A Neurophysiological and Cognitive Ergonomic Methodology Framework for Assessing the Effects of Creative Trauma Cleansing (CTC) Therapy

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ABSTRACT

The study explores the key Biopsychosocial Model, the Neurophysiological Model of Emotional Regulation, and the Cognitive Ergonomic Model as theoretical constructs, including the roles of the trigeminal nerve, amygdala, and sternocleidomastoid muscle, to understand the neuromechanical and psychological basis of Creative Trauma Cleansing (CTC) therapy. By examining the relationship between neck-squeezing angles and speeds and neurophysiological responses, the study aims to provide empirical evidence for the efficacy of CTC therapy. Electromyography (EMG), electrocardiography (ECG), and electroencephalography (EEG) were used to measure muscle activity, autonomic responses, and brain activity, respectively, assessing the impact of CTC on cognitive and emotional states. Preliminary Phase 1 results include demographic and health data from 88 participants (49 men, 39 women, aged 20–58), with 19 showing symptoms of depression, anxiety, and stress, and 12 reporting musculoskeletal disorders. While acknowledging limitations such as the need for broader participant samples and standardized protocols, the study investigates the potential impact on CTC therapy's potential for improving mental health. In future works, the data analysis process statistical evaluation of muscle activity, brainwaves, and autonomic responses to assess CTC's therapeutic effects, offering insights into its role in neuromodulation, emotional regulation, and stress reduction.

Keywords: Biopsychosocial; Cognitive Ergonomics; Creative Trauma Cleansing

1. INTRODUCTION

Mental health disorders can manifest in various forms, including persistent depression, anxiety, sleep disturbances, emotional distress, and obsessive-compulsive tendencies [6], [23], [29]. Early detection and timely intervention are crucial in managing these conditions effectively [5], [27], while traditional psychiatric treatments, such as medication and psychotherapy, remain the primary approaches to mental health care [2], [9], alternative therapies have gained increasing attention as complementary methods for managing psychological symptoms [11], [26]. One such approach is Creative Trauma Cleansing (CTC) therapy, an alternative method developed by Jumala Multazam in 2014 [16]. CTC therapy has been applied to individuals from various backgrounds, including parents, teachers, students, and healthcare professionals. Unlike conventional psychiatric treatments, CTC therapy is non-invasive and does not rely on medication, making it a potentially accessible and holistic approach to mental health management [5], [6].

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Despite the growing use of CTC therapy, there is a critical lack of empirical data regarding the physiological effects of neck-squeezing parameters. Without standardized protocols or measurable evidence of its impact on autonomic and brain activity, its safety and efficacy remain unvalidated. Currently, the efficacy of CTC therapy is predominantly assessed through qualitative measures such as patient testimonials and practitioner observations. However, without rigorous clinical validation and standardized protocols, the reliability and safety of CTC therapy remain uncertain. The absence of scientific research not only limits its credibility but also raises ethical concerns regarding its application. Alternative therapies that lack empirical validation may yield inconsistent outcomes, potentially posing risks to patients. Furthermore, the lack of existing research data on CTC therapy presents a critical gap in its integration into mainstream mental health treatment. To date, no empirical studies have systematically examined the specific effects of neck squeezing parameters such as squeezing angles and speeds on cognitive and physiological responses. Additionally, little is known about the interaction between neck squeezing techniques and physiological activities, such as sternocleidomastoid muscle activity, heart rate, and brain. This gap in research prevents a clear understanding of whether neck squeezing therapy has consistent, measurable effects on mental health. Without such data, it remains impossible to determine whether this therapy offers significant benefits or poses unrecognized risks.

The biopsychosocial (BPS) model provides a comprehensive framework for understanding mental health by integrating biological, psychological, and social factors [2], [9], [29], aligning well with CTC therapy. CTC employs neck-squeezing techniques that potentially stimulate the trigeminal nerve and sternocleidomastoid muscle, influencing parasympathetic activity, reducing stress, and promoting muscle relaxation, as measured through EMG, heart rate variability via ECG, and brainwave activity via EEG [27], [24]. By modulating neural regions like the amygdala and prefrontal cortex, CTC may enhance emotional regulation and cognitive relaxation [1], [7], [8]. Psychologically, CTC's tactile stimulation may reduce stress, cortisol levels, and autonomic arousal, improving emotional stability and focus [12], [26]. Socially, CTC offers a cost-effective, non-invasive alternative to traditional psychiatric care, accessible in community settings and culturally aligned with holistic therapies [5], [6]. This positions CTC as a potentially impactful intervention for mental health challenges, especially in resource-limited or culturally diverse contexts.

Emotional regulation is a complex process governed by interactions between the amygdala, prefrontal cortex (PFC), and autonomic nervous system (ANS) [27], [24]. These structures work together to process emotional stimuli, regulate responses, and maintain physiological balance. The amygdala is the central hub for emotion processing, particularly in fear, anxiety, and stress responses [8], [26]. It rapidly evaluates emotional stimuli and triggers appropriate autonomic and behavioural reactions [7], [24]. The amygdala's connections with the hypothalamus and brainstem autonomic centres allow it to influence heart rate, respiration, and muscle tension in response to emotional triggers [10], [25], [28]. Overactivation of the amygdala is associated with anxiety disorders, post-traumatic stress disorder (PTSD), and mood dysregulation [1], [13].

Cognitive ergonomics focuses on the interaction between human cognitive processes and system design, emphasizing how mental workload, decision-making, and human-information processing influence performance and well-being [3], [4], [19]. This field plays a crucial role in understanding how external stimuli, such as sensory input from physical interventions, affect cognitive functions and emotional regulation. In the context of CTC therapy, cognitive ergonomics provides a framework for examining how the application of neck-squeezing techniques influences neural processing, stress reduction, and emotional resilience. By integrating principles from the Biopsychosocial Model and Neurophysiological Model of Emotional Regulation, this study aims to assess whether CTC therapy optimizes cognitive function by modulating attention, memory processing, and emotional responses [5], [6], [26].

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To address this research gap, this study aims to quantitatively analyse the effects of horizontal neck-squeezing therapy on mental health by investigating key physiological responses. The research objectives are to investigate the interaction effect of horizontal neck squeezing angles and speed on muscle activity signals using electromyography (EMG), to examine the interaction effect of horizontal neck squeezing angles and speed on heart rate signals using electrocardiography (ECG) and to analyse the significant effect of horizontal neck squeezing angles and speed on brain activity signals using electroencephalography (EEG) for reducing mental and emotional disorder symptoms among Malaysian adults. Finally, this paper aims to discuss and illustrate the research methodology framework by integrating the Biopsychosocial Model, the Neurophysiological Model of Emotional Regulation, and the Cognitive Ergonomic Model in the context of CTC therapy. The framework outlines how CTC therapy works through Neck Squeezing techniques, focusing on the application of specific angles and speeds that stimulate neurological pathways.

2. MATERIAL AND METHODS

Figure 1 illustrates the research framework and methodology flow chart. The first phase of the study involves a comprehensive assessment of participants to establish a robust baseline for further analysis. Demographic data, such as age, gender, occupation, and medical history, are collected to characterize the study population. General health screening is conducted to identify pre-existing conditions that could influence neck pain or the response to treatment. Additionally, psychological factors, including depression, anxiety, and stress, are assessed using validated tools such as the Depression, Anxiety, and Stress Scale (DASS) [15], [20]. These factors are known to significantly affect pain perception and outcomes. Finally, the Nordic musculoskeletal questionnaire is administered to gather detailed information on the intensity, frequency, duration, and associated symptoms of neck pain [17], [18]. This phase ensures a comprehensive understanding of each participant's condition, providing a foundation for evaluating the impact of CTC therapy.

In the second phase, a controlled experimental approach is implemented to assess the physiological and neurological effects of CTC therapy. Before therapy, participants are subjected to mental load activities designed to induce stress, such as memory recall or arithmetic tasks. Baseline EEG measurements are taken to record brainwave activity under stress, providing control data for comparison. Participants then receive a standardized CTC Therapy session, which focuses on gentle cervical spine adjustments to improve spinal alignment and reduce nerve compression. Following therapy, EEG measurements are repeated to evaluate changes in brainwave patterns. Additional assessments, including EMG to record neck muscle activity, ECG to monitor heart rate, and an Arduino-based system to measure neck squeezing angles and speed, are conducted to evaluate muscle function, stress response, and physical performance.
The third phase involves the analysis and evaluation of data collected during the second phase. Statistical correlation analyses are performed to explore the relationships between neck-squeezing angles and speeds with muscle activity, heart rate, and brainwave patterns. These analyses aim to identify optimal ranges of neck movement and their relationship with physiological and neurological factors. By integrating findings from multiple dimensions, this phase seeks to provide a deeper understanding of the mechanisms underlying the therapeutic effects of CTC therapy.

To ensure participant safety and address the anatomical sensitivity of the cervical region, this research framework incorporates a multi-layered ethical and biomechanical safeguard protocol. The "neck squeezing" intervention is operationalized through standardized kinematics, utilizing an Arduino-based sensor system to maintain specific, gentle angles and speeds that prevent excessive physical strain. These sessions are conducted exclusively by trained practitioners to

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ensure proper application and to mitigate risks such as nerve compression or muscle injury. To objectively validate these safety parameters, participants undergo real-time neurophysiological monitoring—including EMG for muscle activity, ECG for autonomic stress responses, and EEG for brain function—which allows for the immediate detection of adverse physiological reactions. Furthermore, the methodology adheres to strict ethical standards, requiring informed consent and maintaining a "stop" protocol that allows participants to terminate the session at any moment if discomfort arises. Future work will further refine these safeguards by conducting detailed biomechanical studies to establish definitive force thresholds and safe pressure limits for the intervention.

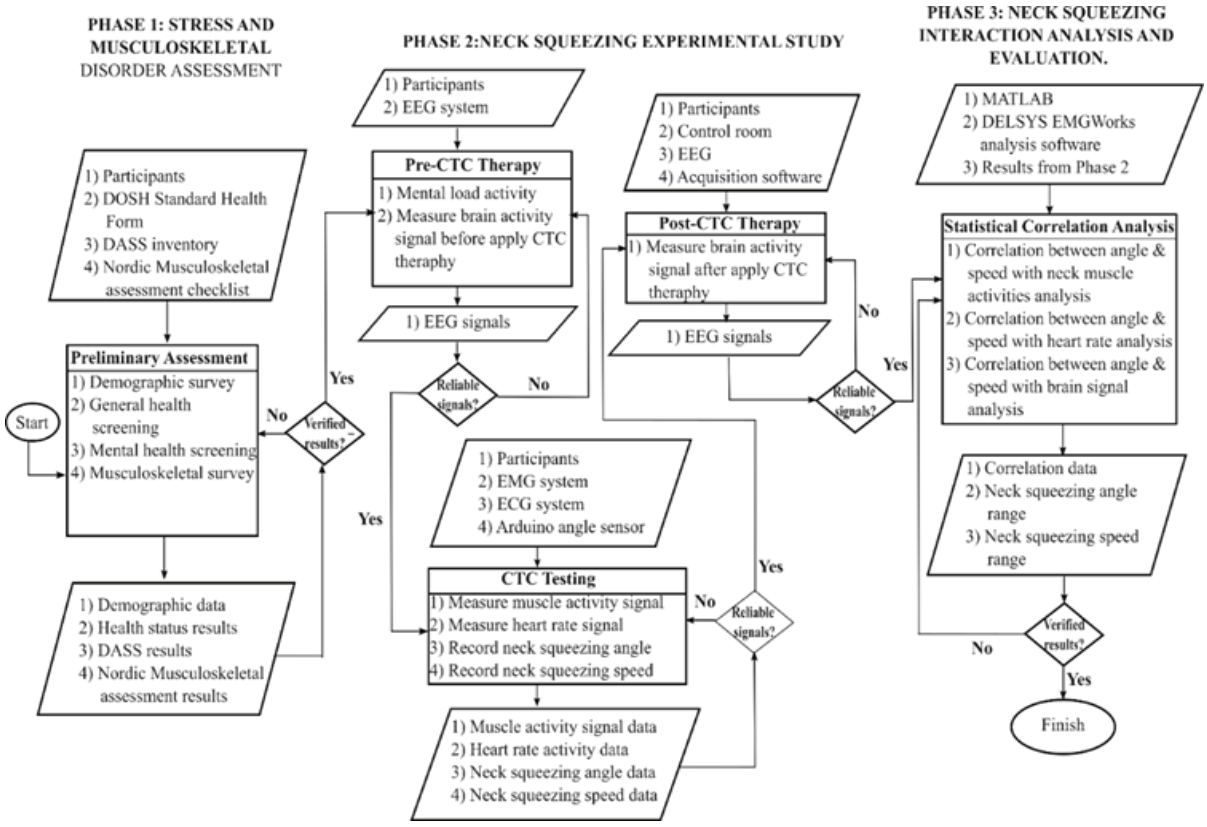

Figure 1. Research Methodology Framework Diagram.

3. RESULTS

The preliminary findings obtained from Phase 1 of this study will provide key demographic and health-related data on the participant cohort. A total of 88 volunteers (49 men and 39 women) with ages ranging from 20 to 58 years actively participated in the initial stage of the study, ensuring diverse representation among different gender and age groups. Among the participants, 11 individuals were identified as left-handed, while 13 reported having pre-existing health conditions, which include a range of acute and chronic medical histories. Within the participant cohort, musculoskeletal disorders that are specifically localized to the upper limb region, including the neck, shoulder, and back, were identified in 12 participants. Additionally, it is revealed that 19 participants exhibited symptoms of depression, anxiety, and stress, as assessed through validated mental health screening tools such as the Depression, Anxiety, and Stress Scale (DASS). These results offer an initial overview of the participant cohort biopsychosocial profiles encompassing demographic characteristics, psychological states and physical health parameters. Besides that, the data can also be used to form a critical foundation for further exploration of the impact of CTC therapy on musculoskeletal and psychological health in Phase 2.

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Figure 2 presents a thorough schematic illustration of the experimental study setup for the CTC horizontal neck-squeezing intervention. The figure also clearly specifies the types of data collection hardware, such as EEG, EMG, and ECG, data acquisition process, and analytical framework. Figure 2 (a) illustrates the EEG, EMG and ECG measurement hardware utilized to capture neurophysiological and neuromuscular responses, including brain activity, muscle activation, and heart rate variability. It is guaranteed by having a controlled laboratory environment able to ensure that the data collecting process is consistent, therefore reducing the number of external factors that might affect the physiological responses. Figure 2 (b) represents the pre-CTC therapy assessment phase, and it is during this phase that the baseline physiological parameters and participant-specific health conditions are recorded to establish comparative benchmarks. Figure 2 (c) demonstrates the data analysis process, which involves statistically analysing the signals that have been recorded, such as muscle signal activity, brainwave oscillations, and autonomic function, to evaluate the therapeutic benefits of CTC intervention. By combining these methodologies, a complete evaluation of CTC treatment's physiological and psychological effects is carried out. This evaluation gives insights into the possible function that CTC therapy may play in neuromodulation, emotional regulation, and stress reduction.

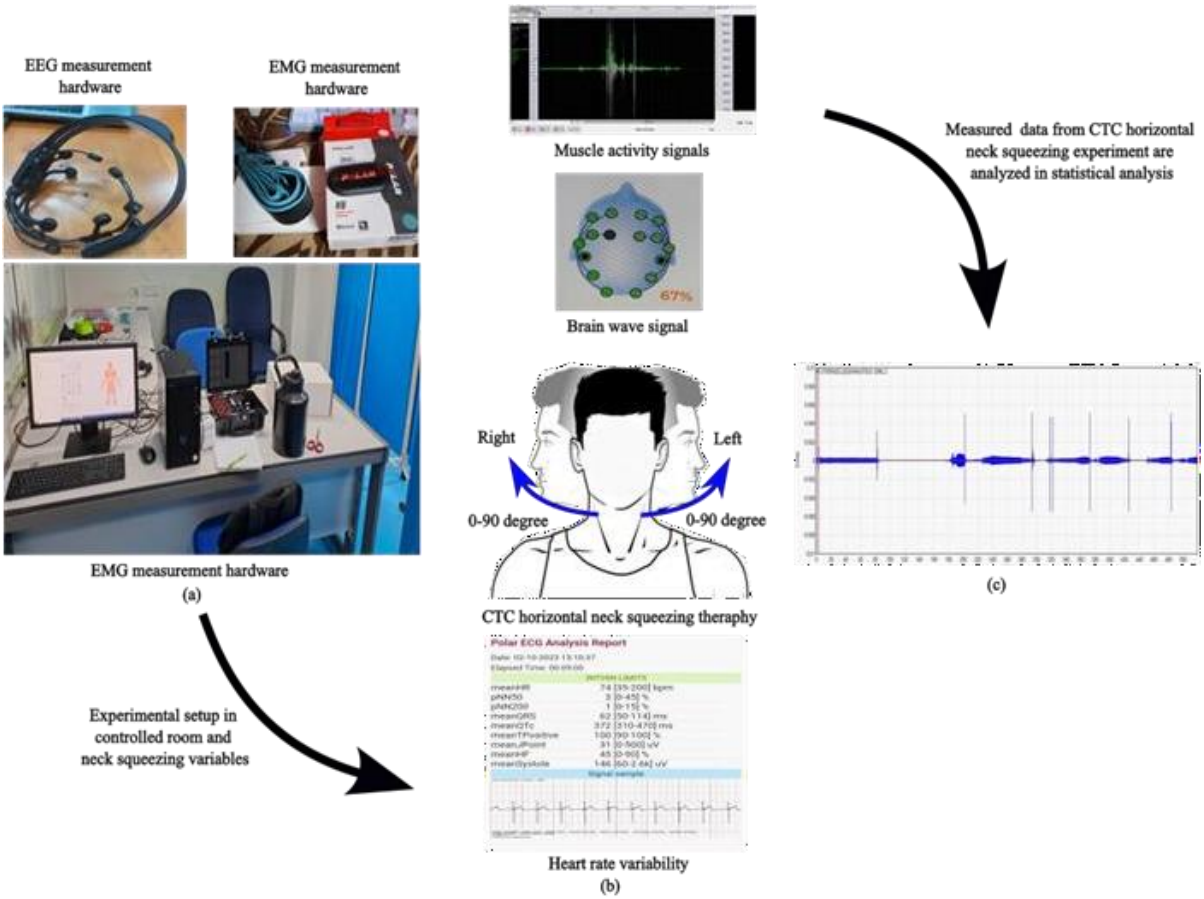

Figure 2. Neck Squeezing Experimental Study Setup: (a) Measurement hardware and setup, (b) Pre-CTC Therapy and Testing, (c) Phase 3 Neck Squeezing Interaction Analysis and Evaluation.

4. DISCUSSION

This study presents a comprehensive research framework that integrates the Biopsychosocial Model, the Neurophysiological Model of Emotional Regulation, and the Cognitive Ergonomic Model to investigate the effects of Creative Trauma Cleansing (CTC) therapy. Compared to existing frameworks in the fields of mental health therapy, emotional regulation, and cognitive ergonomics, the proposed framework introduces significant improvements in theoretical

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integration, measurement techniques, operationalization of emotional regulation, and empirical validation of alternative therapies. Unlike fragmented approaches in previous research [8], [10], [25], the framework in this study synthesizes the integration models into a cohesive structure, examining how the biological, psychological, and cognitive aspects of CTC therapy interact to influence emotional regulation. This holistic integration represents a significant advancement over existing models, as it acknowledges both the neurophysiological and experiential dimensions of therapeutic interventions.

Another major improvement lies in the use of neuromuscular and cardiovascular measures to evaluate CTC therapy. Existing research on alternative therapies often relies on qualitative methods such as self-reported stress reduction or observational assessments [21], [24], limiting the objectivity and reliability of findings. In contrast, this study employs electrophysiological tools, including EMG to measure electrical activity in the sternocleidomastoid muscle, ECG to assess autonomic responses via heart rate variability, and EEG to capture changes in brain activity. By incorporating these objective biomarkers, the framework ensures that the effects of CTC therapy can be quantitatively validated, offering a more scientifically rigorous approach than existing models that predominantly rely on subjective measures.

Another key improvement of this study's framework is its application of cognitive ergonomic principles to therapeutic interventions. Traditional cognitive ergonomics focuses on human–system interactions, mental workload, and performance optimization [11] but does not consider how physical interventions might influence cognitive relaxation and stress reduction. This framework extends cognitive ergonomic concepts by proposing that CTC therapy induces relaxation through neuromuscular and autonomic regulation, which can be measured using EEG to assess cognitive state changes. This novel approach enhances the applicability of cognitive ergonomics beyond workplace and technological environments, demonstrating its relevance in the context of mental health interventions.

Finally, this study addresses critical gaps in alternative therapy research by establishing standardized protocols and empirical validation methods. Alternative therapies, including CTC therapy, often lack scientific validation due to a reliance on anecdotal evidence and an absence of standardized parameters [22]. The proposed framework seeks to overcome these limitations by defining specific neck-squeezing parameters (angles, speeds) and analysing their effects on neuromuscular and cardiovascular responses. This structured approach ensures that CTC therapy can be systematically evaluated and replicated, laying the groundwork for its integration into evidence-based mental health practices.

Despite the potential contributions of this research framework, several limitations must be acknowledged, which also provide opportunities for future investigation. One major limitation is the lack of prior empirical studies on CTC therapy, particularly in the context of neurophysiological and biomechanical assessments. Since CTC therapy is largely anecdotal and lacks standardized clinical protocols, there is a risk that individual differences in practitioner technique and patient response could introduce variability in the results, making it challenging to establish generalizable conclusions [22]. To address this limitation, future studies should aim to develop standardized guidelines for neck-squeezing parameters, ensuring consistent application across different practitioners and study populations.

Another constraint is the reliance on physiological biomarkers i.e. EMG, ECG, EEG without direct psychological correlations, such as longitudinal assessments of mental health improvements. While neurophysiological data provides objective insights into immediate bodily responses, it does not fully capture the long-term psychological benefits or potential adverse effects of CTC therapy. Future research should incorporate validated psychological assessment tools, such as stress and anxiety scales, to evaluate whether changes in physiological activity translate into sustained mental health improvements over time [23]. Additionally, a longitudinal study design

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should be considered to examine the lasting effects of repeated CTC therapy sessions on emotional resilience and cognitive function.

A further limitation of this study is its focus on a specific demographic group, namely male Malaysian adults, which may restrict the generalizability of findings to other populations even the practitioners claim different cultural backgrounds are not a concern when executing the CTC therapy. Given that mental health responses can vary based on age, gender, and cultural background, future studies should expand the sample size to include a more diverse population, including female participants and individuals from different ethnic and cultural backgrounds [28]. Moreover, cross-cultural comparisons could provide insights into whether the effectiveness of CTC therapy varies across different sociocultural contexts, further supporting its potential application as a widely accepted therapeutic intervention.

The methodological approach also presents certain constraints. Although EEG, ECG, and EMG provide valuable insights into physiological responses, they require signal monitoring, equipment calibration and controlled laboratory conditions, which may limit real-world applicability. Future research should explore the feasibility of using wearable biometric devices to monitor real-time physiological changes in natural settings, such as clinics, workplaces, or home environments. The integration of portable neurophysiological monitoring systems would enable broader application and accessibility of CTC therapy assessment, potentially making it a scalable intervention for mental health practitioners.

Lastly, ethical considerations and safety concerns regarding neck-squeezing techniques need further exploration. While this study aims to assess potential therapeutic benefits, there is a possibility that improper application of pressure could lead to adverse effects, such as muscle strain, nerve compression, or discomfort [22]. Future research should prioritize safety assessments, including detailed biomechanical studies on force thresholds, to establish safe and effective pressure limits for neck squeezing therapy. Additionally, qualitative studies on patient experiences and perceptions could provide valuable feedback on comfort levels, trust in the therapy, and overall satisfaction with CTC interventions.

5. CONCLUSION

This study introduces a novel research methodology framework that combines the Biopsychosocial Model, the Neurophysiological Model of Emotional Regulation, and the Cognitive Ergonomic Model to systematically examine the effects of Creative Trauma Cleansing (CTC) therapy from biomechanical, neurophysiological, and psychological perspectives. By employing electromyography (EMG), electrocardiography (ECG), and electroencephalography (EEG), this framework provides objective data on how neck squeezing kinematics influence muscle activity, autonomic responses, and brain function, addressing the existing gap in empirical evidence on CTC therapy. Furthermore, the study explores key theoretical constructs, including the roles of the amygdala, trigeminal nerve, and sternocleidomastoid muscle in emotional regulation, contributing to a scientific basis for validating alternative mental health interventions. The preliminary findings from Phase 1 of the study provide essential demographic and health-related data for the participant cohort, which includes 88 volunteers (49 men, 39 women, aged 20 to 58 years). Key observations include 11 left-handed participants, 13 with pre-existing health conditions, and 12 with musculoskeletal disorders affecting the neck, shoulder, and back. Additionally, 19 participants exhibited symptoms of depression, anxiety, and stress. These data establish a crucial biopsychosocial profile for further exploration of CTC therapy's impact on musculoskeletal and psychological health in Phase 2. The experimental setup for the CTC intervention presents detailed measurement hardware and the data acquisition process for statistical analysis purposes. In future work, the statistical analysis of physiological signals from muscle activity, brainwaves, and autonomic function will offer valuable insights into the therapeutic potential of CTC in neuromodulation, emotional regulation, and stress reduction,

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advancing the development of evidence-based practices in mental health therapy and cognitive neuroscience.

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APPENDIX

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