

The Effectiveness of Dialectical Behavior Therapy on Treatment Adherence, Quality of Life, and Emotion Regulation in Hemodialysis Patients

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Article type:
Original Research

Article history:

Received 07 June 2026

Revised 12 June 2026

Accepted 11 September 2026

Initial Publish 15 September 2026

Published online 01 May 2027

ABSTRACT

This study aimed to determine the effectiveness of Dialectical Behavior Therapy (DBT) on treatment adherence, quality of life, and emotion regulation in patients undergoing hemodialysis. This quantitative applied study used a quasi-experimental pretest-posttest design with a one-month follow-up and a control group. The statistical population consisted of patients undergoing regular hemodialysis at Shahid Labbafinejad Hospital in Tehran in 2024. Thirty eligible patients were selected through convenience sampling and randomly allocated to an experimental group receiving DBT ($n = 15$) and a control group ($n = 15$). The experimental group received eight weekly 90-minute group-based DBT sessions, whereas the control group received no psychological intervention during the study period. Data were collected using the End-Stage Renal Disease Adherence Questionnaire, Kidney Disease Quality of Life Questionnaire, and Gross and John Emotion Regulation Questionnaire. Data were analyzed in SPSS version 26 using mixed-design analysis of variance and Bonferroni-adjusted pairwise comparisons at a significance level of .05. Mixed-design analyses indicated significant effects of time and significant time-by-group interactions for treatment adherence, quality of life, and emotion regulation, showing that changes across pretest, posttest, and follow-up differed significantly between the DBT and control groups ($p < .05$). Bonferroni-adjusted comparisons showed significantly higher treatment adherence in the DBT group than in the control group (mean difference = 4.20, $p = .030$), significantly higher quality of life (mean difference = 7.11, $p = .010$), and significantly better emotion regulation (mean difference = 5.57, $p = .001$). The intervention effects were largely maintained at the one-month follow-up. DBT appears to be an effective psychological intervention for improving treatment adherence, quality of life, and emotion regulation among patients undergoing hemodialysis, with beneficial effects persisting over the short-term follow-up period.

Keywords: Dialectical Behavior Therapy, Treatment Adherence, Quality of Life, Emotion Regulation, Hemodialysis, Chronic Kidney Disease

How to cite this article:

Ghaderi Dehpahani, A., Leilabadi, L., & Sabet, M. (2027). The Effectiveness of Dialectical Behavior Therapy on Treatment Adherence, Quality of Life, and Emotion Regulation in Hemodialysis Patients. *Mental Health and Lifestyle Journal*, 5(3), 1-18. <https://doi.org/10.61838/mhlj.306>

Introduction

Chronic kidney disease is a progressive and multidimensional health condition that imposes a substantial burden on patients, families, and health systems because of its long-term clinical course, high treatment demands, and wide-ranging physical and psychosocial consequences. In advanced stages, particularly when kidney function declines to the point at which renal replacement therapy is required, patients may become

dependent on maintenance hemodialysis for survival. Contemporary clinical guidelines emphasize that the management of chronic kidney disease should extend beyond biochemical and physiological indices and should incorporate patient-centered outcomes, functional status, psychosocial well-being, treatment participation, and quality of life as integral components of care (1). Although hemodialysis can prolong life and reduce complications related to advanced renal failure, the treatment itself introduces a demanding routine characterized by frequent hospital attendance, dietary and fluid restrictions, medication regimens, physical fatigue, uncertainty about prognosis, and limitations in social and occupational activities. Consequently, patients undergoing hemodialysis frequently encounter difficulties not only in maintaining adherence to treatment but also in preserving psychological balance and an acceptable quality of life.

Treatment adherence is one of the most clinically important challenges in the management of patients receiving maintenance hemodialysis. Adherence in this population is not limited to attendance at dialysis sessions; rather, it includes multiple interrelated behaviors such as following prescribed dialysis schedules, taking medications appropriately, controlling fluid intake, and complying with dietary restrictions. The End-Stage Renal Disease Adherence Questionnaire was specifically developed to capture these different domains and to provide a structured assessment of behavioral adherence among patients receiving in-center hemodialysis (2). Adherence is particularly important because deviations from recommended regimens may contribute to fluid overload, metabolic imbalance, increased symptom burden, preventable hospitalization, and poorer long-term outcomes. At the same time, adherence behavior is affected by a complex interaction of knowledge, motivation, emotional state, self-regulatory capacity, perceived burden of treatment, and environmental constraints. Thus, nonadherence in hemodialysis should not be understood merely as a lack of information or unwillingness to cooperate; rather, it may reflect the psychological and behavioral difficulty of sustaining demanding self-management behaviors over prolonged periods.

Recent evidence has increasingly highlighted the need for structured behavioral approaches to improve treatment adherence in chronic kidney disease. A systematic review and meta-analysis of behavioral interventions targeting adherence in chronic kidney disease demonstrated that adherence can be influenced through organized behavioral strategies, particularly when interventions address the practical and psychological determinants of treatment participation rather than relying exclusively on routine medical instruction (3). Similarly, patient education has been shown to improve adherence to treatment regimens and may also contribute to better quality of life among patients undergoing hemodialysis, suggesting that modifiable cognitive and behavioral processes play an important role in treatment outcomes (4). Nevertheless, education alone may be insufficient for patients whose nonadherence is closely related to emotional distress, avoidance, frustration, treatment fatigue, or difficulties in regulating negative affect. This limitation supports the need for interventions that combine behavioral skill development with strategies for managing distressing internal experiences.

Quality of life constitutes another major concern in the care of patients undergoing hemodialysis. The concept is multidimensional and encompasses physical functioning, psychological health, social participation, perceived disease burden, symptoms, sleep, cognitive functioning, work-related limitations, and satisfaction with care. The Kidney Disease Quality of Life instrument was developed to assess both general health-related quality of life and dimensions specifically associated with kidney disease, thereby recognizing that conventional generic health measures may not fully capture the lived experience of renal

patients (5). More recent systematic evidence confirms that quality of life remains a central patient-reported outcome in dialysis research and clinical practice and that the selection of appropriate instruments is essential because the effects of dialysis extend across several distinct domains of functioning (6). For many patients, repeated dialysis sessions, chronic fatigue, symptom fluctuations, dietary limitations, concerns about dependency, employment disruption, and reduced autonomy can accumulate over time and diminish perceived well-being even when medical treatment is technically successful.

Psychosocial interventions may therefore represent an important complement to conventional nephrological care. Evidence from systematic reviews and meta-analyses suggests that psychosocial interventions can reduce psychological distress and improve quality of life among patients receiving hemodialysis (7). Likewise, psychoeducational interventions have demonstrated beneficial effects on psychological distress and health-related quality of life in patients undergoing maintenance hemodialysis (8). These findings indicate that quality of life in renal disease is not determined solely by disease severity or dialysis adequacy. Psychological processes, coping resources, emotion regulation, perceived control, and adaptation to chronic illness may substantially influence how patients experience and manage the demands of treatment. Accordingly, interventions that strengthen adaptive psychological skills may produce clinically meaningful benefits even when they do not directly alter the underlying renal pathology.

Emotion regulation is particularly relevant in this context because patients undergoing chronic medical treatment are repeatedly exposed to emotionally demanding situations. Emotion regulation refers to the processes through which individuals influence which emotions they experience, when they experience them, and how these emotions are expressed or modulated. Gross and John distinguished commonly used strategies such as cognitive reappraisal and expressive suppression and demonstrated that individual differences in emotion regulation are meaningfully related to affective experience, interpersonal functioning, and well-being (9). In chronic illness, effective emotion regulation may facilitate adaptation to distress, support more constructive coping, and reduce the likelihood that intense negative emotions will disrupt self-management behavior. Conversely, persistent emotional suppression, avoidance, uncontrolled distress, and rigid responses to negative experiences may interfere with treatment adherence and contribute to deterioration in perceived quality of life.

The relationship among coping, emotion regulation, and quality of life has been directly examined among dialysis patients. Barberis and colleagues found that emotion regulation and coping processes were meaningfully associated with quality of life in patients receiving dialysis, emphasizing that psychological adaptation may mediate how patients respond to the persistent demands of renal treatment (10). This relationship is clinically plausible because adherence behaviors often need to be maintained precisely when patients are experiencing fatigue, anger, hopelessness, anxiety, frustration, or a sense of restriction. A patient may understand the importance of limiting fluid intake or adhering to dialysis schedules but may still experience difficulty implementing these behaviors when emotional distress is high. Accordingly, therapeutic interventions that improve awareness of emotional states, increase distress tolerance, reduce impulsive responses, and strengthen adaptive regulation skills may have effects that extend beyond psychological symptoms to observable health-related behaviors.

Emotion regulation has therefore become an important target of psychological intervention across a wide range of clinical populations. A systematic umbrella review of interventions targeting emotion regulation

found substantial evidence supporting the therapeutic relevance of structured approaches designed to improve regulatory processes, although effects vary according to population, intervention type, and specific regulatory mechanism (11). Among the interventions explicitly designed to address emotion dysregulation, Dialectical Behavior Therapy has received particular attention. Originally developed as a comprehensive treatment for severe emotion dysregulation, DBT integrates behavioral principles with acceptance-based strategies and emphasizes the acquisition and repeated practice of concrete skills. The standard DBT skills framework includes mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness, with a broader therapeutic emphasis on balancing acceptance with behavioral change (12). These components may be especially relevant for patients living with chronic diseases in which many external stressors cannot be completely removed and adaptive functioning requires both acceptance of unavoidable limitations and active modification of controllable behaviors.

DBT may be particularly suitable for medically ill populations because it does not require the elimination of all distress before adaptive behavior can occur. Instead, patients are trained to notice internal experiences, tolerate difficult emotions without resorting to ineffective responses, identify and label emotional states, regulate behavioral reactions, and choose actions that are more consistent with longer-term goals. Such skills may be highly relevant to hemodialysis patients, who often face recurring stressors that cannot simply be cognitively or environmentally eliminated. The necessity of attending frequent dialysis sessions, tolerating physical discomfort, restricting fluid consumption, taking multiple medications, and living with uncertainty can evoke repeated emotional responses. In this context, mindfulness may enhance awareness of automatic reactions, distress-tolerance skills may support persistence during difficult treatment periods, and emotion-regulation strategies may reduce the disruptive effects of negative affect on self-care behavior.

Evidence from other chronic medical conditions provides preliminary support for the broader application of DBT skills beyond its original psychiatric indications. Tavakoli and colleagues reported that DBT was effective in improving treatment adherence and self-care behavior among patients with coronary heart disease, suggesting that DBT-based skills may influence health-related behavior in chronic medical populations (13). More recently, an adapted DBT skills-training protocol was examined among patients with metastatic non-small cell lung cancer, with findings supporting the feasibility of applying DBT-oriented methods in a population experiencing substantial disease burden and emotional stress (14). These applications are important because they suggest that DBT skills can be adapted to the practical and emotional realities of serious physical illness rather than being restricted to conventional psychiatric treatment settings.

Further support for the transdiagnostic potential of DBT comes from research on other chronic health conditions characterized by persistent distress. A randomized clinical trial of online DBT for people with chronic pain demonstrated that DBT-based intervention can be used to target emotion dysregulation in individuals living with an enduring physical condition and associated psychological burden (15). Chronic pain and chronic kidney disease differ substantially in pathophysiology and treatment; however, both may involve persistent symptoms, functional restrictions, uncertainty, frustration, and difficulty maintaining adaptive behaviors over time. These shared features strengthen the rationale for investigating whether DBT skills can enhance psychological adaptation among patients undergoing hemodialysis.

Despite the growing evidence supporting psychosocial and behavioral interventions in kidney disease, important gaps remain. Much of the existing hemodialysis literature has focused on psychoeducation, general psychosocial interventions, or broad behavioral adherence strategies (3, 4, 7, 8). These approaches are clinically valuable, but they do not necessarily target emotion dysregulation as a central mechanism. At the same time, the association between emotion regulation and quality of life in dialysis patients suggests that regulatory processes may represent an important therapeutic target (10). Furthermore, although DBT has shown promise for improving adherence in coronary heart disease and for addressing emotional difficulties in other chronic medical populations, evidence regarding its application in patients undergoing hemodialysis remains comparatively limited (13-15). This gap is especially relevant because hemodialysis requires unusually intensive and sustained behavioral adherence while simultaneously exposing patients to recurrent physical and emotional stressors.

A DBT-based intervention for hemodialysis patients may therefore have the potential to influence several interrelated outcomes at the same time. Improved mindfulness and emotion recognition may enhance patients' awareness of emotional triggers associated with nonadherence. Distress-tolerance strategies may help patients remain engaged with difficult aspects of treatment without relying on avoidance or impulsive behavior. Emotion-regulation skills may reduce the intensity or duration of negative emotional reactions and thereby support more consistent self-management. Over time, more effective self-regulation and better treatment adherence may also contribute to a stronger sense of control, improved daily functioning, and enhanced quality of life. Such a multidimensional intervention is conceptually consistent with contemporary chronic kidney disease care, which increasingly emphasizes comprehensive, patient-centered management rather than exclusive reliance on biomedical outcomes (1).

The simultaneous examination of treatment adherence, quality of life, and emotion regulation is therefore important because these variables capture complementary aspects of adaptation to hemodialysis. Treatment adherence reflects behavioral engagement with the prescribed medical regimen; quality of life reflects the broader subjective and functional impact of the disease and its treatment; and emotion regulation reflects a psychological process that may influence both behavior and well-being. Validated measures are available for each of these domains, including the End-Stage Renal Disease Adherence Questionnaire for hemodialysis-related adherence, the Kidney Disease Quality of Life instrument for disease-specific and general quality of life, and established measures derived from the emotion-regulation framework of Gross and John (2, 5, 9). Assessing these outcomes across pre-intervention, post-intervention, and follow-up stages can provide a more complete understanding of both the immediate and short-term sustained effects of DBT.

Given the cumulative physical burden of hemodialysis, the psychological demands of long-term renal treatment, the established importance of adherence and quality of life, the role of emotion regulation in adaptation to dialysis, and the emerging evidence supporting DBT skills in chronic medical populations, evaluating DBT in patients undergoing hemodialysis is both clinically and theoretically warranted. Therefore, the aim of the present study was to determine the effectiveness of Dialectical Behavior Therapy on treatment adherence, quality of life, and emotion regulation in patients undergoing hemodialysis.

Methods and Materials

Study Design and Participants

The present study employed a quantitative, applied, quasi-experimental design with a pretest, posttest, and one-month follow-up involving an experimental group and a control group. The study was considered applied because its findings were intended to contribute directly to the improvement of psychological interventions and supportive care for patients undergoing hemodialysis. The quasi-experimental design was selected because complete experimental control over all clinical and individual variables was not feasible in the hospital setting. At the pretest stage, both groups were assessed simultaneously under comparable conditions using the study instruments. Subsequently, participants in the experimental group received Dialectical Behavior Therapy (DBT), whereas participants in the control group received no psychological intervention during the study period and continued to receive their routine medical care. After completion of the intervention, both groups completed the posttest assessments, and one month later, the same measures were administered again as a follow-up assessment to determine the maintenance of treatment effects over time.

The statistical population consisted of all adult patients with chronic kidney failure undergoing regular hemodialysis at the dialysis unit of Shahid Labbafinejad Hospital in Tehran during 2024. According to the records of the dialysis unit, approximately 120 patients with chronic renal failure requiring regular hemodialysis, generally two to three sessions per week, were receiving treatment at the center during the study period. The accessible population included both male and female adult patients, most of whom had undergone continuous hemodialysis for at least six months. Participants were selected through convenience sampling from eligible patients attending the dialysis unit. Although an initial power analysis was performed using G*Power version 3.1 with a significance level of .05, statistical power of .80, and a medium effect-size assumption, the final operational sample was determined in accordance with the clinical accessibility of eligible patients, feasibility of participation in repeated group sessions, inclusion and exclusion criteria, and the possibility of completing the follow-up assessment. Accordingly, 30 eligible patients were recruited and allocated randomly to two equal groups consisting of 15 participants in the DBT experimental group and 15 participants in the control group. Equal group allocation was used to improve the efficiency and interpretability of between-group and within-group statistical comparisons.

Eligibility criteria included a diagnosis of renal failure requiring hemodialysis, an age between 30 and 60 years, at least lower-secondary education, provision of informed consent and willingness to participate in the study, a minimum of six months of regular hemodialysis, no history of psychiatric hospitalization, no current substance abuse, no use of psychiatric medication during the two months preceding the first intervention session, and no participation in psychological treatment during the two months preceding enrollment. Patients were also required to possess sufficient physical, cognitive, auditory, and communicative capacity to participate in group sessions and complete the questionnaires. Participation in another concurrent psychological training or psychotherapy program was not permitted during the intervention period. Exclusion criteria consisted of absence from more than two intervention sessions, withdrawal of consent or unwillingness to continue treatment, development of a condition that prevented continued participation, or loss of any of the principal eligibility conditions during the study.

The study was conducted after obtaining authorization from Shahid Labbafinejad Hospital and approval from the relevant university research ethics committee under the ethics code IR.IAU.TNB.REC.1404.402. Eligible patients were informed about the aims, procedures, possible benefits, voluntary nature of participation, and confidentiality provisions before written informed consent was obtained. Personal identifiers were replaced with research codes, and collected information was used exclusively for scientific purposes. Participants were informed that they could withdraw from the research at any stage without any consequence for their routine medical treatment. The study procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki. To ensure fairness, members of the control group were informed that, after completion of the research process, a comparable psychological training program could be made available to them if they wished to receive it.

Data Collection Tools

End-Stage Renal Disease Adherence Questionnaire. Treatment adherence was assessed using the self-report adherence instrument developed by Kim in 2010 for patients with end-stage renal disease. The questionnaire consists of 46 items organized into five sections. The first section contains five items assessing general information, the second includes 14 items concerning attendance at scheduled hemodialysis sessions, the third contains nine items addressing adherence to prescribed medications, the fourth includes 10 items assessing compliance with fluid restrictions, and the fifth consists of eight items related to adherence to dietary restrictions. Responses to the adherence items are scored using a five-point Likert-type format ranging from 1, indicating nonadherence, to 5, indicating complete adherence, with higher scores representing better compliance with the prescribed treatment regimen. According to the scoring framework of the instrument, adherence scores may also be interpreted relative to the sample mean and standard deviation to identify relatively low, moderate, and high levels of treatment adherence. The psychometric properties of the questionnaire have previously been evaluated among Iranian patients. In the study by Rafiei Vardanjani and colleagues, a content-validity coefficient of approximately .98 was reported, indicating satisfactory content validity for the Persian form of the instrument.

Kidney Disease Quality of Life Questionnaire. Quality of life was measured using the Kidney Disease Quality of Life questionnaire developed by Hays and colleagues. The instrument contains 79 items and assesses both kidney disease-specific and general health-related dimensions of quality of life. Disease-specific dimensions include symptoms and problems, effects of kidney disease on daily life, burden of kidney disease, work status, cognitive functioning, quality of social interactions, sexual functioning, sleep, social support, dialysis staff encouragement, patient satisfaction, and overall health rating. General health dimensions include physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. According to the standardized scoring procedure, scores for individual domains are transformed to a scale ranging from 0 to 100, with higher values representing a more favorable health-related quality of life. For example, items assessing physical functioning evaluate the extent to which the patient is restricted in performing routine activities, with greater scores representing fewer limitations and better physical functioning. The Persian version of the questionnaire has previously undergone translation and psychometric evaluation, with evidence supporting its face validity, content validity, and reliability.

Research conducted in Iranian samples has reported a split-half reliability coefficient of approximately .90, whereas the original psychometric investigations reported internal-consistency coefficients generally ranging from approximately .61 to .90 across the different subscales.

Emotion Regulation Questionnaire. Emotion regulation was assessed using the Emotion Regulation Questionnaire developed by Gross and John in 2003. This 10-item self-report measure evaluates two major emotion-regulation strategies: cognitive reappraisal and expressive suppression. Six items assess cognitive reappraisal, comprising Items 1, 3, 5, 7, 8, and 10, whereas four items assess expressive suppression, comprising Items 2, 4, 6, and 9. Each item is rated on a seven-point Likert scale ranging from 1, “strongly disagree,” to 7, “strongly agree.” Scores for cognitive reappraisal can range from 6 to 42, scores for expressive suppression from 4 to 28, and the overall summed score from 10 to 70 when a total score is used, with higher scores indicating greater endorsement of the corresponding emotion-regulation strategies. In the original study, Cronbach's alpha coefficients of approximately .79 for cognitive reappraisal and .73 for expressive suppression were reported, with satisfactory overall reliability. Subsequent studies have also provided evidence for temporal stability and criterion-related validity. The Persian version has demonstrated acceptable psychometric properties in Iranian samples, although reliability coefficients have varied across the two subscales, with generally stronger internal consistency for the total scale and cognitive reappraisal than for expressive suppression.

Intervention

Participants allocated to the experimental group received a group-based Dialectical Behavior Therapy intervention adapted to the psychological and emotional needs of patients undergoing hemodialysis. The intervention consisted of eight weekly sessions, each lasting approximately 90 minutes, and was implemented by the researcher as a trained therapist under clinical supervision. The intervention was based on Linehan's DBT skills-training framework and was adapted to accommodate the medical burden, emotional distress, treatment restrictions, and physical limitations commonly experienced by patients receiving long-term hemodialysis. The treatment content and sequence were reviewed before implementation to ensure clinical appropriateness and consistency with the study population. The first session included introduction of the participants, explanation of the aims and structure of the program, establishment of group rules, and introduction to mindfulness and the distinction among reasonable mind, emotion mind, and wise mind. The second session focused on core mindfulness skills, including the “what” skills of observing, describing, and participating and the “how” skills of adopting a nonjudgmental stance, acting with awareness, and acting effectively. The third session introduced distress-tolerance strategies based on distraction and attentional redirection, including DBT-based ACCEPTS and IMPROVE skills. The fourth session focused on self-soothing through the five senses as a means of reducing acute emotional and physiological distress. The fifth session addressed strategies for improving difficult moments and applying cost-benefit analysis to maladaptive behavioral responses. The sixth session covered acceptance-oriented skills, including reality acceptance, radical acceptance, turning the mind toward acceptance, and willingness rather than resistance. The seventh session focused on identifying, labeling, and differentiating emotional experiences to increase awareness and regulation of emotions. The eighth session emphasized the development of positive emotional experiences, consolidation and integration of previously learned skills,

application of the acquired strategies to daily difficulties associated with hemodialysis, relapse-prevention principles, and overall review of the intervention. The control group did not receive any structured psychological intervention during the corresponding period and continued routine medical treatment. Sessions for the experimental group were held once per week in an appropriate counseling or educational room at the hospital. To promote treatment fidelity, the sessions followed a predetermined clinical protocol and were conducted by the same therapist throughout the intervention. With participants' informed consent, selected portions of the sessions could be reviewed under supervision to verify adherence to the therapeutic protocol. The posttest was administered approximately one week after completion of the eighth session, and the follow-up assessment was conducted one month after completion of treatment, preferably during patients' scheduled hospital visits for hemodialysis.

Data Analysis

Data were analyzed using descriptive and inferential statistical procedures in SPSS version 26. Descriptive statistics were used to summarize the demographic characteristics of participants and the distributions of treatment adherence, quality of life, and emotion-regulation scores at the pretest, posttest, and one-month follow-up stages. Continuous variables were summarized using means and standard deviations, whereas relevant categorical demographic characteristics were described using frequencies and percentages. Because the study included two groups assessed repeatedly at three measurement occasions, the principal inferential analysis was mixed-design analysis of variance, with group as the between-subjects factor and measurement time as the within-subjects factor. This analytical framework was used to evaluate the main effect of time, the main effect of group, and particularly the group-by-time interaction indicating whether changes across the three measurement occasions differed between the DBT and control groups. Before conducting the mixed analysis of variance, the relevant statistical assumptions were examined. The normality of score distributions was evaluated using the Shapiro–Wilk test together with distributional indices where appropriate, and homogeneity of between-group variances was assessed using Levene's test. For repeated measurements, Mauchly's test was used to examine the assumption of sphericity; when this assumption was violated, the Greenhouse–Geisser correction was applied to adjust the degrees of freedom. Where appropriate for the multivariate structure of the outcomes, equality of covariance matrices was additionally examined using Box's M test. Statistically significant omnibus effects were followed by Bonferroni-adjusted pairwise comparisons to determine the specific differences between the pretest, posttest, and follow-up stages while controlling the familywise Type I error rate. Statistical significance was evaluated at the .05 level, and effect-size indices were reported where appropriate to indicate the magnitude of observed intervention effects.

Findings and Results

The final sample consisted of 30 patients undergoing hemodialysis, including 15 participants in the Dialectical Behavior Therapy (DBT) group and 15 participants in the control group. The mean age of participants was 34.53 years (SD = 6.09, range = 26–44) in the DBT group and 34.06 years (SD = 7.39, range = 26–45) in the control group, indicating very similar age distributions across the two groups. An independent-samples comparison showed no significant difference between the groups in age, $t(28) = 0.19$, $p = .851$. Regarding sex, the DBT group consisted of 6 women (40.0%) and 9 men (60.0%), whereas the

control group included 9 women (60.0%) and 6 men (40.0%); the difference in sex distribution was not statistically significant, $\chi^2(1) = 1.20$, $p = .273$. With respect to education, 11 participants (73.3%) in the DBT group held a high-school diploma, 3 (20.0%) held a bachelor's degree, and 1 (6.7%) held a doctoral degree, whereas in the control group 12 participants (80.0%) held a high-school diploma and 3 (20.0%) held a bachelor's degree. Overall, the demographic distributions indicated substantial baseline comparability between the DBT and control groups.

Table 1. Descriptive Statistics for Treatment Adherence, Quality of Life, and Emotion Regulation by Group and Measurement Time

Variable	Group	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Follow-up Mean	Follow-up SD
Treatment Adherence	DBT	63.46	6.74	70.56	5.61	69.50	5.95
	Control	63.00	4.56	62.93	4.46	62.60	4.71
Quality of Life	DBT	38.46	5.33	51.13	7.42	50.40	7.08
	Control	39.33	7.32	39.93	7.72	39.40	7.46
Emotion Regulation	DBT	20.53	2.50	32.66	1.54	31.53	1.40
	Control	22.60	3.60	22.93	3.30	22.46	3.31

As shown in Table 1, the two groups had relatively similar scores at the pretest stage, whereas clear differences emerged following the intervention. For treatment adherence, the mean score in the DBT group increased from 63.46 ± 6.74 at pretest to 70.56 ± 5.61 at posttest and remained elevated at 69.50 ± 5.95 at the one-month follow-up. In contrast, scores in the control group remained essentially unchanged across pretest (63.00 ± 4.56), posttest (62.93 ± 4.46), and follow-up (62.60 ± 4.71). A comparable pattern was observed for quality of life. The DBT group's mean quality-of-life score increased from 38.46 ± 5.33 at pretest to 51.13 ± 7.42 at posttest and remained at 50.40 ± 7.08 at follow-up, whereas the control group showed only negligible variation from 39.33 ± 7.32 at pretest to 39.93 ± 7.72 at posttest and 39.40 ± 7.46 at follow-up. The largest descriptive change was observed for emotion regulation, for which the DBT group increased from 20.53 ± 2.50 at pretest to 32.66 ± 1.54 at posttest and maintained a mean of 31.53 ± 1.40 at follow-up. Conversely, emotion-regulation scores in the control group remained comparatively stable at 22.60 ± 3.60 , 22.93 ± 3.30 , and 22.46 ± 3.31 , respectively. These descriptive findings indicate improvement following DBT across all three outcomes, with most of the gains remaining evident one month after completion of the intervention.

Before inferential analysis, the assumptions relevant to the mixed-design analysis were examined. Because each group contained fewer than 50 participants, normality was evaluated using the Shapiro–Wilk test together with skewness and kurtosis indices. The distributions of treatment adherence, quality of life, and emotion regulation were approximately normal across measurement occasions, and the skewness and kurtosis coefficients remained within the acceptable range of -2 to $+2$. Levene's tests did not indicate significant heterogeneity of error variances for the retained DBT and control observations across the principal measurement occasions. Because the original Mauchly tests indicated violation of the sphericity assumption for the repeated measurements, Greenhouse–Geisser-adjusted results were considered when evaluating within-subject effects. This correction provided a more conservative assessment of changes over time and group-by-time effects.

Table 2. Mixed-Design Analysis of Variance for Treatment Adherence, Quality of Life, and Emotion Regulation

Variable	Effect	Interpretation	Significance
Treatment Adherence	Time	Scores changed significantly across pretest, posttest, and follow-up	$p < .001$
	Group	Overall scores differed between the DBT and control groups	$p < .05$
	Time $\times$ Group	Change across time differed significantly between the DBT and control groups	$p < .001$
Quality of Life	Time	Scores changed significantly across pretest, posttest, and follow-up	$p < .001$
	Group	Overall scores differed significantly between the DBT and control groups	$p < .001$
	Time $\times$ Group	Change across time differed significantly between the DBT and control groups	$p < .01$
Emotion Regulation	Time	Scores changed significantly across pretest, posttest, and follow-up	$p < .001$
	Group	Overall scores differed significantly between the DBT and control groups	$p < .001$
	Time $\times$ Group	Change across time differed significantly between the DBT and control groups	$p < .001$

The mixed-design analysis demonstrated a consistent intervention-related pattern across the three dependent variables. For treatment adherence, a significant effect of measurement time was observed, accompanied by a significant between-group difference and, more importantly, a significant interaction between time and group. This interaction indicates that the pattern of change from pretest through posttest and follow-up was significantly different for participants receiving DBT compared with those in the control condition. Similar results were found for quality of life, for which significant effects of time and group were accompanied by a significant time-by-group interaction. Thus, the increase in quality of life observed after the intervention could not be attributed merely to the passage of time, because the change was concentrated in the DBT group while control-group scores remained relatively stable. Emotion regulation also showed significant effects of time and group together with a significant time-by-group interaction. The particularly pronounced increase in emotion-regulation scores among DBT participants, coupled with the stability of control-group scores, supports the effectiveness of DBT in improving patients' capacity for emotion regulation. Collectively, the mixed-model findings indicate that DBT produced significant improvements in treatment adherence, quality of life, and emotion regulation among patients undergoing hemodialysis and that these improvements were substantially maintained at the one-month follow-up.

Table 3. Bonferroni Post-Hoc Comparisons Between the DBT and Control Groups

Dependent Variable	Comparison	Mean Difference	p
Treatment Adherence	DBT vs. Control	4.20	.030
Quality of Life	DBT vs. Control	7.11	.010
Emotion Regulation	DBT vs. Control	5.57	.001

The Bonferroni-adjusted comparisons presented in Table 3 further clarified the significant group effects. Treatment-adherence scores were significantly higher in the DBT group than in the control group, with an adjusted mean difference of 4.20 points ($p = .030$). This finding indicates that participation in DBT was associated with improved adherence to the therapeutic regimen among patients undergoing hemodialysis. A significant difference was also found for quality of life, with the DBT group demonstrating an adjusted mean advantage of 7.11 points over the control group ($p = .010$), indicating that the intervention was associated with clinically favorable changes in patients' perceived quality of life. The largest and most statistically robust difference was observed for emotion regulation, for which the DBT group exceeded the control group by 5.57 points ($p = .001$). Taken together with the longitudinal descriptive pattern, these pairwise

comparisons demonstrate that DBT was effective in improving all three study outcomes relative to the control condition, with the strongest comparative effect evident for emotion regulation. The persistence of elevated scores in the DBT group at the one-month follow-up, alongside the absence of comparable improvements in the control group, further suggests that the beneficial effects of the intervention were maintained beyond the immediate post-intervention assessment.

Discussion and Conclusion

The present study investigated the effectiveness of Dialectical Behavior Therapy (DBT) on treatment adherence, quality of life, and emotion regulation among patients undergoing hemodialysis. The findings demonstrated that participants who received DBT showed significantly greater improvements than those in the control group across all three outcomes. Specifically, treatment adherence increased following the intervention and remained higher at the one-month follow-up, quality of life improved substantially from pretest to posttest and remained relatively stable during follow-up, and emotion regulation showed the most pronounced improvement among the measured outcomes. In contrast, the control group showed minimal changes across the three assessment stages. The significant time-by-group interaction observed for treatment adherence, quality of life, and emotion regulation indicated that the pattern of change across pretest, posttest, and follow-up differed between the DBT and control groups. Taken together, these findings support the effectiveness of DBT as a psychologically oriented intervention for improving both behavioral and psychosocial outcomes among patients receiving long-term hemodialysis.

The first major finding was that DBT significantly improved treatment adherence in patients undergoing hemodialysis. Participants in the DBT group demonstrated a meaningful increase in adherence scores at posttest, and this improvement was largely maintained at the one-month follow-up, whereas the control group remained almost unchanged across time. This finding is consistent with previous evidence indicating that treatment adherence in chronic kidney disease can be modified through structured behavioral interventions rather than being regarded as a fixed patient characteristic. A recent systematic review and meta-analysis showed that behavioral interventions can improve adherence-related outcomes in chronic kidney disease, particularly when interventions address behavioral regulation, motivation, and self-management rather than focusing solely on information provision (3). Similarly, systematic evidence suggests that patient education can strengthen adherence to the complex treatment regimen required in hemodialysis, while also contributing to improvements in broader patient-reported outcomes (4). The present findings extend this literature by suggesting that DBT, which directly targets emotional and behavioral self-regulation, may also constitute an effective adherence-oriented intervention in the hemodialysis setting.

One possible explanation for the observed improvement in treatment adherence is that DBT provides patients with concrete skills for managing distress that might otherwise interfere with adherence behaviors. Hemodialysis requires repeated engagement in demanding routines, including regular attendance at dialysis sessions, medication use, dietary restrictions, and fluid control. These requirements must often be maintained despite fatigue, frustration, anxiety, discomfort, or a sense of restriction. The multidimensional nature of hemodialysis adherence is reflected in the End-Stage Renal Disease Adherence Questionnaire, which evaluates adherence across dialysis attendance, medication use, fluid restriction, and dietary behavior

(2). From this perspective, poor adherence may arise not only from insufficient knowledge but also from difficulties tolerating the emotional and physical burden associated with treatment. DBT may improve adherence by helping patients observe internal states without acting impulsively, tolerate uncomfortable experiences, and maintain health-related behaviors even in the presence of negative emotions.

The treatment-adherence finding is also consistent with Tavakoli and colleagues, who demonstrated that DBT improved adherence to treatment and self-care behavior in patients with coronary heart disease (13). Although coronary heart disease and end-stage renal disease differ clinically, both conditions require prolonged self-management, consistent engagement with medical recommendations, and behavioral persistence under conditions of psychological stress. The convergence of these findings suggests that DBT may influence treatment adherence through transdiagnostic mechanisms such as distress tolerance, mindful awareness, reduced emotional impulsivity, and increased behavioral commitment. These mechanisms are particularly relevant to patients whose adherence difficulties emerge in emotionally challenging situations rather than solely from a lack of knowledge concerning the prescribed regimen.

The second major finding was that DBT significantly improved quality of life among patients receiving hemodialysis. The DBT group showed a substantial increase in quality-of-life scores from pretest to posttest, and most of this improvement persisted at the one-month follow-up. By comparison, the control group showed little change across the same period. This finding is clinically important because quality of life is a core patient-centered outcome in chronic kidney disease and includes more than the absence of physical symptoms. The Kidney Disease Quality of Life framework incorporates disease-specific areas such as symptom burden, effects and burden of kidney disease, work status, social functioning, sleep, cognitive functioning, and satisfaction with care, alongside general dimensions of physical and mental health (5). More recent systematic research has reinforced the importance of multidimensional quality-of-life assessment in dialysis populations because the impact of kidney disease extends across physical, psychological, social, and functional domains (6).

The improvement in quality of life observed in the present study is broadly consistent with previous evidence supporting psychosocial interventions in hemodialysis. Barelló and colleagues reported in a systematic review and meta-analysis that psychosocial interventions can improve quality of life while simultaneously reducing psychological distress among hemodialysis patients (7). Similarly, Zhang and colleagues found that psychoeducational interventions were effective in reducing psychological distress and improving health-related quality of life among patients receiving maintenance hemodialysis (8). The present study adds to these findings by showing that a DBT-based intervention focused specifically on mindfulness, distress tolerance, acceptance, and emotion-regulation skills may yield comparable benefits. Unlike interventions that focus primarily on information or general emotional support, DBT offers a systematic skills-training framework that may enable patients to respond more adaptively to recurring medical and emotional stressors.

The association between emotion regulation and quality of life may provide an important explanation for this result. Barberis and colleagues demonstrated that coping and emotion-regulation processes are meaningfully related to quality of life among dialysis patients (10). Patients who are better able to identify, accept, and regulate negative emotions may experience fewer secondary psychological consequences of chronic illness, even when their physical disease remains unchanged. In hemodialysis, many stressors

cannot be fully eliminated. Patients must repeatedly attend treatment, cope with restrictions, manage uncertainty, and accommodate physical limitations. DBT emphasizes the distinction between situations that can be changed and realities that must be accepted while still encouraging effective behavioral responses (12). Consequently, quality of life may improve not because the medical burden disappears, but because patients become more capable of managing their reactions to it and functioning more effectively within existing constraints.

The finding is also consistent with emerging applications of DBT in serious and chronic medical conditions. Hyland and colleagues reported the feasibility of an adapted DBT skills-training protocol among patients with metastatic non-small cell lung cancer, suggesting that DBT skills can be integrated into care for patients facing considerable disease burden and emotional stress (14). Likewise, Norman-Nott and colleagues demonstrated the usefulness of online DBT for emotion dysregulation in people with chronic pain, another clinical population characterized by persistent symptoms, functional limitations, and long-term emotional strain (15). Although these conditions differ from chronic kidney disease, the shared burden of persistent physical symptoms and psychological adjustment supports the broader applicability of DBT skills across chronic medical populations.

The third and strongest finding concerned emotion regulation. Participants in the DBT group exhibited a marked increase in emotion-regulation scores after the intervention, and this improvement remained evident at follow-up, whereas the control group remained relatively stable. This result is theoretically consistent with the central mechanisms of DBT because emotion regulation is one of its primary treatment targets. DBT skills training is specifically structured around mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness, with the goal of helping individuals recognize emotions, reduce maladaptive responses, and engage in behaviors that are more consistent with long-term goals (12). The observed improvement therefore provides direct evidence that the intervention affected the psychological process it was designed to modify.

This finding is also consistent with the broader theoretical literature on emotion regulation. Gross and John conceptualized emotion regulation as involving strategies through which individuals influence the experience and expression of emotion and demonstrated that differences in these strategies are associated with well-being, interpersonal functioning, and affective outcomes (9). From this perspective, patients with more adaptive emotion-regulation capacities may be better able to reinterpret stressful situations, tolerate distressing affect, and avoid excessive suppression or impulsive responses. The skills taught in DBT may strengthen these processes by encouraging mindful observation of emotional experiences, accurate labeling of emotions, acceptance of difficult internal states, and deliberate selection of more adaptive behavioral responses.

The improvement in emotion regulation is additionally supported by broader intervention research. A systematic umbrella review examining interventions targeting emotion regulation concluded that structured psychological interventions can produce meaningful changes in emotion-regulatory processes across clinical populations (11). The results of the present study are consistent with this general conclusion and suggest that such benefits may extend to patients undergoing hemodialysis. This is particularly important because emotion dysregulation in medically ill populations may have consequences that reach beyond psychological distress and may influence treatment behavior, interpersonal functioning, and perceived quality of life.

The magnitude of change observed in emotion regulation may also help explain why DBT improved both treatment adherence and quality of life. These outcomes are conceptually interconnected rather than independent. A patient who is able to tolerate distress more effectively may be more likely to continue attending dialysis sessions, comply with restrictions, and follow treatment recommendations despite frustration or discomfort. Similarly, a patient who can regulate negative emotional states may experience less psychological disruption in daily life and consequently report better social, functional, and subjective well-being. The relationships among coping, emotion regulation, and quality of life previously identified in dialysis populations support this interpretation (10). Thus, improvement in emotion regulation may represent one of the mechanisms through which DBT contributes to broader changes in adherence and quality of life.

The persistence of intervention effects at the one-month follow-up is another important aspect of the findings. Although the posttest scores showed the strongest immediate gains, the DBT group's scores remained substantially better than baseline at follow-up. This pattern suggests that participants were able to retain and continue applying at least some of the skills learned during the intervention. DBT is strongly oriented toward skills acquisition and repeated practice rather than temporary symptom reduction alone (12). Mindfulness, distress tolerance, acceptance, and emotion-regulation strategies can be practiced outside therapy sessions and incorporated into everyday responses to stress. Such transfer of learning may account for the persistence of improvements after formal sessions had ended.

These findings are also consistent with contemporary recommendations emphasizing patient-centered and multidimensional management of chronic kidney disease. Current clinical guidance increasingly recognizes that effective chronic kidney disease care should incorporate psychosocial functioning, patient engagement, quality of life, and capacity for sustained self-management alongside conventional biomedical targets (1). The present findings support this broader model of care by showing that a structured psychological intervention may improve outcomes that are highly relevant to long-term disease management but cannot be addressed adequately through dialysis procedures or medication alone.

The results further suggest that DBT may offer advantages as an adjunctive intervention because it simultaneously targets several mechanisms relevant to chronic illness management. Behavioral interventions have been shown to improve treatment adherence in chronic kidney disease (3), psychosocial and psychoeducational interventions have demonstrated benefits for quality of life (7, 8), and emotion-regulation interventions have demonstrated efficacy across a broad range of clinical contexts (11). DBT integrates elements relevant to each of these domains within a single structured skills-based framework. Rather than treating adherence, emotional distress, and quality of life as completely separate problems, DBT may influence them through shared regulatory mechanisms. This integrative characteristic may be particularly useful in hemodialysis, where emotional, behavioral, and functional challenges frequently reinforce one another.

The present study had several limitations that should be considered when interpreting the results. First, the sample was relatively small and consisted of patients recruited from a single hemodialysis center in Tehran, which limits the generalizability of the findings to patients from other hospitals, geographic areas, cultural settings, or different stages of chronic kidney disease. Second, convenience sampling may have introduced selection bias because patients willing and physically able to participate in repeated group

sessions may differ from those who declined participation. Third, the outcomes were primarily assessed using self-report questionnaires, making the results potentially susceptible to recall bias, social desirability, and response tendencies. Fourth, the follow-up period was limited to one month, and therefore the longer-term durability of the intervention effects remains uncertain. Fifth, the study did not directly assess possible mediating mechanisms such as mindfulness, distress tolerance, psychological flexibility, or perceived stress, which could help clarify how DBT produced improvements in treatment adherence and quality of life. Finally, although efforts were made to standardize intervention delivery, therapist effects and participants' interpersonal experiences within the group setting could not be completely controlled.

Future research should replicate the present study using larger and more diverse samples recruited from multiple dialysis centers and, where feasible, employ fully randomized controlled designs with allocation concealment and longer follow-up periods. Follow-up assessments at three, six, and twelve months would provide stronger evidence regarding the stability of treatment effects. Future studies should also combine self-report measures with objective indicators of adherence, such as attendance records, interdialytic weight gain, medication-monitoring data, or relevant laboratory indices. Examining potential mediators including mindfulness, distress tolerance, perceived stress, acceptance, self-efficacy, and emotional reactivity could clarify the mechanisms underlying DBT-related changes. Moderator analyses may also determine whether factors such as age, sex, dialysis duration, baseline emotional distress, disease severity, or social support influence responsiveness to treatment. Comparative effectiveness studies could additionally evaluate different delivery formats, including individual, group-based, online, and hybrid DBT skills training, to identify approaches that are most feasible for patients whose physical condition or dialysis schedule limits regular participation.

From a clinical perspective, the findings suggest that DBT skills training can be considered as an adjunct to routine psychosocial care for patients undergoing hemodialysis, particularly for individuals who experience difficulty managing treatment-related distress, maintaining adherence, or regulating intense negative emotions. Dialysis centers could incorporate brief, structured skills-based programs into multidisciplinary care, with sessions coordinated around patients' treatment schedules to reduce participation burden. Clinical psychologists, health psychologists, psychiatric nurses, counselors, and appropriately trained members of renal-care teams may use selected DBT skills such as mindfulness, distress tolerance, emotional identification, radical acceptance, and adaptive behavioral planning within supportive care programs. Screening patients for emotional dysregulation and adherence difficulties may help identify those most likely to benefit. Integrating these interventions with routine nephrology care may contribute to more comprehensive treatment by addressing not only biomedical management but also the behavioral and psychological demands of living with long-term hemodialysis.

Acknowledgments

The authors express their deep gratitude to all participants who contributed to this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

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

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

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