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Management of hot tooth: Clinical challenges and emerging strategies: A narrative review

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Abstract:
Symptomatic irreversible pulpitis (hot tooth) is a common endodontic problem characterized by severe spontaneous pain and difficulty in achieving profound local anesthesia. Accurate diagnosis and effective pain control remain major clinical challenges because intense pulpal inflammation lowers the pain threshold and increases nociceptive activity. These inflammatory changes reduce the success of conventional anesthetic techniques and may compromise endodontic treatment outcomes. Adjunctive approaches including supplemental anesthetic techniques, preoperative inflammation control and anxiety management can enhance anesthetic efficacy and patient comfort. Thus, data shows that integrating the mechanisms underlying anesthetic failure in hot teeth with evidence-based strategies for improving pain management and treatment success.

Keywords: Hot tooth, irreversible pulpitis, anesthesia, inferior alveolar nerve block failure, pulp inflammation, intrapulpal anesthesia

Background:
In endodontics, the term 'hot tooth' is commonly used to describe a tooth exhibiting symptoms of symptomatic irreversible pulpitis, as defined by the American Association of Endodontists (AAE) **[1].** While the term lacks a precise diagnostic classification, it refers to a tooth experiencing significant pulpal inflammation, resulting in intense pain responses and increased sensory responsiveness. The AAE categorizes such cases as symptomatic irreversible pulpitis, often linked to either normal apical tissues or symptomatic apical periodontitis, depending on the extent of periapical involvement **[2, 3]**. This condition presents unique challenges in diagnosis, anesthesia and management due to the intense and persistent symptoms that patient's experience. Symptomatic irreversible pulpitis is characterized by sudden, sharp pain, heightened temperature sensitivity and an exaggerated response to pulp sensibility tests. The most common causes of this condition include deep carious lesions, microleakage beneath restorations, cracked teeth, or traumatic damage, which allow bacterial byproducts to enter the dentinal tubules and trigger pulpal inflammation **[4]**. Over time, this inflammation escalates, leading to intense nociceptive signals and chronic pain, commonly referred to as hot tooth. Clinically, spontaneous pain is a hallmark of symptomatic irreversible pulpitis, often described as throbbing or pulsatile, with sudden onset and worsening symptoms at night. The pain may be exacerbated by changes in posture, such as lying down, due to increased pulpal blood pressure. Furthermore, pain localization can be difficult and patients may report discomfort that radiates to neighboring teeth or facial tissues, making the diagnosis challenging and necessitating thorough clinical evaluation **[5]**. Thermal testing plays a crucial role in diagnosing symptomatic irreversible pulpitis, with cold testing often inducing an intense, prolonged pain response that persists after the stimulus is removed. In more severe cases, heat application may trigger significant pain, with patients occasionally finding relief from cold stimuli. This paradoxical response is linked to altered pulpal blood flow and pressure dynamics within the inflamed pulp **[6]**. Electric pulp testing is another diagnostic tool, although it must be interpreted with caution, as the increased neural excitability in hot teeth can lead to exaggerated responses. These sensibility tests assess neural activity rather than the true histological status of the pulp and should be correlated with clinical symptoms to avoid misdiagnosis **[7].** A critical clinical challenge associated with hot teeth is the difficulty in obtaining effective local anesthesia, particularly in mandibular posterior teeth, which is commonly seen in cases of severe pulpal inflammation and serves as an indicator of disease severity **[8]**. Radiographic findings in teeth with symptomatic irreversible pulpitis are often inconclusive, as the absence of periapical radiolucency does not rule out pulpal pathology. Pulpal inflammation typically precedes visible changes in the apical tissues, making clinical evaluation more reliable than radiographic evidence alone **[9]**. Therefore, the AAE emphasizes the importance of clinical observations in diagnosing hot teeth. The etiology of symptomatic irreversible pulpitis is most commonly attributed to bacterial invasion from dental caries, although thermal injury, chemical insults and trauma can also contribute. In terms of pathophysiology, bacterial metabolic products penetrate the enamel and dentin, triggering local immune responses **[10]**. This inflammatory process, marked by the release of proinflammatory cytokines, leads to tissue damage and, if left unchecked, pulp necrosis. The pathological changes in the pulp involve inflammatory, vascular and neurogenic events that collectively contribute to the severe

pain and clinical presentation of hot teeth **[11].** Therefore, it is of interest to describe the diagnostic challenges, anesthetic considerations and contemporary management strategies for hot teeth to improve pain control and treatment outcomes in endodontic practice.

Diagnostic challenges in the hot tooth:
The management of the hot tooth, most commonly associated with symptomatic irreversible pulpitis, represents one of the most diagnostically demanding scenarios in endodontic practice. This condition poses significant challenges that require the integration of pulpal biology, pain physiology and diagnostic methodology based on anesthetic strategies **[12]**. Irreversible pulpitis is characterized by spontaneous pain, lingering thermal sensitivity and heightened pulpal inflammation. A principal challenge lies in distinguishing irreversible pulpitis from other odontogenic and non-odontogenic sources of pain **[13]**.

Limitations of conventional diagnostic methods:
Symptomatic apical periodontitis, cracked tooth syndrome, occlusal trauma, referred orofacial pain and neuropathic pain disorders may present with overlapping clinical features, complicating diagnostic interpretation. Conventional diagnostic tests, including thermal testing, electric pulp testing (EPT), percussion, palpation and radiographic assessment, are essential in the evaluation of symptomatic irreversible pulpitis. However, radiographic findings are often inconclusive in early pulpal inflammation because periapical osseous changes may not yet be visible **[14]**.

Patient-related factors affecting diagnosis:
Similarly, responses to cold testing may not always distinguish irreversible pulpitis from reversible pulpitis, as both conditions can show hypersensitivity. Therefore, diagnostic accuracy depends on synthesizing multiple clinical findings rather than relying on any single test. Additional complexity arises from patient-related factors, including anxiety and heightened pain perception, which can amplify symptom reporting and complicate diagnostic testing. Patients often have difficulty localizing their pain, particularly in the posterior quadrants, leading to misidentification of the offending tooth. Extensive restorations and calcifications can further obscure radiographic interpretations **[15]**.

Differential diagnosis of the hot tooth:
Effective management of the hot tooth demands diagnostic precision and critical reasoning. It requires the clinician to correlate clinical findings with pulpal pathophysiology and apply evidence-based anesthetic protocols. Accurate differential diagnosis is crucial to avoid unnecessary endodontic treatment and ensure predictable pain resolution. Several odontogenic and non-odontogenic conditions may present with similar clinical signs, including symptomatic irreversible pulpitis, symptomatic apical periodontitis, reversible pulpitis, cracked tooth syndrome, acute apical abscess, occlusal trauma and non-odontogenic pain. Differential diagnosis necessitates a systematic evaluation, including detailed pain history, thermal and electric testing, percussion, palpation testing, bite tests for fracture detection, periodontal evaluation and radiographic assessment **[16]**. Misdiagnosis can lead to unnecessary treatments and persistent pain even after endodontic procedures. Ultimately, successful management of the hot tooth relies on the clinician's ability to navigate uncertainty with systematic evaluation and informed judgment **[17]**.

Challenges in achieving local anesthesia:
The primary challenge in the management of a hot tooth is achieving successful local anesthesia. Research has shown that the success rate of infiltrative anesthesia is significantly reduced in patients with irreversible pulpitis, regardless of the anesthetic technique used. The 2% Lidocaine with epinephrine, considered the gold standard, has significant limitations in pulpal anesthesia **[18]**. Traditional anesthetic techniques are designed to work under normal pH conditions, but in symptomatic irreversible pulpitis, the pH of the pulpal tissue is lowered, which diminishes the effectiveness of local anesthetics **[19]**. Moreover, sodium channels in C fibers, such as Tetrodotoxin, become resistant to the effects of local anesthetics in inflamed pulp **[20]**. Additional factors, such as thick cortical bone in the mandible, cross-innervation and altered foramina position, contribute to the difficulty in achieving successful anesthesia in mandibular teeth **[21]**.

Pharmacological premedication:
Once the pulp is inflamed, inflammatory mediators lower the threshold for pain in nerve endings, making local anesthesia ineffective. To overcome this challenge, several strategies have been proposed to enhance the effectiveness of local anesthetics. Premedication with nonsteroidal anti-inflammatory drugs (NSAIDs), such as Lornoxicam, Diclofenac and Ketorolac, has been found to improve the success rate of inferior alveolar nerve blocks (IANB) in patients with irreversible pulpitis **[22].** A study by Neelakantan *et al.* and Shantiaee *et al.* showed that pre-operative medication with 7.5 mg of meloxicam improved IANB success by 73.9% **[23, 24]**. Similarly, pre-anesthetic medication with steroids such as Dexamethasone (4mg) or in combination with Ibuprofen has been shown to improve the efficacy of IANB in irreversible pulpitis cases **[25]**. Additionally, modifying the anesthetic solution with agents like dexamethasone has been shown to improve the pH and efficacy of the local anesthetic action **[26]**.

Pre-operative pain modulation:
Pre-operative pain modulation is crucial in the management of hot teeth, as inflammation-induced sensitization significantly reduces the success of local anesthetic techniques. The administration of NSAIDs before treatment helps reduce peripheral nociceptor excitability and enhances the depth of pulpal anesthesia in teeth with symptomatic irreversible pulpitis **[26].** Corticosteroid premedication may further enhance anesthetic success by suppressing inflammatory mediators involved in pulpal hyperalgesia and neural sensitization **[27].**

Inferior alveolar nerve block (IANB) and infiltration anesthesia are the primary techniques used in routine endodontic practice. However, in cases of symptomatic irreversible pulpitis, particularly in mandibular posterior teeth, these techniques often fail due to tissue inflammation, altered pH and increased neural excitability **[28].** Pulpal anesthesia should be confirmed using objective tests such as cold or electric pulp testing rather than relying solely on subjective signs like lip numbness **[29].** When conventional anesthesia fails, supplemental techniques such as intraligamentary injections, intraosseous anesthesia and supplemental buccal infiltration using articaine can improve anesthetic success. These techniques are particularly useful in mandibular molars, as articaine has superior diffusion through dense cortical bone **[30, 31].**

Emergency management and clinical considerations:

In cases of severe pain or limited tolerance for prolonged procedures, emergency interventions such as pulpotomy or partial pulpectomy may be necessary to provide immediate symptom relief. Definitive root canal therapy can be performed in subsequent appointments once anesthesia is adequately achieved **[32].** An anesthetic strategy for hot tooth management has been denoted in **Table 1** and differential diagnosis of hot tooth is shown in **Table 2.**

Table 1: Anesthetic strategies for hot tooth management

Strategy	Description	Outcome/Effectiveness
NSAID Premedication	Lornoxicam, Diclofenac, Ketorolac before anesthesia	Improves anesthesia success in irreversible pulpitis **[23]**
Steroid Premedication	Dexamethasone (4mg) or combination with Ibuprofen	Enhances anesthetic efficacy **[25]**
Modified Anesthetic Solution	Addition of Dexamethasone or buffering with sodium bicarbonate	Increased pH and improved anesthetic action **[27]**
Alternative Anesthetic Techniques	Articaine buccal infiltration, Intraosseous anesthesia	Improved success rates when IANB fails **[29, 30]**

Table 2: Differential diagnosis of hot tooth

Condition	Key Features	Diagnostic Approach
Symptomatic Irreversible Pulpitis	Spontaneous, intense pain, heightened thermal sensitivity	Thermal testing, EPT, pain history **[13, 14]**
Symptomatic Apical Periodontitis	Pain on percussion, localized tenderness	Percussion, palpation, radiographs **[15]**
Cracked Tooth Syndrome	Pain on biting, sharp pain during mastication	Bite tests, radiographs for fractures **[15]**
Non-odontogenic Pain	Pain not originating from the tooth	Detailed pain history, exclusion of odontogenic causes

Clinical significance of pain control:

For patients experiencing pain in the dental chair due to a hot tooth, the discomfort can often feel unbearable. However, there is real hope for relief. Research consistently shows that once the source of the pain is addressed through root canal treatment, most patients recover well and their outcomes are no different from those with less painful dental issues **[33]**. The main complication in these cases, however, is not the tooth itself but rather the challenge of achieving adequate anesthesia to perform the treatment. When anesthesia fails, the treatment gets delayed or may even be incomplete, leading to poor outcomes. Simply put, pain control is not just about ensuring patient comfort; it is the foundation of achieving successful results in endodontic procedures **[34].**

Role of supplemental anesthetic techniques:

Every clinician who has worked on a hot tooth case understands the frustration that arises when a nerve block fails to provide adequate anesthesia. Techniques like intraosseous and intraligamentary injections have revolutionized the way clinicians approach these cases by administering the anesthetic closer to the problem area, rather than relying solely on blocking the nerve at a distance **[35]**. The inflamed tissue environment surrounding a hot tooth creates barriers to conventional anesthesia and these supplemental methods allow clinicians to bypass these challenges. Introducing these techniques early, rather than waiting for a block to fail, has shown significantly better outcomes in clinical practice **[36]**. Not all local anesthetics behave the same way in an inflamed environment and articaine has emerged as a preferred option for treating hot tooth cases. Its chemical structure allows it to diffuse through bone tissue more effectively than lidocaine, making it particularly useful when dealing with the dense bone of the lower jaw. Whether used alone as a buccal infiltration or in combination with a nerve block, articaine has proven to be a more reliable choice when pulpitis makes routine anesthesia techniques unreliable **[37]**.

Benefits of articaine:

Researchers are also exploring newer strategies to tackle the problem of anesthesia failure at its root, including agents that specifically target pain-conducting channels that remain open during inflammation. Some studies have examined cryotherapy as a means to calm the hypersensitive tissue, potentially improving anesthesia success and reducing post-operative discomfort **[38]**.

Future perspectives:

Furthermore, the field is looking ahead to the possibility of preserving pulpal vitality in the early stages of pulpitis through regenerative approaches, potentially preventing the development of a hot tooth scenario altogether. Additionally, artificial intelligence (AI) is beginning to play a role in endodontics, with tools being developed that can help identify inflamed pulps earlier and predict which cases are likely to be the most challenging to anesthetize. These innovations offer promising avenues for improving both diagnostic and therapeutic outcomes in the management of symptomatic irreversible pulpitis **[39, 40]**. As we continue to enhance our understanding of pain mechanisms and refine anesthetic techniques, the goal is clear: to ensure that patients with hot teeth can receive the necessary treatment promptly, safely and with minimal discomfort. The incorporation of newer anesthesia methods, alongside emerging strategies, represents a significant step forward in achieving this goal.

Conclusion:
Management of hot tooth cases requires effective communication, reassurance and a planned clinical approach employing alternative techniques in addition to conventional methods in anesthesia and treatment. Practitioners can effectively handle even the most difficult cases of hot tooth and guarantee a favorable treatment outcome by combining the emerging strategies with good clinical judgment.

References:
[1] Glickman GN *et al. J Endod.* 2009 **35**:1619. [PMID: 19932336]
[2] Nusstein JM *et al. Dent Clin North Am.* 2010 **54**:237. [PMID: 20433976]
[3] Erdogan O *et al. J Endod.* 2021 **47**:1376. [PMID: 34256059]
[4] Shoba J *et al. J Oper Dent Endod.* 2024 **8**:17. [DOI: 10.5005/jp-journals-10047-0128]
[5] Donnermeyer D *et al. Int Endod J.* 2023 **56**:296. [PMID: 35536159]
[6] Ramachandran A *et al. J Pharm Bioallied Sci.* 2023 **15**:S383. [PMID: 37654287]
[7] Patro S *et al. Int J Environ Res Public Health.* 2022 **19**:9599. [PMID: 35954958]
[8] Pohl S *et al. Front Immunol.* 2024 **15**:1474466. [PMID: 39534600]
[9] Ricucci D *et al. J Endod.* 2021 **47**:740. [PMID: 33610600]
[10] Jain N *et al. Korean J Pain.* 2013 **26**:347. [PMID: 24156000]
[11] Sherwood ER & Toliver-Kinsky T. *Best Pract Res Clin Anaesthesiol.* 2004 **18**:385. [PMID: 15212335]
[12] Aggarwal V *et al. Journal of Oral and Maxillofacial Anesthesia*. 2026 **5**:12. [DOI: 10.21037/joma-2025-1-38]
[13] Edwards D *et al. Br Dent J.* 2025 **238**:517. [PMID: 40217034]
[14] Essam O *et al. Br Dent J.* 2025 **238**:441. [DOI: 10.1038/s41415-025-8452-6]
[15] Meechan JG. *Dent Update.* 2005 **32**:66. [PMID: 15819149]
[16] Eminsoy Avcı AT *et al. BMC Oral Health*. 2026 **26**:493. [PMID: 41673605]
[17] Bigby J *et al. J Endod.* 2006 **32**:1044. [PMID: 17055903]
[18] Gandhi SA *et al. J Pharm Bioallied Sci*. 2021 **13**:S731. [PMID: 34447191]
[19] Parirokh M & Abbott PV. *Int Endod J.* 2022 **55**:951. [PMID: 35119117]
[20] Sahu S *et al. Int J Sci Res.* 2019 **8**:106. [DOI: 10.21275/ART20195849]
[21] Boopathi T *et al. J Pharm Bioallied Sci.* 2013 **5**:S103. [PMID: 23946560]
[22] Modaresi J *et al. J Endod*. 2008 **34**:438. [PMID: 18358891]
[23] Neelakantan P *et al. Int Endod J.* 2011 **44**:330. [PMID: 21692235]
[24] Shantiaee Y *et al. Int Dent J.* 2017 **67**:85. [PMID: 27933616]
[25] Kumar M *et al. J Endod.* 2021 **47**:705. [PMID: 33548329]
[26] Jalalzadeh SM *et al. J Endod.* 2010 **36**:978. [PMID: 20478449]
[27] Bhargava D *et al. Oral Maxillofac Surg.* 2013 **17**:275. [PMID: 23143710]
[28] Saatchi M *et al. J Endod.* 2015 **41**:33. [PMID: 25442722]
[29] Kanaa MD *et al. J Endod*. 2006 **32**:296. [PMID: 16554198]
[30] Asgary S *et al. Clin Oral Investig*. 2014 **18**:635. [PMID: 23712823]
[31] Manfredi M *et al. Cochrane Database Syst Rev*. 2022 **12**:CD005296. [PMID: 27905673]
[32] Vera J *et al. J Endod.* 2012 **38**:1340. [PMID: 22980174]
[33] Pak JG & White SN. *J Endod.* 2011 **37**:429. [PMID: 21419285]
[34] Matthews R *et al. J Endod.* 2009 **35**:343. [PMID: 19249592]
[35] Tortamano IP *et al. J Endod*. 2009 **35**:165. [PMID: 19166765]
[36] Ingale PC *et al. J Pharm Bioallied Sci*. 2024 **16**:S35. [PMID: 38595533]
[37] Ashok HK *et al. Endodontology*. 2026 **38**:139 [DOI: 10.4103/endo.endo_213_25]
[38] Nagendrababu V *et al. J Endod.* 2021 **47**:1352. [PMID: 34119562]
[39] Fiegler-Rudol J *et al. Dent J (Basel).* 2025 **13**:25. [PMID: 39851601]
[40] Bhargav P *et al. Yemeni J Med Sci*. 2025 **19**:25. [DOI: 10.20428/yjms.v19i6.2979]