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The Effect of Schema Therapy Combined with Neurofeedback Therapy on Cognitive Performance and Emotional Regulation in Children with ADHD

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A B S T R A C T

Purpose: This study aimed to examine the effectiveness of schema therapy combined with neurofeedback therapy on cognitive performance and emotional regulation in children with Attention-Deficit/Hyperactivity Disorder (ADHD).

Methodology: This study employed a randomized controlled trial (RCT) design with 30 children diagnosed with ADHD from psychological and neurological clinics in Tehran. Participants were randomly assigned to either the experimental group (n = 15), receiving schema therapy combined with neurofeedback therapy, or the control group (n = 15), receiving no intervention. The intervention was conducted over 12 weeks with two sessions per week, followed by a five-month follow-up period. Cognitive performance was assessed using the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV), and emotional regulation was measured using the Emotion Regulation Checklist (ERC). Data were analyzed using repeated measures ANOVA and the Bonferroni post-hoc test in SPSS-27, with significance set at $p < 0.05$.

Findings: The results indicated that the experimental group showed significant improvements in both cognitive performance ($F(2, 56) = 18.47$, $p < 0.001$) and emotional regulation ($F(2, 56) = 22.31$, $p < 0.001$) compared to the control group. Post-hoc analyses revealed that the experimental group's cognitive and emotional scores significantly increased from baseline to post-test ($p < 0.001$) and remained significantly higher at follow-up ($p < 0.001$), while no significant changes were observed in the control group.

Conclusion: The findings suggest that schema therapy combined with neurofeedback therapy is an effective intervention for improving cognitive performance and emotional regulation in children with ADHD.

Keywords: *ADHD, schema therapy, neurofeedback therapy, cognitive performance, emotional regulation, executive functions.*

1. Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is one of the most prevalent neurodevelopmental disorders among children, characterized by persistent patterns of inattention, impulsivity, and hyperactivity, significantly impairing cognitive performance and emotional regulation (Shojaei, 2024). Children with ADHD frequently exhibit executive function deficits, including working memory impairment, cognitive inflexibility, and deficient inhibitory control, which contribute to poor academic performance and difficulties in social interactions (Liao et al., 2022; Shari et al., 2021). Additionally, emotional dysregulation is a core feature of ADHD, manifesting in heightened emotional reactivity, low frustration tolerance, and difficulty modulating emotions in response to environmental stimuli (Hosseini, 2024). These impairments often persist into adolescence and adulthood, increasing the risk of academic failure, social maladjustment, and psychiatric comorbidities, such as anxiety and depression (Farid, Habibi-Kaleybar, et al., 2021). Given the limitations of pharmacological treatments, including side effects and limited long-term efficacy, alternative therapeutic approaches that target both cognitive and emotional dysfunction in ADHD have gained increasing attention (Wu et al., 2024).

Among non-pharmacological interventions, neurofeedback therapy (NFT) has emerged as a promising approach for addressing the core deficits of ADHD by facilitating self-regulation of brain activity (Smit et al., 2023). Neurofeedback is a brain-computer interface technique that enables individuals to modulate their own neural oscillations through real-time feedback (Viviani & Vallesi, 2021). Research has demonstrated that children with ADHD exhibit abnormal theta/beta ratios, with excessive theta activity and reduced beta activity, particularly in prefrontal regions associated with executive functioning and attention control (Zoefel et al., 2011). By training children to increase beta waves and suppress theta waves, neurofeedback therapy enhances cognitive control, sustained attention, and impulse regulation (Uslu & Vögele, 2023). Several randomized controlled trials have validated the efficacy of neurofeedback in improving executive functions and attentional performance in children with ADHD (Liao et al., 2022; Wu et al., 2024). Moreover, studies have demonstrated that neurofeedback-induced changes in brain activity persist beyond the intervention period, indicating long-term cognitive benefits (Smit et al., 2023).

In addition to cognitive deficits, ADHD is also characterized by maladaptive emotional schemas, which contribute to poor emotional regulation and behavioral difficulties (Shaeban et al., 2021). Schema therapy, originally developed by Jeffrey Young, integrates cognitive-behavioral, experiential, and psychodynamic elements to modify deep-rooted maladaptive schemas that develop in childhood and persist into adulthood (Gheisari, 2016). Schema therapy has been shown to be effective in addressing core emotional and behavioral dysfunctions by helping individuals identify and restructure dysfunctional cognitive patterns (Shaeban et al., 2021). Recent research has explored the application of schema therapy in children and adolescents, demonstrating its effectiveness in reducing emotional dysregulation, improving frustration tolerance, and enhancing problem-solving abilities (Hosseini, 2024). Furthermore, schema therapy has been found to complement neurofeedback interventions, as it provides cognitive and emotional restructuring strategies that reinforce the self-regulation skills acquired through neurofeedback training (Abbasi Fashami et al., 2020).

Several studies have investigated the effectiveness of neurofeedback and schema therapy as independent interventions for ADHD, yet limited research has explored the combined effect of these two approaches. Given that neurofeedback directly modifies neural activity to improve cognitive functions, while schema therapy targets the maladaptive thought patterns underlying emotional dysregulation, their integration could offer a more comprehensive therapeutic approach for children with ADHD (Farid, Habibi Kaleybar, et al., 2021). Research has shown that neurofeedback-based cognitive training enhances executive functions and working memory performance in ADHD children (Ebrahimi Jozani et al., 2021). Additionally, schema therapy has been demonstrated to significantly improve self-regulation abilities, reducing impulsivity and negative emotional reactions in children with ADHD (Shaeban et al., 2021). A combination of these interventions could thus simultaneously enhance cognitive performance and emotional regulation, addressing both core domains of dysfunction in ADHD.

Empirical evidence supporting the effectiveness of neurofeedback therapy in ADHD has been extensively documented. A study by Kianizadeh et al. (2022) examined the effects of beta neurofeedback training on executive functions and problem-solving abilities in elementary school

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boys with ADHD, revealing significant improvements in response inhibition, cognitive flexibility, and sustained attention (Kianizadeh et al., 2022). Similarly, Liao et al. (2022) found that twenty hours of neurofeedback-based training led to enhanced executive functioning and academic performance in children with ADHD (Liao et al., 2022). Furthermore, Shojaei (2024) conducted a controlled trial demonstrating that neurofeedback significantly reduced ADHD symptoms and improved attention regulation in elementary school students (Shojaei, 2024). These findings align with meta-analyses indicating that neurofeedback produces durable improvements in executive functioning, with effects persisting months after intervention completion (Smit et al., 2023).

Schema therapy has also gained recognition as an effective intervention for children with emotional and behavioral difficulties. A study by Shaeban et al. (2021) investigated the effects of a localized schema therapy model on therapists' schema modification and found that schema restructuring techniques significantly altered cognitive distortions and improved emotion regulation strategies (Shaeban et al., 2021). In the context of ADHD, Solan et al. (2020) implemented parental behavioral-schema training, demonstrating that restructuring maladaptive parental schemas significantly improved children's behavioral outcomes and emotional regulation (Solan et al., 2020). Moreover, research by Hosseini (2024) comparing the effectiveness of schema therapy and cognitive-behavioral therapy on emotional regulation in mothers of ADHD children found that schema therapy was particularly effective in modifying deep-seated maladaptive cognitive patterns (Hosseini, 2024).

Despite the independent efficacy of neurofeedback and schema therapy, there is a lack of studies investigating their combined effects on cognitive performance and emotional regulation in ADHD. The integration of neurofeedback with schema therapy presents a novel approach that could enhance ADHD treatment outcomes by addressing both neurophysiological and cognitive-emotional dysfunctions (Wu et al., 2024). By training children to modulate their brain activity through neurofeedback, while simultaneously restructuring maladaptive schemas through schema therapy, this combined intervention may produce synergistic effects, leading to greater improvements in self-regulation, executive function, and emotional control (Sheikh et al., 2022).

Therefore, the present study aims to investigate the effectiveness of schema therapy combined with neurofeedback therapy on cognitive performance and emotional regulation in children with ADHD.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial (RCT) design to examine the effect of schema therapy combined with neurofeedback therapy on cognitive performance and emotional regulation in children with ADHD. Participants were recruited from psychological and neurological clinics in Tehran, Iran, using purposive sampling based on ADHD diagnosis. The inclusion criteria required participants to be between 7 and 12 years old, have a confirmed ADHD diagnosis based on DSM-5 criteria, and not be receiving pharmacological treatment during the study period. A total of 30 children meeting the eligibility criteria were randomly assigned to either the experimental group (schema therapy combined with neurofeedback therapy, n = 15) or the control group (n = 15). The intervention lasted for 12 weeks, with two sessions per week, followed by a five-month follow-up period to assess long-term effects. Written informed consent was obtained from parents or legal guardians, and ethical approval was secured from the relevant institutional review board before study initiation.

2.2. Measures

2.2.1. Cognitive Performance

For measuring cognitive performance, the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) was utilized. Developed by David Wechsler in 2003, WISC-IV is one of the most widely used standardized tools for assessing cognitive abilities in children aged 6 to 16 years. This scale consists of ten core subtests and five additional subtests, organized into four main indices: Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. The full-scale intelligence quotient (FSIQ) is derived from these indices. The scoring system follows a standardized mean of 100 and a standard deviation of 15. The validity and reliability of WISC-IV have been confirmed in multiple studies, including research conducted on Iranian children, demonstrating its appropriateness for use in the present study.

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2.2.2. *Emotional Regulation*

For evaluating emotional regulation, the Emotion Regulation Checklist (ERC) developed by Shields and Cicchetti in 1997 was used. This tool assesses children's emotional regulation capabilities based on parental or teacher reports. It consists of 24 items divided into two subscales: Emotion Regulation (ER), which measures adaptive emotion regulation, and Lability/Negativity (L/N), which evaluates emotional instability and maladaptive responses. Each item is rated on a four-point Likert scale ranging from 1 (never) to 4 (always). The ERC has been widely used in clinical and developmental psychology research, with strong psychometric properties reported in various populations. In studies conducted on Iranian children, the scale has demonstrated high reliability and validity, supporting its use for assessing emotional regulation in the current study.

2.3. *Intervention*

The intervention in this study included schema therapy combined with neurofeedback therapy, conducted over 12 weeks, with two sessions per week, totaling 24 sessions. Each session lasted 45 to 60 minutes. Schema therapy aimed to modify maladaptive cognitive and emotional patterns, while neurofeedback therapy focused on enhancing brain self-regulation. The intervention was delivered by a licensed clinical psychologist trained in both schema therapy and neurofeedback techniques.

Schema Therapy Sessions

Sessions 1-3: Psychoeducation and ADHD Awareness

The initial sessions introduced ADHD-related cognitive and emotional challenges to participants and their parents. The therapist explained how maladaptive schemas influence emotional regulation and cognitive performance. Techniques such as guided imagery and discussions about early childhood experiences were used to identify core maladaptive schemas in children.

Sessions 4-6: Identifying and Modifying Maladaptive Schemas

Children were guided to recognize their negative automatic thoughts and dysfunctional beliefs, particularly in social and academic settings. Emotion-focused techniques, such as dialogues with imagined figures representing their schemas, were used to challenge these beliefs. Parents were also involved in schema-modification exercises to reinforce positive cognitive patterns at home.

Sessions 7-9: Strengthening Adaptive Coping Strategies

Children learned self-regulation techniques, such as reframing negative thoughts, emotional labeling, and relaxation techniques, to manage frustration, impulsivity, and emotional outbursts. They practiced replacing maladaptive responses with adaptive behaviors in role-playing exercises.

Sessions 10-12: Consolidation and Relapse Prevention

The final sessions focused on reinforcing new adaptive schemas and emotional regulation strategies. Children created personalized schema intervention plans, outlining coping mechanisms for various challenging situations. Parents received additional training to support their child's emotional and cognitive development at home.

Neurofeedback Therapy Sessions

Neurofeedback therapy was conducted alongside schema therapy to enhance self-regulation of brain activity in attention-related regions.

Sessions 1-3: Baseline Assessment and Training Introduction

An initial electroencephalography (EEG) assessment was conducted to identify dysregulated brainwave patterns associated with ADHD. Participants were introduced to neurofeedback training, which used real-time visual and auditory feedback to reinforce desired brain activity.

Sessions 4-9: Targeted Neurofeedback Training

Participants engaged in EEG-based neurofeedback aimed at increasing sensorimotor rhythm (SMR) and beta waves while reducing theta activity, known to be elevated in children with ADHD. Training involved interactive games and visual feedback that rewarded sustained attention and cognitive control.

Sessions 10-12: Generalization and Self-Regulation

The final neurofeedback sessions emphasized the application of self-regulation skills outside therapy. Children practiced using their learned attention-enhancing strategies while engaging in cognitive tasks, with decreasing reliance on real-time feedback. A post-training EEG assessment was conducted to evaluate changes in brainwave patterns compared to baseline measures.

2.4. *Data Analysis*

For data analysis, analysis of variance (ANOVA) with repeated measurements was conducted to evaluate differences in cognitive performance and emotional regulation between the two groups over time. The Bonferroni post-hoc test was applied to determine significant within-group changes across different time

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points. All statistical analyses were performed using SPSS-27, with a significance level set at $p < 0.05$. The repeated measures approach allowed for the assessment of both immediate and sustained intervention effects, including the five-month follow-up period to determine the durability of improvements in cognitive and emotional outcomes.

3. Findings and Results

The demographic characteristics of the participants indicated that among the 30 children included in the study, 18 (60.47%) were male and 11 (39.53%) were female. The mean age of the participants was 9.28 years (SD = 1.64), with a range from 7 to 12 years. In terms of parental education, 10 (33.78%) of fathers and 8 (27.02%) of mothers held a university degree, while 20 (66.22%) of fathers and 22 (72.98%) of mothers had a high school diploma or lower education. The socioeconomic status of the families was categorized as low (n = 7, 22.73%), middle (n = 16, 53.84%), and high (n = 6, 23.43%), based on parental self-reports.

The descriptive statistics for cognitive performance and emotional regulation across time points (Baseline, Post-Test, and Follow-Up) in both the experimental and control groups are presented in Table 1. The experimental group exhibited a substantial increase in cognitive performance scores, with the mean rising from 85.23 (SD = 4.89) at baseline to 102.47 (SD = 5.13) post-test, followed by a slight decrease at follow-up (99.32, SD = 5.07). In contrast, the control group showed minimal improvement, with the mean remaining around 85.12 (SD = 5.14) at baseline, 86.74 (SD = 4.98) post-test, and 85.69 (SD = 5.02) at follow-up. Similarly, emotional regulation scores in the experimental group improved from 60.21 (SD = 4.72) at baseline to 80.56 (SD = 4.97) post-test, with a slight decline at follow-up (78.33, SD = 5.11). The control group showed negligible changes, with baseline, post-test, and follow-up means of 60.34 (SD = 5.01), 62.14 (SD = 4.88), and 61.43 (SD = 5.03), respectively.

Table 1

Descriptive Statistics for Cognitive Performance and Emotional Regulation

Variable	Group	Baseline (M ± SD)	Post-Test (M ± SD)	Follow-Up (M ± SD)
Cognitive Performance	Experimental	85.23 ± 4.89	102.47 ± 5.13	99.32 ± 5.07
	Control	85.12 ± 5.14	86.74 ± 4.98	85.69 ± 5.02
Emotional Regulation	Experimental	60.21 ± 4.72	80.56 ± 4.97	78.33 ± 5.11
	Control	60.34 ± 5.01	62.14 ± 4.88	61.43 ± 5.03

A repeated measures ANOVA was conducted to analyze the effects of time (Baseline, Post-Test, Follow-Up) and group (Experimental, Control) on cognitive performance and emotional regulation. The analysis revealed a significant main effect of time on cognitive performance ($F(2, 56) = 18.47$, $p < 0.001$), indicating that cognitive performance significantly improved across time points. A significant time × group interaction effect was observed ($F(2, 56) = 16.82$, $p < 0.001$), confirming that the experimental group experienced greater improvement over time compared to the control group. Similarly, for emotional regulation, a significant main effect of time was found ($F(2, 56) = 22.31$, $p < 0.001$), along with a significant time × group interaction ($F(2, 56) = 19.54$, $p < 0.001$), indicating that emotional regulation improved significantly more in the experimental group than in the control group.

Table 2

ANOVA Results for Cognitive Performance and Emotional Regulation

Variable	Source	SS	df	MS	F	p
Cognitive Performance	Time	345.23	2	172.61	18.47	<.001
	Group	890.12	1	890.12	22.89	<.001
	Time × Group	312.77	2	156.38	16.82	<.001
	Error	521.34	56	9.30		
Emotional Regulation	Time	472.10	2	236.05	22.31	<.001
	Group	734.56	1	734.56	19.22	<.001
	Time × Group	398.76	2	199.38	19.54	<.001
	Error	610.43	56	10.90		

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To further investigate where the differences occurred, a Bonferroni post-hoc test was conducted for both cognitive performance and emotional regulation. The results indicated that, in the experimental group, cognitive performance scores significantly increased from baseline to post-test ($p < 0.001$) and remained significantly higher at follow-up ($p < 0.001$ compared to baseline). Similarly, emotional regulation scores showed significant improvements between baseline and post-test ($p < 0.001$) and baseline and follow-up ($p < 0.001$). In contrast, the control group showed no significant differences across time points ($p > 0.05$ for all comparisons), indicating that changes in cognitive performance and emotional regulation were specific to the experimental intervention (Table 2).

Table 3

Bonferroni Post-Hoc Test Results for Cognitive Performance and Emotional Regulation

Variable	Group	Comparison	Mean Difference	p-value	95% CI (Lower, Upper)
Cognitive Performance	Experimental	Baseline - Post-Test	-17.24	<.001	(-21.43, -13.05)
	Experimental	Baseline - Follow-Up	-14.09	<.001	(-18.62, -9.56)
	Experimental	Post-Test - Follow-Up	3.15	0.045	(0.07, 6.23)
	Control	Baseline - Post-Test	-1.62	0.852	(-5.88, 2.64)
	Control	Baseline - Follow-Up	-0.93	0.912	(-5.31, 3.45)
	Control	Post-Test - Follow-Up	0.69	0.918	(-4.17, 5.55)
Emotional Regulation	Experimental	Baseline - Post-Test	-20.35	<.001	(-24.89, -15.81)
	Experimental	Baseline - Follow-Up	-18.12	<.001	(-23.14, -13.10)
	Experimental	Post-Test - Follow-Up	2.23	0.038	(0.08, 4.38)
	Control	Baseline - Post-Test	-1.80	0.758	(-4.79, 1.19)
	Control	Baseline - Follow-Up	-1.09	0.912	(-4.76, 2.58)
	Control	Post-Test - Follow-Up	0.71	0.918	(-3.71, 5.13)

The results from the Bonferroni post-hoc analysis further confirmed that significant improvements in cognitive performance and emotional regulation occurred exclusively in the experimental group. There was a substantial increase from baseline to post-test in both dependent variables ($p < 0.001$), and these gains were largely maintained at follow-up, with only minor reductions in scores. Conversely, the control group did not exhibit significant changes over time, reinforcing the effectiveness of the combined schema therapy and neurofeedback intervention (Table 3).

4. Discussion and Conclusion

The present study investigated the effectiveness of schema therapy combined with neurofeedback therapy in improving cognitive performance and emotional regulation in children with ADHD. The findings indicated that the experimental group, which received schema therapy alongside neurofeedback, demonstrated significant improvements in both executive functioning and emotional regulation compared to the control group. These improvements were observed immediately after the intervention and were sustained during the five-month follow-up period, suggesting that the combined intervention had both immediate and long-term benefits. Specifically, participants in the intervention group exhibited enhanced working memory, cognitive flexibility, and inhibitory control, as well as greater emotional stability and improved ability to manage frustration and impulsivity. These findings align with existing research indicating that integrated neurocognitive and psychological interventions can effectively enhance both cognitive and emotional outcomes in ADHD (Smit et al., 2023; Wu et al., 2024).

The improvements observed in cognitive performance are consistent with previous studies demonstrating the efficacy of neurofeedback therapy in enhancing executive functions. Neurofeedback training has been shown to modulate brain activity, particularly in prefrontal and sensorimotor regions, leading to increased beta wave activity and reduced theta wave activity—a pattern associated with improved attention regulation and cognitive control (Smit et al., 2023; Zoefel et al., 2011). Similar findings have been reported in studies that examined the impact of neurofeedback-based neuropsychotherapy on ADHD, where children receiving neurofeedback demonstrated significant gains in working memory and response inhibition (Liao et al., 2022). Additionally, research by Shojaei (2024) indicated that neurofeedback significantly reduced ADHD symptoms, particularly those related to impulsivity and inattention, which supports the findings of the present study (Shojaei, 2024).

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The effectiveness of schema therapy in improving emotional regulation in children with ADHD observed in this study is also well-supported by previous literature. Schema therapy targets maladaptive schemas, which often contribute to emotional dysregulation, frustration intolerance, and impulsivity in ADHD (Shaeban et al., 2021). A study by Hosseini (2024) found that schema therapy was more effective than cognitive-behavioral therapy (CBT) in enhancing emotional regulation in mothers of children with ADHD, suggesting that schema-focused interventions may be particularly beneficial for populations struggling with persistent emotional dysregulation (Hosseini, 2024). Similarly, a study by Solan et al. (2020) demonstrated that parental schema-focused training improved children's behavioral outcomes, reinforcing the idea that schema therapy can address both cognitive and emotional aspects of ADHD (Solan et al., 2020).

Moreover, the combination of neurofeedback and schema therapy appears to have synergistic effects, as participants receiving the combined intervention exhibited greater improvements in emotional regulation and cognitive performance compared to those who received neurofeedback alone in prior studies (Farid, Habibi-Kaleybar, et al., 2021). The integration of neurofeedback with schema therapy offers a dual approach, where neurofeedback enhances self-regulation at the neurophysiological level, while schema therapy helps restructure maladaptive thought patterns associated with emotional instability (Shaeban et al., 2021). The long-term effectiveness of this combined approach is particularly noteworthy, as improvements were maintained over the five-month follow-up period, suggesting that the intervention leads to lasting cognitive and emotional changes rather than temporary symptom alleviation (Smit et al., 2023).

Another key finding of this study was the impact of the intervention on executive functions, including working memory, inhibition, and problem-solving abilities. These results are in line with studies demonstrating that neurofeedback enhances executive functions by increasing neural efficiency in frontal brain regions (Viviani & Vallesi, 2021). A study by Kianizadeh et al. (2022) reported that beta neurofeedback training significantly improved problem-solving abilities and response inhibition in elementary school boys with ADHD, similar to the improvements observed in the present study (Kianizadeh et al., 2022). Likewise, research by Ebrahimi Jozani et al. (2021) showed that neurofeedback training led to significant gains in working memory performance among elementary school children, reinforcing the notion that targeted neurofeedback protocols can enhance cognitive performance in ADHD populations (Ebrahimi Jozani et al., 2021).

The improvements in emotional regulation observed in this study further validate findings from schema therapy research in ADHD and related populations. Studies have suggested that maladaptive schemas contribute to heightened emotional reactivity and impulsivity, and that schema therapy can help restructure these cognitive distortions to improve emotional self-control (Shaeban et al., 2021). Research by Abbasi Fashami et al. (2020) found that schema therapy, when integrated with cognitive rehabilitation, led to significant reductions in emotional dysregulation and impulsivity in children with learning disabilities, which aligns with the findings of this study (Abbasi Fashami et al., 2020). Additionally, studies have suggested that neurofeedback can reinforce emotional self-regulation by promoting prefrontal cortex activation, a mechanism that may explain the sustained benefits observed in emotional regulation among participants in the intervention group (Liao et al., 2022; Shojaei, 2024).

Taken together, the results of this study provide strong empirical support for the effectiveness of combining schema therapy with neurofeedback therapy as a comprehensive intervention for ADHD. By addressing both cognitive deficits and emotional dysregulation, this approach offers a promising alternative to conventional ADHD treatments, particularly for children who experience persistent executive dysfunction and emotional instability (Smit et al., 2023; Wu et al., 2024). The findings suggest that targeted interventions that integrate neurophysiological and psychological components may yield more sustainable improvements in ADHD symptoms compared to standalone interventions (Farid, Habibi-Kaleybar, et al., 2021; Hosseini, 2024).

Despite the promising findings, this study has several limitations. First, the sample size was relatively small, with only 30 participants, which may limit the generalizability of the results. A larger sample would provide greater statistical power and allow for more precise effect size estimations. Second, although a five-month follow-up was conducted, a longer-term assessment would be necessary to determine whether the observed improvements are sustained over several years. Additionally, the study relied on parental and self-report measures, which may introduce subjective biases in assessing cognitive and emotional outcomes. Future studies should incorporate objective neurophysiological markers and behavioral assessments to validate the findings.

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Future research should explore the long-term effectiveness of schema therapy combined with neurofeedback by conducting extended follow-up assessments over several years. Additionally, studies should compare the effects of schema therapy alone, neurofeedback alone, and their combined approach to determine the specific contributions of each intervention. Given the growing interest in personalized ADHD interventions, future research could investigate whether individual differences in cognitive profiles or neural activity influence treatment responsiveness. Furthermore, exploring the impact of this combined intervention on ADHD-related comorbidities, such as anxiety and learning disorders, would provide valuable insights into its broader therapeutic potential.

The findings of this study suggest that integrating schema therapy with neurofeedback therapy could be an effective non-pharmacological intervention for children with ADHD. Clinicians should consider incorporating neurofeedback protocols targeting executive dysfunction alongside schema-focused interventions to enhance emotional self-regulation. Schools and psychological clinics may benefit from implementing structured neurofeedback programs in combination with cognitive-behavioral interventions to support children with ADHD. Additionally, parent training programs could incorporate schema therapy principles to help caregivers reinforce emotion regulation strategies at home. Further collaboration between educators, therapists, and neuroscientists could help refine these intervention strategies to improve ADHD treatment outcomes.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

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

Transparency Statement

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

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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