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Optimizing Sensory Loads Using a Sensory Processing Skills Therapy among Autistic Spectrum Disorder

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Abstract**Introduction**

Sensory integration therapy can improve language skills, attention, and social interactions in children with ASD. However, it is also important to note that research in this field is ongoing and more studies are needed to confirm the effectiveness of these therapies. The present study is aimed to identify the effects of occupational therapy-based sensory processing skill therapies in improving the autism severity and QoL among ASD children.

Methodology

The intervention was performed for 12-weeks, 6 sessions per week, each session based on 60 minutes of duration. The treatment protocol comprised four sensory processing skills in which Each child was trained on every skill for 15 minutes, making a total of 60 minutes of duration for a single session.

Results

Significant improvements in CARS, CGAS and PedsQL ($p < 0.001$) were observed after 12-weeks of intervention.

Conclusion

Sensory processing skills therapies are a practical treatment approach in optimizing sensory load among ASD children.

Keywords

Art therapies, Autism, Quality of life, Sensory integration

Introduction

Autism, also known as Autism Spectrum Disorder (ASD), is a neurodevelopmental disorder characterized by difficulty with social interactions, communication, and repetitive behaviors¹. Symptoms can range from mild to severe and include difficulty making eye contact, understanding social cues, difficulty with verbal and nonverbal communication, and repetitive behaviors such as rocking or flapping². There is no cure for autism, but early intervention and therapy can help individuals with autism develop the skills they need to live independently and succeed in life³. The global prevalence of autism is estimated to be around 1-2% of the population⁴. However, the prevalence can vary depending on the population and the diagnostic criteria used. Studies have also shown that autism is more common in males than females. The prevalence of autism has also been increasing in recent years. However, it is unclear if this is due to changes in diagnostic criteria or an actual increase in the number of cases⁵.

Additionally, it is essential to note that there may be under-diagnosed of autism in some countries, particularly in low- and middle-income countries, due to a lack of awareness and limited access to diagnostic services. Sensory processing skills therapies aim to help individuals with autism, particularly children, to improve their ability to process and respond to sensory information in their environment⁶. Some of the sensory processing skills therapies that are commonly used for children with autism include; Sensory-based intervention which involves exposing children to different types of sensory stimulation, such as lights, sounds, and textures, in a controlled environment to help them better process and respond to sensory information, Auditory integration therapy which involves exposing children to specific sounds, such as white noise, to help them better process and respond to auditory information, Vision therapy that aims to improve visual processing and visual-motor coordination by training the eyes and brain to work together more effectively, Tactile therapy that aims to improve tactile processing by exposing children to different textures and providing them with opportunities to engage in activities that involve touch and Vestibular therapy that aims to improve balance, coordination and spatial awareness by exposing children to different types of movement, such as spinning or swinging⁷. Multiple studies have provided evidence that sensory processing skills therapies have

been shown to positively impact the severity of symptoms in individuals with ASD. Research has shown that sensory processing skills therapies can improve social interactions, communication, and overall functioning in children with ASD⁸.

One study found that children with ASD who received sensory integration therapy had improved social interactions, communication, and overall functioning compared to those who did not receive the therapy⁹. Similarly, other studies have found that occupational therapy that included sensory integration techniques improved social interactions, communication, and overall functioning in children with ASD¹⁰. Research has also shown that auditory integration therapy can improve language skills, attention, and social interactions in children with ASD. Vestibular therapy has also been shown to improve balance and coordination and reduce hyperactivity in children with ASD¹¹. It is important to note that while sensory processing skills therapies may be beneficial for some individuals yet it is also important to note that research in this field is ongoing and more studies are needed to confirm the effectiveness of this therapies¹². The present study is aimed to identify the effects of occupational therapy-based sensory processing skill therapies in improving the autism severity evaluated by using a Childhood Autism Rating Scale (CARS) and quality of life determined by using the Children's Global Assessment Scale (CGAS) and Pediatric Quality of life inventory (PedsQL) after 12-weeks of intervention.

Methodology

A Quasi-Experimental study was designed to identify sensory processing skills therapy effects among ASD children of age 9-13 years. A total number of 25 ASD-diagnosed children were recruited, and initial records of reading were taken using a Childhood Autism Rating Scale (CARS), Children's Global Assessment Scale (CGAS) and Pediatric Quality of life inventory (PedsQL). The study was performed at Al-Shifa Occupational Therapy OPD of Karachi, Pakistan.

Intervention Strategy

The intervention was performed for 12-weeks, 6 sessions per week, each session based on 60 minutes of duration. Before recruiting participants in a clinical protocol for research, the entire protocol was made understandable to the parents or guardians of a child, and signed consent was taken in English and Urdu. In the next step, initial readings regarding ASD severity and quality of life were recorded using CARS, CGAS and PedsQL, respectively, which were kept safe for comparing post-treatment readings to determine the effectiveness of the treatment protocol. The treatment protocol comprised four sensory processing skills in which each child was trained on every skill for 15 minutes, totaling sixty minutes for a single session.

Each sensory processing skill comprised of the following strategies;

- i. **Sensory Playing Skills:** During sensory playing skills, children were encouraged to play with play dough and use swings like disk swings and platform swings.
- ii. **Drawing and Coloring:** During drawing and coloring activities, children were encouraged to perform the following:
 - **Structured drawing:** This activity provides instructions and guidelines for the individual. This activity can help with attention to detail and following a sequence, for example, sky blue, apple red, and sun yellow.
 - **Free drawing:** This activity allows individuals to express themselves freely and creatively without specific instructions. This activity can help with self-expression and emotional regulation. No guidelines child was free to draw and use the color of choice.
 - **Coloring by numbers:** This activity involves filling pre-drawn shapes with specific colors to help with attention to detail and following a sequence.
 - **Art therapy:** This activity involves working with a therapist or specialist to explore emotions and express feelings through art to help self-expression and emotional regulation.

- iii. **Fast-Moving Skills:** Fast-moving skills refer to activities that involve quick and precise movements. Children during this session were encouraged to perform speed and agility drills. Activities like ladder drills, cone drills and hurdles can be beneficial for individuals with ASD to improve their overall fast-moving skills and
- iv. **Heavy Joint Activities:** In this session, activities like large movement stretch and aerobic dance on music were performed. This session was designed to help the child improve gross motor skills, body awareness, and coordination.

Outcome Measures

The assessment was performed on the following outcome measures:

- i. **Childhood Autism Rating Scale (CARS)**

The Childhood Autism Rating Scale (CARS) is a standardized assessment tool used to evaluate the presence and severity of autism in children. The CARS assessment consists of 15 items, each rated on a 4-point scale (0-3), and it covers the following areas¹³:

- ***Impersonal interactions:*** This item assesses the child's ability to initiate and respond to social interactions and the quality of their interactions with others.
- ***Immediate response to environmental stimuli:*** This item assesses the child's ability to respond appropriately to environmental stimuli, such as sounds or movements.
- ***Relationship to people:*** This item assesses the child's ability to form relationships with others and their level of attachment to familiar people.
- ***Adaptation to change:*** This item assesses the child's ability to adapt to changes in their environment and routine.
- ***Visual response:*** This item assesses the child's visual response to objects and people.
- ***Listening response:*** This item assesses the child's listening response to speech and other sounds.
- ***Taste, smell, and touch response:*** This item assesses the child's response to different textures, tastes, and smells.

- **Emotional response:** This item assesses the child's emotional response to different situations.
- **Body use:** This item assesses the child's body use, including motor skills and coordination.
- **Object use:** This item assesses the child's use of objects, including their ability to manipulate and play with them.
- **Level of intellectual functioning:** This item assesses the child's intellectual functioning, including their ability to understand and use language.
- **General impressions:** This item assesses the overall impression the child makes on the examiner, considering the child's behavior, appearance, and affect.

The CARS assessment is not a diagnostic tool. However, it is used to rate the child's behavior, interaction, and communication skills, and the score obtained can help determine the severity of the child's autism symptoms.

ii. **Children's Global Assessment Scale (CGAS)**

The Children's Global Assessment Scale (CGAS) is a widely used assessment tool to evaluate children and adolescents overall functioning and well-being. The CGAS is a single-item scale that ranges from 1 to 100¹⁴. The CGAS assessment is based on the child's functioning in the following areas:

- **Symptomatology:** This area assesses the child's symptoms, such as anxiety, depression, or behavioral problems.
- **Role functioning:** This area assesses the child's ability to function in daily roles at school or home.
- **Social functioning:** This area assesses the child's ability to interact with others, including family members, friends, and peers.
- **Occupational functioning:** This area assesses the child's ability to participate in activities such as school or hobbies.

- **Educational functioning:** This area assesses the child's academic performance, including their grades, attendance, and engagement in the classroom.
- **Global assessment:** This area is a summary of the overall functioning of the child.

iii. **Pediatric Quality of Life Inventory (PedsQL)**

PedsQL is a widely used assessment tool to evaluate children and adolescents' overall quality of life. The tool is designed to be self-administered by the child or adolescent and can also be completed by a parent or caregiver¹⁵. The PedsQL assessment covers the following areas:

- **Physical functioning:** This area assesses the child's physical health, symptoms and treatment-related side effects, such as pain, fatigue, and mobility.
- **Emotional functioning:** This area assesses the child's emotional well-being, including their mood, self-esteem, and ability to cope with stress.
- **Social functioning:** This area assesses the child's ability to interact with others, including family members, friends, and peers.
- **School functioning:** This area assesses the child's ability to function in school, including their academic performance, attendance, and engagement in the classroom.
- **Overall Quality of Life:** This area summarizes the overall quality of life of the child, taking into account the child's functioning in the areas listed above, strengths and weaknesses, and the impact of any symptoms or problems on the child's daily life.

The PedsQL score is based on the child's self-report or parent/caregiver report, and the scores are transformed into a 0 to 100 scale, where 100 represent the best possible quality of life. The PedsQL can also be used to evaluate the effectiveness of treatments, interventions and clinical programs and track changes over time.

Inclusion Criteria¹⁶

- The child should have a formal diagnosis of ASD from a qualified professional such as a pediatrician, psychiatrist or psychologist.
- The child should have difficulty with activities of daily living (ADLs) such as dressing, eating, grooming, and toileting.
- The child should have difficulties with play and leisure activities, such as difficulty engaging in age-appropriate activities, difficulty with social play, or difficulty with fine motor skills.
- The child should have difficulties with self-regulation, such as emotional regulation or sensory processing.

Exclusion Criteria¹⁶

- Children with significant developmental and cognitive delays.
- Children with significant medical conditions that would prevent them from participating in therapy.
- Children with significant behavioral issues, such as aggression or self-injurious behaviors, were also excluded from this study.

Ethical Consideration

The study was performed per the criteria provided in Belmont report for considering the human subject for research, consent was taken from the parents/guardian of children, and complete autonomy was provided to leave the study at any time without assigning any reason. Moreover, stringent efforts were taken to fulfill the criteria of beneficence, non-maleficence and privacy of personal information of children and family. Additionally, prior to conducting the study, permission was taken from the Institutional Review Board of Al-Shifa Institute of Rehabilitation, Karachi (IRB/AS/OT/11/22).

Results

The study was performed on n=25 children aged between 9-13 years, including 10 males and 15 females. The demographic description of children included in the study is provided in Table-1.

Table-1 Demographic characteristics of children included in the study			
Variables	Number of Participants 'n'	Mean age in years 'X'	Standard Deviation 'SD'
Male	10	11.2	1.12
Female	15	12.4	1.09

The effects of sensory processing skills therapy on the severity of autism was determined based on the CARS. The recording of values at the baseline indicated the mean value of 44.8±2.3, which had been lowered to 36.32±2.24 after 12-weeks of intervention. A detailed description of the change in the mean is provided in Table-2.

Table-2 Paired t-test to determine effect of treatment on severity of ASD					
Variables	Mean ± SD Baseline	Mean ± SD At 12th Week	Mean Difference Δ	Level of Significance	CI
CARS	44.8±2.30	36.32±2.24	8.48±1.25	0.001	95%

Further, the impact of interventional strategies on children quality of life, CGAS and PedsQL inventory was used. The findings revealed that at baseline, the values at CGAS were 58.21±2.34, had been increased to 65.55±1.28 (p<0.001), and PedsQL the values at baseline were 68.26±3.26 that had significant p<0.001 improved to 75.11±2.1 after 12-weeks of intervention (Table-3).

Table-3 Paired t-test to determine effect of treatment on QoL

Variables	Mean ± SD Baseline	Mean ± SD At 12 th Week	Mean Difference Δ	Level of Significance	CI
CGAS	58.21±2.34	65.55±1.28	7.34±1.25	0.001	95%
PedsQL	68.26±3.26	75.11±2.10	6.85±1.36	0.001	95%

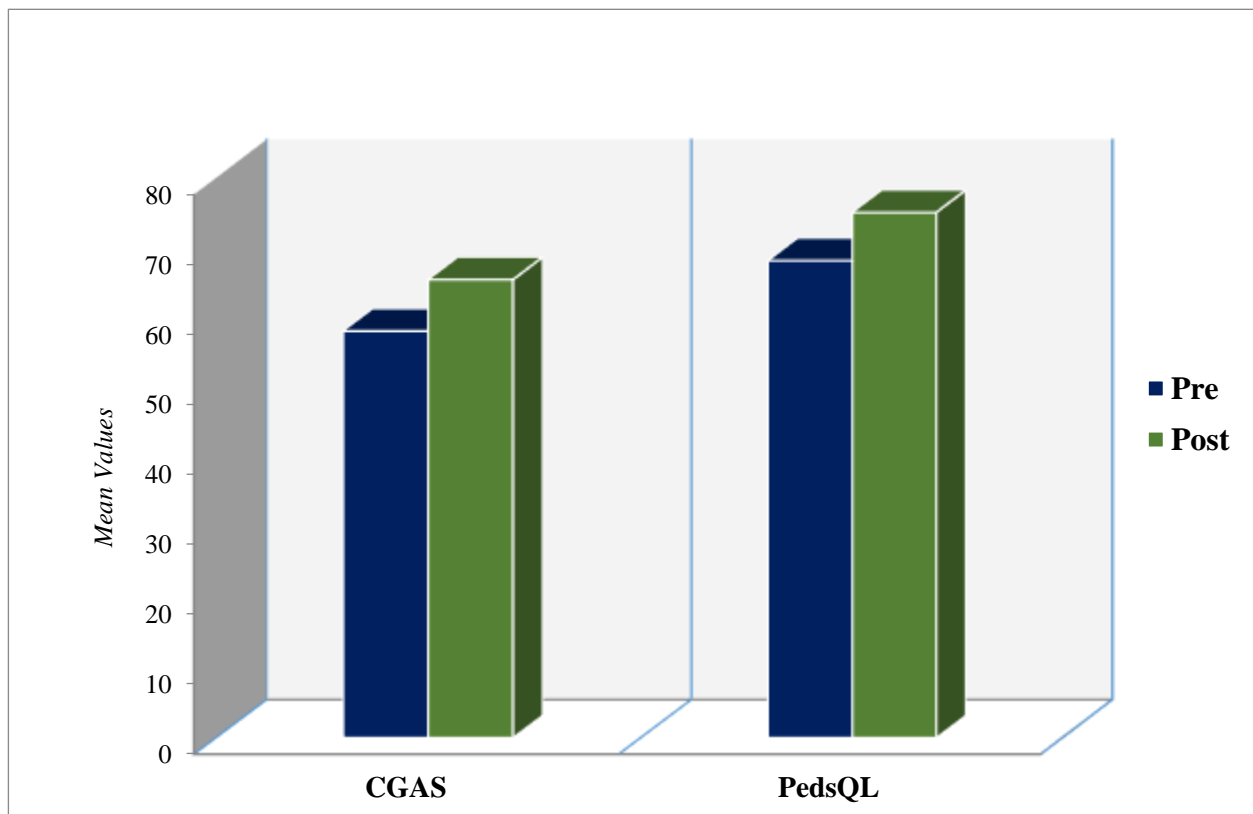


Figure-1 Response of Intervention on QoL

Discussion

The finding of our study revealed that sensory processing skill therapy had significantly reduced ($p < 0.001$). Childhood autism rating scale levels among ASD children and improved quality of life as evaluated using a CGAS and PedsQL inventory. Multiple studies have provided evidence that sensory processing skill therapies can effectively improve symptoms of ASD by addressing the difficulties individuals with autism have with processing and responding to sensory information. These therapies can include a range of interventions, such as sensory integration therapy uses play-based activities to help children improve their ability to process and respond to sensory information., sensory-motor approaches uses movement, exercise, and physical activities to help children with autism develop the skills needed to process and respond to sensory information, behavioral therapy focuses on changing behaviors related to sensory processing difficulties by teaching children new skills and strategies for dealing with sensory information. Besides that, it has also been evident that these therapies can help children with autism improve their ability to process and respond to sensory information, leading to improved behavior, communication, and social skills. As a result, it can also reduce scores on the ARS, a tool used to assess the severity of autism symptoms^{11, 17}. Literature has also suggested that these therapies can be beneficial, but they may not be suitable or practical for every child with autism, and the results may vary. It is always best to consult a qualified professional to assess the child's needs and provide an individualized plan¹⁸.

Further, our study findings were supported by various other studies in which the authors had concluded that sensory processing skills therapy could lead to improvements in areas such as communication, social interaction, and adaptive behaviors¹⁹. Moreover, it has also been emphasized by several researchers that further evidence is needed to fully understand the effects of this therapy on the quality of life of children with ASD²⁰. In a study that was conducted to identify the effects of playing and leisure on ASD children, it was concluded by the authors that playing and leisure have been found to have a calming effect on some children with ASD, as the repetitive motion and sensory input can help to regulate the child's nervous system²¹. Further, it was also evident from the literature that swings can be beneficial for children with ASD in

several ways, including 1) Improving attention and focus: The rhythmic motion of swinging can help to improve attention and focus in children with ASD 2) Reducing anxiety and agitation: Swinging can also help to reduce anxiety and agitation in children with ASD, by providing a calming and soothing sensory experience 3) Improving social interaction: Swinging with another person can help to improve social interaction and communication in children with ASD, as the activity provides a shared experience and a chance for interaction and 4) Improving balance, coordination, and vestibular system: Swings can also help to improve balance, coordination, and vestibular system²². It is important to note that swings can have different effects on children with ASD, and it may be helpful to try different swings or swing activities to find what works best for a particular child. Additionally, swings may also be helpful for children with other conditions like ADHD, Sensory Processing Disorder, and other neurological conditions²³.

Conclusion

The study has concluded that sensory processing skills therapy is a practical approach to reducing the childhood autism rating scale among ASD children and improving the quality of life. Besides that, while going through the literature, the authors also conclude that further research with a greater sample size is required for more robust evidence.

Authors Contribution

Khan NW: Conception, design and data acquisition.

Saghir U: Drafting and data acquisition.

Ali SA: Critical revision and data analysis.

Mursaleen MH: Critical revision and final approval.

Declaration of Interest

None.

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None.

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