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Social Communication of Autism Spectrum Disorders: Efficacy Study of Occupational Therapy using Sensory Integration (OT-SI) among the Mizos

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Abstract:

This study aims to examine the effectiveness of Occupational Therapy using Sensory Integration (OT-SI) on social communication in children with autism spectrum disorder (ASD) in the Mizo community. The Social Communication Questionnaire (SCQ) was used to assess the effects of the intervention on the participants via a pre-test/post-test design consisting of 35 participants (N=35) 29 males and 6 female aged 3-7. The outcomes showed a significant reduction of social communication deficits through intervention. The communication domain demonstrated the most improvement. This was followed by reduced restricted and repetitive behaviours and reciprocal social interaction. Results of the statistical analyses showed these changes to be significant and large. The finding supports Sensory Integration Theory and additionally, targeting primary sensory processing difficulties to ameliorate physiological stress can facilitate engagement, required for communication. According to the research, OT-SI is the most evidence-informed intervention for improving functional and social participation outcomes in ASD.

Introduction

Autism spectrum disorder is a highly impactful neurodevelopmental disorder in terms of its prevalence, morbidity, prognosis, and the impact it has on families and the economic burden on society (Lord et al., 2020; Lai et al., 2014). ASD is defined in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition,* as a neurodevelopmental disorder characterized by a persistent deficit in social communication and social interaction, along with other features such as restricted, repetitive patterns of behavior, interests, or activities that often persist throughout life (American Psychiatric Association, 2022).

Although initial signs and symptoms of ASD typically emerge during the early developmental period. Parents often suspect having a problem before their child reaches 1 year of age and often complain to the pediatricians by 18 months (Zwaigenbaum et al., 2005; Ozonoff et al., 2010). These atypical social and behavioral patterns may often not be identified as ASD symptoms until the child fails to meet key social, educational, occupational, or other developmental demands (Ozonoff et al., 2010; Zwaigenbaum et al., 2005).

Autism Spectrum Disorder (ASD) is a complex neuro-developmental disorder. It is characterized by the presence of persistent deficits in social communication and interaction and

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restricted, repetitive patterns of behaviour (American Psychiatric Association, 2022; Lord et al., 2020). Core deficits may manifest as deficits in social-emotional reciprocity, nonverbal communication, or in the development, maintenance, and understanding of relationships, often contributing to a diminished quality of life (American Psychiatric Association, 2022; Lord et al., 2020).

Children with ASD frequently suffer from social communication impairments with atypical sensory processing that affects their ability to respond and interpret social responses (Rabiei et al., 2024a, 2024b; Cascio et al., 2016; Zhai et al., 2023). Children with ASD commonly exhibit sensory processing problems that involve atypical responses to sensory input. The responses typically involve hypersensitivity to some stimuli and a hyposensitivity to other stimuli. This often results in a delay in adaptive social behaviours and communication skills (Baharian et al., 2023). Challenges encountered in the processing of auditory, visual or tactile stimuli can hamper the understanding of and response to social cues necessary for communication (Baum et al., 2015; Cascio et al., 2016).

As a result, sensory processing intervention is becoming crucial for supporting social communication deficits of children with autism spectrum disorder (Schaaf et al., 2018; Schoen et al., 2019). In fact, sensory processing problems are the norm, especially in proprioception, olfaction, audition, and vision for children with ASD. More than 90% of those diagnosed with the disorder face these issues which severely hamper their abilities to interpret and engage with social environments. (Ben-Sasson et al., 2009; Leekam et al., 2007; Tomchek & Dunn, 2007). As a result, children have some trouble switching their attention away from objects and toward social stimuli. This can delay the development of social orientation and interaction skills (Jones & Klin, 2013; Dawson et al., 2012). Thus, it is necessary to understand the complexity of these interactions to generate effective therapies (Fotoglou et al., 2023). In addition, research indicates a direct proportionality of sensory processing issues (especially multisensory ones) with the severity of social-communicative issues. Hence, stronger sensory foundations would improve higher social functions (Khaledi et al., 2022). Recent research further highlights that more than96% of children with ASD are reported as having such difficulties because they show hyper- and hypo-sensitive responses to sensory information, which makes it necessary to start intervention programs that work on these core issues (Ben-Sasson et al., 2009; Tomchek & Dunn, 2007).

The presentation of ASD is variable and multidimensional. This variability can significantly hinder daily participation, which require specific therapies to address the core and associated features of ASD (Lord et al., 2020; Lai et al., 2014). One emerging intervention is Occupational Therapy using Sensory Integration (OT-SI) focusing on sensory processing difficulties that often lead to impaired adaptive responses and social engagement for children with Autism Spectrum Disorder (Randell et al., 2019). OT-SI may effectively reduce social communication challenges at the core of ASD by addressing sensory processing issues (Bašić et al., 2021). Since social communication deficits characterize a core symptom of ASD, the incorporation of sensory processing strategies into OT will assist children in processing and responding to sensory stimuli in the environment (Rabiei et al. 2024a, 2024b). This method proposes that the better the sensory processing, the better the regulation of arousal, which results in an improvement in attention, engagement, and ultimately social communication (Randell et al., 2019). This study aimed to determine the effectiveness of Occupational Therapy using Sensory Integration to reduce these social communication in children with ASD in the Mizo population where there

is little research in the field. The research will provide culturally appropriate intervention by documenting the efficacy and implementation of OT-SI on ASD based on the cultural dynamics of Mizo community.

Review of Literature

The recent literature on autism has been focusing on the links between sensory processing and social communication, which are two core domains of autism spectrum disorder (ASD) (Zhai et al., 2023). This review outlines the theories, patterns, and interventions in sensory-based intervention for social communication impairment.

Autism spectrum disorder is essentially the ongoing deficits in social communication and the existence of restricted, repetitive patterns of behavior (Frye, 2018) Social communication limitations are seen as a major diagnostic criterion and a strong predictor of long-term functional outcomes (Anagnostou et al., 2014). Often they appear as difficulties in social-emotional reciprocity, nonverbal communication and in developing and maintaining relationships (Amoretti et al., 2021). According to recent epidemiological data in India, the prevalence of ASD is estimated to be approximately 1 in 89 children, although higher rates in certain age groups (1 in 125 in 2-6 years and 1 in 80 in 6-9 years) have been reported (Tiwari et al., 2021).

Neurodevelopmental and psychological theories support the link between sensory processing and social communication.

1. Ayres Sensory Integration Theory – According to this theory, the brain's ability to process and organize information coming from the senses, the body, and the environment forms the foundation for more complex functions in the behaviours and the social sphere. The engagement of vestibular, proprioceptive, and tactile systems should lead the central nervous system to the optimal state of arousal for social engagement (Ayres, 1972; Schaaf & Mailloux, 2015; Bundy et al., 2002).

2. According to the Enactive Mind Hypothesis, sensory sensitivity alters how an individual experiences the physical world. Any absence, incompleteness, or unpredictability in action in the social world may occur among children with ASD. This leads to difficulties in social communication and social cognition. The inability to pay attention to stimuli due to altered auditory processing may lead to reduced early social interaction by not jointly attending with the caregiver (De Jaegher & Di Paolo, 2007; Di Paolo et al., 2018; Colombetti, 2014).

3. Neurodevelopmental Perspective The theory implies a bottom-top approach whereby sensory processing and perception underlie social functioning. According to research, the brain's sensory and perceptual systems evaluate social and situational information to produce contextually appropriate social behaviours in response to social-emotional cues which include touch (Torres & Whyatt, 2018; Cascio et al., 2016; Mostofsky & Mahone, 2013; Tavassoli et al., 2014).

Research has found that certain sensory processing patterns are strongly correlated with social impairments (Zhai et al., 2023). Those who have autism spectrum disorder (ASD) display atypical sensory modulation, as reflected in their seeking, avoiding, and sensitivity behaviours, (Osório et al., 2021).

1. High sensitive individuals may avoid social situations, which could lead to withdrawal since social environments are often unpredictable multi-sensory environments (Boldsen, 2022).
2. Sensory stimuli have negative impacts on attention and language abilities that predict social withdrawal in ASD (Zhai et al., 2023).
3. The ability to process multiple sensory modalities at the same time i.e., hearing voice and seeing facial expressions. The deficits in multisensory temporal processing are often linked

to speech and language deficits in autism spectrum disorder (ASD), as suggested by Baum et al. (2015).

As occupational therapy using sensory integration (OT-SI) has been found to be effective in achieving sensory as well as social–behavioral goals of children 4–12 years (Schoen et al, 2019).

1. Evidence from systematic reviews of randomized control trials indicates that ASI interventions are effective for improving individually generated functional and participation goals, commonly assessed with Goal Attainment Scaling (Schaaf et al., 2018).
2. Recent findings suggest that children who undergo OT-SI experience limited improvements in their ability to take care of themselves and exhibit behaviour associated with ASD (Schoen et al., 2019).

The findings are promising, however, further study and long-term assessment is needed for a better explanation and sustainability of the social communication benefits of occupational therapy (Rhaman & Rahman, 2024).

Children with autism spectrum disorder experience social communication difficulties affected by sensory processing difficulties. The latter could be hyporesponsive or hypersensitive to sensory stimuli affecting the expression and interpretation of social cues (Alsaedi et al., 2023). The DSM-5 diagnosis for ASD includes sensory processing difficulties because they can cause adverse functional consequences such as in social communication (Raj et al., 2023). The brain's ability to appropriately process social information and contextual facts so as to produce a suitable behavior to respond to social emotional information is severely impacted in people with ASD due to the intense processing of informational matter, which hinders their adaptation to changing sensory environments (Zhai et al., 2023). Often seen in children with ASD, sensorial difficulties particularly regarding the somatosensory system, will be referred in this essay. As mentioned in a study, aberrant skin sensitivity and proprioception may underwrite the pathophysiological processes responsible for impaired social development (Cascio et al., 2016; Zhai et al., 2023). Occupational therapy with sensory integration interventions may help with these problems by addressing neurological processing of sensory information and assisting clients to adapt and manage their sensory processing (Matei et al., 2022). The authors argue that improvement in sensory functioning can lead to improvements in higher-level deficits associated with ASD, such as social interaction and engagement (Cascio et al., 2016). So this study aims to examine the efficacy of occupational therapy using sensory integration (OTSI) on social communication among children with ASD in Mizo population.

Methodology

This study aims to investigate the effects of OT-SI on three domains of the SCQ, the reciprocal social interaction domain, communication domain and the restricted and repetitive behaviour domain. The choice of methodology and material was made in light of the anticipated changes expected to be seen. Utilizing a pre-test/post-test single-group quantitative design enables us to assess changes in children. This is useful for early efficacy studies that could not access any 'larger' samples and controls. To achieve the clinical profiles necessary for meeting the research aims, participants were recruited from specialized pediatric and occupational therapy clinics. Children aged three to seven years, along with their primary caregiver, were given consent to engage in this study, exhibited a clinical diagnosis of autism spectrum disorder per DSM-5 criteria. The SCQ (Social Communication Questionnaire) is a screening measure that consists 40 items which are caregiver-report. It has two variants of Lifetime and Current Form. Lifetime form assists in identifying autism spectrum. It is sensitive to difficulties with social interaction, communication, and a restricted or repetitive behaviours. Meanwhile, Current Form helps collect information about more recent changes and those which respond to intervention. SCQ items are given a score of 0 to 1 depending on the behaviour. Greater cumulative scores suggest greater difficulty related to ASD. A total score of 15 or higher indicates elevated risk

which needs further assessment. The SCQ seems appropriate mechanism to measure treatment effects as indicated by the pretest-to-post-test reductions in total and domain-specific scores interpreted as improved social communication functioning in this intervention research setting. The researchers used sensory integration principles to develop a unique intervention for each child. These children attended the therapy for 1 hour, three times a week, for 8 weeks along with the occupational therapist. There were a total of 24 sessions in 8 weeks. Occupational therapist who was trained in use of sensory integration techniques, and each session was conducted with fidelity using supervision and adherence checklists. Participants underwent pre-assessment before intervention by using the Childhood Autism Rating Scale-Second Edition (CARS-2) to confirm the diagnosis of Autism Spectrum Disorder (ASD) and Sensory Profile-2 to determine sensory processing patterns. The strict adherence to ethical protocols governing research makes the research study genuine. It was thus designed in a way that estimates the internally valid impact of the intervention and meets the needs and constraints of the target population.

Results

Table 1

Descriptive statistics table showing Mean, SD, and Cronbach's alpha of the variables under study

SCQ	Pre-Test	Pre-Test	Post-Test	Post-Test	%	α Pre	α Post
Variable	*M*	*SD*	*M*	*SD*	Change		
RSI	6.31	1.13	5.66	1.33	-10.41%	—	—
Com	7.31	1.49	5.94	1.49	-18.75%	—	—
RRB	3.71	1.02	3.11	1.02	-16.15%	—	—
Total SCQ	18.29	2.76	15.34	2.75	-16.09%	0.437	0.367

Note. N= 35, M = Mean, SD = Standard Deviation, α = Cronbach alpha, SCQ= Social Communication Questionnaire

Results presented in Table 1 revealed that the Social Communication Questionnaire scores had decreased immediately post-intervention in all domains. Of all symptoms, communication showed the greatest improvement (-18.75%), followed by restricted and repetitive behaviours (-16.15%) and reciprocal social interaction (-10.41%). There was an overall decrease of 16.09% in SCQ indicating a moderate clinical effect. The statistical properties of the data were appropriate to allow for further parametric analyses. Nonetheless, the internal consistency, measured with Cronbach's alpha, was found to be low ($\alpha < 0.5$) indicating a rather low reliability of the SCQ scale and hence the items rather not interrelated. It is not surprising that the SCQ, as a screening tool, was not developed to assess one latent construct but rather capture a wide range of autism-related behaviours. Accordingly, we believe these reliability constraints should be taken into account when interpreting changes in either aggregate or domain scores, and that findings should be considered preliminary until replicated with more psychometrically sound outcome measures.

Table 2

Mean comparison of participants' pre-test and post-test scores on the Social Communication Questionnaire (SCQ)

Variable	Pre-test	Pre-test	Post-test	Post-test	t (34)	*P*	Cohen's *d*
	M	*SD*	*M*	*SD*		*Value*	
SCQ	18.29	2.76	15.34	2.94	9.31	< .001	1.57

Note. N = 35. *M* = Mean, *SD* = Standard Deviation, $p < .001$

Table 2 shows the mean of participants' pre-test and post-test on Social Communication Questionnaire. According to a paired samples t-test comparison of Total SCQ scores from pre-

test scores (M = 18.29, SD = 2.76) to post-test scores (M = 15.34, SD = 2.94), t(34) = 9.31, p < .001. A decrease of 2.94 points represents significant improvement in social communication difficulties. With Cohen's d = 1.57, the size effect was large, showing the intervention has a practical significance.

Table 3

Mean comparison of participants' pre-test and post-test scores on Social Communication Questionnaire (SCQ) Domains

SCQ Domain	*M* (Pre)	*M* (Post)	*M* Diff.	*SD* Diff.	*t*(*df*)	*p*-value	*Cohen's d*	Effect Size
RSI	6.31	5.66	0.66	1.18	3.29 (34)	.002	0.56	Moderate
Com	7.31	5.94	1.37	1.27	6.34 (34)	< .001	1.07	Large
RRB	3.71	3.11	0.60	0.93	3.79 (34)	< .001	0.64	Moderate

Note. N = 35. *M* = Mean, *SD* = Standard Deviation, RSI = Reciprocal Social Interaction, Com = Communication, RRB = Restrictive and Repetitive Behaviors $p < .001$

Table 3 presents paired t-tests for SCQ across domains. All domains experienced some significant improvements in SCQ. Participants improved significantly in communication after the programme, t(34) = 6.34, p < .001, d = 1.07. This shows great progress in expressive and receptive communication. Significant improvement observed in reciprocal social interaction (t (34) = 3.29, p = .002, d = 0.56) and restricted repetitive behaviours (t (34) = 3.79, p < .001, d = 0.64). This indicates a greater effectiveness on communication within a broad but moderate impact on.

Table 4

Effects of treatment (pre-test vs post-test) on Social Communication Questionnaire (SCQ) Domains

Domain	*M* (Pre)	*M* (Post)	F(1,34)	*p*-value	Partial η^2	Effect Size
RSI	6.31	5.66	10.83	.002	0.242	Large
Com	7.31	5.94	40.18	< .001	0.542	Large
RRB	3.71	3.11	14.38	< .001	0.297	Large
Total SCQ	18.29	15.34	86.68	< .001	0.718	Very Large

Note. N = 35. *M* = Mean, RSI = Reciprocal Social Interaction, Com = Communication, RRB = Restrictive and Repetitive Behaviors, $p < .001$

In a case of repeated measures ANOVA, time does significantly affect each SCQ domain. The communication domain demonstrated the largest effect, F(1,34) = 40.18, $p < .001$, $\eta^2 = .542$, followed by restricted repetitive behaviours, F(1,34) = 14.38, $p < .001$, $\eta^2 = .297$, and reciprocal social interaction, F(1,34) = 10.83, p = .002, $\eta^2 = .242$. Very large effect was seen for overall SCQ score, F(1, 34) = 86.68, $p < .001$, $\eta^2 = .718$. This indicates that the treatment produced a large effect on the social communication outcomes of the children.

Discussion

According to the findings of the Occupational Therapy-Sensory Integration (OT-SI) intervention on autistic (ASD) children's social communication and behavioural outcomes as measured by the Social Communication Questionnaire (SCQ). The SCI scores on all domains:

Reciprocal Social Interaction (RSI), Communication and Restricted and Repetitive Behaviours (RRB) showed consistent decline indicating moderate clinically meaningful improvement following the intervention.

The improvements referenced above are similar to those cited recently in the literature on sensory OT for ASD. According to modern-day systematic reviews and randomised-controlled trials, Ayres Sensory Integration® (ASI) is an evidence-based intervention and there is high quality literature that demonstrates it as effective in improving the functional and social outcomes of children with autism (Acuña et al., 2025; Schaaf et al., 2018). As you can see, the largest drop is in the Communication domain (-18.75%). This corresponds with research in Hong Kong that finds a sensory integration approach results in significant improvement in social skills, communication and adaptive functioning. It supports the theory that better ability to modulate sensory inputs leads to, "more participation in the social environment" (Lyu et al., 2025).

The findings discussed here contribute to an increasing body of literature which indicates that sensory processing underpins social participation in ASD. Recent research suggests an important link between sensory processing and social functioning (Zhai et al., 2023). Thus, this helps to explain the mechanisms of change in the present study. In particular, stronger sensory processing helps to improve attention and arousal and that improves participation and social communication. In other words, the reductions in the RSI and Communication scores of this study are likely a state of improved neurological regulation and environmental engagement rather than a change in behaviour.

The reduction in RRB in our analysis is moderately aligned with emerging evidence RRB can be reduced with sensory integration interventions leading to improvements in behavioral adaptation and emotional regulation (Alamdarloo & Mradi, 2020). Repetitive actions usually occur with patterns of seeking/avoiding sensory input and irregular arousal, as can be seen from the neurodevelopmental studies (Dawson and others, 1998). A number of studies have argued that sensory based interventions promote optimal arousal levels which in turn reduces RRB (Schaaf et al, 2014; Schoen et al, 2019). The positive changes observed in this study can be best understood based on the new sensory integration theory underpinned by emerging evidence of neuroplasticity. Various new studies are now supporting the sensory integration theory about adaptive neural re-organization mediated by targeted sensory experiences in children with ASD that results in better functional outcomes (Suprunowicz et al., 2025). Specifically, the latest evidence corroborates the "Just-right challenge" sensory input principle is responsible for neural adaptation to functional improvement.

As a result of the observed pre- and post-test changes in SCQ scores, the proposed energy-neurophysiological adaptation is probably not of any near-surface behavioural gains. OT-SI produced improvements in clinical measures and daily living as evidenced by recent intervention studies.

The current findings are in line with the above. Improvements in any one domain on the SCQ are likely to be associated with participation in classroom,the better peer interaction and scoring on adaptive functioning scale would go up. Effect sizes were moderate for all domains (see Table 3). Research data demonstrates that most current sensory integration interventions are producing moderate but meaningful gain on functioning and not high level dramatic short-term changes (Schaaf et al., 2018). The values of Cronbach's alpha as reported in the present study are consistent with the SCQ having the nature of a screening tool. The binary scoring used in the majority of the screening instruments limits their internal consistency. Previous researchers have also pointed out that screening tools are deliberately designed to combine indicators that are not necessarily related to each other and that are heterogeneous in nature. Their goal is to achieve breadth rather than depth. Subsequently, this will cause a lowering of reliability coefficients. When a test is multifocal, such tests would nevertheless continue to be

clinically useful (Ellis, 2021). The effect size d (1.57) is greater than that of many intervention effects reported in many ASD intervention studies (Chow et al., 2022). The high effect size likely stems from the targeted, individualized approach adopted, which helps address specific sensory deficits, thus facilitating functional gains in everyday life. Another approach is sensory-based which addresses the core underlying deficit but in a more controlled setting and lastly the homogenizing of the sample characteristics.

Clinical Implications

OT-SI could prove to be a crucial part of multidisciplinary planning from the findings The SI might serve as a component in multidisciplinary treatment planning instead of being an "add-on" component. In light of the findings, clinicians might consider OT-SI as an initial step to alter sensory processing followed by structured interventions for specific social and behavioural goals. For instance, clinicians may first work to individualize sensory experiences to enhance arousal and attention, subsequently building in group communication and social skill training within the classroom or peer groups. Also, monitoring progress may occasionally assist the clinician with varying intervention intensity for social interaction and behavioural flexibility, which may take longer or require repeated OT-SI sessions. By utilizing these strategies, we can foster school readiness programs, classroom involvement and peer engagement. Moreover, since each child possesses a different sensory profile, this calls for the tailoring of treatment along with the family and/or caregiver and not just a diagnosis based on the child's sensory likes and dislikes only.

Limitations

This study has limitations, which the reader must take into consideration when interpreting the present findings' impact. In the first place, a relatively small sample (N = 35) was used without a control. A control group was not utilized so that changes cannot be said to be due to the intervention and may be due to maturation or other extraneous factors. The Social Communication Questionnaire is a screening tool that has limited sensitivity to post-intervention change. The yes/no response format restricts the possibility of identifying subtle changes in behavior after occupational therapy through sensory integration. Looking at the immediate post-intervention effects, the present study only. The long-term sustainability of gains following OTSI is hard to conclude. Furthermore, the present study limited to testing SCQ domains and did not report on sensory processing or functional participation, or neurocognitive measures.

Future Directions

The results of the critical appraisal indicated that experimental studies with appropriate sample sizes and strict statistical power need to be developed to carry out powerful inferential analyses. This will help prevent the methodological bias found in several studies and will further boost confidence in future results. Moreover, this will also address the constraints of lack of causal inference in quasi and true experimental design. Further studies should do clinical trials and longitudinal studies with these intervention programs.

Future studies might explore whether the gains from intervention can be maintained with longer follow-up assessments. It is also important to evaluate the transfer of benefits of these intervention programs from home to school and community. The additional future research possibilities can include the evaluation of sensory processing through a psychophysiological/behavioural assessment. Other ecological results and quality of life can also be included with research on others.

Conclusion

The present study provides some initial support for the clinical meaningfulness of OT-SI for improving social-communication and behaviour outcomes in children with autism spectrum disorder (ASD). Results showed significant improvement in all domains of SCQ with the

most marked effect in the communication domain. The importance of sensory processing in affecting social and behavioral functioning will be considered notable but arguably more important will be the development of a mechanismbased intervention having a whole person approach. To verify these findings and understand their applicability to the general population, future studies should, on the one hand, be experimentally rigorous like randomized controlled trials, have a large and heterogeneous sample size and similarly have long follow up durations. This will raise the level and quality of evidence as well as the generalizability of findings. Overall, OT-SI is a clinically relevant and evidence-consistent intervention that helps in improving the functional outcome and quality of life in children with ASD in Mizo.

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