

# ENDODONTICS



*Colleagues for  
Excellence*

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*A "3D" Approach for Treating  
Acute Pain*



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To many patients, pain and dentistry are synonymous. Patient surveys continue to indicate that fear of pain prevents many patients from scheduling dental appointments. This can often lead to the progression of infection or dental disease. Equally important, clinical practice can be disrupted by unscheduled emergencies and possible difficulty in obtaining adequate pain control. Challenges in this area can be a source of frustration to the busy practitioner, and perhaps even more so for the anxious patient. This does not have to be the case. Research conducted by endodontists and other clinicians interested in pain management have revolutionized our ability to treat acute inflammatory pain. This issue of *Colleagues for Excellence* is based upon those studies and describes a simple and effective strategy for managing acute dental pain.

An effective strategy for pain management is the “3D” approach, in which clinicians first **D**isgnose the pain condition, then deliver appropriate **D**ental treatment and finally administer effective **D**rugs. This systematic approach provides a framework, or playbook, that organizes your approach for managing dental pain emergencies — increasing both effectiveness and clinical efficiency.

### The 3D Playbook for Pain Treatment: **Diagnosis, Dental Treatment, Drugs**

**Diagnosis** is the first “D.” Effective pain control begins with an accurate diagnosis. Given the problem of referred pain, it is possible that a patient’s complaint of intraoral pain may actually be due to a non-dental cause. Therefore, it is important to first determine whether the pain originates from a tooth or whether it is referred from another tissue. The Fall 2013 issue of *Colleagues for Excellence* reviewed the latest information on endodontic diagnoses and is available at [www.aae.org/colleagues](http://www.aae.org/colleagues). From the perspective of a dental pain emergency, practitioners need to establish a differential diagnosis of dental pain versus non-dental pain. The common categories of non-dental pain and specific examples are provided in Table 1. For purposes of this review, we will focus on making the distinction between dental pain and pain referred from other tissues; the interested reader can obtain an extensive overview of these non-dental pain conditions from other sources (1, 2).

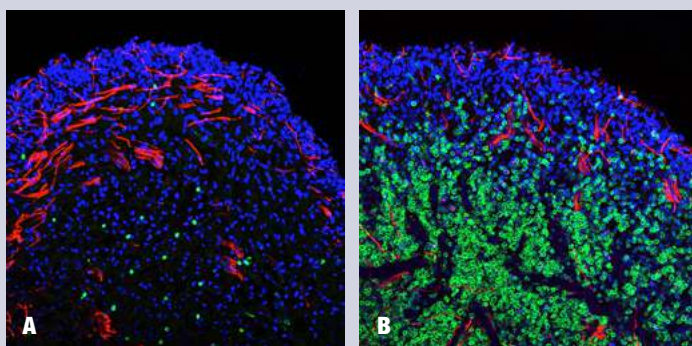
**Table 1. Differential Diagnosis of Dental Pain**

<b>Odontalgia</b> – e.g., reversible pulpitis, symptomatic irreversible pulpitis, symptomatic apical
<b>Musculoskeletal</b> – e.g., TMD
<b>Neuropathic</b> – e.g., trigeminal neuralgia, herpes infection
<b>Neurovascular</b> – e.g., migraine, cluster headache
<b>Inflammatory Conditions</b> – e.g., sinusitis
<b>Systemic Disorders</b> – e.g., cardiac pain
<b>Psychogenic</b> – e.g., persistent somatoform pain disorder

as Endo-Ice®. It is essential to reproduce the chief complaint on the suspected tooth since it provides strong evidence that the pain is neither non-dental nor originating from another tooth. Second, application of local anesthesia should eliminate, or at least reduce, the pain symptoms. If pain is unaltered by a local anesthetic injection and anesthesia is verified by pulp testing adjacent teeth, then a non-dental origin of pain should be considered. For example, patients with temporomandibular joint disorders may continue to report pain upon chewing even after an intraoral injection of a local anesthetic. Third, there is usually an apparent etiology for pulpal involvement: caries, failed restorations, recent history of trauma or recent dental treatment (e.g., crown preparation) all may lead to inflammatory pain by activation of pulpal or periradicular nociceptors (Figure 1).

According to a February 2015 AAE online survey, root canal treatment is the dental procedure that makes Americans most apprehensive. Fifty-six percent said root canal treatment would cause anxiety, followed by tooth extraction (47%) and placement of a dental implant (42%). Women are more likely than men to say dental procedures make them anxious, including root canal treatment (62% vs. 48%), tooth extraction (54% vs. 39%) and dental implant placement (49% vs. 35%). However, a 2008 AAE consumer awareness survey found that patients who have experienced root canal treatment are six times more likely to describe it as “painless” than patients who have not had root canal treatment.

There are several key findings that are helpful in determining whether the pain originates from a tooth. First, and perhaps most important, the clinician should be able to reproduce the patient’s chief complaint when testing the suspected tooth. For example, if the chief complaint is pain upon chewing, then percussing the tooth with a mirror handle or using a device such as a ToothSlooth® should be able to reproduce the pain symptoms, while testing control teeth should have no effect. Similarly, if the chief complaint is pain due to drinking something cold, then applying targeted cold stimuli to the suspected tooth should reproduce the pain. This latter example may require rubber dam isolation of individual teeth to allow the cold water to bathe the entire crown surface, or the use of a spray refrigerant such



**Fig. 1.** Confocal microscopic images of normal dental pulp (A) and dental pulp from a patient with a diagnosis of symptomatic irreversible pulpitis (B). Red depicts nerve endings (staining for NFH), green depicts leukocytes (CD45) and blue indicates cell nuclei (DAPI). Courtesy of Dr. Michael Henry, UT Health Science Center, San Antonio.

If a diagnosis cannot be made, then referral to a specialist with additional equipment (e.g., microscope, cone beam-computed tomography) and training may be warranted. By virtue of their clinical training, endodontists have extensive experience in diagnosing odontogenic pain. Only when a clear diagnosis is made should the clinician move to the second “D.”

**Dental Treatment** is the second “D.” Appropriate treatment reduces the inflammatory process that underlies most acute dental pain emergencies. This may include nonsurgical root canal treatment. A recent paper on nearly 5,000 patients (3) revealed about a 90% reduction in pain within one week of root canal treatment (Figure 2). Other studies have demonstrated that reducing the occlusion (4), performing a pulpotomy on vital cases (5) or an incision for drainage procedure all lead to reduced pain. Dental treatments effectively relieve pain by virtue of their ability to reduce inflammation, leading to lowered tissue levels of inflammatory mediators. Many of these mediators such as prostaglandins, bradykinin

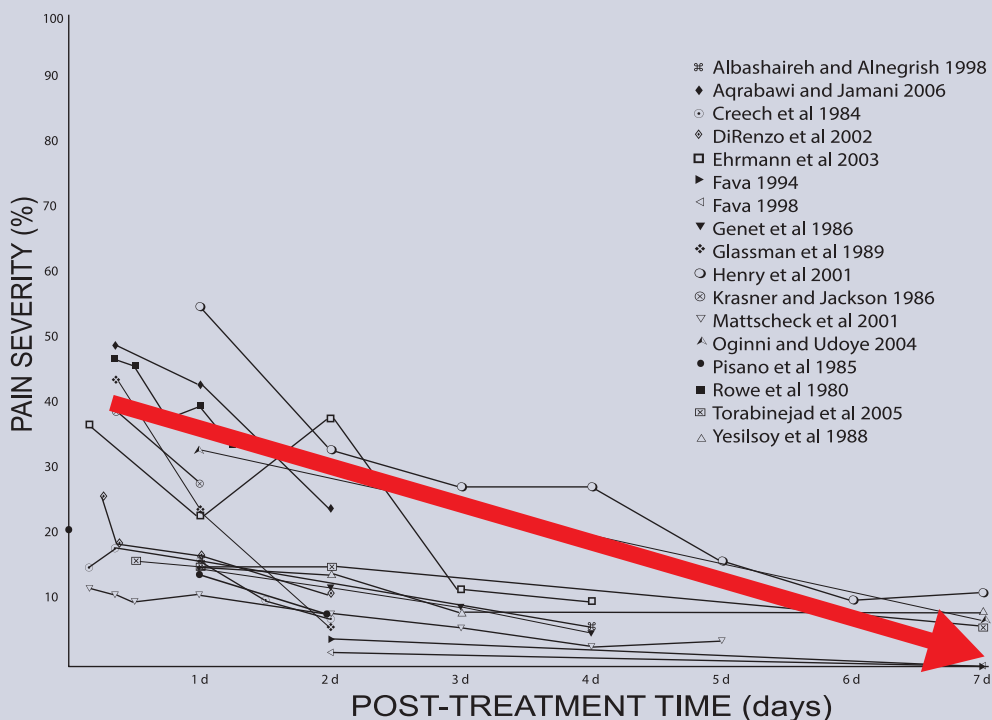


Fig. 2. Post-treatment pain severity over the seven days after treatment. Courtesy of Drs. Shane White and Jaclyn Pak.

and cytokines potently activate and sensitize nociceptive neurons leading to spontaneous pain and reduced pain thresholds (allodynia). Indeed, patient complaints such as pain upon chewing or throbbing pain are likely due to allodynia, where normal gentle stimuli such as mastication or even the heartbeat can lead to pain complaints. Thus, the second “D,” namely effective dental treatment, is a highly effective strategy for managing pain emergencies.

**Drugs** are the third “D” in our emergency pain playbook. Drugs are the third step since, *first*, a proper diagnosis is required in order to select the optimal drugs. For example, sinusitis, trigeminal neuralgia, herpes and headaches all require very different pharmacotherapy (or appropriate medical referral) than irreversible pulpitis. And *second*, appropriate dental treatment is effective in reducing tissue inflammation, providing an independent method for reducing the acute pain condition.

Local anesthetics are an important drug class in treating emergency pain patients. One commonly observed problem, however, is that local anesthetics are often only partially effective in treating dental pain originating from mandibular posterior teeth. Indeed, some studies report an eight-fold increase in local anesthesia failure after inferior alveolar nerve block injection in pain patients versus normal controls (6). The following provides a summary of practical tips for gaining effective anesthesia in patients with a painful mandibular posterior tooth, and a detailed review is available in the Winter 2009 *Colleagues for Excellence* at [www.aae.org/colleagues](http://www.aae.org/colleagues):

- A positive “lip sign” does not guarantee pulpal anesthesia. A more reliable indicator is to retest the tooth with cold (Endo-Ice®)
- Intraosseous administration of a local anesthetic significantly enhances the efficacy of an IAN nerve block injection (Figure 3)
- Although the intraosseous use of a local anesthetic containing a vasoconstrictor (e.g., 2% lidocaine with 1:100,000 epinephrine) increases the efficacy and duration of anesthesia, an acute tachycardia may occur, which precludes its use in some patients



Fig. 3. After confirming by radiograph that there is adequate interproximal bone between the teeth, the perforator and guide sleeve are attached to the slow-speed handpiece and a perforation is made approximately 2 mm coronal to the mucogingival line, distal to the tooth to be anesthetized. The handpiece and perforator are removed, leaving the guide sleeve in the attached gingiva. The 27-gauge ultra-short needle is introduced through the guide sleeve and approximately one-third of the carpule of local anesthetic is injected. Courtesy of Dentsply Tulsa Dental Specialties.

- Administration of a 4% articaine solution into the buccal vestibule of the mandible also enhances the efficacy of an IAN block injection
- Preoperative administration of nonsteroidal anti-inflammatory drugs (e.g., ibuprofen) may increase the effectiveness of the local anesthetic IAN block

Analgesics are another commonly used drug class for treating odontogenic pain patients. NSAIDs are often considered a drug of choice in treating these patients due to the specific inflammatory etiology of most dental pain conditions. Of course, the astute clinician understands that, while many patients can take NSAIDs, they are generally contraindicated in patients with ulcers, ulcerative colitis, uncontrolled hypertension and kidney disease, patients taking blood thinners or aspirin for heart disease, or patients in the third trimester of pregnancy. Multiple randomized, placebo-controlled clinical studies have shown that NSAIDs such as ibuprofen, in doses ranging from 400-600 mg, provide profound analgesia for inflammatory pain (7).

However, a recent study has evaluated an important aspect of this drug class: do NSAID drugs “mask” symptoms in the odontogenic pain patient? This is an important issue since many patients will self-medicate with over-the-counter ibuprofen before coming to the dental office. In a recent study published in the *Journal of Endodontics*, Read and colleagues demonstrated that 800 mg ibuprofen reduced palpation pain by 40%, percussion pain by 25% and cold pain by 25% on teeth with a diagnosis of symptomatic irreversible pulpitis and symptomatic apical periodontitis (8). Thus, clinicians should ask which analgesics were taken in the 4-6 hours prior to clinical evaluation.

Acetaminophen, alone or in combination with an opioid (e.g., codeine, hydrocodone, oxycodone), is often used as an alternative analgesic in patients who cannot tolerate the NSAID class of analgesics. Although acetaminophen has been in use for more than 100 years, it was only in 2014 that its mechanism of action was discovered. Studies have now shown that acetaminophen produces its actions in the brain by inhibiting the activity of a key voltage-gated calcium channel, CaV3.2 (9). Although acetaminophen alone or with opioids is considered an effective alternative analgesic in patients who cannot take NSAIDs, adverse effects do exist and include potential for liver damage, rare incidence of Stevens-Johnson syndrome, and possibly an association with asthma. Additionally, the patient needs to be cautioned about the effects of opioids (e.g., dizziness, drowsiness) if prescribed.

More recent studies have evaluated combined administration of ibuprofen and acetaminophen in patients who can tolerate both classes of drugs. Interestingly, the simultaneous administration of ibuprofen and acetaminophen produces greater peak analgesia and more consistent analgesia (i.e., less variability between patients) without increasing adverse side effects (7, 10-13). This substantial improvement in analgesia has been reported in patients after surgical extractions as well as in patients after nonsurgical endodontic treatment. Based on these studies, combinations such as ibuprofen 200 mg + acetaminophen 500 mg, up to ibuprofen 400 mg + acetaminophen 1,000 mg, have been shown to produce highly significant analgesic benefits

**Table 2. Commonly Prescribed Analgesics for Treating Dental Pain**

Drug	Brand Name	Dosage	Maximum Dosage	Rx or OTC
<b>Ibuprofen</b>	Advil, Motrin, Nuprin	400-600 mg every 4-6 hours	3200 mg/day	Rx > 200 mg OTC 200 mg
<b>Naproxen</b>	Aleve, Naprosyn	440-500 mg every 12 hours	1000-1100 mg/day	Rx > 220 mg OTC 220 mg
<b>Acetaminophen with Codeine #3</b>	Tylenol with Codeine #3 (30 mg codeine/300 mg acetaminophen)	1-2 tablets every 4-6 hours	3000 mg acetaminophen/day and 360 mg codeine/day	Rx
<b>Acetaminophen with Hydrocodone</b>	Vicodin-5 (5 mg hydrocodone/300 mg acetaminophen)	1-2 tablets every 4-6 hours	3000 mg acetaminophen/day and 60 mg hydrocodone/day	Rx
<b>Acetaminophen with Oxycodone</b>	Percocet-5 (5 mg oxycodone/325 mg acetaminophen)	1-2 tablets every 4-6 hours	3000 mg acetaminophen/day and 60 mg oxycodone/day	Rx
<b>Tramadol</b>	Ultram (50 mg tramadol)	1-2 tablets every 4-6 hours	400 mg/day	Rx
<b>Acetaminophen with Tramadol</b>	Ultracet (37.5 mg tramadol/325 mg acetaminophen)	1-2 tablets every 4-6 hours	3000 mg acetaminophen/day and 400 mg tramadol/day	Rx

to patients. Thus, one effective strategy for managing emergency pain patients is the combined use of ibuprofen and acetaminophen. Although this combination is available as a single drug entity in several countries, many of these clinical trials simply administered two tablets of the analgesics at the same time. Table 2 on page 4 lists common NSAIDs, acetaminophen and opiate combinations, and tramadol with and without acetaminophen. Tramadol is a centrally acting narcotic-like analgesic that may be an option in patients who cannot tolerate NSAIDs and/or acetaminophen and opiate combinations. Clinicians should refer to a drug resource or reference before prescribing any medications.

Antibiotics are another drug class often used for treating emergency pain patients with odontogenic infections. However, several randomized, controlled studies have failed to detect an analgesic effect in patients taking antibiotics (14). This is an important issue since the practitioner should not rely on antibiotics to relieve pain. Instead, analgesics may be coprescribed with antibiotics when treating pain patients with odontogenic infections. It should be noted that antibiotics should only be prescribed to patients with systemic signs of infection (*e.g.*, fever, swelling, malaise or compromised airway). Patients with cellulitis or those who are medically compromised may also require antibiotic therapy. A recent issue of *Colleagues for Excellence* (Winter 2012) provides a great overview of issues related to the use of antibiotics in odontogenic infections.

## **Summary**

Toothaches or odontogenic pain are among the most common form of orofacial pain in the United States (15). It is important to develop an organized method for evaluating and treating these patients. Here, we describe a “3D” approach that provides a structural format for appropriate Diagnosis, Definitive Dental Treatment and Drugs. Using this structured approach, together with the best available evidence-based literature, the skilled clinician can effectively manage the acute emergency dental patient, including appropriate referral when dealing with complex or nonodontogenic pain conditions. Together, we can make a difference in our patients’ lives.

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## Endodontic Case Study

This new feature in *Colleagues for Excellence* highlights endodontic treatment that demonstrates the benefits of treatment planning and partnership with an endodontist to improve patient outcomes.

This patient presented to her dentist with swelling and tenderness in the lower right mandibular quadrant. After examination, the dentist referred the patient to a periodontist for an extraction of tooth #30 and an implant. The periodontist suspected an endo-perio lesion and referred the patient to an endodontist for evaluation in hopes of allowing the patient to save her tooth. The endodontist completed a thorough examination finding localized swelling and palpation tenderness in the buccal vestibule adjacent to tooth #30. Periodontal probing of 10+ mm in the buccal furcation as well as on the disto-buccal, probing within normal limits elsewhere. No sensitivity to pressure or percussion. No response to vitality (cold) testing. Radiographic evaluation revealed periapical bone loss circumferentially around the entire distal root as well as a periapical area at the mesial root apex. The diagnosis was chronic apical abscess with drainage through the periodontal sulcus. The patient was informed of risks and benefits and opted to try to save her tooth. The endodontic treatment was completed in two visits, with calcium hydroxide placed as an interim medication. The tooth was evaluated at one month at which time the periodontal probe depths were WNL. The six-month radiograph confirmed nearly complete healing.



Often times a lesion of periodontal nature may have an endodontic origin. It behooves the clinician to explore all options before assuming the tooth is non-salvageable and deemed for extraction. This is an exceptional example of a tooth that will serve this patient well for many years because of the correct diagnosis. *Contributed by Dr. Steven J. Katz.*

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### Exclusive Online Bonus Materials: Treating Acute Pain

This issue of the *Colleagues* newsletter is available online at [www.aae.org/colleagues](http://www.aae.org/colleagues) with the following *exclusive bonus materials*:

- Full-Text Article: Pak JG, White SN. Pain prevalence and severity before, during, and after root canal treatment: a systematic review. *J Endod.* 2011;37(4):429-38.
- Full-Text Article: Rogers BS, Botero TM, McDonald NJ, Gardner RJ, Peters MC. Efficacy of Articaine versus Lidocaine as a supplemental buccal infiltration in mandibular molars with irreversible pulpitis: a prospective, randomized, double-blind study. *J Endod.* 2014;40(6):753-8.

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