Successful Local Anesthesia
FOR RESTORATIVE DENTISTRY AND ENDODONTICS

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Dedication

This book is dedicated to the current and former endodontic graduate students who shared our goal of profound pulpal anesthesia.
Preface

Why do patients avoid going to the dentist? According to a survey by the American Dental Association,¹ fear of pain is the greatest factor that prevents patients from visiting their dentist. Additional surveys²,³ have found that 90% of dentists have some anesthetic difficulties during restorative dentistry procedures. Because adequate pulpal anesthesia is a clinical problem, we and other authors have performed a number of research studies on local anesthesia over the last 25 years. We are excited to present some of these findings in this book.

Profound pulpal anesthesia is a cornerstone to the delivery of dental care. Administration of local anesthesia is one of the most common procedures in clinical practice. It is invariably the first procedure we perform, and it affects almost everything we do during that appointment. If the patient is not adequately anesthetized and you have some extensive restorative work planned, difficulties arise. The information in this book explains why problems occur and offers clinical solutions to help clinicians stay on schedule.

Fortunately, local anesthesia has evolved tremendously over the last 20 years just as the materials and techniques have evolved in restorative dentistry and endodontics. The current technology and drug formulations used for local anesthesia have made it so much easier to treat patients successfully. We now have the ability to anesthetize patients initially, provide anesthesia for the full appointment, and reverse some of the effects of soft tissue anesthesia if desired. Priceless!

This book covers the research-based rationale, advantages, and limitations of the various anesthetic agents and routes of administration. A special emphasis is placed on supplemental anesthetic techniques that are vital to the practice of dentistry. However, this book does not cover the basic techniques utilized for the delivery of local anesthetics because that information is readily available elsewhere in textbooks and publications.

In addition, this book emphasizes information for the restorative dentist and endodontist because the requirements for pulpal anesthesia are different than for oral surgery, implant dentistry, periodontics, and pediatric dentistry. Eighty-five percent of local anesthesia teaching in dental school is done by oral and maxillofacial surgery departments,⁴ and while they do an excellent job, it is sometimes difficult for oral surgeons to appreciate the requirements for pulpal anesthesia in restorative dentistry and endodontic therapy.

Throughout the book, the information has been divided into specific topics so it is understandable and easy to reference. When indicated, summary information has been provided. References to published literature are included in the chapters because clinicians within the specialty of endodontics (of which we are members) communicate with each other by quoting authors and studies. We also think it is important to credit the authors for their contributions to the literature on local anesthesia.

This book is a clinical adjunct to help you successfully anesthetize patients using the newest technology and drugs available. Indeed, the information presented here will help you to provide painless treatment. Pulpal anesthesia will be emphasized throughout this book. That is, pulpal anesthesia will be required by the restorative dentist and endodontist in order to perform painless treatment. We think that is a worthy goal for the dental profession.

References

Acknowledgments

We want to acknowledge the time spent away from our spouses (Dixie Reader, Tammie Nusstein, and Jason Drum) in completing this work. We are so grateful they were willing to help us produce a thoughtful addition to local anesthesia.

All royalties from the sale of this book will be equally divided between the American Association of Endodontist's Foundation and The Ohio State University Endodontic Graduate Student Research Fund to support further research on anesthesia and pain control.
Clinical Factors Related to Local Anesthesia

After reading this chapter, the practitioner should be able to:

- Discuss the clinical factors related to local anesthesia.
- Provide ways of confirming clinical anesthesia.
- Describe issues related to local anesthesia.
- Explain the effects anxiety has on local anesthesia.
- Discuss the use of vasoconstrictors.
- Characterize injection pain.
- Evaluate the use of topical anesthetics.
- Discuss alternative modes of reducing pain during injections.

Clinical pulpal anesthesia is dependent on the interaction of three major factors: (1) the dentist, (2) the patient, and (3) local anesthesia (Fig 1-1). The dentist is dependent on the local anesthesia agents as well as his technique. In addition, the dentist is dependent on the interaction with the patient (rapport/confidence). How the patient interacts with the administration of local anesthesia is determined by a number of clinical factors.

Confirming Pulpal Anesthesia in Nonpainful Vital Teeth

Lip numbness

A traditional method to confirm anesthesia usually involves questioning patients by asking if their lip is numb (Fig 1-2). Although lip numbness can be obtained 100% of the time, pulpal anesthesia may fail in the mandibular first molar in 23% of patients.\(^1\)\(^-\)\(^16\) Therefore, lip numbness does not always indicate pulpal anesthesia. However, lack of lip numbness for an inferior alveolar nerve block (IANB) does indicate the injection was “missed,” and pulpal anesthesia will not be present.

IN CONCLUSION, lip numbness does not always indicate pulpal anesthesia.

Soft tissue testing

Using a sharp explorer to “stick” the soft tissue (gingiva, mucosa, lip, tongue) in the area of nerve distribution (Fig 1-3) has a 90% to 100% incidence of success.\(^2\)\(^-\)\(^5\) Regardless, pulpal anesthesia may still not be present for the mandibular first molar in 23% of patients.\(^1\)\(^-\)\(^16\) Negative mucosal sticks usually indicate that the mucosal tissue is anesthetized.

IN CONCLUSION, the absence of patient response to sharp explorer “sticks” is a poor indicator of pulpal anesthesia.
Commencing with treatment

The problem with commencing treatment without confirming anesthesia is there is no way to know if the patient is numb until we start to drill on the tooth. This may create anxiety for both the patient and the dentist. A typical scenario involving a crown preparation on a mandibular molar can become problematic if the patient feels pain when the mesiobuccal dentin is reached with the bur. If the patient reacts to the pain, the dentist may say, “Oh, did you feel that?” and then may try to continue with treatment. If the patient reacts again when the mesiobuccal dentin is touched with the bur, the dentist may try to work around the pain the patient is feeling by saying, “I’ll be done in a minute.” Such a situation would not make a good day for the dentist or patient.

IN CONCLUSION, commencing with treatment without confirming anesthesia may add apprehension for the dentist and patient because neither one knows if the tooth is anesthetized.
Confirming Pulpal Anesthesia in Nonpainful Vital Teeth

Cold refrigerant or electric pulp testing

A more objective measurement of anesthesia, in nonpainful vital teeth, is obtained with an application of a cold refrigerant of 1,1,1,2-tetrafluoroethane or by using an electric pulp tester (EPT). Cold refrigerant or the EPT can be used to test the tooth under treatment for pulpal anesthesia prior to beginning a clinical procedure.17–20 A dental assistant could test the tooth to determine when pulpal anesthesia is obtained and then inform the doctor that treatment can be started.

In a very anxious patient, the use of pulp testing may cause a very painful reaction. Apprehensive patients can become sufficiently keyed up to react to even minimal stimulation. They may say, “Of course I jumped, it hurts!” or “It’s only normal to jump when you know it is going to hurt.”

IN CONCLUSION, pulp testing with a cold refrigerant or an EPT will indicate if the patient has pulpal anesthesia. For anxious patients, pulp testing may need to be postponed until the patient can be conditioned to accept noninvasive diagnostic procedures.

Cold testing

A cold refrigerant tetrafluoroethylene (Hygenic Endo-Ice, Coltène/Whaledent) (Fig 1-4) can be used to test for pulpal anesthesia before commencing drilling on the tooth. The technique for cold testing is quick and easy; it takes only seconds to complete and does not require special equipment. Once the patient is experiencing profound lip numbness, the cold refrigerant is sprayed on a large cotton pellet held with cotton tweezers21 (Fig 1-5). The cold pellet is then placed on the tooth (Fig 1-6). If clinical anesthesia has been successful, applications of cold refrigerant should not be felt. If the patient feels pain with application of the cold, supplemental injections should be given. If no pain is felt with
Alternate Injection Locations

Gow-Gates and Vazirani-Akinosi techniques

The Gow-Gates technique\(^7\) (Fig 2-15) has been reported to have a higher success rate than the conventional IANB.\(^{34,98}\) However, experimental studies have failed to show that the Gow-Gates technique is superior\(^{14,29,99–102}\) (Fig 2-16).

Akinosi introduced his technique for mandibular anesthesia in 1977,\(^{103}\) while Vazirani had also described a similar technique in 1960,\(^{104}\) and so the name was changed to reflect both contributions.\(^{34}\) The Vazirani-Akinosi\(^{34,103}\) technique (Fig 2-17) has also not been found to be superior to the standard inferior alveolar injection.\(^{14,99,105–107}\) Goldberg and coauthors\(^{14}\) compared the degree of pulpal anesthesia obtained with the conventional, the Gow-Gates, and the Vazirani-Akinosi techniques in vital,
asymptomatic teeth using 3.6 mL of 2% lidocaine with 1:100,000 epinephrine. They found that for the subjects who achieved lip numbness, the conventional IANB was similar to the Gow-Gates and Vazirani-Akinosi techniques regarding anesthetic success (Fig 2-18). However, the Gow-Gates and Vazirani-Akinosi techniques had a slower onset of pulpal anesthesia when compared with the conventional technique. These techniques do not replace the conventional IANB.

When a patient presents with trismus or limited mandibular opening, the Vazirani-Akinosi technique can be used because the mouth is closed during the injection. Neither technique is better than the conventional IANB in reducing the pain of injection.\textsuperscript{14,99,100,108}

IN CONCLUSION, neither the Gow-Gates technique nor Vazirani-Akinosi technique is better than the conventional inferior alveolar technique.

**Incidence of buccal nerve anesthesia**

Gow-Gates\textsuperscript{87} and Akinosi\textsuperscript{103} state that a separate buccal injection is not required for soft tissue anesthesia with their techniques. Goldberg and coauthors\textsuperscript{14} reported the incidence of buccal nerve anesthesia was 84% with the Gow-Gates technique and 80% with the Vazirani-Akinosi technique using 3.6 mL of 2% lidocaine with 1:100,000 epinephrine. Previous studies have found an incidence of 62%,\textsuperscript{109} 68%,\textsuperscript{102} 77%,\textsuperscript{98} 78%,\textsuperscript{110} 20%,\textsuperscript{100} and 89%\textsuperscript{101} for buccal nerve anesthesia with the Gow-Gates technique. For the Vazirani-Akinosi technique, previous studies have found that buccal nerve anesthesia occurred 80%\textsuperscript{105} and 71%\textsuperscript{111} of the time. Generally, some buccal nerve anesthesia can be obtained with these techniques because the long buccal nerve can be anesthetized as it crosses the anterior border of the mandibular ramus\textsuperscript{112} if anesthetic solution is deposited as the needle is inserted or withdrawn or if enough volume is injected to diffuse to the nerve. Regardless of the incidence reported for these techniques, buccal nerve anesthesia was not 100%. Therefore, a separate long buccal injection should be given when soft tissue anesthesia is required in the molar teeth.

IN CONCLUSION, buccal nerve anesthesia is not complete with the Gow-Gates or Vazirani-Akinosi techniques.

**Incisive nerve block at the mental foramen**

Nist and coauthors,\textsuperscript{7} Joyce and Donnelly,\textsuperscript{113} and Whitworth and coauthors\textsuperscript{114} demonstrated that the incisive nerve block (Fig 2-19) alone is reasonably successful in anesthetizing premolars whether the mental foramen is entered or not. The duration of pulpal anesthesia was 20 to 30 minutes\textsuperscript{2,113} (Fig 2-20). Batista da Silva and coauthors\textsuperscript{115} demonstrated that a 4% articaine formulation was better than a lidocaine formulation for the incisive nerve block but only used a volume of 0.6 mL, which resulted in a duration of anesthesia of approximately 10 minutes.
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