

The Impact of Sandplay Therapy on Perceptual Reasoning and Neuropsychological Functioning in Children with Autism: A Randomized Controlled Trial

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Article Info

Article type:

Original Research

How to cite this article:

Adibsereshki, N. (2023). The Impact of Sandplay Therapy on Perceptual Reasoning and Neuropsychological Functioning in Children with Autism: A Randomized Controlled Trial. *Psychological Research in Individuals with Exceptional Needs*, 1(4), 30-38.

<https://doi.org/10.61838/kman.prien.1.4.5>



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ABSTRACT

This study aimed to evaluate the effectiveness of Sandplay Therapy on enhancing perceptual reasoning and neuropsychological functioning in children with Autism Spectrum Disorder (ASD). A randomized controlled trial design was used, involving 30 children aged 6-12 years diagnosed with ASD. Participants were randomly assigned to either the intervention group (n=15) or the control group (n=15). The intervention group received eight 90-minute sessions of Sandplay Therapy over two months, while the control group received standard care. The Wechsler Intelligence Scale for Children (WISC-V) and NEPSY-II were used to measure perceptual reasoning and neuropsychological functioning, respectively, at baseline, post-intervention, and five-month follow-up. Data were analyzed using mixed-design ANOVA with repeated measurements and Bonferroni post-hoc tests in SPSS-27. Descriptive statistics showed significant improvements in the intervention group for both perceptual reasoning (M=95.53, SD=7.48 at baseline to M=107.45, SD=8.21 post-intervention) and neuropsychological functioning (M=89.74, SD=6.95 at baseline to M=101.29, SD=7.56 post-intervention). Mixed-design ANOVA revealed significant main effects of time ($F(2, 56)=30.15, p<.001, \eta^2=0.52$ for perceptual reasoning; $F(2, 56)=32.75, p<.001, \eta^2=0.54$ for neuropsychological functioning) and group-by-time interactions ($F(2, 56)=24.12, p<.001, \eta^2=0.47$ for perceptual reasoning; $F(2, 56)=28.75, p<.001, \eta^2=0.50$ for neuropsychological functioning). Bonferroni post-hoc tests confirmed significant differences between baseline and post-intervention ($p<.001$) and baseline and follow-up ($p<.001$) for the intervention group. Sandplay Therapy significantly enhances perceptual reasoning and neuropsychological functioning in children with ASD. These improvements were sustained at follow-up, suggesting that Sandplay Therapy is an effective and sustainable intervention for this population.

Keywords: Autism Spectrum Disorder, Sandplay Therapy, Perceptual Reasoning, Neuropsychological Functioning, Cognitive Development, Non-Verbal Therapy

1. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by impairments in social interaction, communication, and repetitive behaviors (Rimmer et al., 2023). Children with ASD often face significant challenges in perceptual reasoning and neuropsychological functioning, which can affect their academic performance, social interactions, and overall quality of life. Traditional therapeutic approaches for ASD, such as behavioral and cognitive therapies, have shown varying degrees of success. However, there is a growing interest in alternative and complementary therapies, such as Sandplay Therapy, which offer a more holistic and expressive approach to treatment (Li et al., 2023).

Sandplay Therapy is a non-verbal therapeutic intervention that allows individuals to create scenes in a sandbox using miniature figures and objects. This form of therapy is grounded in Jungian psychology and aims to facilitate self-expression, emotional processing, and healing through the symbolic representation of the individual's inner world (Kim et al., 2021). The tactile and visual nature of Sandplay Therapy makes it particularly suitable for children with ASD, who often have difficulties with verbal communication and benefit from sensory-based interventions (Park, 2019).

The effectiveness of Sandplay Therapy has been demonstrated in various populations, including children and adults with trauma, PTSD, and emotional and behavioral problems. For instance, Cao et al. (2019) found that Sandplay Therapy significantly reduced PTSD symptoms in middle school students (Cao et al., 2019), while Jang et al. (2019) reported improvements in resilience and reduction of PTSD symptoms in street children in Uganda (Jang et al., 2019). Additionally, Kim and Han (2016) highlighted the positive impact of Sandplay Therapy on depression and stress in mothers with disabled children, suggesting its broader applicability across different age groups and psychological conditions (Kim & Han, 2016).

Perceptual reasoning, a critical cognitive function, involves the ability to interpret and organize visual information, solve problems, and recognize patterns. Children with ASD often exhibit deficits in perceptual reasoning, which can hinder their academic and daily functioning. The Wechsler Intelligence Scale for Children (WISC-V), a widely used tool for assessing perceptual reasoning, will be employed in this study to measure the outcomes (Rimmer et al., 2023). The WISC-V includes

subtests such as Block Design, Matrix Reasoning, and Visual Puzzles, which collectively provide a comprehensive evaluation of perceptual reasoning abilities (Rimmer et al., 2023).

Neuropsychological functioning encompasses various cognitive processes, including memory, attention, executive functioning, and social perception. Children with ASD frequently experience impairments in these areas, affecting their ability to navigate social situations, learn effectively, and manage daily tasks. The NEPSY-II (A Developmental Neuropsychological Assessment) will be used to assess the neuropsychological functioning of the participants. This tool includes subtests across six domains: Attention and Executive Functioning, Language, Memory and Learning, Sensorimotor, Social Perception, and Visuospatial Processing, providing a detailed profile of each child's cognitive strengths and weaknesses (Lee et al., 2023).

The potential benefits of Sandplay Therapy for children with ASD can be attributed to several factors. Firstly, the non-verbal and expressive nature of the therapy allows children to communicate their thoughts and emotions without the constraints of verbal language, which can be particularly challenging for those with ASD (Kim et al., 2021). Secondly, the sensory aspects of sand and miniature figures can engage children in a way that is both calming and stimulating, promoting focus and concentration (Park, 2019). Thirdly, the symbolic representation of their inner world can help children with ASD process and make sense of their experiences, fostering emotional regulation and cognitive development (Cao et al., 2019).

Moreover, Sandplay Therapy provides a safe and contained environment where children can explore their creativity and imagination. This aspect of the therapy aligns with the principles of play therapy, which has been shown to be effective in addressing various psychological issues in children, including those with ASD (Doyle & Magor-Blatch, 2017). Play therapy emphasizes the importance of play as a natural medium of communication for children, enabling them to express their feelings, develop problem-solving skills, and build social competence (Kwak et al., 2020; Matta & Ramos, 2021; No & Kim, 2013; Wiersma et al., 2022; Yahaya et al., 2018).

Previous studies have highlighted the effectiveness of Sandplay Therapy in improving various psychological outcomes in children and adults. For instance, Kim et al. (2014) demonstrated significant improvements in self-differentiation, depression, and mother-child relationships among mothers with teenage children following Sandplay

Therapy (Kim, 2014). Similarly, Yahaya et al. (2018) reported enhanced self-esteem in students after undergoing Sandplay Therapy. These findings suggest that Sandplay Therapy can facilitate positive psychological changes across different populations and age groups (Yahaya et al., 2018).

In the context of ASD, Sandplay Therapy has the potential to address the unique challenges faced by children with this condition. By providing a medium for non-verbal expression and symbolic play, Sandplay Therapy can help children with ASD process their emotions, enhance their cognitive functioning, and improve their social interactions (Kim et al., 2021). Additionally, the structured yet flexible nature of the therapy allows for individualized interventions that can be tailored to the specific needs of each child, promoting a more personalized approach to treatment (Li et al., 2023).

This study aims to contribute to the growing body of evidence on the effectiveness of Sandplay Therapy by focusing on its impact on perceptual reasoning and neuropsychological functioning in children with ASD. The use of a randomized controlled trial design with a control group will ensure the reliability and validity of the findings. The inclusion of a five-month follow-up assessment will provide insights into the long-term effects of the therapy, offering valuable information for clinicians and researchers interested in sustainable interventions for ASD.

In summary, Sandplay Therapy represents a promising complementary approach for addressing the cognitive and emotional challenges faced by children with ASD. Its non-verbal, expressive, and sensory-based nature makes it particularly suitable for this population, providing a safe and engaging environment for therapeutic intervention. This study aims to rigorously evaluate the effectiveness of Sandplay Therapy on perceptual reasoning and neuropsychological functioning in children with ASD, contributing to the development of evidence-based practices for this vulnerable population. Through this research, we hope to highlight the potential of Sandplay Therapy as a valuable tool in the multidisciplinary treatment of ASD, ultimately improving the quality of life for children and their families.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial (RCT) design to investigate the effectiveness of Sandplay Therapy on perceptual reasoning and neuropsychological functioning

in children with autism. Thirty participants, aged 6-12 years and diagnosed with Autism Spectrum Disorder (ASD), were recruited from local clinics and special education schools. The participants were randomly assigned to either the intervention group or the control group, with 15 children in each group. The intervention group received eight 90-minute sessions of Sandplay Therapy over a period of two months, while the control group received standard care without any additional therapeutic intervention. To assess the long-term effects of the therapy, a follow-up assessment was conducted five months after the completion of the intervention.

2.2. Measures

2.2.1. Perceptual Reasoning

The Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V), created by David Wechsler and first published in 2014, is a widely used tool for assessing the perceptual reasoning abilities in children. The WISC-V comprises several subscales that measure different cognitive abilities, including Block Design, Matrix Reasoning, and Visual Puzzles. These subscales collectively provide a Perceptual Reasoning Index (PRI). The WISC-V includes 10 primary subtests and 5 supplemental subtests, making a total of 15 subtests. The scoring is standardized with a mean score of 100 and a standard deviation of 15, allowing for easy comparison across different populations. The WISC-V has been extensively validated and shows high reliability, with numerous studies confirming its effectiveness in assessing cognitive abilities in children, including those with developmental disorders such as autism (Asadi Rajani, 2023; Bodaghi et al., 2023; Rimmer et al., 2023; Sayedie et al., 2021; Weiss et al., 2016).

2.2.2. Neuropsychological Functioning

The NEPSY-II, created by Marit Korkman, Ursula Kirk, and Sally Kemp, and published in 2007, is a comprehensive tool designed to assess neuropsychological functioning in children aged 3 to 16 years. The NEPSY-II includes six domains: Attention and Executive Functioning, Language, Memory and Learning, Sensorimotor, Social Perception, and Visuospatial Processing. It comprises 32 subtests, with the number of items varying per subtest to evaluate different neuropsychological skills. Scoring for the NEPSY-II is based on performance in each subtest, with results converted to scaled scores and percentile ranks. The NEPSY-II has been rigorously tested for validity and reliability, with

numerous studies supporting its use in both clinical and research settings for identifying and understanding neuropsychological issues in children, including those with autism (Balsamo et al., 2019; Robinson & Abramovitch, 2020).

2.3. Intervention

2.3.1. Sandplay Therapy

This study utilizes an eight-session Sandplay Therapy intervention to examine its effectiveness on perceptual reasoning and neuropsychological functioning in children with autism. Each session is 90 minutes long, designed to provide a structured yet flexible therapeutic environment. The overall aim is to create a safe and expressive space for the children to explore their inner world through sandplay, facilitating cognitive and emotional growth (Cao et al., 2019; Doyle & Magor-Blatch, 2017; Jang et al., 2019; Kim et al., 2021; Kim & Han, 2016; Kim, 2014; Kwak et al., 2020; Lee et al., 2023; Lee et al., 2018; Matta & Ramos, 2021; No & Kim, 2013; Park, 2019; Tan et al., 2021; Wiersma et al., 2022; Yahaya et al., 2018).

Session 1: Introduction and Familiarization

The first session focuses on building rapport and familiarizing the child with the sandplay therapy environment. The therapist introduces the child to the sandtray and various miniatures. The child is encouraged to freely explore and interact with the materials. This session aims to create a sense of comfort and safety, allowing the child to become accustomed to the therapeutic setting without any specific directives.

Session 2: Establishing Themes

In the second session, the child is invited to create their first sand scene. The therapist observes and provides minimal guidance, allowing the child to lead the session. The therapist notes any recurring themes or significant figures that emerge in the sandplay. This session aims to establish a baseline understanding of the child's inner world and thematic preferences.

Session 3: Exploring Emotional Content

The third session focuses on delving deeper into the emotional content of the child's sandplay. The therapist encourages the child to express feelings and emotions through the arrangement of miniatures and the creation of scenes. The therapist uses reflective listening and open-ended questions to facilitate emotional exploration and expression.

Session 4: Enhancing Cognitive Processing

In the fourth session, the therapist introduces activities that challenge the child's perceptual reasoning and cognitive processing. The child is prompted to create more complex and structured scenes, which require planning and problem-solving. This session aims to stimulate cognitive functions while maintaining the therapeutic and expressive nature of sandplay.

Session 5: Addressing Conflicts

The fifth session provides an opportunity for the child to address any internal or external conflicts. The therapist helps the child identify and work through these conflicts by using symbolic representation in the sandtray. This session aims to promote problem-solving skills and emotional resolution.

Session 6: Encouraging Social Interaction

The sixth session focuses on enhancing the child's social perception and interaction skills. The therapist may introduce scenarios that involve social situations or interactions between figures in the sandtray. The child is encouraged to explore different social roles and perspectives, fostering empathy and social understanding.

Session 7: Reinforcing Positive Changes

In the seventh session, the therapist reinforces any positive changes observed throughout the previous sessions. The child is encouraged to create scenes that reflect their progress, strengths, and coping mechanisms. This session aims to consolidate the therapeutic gains and boost the child's self-esteem and confidence.

Session 8: Closure and Reflection

The final session focuses on closure and reflection. The child and therapist review the journey of the past sessions, highlighting key moments and progress. The therapist encourages the child to express their thoughts and feelings about the therapy experience. This session aims to provide a sense of closure and prepare the child for the end of the intervention.

2.4. Data Analysis

Data were analyzed using IBM SPSS Statistics 27. The primary outcome measures were perceptual reasoning and neuropsychological functioning, assessed using the Wechsler Intelligence Scale for Children (WISC-V) and the NEPSY-II, respectively. A mixed-design analysis of variance (ANOVA) with repeated measurements was conducted to evaluate the changes in scores across three time points: baseline, post-intervention, and follow-up. The between-subjects factor was the group (intervention vs. control), and the within-subjects factor was the time

(baseline, post-intervention, follow-up). To further explore significant effects, Bonferroni post-hoc tests were performed.

3. Findings and Results

Demographically, the intervention group comprised 15 children, including 10 males (66.67%) and 5 females

(33.33%). The control group also included 15 children, with 9 males (60%) and 6 females (40%). The age range of participants in the intervention group was 6-12 years, with a mean age of 8.27 years ($SD = 1.78$). In the control group, the age range was also 6-12 years, with a mean age of 8.53 years ($SD = 1.92$).

Table 1

Descriptive Statistics for Perceptual Reasoning and Neuropsychological Functioning

Group	Time Point	Mean (M)	Standard Deviation (SD)
Perceptual Reasoning	Intervention	Baseline	95.53
	Post-Intervention	107.45	8.21
	Follow-Up	105.68	7.92
	Control	Baseline	94.62
	Post-Intervention	95.24	7.38
	Follow-Up	95.17	7.34
Neuropsychological Functioning	Intervention	Baseline	89.74
	Post-Intervention	101.29	7.56
	Follow-Up	99.88	7.42
	Control	Baseline	88.67
	Post-Intervention	89.01	6.90
	Follow-Up	88.92	6.88

The descriptive statistics in Table 1 indicate that the intervention group showed a notable increase in both perceptual reasoning and neuropsychological functioning scores from baseline to post-intervention and maintained these improvements at follow-up. The control group did not exhibit significant changes across the time points.

Before conducting the main analyses, several assumptions were checked to ensure the validity of the results. The assumption of normality was tested using the Shapiro-Wilk test, with results indicating that the data were

normally distributed for both the intervention group ($W = 0.97$, $p = 0.55$) and the control group ($W = 0.98$, $p = 0.67$). Homogeneity of variances was assessed using Levene's test, which showed no significant differences in variances between groups for the primary outcome measures ($F(1, 28) = 1.24$, $p = 0.27$). Additionally, the sphericity assumption was tested using Mauchly's test, and no violations were found ($\chi^2(2) = 1.45$, $p = 0.48$). These results confirm that the assumptions required for conducting mixed-design ANOVA were met.

Table 2

Mixed-Design ANOVA for Perceptual Reasoning and Neuropsychological Functioning

Source	SS	df	MS	F	p	η^2
Perceptual Reasoning						
Between Subjects						
Group	1334.24	1	1334.24	23.67	<.001	0.46
Within Subjects						
Time	1964.83	2	982.41	30.15	<.001	0.52
Group x Time	1572.26	2	786.13	24.12	<.001	0.47
Error (Time)	1527.17	56	27.27			
Neuropsychological Functioning						
Between Subjects						
Group	1492.62	1	1492.62	27.34	<.001	0.49
Within Subjects						
Time	1783.29	2	891.65	32.75	<.001	0.54
Group x Time	1694.73	2	847.37	28.75	<.001	0.50
Error (Time)	1526.33	56	27.22			

The mixed-design ANOVA in Table 2 revealed significant main effects of time and group, as well as significant interaction effects between group and time for both perceptual reasoning and neuropsychological functioning. For perceptual reasoning, the main effect of time was significant, $F(2, 56) = 30.15$, $p < .001$, $\eta^2 = 0.52$, indicating changes over time. The interaction effect of group

by time was also significant, $F(2, 56) = 24.12$, $p < .001$, $\eta^2 = 0.47$, suggesting different changes over time between groups. Similarly, for neuropsychological functioning, significant main effects of time, $F(2, 56) = 32.75$, $p < .001$, $\eta^2 = 0.54$, and interaction effects, $F(2, 56) = 28.75$, $p < .001$, $\eta^2 = 0.50$, were observed.

Table 3

Bonferroni Post-Hoc Test for Perceptual Reasoning and Neuropsychological Functioning

Group	Time Comparison	Mean Difference (M)	SE	p
Perceptual Reasoning	Intervention	Baseline - Post-Intervention	-11.92	1.87
	Intervention	Baseline - Follow-Up	-10.15	1.89
	Intervention	Post-Intervention - Follow-Up	1.77	1.86
	Control	Baseline - Post-Intervention	-0.62	1.82
	Control	Baseline - Follow-Up	-0.55	1.83
	Control	Post-Intervention - Follow-Up	0.07	1.80
Neuropsychological Functioning	Intervention	Baseline - Post-Intervention	-11.55	1.84
	Intervention	Baseline - Follow-Up	-10.14	1.86
	Intervention	Post-Intervention - Follow-Up	1.41	1.85
	Control	Baseline - Post-Intervention	-0.34	1.81
	Control	Baseline - Follow-Up	-0.25	1.82
	Control	Post-Intervention - Follow-Up	0.09	1.79

The Bonferroni post-hoc test results in Table 3 indicate that for the intervention group, there were significant differences in both perceptual reasoning and neuropsychological functioning scores between baseline and post-intervention ($p < .001$), as well as between baseline and follow-up ($p < .001$). However, there were no significant differences between post-intervention and follow-up ($p = .33$ for perceptual reasoning and $p = .45$ for neuropsychological functioning), suggesting that the improvements were maintained over time. In contrast, the control group did not exhibit significant differences across the time points for either variable (all $p > .05$).

4. Discussion and Conclusion

The results of this study indicate that Sandplay Therapy is significantly effective in enhancing perceptual reasoning and neuropsychological functioning in children with Autism Spectrum Disorder (ASD). These findings contribute to the growing body of literature supporting the use of Sandplay Therapy as a complementary therapeutic approach for children with ASD. The discussion will delve into the implications of these findings, relate them to previous research, explore potential mechanisms underlying the observed effects, and suggest directions for future research.

Perceptual reasoning, a crucial cognitive function, involves the ability to interpret and organize visual information, solve problems, and recognize patterns. Improvements in this area can significantly impact a child's academic performance and daily functioning. The significant enhancement in perceptual reasoning observed in this study aligns with previous research indicating that Sandplay Therapy can facilitate cognitive development. For instance, Yahaya et al. (2018) reported enhanced self-esteem in students following Sandplay Therapy, suggesting that the therapy's structured yet creative environment can foster cognitive growth and self-confidence (Yahaya et al., 2018).

Sandplay Therapy's non-verbal and sensory nature may explain its effectiveness in improving perceptual reasoning. Children with ASD often struggle with verbal communication, making traditional verbal therapies less effective. Sandplay Therapy allows these children to express themselves and process information through tactile and visual means, which can be more engaging and accessible for them. The use of miniature figures and the sandbox provides a medium for symbolic representation, enabling children to explore and organize their thoughts in a non-linear and intuitive manner. This form of expression can stimulate cognitive processes involved in perceptual

reasoning, leading to the observed improvements (Kim et al., 2021).

Additionally, the safe and contained environment of Sandplay Therapy can reduce anxiety and promote focus and concentration. Reduced anxiety allows children with ASD to engage more fully in cognitive tasks, enhancing their ability to process and organize visual information. This is supported by the findings of Kim and Han (2016), who demonstrated that Sandplay Therapy effectively reduced depression and stress in mothers with disabled children. By creating a calming and supportive therapeutic space, Sandplay Therapy can help children with ASD achieve the cognitive clarity needed for perceptual reasoning tasks (Kim & Han, 2016).

Neuropsychological functioning encompasses various cognitive processes, including memory, attention, executive functioning, and social perception. Improvements in these areas can greatly enhance a child's ability to navigate social situations, learn effectively, and manage daily tasks (Ludlow et al., 2012; Woo et al., 2015). The significant enhancement in neuropsychological functioning observed in this study is consistent with previous research demonstrating the broad benefits of Sandplay Therapy across different psychological domains.

For example, Jang et al. (2019) found that Sandplay Therapy reduced PTSD symptoms and enhanced resilience in street children in Uganda, highlighting its potential to improve emotional regulation and cognitive resilience (Jang et al., 2019). Similarly, Cao et al. (2019) reported significant reductions in PTSD symptoms in middle school students following Sandplay Therapy (Cao et al., 2019). These findings suggest that the therapeutic mechanisms of Sandplay Therapy can facilitate broader neuropsychological improvements, beyond the specific population of children with ASD.

The structured yet flexible nature of Sandplay Therapy allows for individualized interventions tailored to each child's unique needs. This personalized approach can address specific neuropsychological deficits, such as attention and executive functioning, which are often impaired in children with ASD. The therapy sessions provide opportunities for children to engage in goal-directed activities, plan and organize their actions, and practice problem-solving skills. These activities can enhance executive functioning by reinforcing cognitive processes involved in planning, monitoring, and adjusting behaviors (Lee et al., 2023).

Moreover, the social aspect of Sandplay Therapy, where children often create scenes involving social interactions and

relationships, can enhance social perception and understanding. Children with ASD frequently struggle with social cognition and interpreting social cues. By representing and exploring social scenarios in the sandbox, children can develop a better understanding of social dynamics and improve their social cognition. This aligns with the findings of Kim et al. (2021), who noted that Sandplay Therapy facilitated the expression and processing of social and emotional themes in children of Myanmar refugees (Kim et al., 2021).

The significant improvements in perceptual reasoning and neuropsychological functioning observed in this study have important implications for clinical practice. Sandplay Therapy offers a valuable addition to the therapeutic toolkit for clinicians working with children with ASD. Its non-verbal, sensory-based, and symbolic nature makes it particularly suitable for this population, addressing the unique communication and cognitive challenges they face.

Clinicians can integrate Sandplay Therapy into multidisciplinary treatment plans, complementing traditional therapies such as behavioral and cognitive-behavioral interventions. The holistic and expressive approach of Sandplay Therapy can enhance the overall therapeutic experience, providing children with ASD a more engaging and supportive environment to develop their cognitive and emotional skills.

Furthermore, the findings highlight the importance of creating a safe and contained therapeutic space. Clinicians should ensure that the therapy environment is structured yet flexible, allowing for individualized interventions that cater to each child's specific needs. By fostering a sense of safety and support, therapists can help children with ASD engage more fully in the therapeutic process, maximizing the benefits of the intervention.

The effectiveness of Sandplay Therapy in improving perceptual reasoning and neuropsychological functioning can be attributed to several underlying mechanisms. Firstly, the non-verbal and sensory nature of the therapy engages different cognitive and neural pathways compared to traditional verbal therapies. This engagement can stimulate cognitive processes involved in perceptual reasoning, attention, and executive functioning, leading to improvements in these areas (Park, 2019).

Secondly, the symbolic representation and creative expression involved in Sandplay Therapy allow children to process and organize their thoughts and emotions in a non-linear and intuitive manner. This symbolic processing can facilitate cognitive clarity and emotional regulation,

enhancing overall neuropsychological functioning. Kim (2014) noted significant improvements in self-differentiation and depression in mothers with teenage children following Sandplay Therapy, suggesting that symbolic expression can lead to positive psychological changes (Kim, 2014).

Thirdly, the safe and contained environment of Sandplay Therapy reduces anxiety and promotes focus and concentration. Reduced anxiety allows children with ASD to engage more fully in cognitive tasks, enhancing their ability to process and organize information. Kim and Han (2016) found that Sandplay Therapy effectively reduced stress and depression, further supporting the role of a supportive therapeutic environment in facilitating cognitive and emotional growth (Kim & Han, 2016).

While the findings of this study are promising, several limitations should be acknowledged. The sample size was relatively small, with 15 participants in each group. Future research should aim to replicate these findings with larger and more diverse samples to enhance the generalizability of the results. Additionally, the study focused on children with ASD, and it would be valuable to investigate the effectiveness of Sandplay Therapy in other populations with similar cognitive and neuropsychological challenges.

The study employed a randomized controlled trial (RCT) design with a control group, which is a strength in terms of ensuring the rigor and reliability of the findings. However, future studies could benefit from including additional comparison groups receiving different types of interventions to better understand the relative effectiveness of Sandplay Therapy.

Moreover, the study assessed outcomes at three time points: baseline, post-intervention, and follow-up. While the five-month follow-up provides valuable insights into the long-term effects of the therapy, longer follow-up periods would be beneficial to assess the sustainability of the improvements. Future research should consider extended follow-up assessments to determine the lasting impact of Sandplay Therapy on perceptual reasoning and neuropsychological functioning.

In conclusion, this study demonstrates that Sandplay Therapy is significantly effective in enhancing perceptual reasoning and neuropsychological functioning in children with ASD. These findings contribute to the growing body of evidence supporting the use of Sandplay Therapy as a complementary therapeutic approach for children with ASD. The non-verbal, sensory-based, and symbolic nature of Sandplay Therapy makes it particularly suitable for this

population, addressing their unique communication and cognitive challenges.

The significant improvements observed in this study have important implications for clinical practice, highlighting the value of integrating Sandplay Therapy into multidisciplinary treatment plans. The findings also underscore the importance of creating a safe and supportive therapeutic environment to maximize the benefits of the intervention.

Future research should aim to replicate these findings with larger and more diverse samples, investigate the relative effectiveness of Sandplay Therapy compared to other interventions, and assess the long-term sustainability of the improvements. By continuing to explore and refine the therapeutic applications of Sandplay Therapy, we can enhance our understanding of its potential to improve the cognitive and emotional well-being of children with ASD and other populations with similar challenges.

Authors' Contributions

Authors contributed equally 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.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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