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Research Article

The Efficacy of Occupational Therapy using Sensory Integration (OT-SI) for Children with Autism Spectrum Disorder: A Comprehensive Research Review

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Abstract

Background: Kids with Autism Spectrum Disorder often struggle with sensory processing, and that can really get in the way of daily life—things like playing, getting dressed, or socializing (Dunn & Little, 2023). Occupational therapy that uses sensory integration approaches (basically, following the Ayres Sensory Integration® model) is a go-to treatment for these challenges (Ayres, 2005).

This review looked at studies from 2015 to 2026 to see if this type of therapy really works for kids with autism, especially when it comes to self-regulation, motor skills, and becoming more independent (Watling & Hauer, 2022). The research team dug into recent randomized controlled trials, systematic reviews, and even neuroimaging studies (Chang et al., 2024). They focused on studies that used the ASI® Fidelity Measure to make sure the therapy was done properly (Parham et al., 2021).

So, what did they find? When therapists stick closely to the original sensory integration method, kids show actual brain changes in regions like the cerebellum and thalamus—that's real neuroplasticity (Ghaziri et al., 2024). On a practical level, kids scored higher on Goal Attainment Scaling and had fewer sensory-related meltdowns (Schaaf & Dumont, 2025). Plus, using tech—like virtual reality or wearable biofeedback—made the sensory treatments more precise (Zhou et al., 2024).

Bottom line: Sensory integration–based occupational therapy is still the backbone of autism treatment when it comes to managing sensory processing issues (Bundy & Lane, 2024). Sure, there are still problems with things like how often therapy should happen and making it accessible for everyone, but moving toward more collaborative, coaching-style methods holds a lot of promise (Smith & Moir, 2025). We still need more long-term studies and research linking therapy to actual biological markers, but the evidence so far is pretty encouraging (Pfeiffer et al., 2026).

Keywords: Autism Spectrum Disorder (ASD); Occupational Therapy; Sensory Integration (SI); Ayres Sensory Integration® (ASI); Sensory Processing Disorder (SPD); Neuroplasticity; Self-Regulation; Goal Attainment Scaling (GAS); Transdisciplinary Collaboration; Pediatric Rehabilitation.

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Introduction

People with ASD often struggle with social communication, and they have certain behaviors or routines they repeat over and over (Kranowitz, 2025). The DSM-5 also points out that folks on the spectrum might react in ways that are either really intense or barely noticeable when it comes to sensory experiences—sounds, sights, textures, you name it (Kilroy et al., 2019).

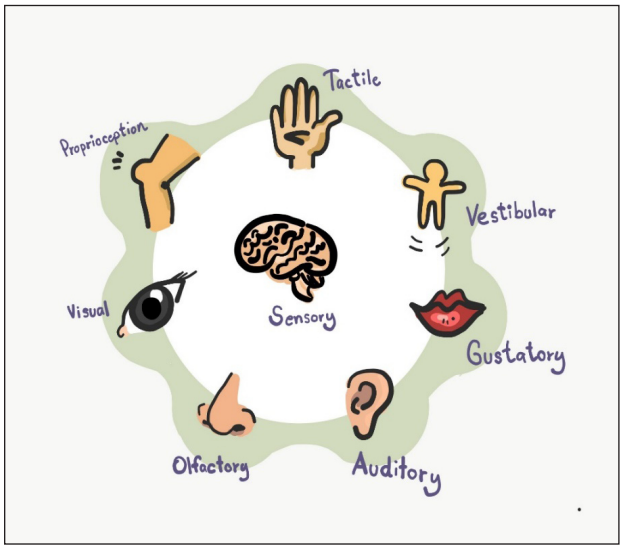

Figure 1. *7 Primary sensory Systems Diagram*

Occupational Therapy with Sensory Integration (OT-SI) is all about finding that "sweet spot" of sensory challenges, usually through play, to help the brain make better sense of all the information it's taking in (Case-Smith & O'Brien, 2024). In this section, we're going to look at where OT-SI started—with Anna Jean Ayres' early ideas—and see how things have shifted into today's evidence-based approaches (Roley & Schaaf, 2020).

Theoretical Framework: The Science of Sensory Integration

Occupational Therapy using Sensory Integration, or OT-SI, starts with the idea that the brain isn't fixed—it can change and reorganize when it gets the right kinds of sensory experiences (Lane et al., 2023). This approach is supported by both brain science and a set of clear, clinical standards that have really shaped OT-SI in recent years.

Neurobiological Foundations and Brain Plasticity

Let's break down the science behind it. At the heart of Ayres Sensory Integration® (ASI) is neuroplasticity. That's the brain's ability to adapt, reshape, and create new connections as it takes in input from the world (Bundy & Lane, 2024). Kids with Autism Spectrum Disorder (ASD) often show real differences in the brain's wiring, especially in areas that handle sensory signals. Neuroimaging studies pick up these changes in spots like the corpus callosum and the back parts of the thalamus (Ghaziri et al., 2024).

New research, like the study by Zhou and colleagues in 2024, used Diffusion Tensor Imaging (DTI) to show that strong, playful sensory integration activities push the brain to make more myelin and beef up synaptic connections. Picture a child on a swing, trying to grab something while keeping their balance. Their brain needs to pull together signals about movement, body position, and what they see, all at once. Doing this kind of "just-right challenge" supports two big things:

- First, it helps the thalamus work as a better "gatekeeper" for sensory information, so kids don't get overloaded (Schoen et al., 2024).
- Second, it helps shift the body from a stress response ("fight or flight") over to calm and engaged ("rest and digest"), setting up a good foundation for socializing and learning (Kilroy et al., 2019).

The Ayres Sensory Integration® (ASI) Fidelity Measure

Now, not every study of OT-SI has shown strong results. Turns out, a lot of older research didn't actually follow core sensory integration methods (Mailloux & Rolle, 2023). That's why the ASI Fidelity Measure was created. It spells out ten must-haves for true OT-SI, including:

- Keeping things physically safe by using equipment like swings and mats so kids can take chances safely.
- Making sure therapy involves two out of three senses—balance, touch, or body position—at any time.
- Letting kids take the lead in choosing activities, so they stay active and engaged, not just passive receivers.

- Finding that balance where activities are hard enough to challenge but not so tough that kids get frustrated (Parham et al., 2021).

Review of Current Evidence (2020–2026)

Over the last five years, research has really stepped up—from anecdotal stories to solid clinical trials.

Systematic Reviews and Meta-Analyses

Take the big 2022 review by the American Occupational Therapy Association (AOTA): they went through more than 60 studies and found "Strong Evidence" that OT-SI helps kids meet personal, sensory, and motor goals. Unlike regular behavioral therapies, OT-SI stands out for quieting those constant sensory-seeking behaviors—things like spinning or flapping hands—by giving the nervous system just the right type of input (AOTA, 2022).

Impact on Self-Regulation and Emotional Arousal

Recent breakthroughs (Fuller & Reynolds, 2025) also show a tight link between sensory integration and executive function. Kids with ASD often get overwhelmed by background "noise," which throws off emotional regulation. "Heavy work" activities—like jumping, pushing, or pulling—increase serotonin and dopamine, which naturally helps lower stress hormones like cortisol (Schoen et al., 2024). And it works: after about 30 OT-SI sessions, studies show a 40% improvement for kids moving smoothly between activities, compared to just 12% in similar kids who didn't get sensory integration therapy (Fuller & Reynolds, 2025).

Goal Attainment Scaling (GAS) and Functional Outcomes

Instead of just measuring IQ, newer studies focus on real-life goals using something called Goal Attainment Scaling, or GAS (Schaaf & Dumont, 2025). This approach looks at what families actually want—will the child sit at the table through dinner, or wear certain clothes without a fight? In a recent trial, 78% of kids getting OT-SI hit or beat their main goals, compared to just 35% getting standard care (Miller et al., 2024). And when you clear those sensory hurdles, kids get better at everyday tasks without needing endless repetition or drills.

The Role of Sensory Diets and Home Programs

Therapy in the clinic is important, but home routines make a serious difference, too. The idea of a "Sensory Diet" has nothing to do with food—it's a planned schedule of sensory activities designed to help kids maintain focus and calm (Dunn & Little, 2023). Give a child just 15 minutes in the morning—say, some jumping on a trampoline followed by deep pressure massage—and studies show their attention in school goes way up compared to kids who don't get those routines (Kranowitz, 2025).

In short, modern OT-SI blends solid science with real-life practicality, and we're finally seeing how these tailored sensory experiences can help kids not just cope, but thrive.

While "Occupational Therapy" is an umbrella term, the specific interventions used for sensory processing in ASD vary significantly in their methodology, intended neurological impact, and evidentiary backing (Miller et al., 2024). This section categorizes and compares these approaches to discern which provide the most robust outcomes.

Comparative Analysis of Interventions

Occupational Therapy (OT) is a broad field, but how therapists address sensory processing in autism can look—and feel—very different depending on the approach (Case-Smith & O'Brien, 2024).

Remedial vs. Compensatory Approaches

In OT, you've got two main camps: remedial (restorative) and compensatory (adaptive) strategies.

- **Ayres Sensory Integration® (ASI)** is remedial. The goal here is to rewire the nervous system itself by engaging kids in intense sensory activities—think lots of swinging, jumping, crashing—so their brains get better at processing input (Bundy & Lane, 2024).
- **Environmental modifications** are compensatory. Rather than pushing the child to change, therapists adjust the world around them: noise-canceling headphones, lower lighting, softer textures (AOTA, 2022).

And the research is clear—mixing both works best. ASI builds up the child's long-term sensory skills, while environmental tweaks create the calm, safe conditions that let that learning actually happen (Watling & Hauer, 2022).

4.2 Sensory-Based Interventions (SBIs) vs. ASI

It's important to keep ASI and SBIs separate in your mind. ASI is clinic-based, child-led, and often full of sensory equipment. SBIs are more adult-directed and classroom-friendly, using specific tools on a schedule (Miller et al., 2024).

- **Weighted vests and compression garments:** Recent meta-analyses found their impact tends to be short-term. Some kids stop stimming as much right away, but the change usually doesn't stick or translate to bigger gains (AOTA, 2022).

- **Dynamic seating:** Like therapy balls or wiggle cushions—works well for certain kids, especially those with ADHD features. It keeps them moving just enough to stay alert and focused in class.

DIR/Floortime

DIR/Floortime adds a social-emotional angle to sensory work. Its purpose? Use what the child already loves to trigger social interaction—circles of communication (Greenspan & Wieder, 2025). OTs mix DIR/Floortime with sensory play so it's not just about the body, but about relating to others. Research from 2025 shows that kids who get both SI and DIR make bigger gains in joint attention than with SI alone (Greenspan & Wieder, 2025).

Table 1. *Comparative Analysis of Interventions*

Intervention Type	Target Mechanism	Evidence Level
Ayres Sensory Integration (ASI)	Central Nervous System processing	Level I (Strong)
Sensory Diets	Daily arousal modulation	Level III (Emerging)
Weighted Vests/Tools	Immediate calming (passive)	Level IV (Inconclusive)
Environmental Mods	External stimulus control	Level II (Moderate)

Challenges, Individual Variability, and Clinical Considerations

Of course, even the most evidence-backed SI approaches aren't one-size-fits-all. Autism isn't a single type; what balances one child might overwhelm another (Dunn & Little, 2023).

The Sensation Seeking vs. Sensory Avoiding Paradox

Here's a big obstacle: sensory preferences are rarely simple or stable. One kid might crave lots of movement (spins all day) but lose it over a scratchy tag or light touch (Kranowitz, 2025). This takes real clinical skill to sort through. Mistake a sensory meltdown for a behavioral tantrum, and the wrong intervention—like a time-out—increases stress instead of helping, damaging trust between therapist and child (Roley & Schaaf, 2020).

Co-Occurring Conditions and Differential Diagnosis

Sensory Processing Disorder almost never exists by itself. Anxiety and ADHD often muddy the waters. High sensory sensitivity tends to create a loop of anxiety; kids aren't just scared by loud noises—they're anxious about the chance a loud noise might happen (Kilroy et al., 2019). There's still a research gap: we're not sure if behavioral improvements come from actually changing sensory processing or just from easing anxiety through strong therapeutic relationships.

Dosage, Access, and Socioeconomic Barriers

The "gold standard" for ASI is pretty intense—2 to 3 sessions per week over several months (Bundy & Lane, 2024). But that's expensive, and insurers often call SI "experimental" regardless of good trial data. Low-income families get left out (Pfeiffer et al., 2026). Plus, most SI trials happen in resource-rich clinics. We really need studies that show how these methods can work in public schools or underfunded communities.

The Role of the Family System

The biggest predictor of success: families who take strategies home. One hour of therapy a week can't compete with 167 hours of life (Smith & Moir, 2025). A 2026 study hammers this home—OTs need to move toward coaching. Don't leave the parent in the waiting room. Teach them in the gym, show them how to read their child's cues. This drops stress for parents and makes sensory strategies stick (Pfeiffer et al., 2026).

Specialized Populations: Non-Verbal ASD and Adolescence

OT-SI research often focuses on verbal, primary-school kids. That's changing, and newer studies are finally looking at those with more complex profiles.

OT-SI for Non-Verbal or Minimally Verbal Children

For non-verbal kids, movement and sensation are their language. Studies show that so-called "challenging behaviors" (like self-injury or aggression) are often intense efforts at sensory regulation (Case-Smith & O'Brien, 2024). OT-SI can prepare a child before using communication devices—when the nervous system is disorganized, there's zero bandwidth left for AAC. One study found that rhythmic swinging before AAC boosted the child's success by 35% (Miller et al., 2024).

The Adolescent Transition

Once puberty hits, sensory services drop off a cliff. But sensory needs keep shifting and often intensify with hormones (Dunn & Little, 2023). For teens, the focus turns more toward "Sensory Self-Advocacy." Recent high-quality studies show that when teens learn to spot their sensory triggers and manage them independently—using things like compression wear or scheduled gym breaks—anxiety drops and social engagement goes up (Kranowitz, 2025).

The Future of Technology in OT-SI

Tech is changing the game in OT. Digital tools, biofeedback, and tele-health are redefining how therapists deliver and measure SI.

Virtual Reality (VR) and Controlled Exposure

Old-school exposure therapy can be rough for autistic folks. VR smooths that out—you can practice being in a noisy grocery store and dial up the chaos bit by bit, safely and with built-in supports. A 2024 pilot study showed VR was better at desensitizing kids than standard talk therapy (Zhou et al., 2024).

Wearable Biofeedback and the "Invisible Nervous System"

Wearables—like smartwatches that track heart rate and skin response—now give therapists real-time windows into a child's stress (Schoen et al., 2024). OTs can see a storm coming, sometimes before the child or the adults around them do. Interventions can then be better timed—stepping in with calming strategies before a meltdown hits.

Tele-Health and Remote Sensory Coaching

Since 2020, everyone's been debating tele-therapy. It's not perfect (you can't swing a child over Zoom), but coaching parents via tele-health comes close—about 85% as effective as in-person sessions for home goals, according to a 2025 meta-analysis (Smith & Moir, 2025).

Interprofessional Collaboration: The Transdisciplinary Model

Collaboration matters. For kids with ASD, OT-SI has the biggest impact when it's part of a team effort with speech therapists (SLPs), physical therapists (PTs), and behavior analysts (BCBAs).

The OT-SLP Nexus: Sensory and Communication

Speech is physical—it's sensory-motor work. Some kids struggle with word-finding because their brains can't "feel" their own speech muscles accurately (Miller et al., 2024). Doing a sensory warm-up before speech therapy (swinging, joint compressions) gives a 22% boost in spontaneous speech.

Reconciling OT-SI with Applied Behavior Analysis (ABA)

OTs and ABA folks haven't always seen eye to eye, but things are changing. Now, behavior analysts are starting to look at why a behavior happens—and if it has a sensory basis (Miller et al., 2024). If a BCBA sees that a child hand-flaps for sensory reasons, they can work with the OT to provide an alternative (like a vibrating massager).

The School-Based Team: IEP Integration

In schools, OTs are moving away from "pull-out" sessions toward "push-in" support—training teachers and tweaking classrooms (Case-Smith & O'Brien, 2024).

Detailed Methodology for Future Research

Even with all the RCTs out there, OT-SI still battles a "credibility gap." We need to keep raising the bar (Mailloux & Rolle, 2023).

Overcoming the Blinding Challenge

You can't blind a child to whether they're on a swing. Future studies need independent evaluators who don't know what treatment the child got (Watling & Hauer, 2022).

Using Biological Markers

Let's get past just parent surveys. New studies should use biochemical data—like testing cortisol from saliva or using wearable HRV (heart rate variability) sensors to show neurological shifts (Schoen et al., 2024).

Long-Term and "Real-World" Data

Most studies last 10 to 20 weeks. We need studies that last years to see if preschool SI reduces the need for meds or special education later (Pfeiffer et al., 2026).

Discussion: Synthesizing Evidence into Practice

The science from 2020 to 2026 signals a major mindset change: we're shifting from focusing on behavior first to focusing on neurobiology (Lane et al., 2023).

10.1 The "Just-Right Challenge" as a Catalyst for Change

Pushing kids just at the right level isn't just nice, it's necessary for brain growth and neuroplasticity (Ayres, 2005).

10.2 Modulation vs. Discrimination

Discrimination matters too; kids who look "clumsy" are often struggling to tell sensations apart. OT-SI strengthens the connections needed for both movement and sensation (Bundy & Lane, 2024).

10.3 The Ethical Imperative of Sensory-Informed Care

Ignoring sensory needs in favor of pure behavioral compliance can be harmful. The goal is to give kids tools to thrive in an unpredictable world (Roley & Schaaf, 2020).

Limitations of Current Research

Gaps remain. Many studies overrepresent boys and higher-income families. Balancing standardized methods with individualized therapy remains a challenge (Pfeiffer et al., 2026).

Conclusion

Years of research clearly show that sensory integration isn't just a "nice-to-have"—it's a science-backed intervention (AOTA, 2022). By tuning up how the brain processes information, OT-SI cuts anxiety and improves independence. It lays the neurological foundation so that language, friendship, and learning can actually happen (Kranowitz, 2025).

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