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## **CURRENT APPROACHES IN THE DIAGNOSIS AND MANAGEMENT OF PULPITIS**

Toyirova Azizabonu Alisher qizi

Student, Kimyo International University in Tashkent

Xatamov Ulugbek Altibayevich

Scientific Supervisor, PhD, Associate Professor,

Kimyo International University in Tashkent

Pulpitis remains one of the most common and clinically significant inflammatory conditions in dentistry, primarily resulting from microbial invasion and subsequent activation of host immune responses. Although the etiology is well understood—most often linked to dental caries, trauma, or restorative procedures—the complexity of pulp tissue reactions continues to challenge clinicians. When bacterial metabolites penetrate dentinal tubules, the pulp responds with localized inflammation that can rapidly progress if left untreated. The confined nature of the pulp chamber, combined with limited vascular supply, means that even minor inflammatory changes can lead to severe pain and structural compromise.

Clinically, pulpitis is categorized as reversible or irreversible, and accurate diagnosis is essential to determine the appropriate intervention. Reversible pulpitis is characterized by transient pain usually triggered by thermal stimuli, with symptoms subsiding upon stimulus removal. In contrast, irreversible pulpitis manifests as spontaneous, lingering pain, often intensified by thermal changes or lying down, indicating advanced pulpal inflammation. Contemporary diagnostic methods rely on a combination of patient-reported symptoms, clinical examination, and advanced imaging modalities. Thermal and electric pulp tests remain widely used, though limitations exist in their ability to assess true pulpal vitality. Recent studies have highlighted the role of laser Doppler flowmetry and pulse oximetry in improving diagnostic accuracy by evaluating pulpal blood flow rather than relying solely on neural responses.

Radiographic imaging continues to serve as an adjunctive tool, with cone-beam computed tomography (CBCT) providing superior visualization of periapical



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changes and internal anatomy. Nevertheless, imaging should complement, not replace, clinical judgment. Artificial intelligence-based diagnostic algorithms are emerging, showing promise in detecting subtle radiographic changes that may indicate early disease progression, thus supporting evidence-based treatment planning.

Management strategies for pulpitis aim to preserve pulp vitality whenever possible, aligning with the principles of minimally invasive dentistry. For reversible pulpitis, removing the causative irritant and restoring the tooth with biocompatible materials usually results in complete recovery. Materials such as calcium hydroxide and mineral trioxide aggregate (MTA) remain gold standards for pulp protection, though newer bioactive cements are gaining popularity due to their superior sealing ability and bioinductive properties.

Irreversible pulpitis typically necessitates pulpectomy or root canal treatment. Advances in rotary instrumentation, irrigation protocols, and thermoplastic obturation techniques have significantly improved treatment outcomes. Recent trends emphasize the use of nickel-titanium instruments and irrigants activated by sonic or ultrasonic energy to ensure optimal disinfection of the root canal system. In pediatric and adolescent patients, vital pulp therapy procedures, including pulpotomy with bioceramic materials, are increasingly recommended as alternatives to full pulpectomy, preserving root development and tooth structure.

Pain management remains central to successful treatment. Nonsteroidal anti-inflammatory drugs (NSAIDs) are widely used to control postoperative discomfort, and local anesthetic techniques have evolved to provide profound pulpal anesthesia, even in inflamed tissues. There is growing interest in adjunctive pharmacological strategies, such as preoperative analgesia and long-acting anesthetics, to enhance patient comfort.

Looking forward, regenerative endodontics represents a transformative direction in managing pulpal disease. Techniques employing stem cells, growth factors, and scaffolds aim to restore functional pulp tissue rather than replace it with inert filling materials. Although still under investigation, these methods hold promise for preserving tooth vitality and biomechanics, reducing the need for conventional root canal therapy in selected cases.



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In summary, modern approaches to diagnosing and managing pulpitis integrate traditional clinical methods with innovative technologies. The primary goal remains the preservation of pulp vitality whenever feasible, supported by accurate diagnosis, biocompatible materials, and minimally invasive techniques. Continued research into biologically driven therapies and digital diagnostic tools is expected to further improve outcomes and shift clinical paradigms in endodontics.

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