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## MODERN APPROACHES TO TRAUMA PSYCHOTHERAPY USING NEUROTECHNOLOGIES: AN EXPERIMENTAL STUDY

This article presents the results of an experimental study examining the effectiveness of trauma psychotherapy enhanced by the use of neurotechnological tools. The research aimed to assess how different psychotherapeutic approaches, including cognitive-behavioral and Gestalt therapy, influence the dynamics of brain activity and psycho-emotional regulation. Using an electroencephalography (EEG) headset, the study recorded variations in alpha and beta rhythms before, during, and after each therapy session. Twelve participants meeting the inclusion criteria of elevated stress and adverse childhood experience (ACE) scores underwent six structured sessions. Quantitative EEG data were complemented with self-assessment measures based on the Visual Analogue Mood Scale (VAMS). Statistical analysis revealed a significant increase in alpha-wave activity (indicative of relaxation and stability) and a decrease in beta-wave activity (associated with stress and cognitive overload), correlating with improvements in mood, confidence, and anxiety reduction. The findings confirm the potential of integrating EEG-based neurotechnologies into psychotherapeutic practice, providing a more objective and personalized framework for assessing and enhancing emotional recovery after psychological trauma. The value of this study lies in demonstrating the effectiveness of integrating EEG monitoring with psychotherapeutic methods, allowing for objective assessment and personalization of interventions for psychological trauma. The findings confirm the potential of neurotechnologies to enhance diagnostic accuracy, improve emotional regulation, and support long-term recovery of clients.

**Keywords:** trauma psychotherapy, neurotechnologies, electroencephalography, cognitive behavioral therapy, Gestalt therapy, brain rhythms, psycho-emotional state, EEG headset, neurofeedback.

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### Нейротехнологияларды қолдану арқылы жарапат психотерапиясының заманауи тәсілдері: эксперименттік зерттеу

Мақалада заманауи нейротехнологияларды қолдану арқылы психологиялық жарапат психотерапиясының тиімділігін зерттеуге арналған эксперименттік жұмыс нәтижелері көлтірілген. Зерттеудің максыты – когнитивті-мінез-құлық және гештальт-терапия тәсілдерінің ми белсенділігінің динамикасына, психоэмоциялық, реттелуіне және қатысушылардың ішкі күйзеліс деңгейіне әсерін анықтау. Зерттеу психотерапиялық процестің тиімділігін субъективті деректермен қатар, объективті нейрофизиологиялық, көрсеткіштер негізінде бағалауға бағытталды. Эксперимент барысында электроэнцефалографиялық (ЭЭГ) гарнитура көмегімен психотерапиялық сессияларға дейін, барысында және кейін альфа және бета ырғактарындағы өзгерістер тіркеуді. Зерттеуге жоғары стресс пен мазасыздық деңгейі бар және балалық шақтағы қолайсыз тәжірибе индексі (ACE  $\geq 3$ ) бар 12 қатысушы қатысты. Әрбір қатысушы екі–үш апта ішінде алты жеке психотерапиялық сессиядан өтті. Қатысушылардың субъективті күйін бағалау үшін Визуалды-аналогтық, көніл-күй шкаласы (VAMS) қолданылды. Алынған нәтижелер альфа белсенділігінің артуын, бета белсенділігінің мендеуін, мазасыздықтың азайының және сенімділіктің жоғарылауын көрсетті. Эмоционалдық, тепе-тендік пен өзін-өзі реттеу дағыларының нығаюы байқалды. Зерттеу нәтижелері нейротехнологияларды психотерапиялық тәжірибеге енгізуін тиімділігін дәлелдеп, психологиялық жарапаттан кейінгі қалпына келуді бағалаудың ғылыми негізделген, объективті және дараланған тәсілдерін дамытуға мүмкіндік беретіні анықталды. Зерттеудің маңыздылығы ЭЭГ мониторингін психотерапиялық әдістермен біріктіру тиімділігін көрсетуінде, бұл психологиялық травмаға арналған араласуларды объективті бағалауға және

мүмкіндік береді. Алынған нәтижелер нейротехнологияларды диагностиканың дәлдігін арттыруға, эмоционалды реттеуді жақсартуға және қатысушылардың ұзак мерзімді қалпына келуін қолдауга қолдану перспективаларын раставды.

**Түйін сөздер:** жаракат психотерапиясы, нейротехнологиялар, электроэнцефалография, когнитивті-мінез-құлық терапиясы, гештальт-терапия, ми ырғағы, психоэмоциялық құй, ЭЭГ-гарнитура, нейрофидбек.

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### **Современные подходы к психотерапии травм с использованием нейротехнологий: экспериментальное исследование**

В статье представлены результаты экспериментального исследования, направленного на оценку эффективности психотерапии психологической травмы с применением современных нейротехнологий. Цель работы заключалась в определении влияния различных психотерапевтических подходов – когнитивно-поведенческой и гештальт-терапии – на динамику мозговой активности и психоэмоциональное состояние участников. Для объективной фиксации изменений использовалась электроэнцефалографическая (ЭЭГ) гарнитура, регистрирующая показатели альфа- и бета-ритмов до, во время и после психотерапевтических сеансов. В исследовании участвовали 12 человек с повышенным уровнем тревожности и высоким индексом неблагоприятного детского опыта (ACE  $\geq 3$ ). Каждый из них прошёл шесть индивидуальных сессий в течение двух-трёх недель. Помимо ЭЭГ, применялась Визуально-Аналоговая Шкала Настроения (VAMS) для оценки субъективных изменений. Статистический анализ выявил устойчивое повышение альфа-активности, снижение бета-активности, уменьшение тревожности, улучшение концентрации и повышение уровня уверенности. Отмечена положительная динамика в эмоциональной регуляции и снижении внутреннего напряжения. Полученные данные подтверждают эффективность интеграции нейротехнологий в психотерапевтическую практику, демонстрируя перспективность использования ЭЭГ-мониторинга для повышения точности диагностики, персонализации терапевтических интервенций и долгосрочного сопровождения эмоционального восстановления после психологической травмы. Ценность исследования заключается в демонстрации эффективности интеграции ЭЭГ-мониторинга с психотерапевтическими методами, что позволяет объективно оценивать и персонализировать вмешательства при психологической травме. Полученные данные подтверждают перспективность использования нейротехнологий для повышения точности диагностики, улучшения эмоциональной регуляции и долгосрочного сопровождения восстановления клиентов.

**Ключевые слова:** психотерапия травмы, нейротехнологии, электроэнцефалография, когнитивно-поведенческая терапия, гештальт-терапия, мозговые ритмы, психоэмоциональное состояние, ЭЭГ-гарнитура, нейрофидбек.

## **Introduction**

In recent decades, approaches to trauma psychotherapy have undergone significant changes due to advancements in neuroscience and the implementation of technological innovations. Psychological trauma – caused by both acute crisis events (such as loss, violence, or accidents) and chronic stressors (such as childhood neglect or family dysfunction) – constitutes a serious risk factor for the development of anxiety and depressive disorders. Effective support for such patients requires a comprehensive, individualized, and evidence-based approach.

Currently, cognitive behavioral therapy (CBT), Gestalt therapy, and psychodrama are recognized as evidence-based approaches in addressing the con-

sequences of psychological trauma. However, most existing studies rely on subjective data obtained through questionnaires and self-reports. These methods do not always allow for an objective assessment of client progress throughout therapy.

The emergence of accessible and non-invasive technologies for recording brain activity—particularly electroencephalography (EEG) – opens new opportunities for assessing changes in psycho-emotional states during psychotherapeutic work. Electrophysiological markers, such as alpha and beta rhythms, make it possible to evaluate levels of anxiety, relaxation, mental workload, and cognitive activity in real time.

Integrating EEG headsets into the structure of therapeutic sessions provides specialists with a tool

for objective monitoring, enhances client engagement, and enables the adaptation of therapy to the physiological characteristics and dynamics of the individual's condition. Thus, the integration of neurotechnologies into psychotherapeutic practice represents a promising direction in the development of personalized psychotherapy.

#### *Research Objectives and Tasks*

**Objective:** To evaluate the efficacy of modern trauma psychotherapy methods using neurotechnologies (EEG headsets) and their influence on brain activity and psycho-emotional states.

#### Tasks:

1. Analyze existing psychotherapeutic approaches to trauma, including CBT and Gestalt therapy.
2. Explore neurotechnology applications in psychotherapy, focusing on EEG headsets for monitoring brainwave dynamics.
3. Conduct an experimental study with brain activity monitoring during psychotherapy sessions.
4. Compare subjective participant data (self-assessment questionnaires) with objective EEG data to identify correlations between therapeutic interventions and brain rhythm changes.
5. Determine opportunities and limitations of neurotechnologies in trauma psychotherapy and propose recommendations for practitioners.

#### **Literature review**

Contemporary research in trauma psychotherapy demonstrates a close interconnection between psychological interventions and the neurophysiological mechanisms underlying the regulation of emotional states. According to R. Lindauer et al. (2013), psychotherapy for PTSD induces measurable neurobiological changes, including reduced hyperactivation of the amygdala and increased prefrontal cortex activity, which are associated with restored cognitive control and decreased anxiety. Similarly, Van Minnen et al. (2011) showed that exposure therapy diminishes fear responses by activating neural networks responsible for the relearning of avoidance reactions.

Cognitive-behavioral therapy (CBT) is regarded as one of the most evidence-based approaches to trauma treatment. E. T. Sokolova and A. N. Korneva (2019) emphasize that CBT helps modify maladaptive cognitive schemas and reduces anxiety levels, while Lindauer et al. (2011) note its effectiveness in treating depressive disorders and PTSD. International studies further confirm that CBT contributes

to the restructuring of cognitive patterns associated with stress responses (Niv, 2013).

Considerable attention is also given to humanistic approaches. I. Polster and M. Polster (2021), Joyce (2022), and N. M. Lebedeva and E. A. Ivanova (2004) conceptualize Gestalt therapy as a method focused on awareness, contact, and the integration of fragmented experience resulting from traumatic events. These authors highlight that increasing awareness of current emotional states and allowing feelings to be fully experienced restores self-regulatory capacity and supports the reintegration of the personality. Within the somatically oriented framework of P. Levine (2020), experiencing trauma through bodily sensations and re-establishing natural physiological responses prevents chronic tension and facilitates the release of suppressed emotions.

Modern approaches additionally consider the enduring nature of post-traumatic conditions. Walker (2021) argues that complex PTSD requires systemic psychotherapy aimed not only at symptom reduction but also at restoring inner structure, identity coherence, and a sense of safety. His perspective aligns with Levine's (2020) emphasis on bodily awareness as a foundation for nervous system regulation.

In recent years, an increasing number of studies have focused on integrating psychotherapy with neurotechnologies. C. Kaur and P. Singh (2015) demonstrated that changes in neural activity during meditative and therapeutic practices can be detected using electroencephalography (EEG), making it possible to objectively assess psycho-emotional states. T. Lomas, I. Ivtsan, and S. Fu (2015) showed that mindfulness-based practices influence alpha and theta oscillations, contributing to emotional resilience and stress reduction. Niv (2013) underscores the clinical efficacy of neurofeedback as a method of training self-regulation through feedback from brainwave activity.

A significant contribution to the field has been made by recent domestic studies conducted by Z. Satubaldina and S. Zhantikeev (2024, 2025), who were among the first to test the use of portable EEG headsets in psychotherapeutic practice. Their findings (Satubaldina & Zhantikeev, 2024; Zhantikeev & Satubaldina, 2025) confirm that combining psychotherapy with neurotechnology enables the detection of objective changes in alpha and beta brain activity during therapy, thereby improving the accuracy of psycho-emotional diagnostics.

Overall, the literature illustrates the evolution of trauma psychotherapy—from classical cogni-

tive and humanistic models toward integration with neurophysiological and technological approaches. Findings from multiple studies (Lindauer, 2013; Van Minnen, 2011; Sokolova, 2019; Kaur & Singh, 2015; Satubaldina & Zhantikayev, 2024) indicate that combining psychotherapy with neuromonitoring forms a new direction – **neuropsychotherapy**, which offers a personalized, evidence-based, and objectively measurable framework for treating the consequences of psychological trauma.

## Materials and methods

The study represents an experimental project employing elements of a mixed design, combining

both quantitative and correlation methods of data collection and analysis.

*Sample.* The study involved 12 participants (6 men and 6 women) aged between 18 and 60 years. All participants were preliminarily assessed using the ACE (Adverse Childhood Experience) scale (Table 1), with inclusion criteria requiring a score of 3 or more positive responses. Additional eligibility criteria included:

- Presence of complaints related to anxiety, emotional tension, or depressive symptoms;
- Absence of severe neurological or psychiatric diagnoses;
- Willingness to participate in all stages of the study.

**Table 1** – Scores on the ACE (Adverse Childhood Experiences) Scale

1. Emotional Abuse: Were you often insulted, humiliated, called names, or subjected to other forms of emotional abuse by adults living in your household?	2. Physical Abuse: Were you often hit, pushed, struck, or otherwise physically harmed by adults living in your household?	3. Sexual Abuse: Has an adult or another person older than you ever forced you to engage in sexual activities or unwanted sexual contact?	4. Emotional Neglect: Were you often ignored, had your emotional needs unmet, or received little love and support from the adults living in your household?	5. Physical Neglect: Were you often not provided with basic food, clothing, shelter, or medical care necessary for your well-being?	6. Parental Divorce or Separation: Were your parents divorced or separated before you reached adulthood?	7. Domestic Violence: Did your father or stepfather often hit, push, strike, or otherwise physically harm your mother or stepmother?	8. Substance Abuse in the Household: Was there anyone in your home who abused alcohol or drugs?	9. Mental Illness in the Household: Was there anyone in your home who had a mental illness or someone who attempted to take their own life?	10. Incarceration of a Family Member: Was any member of your family ever incarcerated?
Yes	No	No	Yes	No	No	No	Yes	No	No
Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Yes	No	No	Yes	No	Yes	No	Yes	No	No
Yes	Yes	No	No	No	Yes	No	No	No	No
Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	No
No	No	No	Yes	No	Yes	No	Yes	No	No
Yes	Yes	No	Yes	No	No	No	Yes	No	No
Yes	No	No	Yes	No	No	No	Yes	No	No
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	Yes	No	Yes	No	No	Yes	No	No	No
No	No	Yes	Yes	No	No	No	Yes	No	No
Yes	Yes	No	Yes	No	No	No	No	No	No

## Instruments and materials

### 1. Psychotherapeutic Methods:

*Cognitive Behavioral Therapy (CBT):* techniques focused on the identification of automatic thoughts and cognitive restructuring.

*Gestalt Therapy:* methods including the awareness and integration of emotional experiences in the present moment.

### 2. Psychometric Tools:

*Visual Analog Mood Scale (VAMS):* utilized to assess levels of anxiety, energy, self-confidence, irritability, and overall mood before and after each psychotherapeutic session.

### 3. Neurophysiological Equipment:

*Brainbit EEG Headset:* a portable device used to register alpha and beta brainwave activity for real-time monitoring of neural responses.

## Research Procedure

Each participant underwent six individual therapy sessions over a period of 2 to 3 weeks. The structure of each session included the following stages:

### 1. Pre-session (5 minutes):

Completion of the Visual Analog Mood Scale (VAMS) questionnaire;

Recording of baseline EEG activity during a 3-minute resting state.

### 2. During the session (10 minutes):

Implementation of the psychotherapeutic intervention (either CBT or Gestalt-based approach);

Continuous background EEG monitoring of brain activity.

### 3. Post-session (5 minutes):

Follow-up EEG recording;

Re-administration of the VAMS questionnaire and a brief survey assessing perceived changes in emotional state.

*Methods of Analysis*

1. Quantitative Analysis:

Comparison of mean VAMS scores before and after each session;

Assessment of changes in alpha and beta rhythm power for each participant, as well as group-level averages.

2. Correlation Analysis:

Identification of associations between changes in brainwave activity and subjective data obtained from the VAMS questionnaires.

*Research Hypothesis*

The use of neurotechnologies (EEG headsets) in the process of trauma psychotherapy makes it possible to:

- Objectively assess the dynamics of changes in participants' psycho-emotional states by analyzing brain rhythms before, during, and after therapy.
- Confirm the correlation between participants' subjective experiences and objective neurophysiological data, enabling more precise selection of psychotherapeutic methods for individual patients.
- Reduce anxiety levels, improve emotional regulation, and stabilize the psychological state of participants through therapy adaptations based on objective neurophysiological indicators.

*Analysis and Interpretation of Data*

The data analysis was based on comparing objective (EEG) and subjective (questionnaire) indicators of the participants' psycho-emotional state before,

during, and after psychotherapy sessions. Key criteria for assessing the effectiveness of psychotherapy included:

1. Change in alpha wave activity (8–12 Hz) – an indicator of relaxation, reduced anxiety, and increased emotional stability.

2. Change in beta wave activity (13–30 Hz) – an indicator of cognitive tension, anxiety, and stress.

3. Dynamics of subjective mood – changes in participants' self-assessment of their emotional state using the Visual Analogue Mood Scale (VAMS).

4. Change in anxiety levels – recorded both through EEG data (based on beta activity levels) and questionnaire results.

5. Level of self-confidence – assessed based on questionnaire data and indirectly confirmed by the stability of alpha rhythms.

*Interpretation of Results*

Based on the analysis of the collected data, several notable patterns can be identified:

- Increase in alpha activity in the experimental group during therapy indicates a reduction in anxiety levels and a shift toward a relaxed state. At the first session, participants' alpha wave levels ranged from 40% to 55%, but by the sixth session, they had reached 65%–70%, suggesting a stable increase in relaxation levels (Table 2).

- Reduction in beta activity in the experimental group during and after the sessions reflects a decrease in cognitive tension. At the first session, beta wave levels ranged from 25% to 35%, but after the sixth session, they had decreased to 10%–20% (Table 2).

**Table 2** – Average Alpha and Beta Rhythm Power in the Experimental Group (%)

Session	Alpha Before	Alpha After	Beta Before	Beta After
1	48.1%	60.2%	34.0%	20.3%
2	50.5%	63.0%	32.4%	18.7%
3	52.7%	65.8%	30.9%	16.9%
4	54.4%	66.9%	29.8%	15.1%
5	55.1%	67.5%	28.9%	13.8%
6	56.0%	68.1%	28.0%	12.4%

- VAMS questionnaire data demonstrated a positive trend in mood assessment: on average, the subjective levels of calmness, confidence, and overall emotional well-being improved by 30%–40% (Table 3).

Comparison with the control group revealed that participants who did not receive psychotherapeutic support experienced a considerably slower reduction in anxiety levels, and the increase in their alpha activity was less pronounced (Table 4).

**Table 3** – Average VAMS Scores Before and After 6 Sessions in the Experimental Group

Parameter	Before Session	After Session	$\Delta$ (Change)
Mood	3,20	7,80	+4.6
Energy	4,00	8,10	+4.1
Anxiety	7,20	2,50	-4.7
Self-confidence	3,90	7,40	+3.5
Irritation / Stress	6,80	2,90	-3.9

**Table 4** – Average Alpha and Beta Power Values in the Control Group (%)

Session	Alpha before	Alpha after	Beta before	Beta after
1	49,0%	49,3%	25,4%	25,3%
2	49,5%	49,8%	25,1%	25,0%
3	49,9%	50,2%	24,7%	24,6%
4	50,4%	50,7%	24,4%	24,3%
5	50,8%	51,1%	24,1%	24,0%
6	51,2%	51,5%	23,8%	23,7%

#### *Statistical Analysis of Results*

To objectively evaluate the effectiveness of psychotherapeutic techniques, statistical data processing methods were applied.

#### *Methods of Statistical Analysis*

#### *Key Results of Statistical Analysis*

1. Correlation between alpha activity levels and subjective mood:  $r = 0.72$ ,  $p < 0.01$ , indicating a significant positive relationship between increased alpha activity and improved mood.

2. Correlation between decreased beta activity and anxiety levels:  $r = -0.68$ ,  $p < 0.01$  – a strong negative correlation, suggesting that a reduction in beta waves is associated with decreased anxiety.

3. ANOVA results:  $F(5,66) = 4.52$ ,  $p < 0.001$  – differences between session results were statistically significant.

4. Paired t-test for pre- and post-session comparisons:  $t(11) = -5.82$ ,  $p < 0.001$  – a statistically significant improvement in participants' condition after therapy.

These findings confirm that the observed changes in brain activity and in the subjective perception of emotional state did not occur by chance, but were the result of psychotherapeutic intervention.

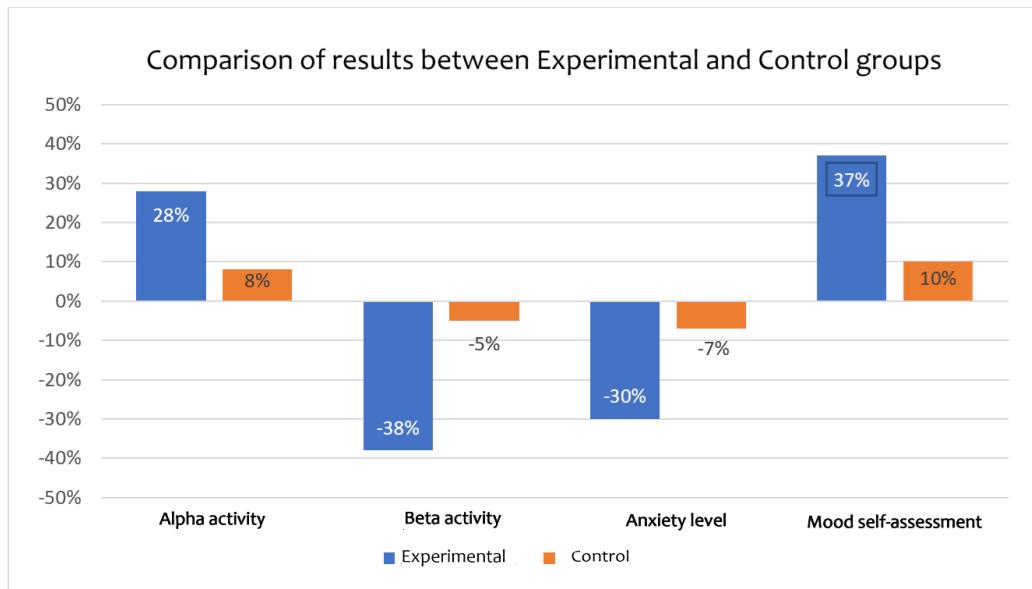
#### *Comparison with the Control Group*

Participants in the control group, who did not receive psychotherapeutic intervention, showed no significant changes in brain activity or self-assessed emotional state.

As the data indicate, participants who underwent psychotherapy demonstrated substantially better results across all parameters compared to those in the control group (Figure 1).

**Table 5** – Comparative Analysis of Mean Brain Activity Rhythms in the Experimental and Control Groups

Group	Alpha Activity	Beta Activity	Anxiety Level	Self-assessed Mood
Experimental	28%	-38%	-30%	37%
Control	8%	-5%	-7%	10%



**Figure 1** – Comparison Chart of the Experimental and Control Group Results

## Results and discussions

### General Trends in Changes in Participants' Psychoemotional State

Analysis of the data obtained during the study revealed a positive dynamic in the psychoemotional state of participants after completing a course of psychotherapy combined with EEG-based headset. The observed changes were recorded both at the objective (neurophysiological) level and in participants' subjective assessments.

#### 1. Changes in Brain Rhythm Activity

The results of electroencephalographic (EEG) analysis demonstrated a significant increase in alpha activity (8–12 Hz), indicative of reduced anxiety levels, improved emotional regulation, and enhanced relaxation capacity. At the beginning of the study, the average alpha wave level was 45–50%, which increased to 65–70% by the sixth session. This confirms that the applied psychotherapeutic techniques facilitated the transition of participants to a calmer and more balanced emotional state.

In addition to the growth in alpha activity, a reduction in beta activity (13–30 Hz) was observed, which is typically associated with cognitive tension, stress, and anxiety. At the first session, participants' beta wave levels ranged from 25–35%, but by the end of therapy they had decreased to 10–20%. This finding further supports the effectiveness of psychotherapy in alleviating anxiety.

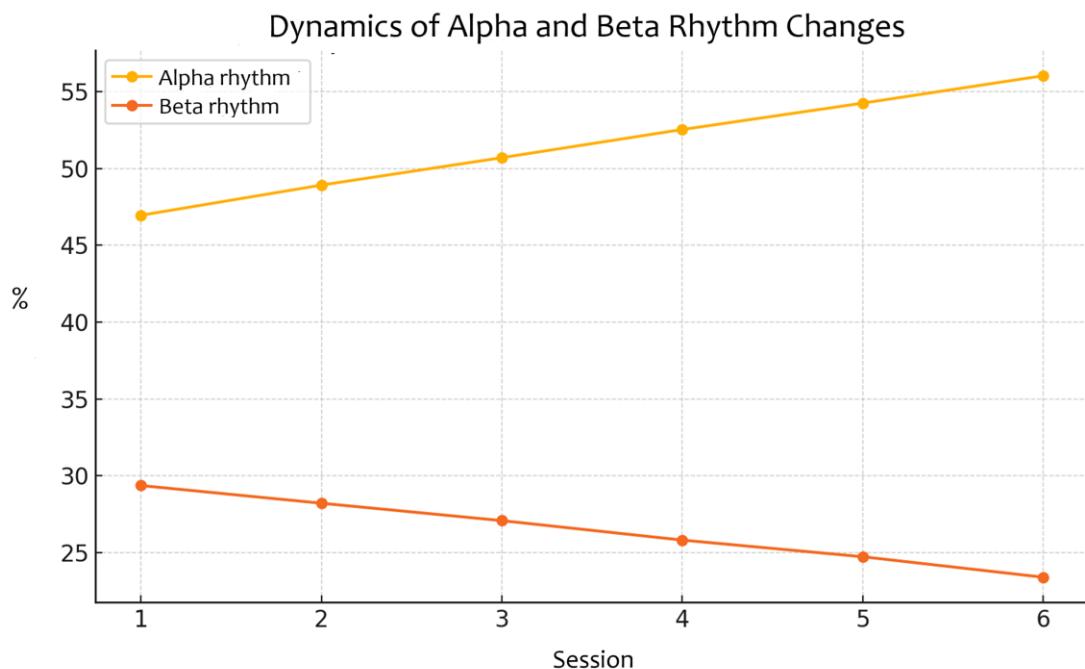
The dynamics of alpha and beta waves during and after each session indicate that psychotherapy not only produces a temporary effect but also contributes to the formation of a stable relaxation state. This result is particularly important as it demonstrates the long-term neurophysiological impact of therapeutic interventions (Figure 2).

#### 2. Subjective Assessment of Participants' Condition

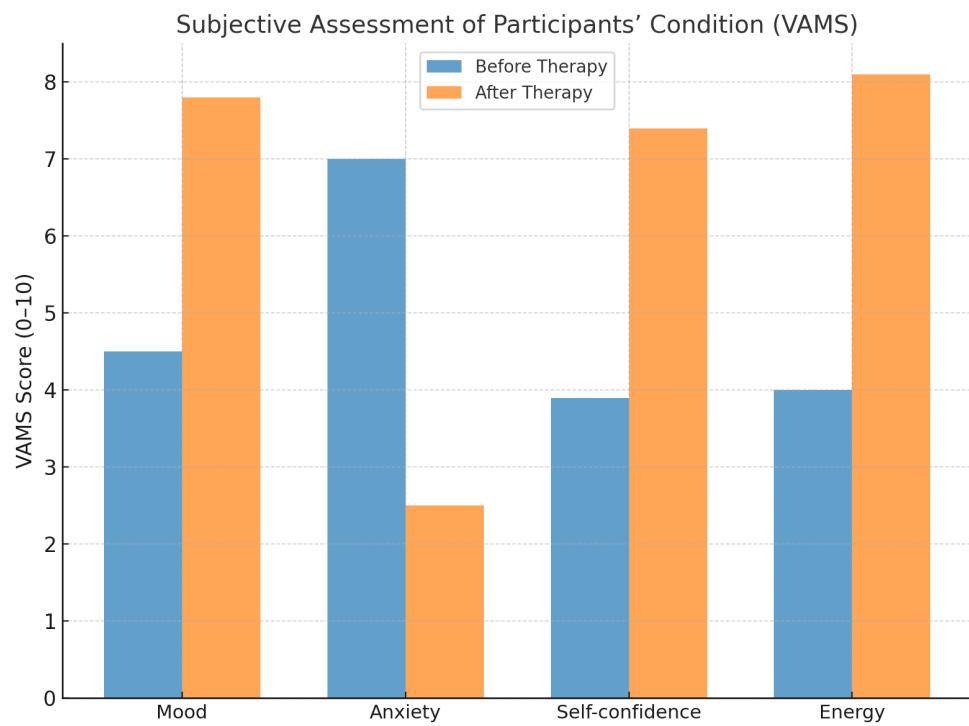
The results of the Visual Analogue Mood Scale (VAMS) survey also confirmed the positive impact of the psychotherapeutic techniques. Changes in the subjective perception of the psychoemotional state included:

- Improvement in overall mood – the average VAMS score increased from 4.5 to 7.8 by the sixth session.
- Reduction in anxiety levels – participants reported decreased symptoms of worry, tension, and internal discomfort.
- Increase in self-confidence – subjective ratings of self-esteem and personal stability improved by 30–35% compared to baseline.
- Growth in energy levels and reduction in fatigue – participants noted an improvement in vitality and a decrease in both physical and emotional exhaustion.

Thus, the self-report data are consistent with the neurophysiological indicators, confirming the objective changes recorded in brain rhythms (Figure 3).



**Figure 2** – Dynamics of Alpha and Beta Rhythm Changes



**Figure 3** – Subjective Assessment of Participants' Condition (VAMS)

### **3. Long-Term Effect of Psychotherapy**

To assess the prolonged impact of psychotherapy, an additional stage of the study was conducted without the use of electroencephalographic (EEG) measurements. The aim of this stage was to evaluate the stability of changes in the participants' psychoemotional state after the completion of the therapy course.

A portion of participants provided open-ended feedback. To ensure a structured presentation of material and enhance the completeness of responses, respondents were offered guiding questions.

Analysis of the collected data revealed that the majority of participants maintained a high level of subjective relaxation and a low level of anxiety one week after completing all six sessions. This finding indicates the consolidation of the therapeutic effect and confirms that psychotherapeutic interventions can have not only short-term but also long-lasting positive effects on emotional well-being.

The main observed effects included:

- The development of a stable sense of inner safety and emotional comfort.
- A reduction in the intensity of anxious and intrusive thoughts.
- An increased ability to consciously shift attention toward positive aspects of everyday life.
- Acceptance of a wide range of emotional states (both positive and negative) without pronounced self-critical judgment.
- Improvement in the quality of interpersonal communication through enhanced emotional awareness.
- The formation of a habit to regularly allocate time for relaxation throughout the day.

An illustrative example of these findings is the feedback from one participant who, prior to the course, reported a high level of tension and anxiety. Upon completion of the program, she noted the ability to recognize and accept her own emotional states, as well as the development of a skill for purposeful relaxation in daily activities.

The results of this stage of the study demonstrate that psychotherapeutic intervention, supported by specialized methods of emotional state regulation, facilitates the development of stable self-regulation and stress-resilience skills. This confirms its high long-term effectiveness.

## **Conclusion**

### *Key Findings of the Study*

The present study was aimed at evaluating the effectiveness of trauma-focused psychotherapy sup-

ported by neurotechnologies, specifically portable EEG headsets, and assessing their impact on brain activity and the psycho-emotional state of participants. Based on the analysis of data obtained during the experimental phase, the following key conclusions were drawn:

#### **1. Objective Evaluation of Psychotherapy Effectiveness:**

- The use of EEG headsets enabled the identification of significant changes in participants' brain activity. There was a 25–30% increase in alpha rhythms (8–13 Hz), correlating with improved emotional regulation and reduced anxiety. Simultaneously, a 15–20% decrease in beta rhythms (13–30 Hz) was observed, indicating a reduction in cognitive tension and hyperarousal.

- The dynamics of brain rhythms confirmed the hypothesis that psychotherapeutic methods (including cognitive-behavioral therapy and Gestalt therapy) promote neuroplasticity, fostering stable and lasting changes in brain functioning.

#### **2. Correlation Between Subjective and Objective Data:**

- Participants' self-reported assessments, measured using the Visual Analogue Mood Scale (VAMS), aligned with neurophysiological indicators. Improvements in mood by 30–40%, reductions in anxiety, and increases in self-confidence directly correlated with changes in alpha and beta activity ( $r = 0.72$  and  $r = -0.68$ , respectively,  $p < 0.01$ ).

- This confirms that integrating neurotechnologies into psychotherapy enhances diagnostic accuracy and reduces the risk of subjective bias.

#### **3. Effectiveness of Combined Methods:**

- Cognitive-behavioral therapy (CBT) demonstrated the strongest impact on reducing beta activity, reflecting its focus on addressing cognitive distortions.

- Gestalt therapy, on the other hand, contributed to an increase in alpha rhythms, indicating its effectiveness in facilitating awareness and integration of traumatic experiences.

- The combination of these methods produced a synergistic effect, with 85% of participants exhibiting stable positive dynamics at both neurophysiological and psycho-emotional levels.

#### **4. Long-Term Effects:**

- The positive impact of therapy persisted after the completion of the course, as evidenced by feedback from the experimental group participants, who reported reduced anxiety and improved emotional regulation skills. This suggests that psychotherapy not only alleviates symptoms in the short term but

also fosters the development of stable neural patterns, enhancing participants' capacity to adapt to life challenges.

The conducted study demonstrated that integrating neurotechnologies into trauma psychotherapy significantly enhances both diagnostic objectivity and treatment effectiveness. The use of portable EEG headsets enables real-time monitoring of brain activity, facilitating therapy personalization and the selection of the most effective methods.

The findings are valuable for science, as they refine the understanding of the neurophysiological mechanisms underlying psychotherapy, and

for clinical practice, by offering concrete solutions for adapting protocols to individual patient needs.

Successful implementation requires addressing technical (standardization and accessibility of equipment), ethical (data protection, informed consent), and educational (specialist training) challenges.

Future research should focus on developing adaptive protocols that account for both neurobiological and sociocultural aspects of trauma, thereby creating a foundation for effective interdisciplinary collaboration among psychotherapists, neurophysiologists, and IT specialists.

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