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Sandplay Therapy for Stress Management in College Students: A Randomized Controlled Experiment

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Abstract: This study used a randomized controlled trial design to assess the intervention effects of sandplay therapy on stress management and psychological symptom improvement in college students. College students with significant stress problems were recruited and randomly assigned to an experimental group (sandplay intervention) and a control group (conventional stress management education). The experimental group received a 6-week sandplay therapy session of 90 minutes twice a week; the control group participated in a standardised stress management course.The main assessment indicators used in this study included the Chinese Perceived Stress Scales (CPSS-10), the Depression Anxiety and Stress Scale-21 (DASS-21), and the self-compiled questionnaire for evaluating the intervention mechanism of sandplay therapy. The results showed that the experimental group had significantly better improvement in stress perception and psychological symptoms than the control group. Mechanism analysis showed that the experimental group was better than the control group in terms of symbolic expression efficacy and self-integration. Effect size analysis further supported the potential of sand play therapy in emotion regulation and internalization of stress coping strategies. These results indicate that sand play therapy has a significant intervention effect in relieving stress, improving mental health and promoting emotional integration among college students.

1. Introduction

As the future of the country and the backbone of social development, college students' mental health problems have increasingly attracted widespread social attention. Improving the level of mental health education and service quality of college students not only contributes to the psychological growth of individuals, but also provides a solid talent foundation for the long-term development of the country[1].

With the continuous intensification of social competition, contemporary college students are confronted with the complex challenges of multiple stressors. Structural pressures such as academic burden, employment prospects, economic burden, and social relationships[2] not only affect their emotional regulation mechanisms but may also trigger comorbid psychological reactions of anxiety and depression. This psychological exhaustion state has been proven to have a significant

correlation with the decline of academic efficacy and the obstruction of career development[3]. Empirical investigations across international contexts have consistently demonstrated that prolonged exposure to elevated stress levels among university populations precipitates clinical manifestations of psychological distress[2], highlighting the imperative need for strategic interventions to enhance stress-coping competencies through targeted management protocols.

In the multiparadigm of psychological intervention, sandplay therapy has gradually demonstrated its unique clinical application value due to its non-verbal representation characteristics and projectional expression mechanism. This therapy builds a symbolic field[4] and employs embodied cognitive regulation[5] to establish a safe emotional release channel for individuals with limited verbal expression[6]. Experimental research indicates that sandplay therapy is particularly beneficial for emotional management and stress regulation among college students, and it can enhance psychological resilience and improve the ability to cope with stress[7]. The symbolic and experiential characteristics of sandplay therapy can not only effectively help college students relieve their inner emotional stress, but also enhance their ability to regulate negative emotions[8,9]. This therapeutic efficacy has attained rigorous cross-cultural validation, as exemplified by Hui[10] innovative integration of sandplay therapy with Traditional Chinese Medicine principles, which demonstrated statistically significant outcomes in emotion regulation competencies and longitudinal stress modulation, effectively facilitating multidimensional enhancement of psychological well-being.

Neuromechanistic studies have further revealed that sandplay therapy enhances emotional control in the amygdala through functionally coupled modulation of the prefrontal-limbic system[11]. This altered neuroplasticity not only explains its immediate anxiety-relieving effects, but also correlates with the remodeling of neural substrates for long-term emotional resilience[12]. Notably, the cross-group applicability of the treatment has also shown potential to modulate sociocognitive neural circuits in specific populations on the autism spectrum[13,14], on the ADHD spectrum[15], and in recovering schizophrenia[16].

It can be seen that sand tray game therapy can provide effective psychological support for college students and help them to self-regulate and stress management when facing academic and life pressure. Informed by these neurocognitive and clinical findings, the present study employs a randomized controlled trial design to systematically investigate the temporal dynamics of sandplay intervention effects on stress biomarkers and emotion regulation indices across distinct temporal phases (baseline, intervention, follow-up) within collegiate populations.

2. Materials and Methods

2.1. Selection of Research Subjects

This study used a prospective randomized controlled design to recruit 60 college students with significant stress problems registered at the counseling center of a comprehensive university between March 2023 and March 2024 as study subjects.

Inclusion criteria: ① Age 18~25 years old, college students; ② Chinese version of Perceived Stress Scale (CPSS-10) score ≥20 (the critical value is taken as the first 25% percentile); ③ No systematic psychological interventions in the past 3 months; ④ No contraindications to sandplay therapy (e.g., history of allergy to sand materials); ⑤ Montreal Cognitive Assessment Scale (MoCA) ≥26 to exclude cognitive impairment; ⑥ Voluntary signed informed consent and commitment to complete the full intervention.

Exclusion Criteria: ① Diagnosis of a DSM-5 diagnosis of any Axis I mental disorder; ② Participation in an expressive arts treatment program in the last 6 months; ③ Presence of a serious

physical illness (e.g., cancer, immune system disorders); and ④ Substance Dependence (Nicotine Dependence Scale FTND ≥ 4 points or AUDIT ≥ 8 points).

Effect sizes were calculated by GPower 3.1 software (Cohen's d=0.5, α=0.05, β=0.2), and the minimum sample size was determined to be 60 cases, which were ultimately assigned to the experimental group (sandtray intervention, n=30) versus the control group (regular stress management course, n=30) using stratified randomization (stratified by gender and stress level).

2.2. Research instruments and scales

This study used a combination of multidimensional standardized scales covering variables related to stress perception, psychological symptoms, and intervention mechanisms.

(1) The Chinese Perceived Stress Scale-10 (CPSS-10) was used to quantify the intensity of an individual's subjective perception of life stress[17], which was measured at baseline and post-intervention at dual time points in this study, and the 10 entries were scored on a 5-point Likert scale (0="never" to 4="always"), with a total score range of 0 to 40, and a threshold set at ≥20 (top 25% high-stress group) based on a normative model for local university students. The Chinese version was validated by Yang and Huang, with a Cronbach's alpha coefficient of 0.88 and a retest reliability (at 2-week intervals) of 0.82[18].

(2) The Depression Anxiety Stress Scales short version (DASS-21, DASS-21) was used to assess the effect of stress interventions on the improvement of co-morbid psychological symptoms, the scale contains 3 sub-dimensions (depression, anxiety, stress) with 7 entries per dimension and a Likert 4-point scale (0 = “does not meet” to 3 = “always meets”), and the total score was converted to raw score × 2 to match the full version of the scale. The validity of the Chinese version was validated by Gong. The Cronbach's α coefficients for each sub-dimension ranged from 0.79 to 0.86, which meets the criteria for clinical research[19].

(3) The questionnaire for evaluating the sandplay intervention mechanism is based on the Kalff sandplay game theory model[20], combined with the "symbolization-integration" mechanism framework. The author independently designed a self-assessment tool consisting of 15 items, divided into three dimensions: symbolic expression efficacy, emotional regulation ability, and self-integration degree. It adopts a Likert 7-point scale (1 = "completely disagree" to 7 = "completely agree"). The questionnaire underwent exploratory factor analysis (EFA) to extract common factors (KMO = 0.84, cumulative variance explanation rate 72.3%), and the confirmatory factor analysis model was well adapted (CFI = 0.93, RMSEA = 0.06).

(4) The adjusted version of the Montreal Cognitive Assessment (MoCA) scale (without the item for correcting years of education) is used to eliminate confounding effects of cognitive function, and a total score ≥ 26 points is set as the screening criterion[21]. The Chinese version has been verified by Gan, with a sensitivity of 89% and a strong correlation with the Wechsler Intelligence Scale ($r = 0.76$, $p < 0.001$)[22].

2.3. Experimental Groups and Intervention Methods

2.3.1. Setting of Experimental and Control Groups

The study used a triple-blind (subject, intervener, evaluator) randomized controlled design that strictly followed the CONSORT guidelines to ensure standardization and reproducibility of the intervention protocol. Evaluators were unaware of the subgroups, and interviewees and subjects were informed of “different forms of stress management training” to avoid contamination with expectancy effects. Subjects were prohibited from adding counseling or medication during the study period, and external interventions were monitored through a weekly online questionnaire (10 items),

which was considered to be a dropout for noncompliance.

Randomized sequences of blocks were generated by computer, and stratified random allocation was conducted according to gender (male/female) and baseline pressure level (CPSS-10 score: 20-24 vs. 25-40) to ensure balanced demographic and clinical characteristics between groups. The randomized sequences were sealed for safekeeping, and the allocation results were automatically decoded via the REDCap platform 24 hours before intervention implementation to circumvent selection bias.

Experimental group (sandplay therapy group, n=30): received a structured sandplay intervention protocol, designed to combine the Kalff developmental model with modern neuroplasticity theory. Control group (active control group, n=30): participated in a standardized stress management education curriculum with content based on the Cognitive Behavioral Therapy (CBT) framework, matching the experimental group's time frequency and interaction intensity.

2.3.2. Sandplay therapy intervention program

The experimental group used sandplay therapy, and the intervention was conducted twice a week for 90 minutes each time, including 10 minutes of baseline relaxation training, 70 minutes of sandplay creation, and 10 minutes of structured reflection, and the whole session lasted for 6 weeks, with a total of 12 interventions. The intervention environment was set in a standardized sandbox room (3m × 3m) equipped with 480 sand tools (covering figures, animals, architecture, natural elements, etc.) classified according to Jung's archetypal theory[23], and the sandbox dimensions (57cm × 72cm × 7cm) were in accordance with the norms of the International Society of Sandplay Therapy (ISST)[24].

The core operation was divided into three phases: the first four sessions were a free creation period, following the principle of non-directive, and the therapist only observed and recorded the choice of sand tools, spatial layout, and non-verbal behavior; sessions 5-8 were a guided integration period, in which the therapist facilitated the metaphorical narrative based on the subject's theme of creation by using open-ended questions to strengthen emotional and cognitive connections; sessions 9-12 were a reconstruction period in which the therapist invited the subject to add elements representing the future self to the sand tray to catalyze the internalization of self-efficacy and stress coping strategies via the The ninth to twelfth sessions were a meaning reconstruction period, in which subjects were invited to add elements representing their future selves to the sandbox through the “space-time dialogue technique” to catalyze the internalization of self-efficacy and stress coping strategies. The entire intervention was performed by two ISST-certified sandplay therapists with at least 5 years of clinical experience, and treatment adherence was assessed every two weeks by the Sandplay Therapy operation manual (Cronbach's $\alpha = 0.91$), with an intragroup correlation coefficient of more than 0.85 considered to be protocol consistency.

The control group received stress management education, which was designed as a modularized curriculum with 12 sessions covering stress cognitive reconstruction (using CBT techniques), relaxation training (including progressive muscle relaxation and abdominal breathing), and time management strategies, with each session consisting of a 20-minute lecture, a 50-minute group exercise, and a 20-minute feedback. The teaching process was based on the Ministry of Education's standardized textbook on Mental Health Education for College Students, and the introduction of expressive arts therapy components was deliberately avoided. The course was taught by two clinical psychologists with at least 200 hours of CBT training, and the course content was videotaped in its entirety, and a third-party expert blindly reviewed 30% of the lessons randomly selected, with fidelity scores of 5 or more (out of 5) in all cases, to ensure quality control.

2.4. Statistical methods

The study in this paper was designed as a randomized controlled trial, and data were analyzed using SPSS 26.0 statistical software. Measurement information was tested for normality and compared between groups using independent samples t-test and ANOVA; if it did not conform to normal distribution, non-parametric tests were used. Count data were expressed as frequency and percentage, and chi-square test was used for comparison between groups. To improve the rigor of statistical analysis, effect sizes and their 95% confidence intervals were reported and corrected for multiple comparisons. All statistical tests were two-sided, and differences were considered statistically significant at $p<0.05$.

3. Results

Continuous variables were analyzed by analysis of covariance (ANCOVA), covariates were baseline score, gender and total MoCA score, effect size indicators Cohen's d (small effect ≥0.2, medium effect ≥0.5, large effect ≥0.8), η^2 (small effect ≥0.01, medium effect ≥0.06, large effect ≥0.14); missing data processing was done by multiple interpolation (m=5 iterations) , sensitivity analysis showed that ITT was consistent with PP results; mediation effect test symbolized the indirect effect of expression efficacy on stress relief β= -0.36 (95% CI=[-0.52 to -0.21]), $p<0.001$, with a mediation contribution of 62.3%.

Table 1: Baseline characteristics.

Name	Experimental group	Control group	Statistic	p	Effect size (95% CI)
Age	20.58 ±1.82	21.12 ±1.97	t=1.73	0.086	d=0.28 [-0.04, 0.61]
Gender (proportion of men, %)	34.30%	32.90%	χ^2=0.03	0.865	OR=1.06 [0.53, 2.13]
CPSS-10 total score (baseline)	26.45 ±3.21	25.89 ±3.54	t=0.98	0.329	d=0.17 [-0.16, 0.49]
MoCA Total Score	27.32 ±1.05	27.18 ±1.12	t=0.75	0.455	d=0.13 [-0.20, 0.46]

Table 2: Comparison of scale scores after intervention.

Name	Experimental group	Control group	Statistic	p	Effect size (95% CI)
CPSS-10 total score	-9.87 ±2.65	-4.12 ±3.01	F=58.34***	0.000	η^2=0.32 [0.21, 0.43]
DASS-21 Stress Score	-5.43 ±1.89	-2.76 ±2.11	F=27.15***	0.000	η^2=0.18 [0.09, 0.28]

Table 3: Comparison of institutional indicators.

Name	Experimental group	Control group	Statistic	p	Effect size (95% CI)
Symbolic expression	5.12 ±0.78	3.45 ±0.92	F=42.67***	0.000	d=1.02 [0.72, 1.32]
Self-Integration	5.89 ±0.65	4.02 ±0.81	F=39.22***	0.000	d=1.18 [0.87, 1.49]

The baseline data analysis in Table 1 indicates that there were no significant differences between the experimental and control groups in terms of various demographic characteristics, perceived levels of stress and cognitive functioning scores, proving that there was a balance between the two groups prior to the intervention. In terms of stress perception, the amount of change in the CPSS-10 total score was significantly different between the experimental and control groups, and the change in the stress scores of the experimental group was significantly higher than that of the control group, thus indicating that sandplay therapy has a significant efficacy in reducing college students' stress. The statistical significance of this finding was verified by ANOVA ($F=58.34$, $p<0.001$), implying

that the method has practical significance in relieving stress and far exceeds convention-al educational programs.

From the data in Table 2, it can be seen that in the evaluation of the DASS-21 pressure subscale, the change of stress score in the experimental group was significantly greater than that in the control group, which was confirmed by ANOVA ($F=27.15$, $p<0.001$), and the effect size also showed a significant intervention effect. Although the effect size was slightly smaller than the aforementioned CPSS-10 results, this indicator still suggests that sandplay therapy has a strong advantage in reducing the multidimensional experience of stress.

As shown in Table 3, in terms of mechanism analysis, sand tray game therapy not only effectively relieves stress, but also improves the individual's emotional regulation and self-integration. The scores of the experimental group were significantly higher than those of the control group in both Symbolic Expression and Self-Integration as measured by self-administered questionnaires, and the significance of the results was verified by ANOVA (Symbolic Expression: $F=42.67$, $p<0.001$; Self-Integration: $F=39.22$, $p<0.001$) and the effect sizes of Symbolic Expression and Self-Integration indicated that sandplay therapy was significant in promoting individual's emotional integration and self-awareness was significant.

From a statistical point of view, this study used analysis of covariance (ANCOVA) to adjust the baseline values to ensure the reliability of the intervention effect. All multiple comparisons were corrected by Bonferroni to avoid the false discovery rate associated with multiple hypothesis testing, which provides strong support for the selection of future psychological intervention methods.

4. Discussion

The comparative study of this research reveals the unique intervention value of sandplay therapy in college students' stress management. The effect of sandplay therapy in reducing college students' stress and improving related psychological symptoms was significantly demonstrated, and it can improve individuals' emotional regulation and self-integration ability, and promote individuals' emotional integration and self-awareness. Thus, sandplay therapy has a holistic psychological improvement effect[5].

Sandplay therapy has shown significant effects in improving college students' perception of stress, a result that is consistent with existing research, which shows that sandplay therapy can help college students reduce their internal stress through non-verbalization[25]. In the context of facing multiple pressures such as academics and employment, college students often face difficulties in emotional expression and psychological regulation, and sandplay therapy can effectively help individuals release their emotions through symbolic expression[26], which can reduce the individual's perception of stress.

Sandplay therapy has also demonstrated positive intervention effects in improving psychological symptoms in college students. Sandplay therapy was effective in reducing anxiety and depression among college students[27] and enhancing their psychological resilience. This result may be closely related to the Symbolic Expression of sandplay therapy. As an intuitive non-verbal expression, the sand tray enables individuals to present their inner conflicts and disturbances in an external form through the selection and arrangement of sand tools, thus facilitating emotional integration and self-awareness enhancement[28]. Compared with traditional cognitive-behavioral therapy, sand tray play therapy can provide individuals with a more flexible and creative space for emotional expression, which can help to release internal emotional conflicts[29] and effectively alleviate psychological symptoms.

Mechanistic analyses revealed that sandplay therapy's enhancement in Symbolic Expression and self-integration supported its unique advantages in emotion regulation and stress management[26,30].

Improvements in symbolic expression and self-integration also suggest that sandplay therapy not only helps college students alleviate immediate emotional stress[25], but also promotes self-integration at a deeper level, enabling individuals to develop more positive and effective coping strategies in the face of stress[24].

This study provides important empirical evidence for the application of sandplay therapy in college students' stress management, proving that the method has significant intervention effects in relieving stress, improving mood and promoting self-integration. Future research can further explore the mechanism, long-term effects, and combined application of sandplay therapy with other psychological intervention methods to promote its promotion and popularization in college students' mental health education.

5. Conclusions

This study explored the intervention effects of sandplay therapy and conventional stress management education courses on college students' stress and related psychological symptoms through a randomized controlled trial design. Sandplay therapy has significant advantages in reducing college students' perceived stress, improving psychological symptoms, and promoting emotional regulation ability and self-integration. Sandplay therapy can not only effectively relieve stress, but also help college students realize self-integration at the emotional and cognitive levels.

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