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An Empirical Study on Multisensory-Based Wearable Art Therapy as an Adjunctive Intervention for Depression

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Abstract

In response to the phenomenon of "alexithymia" often observed in clinical depression treatment and the spatiotemporal limitations of traditional art therapy, this study proposes an adjunctive intervention model termed "Wearable Art Therapy Based on Multisensory Cognition." Through interdisciplinary collaboration between medicine and art, 11 patients with depression were randomly assigned to either a control group or an experimental group. The control group received standard treatment only, whereas the experimental group underwent additional wearable art therapy sessions, which comprised three core stages: material perception, embodied creation, and wearing experience. To address the limitations of subjective assessment scales, heart rate variability (HRV) was introduced as an objective physiological evaluation metric. The results showed that the mean HRV of patients in the experimental group increased significantly following the intervention, with an exploratory trend indicating a moderate to large effect size compared to the control group. The findings demonstrate that wearable art creation, integrating multisensory interaction and embodied cognition, effectively mitigates physiological stress and activates the parasympathetic nervous system. Additionally, the handcrafted wearable artifacts serve as "transitional objects," offering patients portable psychological support and sustained companionship beyond the confines of the clinical setting. This model has shown efficacy in alleviating depressive and anxiety symptoms, providing a scientifically grounded and innovative pathway for non-pharmacological adjunctive interventions in depression treatment.

Keywords

Depression, Wearable Art, Art Therapy, Heart Rate Variability (HRV)

1. Introduction

1.1. Rationale and Background

Major Depressive Disorder (MDD) is a mental illness with high prevalence and high disability rates worldwide. Its core symptoms include not only persistent low mood and anhedonia, but also, at a deeper level, a rupture in the emotional connection between the individual and their self, as well as with the external environment. Statistics from the World Health Organization (WHO) indicate that depression has become one of the leading causes of the global disease burden, placing a heavy strain on socioeconomic systems and family life. The current clinical treatment system primarily relies on psychopharmacological interventions. Selective serotonin reuptake inhibitors (SSRIs), followed by newer dual- or multi-target drugs that address multiple pathways (such as SNRIs, NaSSAs, and NDRIs), have played an irreplaceable role in alleviating acute symptoms. However, a common phenomenon observed in clinical practice is that many patients, even after improvements in physiological symptoms (such as sleep and appetite), still feel an inner emptiness and experience severe "emotional aphasia"—that is, difficulty accurately describing their inner pain and needs in words. This often results in the restoration of social functioning lagging behind the relief of clinical symptoms.

Faced with this dilemma, seeking non-pharmacological adjunctive interventions has become a consensus within the fields of psychiatry and psychology. Art therapy, due to its ability to provide a nonverbal channel for expression, high safety profile, and minimal side effects, has gradually been incorporated into the scope of integrated treatment. Oztürk-Arenz et al. noted in their study of cancer patients that creative art therapy can effectively alleviate "emotional aphasia" and help patients process complex emotions on a nonverbal level (Oztürk-Arenz et al., 2023). Research by Geipel et al. on adolescent depression also confirmed that art-based interventions can effectively reduce cortisol levels and improve stress responses (Geipel et al., 2022). However, a review of previous studies reveals that existing forms of art therapy are largely concentrated on painting, music, or dance therapy. While effective, these forms often face temporal and spatial limitations—paintings are typically confined to therapy rooms or file folders, and music dissipates once the melody ends. When patients leave the therapeutic setting and return to their stressful daily lives, they often lack a concrete, tangible "transitional object" to sustain the sense of security and support derived from therapy.

Based on a deep understanding of this challenge, the Department of Jewellery Design at the Gemmological Institute of China University of Geosciences (Wuhan), has actively explored pathways to integrate art and medicine in recent years,

striving to expand the scope of jewelry design from the traditional realm of decorative aesthetics into the field of mental health services. As a unique art form, jewelry possesses the distinct attributes of being tangible, wearable, and symbolic; it is not only an object of visual aesthetics but also an extension of the body. Through in-depth interdisciplinary collaboration with the Department of Psychiatry at Liyuan Hospital, affiliated with Tongji Medical College of Huazhong University of Science and Technology, this study integrates this concept into clinical practice, namely "wearable art therapy based on multisensory cognition." The research goes beyond simply having patients create a wearable art piece; it seeks to construct a comprehensive psychological intervention model encompassing material perception, manual labor, physical wear, and social display, aiming to achieve this through deep engagement in multisensory cognition.

1.2. Current Research and Theoretical Foundation

1) Multisensory Cognition and Embodied Regulation

Traditional psychotherapy often emphasizes verbal communication at the cognitive level; however, patients with depression frequently experience a sense of disconnection between mind and body. In a study comparing the physiological and psychological effects of painting and pottery-making, Rankanen et al. found that three-dimensional modeling activities involving multisensory engagement—such as touch and proprioception—can induce significant changes in heart rate variability (HRV), reflecting deeper physiological relaxation and focus (Rankanen et al., 2022). Art therapy integrates information from multiple sensory channels, including vision, touch, and even smell. Its advantages in multisensory stimulation, emotional expression, and self-awareness can yield more positive effects. Research by Wu Qiyong et al. indicates that training in handicrafts effectively improves depressive symptoms and cognitive function in post-stroke patients, while also enhancing their proactive engagement in rehabilitation (Wu et al., 2011). Wang Ping and colleagues found that painting and horticultural therapy can effectively alleviate patients' physiological symptoms, such as poor appetite and abnormal mood fluctuations, while also helping to reduce autonomic nervous system dysfunction (Wang & Liu, 2020). Consequently, it is believed that creative arts are more effective than traditional art therapy, as they better enhance patients' sense of participation and promote emotional stability through visual and artistic appeal. The creative process of wearable art proposed in this project involves the combination of materials, the selection and coordination of colors, and the patient's own thought processes and craftsmanship—all of which require a high degree of coordination between the patient's hands, eyes, and brain. Ye Haosheng and colleagues also argue that resolving emotional knots should not rely solely on the brain to correct course; embodied cognition posits that the human mind is inherently intertwined with the body and the surrounding environment (Ye & Su, 2024). By using the tangible physical intervention of creating wearable art to strengthen the inner self, this "embodied" experience forcibly draws patients' attention away from

ruminative negative thoughts and back to the present moment. Through rhythmic physical movement, it regulates the excitability of the nervous system, thereby generating a "flow" experience similar to meditation.

2) Object Relations Theory and Transitional Objects

The concept of "transitional objects" proposed by British psychoanalyst D. W. Winnicott provides the core psychodynamic basis for the intervention mechanism in this study (Xi, 2007). In developmental psychology, as infants transition from the symbiotic state with their mothers and cope with separation anxiety, they often project their inner sense of security onto a physical object (such as a stuffed toy or blanket), using it as a substitute source of security and a psychological buffer. For patients with depression who have long been in a state of depression and repression, with compromised self-boundaries and often accompanied by psychological regression to a vulnerable state, their internal self-soothing mechanisms are often deficient. In this context, wearable art objects that patients create with their own hands within a safe therapeutic space—and into which they pour their personal emotions—transcend the realm of ordinary decorative items to serve as "transitional objects" that help adults rebuild their inner order.

The healing power of such objects relies heavily on their irreplaceable material properties. A comparative study by Richesin et al. on virtual reality and physical art creation confirmed that, compared to digital virtual experiences, physical media with tangible sensory perception and immersion can penetrate psychological defense mechanisms more deeply and evoke genuine emotional resonance (Richesin, Baldwin, & Wicks, 2021). The uniqueness of wearable art lies precisely in its intimate, constant presence, which breaks through the physical limitations of traditional psychotherapy in the clinic and transforms into a portable holding environment.

When patients leave the therapy room and encounter moments of crisis—such as anxiety attacks or depressive rumination—in their daily lives, actively touching the physical texture of wearable art objects and sensing the weight against their skin along with the thermal feedback of the material allows their attention to be swiftly redirected from uncontrolled internal negative thoughts back to present-moment bodily sensations. This sustained "sense of presence," driven by real tactile and kinesthetic sensations, not only instantly evokes the sense of control and psychological support experienced during the intervention but also effectively generalizes therapeutic effects into daily life—a feat that traditional art forms, such as painting or sandplay, which cannot be carried on one's person, struggle to match.

3) Heart Rate Variability as a Biomarker for Efficacy Assessment

To overcome the subjective limitations of traditional self-report psychological scales—which are highly susceptible to patients' cognitive biases, psychological defense mechanisms, and expressive abilities—this study introduced heart rate variability (HRV) as an objective physiological indicator that reflects the autonomic nervous system's ability to regulate the cardiovascular system. In psychopathological mechanisms, patients in prolonged states of depression and emotional suppression often exhibit persistent hyperactivity of the hypothalamic-pituitary-ad-

renal (HPA) axis. This chronic physiological stress leads to long-term imbalance in the autonomic nervous system—with the sympathetic nervous system abnormally active, while the vagus nerve (parasympathetic nervous system), acting as the "braking system" for emotions, experiences a severe decline in tone—ultimately manifesting as a significant decrease in HRV indicators.

The intervention of wearable art therapy effectively improves HRV metrics, indicating that this activity successfully provides a bottom-up pathway for bodily regulation through embodied sensory interaction and rhythmic movement. This not only effectively alleviates excessive nervous system arousal and reactivates the patient's parasympathetic-driven internal physiological repair mechanisms, but also substantially enhances the patient's psychological resilience at the deeper level of mind-body integration.

2. Research Design and Implementation Methods

2.1. Study Population and Ethical Considerations

This study was conducted using the clinical platform of the Department of Psychiatry at Liyuan Hospital, affiliated with Tongji Medical College of Huazhong University of Science and Technology, and strictly adhered to the standard procedures for empirical research in clinical psychology. The study protocol strictly followed the ethical principles for medical research involving human subjects as outlined in the Declaration of Helsinki and was approved by the Medical Ethics Committee of Liyuan Hospital, affiliated with Tongji Medical College of Huazhong University of Science and Technology. During the recruitment phase (**Figure 1** shows the recruitment posters), the research team provided all potential participants and their legal guardians with a detailed explanation of the study objectives, intervention procedures, data confidentiality measures, and potential risks, ensuring that all participants signed written informed consent forms on the basis of full understanding and voluntary participation.

The case screening process followed rigorous inclusion and exclusion criteria. Inclusion criteria included: meeting the ICD-10 diagnostic criteria for depressive episodes; being between 10 and 40 years of age—a criterion referenced from the "Chinese Guidelines for the Prevention and Treatment of Depressive Disorders" compiled by Li Lingjiang et al.—to ensure participants possessed basic cognitive and cooperative abilities (Li & Ma, 2015). A Hamilton Depression Rating Scale (HAMD-24) score of 20 or higher, indicating mild to moderate depression or a recovery phase; and the ability to communicate verbally and perform fine motor tasks with the hands. Exclusion criteria included: severe psychotic symptoms, risk of manic episodes in bipolar disorder, and severe suicidal tendencies; as well as severe cardiovascular or cerebrovascular diseases or other physical conditions that might interfere with HRV data collection.

After rigorous screening, a total of 11 eligible patients with depression were ultimately included. Using a random number table, the patients were divided into a control group (n = 5) and an experimental group (n = 6).

Figure 1. Roll-up banner displayed in the Department of Psychiatry at Liyuan Hospital, affiliated with Tongji Medical College of Huazhong University of Science and Technology.

2.2. Experimental Procedure and Intervention Protocol

This study employed a pre-test/post-test control group design to control for extraneous variables and accurately assess the effectiveness of the intervention. Patients in both groups maintained their existing psychiatric medication regimens (primarily SSRIs or SNRIs) and received routine psychiatric care and health education, in accordance with the "Treatment as Usual" (TAU) principle of medical ethics. In addition, patients in the experimental group participated in a "Wearable Art Therapy" intervention program designed by the team led by Associate Professor Bao Rui from the Department of Jewelry Design at the School of Jewelry, China University of Geosciences (Wuhan). To monitor and evaluate objective physiological indicators, this study utilized portable devices to track patients' heart rate variability (HRV) data. The research team introduced a portable physiological monitoring device (Wrist-Worn ECG Monitor GJ-SH-01) (Figure 2) and used SDNN (standard deviation of all normal heartbeats) as the core HRV assessment index to objectively reflect the overall regulatory capacity of the patients' autonomic nervous system. Data collection spanned 24 hours daily, with the software automatically filtering out abnormal waveforms caused by physical activity. Considering patient compliance and actual wear patterns, this study established a threshold for valid data selection: only records with a continuous monitoring duration exceeding 6 hours per day were selected, with values recorded in 30-minute time windows. To account for individual patient differences and treatment adaptability, the complete monitoring cycle for each participant was set at 2 weeks. After completing two weeks of continuous monitoring and the endpoint assessment, patients in the experimental group uniformly participated in the healing workshop experiment the following afternoon. To minimize random errors and ensure data stability, this study did not use instantaneous readings; instead, daily averages were calculated based on data from multiple time windows within the aforementioned daily valid monitoring periods, serving as baseline physiological indicators for pre- and post-intervention comparisons.

Figure 2. Wrist-worn ECG monitor (GJ-SH-01).

This intervention protocol deeply integrates Norman's theory of affective design, creatively transforming his classic three-dimensional framework—comprising the instinctive, behavioral, and reflective layers—into a clinical pathway for psychological intervention (Norman, 2003). This study selected materials rich in color and varied in texture to provide patients with immediate sensory comfort through safe and pleasant visual and tactile stimuli, effectively calming their over-aroused nervous systems. Moreover, the wearable art pieces evolve into a medium for personal narrative and psychological projection, serving as a tangible vehicle for the reconstruction of inner order and helping patients continuously reshape a positive self-identity in their subsequent daily lives. Patients in the experimental group participated in a single session lasting approximately 90 to 120 minutes. The activity takes place in the group activity room at the Psychotherapy Center of Liyuan Hospital, where the environment is warm and private. The intervention process is not merely a craft workshop but emphasizes psychodynamic guidance, specifically divided into the following three core phases.

2.2.1. Phase 1: Material Perception and Awakening of Subjectivity (Introduction Phase)

For patients who have been in a state of prolonged depression and emotional suppression, core symptoms often manifest as anhedonia and reduced volitional activity—that is, a profound "lack of drive." Under the psychological mechanism of learned helplessness, patients frequently lose their sense of control over life and exhibit a complete withdrawal from external stimuli. Therefore, in clinical intervention, empowering "patient choice" itself serves as a therapeutic strategy to break this impasse. Based on Gibson's ecological psychology theory of "affordance," physical materials are not passive objects; their inherent physical properties and textures can actively induce and awaken human perception and behavioral responses (Gibson, 1986). In conjunction with the perceptual/kinesthetic dimension of the Expressive Arts Therapy Continuum (ETC), the texture of materials is directly linked to various psychological metaphors and emotional capacity (Huang & Li, 2025). At the activity site, the therapeutic team carefully set up a rich "materials buffet" table (**Figure 3**), displaying materials of various colors and shapes, such

as soft, warm fibers; translucent, malleable resin; and rough, dense paper. The cold, hard, and malleable nature of heat-shrink film often symbolizes the establishment of psychological boundaries and the reshaping of resilience; the softness and warmth of fibers provide a sense of psychological holding and comfort akin to the mother-infant relationship; while the transparency and malleability of resin suggest the flow of emotions and unknown possibilities. These diverse sensory stimuli offer patients a rich medium for nonverbal expression.

At this stage, the project strictly adhered to a non-directive intervention strategy, committed to creating a psychologically safe space free from judgment within the group. The research team guided participants to let go of the aesthetic burdens associated with traditional handicrafts—such as judgments of "likeness" or "beauty versus ugliness"—and encouraged them to bypass the prefrontal cortex's excessive rational scrutiny and self-criticism, instead relying entirely on their immediate bodily intuition to touch and select materials that resonated with them. Research by Czamanski-Cohen et al. indicates that in art therapy, the absolute freedom to choose materials is itself a crucial pathway for patients to break free from a victim mentality and rebuild their sense of internal locus of control (Czamanski-Cohen et al., 2019). This subtle yet pivotal process aims to gently and safely reawaken patients' long-dormant sense of agency.

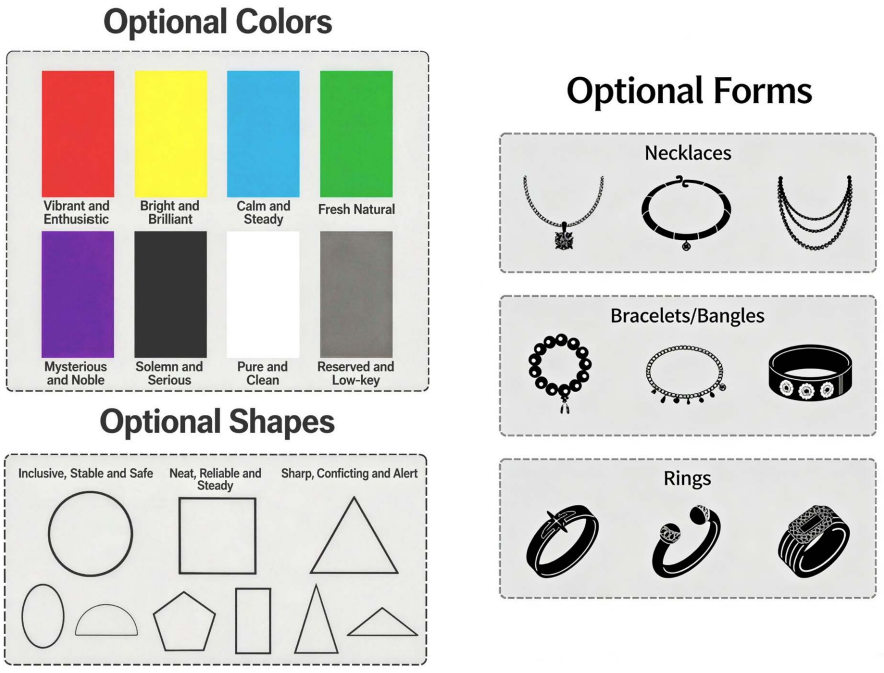

Figure 3. "Material buffet" information poster.

Field observations revealed significant changes in many patients' body language: from initial hesitation, physical stiffness, and averted gaze when faced with a vast array of materials, they gradually began—with the gentle accompaniment and encouragement of volunteers—to reach out, repeatedly comparing, touching,

and even gently kneading the materials. These subtle shifts—from "avoiding interaction" to "active exploration," and ultimately reaffirming "I like this" and "my personal preferences"—break the vicious cycle of "inaction" characteristic of depression. This essentially constitutes the foundational first step in rebuilding self-efficacy, as outlined in Bandura's theory (Bandura, 1977).

2.2.2. Embodied Creation and Emotional Transformation (Core Phase)

This is the most critical phase for healing, deeply involving embodied cognition and bottom-up bodily regulation mechanisms. After selecting materials, patients begin creating with the assistance of faculty and student volunteers (**Figure 4**). The team deliberately slows down the pace of technical guidance and strictly avoids "substituting for the patient." This intervention strategy aims to safeguard the patient's agency and compel them to anchor their attention in the present moment. Through non-directive demonstrations by volunteers, patients are guided to personally attempt bending, painting, or weaving the materials, fully engaging their senses to perceive the texture of the materials, observe the evolution of colors, and create embodied works based on the surges of their inner intuition.

Figure 4. The team guides patients in creating.

Feng et al., (2024) empirically validated the crucial role of "hand" movements in emotional regulation, finding that hospitalized patients with depression exhibited significantly reduced emotional fluctuations and improved concentration after participating in handicraft activities (Feng, Li, & Liu, 2024). The core mechanism lies in the fact that these "hand-brain" coordinated fine motor skills—particularly rhythmic and repetitive physical operations—can effectively activate the parasympathetic nervous system. During this process, patients are highly likely to enter a meditative flow state, thereby interrupting the ruminative thinking typical of depression. In this dynamic process, the physical malleability of the materials serves as a container for emotions. For example, some patients choose to tightly and intricately coil cold, hard metal wire, essentially using a projection mechanism to "externalize" their inner anxieties and emotional entanglements that are difficult to articulate; others opt for soft weaving with bright colors, attempting to recapture long-lost joy—a classic form of nonverbal emotional sublimation and psychological compensation. At this stage, the research team adjusts their interaction methods in real time based on the patient's emotional responses (such as

pauses during agitation or silence during concentration), creating a "holding environment" as described by Winnicott, where patients feel safe and accepted (Figure 5).

Figure 5. Medical staff measuring the patient's HRV data and a close-up of the artwork.

2.2.3. Phase Three: Wearing Experience and Meaning Reconstruction (Consolidation Phase)

Once the artworks are completed (Figure 6), rather than being submitted or displayed statically as in traditional art classes, healthcare staff assist the patients in solemnly donning the handmade wearable artworks on their own bodies through a highly therapeutic, ritualistic gesture. As object relations theory suggests, at this point, the piece of jewelry has completely transcended its material properties; imbued with significant psychological energy, it has been transformed into an "object transition" unique to adults (Winnicott, 1971). Subsequently, within a safe and supportive group setting, the research team encouraged patients to use their self-made wearable artworks as metaphorical vehicles to share the underlying messages and life stories behind their creations, thereby helping patients transform chaotic, latent emotions into coherent, explicit narratives. This not only completes the clinical cycle from embodied sensory experience to higher-order cognitive reconstruction but also enables patients to establish a new sense of self-identity as "creators" beyond the traditional "patient" label. The entire research process is illustrated in Table 1.

Figure 6. The team displays wearable artworks created by patients.

Table 1. Research process flowchart.

Steps	Intervention	Expected Outcomes
First step: Material Perception and Agency Activation (Introduction Phase)	• Provide jewelry materials with diverse textures and colors for free exploration • Encourage intuitive and tactile engagement through non-directive guidance	• Stimulate sensory engagement • Enhance sense of agency and control
Second step: Embodied Creation and Emotional Expression (Core Phase)	• Conduct jewelry-making with guided demonstration and support • Encourage emotional expression through hands-on material manipulation	• Improve engagement and concentration • Facilitate non-verbal emotional expression
Third step: Wearing Experience and Meaning Integration (Consolidation Phase)	• Assist participants in wearing the finished jewelry and noticing bodily sensations • Encourage sharing the personal meaning of the work	• Reinforce the sense of self-created value • Promote self-identity and emotional integration

3. Analysis of Heart Rate Variability Physiological Indicators

This study ultimately rigorously screened and included 11 valid cases, comprising 6 in the experimental group and 5 in the control group. To ensure the scientific validity and rigor of the evaluation results, the research team designed the study to maintain consistency between the two groups in terms of disease severity at enrollment, psychiatric medication regimens (including drug types and dosages), and the overall intervention duration (2 weeks). This approach aimed to minimize the interference of extraneous factors—such as medication differences or variations in treatment duration—on the final results, ensuring a high degree of comparability between the two groups' data. In the specific efficacy assessment process, recognizing that traditional psychological scales primarily rely on patients' subjective self-reports and are thus susceptible to emotional fluctuations, this study supplemented subjective questionnaires with HRV data collected via portable devices to provide objective physiological evidence for efficacy evaluation. The definition of post-intervention HRV measured by the device refers to the heart rate variability index calculated from RR intervals of a sinus rhythm continuously recorded for ≥1 minute during a specified recovery period while the subject is at

rest following the completion of the intervention. Through multidimensional cross-comparative analysis of subjective and objective data from the experimental and control groups before and after the intervention, this study aims to scientifically verify whether "wearable art therapy" has a significant synergistic effect on regulating patients' autonomic nervous system function when used in conjunction with conventional clinical treatment.

3.1. Test of Homogeneity of Baseline Data and Overall Data Overview

Prior to the formal commencement of the intervention, this study first assessed the initial HRV status of patients in both groups (Table 2 and Table 3). At enrollment, the mean HRV values for the experimental and control groups were 67.33 ms and 68.60 ms, respectively. An independent samples t-test revealed no statistically significant difference in baseline levels between the groups ($t = 0.06$, $p > 0.05$). Both groups of patients were aged between 10 and 40 years, as per the screening criteria, and had HAMD-24 scores of 20 or higher; they were treated with SSRIs such as sertraline and escitalopram; the doses were 100 mg of sertraline and 10 mg of escitalopram, and the duration of illness ranged from 6 to 12 months. This result demonstrates that, prior to receiving different intervention protocols, the stress states of the autonomic nervous systems in both groups were at the same baseline level, ensuring clinical comparability.

Table 2. Experimental group data table.

Experimental Group					
Name	Gender	Age	Symptoms	HRV Data	
				Start	End
A	Female	13	Depressive episode	125	93
B	Male	20	Anxiety and depressive state	44	143
C	Male	21	Depressive episode	120	135
D	Female	15	Depressive episode	25	29
E	Female	12	Depressive episode	25	79
F	Male	14	Depressive and anxiety state	65	95

Table 3. Control group data table.

Control Group					
Name	Gender	Age	Symptoms	HRV Data	
				Start	End
a	Female	11	Depressive episode	93	97
b	Female	15	Depressive episode	77	70
c	Female	33	Depressive episode	66	78
d	Female	38	Depressive episode	53	59
e	Female	25	Depressive disorders	54	55

3.2. Comparison of Overall Intervention Trends between Groups

After ensuring baseline consistency, this study further compared the trends in mean changes between the two groups of patients following completion of the treatment cycle (Figure 7). The data from the two groups exhibited distinctly different trajectories:

In the control group, after receiving only conventional drug therapy, the mean HRV rose slightly from 68.60 ms to 71.80 ms, with an average change of just +3.20 ms, and the trend line was extremely flat. This reflects that conventional drug therapy alone has a relatively limited effect on activating and repairing the parasympathetic nervous system in the short term.

In stark contrast, after the experimental group received "wearable art therapy" in addition to conventional treatment, the mean HRV surged significantly from 67.33 ms to 95.67 ms, with an average change of as much as +28.33 ms. In the graph, the experimental group exhibits a highly significant steep upward slope, visually confirming the intervention effect of multisensory wearable art interventions in alleviating physiological stress and enhancing cardiac vagal tone.

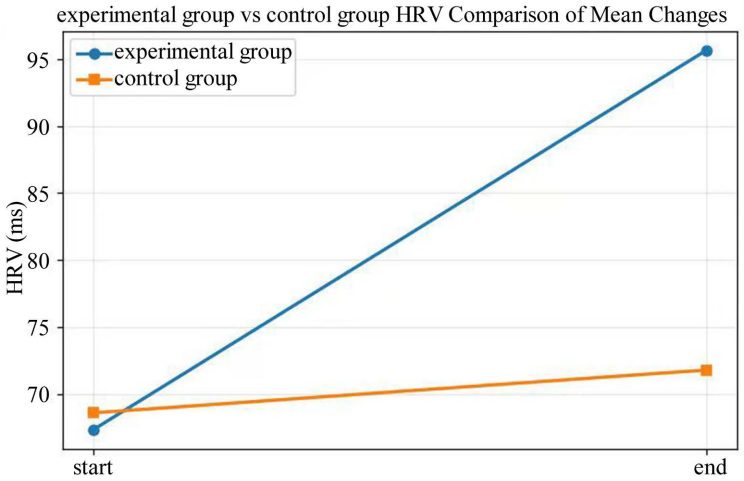

Figure 7. Comparison of mean changes in HRV data between the experimental group and the control group.

3.3. Individual Intervention Trajectories

Given the individual heterogeneity in psychological and physiological responses to intervention, in addition to macro-level averages, this study simultaneously plotted individual HRV change trajectories for each patient to comprehensively assess the clinical validity of the intervention's effects.

As shown in the control group's trajectory plot (Figure 8), the lines for the vast majority of patients remained nearly horizontal, indicating a lack of significant physiological improvement. In contrast, observation of the experimental group's trajectory plot (Figure 9) reveals that all five patients exhibited a substantial positive shift following the art intervention (e.g., Patient B's HRV surged from 44 ms to 143 ms).

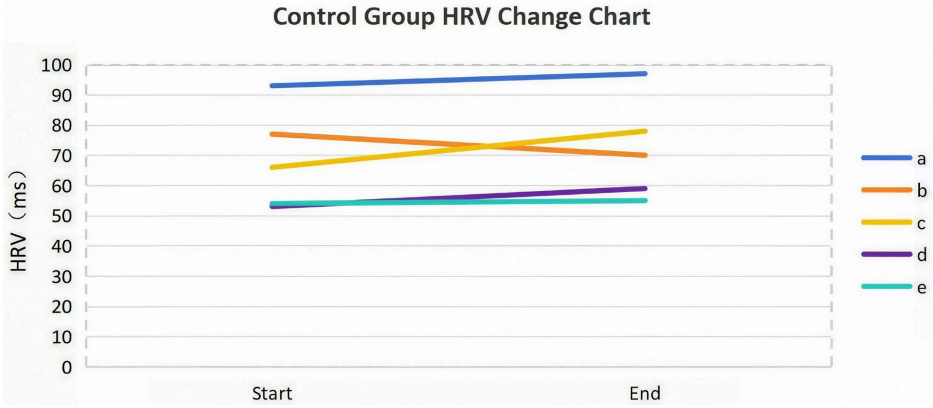

Figure 8. Trajectory plot of individual changes in the control group.

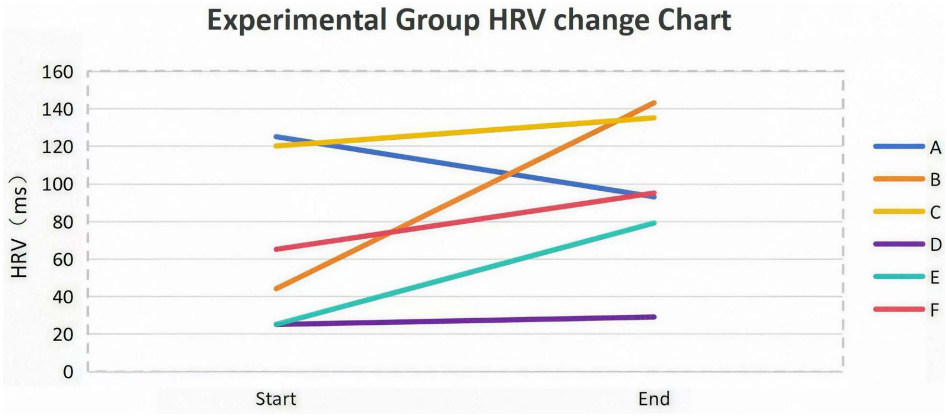

Figure 9. Trajectory plots of individual changes in the experimental group.

However, adhering to the objective principles of real-world studies (RWS), we also observed one atypical trajectory in the experimental group (Patient A, a 13-year-old female) where HRV decreased (from 125 ms to 93 ms). Combining clinical observations with the ABER (Art-Based Emotional Regulation) framework, this phenomenon does not negate the therapy's efficacy but rather profoundly reflects the complexity of the "embodied cognition" intervention process: this patient may have experienced anxiety and frustration regarding operational failure when encountering unfamiliar metal or woven materials, and this short-term "operational resistance" triggered a defensive activation of the sympathetic nervous system.

3.4. Distribution Characteristics of Change Scores and Analysis of Large Effect Sizes

To more rigorously evaluate the observed differences in change scores, this study conducted statistical analyses of the distribution of HRV change scores and effect size tests for the two patient groups.

As shown in the box plot in Figure 10, the variation in the control group is highly concentrated around the 0 value (with a median of approximately +4), and the data distribution is skewed; in contrast, the overall median variation in the

experimental group is significantly higher (approximately +22.5), with a generally positive distribution and a maximum increase of +99 ms.

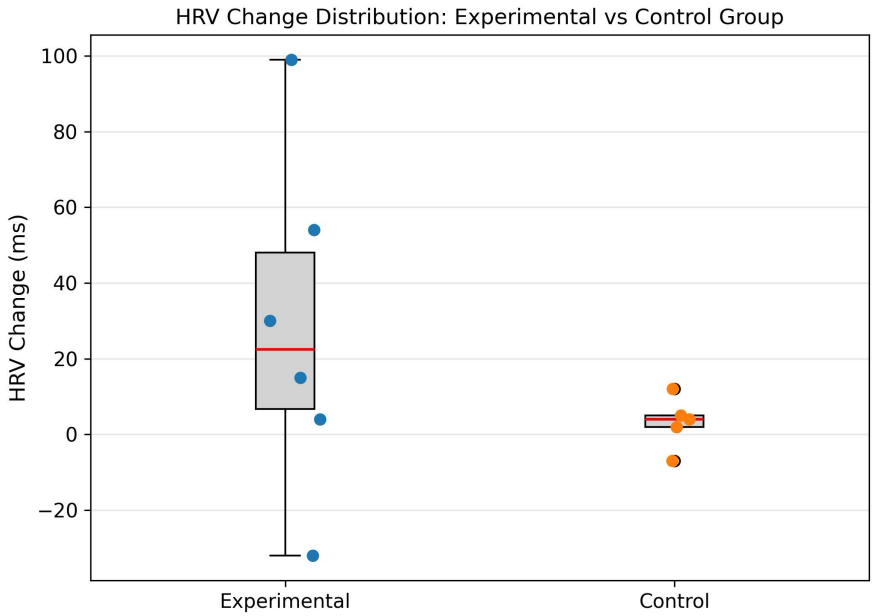

Figure 10. Box-and-whisker plot comparing changes between the experimental and control groups.

An independent samples t-test comparing the HRV changes between the two groups revealed that the difference between the experimental and control groups did not reach conventional statistical significance ($t = 1.23$, $df = 9$, $p = 0.25$). However, from the perspective of effect size, the difference between the two groups still exhibited a relatively clear trend, with a Cohen's d of 0.74, indicating a medium-to-large effect size. Given that this study is a small-scale exploratory pilot study with relatively limited statistical power, the final data presentation may be partially constrained by sample size. Overall, combined with the results of the box plots, it is evident that the increase in HRV in the experimental group was significantly greater than that in the control group, suggesting that wearable art therapy has potential clinical value and practical significance for improving autonomic nervous system function in patients with depression. As this study is a small-sample pilot study, future research could expand the sample size to further validate the therapeutic efficacy.

4. Discussion

4.1. Mechanisms Underlying the Synergistic Effects of Wearable Art Therapy

The results of this study demonstrate a synergistic effect of the "pharmacotherapy + wearable art therapy" model. Although the sample size was limited, preventing the *P*-value from reaching statistical significance, the moderate to large effect sizes

suggest that this model has potential clinical value in regulating autonomic nervous system function.

First, embodied cognition and multisensory stimulation form the physiological foundation of its efficacy. During the process of creating wearable art, patients are not merely performing mechanical labor. The tactile sensations of materials transmitted through their fingertips and the visual impact of color combinations—these rich sensory inputs travel directly through neural pathways to the cerebral cortex, activating the perceptual systems that have become dulled by depression. This process of learning while creating forcibly shifts patients' attention away from ruminative thoughts—such as regret over the past or anxiety about the future—and focuses it on present-moment actions and sensations. As confirmed by HRV data, this shift and focus of attention effectively reduces physiological stress levels, creating a physiological window for emotional recovery.

Secondly, emotional design and the rebuilding of self-efficacy are its core psychological mechanisms. People with depression often experience intense feelings of helplessness and self-denial. In conventional medical settings, patients are typically passive recipients; however, in this project's multisensory, wearable art therapy, the team's design grants patients a high degree of autonomy. From selection to preference to creation, this series of small successes gradually eroded patients' learned helplessness. As observed during the activity, some patients repeatedly stroked their finished pieces and softly expressed a sense of accomplishment. This sense of control over the external world, gained through altering the physical form of an object, is crucial for rebuilding self-efficacy in psychological rehabilitation.

4.2. Continuation of Object Relations and Long-Term Support

The greatest innovation of this study, distinguishing it from traditional art therapy and music therapy, lies in the unique nature of "wearable art" as a medium. Traditional artworks are often left in the therapy room after the session ends, creating a physical separation from the patient. In contrast, wearable art pieces possess inherent "wearability" and "portability."

According to object relations theory, this handcrafted piece of jewelry becomes a "transitional object" for the patient. When patients leave the hospital and return home, or when they face stressful situations in daily life, the jewelry on their wrists or around their necks provides an immediate, physical tactile anchor. By touching the texture of the jewelry and sensing its weight and temperature, patients can instantly recall the sense of security and accomplishment they experienced in the therapy room. This sustained physical contact extends the therapeutic effects across time and space, transforming them into a round-the-clock source of psychological support. This also explains why the emotional improvements observed in the experimental group were maintained at a relatively high level even after leaving the classroom.

5. Conclusion

Building upon conventional pharmacological treatment for patients with depres-

sion, this study sought to introduce an innovative "multisensory cognitive-based wearable art therapy" adjunct intervention model. In simple terms, the study invited patients to physically touch different materials, experiment with color combinations, and ultimately create their own wearable art pieces. To address the limitations of traditional psychological questionnaires—which are prone to being influenced by subjective emotions—heart rate variability (HRV) was incorporated as an objective physiological monitoring metric. The results indicate that this creative process, which engages multiple senses and the body, not only helps patients detach from repetitive, self-defeating negative thoughts but also effectively activates the parasympathetic nervous system physiologically, helping the body regain long-lost relaxation and calm. More importantly, the wearable art pieces created by the patients serve as vessels for transitional objects, providing long-lasting psychological companionship and comfort even after they leave the hospital and return to their daily lives.

However, due to the constraints of real-world clinical settings, this study faces several notable limitations in its practical implementation. First, the sample size is limited; only 11 valid cases remained after rigorous screening and full participation. The small sample size posed significant challenges for data analysis. When comparing the experimental and control groups, traditional statistical significance tests (i.e., *P*-values) struggled to meet conventional thresholds, necessitating a greater reliance on "effect sizes" to assess intervention trends. This, to some extent, limits the confidence with which conclusions can be generalized to a broader population. Second, if patients encounter minor setbacks during manual operation, it may trigger anxiety; this short-term stress response introduces potential fluctuations in the physiological data collection. Additionally, given that patients with depression are inherently prone to low motivation, ensuring their adherence to multiple daily measurements on time for two consecutive weeks and sticking to the regimen of wearing the device for long periods every day is a challenge in itself is a challenging task in itself.

Future research is expected to pursue more pragmatic optimizations in methodology and standards: on the one hand, as conditions mature, studies will conduct validation with larger sample sizes and longer durations to enhance the statistical robustness of the data; on the other hand, regarding assessment methods, future research should consider introducing more "unobtrusive" wearable devices for continuous dynamic monitoring and standardize measurement time windows to minimize interference from daily activities. In addition to HRV, future research may incorporate a broader range of biological indicators, such as electrodermal activity (EDA) and salivary cortisol, alongside refined psychological scales, to establish a "physiological-psychological" multimodal cross-validation assessment standard. Simultaneously, in response to the specific psychological feedback elicited by different materials, the study will also attempt to design more diverse, tiered intervention protocols, thereby enabling this warm and compassionate art of healing to truly mature into a clinically applicable practice.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Bandura, A. (1977). Self-efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review, 84,* 191-215. https://doi.org/10.1037/0033-295x.84.2.191

Czamanski-Cohen, J., Wiley, J. F., Sela, N., Caspi, O., & Weihs, K. (2019). The Role of Emotional Processing in Art Therapy (REPAT) for Breast Cancer Patients. *Journal of Psychosocial Oncology, 37,* 586-598. https://doi.org/10.1080/07347332.2019.1590491

Feng, T., Li, R. Z., & Liu, D. M. (2024). A Study on the Impact of Mind-Body Healing-Oriented Art Therapy on the Rehabilitation Outcomes of Inpatients with Chronic Mental Disorders. *Social Welfare, 8,* 20-28. (In Chinese) https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW-7hPh0VDJpl-mEeTNd_iD34e-J37-CVCqUyL3rWlIbDkHZbSm8ER8iO_LDAVmNnsG3ssmWh-Iau_aZjDH2CRSUwsIGZGtLYb1amGDSNzu1hOS_iuORn-hjlAU7n9pPMoKKQYclMVCsqOfaG-dr9pG71q99JHh2ALaR-jeIzdIzhmUbQ==&uniplatform=NZKPT&language=CHS

Geipel, J., Koenig, J., Hillecke, T. K., & Resch, F. (2022). Short-Term Music Therapy Treatment for Adolescents with Depression—A Pilot Study. *The Arts in Psychotherapy, 77,* Article 101874. https://doi.org/10.1016/j.aip.2021.101874

Gibson, J. J. (1986). *The Ecological Approach to Visual Perception*. Psychology Press. https://library.uniq.edu.iq/storage/books/file/The%20Ecological%20Approach%20to%20Visual%20Perception%20Approach/1667383098The%20Ecological%20Approach%20to%20Visual%20Perception%20Classic%20Edition%20(James%20J.%20Gibson)%20(z-lib.org)%20(1).pdf

Huang, H. Q., & Li, J. Y. (2025). A Case Study of Art Therapy Intervention for Children with Autism: Taking the Application of the Expressive Arts Therapy Continuum as an Example. *Education Observation, 14,* 88-91. https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW9ovsyUwQ2uFXGO-G1M0fK6eNQ7XweNkKC3DBiEjxrh1xp4WI10EYM32p6s58kgbTYuROK78NzniTLAW75b3uK9Z67u2-GCua7pl0E4KZJsjE4QlwY1kMVPZzaqGfqIFxl9gEA1yfvSBktzE-F6nAeHgShfo-F7bcH1l2A7DF3SHg==&uniplatform=NZKPT&language=CHS

Li, L. J., & Ma, X. (2015). *Chinese Guidelines for the Prevention and Treatment of Depressive Disorders* (2nd ed.). China Medical Audio-Visual Publishing House. (In Chinese) http://www.cma-cmc.com.cn/cms/znygfxl/12/4212.htmhttp://www.cma-cmc.com.cn/cms/znygfxl/12/4212.htm

Norman, D. A. (2003) *Emotional Design: Why We Love (or Hate) Everyday Things*. Basic Books. https://www.researchgate.net/publication/224927652_Emotional_Design_Why_We_Love_or_Hate_Everyday_Things

Oztürk-Arenz, H., Dietz, T., Schiewer, V., Durakovic, V., & Kusch, M. (2023). The Impact

of Creative Arts Therapies on Emotional Speechlessness in Cancer: A Pilot Study. *The Arts in Psychotherapy, 85,* Article 102056. https://doi.org/10.1016/j.aip.2023.102056

Rankanen, M., Leinikka, M., Groth, C., Seitamaa-Hakkarainen, P., Mäkelä, M., & Huotilainen, M. (2022). Physiological Measurements and Emotional Experiences of Drawing and Clay Forming. *The Arts in Psychotherapy, 79,* Article 101899. https://doi.org/10.1016/j.aip.2022.101899

Richesin, M. T., Baldwin, D. R., & Wicks, L. A. M. (2021). Art Making and Virtual Reality: A Comparison Study of Physiological and Psychological Outcomes. *The Arts in Psychotherapy, 75,* Article 101823. https://doi.org/10.1016/j.aip.2021.101823

Wang, P., & Liu, X. W. (2020). The Effect of Combined Painting and Horticultural Therapy on Clinical Symptoms and HAMD Scores in Patients with Depression. *Clinical Medical Research and Practice, 5,* 33-35. (In Chinese) https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW8h28LAspbjT3wjpaugom3_vSp5MXwQcT-mNXvZ_sWVWaW61gT_KkfpZCxHMqkqiymiZ5rOoz-gxvqWGhgZ4wbsHaioQABk6UaZKAm8OKx6MUsipBXze6848FGLGw3jWY3TzL-F7OZPeXkBJUidPLz_qfEu3jfTBDX4QamtaXzCr4Q==&uniplatform=NZKPT&language=CHS

Winnicott, D. W. (1971). *Playing and Reality*. Taylor and Francis.

Wu, Q. Y., Nie, J. Y., Ouyang, W. M., & Li, S. M. (2011). The Effect of Handicraft Training on Patients with Post-Stroke Depression. *Chinese Rehabilitation, 26,* 259-261. (In Chinese) https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW9JkNWLn-zUfO2TflbbzYFZg01c0eja-CJu1DkEptqWmwxgKWWhnYuQLq9yxlEBldt0ACxxDD-aglSfW1TaijpQ7WM9Z9EzCNF-_xivt1TG1DAy8CcQ2gSbcr0daRoFERxdomf_4tzuU-cEuUa0vhPj2A9Dw4CO4B9bOsgrzV-1ou-Q==&uniplatform=NZKPT&language=CHS

Xi, H. L. (2007). *The Shift in Object Relations Theory*. Nanjing Normal University. (In Chinese) https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW8IxyISXWLa-NzWkdsi4Q4wJQDqD-44tOH7_8Ie7z7_SpsWVn8O3v7_APU-JIqP9BLFwBRUfDK9C78i49FfRNquJgH4wTUeKir9_t94wQJAGWNDZuwk48uEykc-7IwKppn2N5zjHTRdZ_NIz5yBM965WQJrJV7EXwN-kx1mzKXnL5w==&uniplatform=NZKPT&language=CHS

Ye, H. S., & Su, J. J. (2024). Mental Health Education from the Perspective of Embodied Cognition. *Chinese Moral Education, 16,* 15-25. (In Chinese) https://kns.cnki.net/kcms2/article/abstract?v=Omth-A4cfW_CfDEfY-IGdnr1HcxRzJk6mhXpIx5L__EIPR7GEhc-0XxqvgOfzzpDYA6qOHTq5iz-TxhN_eA2ybD1TSrDEN3cHOpFNaFZhiLSxFxcoJGexM4WYIgTjrg-nWiWFi8zd1FX4R5IQ1Ooqkr11ux-mxNqZsr6UujRX0yYiyhSFzoVwA1HA==&uniplatform=NZKPT&language=CHS