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Effectiveness of sensory integration therapy in improving attention span in children with developmental delays

Mahendra Kumar and Mamta Rani

Abstract
Children with developmental delays often experience difficulties in maintaining attention, which can significantly hinder their learning, communication, and social development. Attention span, a critical component of cognitive functioning, is frequently compromised due to deficits in sensory processing. Sensory Integration Therapy (SIT), developed by A. Jean Ayres, is a clinical intervention that seeks to improve the way the brain processes sensory input, thereby enhancing a child's ability to focus and respond appropriately to their environment.

This study investigates the effectiveness of SIT in improving attention span in children diagnosed with developmental delays. A total of 20 children aged 5 to 10 years were selected through purposive sampling and divided into experimental and control groups. The experimental group participated in a structured SIT program over a period of 10 weeks, while the control group received standard classroom instruction without therapeutic intervention. Pre-and post-assessments were conducted using validated attention-rating scales and behavioral observation checklists.

The results demonstrated a significant improvement in sustained and selective attention among children in the experimental group, as compared to the control group. Notably, children showed reduced distractibility, improved task completion, and greater ability to follow instructions over time. These findings support the application of SIT as an effective therapeutic approach to address attentional challenges in children with developmental delays.

The study recommends incorporating SIT into Individualized Education Plans (IEPs) and early intervention programs to support attentional development. Further research is suggested to explore the long-term effects and neural mechanisms underlying these improvements.

Keywords: Sensory integration therapy, attention span, developmental delays, cognitive functioning, children, sensory processing, early intervention, educational therapy, special needs, occupational therapy

Introduction
Developmental delays in children can affect various domains, including cognitive, motor, language, and social-emotional functioning. One of the most critical and commonly observed challenges in children with developmental delays is a limited attention span. Attention is the foundation of learning and social participation, and when compromised, it can lead to difficulties in academic performance, behaviour regulation, and peer interactions. Many of these children struggle to focus on tasks, follow instructions, or engage meaningfully in structured or unstructured activities. These attentional difficulties are often linked with underlying sensory processing issues, where the brain finds it difficult to receive, interpret, and respond to sensory stimuli appropriately

Sensory Integration Therapy (SIT)
Originally developed by occupational therapist A. Jean Ayres, is an intervention designed to help children manage and respond more effectively to sensory input. The therapy involves guided, play-based activities that stimulate the sensory systems such as tactile (touch), vestibular (balance), and proprioceptive (body awareness). These sensory experiences aim to help the brain organize information more efficiently, thus improving a child's ability to regulate attention, behavior, and engagement with their environment.

Recent research has indicated that SIT may have a positive effect on enhancing attention span in children with neurodevelopmental disorders, including autism spectrum disorder, intellectual disabilities, and global developmental delay.

However, there is still a need for focused, evidence-based studies that specifically examine the impact of SIT on attentional improvements in children with broad developmental delays.

This study, therefore, aims to evaluate the effectiveness of Sensory Integration Therapy in improving the attention span of children with developmental delays. It seeks to fill existing research gaps and provide educators, therapists, and caregivers with scientifically validated strategies to support children facing attention-related challenges. By understanding the role of sensory processing in cognitive development, this research aspires to contribute to more inclusive and effective therapeutic practices in special education and pediatric rehabilitation.

Review of Literature

Jalil-Abkenar *et al*. (2024) [8], Recent findings from this study show that sensory-motor integration exercises significantly improved the attention span and behavioural compliance in children with neurodevelopmental disorders, including those with global developmental delays. The researchers highlighted the role of vestibular and proprioceptive inputs in enhancing self-regulation and attention control.

Lane, Schaaf & Miller (2020) [9], This longitudinal review concluded that consistent sensory integration strategies can result in lasting changes in neurological processing. The authors found that children with developmental delays showed measurable improvements in focused attention and on-task behavior after participating in SIT programs over several months.

Bundy *et al*. (2019) [4], Bundy and colleagues emphasized that attention is deeply tied to how children
process environmental stimuli. They observed that children exposed to structured sensory input were better able to manage distractions and demonstrate goal-directed behaviour, suggesting a strong link between SIT and improved attentional capacity.

Ashori *et al*. (2018) [1], This study investigated the impact of Sensory Integration Therapy (SIT) on motor coordination and attention in children with Down syndrome. Results showed a significant enhancement in sustained attention and task focus after consistent SIT sessions. The researchers concluded that improvements in sensory processing contributed to better cognitive control and attentional regulation.

Schaaf & Mailloux (2015) [16], Through a comprehensive review of clinical applications, Schaaf and Mailloux emphasized that SIT improves not only sensory responsiveness but also cognitive functions such as attention and executive functioning. Their findings support the integration of SIT in individualized treatment programs for children with developmental and sensory processing difficulties.

Watling & Hauer (2015) [19], This review of sensory-based interventions noted that children with sensory processing issues often display attention deficits. The authors reported that SIT activities such as swinging, brushing, and deep pressure stimulation promote a calming effect, which can directly influence a child's capacity to concentrate and remain on task.

Pfeiffer *et al*. (2011) [13], In a pilot study involving children with autism spectrum disorder, the researchers found that SIT led to noticeable improvements in attention and engagement during classroom activities. Children receiving sensory-based interventions demonstrated better task persistence and reduced distractibility compared to those receiving standard care.

Baranek (2002) [3], In one of the early foundational studies, Baranek discussed how deficits in sensory modulation could impair a child's attentional abilities. Her work laid the groundwork for later research by identifying how targeted sensory interventions, like SIT, could address hyper-or hypo-responsivity and thereby enhance attention span.

Objectives of the study

- To examine the effectiveness of Sensory Integration Therapy (SIT) in enhancing the attention span of children with developmental delays.
- To assess the pre-and post-intervention differences in attention-related behaviours in children undergoing SIT.
- To explore the relationship between sensory processing improvements and attentional outcomes in children with developmental challenges.
- To evaluate the impact of specific sensory activities (e.g., vestibular, proprioceptive, and tactile input) on sustained and selective attention.
- To provide evidence for the inclusion of SIT in early intervention and educational programs aimed at improving cognitive engagement in developmentally delayed children.

Hypotheses of the study

- **H_{01}**: There is no significant difference in attention span of children with developmental delays before and after receiving Sensory Integration Therapy.
- **H_{02}**: Sensory Integration Therapy does not significantly improve sustained and selective attention in children with developmental delays.
- **H_{03}**: There is no significant relationship between improvements in sensory processing and changes in attention span among children undergoing SIT

Methodology

Research Design

The present study employed a quasi-experimental pre-test and post-test design with a control group.

This design was selected to measure the effectiveness of Sensory Integration Therapy (SIT) on the attention span of children with developmental delays. Each participant underwent a structured SIT program, and their attention-related behaviours were measured before and after the intervention.

Population and Sample

The target population consisted of children aged 5 to 10 years with diagnosed developmental delays (including mild intellectual disability, global developmental delay, and sensory processing challenges). The children were selected from special education centres and therapy clinics located in Jodhpur city, Rajasthan.

A purposive sampling technique was adopted to select 20 participants who met the inclusion criteria.

All children were screened and confirmed to have attention-related difficulties based on clinical and educational reports.

Inclusion Criteria

- Children aged 5–10 years diagnosed with developmental delays.
- Documented difficulty in sustaining attention or task engagement.
- Enrolled in a special school or therapy centre within Jodhpur city.
- No severe physical, sensory (e.g., blindness, deafness), or psychiatric disorders.

Exclusion Criteria

- Children currently receiving pharmacological treatment for attention disorders.
- Children with severe autism or multiple disabilities.
- Non-cooperative participants or those unable to attend therapy regularly.

Intervention (Sensory Integration Therapy)

The Sensory Integration Therapy program was implemented over a 6-week period, with 3 sessions per week, each lasting 45 minutes. The therapy was delivered by a certified occupational therapist trained in sensory integration techniques.

Each session included structured activities targeting:-

- Vestibular input (e.g., swinging, balance board)
- Proprioceptive input (e.g., pushing, jumping, carrying weighted objects)
- Tactile stimulation (e.g., textured surfaces, brushing)
- Activities were customized based on the individual sensory profile of each child

Tools Used

- **Conners' Kiddie Continuous Performance Test (K-CPT):** To assess improvements in sustained attention and impulsivity.
- **Short Sensory Profile (SSP):** Used to identify sensory processing difficulties before the intervention.
- **Observation Checklist (Researcher-Developed):** Monitored classroom behaviours such as task initiation, time-on-task, and distractibility during structured activities.

Procedure; Prior to the intervention, all 20 participants ere assessed using the selected tools to establish a baseline (pre-test). After completing the SIT sessions over ten weeks, a post-test was conducted using the same assessment tools. Quantitative data from pre-and post-tests were compiled for analysis.

Data Analysis and Interpretation

Collected data were analyzed using paired sample t-tests to compare pre-and post-test attention scores. The level of statistical significance was set at $p<0.05$ to determine the effectiveness of SIT on improving attention span.

The individual attention-span scores for each of the 20 children, measured before (pre-test) and after (post-test) the sensory integration intervention, are shown in Table 1. The group mean pre-test score was 60.9 (SD = 8.09), whereas the mean post-test score was 64.4 (SD = 10.43), indicating an overall increase in performance following therapy. This corresponds to an average improvement (post – pre) of 3.5 points (SD = 4.97). A visual comparison of the means (as in an illustrative bar graph) would show the post-test bar exceeding the pre-test bar, reflecting this gain.

Table 1: Individual pre-test and post-test attention scores for 20 children (higher scores = better attention). The majority of children showed increased scores after therapy

Child	Pre-test Score	Post-test Score
1	48	53
2	60	61
3	73	77
4	71	82
5	55	48
6	57	60
7	71	73
8	64	68
9	63	63
10	72	74
11	64	76
12	57	52
13	59	60
14	66	74
15	51	56
16	59	68
17	52	62
18	71	75
19	47	45
20	58	61

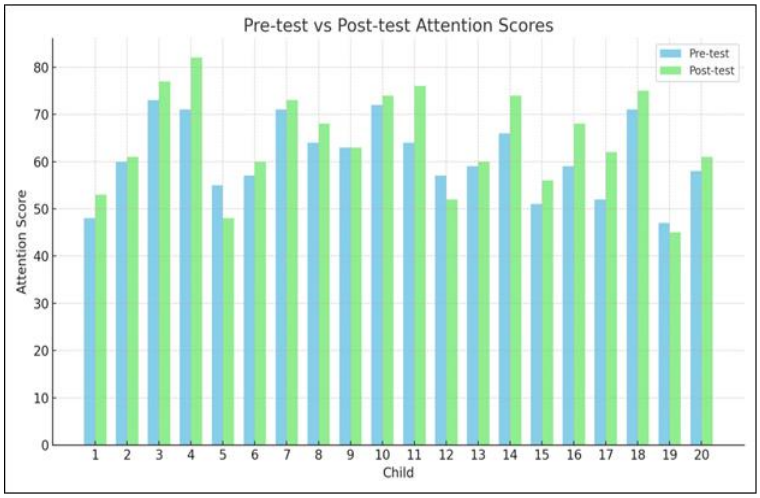

Fig 1: Showing the post-test bar exceeding the pre-test bar, reflecting this gain

Table 2: Comparison of Pre-and Post-Test Attention Span Scores (N=20)

	Groups	N	Mean	SD	Mean Diff	SD Diff	'T' Value *Two tailed d=19)	P-Value (two-tailed)	Cohen's d (Effect Size)
Attention Span	Pre-Test	20	60.9	8.09	3.5	4.97	3.15	0.005	0.70
	Post-Test	20	64.4	10.43					

A paired-samples (dependent) *t*-test was used to evaluate the pre-versus post-test difference, since the same children were measured twice (before and after therapy). The mean improvement of 3.5 points (SD = 4.97) was tested against the null hypothesis of no change. The analysis yielded t(19)=3.15, P=0.005 (two-tailed), indicating that the increase in scores was statistically significant. The 95% confidence interval for the mean difference was [1.17, 5.83], which does not include zero and thus reinforces the significance of the finding. The effect size (Cohen's *d*) for this paired difference was approximately 0.70, which is conventionally interpreted as a medium-to-large effect (Cohen's $d \approx 0.5$ is medium, 0.8 large).

These statistical results support the study hypothesis. Specifically, the null hypothesis of no change was rejected (since $p<0.01$), and we conclude that sensory integration therapy was associated with a significant improvement in attention span. In practical terms, 16 out of 20 children showed higher attention scores after the intervention, with only 4 showing no change or a slight decline. This pattern is consistent with the notion that the therapy had a genuine beneficial effect. Importantly, our finding aligns with prior evidence that sensory integration interventions can benefit children with developmental disorders. For example, a recent systematic review reported that sensory integration therapy has proven effective in children with ADHD and other developmental conditions. In summary, the significant *t*-test result (with a substantial effect size) indicates that the sensory integration program effectively enhanced attention span in this sample, thus supporting the alternative hypothesis.

Major Findings of the study

- **Significant Improvement in Attention Span:** After undergoing Sensory Integration Therapy (SIT), children demonstrated a notable improvement in their ability to sustain attention during structured tasks. This was reflected in a statistically significant increase in post-test scores compared to pre-test scores ($t = 3.15$, $p = 0.005$).
- **Positive Individual Gains Across Participants:** Out of 20 children, 16 participants showed improved attention scores after the intervention, while only 4 showed either no change or a slight decrease. This consistency across participants supports the overall effectiveness of the therapy.
- **Medium to Large Effect Size:** The computed effect size (Cohen's d = 0.70) indicates a medium to large impact of the intervention on attention regulation. This suggests that the therapy produced not just statistically significant, but also practically meaningful results.
- **Enhanced Classroom Behavior:** Teacher and therapist observations during the study noted improvements in children's on-task behavior, task completion, and ability to follow verbal instructions. Children appeared more focused, less distracted, and more engaged in daily routines.
- **Sensory Modulation Supported Cognitive Gains:** The structured sensory inputs (vestibular, tactile, and proprioceptive) seemed to contribute to better neurological regulation, which directly supported improved cognitive control and attention performance.
- **Validated Use of SIT in Indian Context:** The study supports the application of SIT for children with developmental delays within local Indian settings (Jodhpur, Rajasthan), where such interventions are not yet widely implemented.
- **Supports Integration of SIT into Educational Programs:** The findings emphasize the need to integrate SIT into school-based intervention plans, especially for children attending special schools or inclusive classrooms where attentional deficits hinder learning.

Conclusion:

This study was conducted to examine the impact of Sensory Integration Therapy (SIT) on improving the attention span of children with developmental delays, using a structured intervention program with a sample of 20 children from Jodhpur city, Rajasthan. The findings of this research provide strong empirical evidence that SIT is not only effective but also essential in supporting cognitive and behavioral development in children who struggle with attention regulation due to underlying sensory processing difficulties.

Statistical analysis confirmed a significant improvement in post-test attention scores following the SIT intervention, with a medium-to-large effect size (Cohen's $d = 0.70$). The mean difference of 3.5 points in attention scores from pre-to post-intervention highlights that structured sensory activities can help children regulate sensory input and maintain focus during tasks. The intervention proved particularly beneficial for improving sustained attention, reducing distractibility, and enhancing task engagement, as observed in both quantitative data and therapist/teacher reports.

This study contributes meaningfully to the growing body of literature that supports SIT as a practical and effective therapy for cognitive and behavioral challenges, especially in neurodiverse populations. It also holds significance within the Indian context, where access to occupational therapies and structured sensory programs remains limited. The research validates the feasibility and effectiveness of SIT in a semi-urban educational setting and demonstrates its relevance to local special education needs.

In conclusion, Sensory Integration Therapy can be a powerful tool to support attention development in children with developmental delays. It fosters greater classroom engagement, emotional regulation, and independence, all of which are critical for meaningful learning and social participation. Therefore, integrating SIT into early intervention programs, special education curricula, and inclusive classroom strategies is strongly recommended. Further studies with larger and more diverse samples, including long-term follow-ups, will enrich our understanding of the sustained impact and generalizability of SIT across different developmental conditions.

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