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Designing an Educational Complex for Children with Autism

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A B S T R A C T

Purpose: The objective of this study was to design an educational and rehabilitation complex specifically tailored to the needs of children with Autism Spectrum Disorder (ASD) in order to enhance their social interaction, concentration, and overall well-being through architectural strategies.

Methods and Materials: This research employed a qualitative and applied design methodology based on architectural and environmental psychology principles. Data collection was conducted through extensive library research and case study analyses, and the spatial design process followed both legal geometric modeling and conceptual development. Key design elements were derived from interdisciplinary studies in architecture, child development, and autism intervention. Spatial standards were defined based on the functional zoning of educational, administrative, rehabilitative, recreational, and public service areas. The site planning emphasized accessibility, safety, sensory responsiveness, and user-friendly circulation, with particular attention to climatic suitability for southern Iran.

Findings: The findings highlight the critical role of spatial organization, predictability, and flexibility in supporting children with autism. Design strategies included the use of bright colors, natural lighting, acoustic control, human-scale outdoor spaces, and multiple quiet rooms to reduce sensory overload. Central courtyards, low-rise building layouts, and retreat zones were integrated to ensure comfort and supervision. The functional zoning featured specific areas such as speech therapy, occupational therapy, physiotherapy, playrooms, and quiet spaces, all of which contribute to the cognitive and emotional empowerment of autistic children. The spatial layout adhered to national building standards while incorporating therapeutic principles.

Conclusion: A well-planned environment that accounts for sensory needs, mobility, privacy, and interaction can significantly reduce stress, improve learning outcomes, and foster social development. The proposed model offers a replicable framework for future autism-friendly educational facilities.

Keywords: *autistic child, social interactions, autism, child, architecture.*

1. Introduction

Constructing educational environments using architectural science and the correct application of environmental psychology in design—alongside proper educational tools and trained staff—can be crucial in reintegrating children with autism into regular life. One of the primary characteristics of individuals with this condition is the wide range of symptoms, manifestations, and treatments. Autism is a disorder with various manifestations, making design for autistic children more complex and highlighting the critical importance of spatial flexibility. This means that the learning environment should be tailored to meet the specific needs of the learner (Gholami Royin-Tan & Salehi, 2018).

Observing social norms is difficult for individuals with autism. In fact, they often cannot understand when to make eye contact, interrupt their speech, or respond appropriately in conversations. These social norms, which may seem simple to us, are not easily understood by them. We have internalized these norms through our interactions from early childhood, but for those lacking these skills, communication becomes uncomfortable and difficult. Human beings need to engage with others throughout their lives. Interaction and communication encompass speaking and expressing oneself so that others understand our intentions. All of these abilities are challenging for children with autism—not just speaking, but all forms of communication. According to studies, while neurotypical individuals expect a response within about two seconds during a conversation, children with autism take about four seconds to respond, which may give the impression that they are unwilling to engage (Malek & Soltani, 2015).

The most notable aspect of autism is the difficulty in reciprocal social interaction. Individuals with autism, even from a very early age, may struggle with behaviors such as eye contact, facial expressions, gestures, vocal intonations, and more (Karna & Stefaniuk, 2024; Ramezani & Zangeneh Motlagh, 2023; Rashmani & Mojtabaie, 2023). Many do not exhibit reciprocal sensory and social behavior, do not readily participate in or express joy with their parents, and show minimal interest in their peers. Even if they show interest, they often struggle with initiating and maintaining friendships (Karbalaei Hosseini Ghiathvand et al., 2019; Ramezani & Zangeneh Motlagh, 2023).

The process through which children and adults comprehend their environment is quite different. Children learn and grow through exploration and direct interaction with their surroundings. Understanding is an active experience in which children absorb information through interaction; thus, incorporating kinesthetic awareness into the design of children's spaces is essential. The environment must allow these children to engage, explore, create, and innovate. Autism is a mental disorder, and those affected interact with space more intensely than any other group of children with disabilities, as these spaces are directly related to their learning. These children spend considerable time in educational settings, and if they feel safe within a space, their learning capacity improves and their educational outcomes become more positive (Ghorishvandi et al., 2022). Therefore, it is vital to describe the potential sensory differences in perception, processing, and response because these children can indeed be educated in mainstream spaces. The sensory stimuli received from the environment significantly impact their progress. When the environment is appropriate to their strengths and challenges, they can experience low-stress, high-learning periods. Ambiguity-free and non-mysterious design is especially necessary for children with disorders, as they should never feel lost or be physically disoriented within a building. Educational and rehabilitative environments for children with autism must be equipped with appropriate potentialities based on an understanding of their emotional, psychological, and developmental characteristics. To meet their needs, the designed spaces should incorporate not only psychological attributes but also physical proportions and safety considerations. Moreover, spaces must be designed to challenge the autistic child's mind and support their treatment and education. Space significantly influences the healing process. Thoughts, the brain, and the nervous system are directly affected by environmental sensory elements and may respond positively or negatively. Research indicates a direct correlation between environment and rehabilitation outcomes, including improved privacy in educational spaces, stress reduction techniques, fatigue relief, enhanced satisfaction, fewer errors, greater patient safety, and increased control and stress reduction. Studies show that poor spatial design can lead to stress, delusion, high blood pressure, and social withdrawal, while well-designed spaces reduce stress, anxiety, and blood pressure, improving patients' mental health. Appropriate design can reduce the need for pain medication, shorten hospitalization periods, and accelerate recovery. Specific characteristics of educational-rehabilitation interior environments such as lighting (natural and artificial), temperature, humidity, ventilation systems, music and auditory stimuli, sound levels, views of nature, indirect sunlight in rooms and corridors, placement of equipment, flooring, and the inclusion of solitude spaces in classrooms, corridors, and courtyards—as well as bed protection and privacy or openness of rooms—are all proven to correlate with treatment and recovery. Environmental awareness only arises from spaces that are dynamic and changing; therefore, monotonous design and unchanging artificial lighting can dull sensory activity and visually and physically induce stress. Overall, autistic children require environments free from stress and tension to ensure optimal conditions for treatment (Kargar, 2017). One of the most critical design factors in educational-rehabilitative centers that positively affect patients' recovery is the reduction or elimination of environmental stressors, the creation of positive recreational activities, the facilitation of social connections, and providing a sense of calm and safety to autistic individuals. A condition that supports recovery is the proximity and familiar location of classrooms and rooms for patients. Furthermore, individualized treatment services are preferable over general services for better therapeutic outcomes for autistic patients (Kargar, 2017). Designing such a complex with proper educational support can enhance the social behaviors of autistic children.

2. Design Principles and Criteria

The environment, as one of the influencing factors on human mental state, must accommodate individual differences and respond to varied needs. Therefore, the environment should align with fundamental human psychological needs. Each environment possesses its unique characteristics. To design any space, one must first understand its essence and function.

Khuzestan Province is a flat, unobstructed, rectangular region, with its width varying from 110 kilometers in the north to 200 kilometers in the south. The Khuzestan plain is formed by soft alluvial deposits from rivers that have covered the folded Zagros Mountains, with only a few peaks emerging from these sediments, causing minor surface features. Topographically, Khuzestan is divided into mountainous, plain, and coastal regions. The southernmost part of Khuzestan lies seven degrees below the Tropic of Cancer, which gives it a climate similar to equatorial regions. Historically, Khuzestan has been known for its hot climate, and Abadan, located in this area, is no exception. The absence of cold winters makes it a popular destination for tourists from across Iran in spring and autumn. The average annual temperature in Abadan between 1958 and 1983 was reported as 26.3°C; from 1958 to 1959 it was 24.8°C, and from 1959 to 1960, 25.7°C. Research has identified August as having the highest average temperature and February the lowest. Annual atmospheric pressure in Abadan varies seasonally, peaking at the end of autumn and winter.

According to processed meteorological data from the Abadan station, the sky is clear for 255.8 days, partly cloudy for 73.1 days, and overcast for 34.9 days each year. This translates to 70% clear skies, 20% partly cloudy, and only 10% overcast annually. Furthermore, Abadan's synoptic station reports an annual average of 3003.9 hours of sunlight. There are three types of winds in Abadan: regular seasonal winds caused by atmospheric pressure changes, local winds (including the northern wind and the humid wind), and the third type, known as "Samum" or "Sam," which originates in Saudi Arabia. This wind carries dust and sand, is extremely dry and hot, and can be toxic during midday sun exposure. These winds occasionally darken the sky as if it were night. Generally, Abadan has a humid climate, with lower humidity in spring and summer than in autumn and winter. Winter humidity can reach up to 89%, although levels as low as 1% have also been recorded. Relative humidity in July and August ranges from 50% to 60%, while in January and February it increases to 70%–80%. Overall, Abadan is characterized by high humidity. Its soil is formed from alluvial deposits of the Karun and Tigris Rivers, making it highly fertile for agriculture despite historically being too saline for cultivation. Abadan is geographically structured like an island, surrounded by rivers, known as Abadan Island. This island includes the city of Abadan, Arvandkenar district, and half of Khorramshahr. The island's fine-grained alluvial soil is currently highly suitable for agriculture (Alizadeh et al., 2022).

3. Spatial Standards

Creating appropriate educational spaces in exceptional education centers requires heightened sensitivity and precision in spatial use, details, and accessibility. The designed space must be accessible—meaning that while it must meet general educational space standards, it must also facilitate ease of use for individuals with limited abilities. These provisions ensure that all members of society can equally and with dignity benefit from educational services, thereby enhancing their capacity for managing life affairs and participating in social activities. The needs of students with disabilities vary depending on the nature of their impairment. Generally, children between the ages of 4 and 17 who use educational buildings differ physically from adults. During this developmental stage, children undergo rapid growth, and their body dimensions change significantly. In the classification of exceptional students, those on the autism spectrum are categorized under pervasive developmental disorders. These students show significant differences from their peers in interpersonal, social, imaginative, and cognitive domains, to the extent that it impacts their educational and social functioning. These students are more influenced by sensory perceptions than verbal communication. An educational environment that meets the psychological needs of children with autism has a positive effect on their performance and well-being. The following section outlines the key considerations in designing educational spaces for children with autism (Naderi Kohneh Oghaz, 2020).

4. Enclosed Spaces in Educational Centers for Students with Autism

The selected site must be entirely distanced from areas lacking social security, lacking urban infrastructure, highly dense and active zones, and areas with heavy vehicular traffic.

Figure 1

Prohibition of Unpleasant Noise and Odors Around the School (Gholami Royin-Tan & Salehi, 2018).

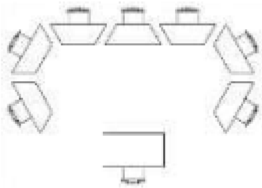
Exceptional schools are composed of four groups of spaces:

1. **Educational spaces** (including classrooms, workshops, and laboratories),
2. **Administrative spaces**, such as the offices of principals and vice-principals, teachers' lounges and lockers, service staff lounges and lockers, printing and copying rooms,
3. **Sanitation facilities**, including student restrooms, showers and lockers, staff restrooms, cleaning rooms, pantries, kitchens, and storage areas (for building equipment, educational and teaching aids, and office supplies),
4. **General spaces**, including the library and media center, multipurpose hall, gymnasium, and rehabilitation spaces for occupational therapy, speech therapy, physiotherapy, play therapy, student and family counseling, horticultural therapy, first aid, vision and hearing screening, and regular check-ups (quiet rooms or sensory white rooms).

Administrative areas include the principal's office, vice-principals' offices, clerical and financial offices, teacher workspaces, teachers' lounges and lockers, service staff lounges and lockers, meeting rooms, and waiting areas for parents meeting with teachers, counselors, or administrators. The meeting room can be integrated with the principal's office. The maximum number of students in autism classrooms is three to five in preschool and three to seven in elementary school.

Figure 2

Number of Students per Classroom (Gholami Royin-Tan & Salehi, 2018).



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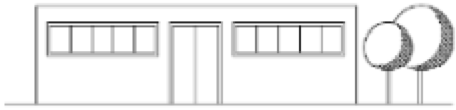
The site must be located in an area surrounded by cultural facilities, residential neighborhoods, low-density buildings, and minimal traffic and noise. It is recommended that the design be single-story; however, if space is limited, a two-story design is permissible.

Figure 3

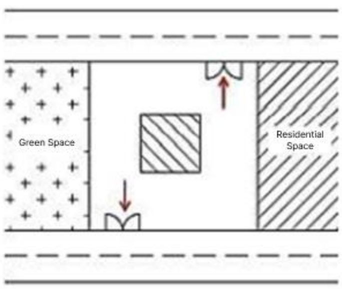
Permitted Number of Floors for School Buildings (Gholami Royin-Tan & Salehi, 2018).



The placement of a dark room for autistic students must be in a completely private and secluded area, with the possibility of indirect observation by a therapist from an adjacent area. The area per person in workspaces is 5.4 to 6 square meters. The manager's and assistant's offices may be 12 to 16 square meters, or 20 to 24 square meters if integrated with a meeting room. Meeting rooms require 3 to 5.2 square meters per person. Seating areas should allow for 2 to 3 square meters per person. Proximity to parks and green spaces is highly desirable. For exceptional schools with 25 to 150 students, the staffing requirement includes 2 to 8 administrative staff, 3 to 12 rehabilitation staff, and 4 to 13 service staff. The spatial allocation per student with Autism Spectrum Disorder is 10 to 15 square meters. The more the building is enclosed by roadways, the more independence it has, supporting the implementation of separate entrances and exits.

Figure 4

Site Boundary Constraints and Multiple Access Points (Gholami Royin-Tan & Salehi, 2018).



Study space capacity is typically calculated at 7 to 10 percent of the student population. One or two computer work areas are recommended. Raised platforms in front of boards are not used in exceptional schools. Doors and windows must not open inward into classrooms. Storage cabinets should be built into wall recesses. The multipurpose or assembly hall requires 1.3 to 1.7 square meters per student. Locker space ranges from 2.7 to 5.5 square meters per student. The terrain of exceptional schools should not have an average slope greater than 8% and must not lie in flood zones, river paths, or beneath high-voltage power lines. Recommended site sizes are 2500 square meters for 50 students, 4500 square meters for 80 students, and 6000 square meters for 120 students. Toilets are mandatory on each floor and near classrooms, as well as in outdoor yard areas and close to gathering spaces such as the assembly hall, gym, and dining area. One toilet is required per two classrooms, and including a shower cubicle is beneficial. Stair widths range from 1.2 to 2.4 meters; step depth is 30 to 32 cm, and riser height is 15 to 18 cm. No more than 12 steps should exist between landings, and stair landings must have a minimum depth of 10 cm.

Students with autism need spacious circulation areas, though budget and technical constraints may limit this. Designing pleasant, well-lit corridors with quiet, secure corners throughout can foster a sense of freedom and calm

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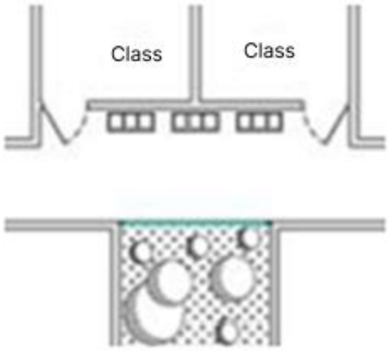
in these students. The minimum capacity for exceptional schools is 25 to 50 students, requiring a library capacity of 275 to 750 volumes, expandable to 3000 volumes for a maximum capacity of 200 students.

Speech therapy rooms must be located in quiet areas of the educational rehabilitation center, with ample lighting and acoustically absorbent and insulating materials. One speech therapy room is recommended per 25 to 50 students. Circulation areas typically make up 20–25% of the total functional area of the center. Educational space designers aim to utilize circulation zones for student interaction and socialization—for example, as spaces for special events, exhibitions, or announcements. The minimum corridor width in administrative areas is 2 meters. For corridors with classrooms on one side, the width should be at least 2.5 meters; if classrooms are located on both sides, the minimum corridor width increases to 3.3 meters (Gholami Royin-Tan & Salehi, 2018).

Figure 5

Quality of Circulation Space (Gholami Royin-Tan & Salehi, 2018).



5. Outdoor Spaces in Exceptional Education Centers

Students with autism often experience psychological stress. For them, open space can be a calming environment. Such spaces must be legible, organized, and unambiguous to be easily remembered and foster a sense of belonging. They should be simple, composed, and friendly—conveying calmness and security to promote mental relaxation. The creation of human-scaled environments, the use of natural materials, and the application of appropriate forms and colors all contribute to this goal. The school's outdoor space should enable various activities such as play, recreation, walking, sitting, conversing, observing, gathering, reading poetry, studying, exercising, taking refuge, and seeking solitude (Gholami Royin-Tan & Salehi, 2018).

Table 1

Functional Zoning

Row	Functional Zones	Key Activities	Space Users	Spatial Function
1	Administrative	Management, deputy offices, public relations, administrative units	Board of directors, staff, agency representatives, parents	Administrative
2	Public	Entrance, lobby, library, cafeteria	General public	Initial interaction with the complex
3	Educational	Classrooms and educational workshops	Children with autism	Educational and rehabilitative
4	Rehabilitative	Physiotherapy, vision screening, speech therapy, etc.	Children with autism	Educational and rehabilitative
5	Recreational	Playroom, toy yard, amphitheater	Children with autism	Play, exploration, observation

Iranian Journal of Educational Sociology
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The administrative section includes: management office, secretary, deputies, accounting, archives and printing, counseling room, pantry, and restroom.

The public and service section includes: entrance, waiting area, lobby, cafeteria.

The educational section includes: classrooms, educational workshops, group learning spaces, quiet rooms, wheelchair rooms, and restrooms.

The rehabilitative section includes: oxygen room, speech therapy, neurologist, general physician, receptionist, wound care and dressing room, aversion therapy, hearing screening, vision screening, massage therapy and packaging, occupational therapy, laboratory, and restrooms.

The recreational section includes: playroom, toy yard, amphitheater.

Table 2

Administrative and Managerial Zone

Row	Section Name	Sub-space	Area (m²)	Quantity
1	Administrative	Management	10	1
		Deputy Office	10	1
		Accounting	10	1
		Archiving and Printing	10	1
		Counseling and Meeting Room	20	1
		Pantry	7	1
		Secretary	6	1
		Restroom	45	4

Table 3

Public and Service Zone

Row	Section Name	Sub-space	Area (m²)	Quantity
2	Public and Services	Entrance	—	2
		Waiting Area	15	2
		Lobby	150	2
		Cafeteria	135	1
		Restroom	15	4
		Waste Collection Room	14	1
		Cleaning Equipment Storage	14	1
		Laundry Room	20	1
		Ironing Room	20	1

Table 4

Educational Zone

Row	Section Name	Sub-space	Area (m²)	Quantity
3	Educational	Classrooms	55	8
		Group Learning Space	60	1
		Quiet Room	6	12
		Wheelchair Room	9	1
		Teachers' Office	9	1
		Internet Room	75	1
		Math Concepts Workshop	30	1
		Storytelling Workshop	35	1
		Music Workshop	35	1
		Cartoon Screening Workshop	30	1
		Vocational Workshop	60	1
		Restroom	20	5

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Table 5

Recreational Zone

Row	Section Name	Sub-space	Area (m²)	Quantity
4	Recreational	Toy Yard	140	1
		Courtyard	50	—
		Indoor Play Space	40	—
		Toy Storage Room	20	1
		Amphitheater	675	1
		Amphitheater Waiting Hall	96	1
		Makeup Room	14	2
		Wardrobe Room	17	2
		Restroom	18	2

Table 6

Rehabilitation Zone

Row	Section Name	Sub-space	Area (m²)	Quantity
5	Rehabilitation	Speech Therapy	51	2
		Oxygen Room	20	1
		Neurologist Office	20	1
		General Physician	20	1
		Wound Care and Dressing	21	1
		Aversion Therapy	22	1
		Hearing Screening	22	1
		Vision Screening	19	1
		Occupational Therapy	30	1
		Laboratory	30	1
		Equipment Room	22	1
		Massage Therapy and Packaging	55	2
		Restroom	28	5
		Physiotherapy Hall	120	2

6. Concept Introduction and Design Idea

In this section, after analyzing the factors that influence the enhancement of social interaction in children with Autism Spectrum Disorder and assembling the core design features, we proceed to the formation process of the final design. A composite geometric method, or legal methodology, was employed in the design of the proposed complex. As a result, creativity was implemented while fully adhering to architectural principles. By integrating various elements and considering environmental constraints as well as trial-and-error results, the final layout was achieved. The achievement of two central courtyards, which interconnect the different spaces of the building, has been one of the defining elements of the design.

Figure 6

Design Concepts

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Table 7

General Overview of the Design

Strategy	Concept
Designing collective spaces to increase children's interaction	Enhancing social interactions
Allocating retreat areas in each section for the child's rest and stress relief	Designing retreat spaces
Dividing each section into smaller zones	Spatial flexibility
Making each section easily recognizable through signs and furniture	Spatial predictability
Designing outdoor seating and play areas in the courtyard for entertainment and enhanced interaction	Outdoor space design integrated with interior environment
Designing the building around a central courtyard	Climate responsiveness and child supervision
Designing ramps at entrances and planning the building as a single story	Minimizing floor levels and facilitating mobility for children with movement difficulties

Table 8

Perspective of the Complex

Strategy	Concept
Using bright colors in educational spaces	Enhancing focus
Designing quiet rooms for times of high environmental stimuli when children need tranquility	Creating a sense of calm
Using appropriate materials and soothing details	Simplicity in floor plan design
Incorporating multiple windows and ceiling openings (natural light improves ability, concentration, and physical health in children with autism)	Utilizing daylight and natural lighting
Designing low ceilings and appropriate acoustics for children	Reducing echo and improving auditory comfort
Using curved surfaces to convey a sense of calm and safety	Creating a safe environment for children
Designing therapeutic, educational, and recreational spaces	Providing spaces that enhance empowerment and concentration
Avoiding the design of narrow, dark, and depressing spaces, as such environments increase stress	Reducing stress

Design considerations include spaces such as occupational therapy, play therapy, speech therapy, and physiotherapy. Bright colors should be used in spatial coloring to visually stimulate underactive vision. Quiet rooms are to be provided for times when environmental stimuli are overwhelming and a silent space is required. The building is designed as a single-story structure for ease of access and movement for children (some of whom may have mobility issues).

7. Conclusion

Since autism spectrum disorder significantly impacts social relationships, and although families of children with autism strive to raise their children in the best way for community participation—which often involves them undergoing therapeutic interventions—there are still psychological, emotional, and social stressors they face. This project was designed with the aim of alleviating these challenges. Taking into account the specific needs associated with autism, and considering spatial organization, preservation of privacy, flexibility, and spatial predictability, this complex has been designed to address these concerns.

Iranian Journal of Educational Sociology
E-ISSN: 2645-3460

Figure 7

Ground Floor Plan

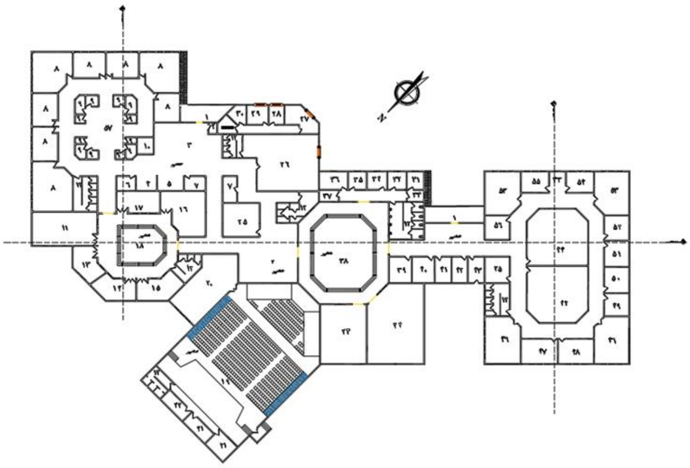

Figure 8

Sample Interior and Exterior Renderings of the Design

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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