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Mini Review

Current Literature Review: Chronic Pain and the Use of Box Breathing Technique

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Introduction

Chronic pain is a persistent condition affecting millions of individuals worldwide, often leading to reduced quality of life, psychological distress, and reliance on medication. Given the limitations of pharmacological interventions, alternative non-pharmacological methods, such as mindfulness-based techniques and controlled breathing exercises, are gaining prominence. Among these, box breathing structured techniques involve equal-duration inhalation, breath-holding, exhalation, and pausing-has been proposed as a tool for pain modulation and stress reduction. This review evaluates recent research on the relationship between chronic pain and box breathing, exploring its physiological, psychological, and clinical implications.

Mechanisms of Breathing in Pain Management

The Physiological Effects of Controlled Breathing on Pain

Breathing techniques influence the Autonomic Nervous System (ANS), helping regulate pain perception and emotional response. Box breathing activates the parasympathetic nervous system, reducing sympathetic overactivity, commonly seen in chronic pain patients. Heart Rate Variability (HRV): A key biomarker for autonomic function, HRV has been shown to increase with slow and controlled breathing techniques [1]. found that mindful breathing, including structured breathing techniques like box breathing, enhances HRV, which correlates with reduced pain perception and improved emotional regulation [1]. Cortisol and Stress Reduction: Stress-related biomarkers, including cortisol levels, have been shown to decrease with breathing exercises [2]. conducted a systematic review demonstrating that deep and structured breathing techniques, including box breathing, lead to reduced inflammatory markers, which may play a role in chronic pain management [2].

Neurocognitive Mechanisms: How Box Breathing Modulates Pain Perception

The cognitive and emotional components of pain are influenced by controlled breathing. Box breathing is hypothesized to engage the prefrontal cortex, reducing amygdala activity, which is responsible for fear and stress responses. Neural Activation and Pain Perception: Studies such as *Gholamrezaei, et al.,* [3]. indicate that slow, deep breathing reduces pain intensity by modulating activity in the insular cortex and anterior cingulate cortex, both of which are involved in pain processing [3]. Attention Regulation: Doran examined mindfulness-based approaches, including structured breathing, and found that techniques that promote focus on breath significantly reduce pain-related distress and enhance coping mechanisms [4].

Empirical Evidence on Box Breathing and Chronic Pain

While research on box breathing specifically in chronic pain is limited, studies on similar structured breathing techniques provide insight into its potential effectiveness.

Box Breathing in Pain and Stress Regulation

A controlled trial by Devi & Priya examined the impact of box breathing on physiological markers and found significant improvements in lung function and stress resilience after 30 days of daily practice[5]. Similarly, *Ramalingam, et al.,* [6]. explored short-du-

ration deep breathing interventions, including box breathing, for musculoskeletal pain, showing promising results for pain reduction and autonomic regulation [6].

Comparative Studies with Other Breathing Techniques

Several studies have investigated the efficacy of various controlled breathing techniques in pain relief. One study reported that slow-paced breathing interventions, including box breathing, significantly increased HRV and reduced pain in fibromyalgia patients [7]. Another explored a telehealth-based breathing intervention for chronic pain and found that box breathing showed similar benefits to other deep breathing exercises in reducing pain sensitivity [8].

Box Breathing and Psychological Well-Being in Chronic Pain

Beyond physiological benefits, box breathing has been linked to psychological resilience in chronic pain patients.

Sleep Improvement and Chronic Pain

Andas, et al., [9] examined the impact of box breathing on sleep disturbances in elderly individuals and found that sleep quality improved significantly after consistent practice, suggesting its potential role in pain management where sleep disturbances are a common comorbidity [9].

Emotional Regulation and Anxiety Reduction

Jacobsen, et al., [10] investigated diaphragmatic breathing, which shares similarities with box breathing, and found improvements in both emotional well-being and pain resilience [10]. Jensen explored the use of hypnosis and breathing exercises in pain management, reporting that box breathing could serve as a valuable self-regulation tool for pain perception [11].

Discussion and Future Directions

Limitations in Current Research

While research on breath control and pain is extensive, studies focusing exclusively on box breathing remain limited. Most available studies assess general deep breathing or mindfulness-based breathing interventions, making it challenging to isolate the specific effects of box breathing.

Clinical Implications

Box breathing presents a low-cost, accessible, and non-invasive intervention for chronic pain patients. Given its potential benefits in pain modulation, stress reduction, and emotional resilience, its integration into chronic pain rehabilitation programs warrants further exploration.

Future Research Recommendations

a) Controlled clinical trials specifically evaluating box breathing for chronic pain management.

b) Neuroimaging studies to examine its impact on pain-processing brain regions.

c) Comparative studies between box breathing and other structured breathing interventions.

d) Longitudinal studies to assess the long-term effects of box breathing in chronic pain patients.

Conclusion

The current literature indicates that box breathing holds promise as an effective tool for chronic pain management, primarily through autonomic regulation, stress reduction, and cognitive modulation of pain perception. Although direct evidence remains limited, findings from similar controlled breathing interventions support its potential efficacy. Future research should focus on targeted studies examining box breathing as a standalone therapy for chronic pain, further validating its physiological and psychological benefits.

Acknowledgement

None.

Conflict of Interest

None.

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