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Internet Plus Dialectical Behavior Therapy Intervention Model for Adolescent Non-Suicidal Self-Injury: An Applied Research Postprint

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Abstract

Background: Adolescent non-suicidal self-injury has emerged as an increasingly serious mental health problem, characterized by a prolonged course and imposing a heavy burden on patients, families, and society. Intervention for adolescent non-suicidal self-injury requires a comprehensive intervention model, and online intervention management practice in China remains in its early stages. Objective: To investigate the intervention effects of the "Internet Plus" Dialectical Behavior Therapy (DBT) intervention model on suicidal ideation, cognitive emotion regulation, and depression alleviation in adolescent patients with non-suicidal self-injury. Methods: A total of 120 adolescent patients with non-suicidal self-injury discharged from the Second Affiliated Hospital of Xinxiang Medical College between May 2021 and May 2022 were enrolled as study participants. Using a randomized controlled single-blind method, they were divided into a control group (n=60) and an intervention group (n=60). The control group received medication intervention, telephone follow-up, and psychological counseling. The intervention group, in addition to the control group's treatment, received a one-year "Internet Plus" DBT training program consisting of four modules: mindfulness training, interpersonal effectiveness training, emotion regulation training, and distress tolerance training. At baseline and at 6 and 12 months post-intervention, the Self-rating Idea of Suicide Scale (SIOSS), Cognitive Emotion Regulation Questionnaire (CERQ-C), and Montgomery-Asberg Depression Rating Scale (MADRS) were used to evaluate suicidal ideation, cognitive emotion regulation, and depression status in both groups. Repeated measures analysis of variance was used to compare changes in these outcomes between the two groups at different time points. Results: Ultimately, 57 participants in the control group and 55 in the intervention group completed the study. There was an interaction effect between group and time on SIOSS, CERQ-C, and MADRS scores ($P<0.05$); the main effect of group on SIOSS, CERQ-C,

and MADRS scores was significant (P<0.05), and the main effect of time on SIOSS, CERQ-C, and MADRS scores was significant (P<0.05). Specifically, within the intervention group, comparisons of SIOSS, CERQ-C, and MADRS scores before and after intervention showed statistically significant differences (P<0.001); within the control group, comparisons of SIOSS scores, MADRS scores, and the positive refocusing, refocusing on planning, positive reappraisal, rational analysis, catastrophizing, and blaming others dimensions of CERQ-C scores before and after intervention showed no statistically significant differences (P>0.001), while comparisons of the self-blame, acceptance, and rumination dimensions of CERQ-C scores before and after intervention showed statistically significant differences (P<0.001). Conclusion: The "Internet Plus" DBT intervention model can effectively reduce suicidal ideation in adolescent patients with non-suicidal self-injury, enhance emotion regulation capabilities, alleviate depression status, and improve patients' quality of life and social functioning.

Full Text

Application Research of "Internet+" Dialectical Behavior Therapy Intervention Mode in Adolescent Non-suicidal Self-injury Intervention

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Abstract

Background: Adolescent non-suicidal self-injury (NSSI) has become an increasingly serious mental health problem with a protracted course, causing heavy burdens to patients, families, and society. Intervention for adolescent NSSI requires a comprehensive model, yet online intervention management practice in China remains in its infancy.

Objective: To investigate the intervention effects of "Internet+" dialectical behavior therapy (DBT) on suicidal ideation, cognitive emotion regulation, and depression alleviation in adolescent patients with NSSI.

Methods: A total of 120 adolescent NSSI patients discharged from the Second Affiliated Hospital of Xinxiang Medical University between May 2021 and May 2022 were selected and randomly divided into a control group (n=60) and an intervention group (n=60) using a randomized controlled single-blind method. The control group received medication intervention, telephone follow-up, and psychological counseling. The intervention group additionally received a one-year "Internet+" DBT training program consisting of four modules: mindfulness training, interpersonal effectiveness training, emotion regulation training, and distress tolerance training. The Self-rating Idea of Suicide Scale (SIOSS), Cognitive Emotion Regulation Questionnaire (CERQ-C), and Montgomery-Asberg Depression Rating Scale (MADRS) were administered to evaluate suicidal ideation, cognitive emotion regulation, and depression status at baseline and at 6 and 12 months post-intervention. Repeated measures analysis of variance was used to compare health status between groups at different time points.

Results: Ultimately, 57 cases in the control group and 55 cases in the intervention group completed the study. There was a significant interaction between group and time on SIOSS, CERQ-C, and MADRS scores ($P<0.05$). The main effect of group was significant for SIOSS, CERQ-C, and MADRS scores ($P<0.05$), and the main effect of time was also significant for these measures ($P<0.05$). Within the intervention group, comparisons of SIOSS, CERQ-C, and MADRS scores before and after intervention showed statistically significant differences ($P<0.001$). Within the control group, comparisons of SIOSS scores, MADRS scores, and dimensions of CERQ-C including positive refocus, refocusing on planning, positive reappraisal, rational analysis, catastrophizing, and blaming others showed no significant differences ($P>0.001$), while comparisons of self-blame, acceptance, and rumination dimensions of CERQ-C showed statistically significant differences ($P<0.001$).

Conclusion: The "Internet+" DBT intervention model can effectively reduce suicidal ideation, improve emotional control, alleviate depression, and enhance quality of life and social functioning in adolescent patients with NSSI.

Keywords: adolescent; Internet-based intervention; non-suicidal self-injury; dialectical behavior therapy; rehabilitation; randomized control

Introduction

Non-suicidal self-injury (NSSI) refers to intentional self-inflicted harm to the surface of one's body that may cause bleeding, bruising, or pain, occurring on 5 or more days within the past year [1]. NSSI is common among adolescents, with a global prevalence of 19.5% and a detection rate of 27.4% in China that continues to rise [2]. Currently, there is a lack of specific and effective management approaches [3]. Spanish scholars have suggested that "Internet+" online interventions show good auxiliary effects for NSSI treatment [4]. Eleven coun-

tries including Germany have published intervention guidelines for NSSI, with dialectical behavior therapy (DBT) being the preferred psychological treatment [5].

DBT emphasizes changing behavior and managing emotions through the "dialectical balance and synthesis of acceptance and change," primarily teaching patients mindfulness skills, distress tolerance skills, emotion regulation skills, and interpersonal effectiveness skills [6]. American scholars KOTHGASSNER et al. [7] have demonstrated that DBT can reduce suicidal ideation and self-injurious behavior, but factors such as long treatment courses, patient stigma, and transportation inconvenience affect compliance. "Internet+" interventions have achieved good results in specialized management of conditions such as ostomy care and diabetes [8-9]. This study utilized the "Henan Psychological Aid Cloud Platform" of the Second Affiliated Hospital of Xinxiang Medical University to apply an "Internet+" DBT intervention model to reduce suicidal ideation, improve emotional control, alleviate depressive emotions, provide rapid and convenient services for patients, and promote the development of continuous care in psychiatric hospitals.

Methods

1.1 Study Participants Adolescent NSSI patients discharged from the Second Affiliated Hospital of Xinxiang Medical University between May 2021 and May 2022 were selected using a random number table method. A total of 120 patients were enrolled and divided into control and intervention groups for follow-up intervention. The follow-up system certificate number is Soft Registration No. 7523879. The purpose and significance of the study were explained to participants and their guardians, and written informed consent was obtained along with signed skills training agreements and crisis plans.

Inclusion criteria: (1) Met DSM-5 diagnostic criteria for depression; (2) Aged 12-18 years; (3) Experienced NSSI $ $1 time during hospitalization; (4) Primary school education or above, with normal comprehension and ability to communicate and express feelings; (5) Able to use the Henan Psychological Counseling Cloud Platform information system; (6) Patients and families provided informed consent and voluntarily participated.

Exclusion criteria: (1) MADRS score $ $35 points, assessed as high-risk severe patients [10]; (2) Patients with psychotic symptoms or diagnosed with organic mental disorders or mental retardation; (3) Patients with severe comorbid physical diseases; (4) Patients with less than primary school education or unable to use Internet systems; (5) Individuals who had studied psychology.

This study was approved by the Ethics Committee of the Second Affiliated Hospital of Xinxiang Medical University (Approval No. XYEFYLL-(Research)-2022-48).

1.2 Intervention Methods 1.2.1 Intervention Group: The intervention included establishing a training team and developing a DBT skills intervention protocol with four modules.

The DBT training team comprised hospital professionals including 8 rehabilitation skills trainers, 4 psychiatrists, 2 case managers, 2 psychological counselors, and 8 psychiatric nurses. Rehabilitation skills trainers were required to complete skills training and obtain hospital-certified rehabilitation training qualifications. Patients were divided into 8 groups of 6-8 patients each. Rehabilitation skills trainers were divided into 4 groups of 2 persons each, serving as primary and assistant leaders. Each DBT training team included 2 rehabilitation skills trainers, 1 psychiatrist, 1 case manager, 1 psychological counselor, and 2 psychiatric nurses. Training sessions were conducted twice weekly, 2 hours per session. Psychiatrists were responsible for selecting participants, diagnosis, medication, and scale assessment; psychological counselors provided online counseling; psychiatric nurses conducted telephone follow-ups and risk assessments; and rehabilitation skills trainers explained the training process to adolescent NSSI patients, establishing cooperative commitments and training alliances.

Adolescent NSSI patients completed all skills learning within 6 months (24 weeks). In the one-year treatment plan, trainers repeated the training at least once. DBT training content was divided into four skills modules: mindfulness skills for 2 weeks (Table 1), distress tolerance skills for 6 weeks (Table 2), emotion regulation skills for 7 weeks (Table 3), and interpersonal effectiveness skills for 5 weeks (Table 4). As mindfulness skills needed to be integrated throughout the entire training process, the sequence was: 2 weeks of mindfulness skills, then distress tolerance skills, repeated 2 weeks of mindfulness skills, then emotion regulation skills, repeated 2 weeks of mindfulness skills, then interpersonal effectiveness skills, cycling in this order.

Each training session included at least four components: (1) Opening ceremony; (2) Review of previous homework exercises; (3) Introduction of new content; (4) Closing "wrap-up." The intervention group accessed the remote intervention module platform through video format, managed uniformly by rehabilitation skills trainers. The platform sent reminders 10 minutes before each session, and patients could join via link. Trainers could set permissions according to the curriculum schedule and conducted training in group format. Video demonstrations were provided in online mode, with assistant leaders providing real-time guidance on patients' training completion.

1.2.2 Control Group: The control group received medication intervention, 10-minute telephone follow-ups once monthly by psychiatric nurses, and 20-minute online psychological counseling once monthly by psychological counselors. Telephone follow-up content included current emotional status and medication side effects. Psychological counseling involved answering questions and providing emotional guidance.

1.3 Measures 1.3.1 Baseline Data: A self-designed general information questionnaire was used to collect data on gender, age, education level, disease course, and hospitalization frequency.

1.3.2 Self-rating Idea of Suicide Scale (SIOSS): The SIOSS [11-12] was used to assess suicidal ideation. The scale contains 26 items divided into four dimensions: despair, optimism, sleep, and concealment. A total score $ $12 on the first three dimensions indicates suicidal ideation, while a concealment score $ $4 suggests unreliable measurement. The total score is the sum of despair, optimism, and sleep dimensions. Items are answered "yes" or "no," with specific items scored 1 point for "yes" or "no" responses as per the scoring protocol. Higher total scores indicate stronger suicidal ideation. The scale has a Cronbach's α coefficient of 0.906, split-half reliability of 0.814, and retest correlation coefficient of 0.86.

1.3.3 Cognitive Emotion Regulation Questionnaire-Chinese Version (CERQ-C): The CERQ-C [13-14] assesses cognitive emotion regulation levels and strategies following negative life events. The questionnaire contains 36 items across 9 subscales: self-blame, rumination, catastrophizing, blaming others, acceptance, positive refocus, planning, positive reappraisal, and rational analysis. Items are rated on a 5-point Likert scale (1 = "never" to 5 = "always"). The total scale Cronbach's α coefficient is 0.81, subscale α coefficients range from 0.48-0.91, and total scale retest reliability is 0.56, with subscale retest reliability ranging from 0.36-0.69. The average inter-item correlation coefficient is 0.10 for the total scale and 0.19-0.71 for subscales. Higher dimension scores indicate greater tendency to use that particular cognitive emotion regulation strategy.

1.3.4 Montgomery-Asberg Depression Rating Scale (MADRS): The Chinese version of MADRS developed by Zhong et al. [15-16] contains 10 items rated on a 7-point scale (0 = normal to 6 = severe depression), with higher scores indicating more severe depression. The scale has an ICC of 0.954, Cronbach's α coefficient of 0.825, and retest correlation coefficient of 0.737. For efficacy evaluation, a reduction $ $50% from baseline is considered effective, and a total score $ $10 indicates clinical remission. The scale is suitable for evaluating depression in adolescents and sensitively reflects changes in depressive symptoms.

1.4 Quality Control

(1) All training followed the standardized DBT rehabilitation training technical process, with unified training required for all staff before participation. (2) Scales and questionnaires were distributed through the platform. After completion, all scales were promptly checked for integrity and key information, with comprehensive review of questionnaire completeness and consistency. (3) Participants used a point system, with appropriate rewards provided for training completion.

1.5 Statistical Analysis SPSS 26.0 statistical software was used for data analysis. Count data were expressed as relative numbers and compared between groups using ^{2} tests. Measurement data were normally distributed and expressed as ($\bar{x}\pm s$), compared between groups using independent t-tests. Repeated measures analysis of variance was used for multi-timepoint scale scores, with simple effect analysis for pairwise comparisons between time points. $P<0.05$ was considered statistically significant.

Results

2.1 Baseline Patient Data Ultimately, 57 cases in the control group and 55 cases in the intervention group completed the intervention. After enrollment, research staff introduced the study purpose, procedures, and content to patients and guardians, and collected baseline data on general information, SIOSS, CERQ-C, and MADRS. At 6 and 12 months post-intervention, SIOSS, CERQ-C, and MADRS were collected again through the platform, with a 48-hour completion window. The platform prevented submission with missing items and provided 2 reminders; otherwise, questionnaires were considered invalid. The response rate was 95.00% for the control group and 91.67% for the intervention group. There were no statistically significant differences between groups in gender, age, education level, disease course, or hospitalization frequency ($P>0.05$) (Table 5).

2.2 Comparison of SIOSS Scores Between Groups There was a significant interaction between group and time on SIOSS scores ($P<0.05$). The main effect of group was significant ($P<0.05$), and the main effect of time was also significant ($P<0.05$). Within the intervention group, comparisons of SIOSS scores before and after intervention showed that at 6 months post-intervention, the despair factor, concealment factor, and total score differed significantly from baseline ($P<0.001$). At 12 months post-intervention, the despair factor, concealment factor, and total score differed significantly from both baseline and 6 months post-intervention ($P<0.001$). The optimism and sleep factors at 6 and 12 months post-intervention differed significantly from baseline ($P<0.001$) but not from 6 months post-intervention ($P>0.001$). Within the control group, there were no significant differences in SIOSS scores before and after intervention ($P>0.001$). At 6 and 12 months post-intervention, SIOSS scores in the intervention group were significantly lower than in the control group ($P<0.05$) (Table 6).

2.3 Comparison of CERQ-C Scores Between Groups There was a significant interaction between group and time on CERQ-C scores ($P<0.05$). The main effect of group was significant ($P<0.05$), and the main effect of time was also significant ($P<0.05$). Within the intervention group, comparisons of CERQ-C scores before and after intervention showed that at 6 months post-intervention, self-blame, acceptance, rumination, positive refocus, rational analysis, catastrophizing, and blaming others differed significantly from baseline

(P<0.001). At 12 months post-intervention, these dimensions differed significantly from both baseline and 6 months post-intervention (P<0.001). Refocus on planning and positive reappraisal at 6 months post-intervention differed significantly from baseline (P<0.001), and at 12 months post-intervention differed significantly from baseline (P<0.001) but not from 6 months post-intervention (P>0.001). Within the control group, there were no significant differences in positive refocus, refocus on planning, positive reappraisal, rational analysis, catastrophizing, or blaming others dimensions (P>0.001), but significant differences were found in self-blame, acceptance, and rumination dimensions (P<0.001) (Table 7).

2.4 Comparison of MADRS Scores Between Groups There was a significant interaction between group and time on MADRS scores (P<0.05). The main effect of group was significant (P<0.05), and the main effect of time was also significant (P<0.05). Within the intervention group, comparisons of MADRS scores before and after intervention showed that at 6 months post-intervention, total depression scores differed significantly from baseline (P<0.001), and at 12 months post-intervention differed significantly from both baseline and 6 months post-intervention (P<0.001). Within the control group, there were no significant differences in MADRS scores before and after intervention (P>0.001) (Table 8).

Discussion

3.1 "Internet+" DBT Intervention Effectively Reduces Suicidal Ideation in Adolescent NSSI Patients Adolescent NSSI patients develop suicidal ideation due to long-term emotional suppression without effective solutions, manifesting as depressive symptoms including crying, self-disapproval, self-deprecation, social withdrawal, and perceptions of life cruelty. Inappropriate responses and lack of understanding from parents and relatives cause cognitive dissonance, leading to suicidal ideation [6,17]. This study demonstrated that through "Internet+" intervention, patients actively participated in training, communication and trust with medical staff increased, and stigma gradually decreased. SIOSS scores in the intervention group at 6 and 12 months post-intervention were lower than in the control group, indicating that online training can reduce suicidal ideation, consistent with findings from KAESS et al. [18] and MEHLUM et al. [19]. Possible reasons include: through mindfulness skills training, patients could consciously experience and observe events with curiosity rather than judgment, focusing on accurately describing current events without distortion or evaluation, recognizing that all events have causes and finding solutions rather than remaining tense, thereby discovering their true selves. Second, through distress tolerance skills training, patients learned that pain is part of life that cannot be escaped or removed, and that temporarily tolerating pain is necessary to attempt change. The curriculum taught patients to step back when facing difficult situations, take time to distance themselves from the situation, take deep breaths until they could control

their emotions, and then observe objectively without rushing to conclusions to handle problems accurately and effectively. When patients experienced intense unbearable emotions and urges to self-injure, they could quickly reduce suicidal ideation through techniques such as washing their face with cold water, holding ice cubes, distraction, and self-soothing. Interpersonal effectiveness training used social simulation scenarios to improve patients' interpersonal skills, such as learning to say "no" seriously through role-play, maximizing benefits through self-expression without damaging self-esteem or relationships. Good interpersonal relationships can transform potentially maladaptive behaviors into positive ones and reduce suicidal ideation, consistent with findings from SANTAMARINA et al. [20] and BERK et al. [21].

3.2 "Internet+" DBT Intervention Improves Cognitive Emotion Regulation Strategies in Adolescent NSSI Patients This study showed that after "Internet+" DBT intervention, the intervention group had lower scores than the control group at 6 and 12 months post-intervention in negative emotion dimensions including self-blame, rumination, catastrophizing, and blaming others ($P<0.001$), and higher scores in positive emotion dimensions including acceptance, rational analysis, positive refocus, planning, and reappraisal ($P<0.001$). This may be because rehabilitation skills trainers explained that emotions such as anger and sadness are reactions to thoughts and interpretations of events rather than reactions to the truth of events themselves, teaching patients to first check the facts, explain life goals, and thereby enabling them to positively refocus, plan, and reappraise emotions and analyze problems rationally. ASARNOW et al. [22] and YEO et al. [23] have suggested that DBT training can improve negative emotions and increase positive emotional coping strategies in adolescent NSSI patients.

3.3 "Internet+" DBT Intervention Alleviates Depression in Adolescent NSSI Patients International studies have shown that DBT training can effectively reduce depressive symptoms in adolescent NSSI [24-25]. Research indicates that adolescent depression patients have difficulty with emotion regulation and tend to use negative, avoidant, and silent attitudes when facing illness, with depressive emotions positively correlating with adolescent NSSI [26]. This study demonstrated that after implementing the "Internet+" comprehensive intervention model, MADRS scores in the intervention group at 6 and 12 months post-intervention were lower than in the control group ($P<0.001$). Possible reasons include: emotion regulation skills training helped patients accumulate positive emotions and engage in self-controlled activities, such as identifying and naming depressive emotions, determining what events caused them, checking the facts, recognizing that low mood and social withdrawal cannot effectively change situations, setting an emotional control goal, taking specific actions, and accepting their emotions to alleviate depression. Mindfulness training helped establish life goals of reducing pain and increasing happiness, teaching patients to live in the present moment and be mindful of thoughts, which positively influ-

enced depressive symptoms. Poor interpersonal relationships are an important cause of anxiety and depression [27], and this study's interpersonal effectiveness skills training taught patients to follow the middle path, accept reality while working to change it, respond to others through expressions or notes when unwilling to communicate, express their thoughts, acknowledge true facts without resistance, check the facts, and find suitable interpersonal methods to improve relationships and alleviate depression.

This study demonstrates that the "Internet+" DBT intervention model can effectively reduce suicidal ideation, improve emotional control, alleviate depression, and enhance quality of life and social functioning in adolescent NSSI patients. However, as this study was conducted during the COVID-19 pandemic, many group activities in DBT training could not be performed, and video demonstration was used instead of face-to-face guidance, leaving patients' self-execution ability to be further discussed. Future studies should increase funding, focus on adolescent mental health, and adopt combined online and offline intervention models. It is also recommended to develop national-level "Internet+" comprehensive interventions for adolescent NSSI, with psychiatric hospitals establishing dedicated Internet intervention teams to provide comprehensive health management for school educators, parents, and non-psychiatric medical personnel, covering parenting styles, early intervention, health education, and school crisis intervention, as a future research direction.

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Table 1 Mindfulness Skills

Table 2 Distress Tolerance Skills

Table 3 Emotion Regulation Skills

Table 4 Interpersonal Effectiveness Skills

Table 5 Comparison of General Information Between Groups

Table 6 Comparison of SIOSS Scores Between Groups ($\bar{x}\pm s$, points)

Table 7 Comparison of CERQ-C Scores Between Groups ($\bar{x}\pm s$, points)

Table 8 Comparison of MADRS Scores Between Groups ($\bar{x}\pm s$, points)

Note: Figure translations are in progress. See original paper for figures.

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