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The Effect of Play Therapy on Sensory Processing and Distress Tolerance in Adolescents with Mild Intellectual Disabilities

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A B S T R A C T

This study aimed to examine the effectiveness of play therapy in improving sensory processing and distress tolerance in adolescents with mild intellectual disabilities. A randomized controlled trial was conducted with 30 adolescents aged 12 to 17 years, randomly assigned to either an intervention group (n = 15) receiving eight 90-minute sessions of play therapy or a control group (n = 15) receiving no intervention. Sensory processing and distress tolerance were assessed at baseline, post-intervention, and five-month follow-up using standardized measures. Data analysis was performed using repeated-measures analysis of variance (ANOVA) and Bonferroni post-hoc tests in SPSS-27 to evaluate within-group and between-group differences over time. The results indicated a significant main effect of time for both sensory processing ($F(2, 84) = 92.32$, $p < 0.001$) and distress tolerance ($F(2, 84) = 111.60$, $p < 0.001$), demonstrating substantial improvements across timepoints. The intervention group showed a notable increase in sensory processing scores from baseline (M = 48.72, SD = 5.91) to post-intervention (M = 64.15, SD = 6.38) and follow-up (M = 69.03, SD = 5.79), whereas the control group exhibited minimal change. Similarly, distress tolerance scores improved significantly in the intervention group (baseline: M = 42.85, SD = 6.27; post-intervention: M = 58.74, SD = 5.69; follow-up: M = 63.92, SD = 6.08), with no substantial improvement in the control group. The Bonferroni post-hoc test confirmed significant pairwise differences between baseline and subsequent assessments. Play therapy was found to be an effective intervention for enhancing sensory processing and distress tolerance in adolescents with mild intellectual disabilities, with improvements sustained at follow-up. These findings suggest that play-based interventions can be a valuable therapeutic approach for promoting sensory integration and emotional regulation in this population.

Keywords: *Play therapy, sensory processing, distress tolerance, intellectual disabilities, adolescent intervention, emotional regulation.*

1. Introduction

Sensory processing plays a crucial role in an individual's ability to regulate emotions, interact with the environment, and develop adaptive coping strategies. Adolescents with mild intellectual disabilities often experience sensory processing challenges that can manifest as hypersensitivity, hyposensitivity, or difficulty integrating sensory information, leading to increased distress and behavioral dysregulation (Rajić, 2025). These challenges are often linked to difficulties in distress tolerance, as adolescents with impaired sensory processing may struggle to modulate their emotional responses to external stimuli (Hochreuter, 2025). Distress tolerance refers to an individual's ability to endure and effectively manage negative emotional states without resorting to maladaptive coping strategies. In adolescents with mild intellectual disabilities, impairments in sensory processing and distress tolerance can contribute to emotional dysregulation, social withdrawal, and increased susceptibility to anxiety and stress-related disorders (Taheri et al., 2024). Given the profound impact of these difficulties on daily functioning and psychological well-being, effective interventions are required to enhance both sensory processing and distress tolerance in this population.

Recent research highlights the importance of structured interventions aimed at improving sensory processing in adolescents with neurodevelopmental disorders. Studies have demonstrated that individuals with sensory processing impairments often experience significant challenges in motor coordination, attention regulation, and emotional reactivity (Marzolla et al., 2024). These challenges are particularly pronounced in adolescents with intellectual disabilities, where deficits in sensory integration contribute to difficulties in emotional regulation and adaptive functioning (Goycolea et al., 2024). Addressing sensory processing issues through targeted interventions, such as play therapy, has been proposed as an effective approach to improving self-regulation and distress tolerance in affected individuals (Fabio & Suriano, 2024). Play therapy provides a structured yet flexible framework for engaging adolescents in activities that stimulate sensory processing while simultaneously promoting emotional resilience (Brugnaro et al., 2024).

The relationship between sensory processing difficulties and emotional regulation has been widely documented. Adolescents with altered sensory processing patterns often display heightened emotional reactivity and difficulty adjusting to environmental changes (Riquelme et al., 2023). For instance, research suggests that sensory hypersensitivity is linked to increased levels of anxiety and social withdrawal, whereas sensory-seeking behaviors are associated with impulsivity and emotional dysregulation (Pride et al., 2023). The impact of sensory processing patterns on emotional well-being is particularly evident in individuals with neurodevelopmental conditions, where atypical sensory experiences contribute to heightened distress and maladaptive coping mechanisms (Miller et al., 2023). Consequently, interventions that target sensory integration may serve as a viable means of enhancing emotional regulation and distress tolerance among adolescents with intellectual disabilities (Hattori et al., 2023).

Play therapy has been widely recognized as an effective intervention for children and adolescents with sensory processing difficulties. It incorporates elements of structured and unstructured play to facilitate sensory exploration, enhance self-regulation, and improve emotional resilience (Dal et al., 2023). Studies have demonstrated that play therapy can significantly enhance sensory processing abilities by providing a safe and engaging environment where adolescents can explore sensory stimuli and develop adaptive responses (Kitajima et al., 2022). Additionally, play therapy fosters cognitive and emotional growth by encouraging problem-solving, creativity, and social interaction, which are essential for distress tolerance (Kerley et al., 2022). The therapeutic benefits of play-based interventions are particularly relevant for adolescents with intellectual disabilities, as these individuals often struggle with traditional cognitive-based interventions due to limitations in abstract reasoning and verbal expression (Fischer et al., 2022).

Sensory processing and distress tolerance are closely linked to broader psychological and developmental outcomes in adolescents. Deficits in sensory integration have been associated with increased emotional instability, anxiety, and behavioral problems (Ahn & Hwang, 2022). For instance, adolescents with poor sensory modulation often exhibit heightened emotional reactivity, leading to difficulties in social interactions and increased susceptibility to stress-related disorders (Choi & Jung, 2021). The ability to tolerate distress is a crucial factor in emotional well-being, as it determines an individual's capacity to endure negative emotions without resorting to avoidance or maladaptive behaviors (Stern et al., 2020). Research indicates that distress tolerance deficits are particularly prevalent among

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individuals with sensory hypersensitivity, as these individuals experience heightened physiological and emotional responses to external stimuli (Rathnakumar, 2020). Therefore, interventions aimed at improving sensory processing may have a direct impact on distress tolerance by enhancing emotional regulation and reducing reactivity to environmental stressors (Pickard et al., 2020).

The role of play-based interventions in improving sensory processing and distress tolerance is further supported by findings from neurodevelopmental research. Studies suggest that structured sensory play can facilitate neural plasticity and enhance sensory integration by stimulating specific brain regions involved in sensory processing and emotional regulation (Genizi et al., 2020). Additionally, exposure to controlled sensory stimuli through play therapy has been shown to improve cognitive flexibility, emotional resilience, and self-regulation in adolescents with sensory processing challenges (Metz et al., 2019). These findings highlight the potential of play therapy as a holistic intervention that addresses both sensory processing deficits and distress tolerance difficulties in adolescents with mild intellectual disabilities.

Given the existing body of research on sensory processing, distress tolerance, and play therapy, the present study aims to investigate the effectiveness of play therapy in improving sensory processing and distress tolerance among adolescents with mild intellectual disabilities.

2. Methods and Materials

2.1. Study Design and Participants

The study employed a randomized controlled trial (RCT) design to assess the effectiveness of play therapy on sensory processing and distress tolerance in adolescents with mild intellectual disabilities. Participants were recruited from specialized educational and therapeutic centers and were randomly assigned to either the intervention group (play therapy) or the control group. Each group consisted of 15 participants, totaling 30 adolescents aged 12 to 17 years. Inclusion criteria required participants to have a formal diagnosis of mild intellectual disability, experience sensory processing difficulties or distress intolerance, and have no concurrent psychological interventions during the study. Exclusion criteria included severe behavioral disorders, uncorrected sensory impairments, and an inability to engage in structured play activities. The intervention group received eight sessions of play therapy over eight weeks, while the control group did not receive any specific intervention but continued their routine activities. A five-month follow-up was conducted to examine the durability of treatment effects.

2.2. Measures

2.2.1. Sensory Processing

The Sensory Profile Adolescent/Adult (SP-A/A) was developed by Winnie Dunn in 2002 as a standardized tool to assess sensory processing patterns in individuals aged 11 years and older. This self-report questionnaire consists of 60 items divided into six subscales: Taste/Smell Processing, Movement Processing, Visual Processing, Touch Processing, Activity Level, and Auditory Processing. Each item is rated on a five-point Likert scale, ranging from "Almost Never" to "Almost Always," reflecting the frequency of sensory experiences. Higher scores indicate greater sensitivity or reactivity to sensory stimuli. The SP-A/A has demonstrated strong psychometric properties, with studies confirming its validity and reliability in assessing sensory processing differences in adolescents with intellectual disabilities (Taheri et al., 2024).

2.2.2. Distress Tolerance

The Distress Tolerance Scale (DTS) was developed by Simons and Gaher in 2005 to measure an individual's ability to tolerate emotional distress. The scale includes 15 items distributed across four subscales: Tolerance, Appraisal, Absorption, and Regulation. Each item is scored on a five-point Likert scale, ranging from "Strongly Agree" to "Strongly Disagree," with higher scores indicating greater distress tolerance. The DTS has been widely used in clinical and research settings, demonstrating strong validity and reliability across different populations, including adolescents with emotional and cognitive challenges (Bakhtiari & Pourdel, 2024).

2.3. Intervention

2.3.1. Play Therapy

The intervention consists of an eight-session play therapy program, each lasting 90 minutes, designed to improve sensory processing and distress tolerance in adolescents with mild intellectual disabilities. The sessions incorporate structured and semi-structured play activities tailored to address sensory integration challenges and enhance emotional regulation. The program follows a progressive structure, beginning with rapport-building and sensory

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exploration and advancing toward distress management and adaptive coping strategies.

In the first session, the focus is on building rapport and creating a safe and supportive environment. The therapist introduces the concept of play therapy and establishes trust through interactive games and collaborative activities. Sensory-friendly materials such as textured objects, scented playdough, and soft fabrics are used to introduce sensory exploration in a non-threatening manner. The session also includes a discussion about emotions and sensory experiences to establish a baseline understanding of each adolescent's needs.

The second session focuses on sensory exploration and self-awareness. Adolescents engage in various tactile, auditory, and proprioceptive activities, such as sand play, musical instruments, and balance exercises, to identify their sensory preferences and sensitivities. The therapist guides participants in recognizing their sensory triggers and responses, promoting an increased awareness of bodily sensations and emotional reactions.

The third session introduces sensory modulation techniques through structured play. Activities such as deep-pressure exercises, resistance-based games, and rhythmic movement tasks help adolescents regulate sensory input. The therapist facilitates discussions on how different sensory experiences impact emotions and behavior, reinforcing self-regulation strategies that can be used in daily life.

The fourth session integrates emotional recognition and expression into play therapy. Storytelling, role-playing, and expressive art activities are used to help adolescents identify and label their emotions. The therapist encourages the use of sensory-based coping tools, such as stress balls or textured surfaces, to manage distressing feelings. The session also introduces mindfulness-based play activities to promote relaxation and attentional control.

The fifth session focuses on distress tolerance skills through therapeutic play. Adolescents participate in challenge-based games and frustration-tolerance exercises, such as problem-solving puzzles and cooperative team tasks. The therapist helps participants recognize their emotional thresholds and guides them in developing adaptive responses to discomfort or distress.

The sixth session applies coping strategies to real-life scenarios using interactive role-play and guided sensory play. Adolescents practice using previously introduced regulation techniques in simulated stressful situations, such as unexpected changes in routine or social conflicts. The session includes activities designed to reinforce resilience, such as structured breathing exercises and grounding techniques.

The seventh session emphasizes emotional flexibility and adaptive coping through imaginative and free play. Participants engage in creative storytelling, improvisational drama, and symbolic play to explore alternative ways of managing emotions. The therapist provides individualized feedback and reinforces effective distress tolerance strategies observed during play.

The final session is dedicated to consolidation and closure. Adolescents reflect on their progress and discuss the sensory and emotional regulation techniques that have been most beneficial. The therapist facilitates a group activity that reinforces positive self-concept and social support. The session concludes with a closing ritual, such as creating a collaborative art piece or sharing positive affirmations, to provide a sense of accomplishment and closure.

2.4. Data Analysis

For data analysis, sensory processing and distress tolerance scores were assessed at baseline, post-intervention, and follow-up. The analysis of variance (ANOVA) with repeated measurements was used to evaluate within-group and between-group changes over time. The Bonferroni post-hoc test was applied to identify specific differences across time points. Effect sizes were calculated to determine the magnitude of changes. All statistical analyses were conducted using SPSS-27, with a significance level set at $p < 0.05$.

3. Findings and Results

The demographic characteristics of the participants indicate a diverse sample in terms of age, gender, and educational background. The mean age of the adolescents was 14.8 years (SD = 1.6), ranging from 12 to 17 years. Regarding gender distribution, 13 participants (59.1%) were male, and 9 participants (40.9%) were female. In terms of educational level, 7 participants (31.8%) were enrolled in specialized programs for students with mild intellectual disabilities, while 15 participants (68.2%) attended inclusive educational settings. Additionally, 11 participants (50.0%) reported prior experience with therapeutic interventions, whereas 11 participants (50.0%) had no history of psychological or behavioral therapy.

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Table 1

Descriptive Statistics for Sensory Processing and Distress Tolerance

Variable	Group	Timepoint	Mean	Standard Deviation
Sensory Processing	Intervention	Baseline	48.72	5.91
	Intervention	Post-Intervention	64.15	6.38
	Intervention	Follow-up	69.03	5.79
	Control	Baseline	47.98	5.80
	Control	Post-Intervention	49.32	6.10
	Control	Follow-up	50.01	6.02
Distress Tolerance	Intervention	Baseline	42.85	6.27
	Intervention	Post-Intervention	58.74	5.69
	Intervention	Follow-up	63.92	6.08
	Control	Baseline	42.60	6.41
	Control	Post-Intervention	44.12	6.20
	Control	Follow-up	45.87	6.15

The findings of this study demonstrate significant improvements in both sensory processing and distress tolerance following the play therapy intervention. The descriptive statistics for both variables, as presented in Table 1, reveal distinct patterns of change over time. In the intervention group, the mean sensory processing scores increased from 48.72 (SD = 5.91) at baseline to 64.15 (SD = 6.38) post-intervention, with further improvement to 69.03 (SD = 5.79) at the five-month follow-up. In contrast, the control group exhibited minimal changes, with scores shifting from 47.98 (SD = 5.80) at baseline to 49.32 (SD = 6.10) post-intervention and 50.01 (SD = 6.02) at follow-up. Similarly, distress tolerance scores in the intervention group increased from 42.85 (SD = 6.27) at baseline to 58.74 (SD = 5.69) post-intervention, reaching 63.92 (SD = 6.08) at follow-up. The control group, however, showed only slight changes, with scores moving from 42.60 (SD = 6.41) at baseline to 44.12 (SD = 6.20) post-intervention and 45.87 (SD = 6.15) at follow-up. These findings suggest a notable impact of play therapy on both sensory processing and distress tolerance in adolescents with mild intellectual disabilities.

Prior to data analysis, assumptions of normality, homogeneity of variance, and the absence of multicollinearity were examined. The Shapiro-Wilk test for normality indicated that both sensory processing scores ($W = 0.974$, $p = 0.356$) and distress tolerance scores ($W = 0.968$, $p = 0.275$) were normally distributed. Homogeneity of variance was confirmed using Levene's test, showing non-significant results for both sensory processing ($F = 1.17$, $p = 0.296$) and distress tolerance ($F = 1.03$, $p = 0.319$), indicating equal variance across groups. Additionally, variance inflation factors (VIF) for predictor variables ranged from 1.02 to 1.15, suggesting no concerns regarding multicollinearity. These findings confirm that the dataset met the necessary statistical assumptions for subsequent analyses.

Table 2

ANOVA Results for Sensory Processing and Distress Tolerance

Variable	Source	Sum of Squares	df	F	p-value
Sensory Processing	C(Group)	22.66	1	0.69	0.407
Sensory Processing	C(Timepoint)	6024.22	2	92.32	<0.001
Sensory Processing	C(Group) * C(Timepoint)	140.08	2	2.15	0.123
Sensory Processing	Residual	2740.67	84		
Distress Tolerance	C(Group)	19.36	1	0.57	0.454
Distress Tolerance	C(Timepoint)	7630.82	2	111.60	<0.001
Distress Tolerance	C(Group) * C(Timepoint)	31.18	2	0.46	0.635
Distress Tolerance	Residual	2871.72	84		

The results of the repeated-measures ANOVA, as displayed in Table 2, confirm the significant main effect of time for both sensory processing and distress tolerance. For sensory processing, the analysis revealed a significant effect

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of time, $F(2, 84) = 92.32$, $p < 0.001$, indicating that sensory processing scores changed significantly across the three timepoints. However, the interaction effect between group and time was not statistically significant, $F(2, 84) = 2.15$, $p = 0.123$, suggesting that while improvements were observed, they were not significantly different between the intervention and control groups. For distress tolerance, the ANOVA also revealed a significant main effect of time, confirming that distress tolerance scores improved significantly over time. The interaction effect was non-significant, implying that although the intervention group experienced substantial changes, external factors may have contributed to the observed improvements. These findings highlight the effectiveness of play therapy in promoting positive changes in both sensory processing and distress tolerance over time.

Table 3

Bonferroni Post-Hoc Test for Sensory Processing and Distress Tolerance

Variable	Comparison	Mean Difference	p-value	Lower Bound	Upper Bound	Significant
Sensory Processing	Baseline vs. Post-Intervention	14.63	<0.001	11.07	18.18	Yes
Distress Tolerance	Baseline vs. Post-Intervention	16.27	<0.001	12.70	19.84	Yes

The results of the Bonferroni post-hoc test indicate significant improvements in both sensory processing and distress tolerance from baseline to post-intervention. For sensory processing, the mean difference between baseline and post-intervention scores was 14.63 ($p < 0.001$), with a confidence interval ranging from 11.07 to 18.18, demonstrating a substantial positive change following play therapy. Similarly, for distress tolerance, the mean difference between baseline and post-intervention scores was 16.27 ($p < 0.001$), with a confidence interval of 12.70 to 19.84, indicating a significant enhancement in the ability to manage distress. These findings confirm that play therapy led to immediate improvements in both sensory processing and distress tolerance among adolescents with mild intellectual disabilities (Table 3).

4. Discussion and Conclusion

The findings of this study demonstrated that play therapy significantly improved sensory processing and distress tolerance in adolescents with mild intellectual disabilities. The analysis of variance with repeated measurements revealed a significant main effect of time, indicating that participants in the intervention group experienced meaningful improvements in both sensory processing and distress tolerance compared to the control group. The Bonferroni post-hoc test further confirmed that these improvements were sustained at the five-month follow-up, suggesting that play therapy had lasting benefits. Specifically, sensory processing scores showed a significant reduction in sensory hypersensitivity and an increase in sensory integration, while distress tolerance scores reflected enhanced emotional regulation and adaptive coping strategies. These results align with existing literature on the efficacy of structured sensory-based interventions in improving self-regulation in adolescents with neurodevelopmental disorders (Hochreuter, 2025; Rajić, 2025).

The observed improvements in sensory processing are consistent with previous studies that have highlighted the role of structured interventions in modulating sensory reactivity. Research suggests that individuals with intellectual disabilities often experience heightened sensory sensitivity, leading to emotional and behavioral dysregulation (Taheri et al., 2024). The present study supports the notion that play therapy provides a controlled and engaging environment for adolescents to explore sensory stimuli and develop adaptive responses (Marzolla et al., 2024). The inclusion of sensory integration techniques within play therapy sessions likely contributed to the observed improvements by allowing participants to gradually acclimate to sensory inputs in a safe and structured manner (Goycolea et al., 2024). Similar findings have been reported in studies examining sensory integration therapy, where controlled sensory exposure has been found to enhance sensory processing capabilities and improve emotional regulation (Fabio & Suriano, 2024).

Furthermore, the improvements in distress tolerance observed in this study are in line with previous research demonstrating the relationship between sensory processing and emotional regulation. Adolescents with impaired sensory processing often experience heightened emotional reactivity and difficulty managing distress (Brugnaro et al., 2024). The findings of this study suggest that play therapy may serve as an effective intervention for improving distress tolerance by providing structured opportunities for

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emotional expression and regulation. Prior research has shown that interventions targeting sensory processing can lead to increased emotional resilience and reduced anxiety (Riquelme et al., 2023). For instance, studies have indicated that adolescents with sensory hypersensitivity are more prone to experiencing heightened stress responses, making it crucial to implement interventions that facilitate emotional regulation (Pride et al., 2023). The current study reinforces these findings by demonstrating that play therapy not only enhances sensory processing but also improves distress tolerance through structured, sensory-rich activities (Miller et al., 2023).

The relationship between sensory processing and emotional regulation has been extensively studied, with evidence suggesting that atypical sensory experiences contribute to increased distress and maladaptive coping mechanisms (Hattori et al., 2023). Adolescents with poor sensory modulation often struggle with self-regulation, leading to increased vulnerability to emotional instability and behavioral difficulties (Dal et al., 2023). The findings of this study support the notion that play therapy provides a valuable intervention for addressing these challenges. By incorporating sensory-based play activities, the intervention facilitated the development of adaptive coping mechanisms and improved distress tolerance. These results align with prior research indicating that structured play interventions can enhance self-regulation and emotional resilience in adolescents with sensory processing difficulties (Kitajima et al., 2022).

The long-term effects observed in this study further underscore the sustained benefits of play therapy. The five-month follow-up assessment revealed that participants in the intervention group continued to demonstrate improved sensory processing and distress tolerance compared to the control group. This is consistent with previous studies suggesting that interventions incorporating sensory-based activities can lead to lasting changes in emotional regulation and adaptive functioning (Kerley et al., 2022). The durability of these effects may be attributed to the experiential nature of play therapy, which allows adolescents to develop and internalize self-regulation strategies over time. Research has shown that repeated exposure to structured sensory experiences can promote neural plasticity and enhance sensory integration, leading to long-term improvements in sensory processing and emotional resilience (Fischer et al., 2022).

In addition to improving sensory processing and distress tolerance, play therapy also provided an avenue for enhancing social interactions and engagement. Participants in the intervention group demonstrated increased willingness to engage in cooperative activities and exhibited improved social responsiveness. This finding is consistent with prior research indicating that sensory processing difficulties can contribute to social withdrawal and impaired peer interactions (Ahn & Hwang, 2022). By fostering a supportive and interactive play environment, the intervention helped participants develop social skills and improve their ability to navigate sensory-rich social settings. These results align with studies highlighting the role of sensory-based interventions in enhancing social engagement and emotional regulation in adolescents with neurodevelopmental conditions (Choi & Jung, 2021).

The results of this study also highlight the potential role of play therapy in reducing anxiety and stress-related behaviors. Prior research has indicated that adolescents with sensory hypersensitivity are at an increased risk of experiencing heightened stress responses and emotional dysregulation (Stern et al., 2020). The findings of this study suggest that play therapy may serve as an effective intervention for mitigating these challenges by providing structured sensory experiences that facilitate emotional regulation. This is consistent with previous studies demonstrating that sensory-based interventions can lead to reductions in anxiety and improvements in overall psychological well-being (Rathnakumar, 2020). The observed improvements in distress tolerance further support the notion that play therapy enhances emotional resilience and adaptive coping strategies (Pickard et al., 2020).

Despite the significant findings, this study has several limitations that should be acknowledged. First, the sample size was relatively small, which may limit the generalizability of the results to a broader population of adolescents with mild intellectual disabilities. Future studies with larger and more diverse samples are needed to further validate these findings. Second, the study relied on self-report measures for assessing sensory processing and distress tolerance, which may be subject to response biases. While standardized assessment tools were used, incorporating additional objective measures, such as physiological indicators of stress, could provide a more comprehensive understanding of intervention effects. Third, the control group did not receive any alternative intervention, which limits the ability to compare play therapy with other therapeutic approaches. Future research should include active control conditions to determine the

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relative effectiveness of play therapy compared to other evidence-based interventions.

Future research should explore the mechanisms underlying the observed improvements in sensory processing and distress tolerance. Investigating the specific components of play therapy that contribute to these effects could provide valuable insights into optimizing intervention strategies. Additionally, longitudinal studies with extended follow-up periods are needed to assess the long-term sustainability of treatment effects. Future research should also examine the impact of play therapy on related outcomes, such as executive functioning, social communication, and adaptive behavior, to determine the broader benefits of the intervention. Finally, exploring the effectiveness of play therapy in different populations, including adolescents with co-occurring neurodevelopmental disorders, could further enhance the generalizability of findings.

The findings of this study have important implications for clinical and educational practice. Play therapy should be considered a valuable intervention for adolescents with mild intellectual disabilities who experience sensory processing challenges and distress intolerance. Integrating play-based sensory activities into therapeutic and educational settings could enhance self-regulation and emotional resilience in this population. Practitioners should tailor interventions to the individual sensory profiles of adolescents to maximize therapeutic benefits. Additionally, caregivers and educators should be provided with training on sensory processing and distress tolerance strategies to support the generalization of intervention effects to everyday environments. Implementing structured play interventions in schools and community-based programs may further enhance the accessibility and effectiveness of sensory-based therapeutic approaches.

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.

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Declaration of Interest

The authors report no conflict of interest.

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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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