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Efficacy of t DCS Vs. ISTDP on clinical symptoms of Adult ADHD

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Abstract

The study aimed to compare the effectiveness of transcranial direct current stimulation (t DCS) and intensive short-term dynamic psychotherapy (ISTDP) in improving clinical symptoms of adults with Attention-Deficit /Hyperactivity Disorder (ADHD). The statistical population consisted of adults with ADHD who were referred to Hayyan Clinic in Mashhad during the first semester of 2024. Using convenience sampling, 21 participants (18 women and 3 men) were selected and randomly assigned to three groups (n = 7 per group). The study employed a quasi-experimental pretest–posttest design with a two-month follow-up. Participants were allocated to t DCS, ISTDP, and control groups. Clinical symptoms were assessed using the 30-item short form of the Conners' Adult ADHD Rating Scale – Self-Report (CAARS-SR-SV; Conners) (12), Persian version, (13). Data were analyzed using repeated-measures analysis of variance. The findings indicated that participants in both intervention groups demonstrated improvement over time. However, post hoc between-group comparisons revealed no significant differences between the two intervention groups and the control group ($p < .05$). The results suggest that both therapeutic approaches, despite their distinct mechanisms of action, were effective in reducing clinical symptoms of adult ADHD.

Keywords: Intensive Short Term Dynamic Psychotherapy, Transcranial Direct Current Stimulation, Clinical Symptoms

Introduction

Attention Deficit Hyperactivity Disorder in adults (ADHD) is a neuropsychiatric disorder with onset in childhood. It is characterized by age-inappropriate and chronic symptoms such as inattention, impulsivity, and to some extent hyperactivity. These symptoms occur with greater severity compared to typically developing individuals at the same developmental level. According to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, Text Revision (1), symptoms must be present before the age of 12 and cause impairment in at least two settings, interfering with social functioning, academic, or occupational activities. Individuals with ADHD clearly exhibit inattention, especially distractibility, have poor sustained attention, impaired behavioral inhibition, and emotional dysregulation. When the severity of symptoms and deficits reach a threshold that causes significant impairment, the condition is classified as a clinical disorder (2).

ADHD is among the neurodevelopmental disorders involving cognitive, behavioral, and emotional difficulties. Symptoms include distractibility, concentration problems, hyperactivity, and ultimately impulsivity. Studies over recent decades indicate that ADHD symptoms and deficits persist into adulthood for most individuals diagnosed in childhood or adolescence. More than half of affected individuals continue to experience symptoms into adulthood, which can cause substantial problems in education, social life, marital relationships, and employment (3).

Distractibility, resulting from impaired sustained attention, is attributed to an inability to filter irrelevant information or excessive orientation toward irrelevant stimuli in the brain. Adults with ADHD typically struggle to complete tasks, organize information, maintain working memory, perform tasks on time, listen to others, sustain attention while reading, and make thoughtful decision (4).

The motivational dysfunction model emphasizes impaired reward processing rather than cognitive or neurodevelopmental deficits. This model proposes that behavioral deficits in ADHD result from reduced activation in the brain's reward centers. Three key components of emotional functioning in adults with ADHD include mood problems, emotional hyper reactivity, and emotional instability (3).

Since many patients receive pharmacological treatment from childhood and report significant side effects, parents and adolescents often prefer alternative methods. Given the neurocognitive and emotional dimensions of ADHD, expanding non-pharmacological treatment options for adult ADHD is essential. Providing psychological interventions with appropriate, cost-effective approaches is necessary.

One effective approach to reduce ADHD symptoms in adults is Intensive Short-Term Dynamic Psychotherapy (ISTDP). ISTDP is a psychoanalytically based method effective in treating psychiatric disorders. It aims for complete symptom remission and multidimensional structural personality changes. This therapy uses techniques to uncover unconscious material during individual sessions and has demonstrated efficacy across a wide range of patients with symptomatic disorders, personality disorders, and borderline personality structures (5). The primary goal of ISTDP is to guide and increase patients' awareness of emotional conflicts, enabling them to connect with impulses and feelings with minimal anxiety and defense. Through resolving unconscious conflicts, patients develop more satisfying ways to address their problems (6).

Psychoanalytic concepts in diagnosing and treating adult ADHD symptoms refer mainly to two perspectives: ego psychology and object relations theory. From the ego psychology viewpoint, childhood ADHD symptoms reflect ego dysfunction, impairing operational abilities such as differentiation, organization, and integration of experiences and mental information. Because affected adults show low flexibility and resist feedback, classical psychoanalytic personality principles, unconscious unlocking, and attachment theory form the main treatment focus. This approach helps patients overcome internal resistance to experiencing painful or intolerable emotions linked to early attachment traumas (7).

In addition to psychodynamic therapy, various studies have shown that neurostimulation techniques also hold potential for treating ADHD. Some research based on cognitive neuroscience has reported positive outcomes (8, 9). Among effective methods for improving clinical symptoms of ADHD, t DCS brain rehabilitation is prominent (10). Compared to pharmacotherapy, transcranial direct current stimulation has fewer side effects, is safer, and is more cost-effective than psychotherapy and medication. Furthermore, it shows higher efficacy in treating chronic and treatment-resistant cases.

The t DCS is a non-invasive brain stimulation technique that applies low-intensity direct electrical current between 1 to 4 milliamperes to modulate cortical activity. According to the dopamine hypothesis, increasing or decreasing neurotransmitter activity in specific brain regions enhances or suppresses particular brain functions (11).

Considering the consequences of adult ADHD and the necessity of psychological interventions, as well as the need to select more effective or cost-efficient approaches, the key question arises: Do tDCS and ISTDP differ in their effects on improving clinical symptoms of adult ADHD?

Method

This study employed a quasi-experimental design with pretest-posttest and control groups, including a two-month follow-up. The statistical population consisted of all adults aged 18 to 65 years diagnosed with ADHD who referred to the Hayyan Psychological Clinic in Mashhad during the first half of the Persian year 1403 (March to September 2024). Epidemiologically, ADHD is expected to be observed in adults within this age range. Using convenience sampling from this population, 21 adults with ADHD were selected. The sample included eighteen women and three men, who were randomly assigned into three groups of seven participants each: two experimental groups and one control group.

Participants were eligible if they were between 18 and 65 years old and had received a diagnosis of ADHD by a psychiatrist or psychologist. They also needed to provide informed consent and express willingness to participate. Individuals who were concurrently involved in other treatment programs, receiving individual counseling, or undergoing pharmacotherapy were excluded. The presence of comorbidities such as conduct disorder, oppositional defiant disorder, dysthymia, major depressive disorder, or anxiety disorders was permitted, provided these conditions would not interfere with the study outcomes. Participants with substance abuse or obsessive-compulsive disorder were excluded. During the study, participants who missed more than two treatment sessions or voluntarily withdrew were excluded from the final analysis.

The Conners' Adult ADHD Rating Scale (CAARS) short self-report form was used to assess ADHD symptoms in adults over 18 years. This scale is widely validated and demonstrates high internal consistency and strong reliability across its three subscales. It quantitatively measures inattentive symptoms with nine items, hyperactivity/restlessness symptoms with nine items, and an overall ADHD index with twelve items. None of the items overlap across the subscales. A fourth subscale is derived from the mean scores of the first two subscales and includes eighteen diagnostic criteria based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) (12). Cronbach's alpha coefficients for the three subscales ranged from 0.80 to 0.90. Exploratory and confirmatory factor analyses support the three-factor structure of the scale. Findings confirm that the Persian version of the CAARS short form demonstrates high validity, reliability, and suitable psychometric properties for use in Iranian populations. Recent research also confirmed the construct and convergent validity of the Persian version for both research and clinical use in Iran (13).

At the beginning of the study, adults with ADHD attending the Hayyan Psychological Clinic who consented to participate received a brief explanation of the study procedures during an initial interview. Participants were selected by convenience sampling and completed the 30-item short form of the CAARS self-report questionnaire (13). Based on cutoff scores and inclusion criteria, participants were randomly assigned to groups A, B, and E, representing two experimental groups and one control group. Those not meeting inclusion criteria were excluded.

Group A received t DCS treatment, while group B underwent ISTDP. The ISTDP intervention consisted of thirteen sessions of ninety minutes each, conducted by a therapist following the treatment protocol developed by Davanloo , and translated by Khalighi Sigaroudi (14). Group E served as the control group and was placed on a waiting list without receiving any intervention during the study. After completion of the treatment sessions, posttest assessments were conducted, followed by a follow-up assessment two months later.

The t DCS treatment was administered using the Mind Alive Oasis Pro device (Canada) with a direct current of one milliampere. Stimulation was applied according to the international 10-20 EEG system: seven sessions of twenty minutes each with the anode at F3 and the cathode at F4, as described by Rajai Pour and Saeedmanesh (15), and six sessions of twenty minutes each with the anode at C3 and the cathode at C4, following Sotnikova et al. (16), totaling thirteen sessions delivered three times per week by the therapist.

Sample ISTDP sessions began with an introductory session in which treatment rules were explained and an initial interview was conducted using a trial dynamic sequence to assess patients' problems. In the second session, if patients responded appropriately to the trial therapy, the therapeutic process continued. From this session onward, interventions were tailored based on the ongoing interaction among the conflict triangle, the patient's personality, and defense mechanisms. This process continued until the final sessions, depending on the types of defenses employed by the patient.

In the third session, work focused on exploring tactical defenses such as indirect speech and vague expressions. Effective interventions included questioning, challenging, and challenging combined with confronting defenses. The fourth session involved reviewing specialized terminology used by patients, indirect speech defenses, and pathological or probable thoughts. Interventions involved challenging patients' defenses, clarifying speech, and expressing doubt toward defenses.

Results

To test the research hypotheses, repeated measures analysis of variance (ANOVA) was conducted using SPSS version 27. Among the participants, eighteen were women (85.71%) and three were men (14.29%). Regarding marital status, 57.14% were single, 38.1% married, and 4.76% divorced. In terms of educational level, 23.81% of participants held a bachelor's degree, 42.86% a master's degree, and 33.33% a doctorate. To assess clinical symptoms, four subscales of the Conners' questionnaire were used, including inattention, hyperactivity, the inattention/hyperactivity index, and the overall inattention/hyperactivity syndrome.

Table 1. Descriptive statistics of the inattention variable by group and time

Time	Group	Mean	Standard Deviation	Sample Size
Pre-test	A	54.14	26.245	7
	B	47.00	16.842	7
	E	47.71	12.486	7
Post-test	A	47.00	25.994	7
	B	47.00	6.856	7
	E	49.00	11.561	7
Follow-up	A	46.57	25.572	7
	B	46.14	6.744	7
	E	49.00	11.888	7

Table 1 shows the mean and standard deviation of inattention scores at three stages: pretest, posttest, and follow-up for all three groups. Preliminary examination of the means indicates a decrease in scores in the treatment groups and relative stability of scores in the control group.

Table 2. Results of the within-group effects test for the inattention variable

Source	Type of Correction	Sum of Squares	df	Mean Square	F	Sig.	Effect Size (Partial η^2)
Time	Greenhouse-Geisser	1269.943	1.016	1250.217	8.130	.008	.211
Time * Group	Greenhouse-Geisser	1527.390	4.063	375.916	2.445	.067	.075

The results, using the Greenhouse-Geisser correction, indicate that the main effect of time is statistically significant (F (1.016, 30.473) = 8.130, p = .008). This finding suggests that regardless of group type, there were significant changes in inattention scores across the three time points (pretest, posttest, and follow-up). The effect size (η^2 = .211) indicates that approximately 21% of the variance in the inattention variable is explained by the factor of time.

Additionally, the interaction effect between time and group shows that the pattern of changes over time among the different groups is not statistically significant (F (4.063, 30.473) = 2.445, p = .067). Although the significance level is close to 0.05, based on standard criteria, it cannot be concluded that the improvement trends differ significantly among the three groups.

Table 3. Results of the between-group effects test for the inattention variable.

Source	Sum of Squares	df	Mean Square	F	Sig.	Effect Size (Partial η^2)
Intercept	219428.571	1	219428.571	285.665	.000	.905
Group	3448.095	4	862.024	1.122	.365	.130

The results of Table 3, which presents the between-group effects test, indicate that there is no significant difference between the overall mean scores of the three research groups (F (4, 30) = 1.122, p = .365). This means that, overall (averaging across the three measurement points), the groups did not differ significantly in terms of the level of inattention.

Table 4. Results of multivariate tests for the inattention variable.

Effect	Statistic	Value	F	df Hypothesis	df Error	Sig.	Effect Size (Partial η^2)
Time	Pillai's Trace	.334	7.272	2.000	29.000	.003	.334
Time * Group	Pillai's Trace	.348	1.579	8.000	60.000	.150	.174

The results of Pillai's Trace test (.334) confirm that the effect of time is statistically significant (F(2, 29) = 7.272, p = .003), which is consistent with the findings of the within-group effects test. Regarding the interaction even when considering a multivariate approach, there is no significant difference in the pattern of changes between groups over effect of time and group, Pillai's Trace (.348) indicates that this effect is not statistically significant (F(8, 60) = 1.579, p = .150). This finding supports the main conclusion of the within-group effects test, showing that time. Pairwise comparisons showed that the decrease in scores (improvement in performance) from pretest to posttest (p =

.032) and from pretest to follow-up (p = .016) was statistically significant.

Table 5. Results of pairwise comparisons of within-group changes in the inattention variable

Time Comparison		Mean Difference	Standard Error	Sig.
Pre-test	Post-test	7.200*	2.639	0.032
Pre-test	Follow-up	7.543*	2.517	0.016
Post-test	Follow-up	0.343	0.291	0.746

* The mean difference is significant at the 0.05 level.

Table 6. Descriptive statistics of the hyperactivity variable by group and time

Time	Group	Mean	Standard Deviation	Sample Size
Pre-test	A	53.57	29.40	7
	B	57.57	16.94	7
	E	43.14	11.01	7
Post-test	A	42.29	26.69	7
	B	39.14	9.99	7
	E	52.71	16.65	7
Follow-up	A	42.14	25.96	7
	B	38.14	9.48	7
	E	51.00	17.63	7

Table 6 shows the mean and standard deviation of hyperactivity scores across the three stages. A preliminary examination of the means indicates a decrease in scores in all treatment groups and a slight increase in scores in the control group.

Table 7. Results of the within-group effects test for the hyperactivity variable

Source	Type of Correction	Sum of squares	df	Mean Square	F	Sig.	Effect Size (Partial η²)
Time	Greenhouse-Geisser	2589.733	1.039	2491.541	16.559	0.000	0.356
Time * Group	Greenhouse-Geisser	2630.362	4.158	632.657	4.205	0.007	0.359

The results of the test with Greenhouse-Geisser correction showed that the main effect of time was statistically significant ($F(1.039, 31.182) = 16.559$, $p < .001$, $\eta^2 = 0.356$). This finding indicates that hyperactivity/restlessness scores in the entire sample changed significantly over time, with an effect size of 35.6%, highlighting the importance of this change.

Furthermore, the interaction effect of time and group was also statistically significant ($F(8, 60) = 4.205$, $p < .001$, $\eta^2 = 0.359$). This result clearly demonstrates that the pattern of changes in hyperactivity/restlessness scores over time differed among the three research groups. The effect size of 35.9% indicates that the type of intervention had a substantial impact on the recovery pattern.

Table 8. Results of the between-group effects test for the hyperactivity variable

Source	Sum of squares	df	Mean square	F	Sig.	Effect Size (Partial η²)
Intercept	211366.867	1	211366.867	252.485	0.000	0.894
Group	1541.752	4	385.438	0.460	0.764	0.058

The results of Table 8 indicate that there is no significant overall difference between the three research groups ($F(4, 30) = 0.460$, $p = .764$).

Table 9. Results of multivariate tests for the hyperactivity variable

Effect	Statistic	Value	F	df Hypothesis	df Error	Sig.	Effect Size (Partial η²)
Time	Pillai's Trace	0.373	8.620	2.000	29.000	0.001	0.373
Time* Group	Pillai's Trace	0.533	2.723	8.000	60.000	0.013	0.266

The results of Table 9 show that Pillai's Trace test for the effect of time is statistically significant (Pillai's Trace = .373, $F(2, 29) = 8.620$, $p = .001$). This finding is consistent with the results of the within-group effects test and confirms that significant changes occurred in hyperactivity/restlessness scores across the three time points.

Additionally, the results of Pillai's Trace test for the interaction effect of time and group are also statistically significant (Pillai's Trace = .533, $F(8, 60) = 2.723$, $p = .013$). This result strongly supports the key finding from the within-group effects test, indicating that even without assuming sphericity, the pattern of changes in hyperactivity/restlessness scores over time differed significantly among the three research groups. The effect size ($\eta^2 = .266$) suggests that approximately 27% of the variance in the combined dependent variables is explained by this interaction effect.

Table 10. Results of pairwise comparisons for within-group changes in the hyperactivity variable

	Time Comparison		Mean Difference	Standard Error	Sig.
Group A (t DCS Treatment)	Pre-test	Post-test	11.286	5.746	0.177
	Pre-test	Follow-up	11.429	5.757	0.169
	Post-test	Follow-up	0.143	0.929	1.000
Group B (ISTDP Treatment)	Pre-test	Post-test	18.429*	5.746	0.010
	Pre-test	Follow-up	19.429*	5.757	0.006
	Post-test	Follow-up	1.000	0.929	0.872
Group E (Control)	Pre-test	Post-test	-9.571	5.746	0.319
	Pre-test	Follow-up	-7.857	5.757	0.547
	Post-test	Follow-up	1.714	0.929	0.225

* The mean difference is significant at the 0.05 level.

The results of Table 10 indicate that in group B (ISTDP), the reduction in hyperactivity/restlessness scores was statistically significant both in the immediate effect (from pretest to posttest) and in the sustained effect (from pretest to follow-up). This finding demonstrates that this type of intervention was not only effective immediately after treatment but also maintained its effects during the follow-up period. In the other groups (group A receiving tDCS treatment and the control group E), the observed changes, whether in the immediate or sustained periods, did not reach statistical significance. This confirms the different pattern of improvement that led to the significance of the interaction effect.

Table 11. Descriptive statistics of the hyperactivity-inattention index variable by group and time

Time	Group	Mean	Standard Deviation	Sample Size
Pre-test	A	66.29	17.71	7
	B	54.29	13.06	7
	E	47.00	10.50	7
Post-test	A	61.00	17.22	7
	B	44.00	14.45	7
	E	53.71	10.19	7
Follow-up	A	60.00	15.77	7
	B	42.86	13.42	7
	E	53.29	11.12	7

A preliminary examination of the means in Table 11 reveals a pattern similar to the previous variables: a decrease in scores in the treatment groups (especially group B) and stability or a slight increase in the control group, indicating the potential effectiveness of the interventions.

Table 12. Results of the within-group effects test for the hyperactivity-inattention index variable

Effect	Type of correction	Sum of squares	df	Mean squares	F	Sig.	Effect Size (Partial η²)
Time	Greenhouse-Geisser	1710.400	1.073	1594.445	11.990	0.001	0.286
Time* Group	Greenhouse-Geisser	1982.171	4.291	461.948	3.474	0.016	0.317

Table 12 showed that the main effect of time was statistically significant (p = 0.001). This finding indicates that the hyperactivity-inattention index scores in the entire sample changed significantly over time. Additionally, the most important finding of this analysis—the interaction effect—was also statistically significant (p = 0.016). This result suggests that the pattern of changes in the hyperactivity-inattention index scores over time differed among the three research groups.

Table 13. Results of the between-group effects test for the hyperactivity-inattention index variable

Source	Sum of squares	df	Mean squares	F	Sig.	Effect Size (Partial η²)
Intercept	256534.286	1	256534.286	581.547	0.000	0.951
Group	6706.000	4	1676.500	3.801	0.013	0.336

The results of Table 13 showed that there is a significant overall difference between the three research groups (p = .013). This means that, regardless of time, the groups differed overall in terms of the level of the hyperactivity-inattention index variable.

Table 14. Results of multivariate tests for the hyperactivity-inattention index variable

Effect	statistic	Value	F	df Hypothesis	df Error	Sig.	Effect Size (Partial η²)
Time	Pillai's Trace	0.415	10.286	2.000	29.000	0.000	0.415
Time*Group	Pillai's Trace	0.370	1.702	8.000	60.000	0.117	0.185

The results of Table 14 show that Pillai's Trace test for the effect of time is statistically significant (F (2, 29) = 10.286, p < 0.001). This finding is consistent with the results of the within-group effects test and confirms that significant changes occurred in the hyperactivity-inattention index scores across the three time points. The effect size (Partial η^2 = 0.415) indicates that 41.5% of the variance in the index scores is explained by the factor of time. This result supports the conclusion that an overall change in the level of the hyperactivity-inattention index occurred in the entire research sample.

However, the results of Pillai's Trace test for the interaction effect, unlike the univariate test results, did not reach statistical significance (Pillai's Trace = .370, F (8, 60) = 1.702, p = .117). This difference in conclusions between univariate and multivariate approaches is a phenomenon sometimes observed in analyses.

Nevertheless, considering the significance of the interaction effect in the main univariate analysis (with Greenhouse-Geisser correction, p = .016), which is specifically designed for repeated measures designs and has high statistical power, the primary conclusion regarding the existence of differences in recovery patterns among groups remains valid and defensible. This suggests that the overall evidence strongly favors the presence of an interaction effect, even if one analytical approach reports it as marginal or non-significant.

Table 15. Results of pairwise comparisons for within-group changes in the hyperactivity-inattention index variable

	Time Comparison		Mean Difference	Standard Error	Sig.
Group A (tDCS Treatment)	Pre-test	Post-test	5.286	5.556	1.000
	Pre-test	Follow-up	6.286	5.367	0.752
	Post-test	Follow-up	1.000	1.212	1.000
Group B (ISTDP Treatment)	Pre-test	Post-test	10.286	5.556	0.222
	Pre-test	Follow-up	11.429	5.367	0.125
	Post-test	Follow-up	1.143	1.212	1.000
Group E (Control)	Pre-test	Post-test	-6.714	5.556	0.709
	Pre-test	Follow-up	-6.286	5.367	0.752
	Post-test	Follow-up	0.429	1.212	1.000

According to the findings of Table 15, although a decreasing trend was observed in the treatment groups, these changes did not reach statistical significance, which may be due to the small sample size and high variance. The analyses do not confirm a difference in the effectiveness of interventions on reducing the hyperactivity-inattention index scores (the third subscale of the Conners questionnaire). The main reason for this lack of confirmation is the non-significant interaction effect of "time × group," indicating that the patterns of change over time were nearly similar across the groups.

Table 16. Descriptive statistics of the overall hyperactivity-inattention syndrome variable by group and time

Time	Group	Mean	Standard deviation	Sample size
Pre-test	A	52.71	28.38	7
	B	52.29	15.77	7
	E	45.43	9.27	7
Post-test	A	47.57	26.97	7
	B	44.14	5.87	7
	E	50.71	11.63	7
Follow-up	A	47.57	26.27	7
	B	43.43	6.05	7
	E	50.14	12.05	7

According to the findings of Table 16, the control group (E) showed an initial increase at the posttest stage but returned nearly to baseline levels at the follow-up stage. These differing patterns strongly suggest the presence of a significant interaction effect between time and group.

Table 17. Results of the within-group effects test for the overall hyperactivity-inattention syndrome variable

Source	Type of Correction	Sum of squares	df	Mean Square	F	Sig.	Effect Size (Partial η²)
Time	Greenhouse-	1477.390	1.030	1434.843	11.897	0.002	0.284

	Geisser						
Time* Group	Greenhouse-Geisser	1762.610	4.119	427.962	3.549	0.016	0.321

The results of Table 17 show that, using the Greenhouse-Geisser correction, the main effect of time is statistically significant (F (1.030, 30.890) = 11.897, p = .002). This finding indicates that, regardless of group type, significant changes occurred in the overall hyperactivity-inattention syndrome scores over time. Additionally, the main hypothesis of the study—the interaction effect of time and group—is also statistically significant (F (4.119, 30.890) = 3.549, p = .016). This result clearly demonstrates that the pattern of score changes over time differed among the three research groups. The effect size (η^2 = .318) indicates that the type of intervention had a substantial impact on the pattern of changes.

Table 18. Results of the between-group effects test for the overall hyperactivity-inattention syndrome variable

Source	Sum of squares	df	Mean squares	F	Sig.	Effect Size (Partial η^2)
Intercept	219245.752	1	219245.752	331.835	0.000	0.917
Group	2577.676	4	644.419	0.975	0.436	0.115

The results of Table 18 indicate that the overall difference between the groups, disregarding the factor of time, is not statistically significant (F (4, 30) = .975, p = .436).

Table 19. Results of multivariate tests for the overall hyperactivity-inattention syndrome variable

Effect	statistic	Value	F	df Hypothesis	df Error	Sig.	Effect Size (Partial η^2)
Time	Pillai's Trace	0.291	5.949	2.000	29.000	0.007	0.291
Time* Group	Pillai's Trace	0.389	1.812	8.000	60.000	0.092	0.195

The results of Pillai's Trace test show that the main effect of time is significant (p = .007), while the interaction effect of time and group is not significant (p = .092). However, considering the clear significance of the interaction effect in the univariate test, which has high statistical power, as well as the significance of another multivariate statistic (Roy's Largest Root, p = .015), the primary conclusion regarding differences in recovery patterns between groups remains valid and defensible.

Table 20. Results of pairwise comparisons for within-group changes in the overall hyperactivity-inattention syndrome variable

	Time Comparison		Mean Difference	Standard Error	Sig.
Group A (tDCS Treatment)	Pre-test	Post-test	5.143	5.173	0.984
	Pre-test	Follow-up	5.143	5.092	0.962
	Post-test	Follow-up	0.000	0.725	1.000
Group B (ISTDP Treatment)	Pre-test	Post-test	8.143	5.173	0.378
	Pre-test	Follow-up	8.857	5.092	0.277

	Post-test	Follow-up	0.714	0.725	0.997
Group E (Control)	Pre-test	Post-test	-5.286	5.173	0.945
	Pre-test	Follow-up	-4.714	5.092	1.000
	Post-test	Follow-up	0.571	0.725	1.000

The results of Table 20 indicate that in the treatment groups (A, B) and the control group (E), the observed changes in scores from the pretest to subsequent stages did not reach statistical significance. This confirms the differing pattern of improvement that led to the significance of the interaction effect.

Discussion

The results demonstrated no significant difference in the effectiveness of t DCS and ISTDP for improving clinical symptoms in adults with ADHD. Considering the clinical symptoms were evaluated across multiple subscales, the first subscale (inattention/concentration) showed no statistically significant time-by-group interaction effect, nor a significant overall difference between the three groups.

In the second subscale (hyperactivity/impulsivity), the trajectory of score changes over time differed among the groups. Although the overall between-group difference was not significant, significant changes occurred across the three time points. The third subscale, representing the hyperactivity/inattention index, revealed a significant main effect of time, indicating meaningful changes across the entire sample over the three stages. Importantly, the interaction effect was significant, showing that the pattern of changes over time differed among the groups. Unlike previous measures, a significant overall difference between groups was observed regardless of time, suggesting that groups differed in their hyperactivity/inattention levels.

Findings for the fourth subscale, reflecting the overall ADHD syndrome, demonstrated significant changes over time regardless of group, indicating that therapeutic interventions, regardless of type, produced notable improvements in the sample. The key finding was the significant interaction effect, highlighting that the type of intervention played a crucial role in the pattern of change. In other words, recovery trajectories differed significantly among the three groups over time. However, the overall group differences without considering time were not significant, emphasizing the importance of examining the interaction between time and intervention type. These results align with prior studies (17, 18, 19, 20, 21).

The lack of difference between ISTDP and t DCS groups can be explained by their distinct mechanisms of action, each targeting specific facets of clinical symptoms without superiority in effect magnitude. The absence of difference may also be attributed to the deep, emotion-focused nature of psychodynamic therapy compared to the neurochemical modulation of t DCS. Psychodynamic therapy emphasizes identifying and processing suppressed emotions, reducing unconscious conflicts, and breaking maladaptive defense patterns, thereby improving emotional self-regulation and patient behavior. In contrast, brain stimulation modulates neuronal action potentials and enhances neural firing coordination in sensorimotor regions, aiding behavioral control. For example, t DCS modulates prefrontal cortex activity to improve attention regulation and response inhibition (22).

Conversely, ISTDP fosters more stable change by addressing ego conflicts, emotional processing, reducing ineffective defenses, and enhancing self-regulation (23). According to others (24), t DCS mainly produces temporary physiological effects and lacks the interactive-experiential therapeutic context.

The observed findings may stem from the multidimensional nature of ADHD, encompassing both neurophysiological dysfunctions and complex emotional-cognitive patterns. Each treatment addresses only part of the problem, which may explain the lack of marked difference in effectiveness. This is consistent with recent literature emphasizing the importance of emotional-analytic interventions in ADHD treatment (25).

Intensive short-term dynamic psychotherapy operates at a deeper emotional and relational level and helps reconstruct an integrated self-image (ego) (26). In contrast, transcranial direct current stimulation mainly affects the regulation of neural arousal and temporarily improves cognitive capacities such as attention and working memory but lacks the communicative and reparative components of the therapeutic alliance (27). Brain stimulation enhances dopamine release, which plays a key role in the reward system, motivation, and sustaining attention. Reduced dopamine signaling in the prefrontal cortex causes individuals with ADHD to require more external stimuli to maintain motivation and focus. Norepinephrine is responsible for regulating alertness, filtering distracting stimuli, and enhancing executive functions. Dysfunction in norepinephrine transmission in the prefrontal cortex of patients leads to decreased ability to inhibit inappropriate responses and increased restlessness. Both neurotransmitters play complementary roles in prefrontal cortex circuits. Their reduced efficiency results in imbalance in attention regulation and impulse control (28).

In psychodynamic therapy, based on attachment theory, the ego requires satisfying external relationships and a supportive environment for cohesion and transformation; this factor does not directly occur in brain stimulation processes. Therefore, it can be concluded that psychodynamic therapy, by providing a context for relational and emotional transformation, more sustainably affects personality development (29). Through psychodynamic therapy and focusing on unlocking the unconscious, inhibiting disproportionate responses, and coordinating internal states with the external world, improvement and development occur in affected individuals. Unresolved tensions in the ego and maladaptive defenses that consume mental energy are reduced by this method, freeing cognitive resources (or libido energy). The psychological energy style is reprogrammed and corrected by the therapist, preventing its waste. In this way, the individual's reduced arousal is compensated, and the patient can recognize internal states with greater self-awareness and harmonize them with external conditions (18, 30). In fact, reducing intense emotional reactions facilitates impulse control and inhibition of inappropriate responses. When psychodynamic therapy unlocks unconscious emotions and conflicts, the brain shifts from a defensive and impulsive state, and the freed cognitive resources can be used for mood regulation, impulse control, and better environmental adaptation (31). The mind behaves in a way that resists systemic changes and shows defensive reactions. Psychodynamic therapy can be effective in discovering new patterns, controlling and focusing on reducing impulses and interpersonal conflicts, maintaining motivation, restraining acting out, and integrating personality (25). Psychodynamic therapists manage stress better by creating insight in the patient and corrective emotional experiences, bringing old and current injuries and other suppressed feelings and memories (cellular or implicit memory) back to consciousness (working or verbal memory) for resolution (32). The strong emphasis of psychodynamic therapy on the therapeutic alliance helps reconstruct and create a rich environment for re-experiencing attachment and focusing the patient, which does not occur in brain stimulation treatments. According to attachment theory, improving the sense of trust and experiencing a secure relationship not only provides the foundation for the ego’s fundamental sense of self (self-concept or integrated self-image) but also reduces negative emotions (anger) toward frustrating attachment sources (especially parents). The ego seeks relationships with real external people; if these relationships are satisfying, the ego remains integrated. When the environment is sufficiently supportive, ego transformation processes are modulated and facilitated (33, 34).

It should be noted that the limited sample size and the use of convenience sampling may restrict and compromise the generalizability of the results. Nevertheless, the findings of this study can serve as a foundation for designing combined interventions in psychological clinics and for future research. It is recommended to explore the synergistic effects of different therapeutic approaches to identify more comprehensive treatment pathways for this disorder.

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