Addressing Sensory Challenges in Athletes With Autism Spectrum Disorder: A Clinical Commentary

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Athletes with autism spectrum disorder (ASD) experience lesser care for injuries, and athletic trainers (ATs) report feeling unprepared to provide care competently for this population. Provision of sports-related care can be impacted by sensory differences associated with ASD, such as hyperreactivity to sensation or poor integration of sensory information. An indepth review of the literature using the Strength of Recommendation Taxonomy guidelines was used to identify articles that address the sensory features of autism for ATs with the purpose of informing ATs about the sensory features of ASD and to present the most current evidence-based recommendations for providing care to athletes with ASD and other neurodivergent individuals who present with sensory differences. Relevant articles were reviewed by 4 independent researchers and organized by theme. Key themes included use of sensoryfriendly or sensory-adapted environments, sensory kits, and informed communication strategies that acknowledge sensory differences. Providing individualized care for athletes with ASD and sensory features can improve the quality of and participation in sports for persons with autism.

Key Words: athletic training, occupational therapy, sensory-adapted environments, sensory friendly, autism spectrum disorder, neurodiversity

Key Points

- Individualized care based on unique sensory needs is crucial for successful participation.
- · Some sensory environmental modifications can be made using readily available equipment.
- Athletic trainers should consider the impact of sensory features on care.

articipation in sports and physical activity has proven to be beneficial for individuals with autism spectrum disorder (ASD); yet, young people with autism are less physically active than their typically developing peers.¹ Participation in therapeutic exercise programs can lead to positive effects on motor and praxis skills, quality of life, and psychosocial functioning.^{2,3} Thus, participation in sports activities may be a positive experience for individuals with autism. Although there are some published guidelines for working with other neurodivergent individuals (eg, those with attention-deficit/hyperactivity disorder), there is limited information available on how athletic trainers (ATs) can meet the needs of individuals with autism to support their participation in sports and other physical activities.² As such, many adults with autism report receiving lesser-quality health care and interactions with their medical professionals.³ To address this need, ATs may require greater education and training on neurodiversity, including autism and sensory differences. The purpose of this clinical commentary article is to inform ATs about the

sensory features of ASD and to present the most current evidence-based recommendations for providing care to athletes with ASD and sensory differences.

AUTISM SPECTRUM DISORDER

Autism spectrum disorder is a lifelong neurodevelopmental disorder characterized by impairments in social communication and interaction, patterns of restricted and repetitive behaviors, and atypical responses to sensory experiences.⁴ These autistic characteristics substantially vary in type and severity among individuals with autism, contributing to a heterogeneous presentation. Over the past 10 years, the rate of diagnosis for ASD has increased 100% to 1 in 36 children in the United States, with boys being 4 times more likely to be diagnosed than girls.⁵ Data have shown that ASD occurs equally across all socioeconomic, racial, and ethnic groups.⁶

The rise in ASD prevalence will likely impact the numbers of athletes with autism. However, many ATs report feeling unprepared to work with athletes with disabilities.⁷ Autism is one of the least covered disabilities in athletic training program curricula and is not mentioned within the *Athletic Training Educational Competencies* or *Curricular Content Standards*.^{8,9} Despite these barriers, research shows that even brief autism-specific training results in positive outcomes on the coaching skills of ATs.¹⁰

Sensory Features

The core features of ASD include deficits in social communication and social interaction and restricted, repetitive patterns of behavior, interests or activities that manifest as stereotypic or repetitive movement or use of objects, insistence on sameness, highly restricted or fixed interests and/or hyporeactivity/hyperreactivity to sensory input, or unusual interest in the sensory aspects of the environment. Here, we focus specifically on the sensory differences in ASD. Up to 90% of children with autism demonstrate sensory-related difficulties across a variety of domains, including sensory perception, sensory reactivity, and somatosensory-based praxis.¹¹ There are 3 main types of sensory difficulties: sensory reactivity (hyper/hypo), poor perception, and integration. Hyperreactivity is defined as a strong or noxious reaction to typical levels of stimuli (ie, adverse responses to specific sounds or textures). Hyporeactivity is characterized by unawareness of stimuli that would typically be recognized by others (ie, apparent indifference to pain, heat, or cold or missing visual, tactile, or auditory cues in the environment). Poor sensory integration occurs when there is difficulty integrating multiple senses simultaneously (ie, using touch and vision to identify an object in the hand). These sensory differences can result in poor praxis or motor planning skills.¹² Some individuals show unusual sensory behaviors such as visual fixation on spinning or lighted objects.¹³

The sensory features that individuals with autism experience can impact the provision of care in sports injuries; however, there is a paucity of literature in the athletic training domain that focuses on these sensory aspects. Currently, athletes with autism are 5 times more likely to be injured than athletes with cognitive disabilities, and when treating these injuries, their sensory differences must be taken into consideration.^{12,14–16} For example, the sensory elements of an AT's exam or treatment session, such as bright lights, different types of touch, noises, and fastpaced nature, can make it difficult for an athlete with autism to participate and receive effective treatment for an athletic injury. When ATs are aware of the sensory features associated with ASD and their impact on exams and treatments for sports-related injuries, it can facilitate successful outcomes.

There is a need to establish evidence-based practices within the scope of athletic training to best consider the sensory needs of these athletes with autism. Although adults with autism are at a greater risk for a variety of health concerns, they often report more unmet health care needs and lower levels of satisfaction with patient-provider interactions than nonautistic adults.^{15,17–20} They report greater discomfort with the environmental features of health care settings and feel more misunderstood by health care providers than their nonautistic counterparts.²¹

Recommendations

An in-depth review of the current literature was used to identify articles that address the sensory features of autism. Relevant articles were reviewed by 4 independent researchers and organized by theme to inform best practices for addressing sensory differences in autistic individuals during athletic participation and the provision of athletic training services. The Strength of Recommendation Taxonomy was used to grade the strength of the evidence presented by the literature.

Findings from each article were organized into 4 overarching themes that can guide ATs when working with autistic clients who have sensory differences: (1) sensory environmental adaptations, (2) specific sensory strategies, (3) sensory kits, and (4) communication-based strategies. Included articles represented participants who varied in age, gender, ability, and communication mode. Recognizing that the level and type of support that each athlete with ASD needs will vary, recommendations are purposely broad with the intention for ATs to use these as guidelines while tailoring individualized care for their patients' specific needs.

Environmental Adaptations

Sensory-adapted environments or approaches provide curated sensory experiences with the goal of reducing negative behaviors.²²⁻²⁵ Best-practice guidelines state that environments should be adapted based on the specific needs of individual patients.²⁶ Generally, excessively loud or bright environments can contribute to sensory overload. Availability of sensory adaptations, such as noise-reducing headphones and sunglasses, can increase comfort and focus for individuals with autism.²⁷ Sensory adaptations, when compared with standard of care, have been shown to decrease physiological anxiety, pain scores, and sensory discomfort in individuals with autism.²⁵ Research suggests that health care centers can facilitate successful health care utilization experiences among persons with autism by using evidence-based environmental adaptations, parent collaboration, and appropriate communication strategies.²⁸ We identified specific recommendations for adapting the sensory environment to facilitate participation in athletics (Table 1). Recommendations for sensory-adaptive environments have also been organized based on Strength of Recommendation Taxonomy levels 1 through 3 (Table 2). Table 3 shows the strength of each recommended adaptation or strategy.

Specific Sensory Strategies

To address the sensory challenges that some individuals with autism experience, providers may use the theory of Ayres Sensory Integration to guide their choices.²⁹ This theory is based on principles that individually tailored sensorimotor activities at the just-right challenge can improve adaptive responses for participation in activities and tasks and explains how people perceive, sort, process, and use sensory information (eg, touch, gravity, body position and movement, sight, smell, hearing, and taste) to meet environmental or activity demands.^{30,31} According to this theory, atypical sensory reactions are categorized by increased or decreased

Table 1. Specific Sensory Strategies for Hyper- and Hyporeactivity to Sensation

Sense	Hyperreactivity	Hyporeactivity
Auditory	Reduce noise through noise-canceling headphones ¹⁶	Play preferred music ³²
-	Provide intervention in areas with limited competing noise when possible ³⁰	Provide toys or objects that make noise ³³ Use a white noise machine ³¹
	Provide written instruction ¹⁶	
	Use a calming, soft voice ³¹	
Tactile	Always ask before initiating any touch	Provide opportunities through tactile input
	Allow the client to control the degree of touch ³⁴	Use of fidget spinners, textured objects, and objects
	Verbally describe touch before initiating ³⁴	that can be manipulated (pulled, stretched, etc) ³⁵
	Avoid crowded areas whenever possible ³⁴	1 AL 2 7,
Proprioception	Not typically problematic	Provide weighted vest/blanket ³⁶
-FF		Wrist weights or ankle weights ³⁷
		Provide breaks with opportunities for heavy work ³⁸
		Clear space of hazards they can bump into
Vestibular	Provide stable seating ³⁹	Provide exercise balls or rocking chairs ⁴⁰
	Minimize exercises that require bending down, spinning, or other motions that exacerbate dizziness and instability	Provide breaks with opportunities for movements (jumping and spinning) ⁴¹

reactivity to sensory input and/or by difficulties integrating multiple stimuli simultaneously for adaptive behaviors.¹³

Table 1 shows some specific recommendations for sensory strategies that may help regulate behavior when sensory hyper- or hyporeactivity is present. These include strategies to alter or adapt the situation, such as finding an area that is less noisy, adapting the activity to reduce the demand for sensory integration, providing simple written or picture instruction, or using specific sensory tools designed to buffer or enhance the sensory experience.

Sensory Kits

Many articles advocate for the inclusion of individualized sensory supports within the health care environment. These supports serve to calm, redirect, and distract during health care visits.³² Importantly, items work best if selected based on a brief previsit survey or interview to help determine the sensory needs of the person so that the kit can be personalized. Examples of commonly used objects are described in Table 1 and include noise-canceling headphones and toys or objects that provide sensory input (eg, fidget spinners and stress balls). Any sensory kit must be individually tailored to address the specific needs of the individual, and shared kits must be able to be cleaned between uses.

Communication Strategies

Although not sensory in nature, the literature supports enhanced communication to acknowledge and identify sensory-related challenges. These include creating social stories as a preparatory material that incorporates real-life pictures of the client in the actual environment where they would be receiving care.³³ These stories should include positive terminology and be read multiple times before the visit. Before and during the health care visit, ATs can give clients with autism social stories to provide context for each step of the evaluation and treatment and help them prepare for the sensations that may accompany the athletic training visit. Social stories should include pictures and written or verbal narration to guide the patient through each step of the session.³⁴ To assist with transitions and multistep directions, visual schedules can be provided to the client and individualized based on the specific steps of their treatment plan.³⁵ Further, allowing extra time for responding to verbal or visual directions and keeping language simple and direct can be helpful. Whenever possible, caregivers or patient advocates should be involved in medically relevant discussions or interactions.³⁶ Athletic trainers and office support staff should be flexible with their communication styles and ensure that they are tailored to the clients' needs, such as by allowing more time for processing information, providing response choices for otherwise open-ended questions, or simplifying instructions.³⁷ Last, it is important to note that repetitive behaviors that are observed during an athletic training session may be communication strategies used by patients with autism to convey anxiety or excitement.³⁷

IMPLICATIONS

There are 3 key recommendations: (1) sensory features can impact participation in sports, and ATs need to be aware of these and create a sensory-friendly environment and interaction; (2) there is a need to shift to an inclusive, strengths-based environment or mindset when working with neurodivergent individuals; and (3) collaboration with occupational therapists (OTs) can be helpful to address the needs of athletes with autism.

First, sensory features have been shown to impact participation in a variety of health care experiences, including sports injury intervention. To facilitate best outcomes for patients with autism, ATs should consider the sensory differences of their autistic clients. When planning for participation in physical activity, it is imperative to respect each individual patient's unique sensory needs and preferences. Attempts should be made to create a controlled environment free of distractions or extraneous auditory stimuli by dampening loud music or sounds from dropped weights. Athletic trainers should create patient-centered routines, use simple tasks and instructions, and conduct sessions in a distraction-free and sensory-friendly treatment environment. It is also important to establish patient-led treatment and individualize the treatment plan for patients with ASD. When possible, ATs should establish a consistent and predictable treatment and exercise routine consisting of single-tier simple tasks that are supplemented with positive feedback and reinforcements.

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Sense	Authors (Year)	Design	Population	Outcome(s)	Level of Evidence (SORT)
Auditory	Stiegler and Davis (2010) ¹⁶	Literature review: 1 case study	Youths with ASD who have vestibu- lar system problems	Gives recommendations on how to thoroughly assess children with ASD who have vestibular system problems	N
	Wood et al (2019) ³⁰	Case series: 1 patient (practice improvement project)	Mix of patient-reported (calmness of patient and environment; from patient and parents) and clini- cian-reported (level of support and education) outcomes	Successful modification of patient care through performing physical examinations on the teacher first before the patient with ASD and appeading to sensory sensitivities	m
	Sadatsafavi et al (2022) ³¹	Systematic review and meta-analysis of 28 studies	Patient-reported outcomes (strate- gies for creating a sensory- friendly experience for patients with ASD in the ED) 21.43% of articles discussed adults with unspecified autism severity	26 consolidated strategies for provid- ing care for patients with ASD in the ED encompassing worker's instructions, interventions/pro- cesses, sensory-friendly objects, and facility design	÷
	Porges et al (2014) ³²	Randomized controlled trial: 175 patients	Patient-reported outcomes (effec- tiveness of LPP on reducing auditory hypersensitivities and improving social behavior) Youths with spontaneous/meaning- ful speech who can follow direc- tions; mental age not specified	LPP successfully improved auditory processing, reduced auditory hypersensitivities, increased vagal regulation of the heart, and increased spontaneous social behavior	-
	Stearns ³³	Literature review	Patient-reported outcomes (effect of classroom changes on the autistic students' classroom eti- quette and ability to reach their full individual and academic potential)	Production of a summary of ideas to implement when creating a sen- sory-friendly classroom, including tips on how to appeal to an autistic individual's physical, cultural, social. and temporal needs	m
Tactile	Robertson and Sim- mons (2015) ³⁴	Qualitative analysis case study: 6 patients	Patient-reported outcomes (responses to group discussion questions about reactivity and impact of sensory stimuli and choosing the most problematic sensory aspect of an environ- ment) Adult population characterized as highly able and articulate and employed locally	Summary of 4 themes that outlined common characteristics among patients with autism: specific aspects of stimuli, control over stimuli/environment, mental states, and emotions; physical responses; and other minor themes. The data show the most problematic and enjoyable experiences of the patients	σ
	Ashburner et al (2013) ³⁵	Qualitative analysis/ case study: 3 patients	Patient-reported outcomes (responses in semistructured interviews and self-question- naires guided by an accredited assessor) Adolescents with sufficient lan- guage and cognitive skills to par- ticipate in a semistructured interview	Summary of findings from the inter- views and questionnaire results based on sensory domains and coping strategies	n

Table 2. Level of Evidence for Sensory Adaptations and Strategies for Autism Spectrum Disorder Continued on Next Page

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Sense	Authors (Year)	Design	Population	Outcome(s)	Level of Evidence (SORT)
Proprioception	Chen et al (2013) ³⁶	Case scenario with a sample size of 12	Tested the effect of a weighted blanket for people with anxiety when going to the dentist and receiving dental treatment. The weighted blanket is used as a deep touch pressure intervention (holding, stroking, hugging, and swaddling) to help relieve anxi- ety. Adults with the ability to compre- hend instructions and express feelings regarding treatment processes	The outcome was positive because it showed that a weighted blanket as a deep touch pressure intervention relieved patients who have anxiety in the dental environment	
	Gee et al (2017) ³⁷	Conducted a research study by doing an online survey for 30 days with 4 partici- pants who were diag- nosed with ASD	Tested the effect of a weighted blanket added to the 4 partici- pants' sleep routine to see if their sleep quality increased Youths with unspecified autism severity	The outcome produced moderate improvement of the 4 participants observed. Adding the weighted blanket increased the participants' amount of sleep per night and allowed them to calm down and remain asleep	N
	Kaviraja et al (2021) ³⁸	Literature review	To give proprioception impairment and treatment approaches for people dealing with youths diag- nosed with ASD	Gave evidence-based recommenda- tions on what proprioception is and how to give input to youths with ASD	N
Vestibular	Howe et al (2004) ³⁹ Lytle et al (2009) ⁴⁰	Literature review Literature review	Gave evidence-based information of the vestibular system and how it affects youths with ASD Evidence-based information on stu-	Gave recommendations to address youths with vestibular system problems inside the classroom Gave recommendations on how to	ი თ
	Larkey et al (2007) ⁴¹	Textbook	dents with autism and how stress plays a role Text that provides a 6-step approach for developing a suc- cessful program to help youths cope with sensory input	treat youths with ASD dealing with stress inside the classroom Gives parents and medical profes- sionals a source to help improve sensory processing in autism and make it adaptable for youths	-

Abbreviations: ASD, autism spectrum disorder; ED, emergency department; LPP, listening project protocol; SORT, Strength of Recommendation Taxonomy.

Table 2. Continued From Previous Page

Table 3. Strength of Recommendation for Sensory Adaptations

Sense	Recommendation	Strength of Recommendation (SORT)
Auditory	For auditory hyperreactivity, the recommendations are to reduce noise through noise-canceling headphones, limit competing noise when possible, provide written instruc- tions, and use a calming/soft voice.	B: Recommendation based on inconsistent or limited-quality patient-oriented evidence
	For auditory hyporeactivity, the recommendations are to play preferred music, provide toys that make noise, and use a white noise machine.	A: Recommendation based on consistent and good-quality patient-oriented evidence
Tactile	For tactile hyperreactivity, it is recommended to always ask before initiating touch, allow the client to control the degree of touch, describe the touch verbally before initiat- ing, and avoid crowded areas whenever possible	C: Recommendation based on consensus, usual practice, opinion, disease-oriented evidence, or case series for studies of diagnosis, treat- ment prevention, and screening
	For tactile hyporeactivity, it is recommended to provide opportunities through tactile input with the use of objects like fidget spinners, textured objects, and objects that can be manipulated (eq. Play-Doh).	C: Recommendation based on consensus, usual practice, opinion, disease-oriented evidence, or case series for studies of diagnosis, treat- ment, prevention, and screening
Proprioception	Proprioceptive hyperreactivity is not typically problematic.	D: Recommendation grade based on not enough evidence or limited observation
	For proprioceptive hyporeactivity, the recommendations are to provide a weighted vest/blanket, wrist weights or ankle weights, breaks with opportunities for heavy work, and clear space of hazards they can bump into.	A: Recommendation based on consistent and good-quality patient-oriented evidence
Vestibular	For vestibular hyperreactivity, it is recommended to provide stable seating and minimize exercises that require bend- ing down, spinning, or motions that exacerbate dizziness and instability.	C: Recommendation based on consensus, usual practice, opinion, disease-oriented evidence, or case series for studies of diagnosis, treat- ment, prevention, and screening
	For vestibular hyporeactivity, it is recommended to provide exercise balls or rocking chairs and breaks with opportuni- ties for movements (jumping or spinning).	A: Recommendation based on consistent and good-quality patient-oriented evidence

Abbreviation: SORT, Strength of Recommendation Taxonomy.

Second, there is a need to shift to a strengths-based neurodiversity perspective. Traditionally, the medical model viewpoint posits that ASD is a disability rooted within the individual that has resulted from underlying biological factors and is seen as both a restriction and an impairment to be resolved.³⁸ Interventions have therefore focused on normalizing behaviors to meet the typical standards for behavior and participation. However, a rise in self-advocacy and the neurodiversity movement has shifted toward a strengths-based approach. This approach can be compared with the social model of disability, where the disability is seen not as the result of the individual and any deficit but due to lack of environmental support of the individual or being able to effectively accommodate them.³⁸

This movement rejects the idea that there is a "typical" mind or that any sort of divergence should be considered a flaw that must be resolved.³⁸ A neurodivergent individual is considered someone who is neurocognitive; neurodevelopmental differences fall outside of what is considered the "norm" in society but do not necessarily reflect a neurodevelopmental disorder.³⁹ Within the neurodiversity movement, autism is considered one of the many variations of the human mind. The neurodiversity movement emphasizes that any life is meaningful no matter how it is lived or how closely it resembles the typical or expected life trajectory.³⁸ Furthermore, it posits that patients with autism need to be involved in and central to decision-making that will affect them, including treatment planning.³⁸

Third, collaboration with OTs can help identify and address the needs of athletes with autism. Prior studies have shown that addressing sensory needs can lead to improved health care experiences for patients with autism.^{21,28,40} Furthermore, OTs have unique knowledge regarding the sensory systems and can work with ATs in a consultative role to address sensory-related challenges.35 Athletes with autism are 5 times more likely to be injured than athletes with cognitive disabilities.¹⁴ Despite this fact, many ATs feel unprepared when providing care for athletes with comorbidities due to a lack of experience, a lack of knowledge of the patient's condition, or an ill-equipped training room. Furthermore, a study of various cultural competence health care models found that many models developed for health care providers do not address disability at all.⁴¹ These discrepancies can lead to ATs feeling less competent when working with neurodivergent athletes than they do when working with their neurotypical counterparts.⁹ However, studies have shown that ATs with prior experience, certifications, or continuing education in disability and neurodiversity feel most competent working with this group.⁹ The current study promotes the idea that education and research can bridge the gap between ATs' concerns and the needs of athletes with autism. Occupational therapists can help provide research-based strategies to facilitate therapeutic relationships between these 2 groups.

Further research, however, may still be needed to support ATs in communicating effectively with athletes with autism. Many ATs report feeling worried about being able to communicate with neurodivergent athletes.⁴¹ To ameliorate communication challenges, athletic training facilities should be prepared with visual aids, such as pain or emotion scales accompanied by pictures. When using communication support tools, practitioners should speak in short specific statements to decrease the cognitive load for patients with autism. Efforts should be made to fully explain each rehabilitation exercise before moving on with the treatment plan to ensure that patients with autism understand expectations, risks, and benefits. Establishing a therapeutic rapport and mutual sense of trust and respect is crucial when communicating with athletes who have autism. To ensure patient-provider comfort and safety, ATs should have a heightened sense of vigilance while monitoring athletes with autism for potential injuries due to a potentially reduced ability to perceive and process noxious sensory stimuli.

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