ELECTROENCEPHALOGRAPHY FOR THE DIAGNOSTIC CHARACTERIZATION OF CHRONIC TENSION-TYPE HEADACHE

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Abstract: Chronic tension-type headache (CTTH) is the most prevalent primary headache disorder, marked by persistent, long-duration pain episodes that significantly affect daily functioning. Electroencephalography (EEG), as a non-invasive and widely accessible neurodiagnostic tool, enables the evaluation of cortical activity and the detection of functional brain alterations associated with CTTH. This article reviews current EEG findings in CTTH, focusing on characteristic modifications in brain rhythms, including alterations in alpha, beta, and theta activity that may reflect impaired cortical regulation and heightened muscle–brain feedback mechanisms. In addition, potential EEG-based diagnostic criteria are discussed, along with emerging evidence on the utility of EEG biomarkers for monitoring therapeutic responses. Overall, the integration of EEG into CTTH diagnostics offers promising prospects for enhancing clinical assessment accuracy and tailoring treatment approaches based on individualized neurophysiological profiles.

Keywords: Chronic tension-type headache, electroencephalography, diagnosis, pain, headache

Chronic tension-type headache (CTTH) is one of the most common primary headache disorders and is characterized by prolonged, recurring episodes of bilateral, pressing, or tightening pain of mild-to-moderate intensity occurring on more than 15 days per month for at least three consecutive months. Despite its high prevalence, the underlying mechanisms of CTTH remain insufficiently elucidated. Growing evidence suggests that dysfunction within central pain-modulating pathways, impaired cortical inhibitory mechanisms, and chronic stress-related regulatory disturbances contribute to its development. Electroencephalography (EEG), as a non-invasive and highly sensitive neurophysiological method, provides valuable insights into the bioelectrical activity of the brain and helps reveal functional abnormalities associated with CTTH.

EEG studies in CTTH employ several main approaches, including resting-state recordings that assess baseline cortical activity, task-based paradigms that examine responses to cognitive or sensory stimuli, and frequency-spectrum analysis that evaluates the power and distribution of alpha, beta, theta, and delta rhythms. These methods allow for the investigation of amplitude, frequency, and coherence changes across cortical regions. The results obtained in CTTH populations consistently demonstrate characteristic EEG deviations. Reduced alpha power, particularly in occipital and parietal areas, indicates compromised inhibitory control and difficulty in achieving cortical relaxation. Increased beta activity reflects heightened central nervous system excitability and chronic stress exposure. Elevated theta activity in frontal and central regions suggests impaired regulatory functions and increased mental fatigue, both frequently observed in CTTH patients. Abnormalities in EEG coherence further support the presence of disrupted functional connectivity within neural networks, which may contribute to persistent sensory hypersensitivity and altered pain modulation.

The diagnostic utility of EEG lies in its ability to differentiate CTTH from other primary headache disorders such as migraine or cluster headache and to provide objective markers of central nervous system dysregulation. EEG-based findings can complement clinical assessment and psychophysiological evaluation, thereby enhancing diagnostic accuracy and aiding in the identification of specific

CTTH subtypes. EEG is also a valuable tool for monitoring the effectiveness of therapeutic interventions. Pharmacological treatments, including antidepressants and anticonvulsants, have been associated with improvements in alpha and beta rhythmic organization. Non-invasive neuromodulation techniques such as transcranial magnetic stimulation produce measurable EEG changes that reflect normalization of cortical excitability. Lifestyle and behavioral interventions targeting sleep, stress, and muscle tension may also lead to EEG improvements, demonstrating their positive impact on cortical regulation.

Future research directions emphasize advanced quantitative EEG (qEEG), machine-learning algorithms, and multimodal integration with autonomic and immunological markers. These developments offer opportunities for creating individualized neurophysiological profiles, predicting the risk of chronicity, and tailoring treatment strategies to maximize clinical efficacy. As such, EEG is expected to play an increasingly prominent role in improving the understanding, diagnosis, and management of chronic tension-type headache.

References

1. Akhmedova, D. B., & Xodjieva, D. T. (2021). Analysis of the prevalence of headaches among the population in Bukhara region. *ACADEMICIA: An International Multidisciplinary Research Journal, 11*(3), 431–433.
2. Khodjieva, D. T., & Akhmedova, D. B. (2021). Historical and scientific foundations of hirudotherapy. *Journal "Medicine and Innovations"*(3), 143–146.
3. Akhmedova, D. B. (2021). Comparative evaluation of the impact of treatment measures on the neuropsychological state of patients with chronic tension-type headaches. *Academic Research in Educational Sciences, 2*(10), 408–413.

4. Khodjieva, D. T., & Akhmedova, D. B. (2022). Differential approach and improvement of rehabilitation methods in managing patients with headaches of various origins. *Journal of Neurology and Neurosurgical Studies, 3*(4).
5. Bakhodirovna, A. D. (2022). Analysis of side effects of drugs used in the treatment of chronic tension-type headache. *International Journal of Inclusive and Sustainable Education, 1*(4), 54–55.
6. Akhmedova, D. B. (2021). Dysfunction of higher nervous activity in chronic tension-type headache and migraine. *Journal of Neurology and Neurosurgical Studies, Special Issue*(1).