The Clinical Journal of Pain Publish Ahead of Print
DOI:10.1097/AJP.0000000000000916

Movement-evoked Pain (MEP)

Disclosure: The authors declare no conflict of interest.

A letter to the editor of CJP on MEP

A recent scoping review by Fullwood et al.[1] identified some key issues in MEP: huge variations in measures, lack of operational or conceptual definition, and limited comparison with related outcomes or concepts. These issues are not only thought-provoking, but also important for future direction on research for improving MEP measure and translating knowledge to clinical practice. For example, the authors suggested the need for distinction between MEP and similar concepts (e.g. movement-evoked hyperalgesia or exercise-induced hyperalgesia).[1] In fact, movement plays a dual paradoxical role in the human body by hyperalgesic effect (provoke pain) or hypoalgesic effect (alleviate pain).[2] These hyperalgesic and hypoalgesic effects represent opposite ends of a spectrum in the pain-movement continuum. Interestingly, there are shared mechanisms between exercise-induced hypoalgesia (EIH) and conditioned pain modulation (CPM).[3] Evidence shows that CPM is impaired in populations with chronic pain (Lewis et al. J Pain 2012).[4] Similarly, a cognitive controlling mechanism like executive function (EF) is impaired in people with chronic pain.[5] We do not know yet the relationship between CPM and EF. However, future research should focus to find out the link of MEP with EIH, CPM, and EF. An operational definition of MEP is challenging due to great variation in the MEP measures, concepts, and terminologies used in literature. The evolving concept of MEP is embodied by few other similar kinds of conceptual frameworks and their research domains (e.g. sensitivity to physical activity,[6] activity-related summation of pain,[7] and delayed-onset muscle soreness[8]). Research is recommended to explore the distinction between MEP and these conceptual frameworks.[1] A neglect of MEP in clinical application is identified, and the fundamental distinction is suggested for standardized measurement for MEP.[9] The knowledge about the frequency of use and method of MEP in clinical trials is still under investigation to reevaluate the use of MEP as outcome evaluation.[10] Notably, a recent call to isolate MEP as a unique measure

highlighted the importance of this emerging area of the research line in pain science and the need for clinimetric studies.[11] MEP represents itself within a spectrum of pain with movement experiences (e.g. pain evoked or provoked with movement, pain produced during or after movement, past pain experienced with movement, pain symptoms worsened or alleviated with movement). Research design with an integrated model[12] (combining sensory, motor and psychological factors) may help us to better understand MEP within this spectrum of pain with movement.

Currently, there are no biomarkers for pain, despite having 3 promising tools (e.g. sensory testing, skin punch biopsy, and brain imaging)[13]. Although, brain imaging technology is questionable in pain intensity mesaure,[14] Fullwood et al.[1] recommended imaging studies (e. g. functional magnetic resonance imaging) studies to understand brain activation in MEP. Nonetheless, sensory testing is shown useful in evaluating psychological factors, pain-related clinical outcomes and MEP measures and is capable of explaining individual variance.[6,15] The tracking and mechanism type of a potential pain biomarker (e.g. monitoring category) can detect a change in the pain or functional degree or extent of chronic pain over time.[16] The next-generation real-time sensor development, combining electrochemical sensors (for pain-related bio-fluids) [17] and wearable device performance (using inertial measurement unit and deep neural network models)[18], might be a better solution for physiological traces of pain with movement, and it may help us to understand MEP, EIH, CPM and EF. Technology development with wearable sensing devices can lead us toward a future broader investigation on the possible interaction and influence of MEP experience with the real-life environment (combining cognitive, psychological, and social factors).

Zakir Uddin, PhD
Postdoctoral Researcher, School of Physical and Occupational Therapy, Faculty of Medicine, McGill University, Canada
&
Assistant Clinical Professor (Adjunct), Rehabilitation Science, Faculty of Health Sciences. McMaster University, Canada

References:

1. Fullwood, D. *et al.* Toward Understanding Movement-evoked Pain (MEP) and its Measurement: A Scoping Review. *Clin. J. Pain* 37, (2020).
2. Hodges, P. W. & Smeets, R. J. Interaction Between Pain, Movement, and Physical Activity. *Clin. J. Pain* 31, 97–107 (2015).
3. Alsouhibani, A., Vaegter, H. B. & Hoeger Bement, M. Systemic Exercise-Induced Hypoalgesia Following Isometric Exercise Reduces Conditioned Pain Modulation. *Pain Med.* 20, 180–190 (2019).
4. Lewis, G. N., Rice, D. A. & Mcnair, P. J. Critical Review Conditioned Pain Modulation in Populations With Chronic Pain: A Systematic Review and Meta-Analysis. *J. Pain* 13, 936–944 (2012).
5. Berryman, C. *et al.* Do people with chronic pain have impaired executive function? A meta-analytical review. *Clinical Psychology Review* 34, 563–579 (2014).
6. Woznowski-Vu, A. *et al.* Comparing Novel and Existing Measures of Sensitivity to Physical Activity Among People With Chronic Musculoskeletal Pain: The Importance of Tailoring Activity to Pain. *Clin. J. Pain* 35, 656–667 (2019).
7. Sullivan, M. J. L., Larivière, C. & Simmonds, M. Activity-related summation of pain and functional disability in patients with whiplash injuries. *Pain* 151, 440–446 (2010).
8. Hotfiel, T. *et al.* Advances in Delayed-Onset Muscle Soreness (DOMS): Part I: Pathogenesis and Diagnostics. *Sportverletzung-Sportschaden* 32, 243–250 (2018).
9. Srikandarajah, S. & Gilron, I. Systematic review of movement-evoked pain versus pain at rest in postsurgical clinical trials and meta-analyses: A fundamental distinction requiring standardized measurement. *Pain* 152, 1734–1739 (2011).
10. Camiré, D., Erb, J., Kehlet, H., Brennan, T. & Gilron, I. Movement-evoked pain versus pain at rest in postsurgical clinical trials and meta-analyses: Protocol for a follow-up systematic review. *JMIR Research Protocols* 9, (2020).
11. Corbett, D. B. *et al.* Movement-evoked pain: Transforming the way we understand and measure pain. *Pain* 160, 757–761 (2019).
12. Butera, K. A., Fox, E. J. & George, S. Z. Toward a transformed understanding: From pain and movement to pain with movement. *Phys. Ther.* 96, 1503–1507 (2016).
13. Smith, S. M. *et al.* The Potential Role of Sensory Testing, Skin Biopsy, and Functional Brain Imaging as Biomarkers in Chronic Pain Clinical Trials: IMMPACT Considerations. *Journal of Pain* 18, 757–777 (2017).
14. Hoeppli, M. E. *et al.* Dissociation between individual differences in self-reported pain intensity and underlying brain activation. *bioRxiv* 2020.11.13.381970 (2020). doi:10.1101/2020.11.13.381970
15. Uddin, Z. *et al.* Evaluating the novel added value of neurophysiological pain sensitivity within the fear-avoidance model of pain. *Eur. J. Pain* 23, 957–972 (2019).
16. Davis, K. D. *et al.* Discovery and validation of biomarkers to aid the development of safe and effective pain therapeutics: challenges and opportunities. *Nat. Rev. Neurol.* 16, 381–400 (2020).
17. Schultz, J., Uddin, Z., Singh, G. & Howlader, M. M. R. Glutamate sensing in biofluids: recent advances and research challenges of electrochemical sensors. *Analyst* 145, 321–347 (2020).
18. Li, Z., Song, F., Clark, B. C., Grooms, D. R. & Liu, C. A Wearable Device for Indoor Imminent Danger Detection and Avoidance With Region-Based Ground Segmentation.

IEEE Access 8, 184808–184821 (2020).