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Original Reports

595 Effectiveness of High-Frequency Electrical Stimulation Following Sensitization With Capsaicin

Catherine R. Jutzeler, Armin Curt, and John L. K. Kramer

Although nonnoxious, high-frequency electrical stimulation applied segmentally (ie, transcutaneous electrical nerve stimulation [TENS]) has been proposed to modulate pain, the mechanisms underlying analgesia remain poorly understood. To study how TENS modulates pain, this work examined evoked responses to noxious thermal stimuli after the induction of sensitization using capsaicin in healthy volunteers. The authors hypothesized that sensitization caused by capsaicin application would unmask TENS analgesia, which could not be detected in the absence of sensitization. The study indicates that sensitization with capsaicin unmasks the effect of TENS. This indicates that TENS may be interacting segmentally to modulate distinct aspects of sensitization, which in turn results in analgesia to thermal stimulation

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ON THE COVER

Phantom limb pain (PLP) is a common sequela of amputation following trauma or peripheral vascular disease. Management is often difficult, refractory to classic pharmacologic and surgical treatments. In recent years, various therapeutic strategies have been proposed, but there is still little evidence-based support of their clinical effectiveness. This study explores the analgesic effects of transcranial direct current stimulation (tDCS) over the motor cortex on postamputation PLP. These results show that a 5-day treatment of motor cortex stimulation with tDCS can induce a stable relief from PLP in amputees. Cover image submitted by Nadia Bolognini. See Bolognini et al, page 657.

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The Mediating Role of Acceptance in Multidisciplinary Cognitive-Behavioral Therapy for Chronic Pain

Sophia Åkerblom, Sean Perrin, Marcelo Rivano Fischer, and Lance M. McCracken

Cognitive-behavioral therapy (CBT) is the most frequently delivered psychological intervention for adults with chronic pain. The treatment yields modest effect sizes, and the mechanisms of action remain understudied and unclear. Efforts are needed to identify treatment mediators that could be used to refine CBT and improve outcomes. This study sought to investigate whether pain-related acceptance, from the psychological flexibility model, mediates changes in outcome over time in a CBT-based treatment program. The results highlight the role of pain-related acceptance as an important treatment process even when not explicitly targeted during treatment. These data may help clinicians and researchers better understand processes of change and improve the choice and development of treatment methods.

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Efficacy of Inhaled Cannabis on Painful Diabetic Neuropathy

Mark S. Wallace, Thomas D. Marcotte, Anya Umlauf, Ben Gouaux, and Joseph H. Atkinson

A randomized, double-blinded, placebo controlled crossover study was conducted in 16 patients with painful diabetic peripheral neuropathy to assess the short-term efficacy and tolerability of inhaled cannabis. In a crossover design, each participant was exposed to 4 single dosing sessions of placebo or to low, medium, or high doses of cannabis. Baseline spontaneous pain, evoked pain, and cognitive testing were performed. Subjects were then administered aerosolized cannabis or placebo and the pain intensity and subjective "highness" score was measured. This small, short-term, placebo-controlled trial demonstrates a dose-dependent reduction in diabetic peripheral neuropathy pain in patients with treatment-refractory pain. This adds preliminary evidence to support further research on the efficacy of the cannabinoids in neuropathic pain.

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Artemin Immunotherapy Is Effective in Preventing and Reversing Cystitis-Induced Bladder Hyperalgesia via TRPA1 Regulation

Jennifer J. DeBerry, Jami L. Saloman, Brian K. Dragoo, Kathryn M. Albers, and Brian M. Davis

Pelvic/suprapubic pain is a cardinal symptom of interstitial cystitis/painful bladder syndrome, a chronic condition affecting 2.7-6.5% of women in the U.S. Injury- or disease-induced artemin (ARTN) signaling can sensitize primary afferents and contribute to persistent pain. The authors demonstrate that administration of an ARTN neutralizing antibody, anti-artemin (α -ARTN), can block the development of, and reverse already established, bladder hyperalgesia associated with cyclophosphamide-induced cystitis in mice. This indicates its potential as an efficacious treatment strategy for ongoing bladder pain associated with interstitial cystitis/painful bladder syndrome.

637 **μ -Opioid Receptor Gene A118 G Variants and Persistent Pain Symptoms Among Men and Women Experiencing Motor Vehicle Collision**

Sarah D. Linnstaedt, JunMei Hu, Andrey V. Bortsov, April C. Soward, Robert Swor, Jeffrey Jones, David Lee, David Peak, Robert Domeier, Niels Rathlev, Phyllis Hendry, and Samuel A. McLean

More than 11 million Americans experience motor vehicle collision (MVC) each year; 4 million of these individuals present to U.S. emergency departments after the MVC for evaluation. More than 90% are discharged without fracture or other identifiable injury, yet persistent musculoskeletal pain (MSP) in this population is a common and costly public health problem. Mechanisms of chronic MSP development remain poorly understood. The μ -opioid receptor 1 (OPRM1) binds endogenous opioids. Increasing evidence suggests that endogenous OPRM1 agonists released at the time of trauma may contribute to the development of posttraumatic MSP. In this prospective observational study, the authors evaluated the hypothesis that individuals with an AG or GG genotype at the *OPRM1* A118G allele, which results in a reduced response to opioids, would have less severe MSP 6 weeks after MVC.

645 **Psychometric Properties of the Pain Stages of Change Questionnaire: New Insights on the Measurement of Readiness to Change in Adolescents, Mothers, and Fathers**

Jenny R. Evans, Kristen Jastrowski Mano, Jessica W. Guite, Steven J. Weisman, and Keri R. Hainsworth

There is increasing interest in the measurement of "readiness to change," or willingness to engage in a self-management approach to pain coping, as a predictor of treatment response in pediatric pain populations. This study sought to provide cross-validation of the Pain Stages of Change Questionnaire (PSOCQ)-Adolescent and -Parent versions in a new, independent pediatric chronic pain sample by examining aspects of reliability, validity, and generalizability of the factor structures identified in the initial validation study. Although slight differences emerged, the factor structures identified in the initial validation were largely replicated, suggesting that the psychometric properties of the measure are robust across pediatric outpatient chronic pain samples. Findings highlight the need for more fine-tuned analyses of the way the construct operates in youth with pediatric pain and their parents.

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Immediate and Sustained Effects of 5-Day Transcranial Direct Current Stimulation of the Motor Cortex in Phantom Limb Pain

Nadia Bolognini, Viviana Spandri, Francesco Ferraro, Andrea Salmaggi, Alessandro C. L. Molinari, Felipe Fregni, and Angelo Maravita

The study explored the analgesic effects of transcranial direct current stimulation (tDCS) over the motor cortex on postamputation phantom limb pain (PLP). Eight subjects with unilateral lower or upper limb amputation and chronic PLP were enrolled in a crossover, double-blind, sham-controlled treatment program. For 5 consecutive days, anodal (active or sham) tDCS was applied over the motor cortex for 15 minutes at an intensity of 1.5 mA. The 5-day treatment with active, but not sham, tDCS induced a sustained decrease in background PLP and in the frequency of PLP paroxysms, which lasted for 1 week after the end of treatment. Moreover, on each day of active tDCS, patients reported an immediate PLP relief, along with an increased ability to move their phantom limb. These results show that a 5-day treatment of motor cortex stimulation with tDCS can induce stable relief from PLP in amputees. Neuromodulation targeting the motor cortex appears to be a promising option for the management of this debilitating neuropathic pain condition, which is often refractory to classic pharmacologic and surgical treatments.

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The Contribution of Differential Opioid Responsiveness to Identification of Opioid Risk in Chronic Pain Patients

Stephen Bruehl, John W. Burns, Steven D. Passik, Rajnish Gupta, Asokumar Buvanendran, Melissa Chont, Erik Schuster, Daria Orłowska, and Christopher R. France

The Screener and Opioid Assessment for Patients with Pain—Revised (SOAPP-R) predicts increased risk of opioid misuse in chronic pain patients. The authors evaluated whether higher SOAPP-R scores are associated with greater opioid reinforcing properties, potentially contributing to their predictive utility. Results indicate that the SOAPP-R may predict elevated opioid risk in part by tapping into individual differences in opioid reinforcing effects. Based on placebo-controlled morphine responses, associations were observed between higher scores on the SOAPP-R and greater desire to take morphine again, fewer negative subjective morphine effects, and greater analgesia. Opioids may provide the best analgesia in those patients at greatest risk of opioid misuse.

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Psychometric Properties of the Centrality of Pain Scale

Benjamin J. Morasco, Dennis C. Turk, and Christina Nicolaidis

The Centrality of Pain Scale (COPS) is a patient-centered, 10-item self-report measure designed to assess how central pain is perceived to be in the lives of individuals with chronic pain. The COPS underwent initial development and validation previously; preliminary results suggested that it had excellent psychometric properties. COPS scores were associated with important clinical factors. This study examined the psychometric properties of the COPS in a sample of individuals with mixed chronic pain diagnoses being treated at a U.S. Veterans Affairs Medical Center. The authors report that the COPS had high internal consistency and was significantly correlated with other measures of pain, mental health, psychological factors associated with pain, and chronic pain coping styles, suggesting convergent and divergent validity.

682 Erratum

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