Research Request – Updated Literature Review: Sensory products/ weighted items for participants with Autism

Date	May 14, 2020
Requester	Karyn s22(1)(a)(ii) - irrelevan (Director - TAB)
Researchers	Jane s22(1)(a)(ii) - irrelevan (Research Team Leader)

Research Brief

Perform literature search to confirm that published TAT advice titled - *Sensory devices and toys to assist with sleep and calming for participant who has Autism* is current and effective.

Contents

Please note:

The research and literature reviews collated by our TAB Research Team are not to be shared external to the Branch. These are for internal TAB use only and are intended to assist our advisors with their reasonable and necessary decision making.

Delegates have access to a wide variety of comprehensive guidance material. If Delegates require further information on access or planning matters they are to call the TAPS line for advice.

The Research Team are unable to ensure that the information listed below provides an accurate & up-to-date snapshot of these matters.

1. Summary

The current TAT digest states Ayres Sensory Integration (SIT) has 'weak to insufficient evidence that the intervention can improve outcomes.' However, evidence supporting the use of Ayres Sensory Integration Therapy (SIT) as an intervention for Autism Spectrum Disorder (ASD) is building.

- A recent systematic review [1] concludes that Ayres SIT is an evidence based practice for children with ASD between the ages of four and 12. However, the intervention delivered must be consistent with the principles described by Ayres and operationalized in the Ayres Sensory Integration Fidelity Measure (ASIFM) [2-6].
- Interventions that utilise isolated sensory stimuli do not adhere to these principles and are not recommended.
- This review included two Randomised Controlled Trials (RCT's). Both indicated statistically significant group differences favouring the Ayres SIT group across Goal Attainment Scale (GAS) outcomes, care giver assistance using the Paediatric Evaluation of Disability Inventory (PEDI) for self-care and social activities scale.
- It should be noted that only one of these RCT's achieved an effect size that would be considered an important intervention effect (≥0.25). Therefore, results should be interpreted with caution.

There is weak evidence to support the use of SIT that doesn't adhere to principles outlined by Ayres or Sensory Based Interventions (SBI) (both single and multi-sensory). Generalisability of results is not possible as many reviews included peer reviewed literature which was of ***low quality***, had ***small sample*** sizes or ***lacked any statistical comparison***. The majority of studies were classified as negative due to a lack of patient benefit, especially weighted vests and/or blankets. In some cases, SIT may have increased problem behaviour [7]. Studies that found positive outcomes were often rated as 'suggestive' evidence due to major methodological limitations.

Single and multi-sensory interventions investigated included: sensory objects, toys, special seating, eye shields, noise cancelling head set, brushes, lotion, books, games, mats, swing,

climbing walls, tubes, ball pit, weighted vests, fine motor activities and Snoezelen equipment.

2. Sensory Integration Therapy Research Evidence

2.1 Systematic reviews utilising the principles of Ayres Sensory Integration Therapy

Ayres Sensory Integration Therapy (SIT) is one of the most highly utilised interventions for autism spectrum disorder (ASD), however, a lack of consensus exists regarding its evidence base. One reason for this is that many studies included in existing systematic reviews and meta-analyses report on sensory-based interventions which are not consistent with the principles of Ayres SIT as described by Ayres [2-5], and operationalized in the Ayres Sensory Integration Fidelity Measure (ASIFM) [6]. Instead, many reviews and meta-analyses include studies of interventions that use isolated sensory stimuli as the active ingredient of the intervention (hereafter referred to as sensory-based interventions (SBI)) and do not adhere to the core principles of Ayres SIT. These sensory-based interventions are largely characterized as protocols that are passively applied to the child and have been found to have few positive effects [8]. They lack many of the key ingredients of the ASI such as **individual-tailoring, active engagement of the child, the establishment of a therapeutic alliance between the child and therapist, targeting the just right challenge and provided within the context of play** [1].

A recent systematic review conducted by **Schaaf, Dumont, Arbesman, and May-Benson (2018)** [9] only included studies where *the intervention approach adhered to the principles of ASI.*

Summary

1) *Research question/purpose/objective*
   - What is the efficacy of occupational therapy using Ayres SIT to support functioning and participation as defined by the International Classification of Functioning, Disability and Health for persons with challenges in processing and integrating sensory information that interfere with everyday life participation?
2) *Methodology*

- Only studies of level I, II and III were included.
- NHMRC level of evidence hierarchy = **Level III-2**
- Comprehensive search strategy

3) *Results/conclusion*
   - 5 included studies (3 RCT's, 1 retroactive analysis and 1 single subject A-B-A design)
   - Included participants were mostly male and ranged in age from 4 – 9 years
   - **Strong evidence** that Ayres SIT intervention demonstrates positive outcomes for improving individually generated goals of functioning and participation as measured by Goal Attainment Scaling (GAS)
   - **Moderate evidence** supported improvements in impairment-level outcomes of improvement in autistic behaviours and skills-based outcomes of reduction in caregiver assistance with self-care activities
   - **Insufficient evidence** for outcomes in play, sensory–motor, and language skills and reduced caregiver assistance with social skills

A further systematic review with far stricter inclusion criteria to establish whether ASI is an evidence based practice was published in 2019 by **Schoen, Lane, Mailloux, May-Benson, Parham, Smith Roley and Schaaf** [1]. The authors of this review identified 'major concerns' with previous reviews which investigate the effectiveness of Ayres SIT such as;

1) Sensory integration interventions described were not consistent with the principles of Ayres SIT and were instead a sensory-based intervention.
2) Fail to provide an adequate description of the phenotypic characteristics of participants.
3) Do not present a replicable description of the intervention, or document intervention fidelity throughout the intervention period using a quantitative measure.
4) Outcomes measured in existing studies vary widely and may not be sensitive to the changes expected following Ayres SIT intervention.

Summary

1) *Research question/purpose/objective*

- Does ASI intervention meet the Council for Exceptional Children (CEC) criteria for an evidence-based practice for children with ASD?

2) *Methodology*
   - Comprehensive strategy which included 3 stages: (1) electronic database search, (2) selection of studies using well defined inclusion criteria and (3) evaluation of included studies using CEC standards.
   - NHMRC level of evidence hierarchy = **Level III-2** (this is because one study included was a retrospective record review and non-randomisation)
   - Quality indicator rating and data extraction was performed by 7 highly experienced OT's (>34 years clinical and academic experience)

3) Results/conclusion
   - 3 studies met inclusion criteria
   - Authors state that "*Ayres SIT is an evidence based practice is supported by the finding of two methodologically sound group comparison studies with random group assignment, positive outcomes, and a collective total of >60 participants.*"
   - Only one study achieved a combined effect size of >0.25 (see effect size interpretation below)
   - The justification and conclusion that ASI is an evidence based practice and provides positive outcomes needs to be interpreted with caution. Although two studies found statistically significant results (<0.05) only the study by Schaaf et al. (2014) [10] achieved effect sizes that would be considered clinically effective. GAS (p = 0.003, d = 1.2), measures of caregiver assistance in self-care (p = 0.008

Effect size interpretation: Measures either the sizes of associations or the sizes of differences.

It is standard practice to use effect size in experimental group comparisons rather than statistical significance to evaluate the strength of the findings, since statistical significance is influenced by the sample size. Effect size is preferable because it takes into account the meaningfulness of the outcomes for the population being studied.

The Schoen et al (2019) [8] paper used the guideline that an effect size ≥0.25 is deemed a substantively important intervention effect and <0.25 is not a substantively important effect. This means that if two groups' means don't differ by 0.25 standard deviations or more, the difference is trivial, even if it is statistically significant.

d = 0.9) and socialization (p = 0.04, d = 0.7) compared to the usual care group (control).

2.2 Systematic Reviews – combined Sensory Integration Therapy and Sensory Based Interventions

Description of Sensory-Based Interventions

Sensory-based interventions (SIB's) typically occur in the child's natural environment and consist of applying adult-directed sensory modalities to the child with the aim of producing a short-term effect on self-regulation, attention, or behavioural organization Common individual SBIs include weighted vests, brushing, bouncing on a ball, and adapted seating devices that allow motion. These modalities may be provided in a systematic manner throughout the child's day or as needed in response to the child's self-regulation and are often combined into what is called a sensory diet.

Lang R, O'Reilly M, Healy O, Rispoli M, Lydon H, Streusand W, Davis T, Kang S, Sigafoos J, Lancioni G, Didden R. Sensory integration therapy for autism spectrum disorders: A systematic review. Research in Autism Spectrum Disorders. 2012 Jul 1;6(3):1004-18 [7].

Summary

1) *Research question/purpose/objective*
   - To systematically identify, analyse, and summarize research involving the use of SIT in the education and treatment of individuals with ASD.
2) *Methodology*
   - Multiple research databases searched
   - Studies had to include at least on participant with ASD and implement some form of SIT
   - No restriction on level of evidence included.
   - NHMRC level of evidence hierarchy = **Level III-2**
   - No differentiation between Ayres SIT and SBI
3) *Results/conclusion*
   - Included studies investigated weighted vests, blanket or body sock, swinging, brushing, joint compressions or stretching, alternative seating, playing with

water or sand sensory table, chewing on a rubber tube, playing with textured toys sensory diets, and vestibular or proprioceptive intervention

- 25 included studies provided SIT intervention to a total of 217 individuals with ASD (*some studies included other diagnoses)
- 14 studies were classified as negative as there was no benefit to the patient. Of these, four suggested that SIT may have increased problem behaviour. Eight studies showed mixed results and three were positive. All three positive studies were rated as 'suggestive' evidence which is the lowest rating due to major methodological limitations.
- SIT had no consistently positive effect as a treatment for children with ASD.

Watling R, Hauer S. Effectiveness of Ayres Sensory Integration® and sensory-based interventions for people with autism spectrum disorder: A systematic review. American Journal of Occupational Therapy. 2015 Sep 1;69 (5):6905180030p1-2 [11].

Summary

1) *Research question/purpose/objective*
   - What is the evidence for SIT and SBIs within the scope of occupational therapy practice to improve performance in daily life activities and occupations for children with autism spectrum disorders?
2) *Methodology*
   - Multiple research databases searched
   - Studies included in the review are Level I, II, and III evidence. Level IV evidence was included only when higher level evidence on a given topic was not found
   - NHMRC level of evidence hierarchy = **Level III-2**
3) *Results*
   - 23 articles met inclusion criteria
   - 506 participants ranging in age from 2 to 39 years. Majority were male
   - Level I SIT studies included significant improvement in individualized goals, improved sleep, decreased autism mannerisms, and reduced caregiver burden

- Level I SIB studies found that active participation in multisensory experiences in home or clinic settings led to significant improvements in autism symptoms and behaviours as well as improved scores in cognitive and vocabulary testing
- Level II SIB studies reported a significant improvement in motor proficiency and sensory functioning after clinic-based multisensory intervention that included enhanced vestibular, proprioceptive, and tactile sensory experiences. Increases in sustained focus, decreases in self-injurious behaviour, and increased perceived relaxation and happiness were found after independent participation in a multisensory centre.
- Level IV SIB study found no effect on self-injurious behaviour, challenging behaviour, or cortisol levels as a result of uniformly designed sensory diets.
- Studies which investigated single SBI's found no effects

4) *Conclusion*
   - Moderate evidence was found to support the use of Ayres SIT. The results for sensory-based methods were mixed. Recommendations include performing higher level studies with larger samples, using the Fidelity Measure in studies of Ayres SIT, and using carefully operationalized definitions and systematic methods in examination of SBIs.

Bodison SC, Parham LD. Specific sensory techniques and sensory environmental modifications for children and youth with sensory integration difficulties: A systematic review. American Journal of Occupational Therapy. 2018 Jan 1; 72(1):7201190040p1-1 [12].

Summary

1) *Research question/purpose/objective*
   - What is the effectiveness of occupational therapy interventions that use specific sensory techniques or sensory environmental modifications to support function and participation of children and youth who have sensory integration difficulties
2) *Methodology*
   - Multiple research databases searched

- Included interventions: cognitive, parent or teacher coaching, and occupation-based interventions; specific sensory techniques; and sensory environmental modifications
- Levels I, II, and III studies included
- NHMRC level of evidence hierarchy = **Level III-2**

3) *Results*
   - 8 articles met inclusion criteria and interventions included weighted vests, Qigong massage, slow linear swinging and sensory environmental techniques
   - Qigong massage had 3 high level 3 RCTs which concluded that all reporting positive outcomes
   - Limited support for weighted vests
   - Insufficient evidence for the effectiveness of slow linear swinging in producing improved on-task behaviour
4) *Conclusion*
   - The evidence is insufficient to draw conclusions regarding slow linear swinging and incorporation of multisensory activities into preschool settings. Although Qigong massage provided positive results all RCT's were conducted by the same research group which is of concern. Further independent studies are required.

Case-Smith J, Weaver LL, Fristad MA. A systematic review of sensory processing interventions for children with autism spectrum disorders. Autism. 2015 Feb; 19(2):133-48 [13].

1) *Research question/purpose/objective*
   - What is the effectiveness of SIT and SBIs for children with ASD and co-occurring sensory processing problems on self-regulation and behaviour?
2) *Methodology*
   - Thorough search strategy
   - Inclusion criteria: (a) peer reviewed studies published in English, (b) participants were youth aged 3–21 years, (c) an SIT or SBI was studied, (d) participants were diagnosed with ASD, and (e) the intervention systematically (i.e. was based on stated goals) targeted self-regulation and arousal state.
   - NHMRC level of evidence hierarchy = **Level III-2**

3) *Results*
   - 19 studies included. 5 SIT and 14 SIB
   - SIB - Among the seven single-subject studies that applied a weighted vest, only one demonstrated positive effects. Although these studies provide low-level evidence, findings suggest that wearing a weighted vest does not result in improved behaviour (e.g. decreased stereotypic behaviours, improved joint attention, or reduced distractibility). The evidence for children sitting on balls or for multisensory stimulation is limited and inconclusive.
   - SIT – Two RCT's found that SIT is associated with positive effects as measured by the child's performance on Goal Attainment Scaling, decreased autistic mannerisms and improved self-care and social function
4) *Conclusion*
   - SIT for children with ASD and sensory processing problems demonstrates positive effects on the child's individualized goals; however, additional studies are needed to confirm these results. Randomized trials using blinded evaluation and larger samples are needed. SBIs have almost no evidence of positive effects.

2.2.1 Weighted vests

Taylor CJ, Spriggs AD, Ault MJ, Flanagan S, Sartini EC. A systematic review of weighted vests with individuals with autism spectrum disorder. Research in Autism Spectrum Disorders. 2017 May 1; 37:49-60 [14].

1) *Research question/purpose/objective*
   - The purpose of the study was to evaluate the current literature on the use of weighted vests with individuals with autism spectrum disorder
2) *Methodology*
   - Thorough search strategy
   - Inclusion criteria: (a) use of a group design or single case research design; (b) inclusion of at least one individual with ASD; (c) examination of the effects of weighted vests on a particular dependent variable (e.g., aggressive behaviour,

attention to task); and (d) publication in English in a peer-refereed journal in the past 25 years.

- NHMRC level of evidence hierarchy = **Level III-2**
- Utilised validated data extraction criteria

3) *Results*
   - 32 studies met inclusion criteria
   - Relatively small sample sizes across studies. Poor levels of evidence/quality
   - 13 were rated as **meets evidence standards** and four were rated as **meets evidence standards with reservations** and fifteen studies were rated as **does not meet evidence standards**.
   - A total of 13 children (4–10 years) with ASD participated in the studies rated as meeting evidence standards or meeting evidence standards with reservations.
   - No effect on engagement, stereotypic behaviour, or problem behaviour as meets evidence standards with reservations
4) *Conclusion*
   - The information from this review indicates that the use of weighted vests with children with ASD is not an evidence-based practice. Practitioners should be aware of the literature examining weighted vests when designing interventions for children with ASD

Gee BM, Peterson TG, Buck A, Lloyd K. Improving sleep quality using weighted blankets among young children with an autism spectrum disorder. International Journal of Therapy and Rehabilitation. 2016 Apr 2; 23(4):173-81 [15].

1) *Research question/purpose/objective*
   - to explore the efficacy of weighted blankets with children with an autism spectrum disorder and sleep disturbances using a single case, multiple baseline design
2) *Methodology*
   - Case study (pilot)
   - NHMRC level of evidence hierarchy = **Level IV (lowest level)**

- Inclusion criteria: (a) Diagnosis of ASD, (b) evidence of sleep disturbance according to the Child Sleep Habits Questionnaire, (c) struggle with sensory over-reactivity as evidenced by achieving a threshold score on the Sensory Processing Measure (d) age between 3 and 6, (e) fluent in English, (f) Have internet access, (g) able to willingly implement the weight vest.
- Intervention: 9 days of no weighted blanket (baseline), 14 days of weighted blanket (intervention) and 7 days of no weighted blanket (withdrawal)

3) *Results*
   - The overall findings demonstrated minimal improvement of the measured constructs related to sleep quality in the two participants.
   - Weak evidence shown for total amount of sleep per night and decrease in the time to fall asleep
   - The findings provide a foundation for the justification of further single subject designs, using more rigorous designs and measurement.

4) *Conclusion*
   - There is need for additional research related to improving the quality of sleep in children with an ASD and sensory over-responsivity, using more robust single subject design methodology and measurement resources.

2.2.2 Systematic reviews of sensory integration therapy non-specific to ASD

Two systematic reviews investigating SIT have been conducted that investigate disabilities other than ASD. Their results and conclusion will be covered for reference.

Leong HM, Carter M, Stephenson J. Systematic review of sensory integration therapy for individuals with disabilities: Single case design studies. Research in developmental disabilities. 2015 Dec 1; 47:334-51 [16].

1) *Results*
   - 17 single case design studies on sensory integration therapy for people with, or at-risk of, a developmental or learning disability, disorder or delay.

- Interventions included: Ayres SIT, vestibular stimulation, tactile stimulation, proprioceptive stimulation, sensory diet, weighted vest, Wilbarger, joint compression
- Based on limited comparative evidence, functional analysis-based interventions for challenging behaviour were more effective that SIT.

2) *Conclusion*
   - Overall the studies do not provide convincing evidence for the efficacy of sensory integration therapy. Given the findings of the present review and other recent analyses it is advised that the use of SIT be limited to experimental contexts

Barton EE, Reichow B, Schnitz A, Smith IC, Sherlock D. A systematic review of sensory-based treatments for children with disabilities. Research in Developmental Disabilities. 2015 Feb 1; 37:64-80 [17].

1) *Results*
   - Thirty studies involving 856 participants met our inclusion criteria and were included
   - Interventions included: Sensory objects, toys, pool, special seating, eye shields, noise cancelling head set, brushes, lotion, books, games, mats, swing, climbing walls, tubes, ball pit, weighted vests, Vestibular, tactile, and proprioceptive-based activities, fine motor activities, Snoezelen equipment,
   - Considerable heterogeneity was noted across studies in implementation, measurement, and study rigor. The research on sensory-based treatments is limited due to insubstantial treatment outcomes, weak experimental designs, or high risk of bias.

2) *Conclusion*
   - Based on the analysis, sensory-based treatments are more likely to be ineffective than effective for children with disabilities

3. Reference List

1. Schoen SA, Lane SJ, Mailloux Z, May-Benson T, Parham LD, Smith Roley S, Schaaf RC. A systematic review of Ayres Sensory Integration intervention for children with autism. Autism Research. 2019 Jan;12(1):6-19.
2. Ayres AJ. Sensory integration and learning disorders. Western Psychological Services; 1972.
3. Ayres AJ. Sensory integration and learning disorders, Western Psychological Services. Los Angeles, CA. 1972.
4. Ayres AJ. Sensory integration and praxis tests (SIPT). Western Psychological Services (WPS); 1996.
5. Ayres AJ, Robbins J. Sensory integration and the child: Understanding hidden sensory challenges. Western Psychological Services; 2005.
6. Parham LD, Cohn ES, Spitzer S, Koomar JA, Miller LJ, Burke JP, Brett-Green B, Mailloux Z, May-Benson TA, Roley SS, Schaaf RC. Fidelity in sensory integration intervention research. American Journal of Occupational Therapy. 2007 Mar 1;61(2):216-27.
7. Lang R, O'Reilly M, Healy O, Rispoli M, Lydon H, Streusand W, Davis T, Kang S, Sigafoos J, Lancioni G, Didden R. Sensory integration therapy for autism spectrum disorders: A systematic review. Research in Autism Spectrum Disorders. 2012 Jul 1;6(3):1004-18.
8. Case-Smith J, Weaver LL, Fristad MA. A systematic review of sensory processing interventions for children with autism spectrum disorders. Autism. 2015 Feb;19(2):133-48.
9. Schaaf RC, Dumont RL, Arbesman M, May-Benson TA. Efficacy of occupational therapy using Ayres Sensory Integration®: A systematic review. American Journal of Occupational Therapy. 2018 Jan 1;72(1):7201190010p1-0.
10. Schaaf RC, Benevides T, Mailloux Z, Faller P, Hunt J, Van Hooydonk E, Freeman R, Leiby B, Sendecki J, Kelly D. An intervention for sensory difficulties in children with autism: A randomized trial. Journal of autism and developmental disorders. 2014 Jul 1;44(7):1493-506.

11. Watling R, Hauer S. Effectiveness of Ayres Sensory Integration® and sensory-based interventions for people with autism spectrum disorder: A systematic review. American Journal of Occupational Therapy. 2015 Sep 1;69(5):6905180030p1-2.
12. Bodison SC, Parham LD. Specific sensory techniques and sensory environmental modifications for children and youth with sensory integration difficulties: A systematic review. American Journal of Occupational Therapy. 2018 Jan 1;72(1):7201190040p1-1.
13. Case-Smith J, Weaver LL, Fristad MA. A systematic review of sensory processing interventions for children with autism spectrum disorders. Autism. 2015 Feb;19(2):133-48.
14. Taylor CJ, Spriggs AD, Ault MJ, Flanagan S, Sartini EC. A systematic review of weighted vests with individuals with autism spectrum disorder. Research in Autism Spectrum Disorders. 2017 May 1;37:49-60.
15. Gee BM, Peterson TG, Buck A, Lloyd K. Improving sleep quality using weighted blankets among young children with an autism spectrum disorder. International Journal of Therapy and Rehabilitation. 2016 Apr 2; 23(4):173-81.
16. Leong HM, Carter M, Stephenson J. Systematic review of sensory integration therapy for individuals with disabilities: Single case design studies. Research in developmental disabilities. 2015 Dec 1;47:334-51.
17. Barton EE, Reichow B, Schnitz A, Smith IC, Sherlock D. A systematic review of sensory-based treatments for children with disabilities. Research in Developmental Disabilities. 2015 Feb 1;37:64-80.