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Endodontic treatment and anxiety: Exploring cortisol-driven stress mechanisms

Endodontic apprehension continues to be a major issue in dental care. Root canal treatments, frequently viewed as intrusive and painful, elicit exaggerated stress reactions in numerous patients. In contrast to generalized dental fear, anxiety related to endodontic procedures encompasses expected pain, feelings of helplessness, and unfavorable previous experiences.[1] These psychological elements engage with biological systems, greatly impacting pain perception and clinical results.

At the heart of this interaction is the hypothalamic-pituitary-adrenal (HPA) axis, a neuroendocrine system that reacts to stress through the release of cortisol. Salivary cortisol acts as a non-invasive indicator of acute stress, and its rise during endodontic treatments has been linked to heightened pain sensitivity and postoperative discomfort.[2] Persistent activation of this pathway leads to central sensitization, where the nervous system enhances nociceptive signals, resulting in increased pain responses despite the lack of tissue injury. Cytokines that promote inflammation, like interleukin-6 and tumor necrosis factor-alpha, frequently increase during psychological stress, worsening neurogenic inflammation and contributing to prolonged recovery.[3]

Considering this psychobiological framework, it is essential to regulate the stress response during endodontic procedures. A recent randomized clinical trial showed that patients who were given a cannabidiol (CBD)-rich cannabis extract before undergoing endodontic therapy had lower salivary cortisol levels and reported less postoperative pain.[4] CBD's promise is found in its combined effects — anxiolytic and anti-inflammatory — facilitated via CB2 (cannabinoid receptor type 2) and TRPV1(transient receptor potential vanilloid type 1) receptors. These results indicate potential supplementary approaches for treating patients with anxiety tendencies, though additional studies are required to establish ideal dosages, safety measures, and administration methods.

Non-drug methods are crucial for reducing dental anxiety, particularly in individuals who cannot use sedatives. Methods like guided breathing, music therapy, and virtual reality (VR) distraction (Table 1) have demonstrated positive outcomes in lowering anxiety and sympathetic arousal during dental procedures. Specifically, music interventions have shown reliable results in reducing perceived stress and enhancing the overall treatment experience in dental and medical environments.[5] Additionally, administering short preoperative questionnaires and utilizing salivary cortisol as a predictive biomarker could assist clinicians in recognizing high-risk patients and customizing anxiety-reducing strategies accordingly.

Table 1 Neurobiological mechanisms and possible clinical strategies for managing endodontic anxiety.

Mechanism	Effect on treatment outcome	Management strategy
HPA axis activation	Elevated cortisol, increased pain	Relaxation techniques, CBD adjuncts
Neuroinflammatory cytokines	Enhanced nociception	Anti-inflammatory modulation
Cognitive-emotional factors	Pain anticipation and avoidance	Patient education, psychological support
Autonomic arousal	Sympathetic activation, discomfort	Music therapy, guided breathing, VR

HPA, hypothalamic-pituitary-adrenal; CBD, cannabidiol; VR, virtual reality.

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In conclusion, merging neurobiological and psychological understanding into endodontic care lays the groundwork for more tailored and efficient treatment methods. By embracing a biopsychosocial approach — considering emotional, physiological, and procedural factors — healthcare providers can reduce dental anxiety, boost patient satisfaction, and ultimately enhance treatment outcomes. Upcoming clinical guidelines ought to include evidence-based methods for evaluating and addressing stress in endodontic patients, promoting a transition towards compassionate and research-informed care.

Declaration of competing interest

The authors have no conflicts of interest.

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