Beyond Cognition: Exploring the Emerging Role of Transcranial Pulse Stimulation in Chronic Pain

Carlos A. Leal, MD

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Abstract

Chronic pain is increasingly understood not simply as a consequence of persistent tissue damage, but as a multidimensional experience generated and maintained by complex neural networks involving sensory, cognitive, and emotional processing. This evolving concept has shifted attention from the site where pain originates toward the central mechanisms that may contribute to its persistence.

Non-invasive brain stimulation has emerged as a promising therapeutic approach for modulating dysfunctional pain networks. Techniques such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS) have provided evidence that targeted neuromodulation can influence pain perception and central pain processing.

Transcranial Pulse Stimulation (TPS®) represents a novel, non-invasive, image-guided neuromodulation technology capable of delivering focused ultrasonic pulses to selected cortical and deeper brain regions. Its precision and ability to target structures involved in pain processing raise the possibility of extending its applications beyond cognitive disorders into chronic pain management.

This presentation reviews the neurobiological rationale for TPS® in chronic pain, the evolution of non-invasive brain stimulation, and the potential role of targeted modulation of pain-related neural networks. Preliminary clinical observations suggest possible improvements not only in pain perception, but also in sleep, functional capacity, emotional well-being, energy levels, and quality of life.

Although these early observations are encouraging, the role of TPS® in chronic pain remains investigational. Controlled clinical studies are required to establish optimal targets, treatment protocols, patient selection, efficacy, and durability of response. TPS® may represent a promising new frontier in non-invasive neuromodulation and warrants systematic investigation as a potential component of multimodal chronic pain management.