Systematic review	May-Benson & Koomar, (2010).
Qualitative - Case study	Schaaf & Nightlinger, (2007).

Best Evidence

The first article retrieved; Systematic Review of the Research Evidence Examining the Effectiveness of Interventions Using a Sensory Integrative Approach for Children, by May-Benson, & Koomar, (2010) from the American Journal of Occupational Therapy, was considered best evidence due to the high level of evidence, the thorough search of the literature and the rigour in the evaluation of the studies.

The second article retrieved was; Effectiveness of Sensory Integration Interventions in Children with Autism Spectrum Disorders: A Pilot Study, by Pfeiffer, Koenig, Kinnealey, Sheppard, and Henderson (2011) also from the American Journal of Occupational Therapy. This article was chosen for appraisal because it was the only article located that specifically addressed the clinical question.

Summary of Best Evidence

Study one: Systematic Review of the Research Evidence Examining the Effectiveness of Interventions Using a Sensory Integrative Approach for Children, by May-Benson and Koomar, (2010).

It must be noted that the methodology for this review was outlined in a separate article; Methodology for the systematic reviews of occupational therapy for children and adolescents with difficulty processing and integrating sensory information, by Arbesman and Lieberman, (2010).

Aim of the Systematic Review

The focus question of this review was “What is the effectiveness of interventions using the SI approach (including the effect of context [cultural, physical, social, personal, spiritual, temporal, and visual]) to create, promote, establish, restore, maintain, modify, and prevent future limitations in ADLs, IADLs, education/transition, play/leisure, and social participation in children and adolescents whose SI and processing patterns are interfering with everyday life participation?” (p.404.).

Study Design

Systematic Review

Search strategy

Databases searched: Medline, PsycInfo, CINAHL, ERIC, BIOSIS Previews, Science Citation Index, Social Science Citation Index, RehabData, and OTseeker. The Cochrane Database of Systematic Reviews and the Campbell Collaboration were also searched.

A hand search was then completed of appropriate articles selected from the reference lists from all other articles (Arbesman & Lieberman, 2010).

See appendix (a) for a full table of search terms.

Selection Criteria

Review authors were either doctoral level trained occupational therapists with expertise in the content area examined, or graduate students, or master’s-level trained occupational therapists under the guidance and direction of the review author (Arbesman & Lieberman, 2010).

Inclusion:

- Published between 1996– 2006. In addition to this a few select studies published in 2007 that were recommended by expertise in the field were also included.
- Participants \geq 21 years of age.
- Peer-reviewed scientific literature.
- Published in English

Exclusion:

- Data from presentations, conference proceedings, non–peer-reviewed research literature, research reports, dissertations, and theses.

Method

A total of 1,079 citations were reviewed and 27 articles were retrieved for the systematic review.

Articles were assessed for rigor and lack of bias and a quality score was then given using the MacDermid Scale, 2004. The articles were then categorised using the AOTA grading system for levels of evidence.

The data from each study was then extracted and analysed. The population, treatment method, number of sessions, frequency of sessions and duration of sessions of each study was recorded in table and compared. The discussions and conclusions were also analysed in detail.

Results

The results were categorised by outcomes. These outcomes were; motor-performance, sensory processing, behavioral outcomes, academic and psychoeducational outcomes, and occupational performance. Each study was then ranked by levels of evidence as determined by MacDermid Scale and the results of each study discussed.

Original Authors conclusions

May- Benson and Koomar (2010, p.412), concluded that SI can have positive outcome in the areas of sensorimotor skills and motor planning; socialization, attention, and behavioral regulation; reading and reading related skills; and individualized goals. From the literature that was systematically reviewed they were able to concluded that SI was more effective than no intervention and just as effective as other interventions such as perceptual motor based therapies. The authors also recommended that further research into the use of SI be done, including a meta-analysis and qualitative studies.

Critical Appraisal

The appraisal was completed by following the guidelines in Taylor (2007, pp.77-84).

Validity:

Did the review address a clearly focused issue?

The review clearly stated the aim of the study “to evaluate, and synthesize the research literature on the effectiveness of sensory integration (SI) intervention on the ability of children with difficulty processing and integrating sensory information to engage in desired occupations” (p.403). The review then went on to define a focused clinical question (as stated on p. 5 of this appraisal) and also define SI as the approach outlines by Dr. Anna Jean Ayres.

Were the important, relevant studies included?

An extensive search of data bases and relevant literature was completed both electronically and by hand. Professionals considered experts in their field were consulted in regards to recommendations of appropriate literature and a clear inclusion and exclusion criteria was identified. The search terms and criteria were developed in consultation with the American Occupational Therapy Association (AOTA) and also reviewed by an advisory board. A medical research librarian was employed to conduct the search and an additional filter base developed by the McMasters University was used to refine the search (Arbesman & Lieberman, 2010). However dissertation and thesis studies were excluded from the search which may have provided relevant key information. The literature was also reviewed for rigor and lack of bias, but not under any specific guidelines.

Results

The results of each article systematically reviewed varied from supporting SI as an effective intervention, to proving it was just effective as other interventions to stating the SI had no effect on occupational performance. The overall results of the review found that SI is an effective intervention in treating children with difficulty processing and integrating sensory information. These results were based on the results of all 27 systematically reviewed articles. Articles which were considered higher levels of evidence were given more weighting as to the influence their results had on the overall results. As SI is a very popular intervention among paediatric OT's the results of this systematic review will be supportive in guiding evidence based practice.

Conclusion

This review was part of an in-depth research project undertaken by the AOTA to explore the use of SI among OT's. It was developed and critiqued by a range of highly qualified professional's and used strict guidelines on the conduction of the search and included articles. The review provided a link to a page outlining the limitations of the review at ajot.net. which could not be located. Overall it can be concluded that this systematic review is a reliable and trustworthy piece of literature due to the rigor and depth of research conducted.

Study two: Research Scholars initiative - Effectiveness of Sensory Integration Interventions in Children with Autism Spectrum Disorders: A Pilot Study, by Pfeiffer, Koenig, Kinnealey, Sheppard, and Henderson (2011).

Purpose of the study

The purpose of the study “was to establish a model for randomized controlled trial research, identify appropriate outcome measures, and address the effectiveness of sensory integration (SI) interventions in children with autism spectrum disorders (ASD)” (p.76).

Study Design

Pilot study based on a randomised controlled trial (RCT).

Setting

The interventions were provided in the context of a summer therapeutic activities program. The area was purposely designed to deliver both SI interventions and fine motor (FM) interventions (p.78).

Participants

A total of 32 boys and 5 girls participated in the study (this is consistent with the prevalence of autism in boys and girls). The participants were aged between 6 and 12 years old with a mean age of 8.8 years. 21 of the children were diagnosed with ASD and 16 were diagnosed with PDD-NOS (p.78).

Method

The participants were randomly assigned to two groups an SI intervention group or a FM group.

The assessments used were Vineland Adaptive Behavioural Scale (VABS-2), the Sensory Processing Measure (SPM), the Social Responsiveness Scale (SRS), the Quick Neurological Screening Test (QNST-II) and the Goal Attainment Scaling (GAS).

Each participant (except for one who was absent for their final session) received 18 intervention sessions over a 6 week period. The sessions were 45 minutes long and consisted of either SI interventions or FM interventions depending on their allocated group (pp.79-80)

Results

An analysis of covariance (ANCOVA) was completed to compare pre and post test scores of all assessment used. The only two assessments which showed a statistical significance in results were the GAS and QNST-II. Both of the results were in favour of SI interventions. However the number of participants able to complete the QNST-II was significantly less in the FM group than in the SI group, therefore these results should be interpreted with caution (p.81).

Original Authors conclusions

The authors concluded that the children who had participated in the SI interventions had significantly less autistic mannerisms than before the interventions allowing them to successfully engage in occupations.

The authors also concluded that for further research assessments that are more compatible with the population need to be identified.

Critical Appraisal:

Validity:

According to Taylor (2007) there are several questions which must be answered to ensure validity when appraising a clinical trial (on which the pilot study was based). These are; did the trial address a purpose? Was the literature review appropriate? Was the assignment of participants randomised? Were the people involved in the study blinded to the treatment and were the ethical issues considered. The answer to each question follows (respectively) below.

The authors clearly stated the purpose of the study "The purpose of this pilot study was to establish a model for randomized controlled trial research, identify appropriate outcome measures, and address the effectiveness of sensory integration (SI) interventions in children

with autism spectrum disorders (ASD)” (p.76). There was an extensive review of the literature which established that the current available literature consisted of predominantly single case studies and that the methodology of the studies was fairly weak. Therefore research of a higher quality was required to determine whether SI is an effective intervention in facilitating occupational performance. A Statistician who was independent to the intervention phase of the study was appointed to randomly assign participants to either the SI group or the FM group. The researchers and parents who complete the pre and post testing were blinded as to avoid bias and the group were treated equally. It was not stated in the report however what ethical issues if any were considered.

Results

Each assessment used to gather data was clearly described and evaluated. The inter-reliability and/or test – retest reliability of each assessment was established, all assessments score high on these tests. As this was a pilot study a range of assessments were used to decide which assessment would be most appropriate for the future RCT. The authors concluded that some assessments were not suited to the population and only the GAS produced reliable, significant results. The study was able to address the purpose of the study and establish a model for a reliable and valid RCT. In respect to the effectiveness for SI as an intervention to facilitate occupational performance in children with ASD the results suggest that SI can produce positive results and is sometimes but not always more effective than FM. It was suggested that further research be conducted to validate these findings.

Conclusion

This pilot study has strong validity and reliability and extensive rigor was employed in conducting the research. This should suggest that the evidence is appropriate to be used in practice. However the results were somewhat inconclusive. Only one outcome measure was deemed appropriate (GAS) to the population and produced significant positive results. The other outcome measures produced varied results some supporting the GAS and some not, however none of these outcome measure produced results that were statistically significant or were deemed to be appropriate for the population.

It can be concluded then that the results of this study need to be interpreted with caution and other research be sought to support the finding of this study if it is to be used in evidence based practice.

Implications from practice and future research

In spite of the vast range of limitations outlined in both the studies, they are the best current research available on the use of SI as an intervention in increasing occupational performance in children with difficulty processing sensory information.

OTs who work with children often use sensory techniques to facilitate positive gains in the areas of behaviour, motor performance, sensory processing and individualised goals. The research suggests that this can be effective particularly in relation to no intervention at all and OT's can employ this method of intervention with some confidence. They must however bear in mind that other interventions have been proven to be just as effective and individual needs and interests of the child must be taken into account, when determining which intervention is best to create positive outcomes with that child.

The studies reviewed emphasised the importance of tailoring the interventions to the clients needs in order to achieve a successful outcome. This is due to the wide variety of behavioural symptoms and developmental abilities that can be demonstrated with sensory processing difficulties and also due to the vast degree to which they can be displayed (Pfeiffer et. al., 2011). The success of the GAS outcome measure is also encouraging in the support towards goal focused client centred practice. Both studies stated that the GAS was the only outcome measure which produced significant positive results.

Further research is needed to strongly establish the effectiveness of SI as an effective intervention. Pfeiffer et. al. (2011) provides a comprehensive model for future RCT's with appropriate outcome measures. Pfeiffer et. al (2011) also emphasise the importance of sample size and ensuring participants are homogenous so the effectiveness of the interventions can be identified and clinically applied.

May-Benson and Koomar (2010) also highlight the need for higher levels of research in this area and recommend a meta-analysis of current research be completed. They also draw attention to the need for qualitative research in this area to gain a more client centred view. May-Benson and Koomar (2010) also state the importance of using a fidelity measure and intervention manuals when comparing two different interventions.

The research also brings to light the issue of client centred-focused vs. occupation or participation-focused studies. The vast majority of studies available are occupation focused based. This does not support the traditional client centred core of occupational therapy. Therefore is it appropriate for OT's to be basing their decisions on this literature? There is a need for more client focused studies using client based interventions.

References

Arbesman, M., & Lieberman, D. (2010). Methodology for the systematic reviews of occupational therapy for children and adolescents with difficulty processing and integrating sensory information. *American Journal of Occupational Therapy, 64*, 368–374. doi: 10.5014/ajot.2010.09068

Ayres, A. J., & Robbins, J. (2005). *Sensory integration and the child: understanding hidden sensory challenges*. Los Angeles, USA: Western Psychology Services.

Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Research Scholars Initiative - Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *American Journal of Occupational Therapy*, 65, 76–85. doi: 10.5014/ajot.2011.09205

Hoehn, T. P., & Baumeister, A. A. (1994). A critique of the application of sensory integration therapy to children with learning disabilities. *Journal of Learning Disabilities*, 27, 338–350. doi:10.1177/002221949402700601

May-Benson, T. A., & Koomar, J. A. (2010). Systematic Review of the Research Evidence Examining the Effectiveness of Interventions Using a Sensory Integrative Approach for Children. *American Journal of Occupational Therapy*, 64, 403–414. doi: 10.5014/ajot.2010.09071

Roberts, J. E., King-Thomas, L., & Boccia, M. L. (2007). Behavioral indexes of the efficacy of sensory integration therapy. *American Journal of Occupational Therapy*, 61, 555–562

Schaaf, R. C., & Nightlinger, K. M. (2007). Occupational therapy using a sensory integrative approach: A case study of effectiveness. *American Journal of Occupational Therapy*, 61, 239–246.

Taylor, C.M. (2007). *Evidence based practice for occupational therapists* (2nd ed.). Oxford: Blackwell Publishing Ltd