Women. Health. Bull. 2025; 12(3)

Published online 2025 July.

Original Article

A Comparison of the Effectiveness of Transcranial Direct Current Stimulation and Hypnotherapy on Rumination, Self-compassion, and Quality of Life in Divorced Women

Ali Nasiri[1], MSc Student; Mohammad Narimani[1], PhD; Esmaeil Sadri Damirchi[2], PhD; Mohammadreza Noroozi Homayoon[2]*, PhD Candidate

[1]Department of Psychology, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran
[2]Department of Counseling, Faculty of Educational Sciences and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran

Corresponding author:* Mohammadreza Noroozi Homayoon, Department of Counseling, Faculty of Education and Psychology, University of Mohaghegh Ardabili, Ardabil, Iran. **Tel: +98-9339412910; **Email:** Mohammadreza.noroozi@uma.ac.ir

Received: December 25, 2024; **Revised:** February 15, 2025; **Accepted:** March 03, 2025

Abstract

Background: The emotional challenges faced by divorced women can significantly affect their mental well-being. This study aimed to evaluate the effectiveness of Transcranial Direct Current Stimulation (tDCS) and hypnotherapy on rumination, self-compassion, and quality of life in divorced women.

Method: This quasi-experimental study used a pre-test, post-test, and control group design. The statistical population consisted of divorced women visiting counseling centers in Ardabil, Iran in 2024. A total of 45 divorced women were selected through convenience sampling. The study participants were randomly assigned to three groups, each consisting of 15 individuals: tDCS, hypnotherapy, and control groups. Each intervention group underwent eight weekly individual sessions. Data collection included the Ruminative Responses Scale (RRS), Self-Compassion Scale (SCS), and the Short Form Health Survey (SF-36). Data were analyzed using analysis of covariance (ANCOVA) and Tukey's post hoc test at a significance level of 0.05 using SPSS version 27.

Results: After controlling the pre-test effects and ensuring that demographic characteristics were homogeneous and non-significant, the post-test scores for rumination, self-compassion, and quality of life in the tDCS group were 53.67±7.65, 65.27±11.07, and 52.80±9.53, respectively. In the hypnotherapy group, these scores were 44.93±3.92, 75.47±9.16, and 58.73±9.51, respectively. The control group had post-test scores of 61.73±5.87, 54.40±10.40, and 39.40±10.89. Tukey's post hoc test confirmed that both tDCS and hypnotherapy significantly affected the dependent variables ($P<0.001$), with hypnotherapy having a greater impact than tDCS.

Conclusions: The findings showed that although both tDCS and hypnotherapy interventions had significant effects on all three dependent variables, the hypnotherapy intervention demonstrated a more substantial and meaningful positive effect compared with transcranial direct current stimulation.

Keywords: tDCS, Hypnotherapy, Rumination, Self-Compassion, Quality of Life

How to Cite: Nasiri A, Narimani M, Sadri Damirchi E, Noroozi Homayoon M. A Comparison of the Effectiveness of Transcranial Direct Current Stimulation and Hypnotherapy on Rumination, Self-compassion, and Quality of Life in Divorced Women. Women. Health. Bull. 2025;12(3):206-217. doi: 10.30476/whb.2025.105249.1333.

1. Introduction

Divorce is one of the most challenging and stressful events in life, significantly impacting individuals' psychological, social, and emotional well-being (1). It is particularly difficult for women, who often face heightened social and cultural pressures in many societies, including Iran (2). Divorced women often face emotional and psychological struggles, leading to mental health issues like anxiety, helplessness, and depression, which can impact their overall well-being (3). The emotional and psychological balance of family members is often disrupted by divorce, and for women, these disruptions are more intricate due to their emotional characteristics and societal expectations (1). Among these challenges, rumination is a common response, acting as a psychological stressor that worsens emotional struggles and impairs problem-solving, playing a key role in understanding the psychological impacts of divorce (4). Repetitive and intrusive thoughts that often dwell on the negative aspects of an event are characteristic of rumination as a cognitive process (5). Among divorced women, rumination can intensify due to the stressful nature of divorce and its associated pressures (1). Research indicated that rumination not only directly contributes to the exacerbation of psychological disorders like depression and anxiety but also disrupts overall

functioning by impairing cognitive-emotional abilities (6). In divorced women, rumination often entails dwelling on past failures, worrying about the future, and feelings of guilt or self-blame. These processes hinder the acceptance of reality and the path toward recovery (7). Addressing negative cognitive and emotional patterns requires fostering positive traits like self-compassion, which can mitigate psychological harm post-divorce and improve quality of life. Divorce often leads to significant psychological challenges, with rumination being a common response. Rumination, the repetitive focus on negative aspects of an event, can worsen emotional struggles and hinder problem-solving (1). In divorced women, this process is amplified by the stress of divorce, contributing to psychological disorders like depression and anxiety (1). To counteract these effects, self-compassion plays a crucial role. By treating oneself kindly during tough times, self-compassion helps reduce psychological harm and improves overall well-being (8). This positive trait acts as a protective factor against divorce-related stress, enhancing emotional regulation and fostering resilience (9). Additionally, addressing rumination and promoting self-compassion are essential for improving the quality of life in divorced women, as these factors significantly impact their emotional recovery and life satisfaction (10).

Various interventions, including transcranial direct current stimulation (tDCS), have been proposed to improve the psychological state and quality of life of divorced women. tDCS is a non-invasive method that uses mild electrical currents to stimulate specific brain areas, potentially affecting rumination, self-compassion, and quality of life. Research showed that tDCS can modulate neural activity in brain regions like the dorsolateral prefrontal cortex (DLPFC), which are linked to rumination and emotional regulation. Stimulating these areas can enhance cognitive-emotional functions and improve the ability to manage negative thoughts (1, 11). Due to its minimally invasive nature and ease of implementation, tDCS has gained attention as an innovative tool for managing psychological problems (12). Studies also supported the efficacy of tDCS in improving rumination, self-compassion, and quality of life (13). For example, Noroozi Homayoon and colleagues (14) demonstrated that cognitive-emotional regulation training combined with tDCS had a positive and significant effect on emotional regulation difficulties, rumination, and quality of life in divorced women. Additionally, the results of Esht and co-workers (15) indicated that tDCS significantly improved quality of life and mental health among stroke survivors. Similarly, Yavari and colleagues (16) showed that tDCS could enhance psychological processes and ultimately promote mental health by increasing self-compassion and reducing rumination.

Another intervention believed to impact the improvement of rumination, self-compassion, and quality of life is hypnotherapy (17). Hypnotherapy involves using psychological techniques such as relaxation and suggestion to access unconscious thoughts and feelings (18). By reducing psychological tension and increasing self-awareness, tDCS can improve self-compassion and quality of life. Similarly, hypnotherapy helps alleviate divorce-related psychological effects by promoting positive thoughts and reducing negative thought patterns (19). Studies showed the efficacy of hypnotherapy in improving rumination, self-compassion, and quality of life. For instance, Khazraee and colleagues (20) demonstrated that mindful hypnosis significantly enhanced self-compassion and psychological well-being in women with major depressive disorder. Similarly, Sharma and Tiwari (21) reported that hypnosis had a significant positive effect on improving psychological health. Moreover, Menon and Baghat (22) found that hypnosis serves as an integrative treatment in reducing psychological problems, increasing self-compassion, and enhancing quality of life. Divorce is a complex, multidimensional issue with significant effects on women's mental, social, and physical well-being, particularly in societies like Iran, where cultural pressures are intensified. Psychological challenges such as depression, anxiety, and rumination are common, and traditional treatments like counseling have had limited success. There is a gap in research regarding innovative interventions like tDCS and hypnotherapy for addressing divorce-related psychological issues. This study aimed to compare the effectiveness of tDCS and hypnotherapy in reducing rumination, enhancing self-compassion, and improving the quality of life in divorced women in Ardabil, Iran where high divorce rates are impacting women's well-being. The study sought to fill the gap in existing literature and offer innovative solutions for this population.

2. Methods

This study employed a quasi-experimental design with pre-test, post-test, and a control group. The statistical population included all divorced women who visited counseling centers in Ardabil, Iran in 2024. The sampling process was carried out by the lead researcher in collaboration with staff at the counseling centers. The participants were selected from those who visited these centers during the recruitment period, based on initial screening and eligibility assessments conducted by the counselors. Eligibility criteria were verified through structured interviews and case histories. The final sample was randomly assigned to three groups using a randomized block design. The random allocation process used random sequences generated for each block to ensure balanced distribution across the groups and minimize bias. This approach ensured an equal number of participants in each group and reduced allocation bias.

The sample size was determined based on a power analysis using G*Power software for ANCOVA, an alpha level of 0.05, and a power of 0.80. The sample size calculation was performed for the primary outcome variable, rumination responses, based on effect sizes reported in a study by Noroozi Homayoon and co-workers in 2025 (1). The analysis indicated that a total of 45 participants (15 per group) would be sufficient to detect statistically significant differences between groups. This sample size also aligns with prior research (1) using ANCOVA for similar interventions, ensuring adequate statistical power while maintaining feasibility in participant recruitment. This study included 45 participants who were randomly assigned to three groups: two experimental groups (hypnotherapy and tDCS) and one control group. Each group consisted of 15 individuals. The participant flow, including eligibility assessment, exclusions, and group assignments, is illustrated in Figure 1.

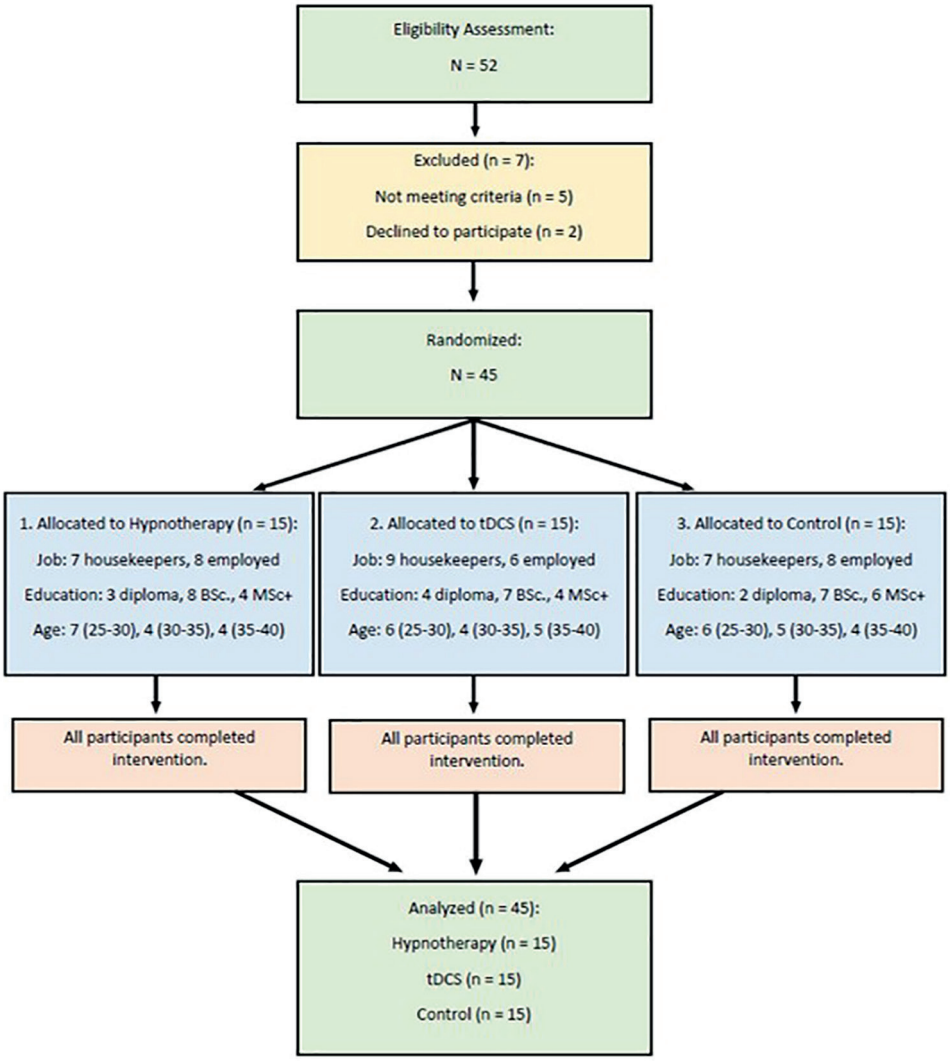

Figure 1: The figure shows the CONSORT flow diagram of the study.

The inclusion criteria were: female gender; maximum of two years since the legal divorce before receiving the intervention; age range of 25 to 40 years; obtaining relevant scores on preliminary screening assessments; absence of psychotic traits based on case history; no metallic objects in the body or head and no intracranial implants; no history of traumatic brain injury or symptoms of dementia; no psychiatric medications (at least one month before the intervention); no history of epilepsy or head trauma; minimum education level of a high school diploma; and willingness to participate in the study. The participants were initially screened by professional counselors at the centers to determine eligibility based on these criteria. The exclusion criteria were: unwillingness to continue participation or missing more than two intervention sessions. Additionally, participants showing adverse reactions during the interventions were excluded to maintain safety and reliability of the study. The participants were assured of confidentiality and anonymity. Information regarding the intervention framework, mechanism of action, and potential side effects was provided to participants and their guardians, and their questions were addressed. The study was conducted over a 12-week period, with interventions starting one week after recruitment and pre-test data collection. All sessions were conducted in private rooms within the counseling centers to ensure comfort and confidentiality.

Before the interventions, participants were asked to complete questionnaires on rumination responses, self-compassion, and quality of life. The participants in the hypnotherapy group attended eight individual sessions lasting 50 minutes each, held weekly. These sessions used Ericksonian techniques focusing on relaxation, visualization, and restructuring negative thought patterns. The mean±SD for rumination responses in this group was 61.47±4.642, for self-compassion 54.87±7.671, and for quality of life 37.80±8.858. The participants in the tDCS group underwent eight 30-minute sessions, also held weekly. Prior to attaching the electrodes, the target area was cleansed with saline solution to enhance conductivity. The electrodes used had a diameter of 5 cm, and a current intensity of 2 mA was applied, with the anode electrode placed over the F3 area and the cathode over the F4 area. Sessions were supervised by a trained technician at the counseling centers in Ardabil, Iran that collaborated with our study to ensure proper application of tDCS and adherence to safety protocols. In the tDCS group, the mean±SD for rumination responses were 61.20±5.784, for self-compassion: 56.07±9.838, and for quality of life: 39.87±8.634. After completing the intervention programs, participants were asked again to complete the same scales measuring rumination responses, self-compassion, and quality of life. The control group, which did not receive any intervention, showed mean±SD scores of 62.67±4.030 for rumination responses, 55.47±8.626 for self-compassion, and 41.00±9.584 for quality of life. Post-intervention feedback was also collected to assess participants' experiences and satisfaction with the process. Analysis of the data was conducted using univariate analysis of covariance (ANCOVA) to compare the effects of the three groups (hypnotherapy, tDCS, and control). ANCOVA was chosen to control for potential pre-test differences between groups and to examine the effects of the interventions on rumination responses, self-compassion, and quality of life. The assumptions for ANCOVA were tested and met. These assumptions included normality using the Shapiro-Wilk test, homogeneity of variance matrices with Levene's test and the Chi-square test was applied to assess the demographic homogeneity of the groups in terms of variables such as age, education level, and employment status, ensuring the observed effects were due to the interventions and not demographic between groups. After controlling for pre-test effects, ANCOVA was conducted at a significance level of 0.05. To further explore significant results, post-hoc comparisons with Bonferroni adjustments were performed to identify group differences. The collected data were analyzed using SPSS version 27 at a significance level of ($P< 0.05$).

2.1. Instruments

2.1.1. Ruminative Responses Scale (RRS): To measure rumination, the Ruminative Responses Scale (RRS) created by Nolen-Hoeksema and Morrow (23) was employed. This scale consists of 22 items rated on a 4-point Likert scale (1=never to 4=always) and assesses the tendency of individuals to engage in repetitive, negative thinking during negative emotional states. The scale includes two major dimensions: Brooding and Reflection. It has been extensively used in research on depression and anxiety, demonstrating strong psychometric properties, with Cronbach's alpha ranging from

0.83 to 0.86 across studies. In domestic studies, this coefficient has been found between 0.88 and 0.92 (24). The concurrent validity of the questionnaire was supported by a significant correlation of 0.55 with the Beck Depression Inventory. The Rumination Response Questionnaire was first standardized in Iran by Bagherinezhad and co-workers, who reported a Content Validity Index (CVI) of 0.84 and a Content Validity Ratio (CVR) of 0.86. Additionally, the Cronbach's alpha coefficient for the scale was reported as 0.84, indicating satisfactory validity (25). In the present study, the overall scale showed a Cronbach's alpha of 0.82.

2.1.2. Self-Compassion Scale (SCS): To assess self-compassion, the Self-Compassion Scale developed by Neff (26) was used. This instrument comprises 26 items scored on a 5-point Likert scale (1=rarely to 5=almost always). The questionnaire evaluates six dimensions of self-compassion: Self-Kindness, Self-Judgment, Common Humanity, Isolation, Mindfulness, and Over-Identification. Scoring involves calculating the mean scores for each dimension as well as an overall score representing the individual's general level of self-compassion. The scale has been widely used in positive psychology research and mindfulness-based therapeutic interventions. Studies reported Cronbach's alpha values ranging from 0.75 to 0.95 for this tool (26). In domestic research, for instance, Khosravi and colleagues (27) reported a Cronbach's alpha of 0.86 for the total scale. In the present study, this coefficient was calculated as 0.89. Azizi and colleagues determined that the Persian version of the scale had a Content Validity Ratio (CVR) of 0.92 and a Content Validity Index (CVI) of 0.90 (28).

2.1.3. Short Form Health Survey (SF-36): To assess quality of life, the Short Form Health Survey (SF-36) developed by Ware (29) was used. This questionnaire consists of 36 items and evaluates eight main dimensions of quality of life: Physical Functioning, Role Limitations Due to Physical Problems, Bodily Pain, General Health, Energy/Fatigue, Social Functioning, Role Limitations Due to Emotional Problems, and Mental Health. Responses are collected on a multi-level Likert scale (varying for each dimension), and the scores for each dimension are converted to a range of 0 to 100, with higher scores indicating better quality of life. The psychometric properties of this tool have been widely validated in various studies, with internal consistency Cronbach's alpha values ranging from 0.70 to 0.95. This tool has been extensively used in international and interdisciplinary medical and psychological research. For example, Banihashmiyan and co-workers (30) reported test-retest reliability and internal consistency coefficients above 0.80. In the present study, the Cronbach's alpha for the total scale was calculated as 0.83. The Content Validity Index (CVI) of the questionnaire was found to be 0.83 in the Iranian population, confirming its validity (31). The questionnaire's validity and reliability were initially assessed in a sample of 4,163 individuals aged 15 and above, with the majority being married. The Content Validity Ratio (CVR) across the eight dimensions ranged from 0.77 to 0.95, with the exception of the vitality dimension, which had a CVR of 0.65. These results validated the Iranian version of the questionnaire as a reliable and valid tool for assessing quality of life in the general population (32). Additionally, the Cronbach's alpha for the overall questionnaire was 0.80, indicating good internal consistency.

2.2. Intervention

2.2.1 Transcranial Direct Current Stimulation (tDCS) Intervention: tDCS is a technique that allows for external manipulation of the human brain in a safe, non-invasive manner without the need for neurosurgery. In this study, the NEUROSTIM-2 dual-channel device, manufactured by Medinatab, was used for transcranial direct current stimulation. This device provides two independent power sources, enabling the use of two separate cathode electrodes and two separate anode electrodes, which increase cortical excitability. The device's output current intensity can be adjusted within the range of 0.1 to 2 mA (33). To prevent chemical reactions caused by electrode contact with the skin, the carbon-based electrodes were covered with sponges soaked in a 0.9% sodium chloride solution at the point of contact. The protocol is described in detail in Table 1.

2.2.2. Ericksonian hypnotherapy intervention: The intervention followed an eight-session protocol aimed at reducing rumination, enhancing self-compassion, and improving quality of life. The protocol integrated indirect suggestion, metaphor, and storytelling, in alignment with the principles established by Erickson (34). The focus was on fostering adaptive coping mechanisms, enhancing self-compassion, and reducing rumination.

Table 1: Description of Transcranial Direct Current Stimulation intervention sessions

Sessions	Description
First	Introduction to tDCS therapy, including an explanation of the procedure, its purpose, and the potential effects on mental clarity and emotional well-being. This session helped participants become familiar with the intervention, fostering initial comfort and engagement.
Second	Baseline stimulation was applied, targeting areas associated with cognitive processing and emotional regulation. Participants were encouraged to relax and reflect on positive thoughts to reduce rumination.
Third	Continued stimulation with a focus on promoting relaxation. Participants were guided to concentrate on self-soothing strategies, indirectly enhancing self-compassion and reducing stress-induced rumination.
Fourth	Emphasis on cognitive clarity, with participants engaging in light mental tasks during stimulation to improve focus and reduce intrusive, ruminative thoughts.
Fifth	Stimulation sessions began focusing on emotional regulation exercises, helping participants address negative self-perceptions and fostering an improved sense of self-compassion.
Sixth	Integration of mindfulness principles during tDCS, encouraging participants to remain present and aware. This session aimed to strengthen both self-compassion and overall quality of life.
Seventh	Continued tDCS application with exercises to reinforce resilience and reduce persistent rumination. This session focused on equipping participants with strategies to maintain emotional balance.
Eighth	Final stimulation session, with a reflective focus on personal progress in reducing rumination, enhancing self-compassion, and improving overall quality of life.

tDCS: Transcranial Direct Current Stimulation

Table 2: Description of Ericksonian hypnotherapy intervention sessions

Sessions	Description
First	Introduction and Rapport Building: The therapist introduced the concept of Ericksonian hypnotherapy, outlined the eight-session protocol, and addressed the client's questions. Relaxation techniques were used to create comfort and a safe environment. This session focused on building rapport and making the client feel at ease for future work.
Second	Exploring the Present and Strengthening Positivity: The therapist helped the client reflect on their challenges while encouraging them to identify personal strengths. Relaxation and visualization techniques were introduced to foster openness and calmness. The session set the stage for addressing deeper emotional concerns.
Third	Addressing Ruminative Thoughts: Using indirect suggestions and metaphors, the therapist helped the client recognize and disrupt cycles of repetitive negative thoughts. Techniques were applied to redirect attention from self-defeating thoughts to more balanced, actionable thinking, reducing emotional distress.
Fourth	Developing Self-Compassion: The therapist used guided imagery and metaphors to help the client develop kindness towards themselves. Negative self-beliefs were reframed, and the client was encouraged to recognize their inherent value. The session aimed at promoting healing and self-acceptance.
Fifth	Reframing Negative Thoughts: Therapist used reframing techniques to help the client reinterpret negative experiences in a more empowering light. Metaphors and confusion strategies were employed to break rigid thought patterns and cultivate a growth mindset.
Sixth	Enhancing Quality of Life: Therapist guided the client through a visualization of their ideal future, focusing on achievable goals. The session emphasized joy, meaning, and empowering the client to take steps toward a fulfilling life.
Seventh	Reinforcing Positive Changes: Therapist reviewed the client's journey, emphasizing the positive changes made. Relaxation and visualization exercises helped strengthen the client's ability to maintain these changes. The session aimed at boosting confidence and readiness to apply the tools learned independently.
Eighth	Consolidating Gains and Preparing for Independence: Therapist reviewed the entire therapy process, celebrating the client's growth. Future-oriented strategies were discussed, and the therapist affirmed the client's ability to thrive beyond therapy. The session focused on preparing the client for independence while maintaining the progress made.

This approach was grounded in Erickson's own work and further elaborated by Zeig (35), providing a flexible framework that could be tailored to individual client needs. The protocol is described in detail in Table 2.

2.3. Statistical Analysis

The data were analyzed using SPSS version 27. To examine group differences in post-test scores, adjusting for baseline values, an Analysis of Covariance (ANCOVA) was performed for each dependent variable (rumination, self-compassion, and quality of life). The assumptions for ANCOVA, including normality, homogeneity of variance, and homogeneity of covariance, were tested using appropriate statistical tests (Kolmogorov-Smirnov, Levene's, and Box's M tests). Chi-square tests were also used to assess the homogeneity of demographic variables (age, education level, and employment status) across the groups. Paired t-tests were conducted to compare pre-test and post-test

scores within each group. Tukey's post hoc test was applied to compare the groups pairwise, given equal sample sizes.

3. Results

The findings were based on the analysis of 45 divorced women from Ardabil, Iran. Table 3 presents participants' demographic information, including age, education level, and employment status. Chi-square tests confirmed no significant differences between the groups in age (χ^2=0.210, P=0.995), education level (χ^2=2.939, P=0.816), and employment status (χ^2=0.711, P=0.701), indicating that any observed differences in outcomes are attributable to the interventions rather than demographic factors.

Table 4 provides descriptive statistics, including means, standard deviations, and significance indicators for within-group and between-group comparisons. The results showed that both

Table 3: Demographic characteristics of participants

Demographic characteristics		Hypnotherapy		Transcranial direct current stimulation		Control		χ2	P value
		Abundance	Percentage	Abundance	Percentage	Abundance	Percentage		
Job	Housekeeper	7	46/7	9	60	7	46/7	0/711	0/701
	Employed	8	53/3	6	40	8	53/3		
Education	Diploma	3	20	4	26/7	2	13/3	2/939	0/816
	BSc	8	53/3	7	46/7	7	46/7		
	MSc+	4	26/7	4	26/7	6	40		
Age	25 to 30	7	46/7	6	40	6	40	0/210	0/995
	30 to 35	4	26/7	4	33/3	5	33/3		
	35 to 40	4	26/7	5	26/7	4	26/7		

BSc: Bachelor of Science; MSc: Master of Science

Table 4: Mean±SD of pre-test and post-test for Ruminative Responses, Self-Compassion and Quality of life

Variables	Phases	Hypnotherapy	Transcranial direct current stimulation	Control	P value (between group)
		Mean±SD	Mean±SD	Mean±SD	
Ruminative Responses	Pre-test	61.47±4.642	61.20±5.784	62.67±4.030	0.682
	Post-test	44.93±3.918	53.67±7.650	61.73±5.873	0.001
P value (within group)		0/001	0/001	0/380	
Self-Compassion	Pre-test	54.87±7.671	56.07±9.838	55.47±8.626	0/932
	Post-test	75.47±9.156	65.27±11.074	54.40±10.405	0.001
P value (within group)		0/001	0/001	0/282	
Quality of life	Pre-test	37.80±8.858	39.87±8.634	41.00±9.584	0/620
	Post-test	58.73±9.513	52.80±9.533	39.40±10.894	0.001
P value (within group)		0/001	0/001	0/217	

SD: Standard Deviation

Table 5: Results of paired comparisons of research variables (Post-test phase)

	Comparison group	Mean difference (MD)	Standard error (SE)	P value	Comparison of adjusted mean difference
Ruminative Responses	Hypnotherapy - Control	-16.80	2.195	0.001	-0.79
	Transcranial direct current stimulation - Control	-8.07	2.195	.0020	-0.20
	Transcranial direct current stimulation - Hypnotherapy	8.73	2.195	0.001	-0.41
Self-Compassion	Hypnotherapy - Control	21.07	3.740	0.001	0.09
	Transcranial direct current stimulation - Control	10.87	3.740	0.016	0.84
	Transcranial direct current stimulation - Hypnotherapy	-10.20	3.740	0.025	-0.69
Quality of life	Hypnotherapy - Control	19.33	3.652	0.001	0.71
	Transcranial direct current stimulation - Control	13.40	3.652	0.002	-0.56
	Transcranial direct current stimulation - Hypnotherapy	-5.93	3.652	0.040	-0.33

SE: Standard Error

intervention groups had significant improvements in all three dependent variables (rumination, self-compassion, and quality of life) from pre-test to post-test. Intervention effects were also significantly different at the post-test stage.

Paired t-tests confirmed that both interventions were effective in improving all dependent variables. Tukey's post hoc test results (Table 5) further indicated that while both interventions were beneficial, the hypnotherapy-based intervention demonstrated significantly greater effectiveness compared with the tDCS-based intervention across all three dependent variables (Table 3).

To compare the groups pairwise, Tukey's post hoc test was used due to equal sample sizes, and the results are displayed in Table 5. The findings indicated that, although both interventions were effective on all three dependent variables, the hypnotherapy-based intervention demonstrated significantly greater effectiveness compared with the tDCS-based intervention across all three dependent variables.

4. Discussion

The aim of the present study was to compare the effectiveness of transcranial direct current stimulation (tDCS) and hypnotherapy on rumination, self-compassion, and quality of life in divorced women. The results of the first hypothesis indicated that tDCS had a positive and significant impact on rumination, self-compassion, and quality of life in divorced women. These findings aligned with the previous studies (1, 13, 15, 16).

To explain these results, it can be stated that tDCS, by applying low-intensity electrical currents to specific brain regions, facilitates the regulation of cortical activity and the reorganization of neural networks. This process, particularly in brain areas associated with cognitive and emotional regulation, such as the dorsolateral prefrontal cortex (DLPFC) and the anterior cingulate cortex (ACC), leads to a reduction in rumination. Rumination, which involves the fixation of negative, maladaptive thoughts, can be disrupted through the reduction of hyperactivity in these regions, allowing individuals to break free from negative thought cycles and focus on more adaptive cognitive strategies. Furthermore, the modulation of DLPFC and ACC activity plays a critical role in enhancing emotional regulation and decreasing stress reactivity. Regarding self-compassion, the effects of tDCS are likely due to its influence on networks related to empathy, self-awareness, and emotional self-regulation, particularly in areas like the medial prefrontal cortex (mPFC) and regions involved in social cognition (36). The stimulation of these areas promotes self-compassion by reducing excessive self-criticism, fostering emotional resilience, and improving one's ability to manage post-divorce challenges such as feelings of isolation and worthlessness (36). Enhanced self-compassion, as a core psychological resource, contributes to greater emotional well-being and can alleviate symptoms of anxiety and depression. Overall, tDCS offers a non-invasive and effective intervention for divorced women facing emotional, social, and economic stressors. It works in conjunction with other psychological approaches to improve quality of life by enhancing cognitive and emotional regulation. The long-term benefits of tDCS in mitigating the negative impacts of past experiences and fostering new adaptive coping mechanisms further underscore its potential as a valuable therapeutic tool in the context of post-divorce psychological health (36). By stimulating brain areas such as the DLPFC, ACC, and mPFC, tDCS enables divorced women to better manage their emotional and cognitive responses, thereby improving their capacity to engage in daily activities, rebuild social relationships, and ultimately enhance their overall life satisfaction (37).

The results of the second hypothesis also indicated that hypnotherapy had a positive and significant impact on rumination, self-compassion, and quality of life in divorced women. These findings were consistent with previous studies (17, 20-22). To explain these results, it can be stated that hypnotherapy, by creating a changed state of consciousness, enables individuals to distance themselves from negative mental and emotional patterns and move toward constructive cognitive processing and positive emotional regulation. Regarding rumination, hypnotherapy can disrupt negative thought cycles and facilitate cognitive restructuring by accessing the unconscious and changing underlying maladaptive beliefs (38). This cognitive restructuring often occurs through the induction of positive suggestions and activation of brain networks related to relaxation, such as the

default mode network, while reducing hyperactivity in stress-related areas, such as the amygdala (38).

In addition, hypnotherapy can play an important role in enhancing self-compassion. Through targeted suggestions, individuals are encouraged to let go of self-critical and harsh attitudes, replacing them with acceptance and self-empathy (39). This process, associated with the activation of neural systems linked to empathy and self-regulation in the medial prefrontal cortex and cingulate regions of the brain, can support divorced women in coping with the psychological and emotional pressures following divorce. Hypnotherapy also reduces excessive self-criticism and fosters positive attitudes toward oneself and life experiences by boosting self-confidence and increasing the sense of control over one's life. Regarding quality of life, the impact of hypnotherapy can be attributed to its combined effects on reducing stress, improving emotional regulation, and increasing the ability to face life challenges. Through enhancing mindfulness skills, hypnotherapy helps divorced women focus on the present moment, rather than dwelling on the past or worrying about the future, which can lead to improved life satisfaction. Additionally, by reducing negative psychological symptoms such as anxiety and depression, hypnotherapy creates a space for psychological and social growth, which can enhance social relationships and increase feelings of belonging to the surrounding environment. Overall, the impact of hypnotherapy in creating lasting changes in the psychological and neural systems related to emotional, cognitive, and social regulation provides a comprehensive explanation for the positive findings of this study (40). This method, as a complementary therapeutic intervention, can serve as an empowering tool for vulnerable groups such as divorced women to cope with life's challenges.

4.1. Limitations

Like many other studies, this research faced several limitations. One of the main limitations was related to the execution of the interventions. The implementation of both tDCS and hypnotherapy required a high level of technical expertise and precise control over the conditions, which presented practical challenges. These challenges included maintaining the consistency of the interventions across participants, ensuring standardized procedures, and addressing the need for individualized adjustments for each participant. Additionally, the study was limited by the difficulty of accessing the target population, as recruiting divorced women in Ardabil, Iran posed logistical barriers, such as the geographic spread of potential participants and societal stigmas surrounding divorce. Moreover, the sample was drawn exclusively from one geographic region, which limits the external validity and generalizability of the findings to other regions with different cultural, social, and economic contexts. These execution-related challenges, combined with limited access to the target population, may have impacted both the consistency of the interventions and the applicability of the results to broader, more diverse groups .To address the study's limitations, future research should expand the sample to include divorced women from diverse geographical regions, social, and cultural backgrounds, allowing for a more comprehensive understanding of tDCS and hypnotherapy's effectiveness across various contexts. Longitudinal studies examining the lasting effects of these interventions on rumination, self-compassion, and quality of life are essential to evaluate the sustainability of their benefits. Additionally, diversifying the sample by including participants from different demographic groups will provide insights into how these interventions impact various subgroups of divorced women. Addressing logistical challenges in recruitment and ensuring the standardization of intervention protocols, particularly for tDCS, are critical for minimizing inconsistencies. Lastly, adapting interventions to cultural norms surrounding divorce in specific regions will enhance their relevance and acceptance.

5. Conclusions

The study results revealed that both tDCS and hypnotherapy have positive and significant effects on rumination, self-compassion, and quality of life in divorced women. These interventions, while effective on their own, can complement each other and serve as valuable psychological tools for divorced women facing emotional challenges. Expanding the sample to other regions, exploring long-term effects, and diversifying the study population are recommended for future research. Practical recommendations include offering training programs that incorporate these modern methods to improve the quality of life for divorced women.

Acknowledgment

We would like to express our sincere gratitude to all those who supported us throughout this research. Additionally, we would like to acknowledge the participants who contributed to the research, as their involvement made this study possible.

Authors' Contribution

Ali Nasiri: Contributed substantially to the conception and design of the study, literature review, data analysis, and statistical interpretation; drafted the manuscript and critically reviewed it for intellectual content. Mohammad Narimani: Contributed substantially to the design and clinical implementation of the interventions; reviewed the manuscript critically for important intellectual content. Esmaeil Sadri Damirchi: Contributed substantially to the design and clinical implementation of the interventions; reviewed the manuscript critically for important intellectual content. Mohammadreza Noroozi Homayoon: Contributed substantially to the conception and design of the study, literature review; drafting the manuscript and reviewed it critically for important intellectual content

Conflict of Interest: None declared.

Funding: None.

Ethical Approval

The Ethics Review Board of Mohaghegh Ardabili University, Ardabili, Iran, approved the present study with the code IR.UMA.REC.1401.041. Also, written informed consent was obtained from all participants.

References

1. Noroozi Homayoon M, Sadri Damirchi E, Sadeghi M, Hatami Nejad M. Comparing the Effectiveness of Cognitive-Emotional Regulation Training and Transcranial Direct Current Stimulation on Difficulty in Regulating Emotions, Rumination and Quality of Life in Divorced Women. Women Health Bull. 2025;12(1):21-29. doi: 10.30476/whb.2024.103315.1300.
2. Broujeni MM, Sajjadian I, Golparvar M. The Effectiveness of the Narrative-Based Acceptance and Commitment Counseling Package on Experiential Avoidance, Affective Capital and Desire to Divorce in Women on the Verge of Divorce. Psychology of Woman Journal. 2024;5(1):23-35. doi: 10.61838/kman.pwj.5.1.3.
3. Alibudbud R, Smith A, Liebrenz M, Arnado JM. Reframing divorce as a mental health policy issue in the Philippines. Lancet Psychiatry. 2024;11(4):241-242. doi: 10.1016/S2215-0366(24)00002-6. PubMed PMID: 38301675.
4. Ciobotaru D, Jones CJ, Cohen Kadosh R, Violante IR, Cropley M. "Too much of a burden": Lived experiences of depressive rumination in early adulthood. J Couns Psychol. 2024;71(4):255-267. doi: 10.1037/cou0000740. PubMed PMID: 38815103.
5. Park H, Kuplicki R, Paulus MP, Guinjoan SM. Rumination and Over-Recruitment of Cognitive Control Circuits in Depression. Biol Psychiatry Cogn Neurosci Neuroimaging. 2024;9(8):800-808. doi: 10.1016/j.bpsc.2024.04.013. PubMed PMID: 38703822; PubMed Central PMCID: PMC11305927.
6. Arana FG, Rice KG, Aiello M. A cross-cultural look at the role of rumination in the relationship between trait anxiety and romantic breakup distress. European Journal of Trauma & Dissociation. 2024;8(1):100376. doi: 10.1016/j.ejtd.2023.100376.
7. Erduran Tekin Ö, Şirin A. Rumination Mediates the Relationship Between Childhood Traumas with Cognitive Defusion, Acceptance, and Emotion Regulation: A Qualitative and Quantitative Study. J Ration Emot Cogn Behav Ther. 2023;41(4):1-28. doi: 10.1007/s10942-023-00503-4. PubMed PMID: 37360921; PubMed Central PMCID: PMC10081932.
8. Saberi F, Mahdi MA, Kazemi AS. The Effect of Compassion-Based Therapy on Women's Mental Health After Divorce. International Journal of New Findings in Health and Educational Sciences (IJHES). 2024;2(3):78-90. doi: 10.63053/ijhes.90.
9. Putri TA, Kurniawan R. Gambaran Self-Compassion pada Wanita yang Pernah Mengalami Dating Violence: Sebuah Pendekatan Fenomenologi. ALSYS. 2024;4(6):805-819. doi: 10.58578/alsys.v4i6.4010.
10. Rakhshani T, Amirsafavi M, Motazedian

N, Harsini PA, Kamyab A, Jeihooni AK. Association of quality of life with marital satisfaction, stress, and anxiety in middle-aged women. Front Psychol. 2024;15:1357320. doi: 10.3389/fpsyg.2024.1357320. PubMed PMID: 39291177; PubMed Central PMCID: PMC11405199.

11. Noroozi Homayoon M, Almasi M, Sadri Damirchi E, Hatami Nejad M. Comparing the Effectiveness of Transcranial Direct Current Stimulation and Repeated Transcranial Magnetic Stimulation Treatment on Working Memory, Impulsivity and Self-Harm Behaviors in People with Borderline Personality. Neuropsychology. 2023;8(31):1-19. doi: 10.30473/clpsy.2023.65222.1678. Persian.
12. Almasi M, Noroozi Homayoon M, Rezaei sharif A. The Effectiveness of Neurofeedback Therapy and Transcranial Direct Current Stimulation in Cognitive Dominance of Children with Attention Deficit/ Hyperactivity Disorder. Neuropsychology. 2021;7(25):111-130. doi: 10.30473/clpsy.2021.59266.1603. Persian.
13. Subramaniam A, Liu S, Lochhead L, Appelbaum LG. A systematic review of transcranial direct current stimulation on eye movements and associated psychological function. Rev Neurosci. 2022;34(3):349-364. doi: 10.1515/revneuro-2022-0082. PubMed PMID: 36310385.
14. Noroozi Homayoon M, Akhavi Samarein Z, Sadeghi M, Hatami Nejad M, Jafari Moradlo M. Comparing the efficacy of emotion-focused therapy and transcranial direct current stimulation on impulsivity, emotional regulation, and suicidal ideation in young people with borderline personality disorder. Journal of Research in Psychopathology. 2025;6(1):33-42. doi: 10.22098/jrp.2024.14488.1221.
15. Esht V, Alshehri MM, Balasubramanian K, Sanjeevi RR, Shaphe MA, Alhowimel A, et al. Transcranial direct current stimulation (tDCS) for neurological disability among subacute stroke survivors to improve multiple domains in health-related quality of life: Randomized controlled trial protocol. Neurophysiol Clin. 2024;54(3):102976. doi: 10.1016/j.neucli.2024.102976. PubMed PMID: 38663043.
16. Yavari F, Chhabra H, Polania R, Nitsche MA. Mechanisms of action of transcranial direct current stimulation. Interventional Psychiatry. Elsevier; 2024. p. 149-86. doi: 10.1016/B978-0-443-18496-3.00006-9.
17. Pdl P, Hasanah N, Rahmawati NAL. A Systematic Review of the Effect of Self-Hypnosis on Quality of Life in Breast Cancer Patients. International Journal of Advanced Health Science and Technology. 2024;4(3). doi: 10.35882/ijahst.v4i3.335.
18. Pang JWV, Subramaniam P, Amit N, Wahab S, Moustafa AA. Hypnotherapy as treatment for depression: A scoping review. Int J Clin Exp Hypn. 2024;72(2):155-188. doi: 10.1080/00207144.2024.2317193. PubMed PMID: 38416132.
19. Talaeezadeh M, Saadi ZE, Heydari A, Joharifard R. Comparing the Effectiveness of" Hypnotherapy" and" Schema Therapy" on Mental Health in Men and Women Who Have Been Marital infidelity in Tehran. Journal of Health Promotion Management. 2023;12(3):65-81. doi: 10.22034/JHPM.12.3.63. Persian.
20. Khazraee H, Bakhtiari M, Kianimoghadam AS, Ghorbanikhah E. The effectiveness of mindful hypnotherapy on depression, self-compassion, and psychological inflexibility in females with major depressive disorder: A single-blind, randomized clinical trial. Int J Clin Exp Hypn. 2023;71(1):63-78. doi: 10.1080/00207144.2022.2160257. PubMed PMID: 36715628.
21. Sharma S, Tiwari P. A systematic review on role of hypnotherapeutic intervention in promoting positive psychological health. International Journal of Health Sciences. 2022;6(S2):4672-4689. doi: 10.53730/ijhs.v6nS2.6123.
22. Menon S, Bhagat V. The role of integrative clinical hypnotherapy interventions and their place in modern medical and psychological treatment: A review study. Research Journal of Pharmacy and Technology. 2022;15(9):4333-40. doi: 10.52711/0974-360X.2022.00727.
23. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. Journal of Personality and Social Psychology. 1991;61(1):115-121. doi: 10.1037/0022-3514.61.1.115.
24. Kazemi N, Arjmandnia AA, Moradi R, Mohammadi S, Sadeghi fard M. The effectiveness of self compassion training program on psychological well-being and rumination of the Mothers of Children with Special Learning Disabilities. Rooyesh. 2020;9(1):27-36. Persian.

25. Bagherinezhad M, Salehi Fadardi J, Tabatabayi SM. The relationship between rumination and depression in a sample of Iranian student. Foundations of Education. 2010;11(1):21-38. doi: 10.22067/fe.v11i1.2246. Persian.
26. Neff KD. The development and validation of a scale to measure self-compassion. Self and Identity. 2003;2(3):223-250. doi: 10.1080/15298860309027.
27. Khosravi S, Sadeghi M, Yabandeh MR. Psychometric Properties of Self-Compassion Scale (SCS). Psychological Models and Methods. 2013;4(13):47-58. Persian.
28. Azizi A, Mohammadkhani P, Foroughi AA, Lotfi S, Bahramkhani M. The validity and reliability of the Iranian version of the Self-Compassion Scale. PCP. 2013;1(3):149-155.
29. Ware JE. SF-36 Health Survey: Manual and Interpretation Guide. Boston: Health Institute; 1993.
30. Banihashmiyan K, Bahrami Ehsan H, Moazen M. Relation between head masters' general health and emotional intelligence and job satisfaction of teachers. Journal of Behavioral Sciences. 2010;4(1):45-50. Persian.
31. Rostami M, Abolghasemi A, Narimani M. The effectiveness of quality of life therapy on quality of life in maladjustment couples. Pajouhan Sci J. 2016;15(1):19-27. doi: 10.21859/psj-15013. Persian.
32. Montazeri A, Goshtasebi A, Vahdaninia MS. The Short Form Health Survey (SF-36): translation and validation study of the Iranian version. Payesh (Health Monitor). 2006;5(1):50-56. Persian.
33. Surowka AD, Ziomber A, Czyzycki M, Migliori A, Kasper K, Szczerbowska-Boruchowska M. Molecular and elemental effects underlying the biochemical action of transcranial direct current stimulation (tDCS) in appetite control. Spectrochim Acta A Mol Biomol Spectrosc. 2018;195:199-209. doi: 10.1016/j.saa.2018.01.061. PubMed PMID: 29414579.
34. Erickson MH. Hypnotherapy: An exploratory casebook; 1979.
35. Zeig JK. Ericksonian approaches to hypnosis and psychotherapy; 1982.
36. Meinzer M, Shahbabaie A, Antonenko D, Blankenburg F, Fischer R, Hartwigsen G, et al. Investigating the neural mechanisms of transcranial direct current stimulation effects on human cognition: current issues and potential solutions. Front Neurosci. 2024;18:1389651. doi: 10.3389/fnins.2024.1389651. PubMed PMID: 38957187; PubMed Central PMCID: PMC11218740.
37. Bouchard AE, Renauld E, Fecteau S. Changes in resting-state functional MRI connectivity during and after transcranial direct current stimulation in healthy adults. Front Hum Neurosci. 2023;17:1229618. doi: 10.3389/fnhum.2023.1229618. PubMed PMID: 37545594; PubMed Central PMCID: PMC10398567.
38. Haipt A, Rosenbaum D, Fuhr K, Batra A, Ehlis A-C. Differential effects of hypnotherapy and cognitive behavioral therapy on the default mode network of depressed patients. Front Psychol. 2024;15:1401946. doi: 10.3389/fpsyg.2024.1401946. PubMed PMID: 38993341; PubMed Central PMCID: PMC11238146.
39. Leo DG, Keller SS, Proietti R. "Close your eyes and relax": the role of hypnosis in reducing anxiety, and its implications for the prevention of cardiovascular diseases. Front Psychol. 2024;15:1411835. doi: 10.3389/fpsyg.2024.1411835. PubMed PMID: 39035095; PubMed Central PMCID: PMC11258040.
40. Ozgunay SE, Kasapoglu Aksoy M, Deniz KN, Onen S, Onur T, Kilicarslan N, et al. Effect of hypnosis on pain, anxiety, and quality of life in female patients with fibromyalgia: Prospective, randomized, controlled study. Int J Clin Exp Hypn. 2024;72(1):51-63. doi: 10.1080/00207144.2023.2277853. PubMed PMID: 38060828.