

The Hot Tooth

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Abstract

Review Article

Management of hot tooth in endodontic is a challenge to the clinician. Achieving profound pulpal anesthesia is a corner stone in endodontic practice and dentistry. Profound pulpal anesthesia during the root canal procedure benefits not only the patient, for obvious reasons, but also the dentist who will be less stressed worrying about patient reactions or sudden movement during therapy. This article describes some of the strategies that can be used when treating patients with teeth having moderate-to-severe pain.

Keywords: Hot tooth, Supplemental injection techniques, Anesthetic solution, Tetrodoxin-resistant channels, Ion trapping.

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INTRODUCTION

Effective local anesthesia is the bedrock of pain control in endodontics and restorative dentistry. Regardless of the clinician's skills, both treatment and patient management are difficult or impossible to deliver without effective pain control. However, effective pain management also represents a unique opportunity to integrate pharmacological, procedural, and behavioral skills in providing outstanding pain control to grateful patients. The term "hot" tooth generally describes to a condition in which a pulp that has been diagnosed with irreversible pulpitis, with spontaneous, moderate-to-severe pain [1]

Hot tooth

The term "hot" tooth generally describes to a condition in which a pulp that has been diagnosed with irreversible pulpitis, with spontaneous, moderate-to-severe pain [1]. An example of this kind of condition is a patient who is sitting in the waiting room, sipping on a large glass of ice water to control the pain. This condition is most commonly seen in mandibular molars. Radiographically, there will be thickening of the periodontal ligament and loss of lamina dura in this condition [2]. Allodynia is a condition in which pain occurs due to a stimulus. Temperature or physical stimuli can provoke allodynia [3], hyper algesia is an increased sensitivity to pain which can be caused due to

damage of nociceptors or peripheral nerves [4]. Clinician should be able to determine the condition which causing pain for the patient. Irreversible pulpitis is the inflammatory condition of the pulp usually caused by any noxious stimuli.

Achieving anesthesia for that tooth is always necessary to commence the endodontic treatment. One must know the proper anatomy and the procedure thoroughly for achieving a proper anesthesia. Sometimes after giving a proper anesthesia also, patient shall respond negatively to the treatment because of pain.

In Endodontics, this condition is often referred as "Hot Tooth". Treating such condition shall always become a trouble to the clinician. This article describes some treatment strategies that the clinician can use when treating patients with "hot" tooth.

SEVERAL HYPOTHESES BEHIND HOT TOOTH

Ion trapping

Low pH is responsible for ion trapping of local anesthetic. According to this hypothesis, low tissue pH shall be responsible for a greater proportion of the local anesthetic being trapped in the charged acid form of the molecule and thus unable to cross cell membrane [5].

However ion trapping is for infiltration injections only, block injections are likely to involve acidotic tissues [6].

Altered Membrane excitability of peripheral nociceptors

Nerves from inflamed tissue shows decreased excitability threshold and altered resting potential. Studies shows that lower excitability thresholds are responsible for transmission of impulses even with action of local anesthetic [6, 7].

Tetrodoxin resistant channels

TTX-resistant channels: Scientists have shown that there is a special class of Sodium channels on C fibers, known as Tetrodoxin-resistant (TTXr). In case of inflammation, neuroinflammatory reactions start and Sodium channel expression on C fibers shifts from TTX sensitive to TTX resistant creating inflammatory hyperalgesia. One of the clinically significant characteristics of these Na⁺ channels is relatively resistant to lignocaine. Researchers found these channels to be five times more resistant to anesthetic than TTX-sensitive channels. After a nerve block, a patient may describe profound anesthesia of soft tissue where no inflammation is witnessed. However, getting into the vital pulp chamber may initiate pain [8].

The Central Core theory

It states that nerves on the outside of the nerve bundle supply molar teeth whereas nerves on the inside supply anterior teeth [9]. The anesthetic solution may not diffuse into the nerve trunk to reach all nerves to produce an adequate block, even if deposited at the correct site. This theory may explain the higher experimental failure rates in anterior teeth with the inferior alveolar nerve block [10-12].

Central sensitization

Central sensitization may contribute to local anesthetic failures. Increased Sensitization may amplify incoming signals from sensory nerves. In central sensitization, there is an increased response to peripheral stimuli and because of this, the IANB may permit for sufficient enough signaling to occur thereby leading to the perception of pain [6].

Psychological factors

Patient anxiety is one of the factors for local anesthetic failure. It is understood that apprehensive patients have a reduced pain threshold and more likely to complain pain during the time of endodontic treatment [13].

Time

In some cases it can be a time factor, as some patients take more time than others for anesthetic to diffuse and block the sensory nerves.

Hyperalgesia

This theory states that the inflammation within the tooth has altered the actual nerve making it more difficult to numb. The nerve arising in an inflamed tissue have altered resting potentials and decreased excitability thresholds. These changes are not restricted to the inflamed pulp itself but affect the entire neuronal membrane extending upto central nervous system. Local anesthetics are not sufficient to prevent impulse transmission, owing to the lowered excitability thresholds [7].

Management of Hot Tooth

1) Patient's education:

Patient should be groomed and acknowledged about the treatment so that he is mentally aware of procedures and the fear of unknown is eliminated thus reducing anxiety.

2) Management of anxious patient

- a) Give short morning appointments followed by good morning breakfast.
- b) Premedication with lorazepam 1 mg (after checking interaction with other drugs) at night before sleep followed by 90 minutes prior to procedure.
- c) Need to be accompanied with friend/relative/escort.
- d) Extremely short or no waiting time in waiting area.
- e) Duration, only as much as patient can tolerate making sure patient feels he/she is in command.
- f) Iatrosedation: Vocal sedation- Use of sentences like "I will be careful", Talk to them as you go through procedure, Avoid use of words like hurt,sharp etc, Music, Aroma, Hypnosis, Acupuncture, Relaxation techniques(deep breathing, guided imagery,progressive relaxation) will be helpful.

3) Even after giving a proper anesthesia, if the patient responds pain two treatment strategies

Could be considered:

- Supplemental Injections
- Change in the Anesthetic solution

Supplemental Injections

Intraligamentary(periodontal ligament) Injection

Periodontal ligament (PDL) injection is still one of the supplemental injections for reducing pain in endodontics. It has been reported that supplemental PDL injection shows 50-96% of cases with successful anesthesia for endodontic procedures [14-16]. But, most of the times, a re-injection is advisable for good result 16.

Duration of Periodontal ligament Injection

- Duration of anesthesia to be around 10-20 min

Intraosseous Injection

Due to the thickness of the cortical plate in posterior mandible, infiltration injection with lidocaine solutions are not effective for posterior mandible. In

such situations intraosseous injection is an alternative. The use of intra- osseous anesthesia was described by Lilienthal [17].

Devices for intra Osseous Anesthesia

Some of the commonly used systems available in the market include:

- Stabident
- X-tip
- Intra Flow
- Comfort Control Syringe

Stabident

The Stabident system (Fairfax Dental Inc, Wimbledon, UK) consists of a 27-gauge bevelled wire which is used by a slow-speed handpiece, which perforates the cortical bone. After perforation, anesthetic solution is delivered into the cancellous bone with a 27- gauge ultrashort needle using a standard anesthetic syringe [14].

X- tip

X- tip system (Dentsply, York, PA, USA) consists of three parts: The driller, a 25-gauge sleeve that fits over the 27- gauge drill, and an ultra- short needle. The needle leads the guide sleeve into the cancellous bone. Using the guide sleeve, the needle 190 is directed into the cancellous bone to deposit the anesthetic solution [6].

Intra flow

The Intra Flow (Pro-DexInc, Santa Ana, CA, USA) anesthesia delivery system is designed as an all – in –one system that allows the clinician to perforate the bone and deposit anesthetic solution in a single step. The intra Flow device consists of a 24 gauge hollow perforator which is used to perforate the bone and infuse the local anesthetic solution [6, 18].

Comfort control syringe

The Comfort Control Syringe (Dentsply, York, PA, USA) is an electronic system for delivering local anesthesia. It consists of 5 different injection rates that are preprogrammed into the system [19].

Disadvantages

- Transient increase in heart rate with Stabident and X-Tip systems when injecting with epinephrine- and levonordefrin-containing anesthetic solutions [21,22].
- Dentinal tooth damage [22].
- Osteonecrosis of bone [22].

Intraseptal anesthesia

Intraseptal anesthesia can be considered as a supplemental anesthesia technique for reducing pain in endodontic treatment.

Area of insertion of the injection will be center of the interdental papilla adjacent to the tooth to be

treated. Slowly inject few drops of anesthetic solution as the needle enters soft tissue and advance the needle till it reaches the bone. Apply pressure to the syringe and push the needle into the interdental septum and deposit 0.2-0.4 ml of local anesthetic solution.

Factors indicating success of intrseptal injection

- Resistance to the deposition of solution
- Ischema of soft tissue adjacent to the injection area [23].

Intrapulpal Anesthesia

This method relies on the principle of back pressure. Once the tooth is opened till pulp chamber, solution is injected into the pulp under pressure. The amount of solution injected is around 0.2 ml.

Disadvantage

- Short duration of action
- Painful injection.

Mandibular Buccal infiltration with articaine

It could be considered as a supplemental injection technique. Studies shows that buccal infiltration of 4% articaine shows higher anesthetic efficiency as compared to 2% lidocaine solution [24-26].

Change in anesthetic solution 4% Articaine

Anesthetic efficiency of 4% articaine with 1:100,000 epinephrine shows higher anesthetic efficiency than using 2% lidocaine with 1:100,000 epinephrine when used as buccal infiltration [27, 28]. Mechanism of action is that articaine contains a thiophene group, which increases its lipid solubility. Lipid solubility determines the extent of molecules penetration into the nerve membranes. Therefore, articaine diffuses better through soft tissues than do other anesthetics, thereby causing better anesthesia [29, 30].

M Mannitol

Combination of 0.5 M mannitol and lidocaine with epinephrine in Inferior Alveolar Nerve Blocks shows higher anesthetic efficiency compared to lidocaine and epinephrine alone [31,32]

CONCLUSION

Management of hot tooth in endodontics is always a challenge to the clinician. One should have thorough knowledge about the supplemental anesthesia techniques and the way of using it. Still studies are going on regarding this area. Due to the advancements of supplemental injection techniques and different anesthetic solutions, managing a hot tooth condition is now no longer a threat to the dentist.

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