

Accessory Innervation Anesthetic Protocol:

From Research Theory to Clinical Reality

by Dr. Daniel Uzbelger Feldman

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Course description

This course describes how the accessory innervation anesthetic protocol can be used for profound pulpal anesthesia of the adult posterior mandible. It will discuss how the accessory innervation theory plays a pivotal role in the inferior alveolar nerve block failure rates, as well as different clinical approaches to overcome these obstacles.



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Abstract

The inferior alveolar nerve block has the highest failure rate not only in dental local anesthesia, but also among all local anesthetic blocks in medicine. The “accessory innervation to the inferior alveolar nerve” theory supports the idea that incidents of unsuccessful anesthesia may result from innervations of the adult mandible arising from the cervical plexus in addition to the auriculotemporal, buccal, mental, incisive, mylohyoid and lingual nerves. Hence, to achieve profound pulpal anesthesia in the posterior mandible, an accessory innervation anesthetic protocol that anesthetizes all the accessory nerves has been clinically proposed. Three different accessory innervation anesthetic protocol approaches are described in this article, as well as how to overcome pulpal anesthesia failure by implementing the intraoral cervical plexus anesthetic technique. This protocol will help alleviate patients’ fear to the dental chair while improving our profession’s reputation.

Educational objectives

After reading the article, participants should be able to:

1. Understand the problems associated with anesthetic failures in permanent dentition with the use of currently available anesthetic techniques.
2. Identify how accessory innervation may play a pivotal role in the high percentage of anesthetic failure on the posterior mandible.
3. Comprehend the cervical plexus nerve description and distribution in the mandible.
4. Recognize how these variations of anatomy allow for clinical decisions for implementing supplemental anesthetic techniques.
5. Administer the intraoral cervical plexus anesthetic technique to their patients.
6. Provide the accessory innervation anesthetic protocol to their patients.

Introduction

Achieving adequate pulpal anesthesia provides a great first impression and the foundation for building a great patient/dentist and specialist/referral relationship. Traditional methods to confirm mandibular anesthesia usually involve:

- Asking the patient, “Is half of your tongue numb? Is your lip numb?”
- Testing soft-tissue responsiveness to a sharp instrument.
- Or simply commencing with treatment.

The presence of soft-tissue anesthesia does not adequately indicate pulpal anesthesia. This is in contradiction to the traditional view when compared with the maxillary arch.¹

The inferior alveolar nerve (IAN) block has the highest failure rate not only in dental local anesthesia, but also among all local anesthetic blocks in medicine.² Previous research illustrated several explanations for this failure, including patient anxiety, central core theory, lowered pH of inflamed tissues, nerve-altered resting potentials, tetrodotoxin-resistant (TTXr) class sodium channels, anesthetic composition, recreational drugs, Ehlers-Danlos syndrome and having red hair, among others.

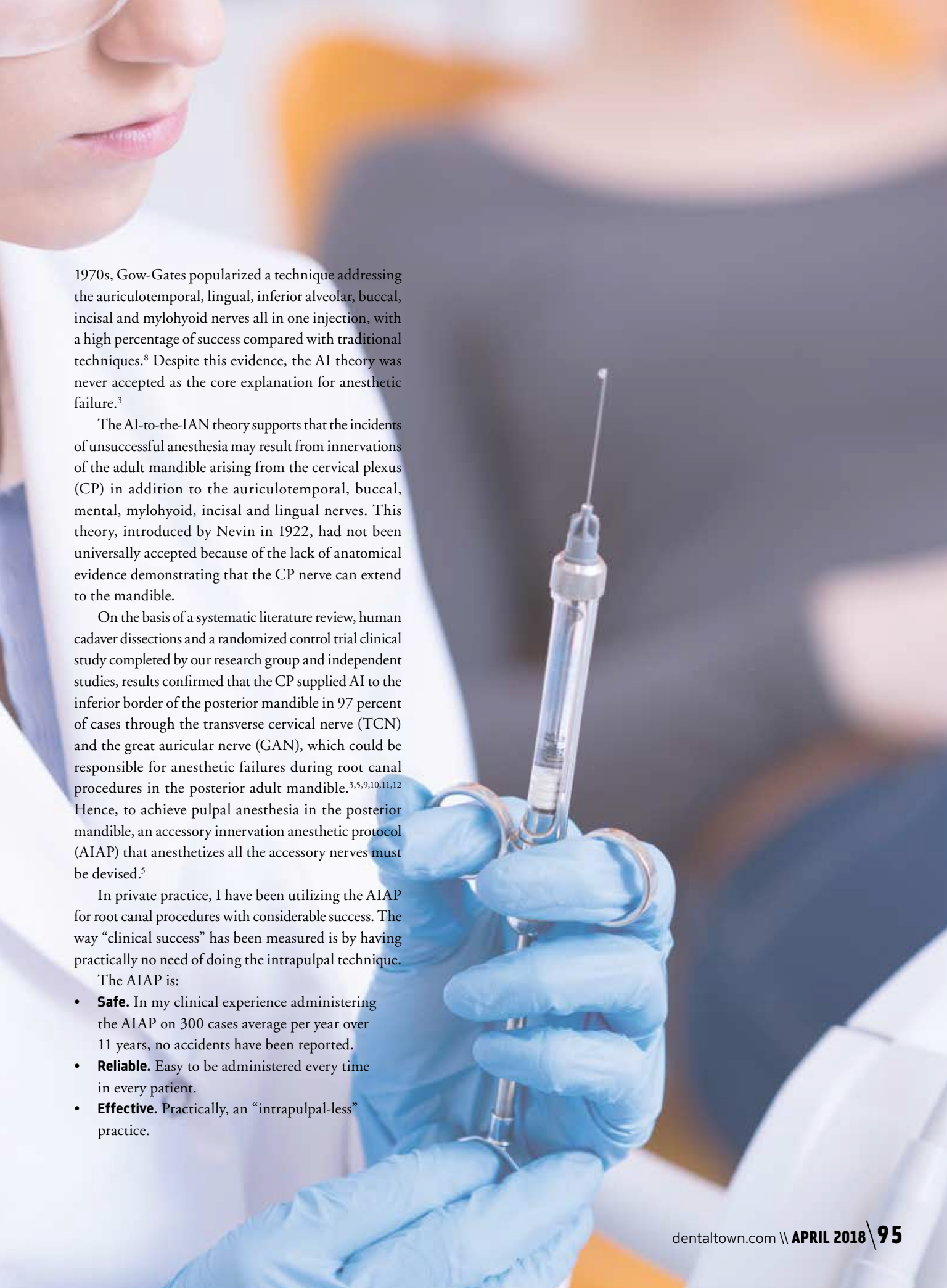
Based on the above information, why can a patient with anxiety, lower pH of inflamed tissues, TTXr sodium channels and red hair be anesthetized for a medical procedure or for a root canal in the posterior maxilla, but not for a root canal in the posterior mandible?³ Although the use of local anesthetics dates back to at least the 1800s, their routine application for dental work in modern times has not alleviated this anxiety.⁴

From an estimated 1.96 billion anesthetic cartridges used each year worldwide, anesthetic failed in 13 percent of injections overall (n = 254.8 million), with 88 percent of those (n = 224.22 million) occurring with the IAN block. In endodontics, it has been reported that as much as 45 percent of IAN block fails, especially in mandibular molars with symptomatic irreversible pulpitis. In addition, failure rates of 10.7 percent for IAN and 17.8 percent for Akinosi technique in permanent dentition during lower molar extractions have been established, as well as lack of success at a rate of 14.2 percent with the IAN during implant drilling and suturing on the edentulous posterior mandibular ridge.^{2,5} No wonder that patients in 2018 still believe that dental procedures will cause them pain!

Accessory innervation (AI) from mental nerves and branches from the mylohyoid have also been implicated as a potential reason for anesthetic failures.^{6,7} In the

Disclosure:

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1970s, Gow-Gates popularized a technique addressing the auriculotemporal, lingual, inferior alveolar, buccal, incisal and mylohyoid nerves all in one injection, with a high percentage of success compared with traditional techniques.⁸ Despite this evidence, the AI theory was never accepted as the core explanation for anesthetic failure.³

The AI-to-the-IAN theory supports that the incidents of unsuccessful anesthesia may result from innervations of the adult mandible arising from the cervical plexus (CP) in addition to the auriculotemporal, buccal, mental, mylohyoid, incisal and lingual nerves. This theory, introduced by Nevin in 1922, had not been universally accepted because of the lack of anatomical evidence demonstrating that the CP nerve can extend to the mandible.

On the basis of a systematic literature review, human cadaver dissections and a randomized control trial clinical study completed by our research group and independent studies, results confirmed that the CP supplied AI to the inferior border of the posterior mandible in 97 percent of cases through the transverse cervical nerve (TCN) and the great auricular nerve (GAN), which could be responsible for anesthetic failures during root canal procedures in the posterior adult mandible.^{3,5,9,10,11,12} Hence, to achieve pulpal anesthesia in the posterior mandible, an accessory innervation anesthetic protocol (AIAP) that anesthetizes all the accessory nerves must be devised.⁵

In private practice, I have been utilizing the AIAP for root canal procedures with considerable success. The way “clinical success” has been measured is by having practically no need of doing the intrapulpal technique.

The AIAP is:

- **Safe.** In my clinical experience administering the AIAP on 300 cases average per year over 11 years, no accidents have been reported.
- **Reliable.** Easy to be administered every time in every patient.
- **Effective.** Practically, an “intrapulpal-less” practice.

- **Time-saving.** No treatment interruption for additional injections.
- **Money-saving.** No need to buy any additional armamentarium.
- **Unstressful.** Patients feel confident and relaxed and they come back to the office.

Adapting the accessory innervation anesthetic protocol

The AIAP below is flexible in terms that can be adapted to existing techniques that clinicians are currently using and familiar with.

The basic AIAP:

- ½ carpule for lingual nerve (short/30-gauge needle).
- 1½ carpules for IAN (long/30-gauge needle).
- ½ carpule for mylohyoid (short/30-gauge needle).
- ½ carpule for buccal (short/30-gauge needle).
- 1 carpule for cervical plexus (short/30-gauge needle).
- 1 carpule for mental nerve (short/30-gauge needle).

Note that this basic AIAP does not cover the auriculotemporal nerve, so a small percentage of failure may occur. If you want to cover this nerve, use the following AIAP approach:

- 2 carpules Gow-Gates (long/30-gauge needle).
- 1 carpule cervical plexus (short/30-gauge needle).
- 1 carpule mental nerve (short/30-gauge needle).

When I show these approaches to dentists' audiences, I consistently receive questions about the last injection, because it's hard to believe the need of a mental nerve technique after the patient is so numb. The above is indeed required, because the mental nerve is in a strategically located anastomosis landmark with the cervical plexus, incisal and cross line nerves. Not administering the mental nerve shot after the cervical plexus may result in inadequate pulpal anesthesia.

If you're not familiar with the Gow-Gates and have already adopted the intraosseous technique, you can administer the AIAP as follows:

- ½ carpule for lingual nerve (short/30-gauge needle).
- 1 carpule for IAN (long/30-gauge needle).
- 1 carpule for cervical plexus (short/30-gauge needle).
- Intraosseous (intraosseous armamentarium).

The main advantage of administering the intraosseous protocol this way is that the patient will not feel the intraosseous injection. The intraosseous technique numbs all the accessory nerves as well and supports the AI theory.

What if, after all these injections, the patient still feels pain?

The main reason for this to happen is failure to get appropriately numb one or more of these nerves. To find out which nerve has been missed, I like to ask patients where the pain is traveling to.

- If they say toward the inside, it may be the lingual or mylohyoid nerves.
- If traveling down to the neck, it may be the CP.
- If it travels toward the ear, it may be the GAN component of the CP, and a most posterior CP injection would be required.
- If pain travels up to the head, it may be the lesser occipital branch of the CP or the auriculotemporal.
- If the lip is not numb and pain travels the IAN path, then another IAN injection should be given.

If you're confident that all these nerves are numb, just deposit some drops of articaine 4 percent 1:200,000 Epi in the pulp chamber; let it sit for 30 seconds, then inject directly, instead of the conventional intrapulpal. The patient may feel a little bit but will not jump out of the chair, as we would see when the AIAP is not applied.

The anesthetic type varies depending on each patient's medical history. Because injections are administered in different locations, you can use different kinds of anesthetic in the same patient. Typically, I use lidocaine 2 percent with 1:100,000 epinephrine. I have applied this AIAP with Mepivacaine 3 percent, no epinephrine, with consistent success. After 45–60 minutes you may want to reinforce the IAN and lingual, if patient requests it because of lack of epinephrine. Regarding to the CP: Because the technique is infiltrative per se, I like to use Articaine 4 percent with 1:200,000 epinephrine. Thus far in my clinical experience, no cases of paresthesia have been reported on this nerve branch.

In terms of timing, the AIAP may take 7–10 minutes to be completed. At conclusion, there is no need to wait 10 minutes to start working, because you practically already waited for it. There is no need of revisiting anesthesia in most of the cases.

Finally, if you have a very large and busy practice and don't have the time to dedicate to this protocol, my advice is to hire a hygienist trained to administer anesthetic and teach her or him the AIAP to get all your patients numb. Then you just go and start working with confidence.

The cervical plexus nerve and anesthetic technique

The description below pertains to the cervical plexus nerve and anesthetic technique as part of the AIAP.

The cervical plexus arises from the spinal cord by two roots—a dorsal root that supplies sensory fibers, and a ventral root that supplies motor fibers. These roots unite within the intervertebral space and exit the spinal column as a single nerve through the intervertebral foramina. The anterior divisions of the second, third and fourth cervical nerves travel toward the lateral surface of the sternocleidomastoid muscle, where they intermingle to form the CP, which has muscular and cutaneous branches.

The CP cutaneous branches comprise the supraclavicular (C3–C4), the lesser occipital (C2), the great auricular nerve (C2–C3) and the transverse cervical nerve, or TCN (C2–C3), which innervates the anterior region of the neck and mandible. For administration of the intraoral cervical plexus anesthetic technique for the GAN and TCN, the patient should keep the mouth closed, or only slightly open, to allow the dentist to relax the soft tissues, cheek and the masseter muscle, which permits the syringe to reach the area to be anesthetized. A syringe with a 30-gauge short needle is placed through the vestibular area of the buccal mucosa below the roots of the mandibular molar, using an inclination of 45 degrees in an anterior-posterior direction (Fig. 1). The tip of the needle is inserted below the roots of the tooth to be anesthetized, and should be in direct contact with the bone (Fig. 2).

An aspiration must be performed before placement of the anesthetic solution, which should be administered slowly to minimize pain while feeling no resistance along the external oblique line of the body of the mandible. Before administering the injection, it's recommended to palpate along the border of the mandible for the transverse facial artery. In addition, the finger should be maintained externally to follow the path of the needle to ensure that it has reached the desired position.⁵

Posterior mandible anesthetic failure is a major public health issue, and the AIAP will help alleviate the patient's fear to the dental chair while improving our profession's reputation. After getting profound pulpal anesthesia on the posterior mandible with the AIAP, confidently you would be able to say more often, "Hello, dental pulp!" ■



Fig. 1: Cervical plexus intraoral technique needle insertion and angulation (second molar).

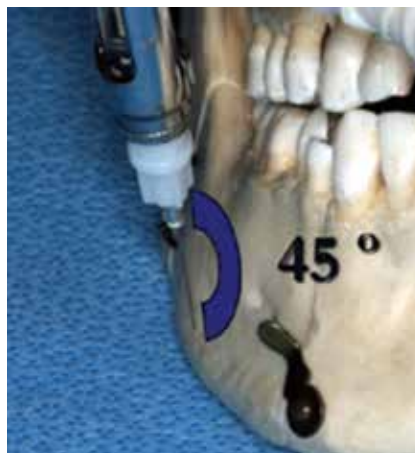


Fig. 2: Intraoral cervical plexus anesthetic technique, lateral view (first molar).

References

1. Endodontics: Colleagues for Excellence. Important Clinical Factors Related to Local Anesthesia. American Association of Endodontists. Bonus Material A. Winter, 2009.
2. Malamed S. Handbook of Local Anesthesia. 6th ed. St Louis, MO: Mosby; 2013. p.387.
3. Uzelger-Feldman D. The Cervical Plexus: An Evolution Shift in the Accessory Innervation Theory. Eur Endod J 2017; 2(1): 17-17.
4. Resnik, CM. Pressure or Pain in the Dental Chair? Journal of Anesthesia History 2 (2016) 69–70.
5. Bitner D, Uzelger-Feldman D, Axx K, Albandar AM. Description and evaluation of an intraoral cervical plexus anesthetic technique. Clin Anat 2015; 28(5):608-13.
6. Nusstein JM, Reader A, Drum M. 2010. Local anesthesia strategies for the patient with a "hot" tooth. Dent Clin North Am 54:237–247.
7. Malamed SF. 2011. Is the mandibular nerve block passe? JADA 142:3S–7S.
8. Gow-Gates GA, Watson JE. The Gow-Gates mandibular block: further understanding. Anesth Prog. 1977 Nov-Dec;24(6):183–189.
9. Uzelger-Feldman D, Bitner D, Axx KT, Chattopadhyay A. 2007. Effectiveness of supplemental cervical plexus anesthetic technique for achieving anesthesia in mandibular molars with irreversible pulpitis. J Endod 33:345.
10. Lin K, Uzelger-Feldman D, Barbe MF. Transverse cervical nerve: implications for dental anesthesia. Clin Anat 2013; 26(6):688-92.
11. Ella B, Langbour N, Caix P, Midy D, Deliac P, Burbaud P. Transverse cervical and great auricular nerve distribution in the mandibular area: A study in human cadavers. Clin Anat 2014; 28(1):109-117.
12. Kim S, Uzelger-Feldman D, Yang J. A Systematic Review of the Cervical Plexus Accessory Innervation and Its Role in Dental Anesthesia. Journal of Anesthesia History 2016; 2(3):79–84.

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1. The inferior alveolar nerve block has the highest failure rate not only in dental local anesthesia, but also among all local anesthetic blocks in medicine.

- A. True.
- B. False.

2. Previous research illustrated several explanations for posterior mandibular anesthesia failure, including:

- A. Patient anxiety.
- B. Central core theory.
- C. Both A and B.
- D. None of the above.

3. Which is *not* one of the theories of posterior mandibular anesthetic failure?

- A. Nerve altered resting potentials.
- B. Tetrodotoxin-resistant (TTXr) class sodium channels.
- C. Ehlers-Danlos syndrome.
- D. Having blond hair.

4. Posterior mandible pulpal anesthesia can be determined when we find:

- A. Half of the lip numb.
- B. Half of the tongue numb.
- C. Negative response to the cold test.
- D. None of the above.

5. The accessory innervation theory supports that incidents of unsuccessful anesthesia may result from innervations of the adult mandible arising from the cervical plexus, in addition to the auriculotemporal, buccal, mental, incisive, mylohyoid, incisal and lingual nerves.

- A. True.
- B. False.

6. The "accessory innervation to the inferior alveolar nerve" theory had not been universally accepted because of:

- A. The lack of anatomical evidence demonstrating that the auriculotemporal nerve innervates teeth.
- B. The lack of anatomical evidence demonstrating that the mylohyoid nerve can extend to the mandible.
- C. The lack of anatomical evidence demonstrating that the cervical plexus nerve can extend to the mandible.
- D. This theory will never be accepted.

7. In order to achieve pulpal anesthesia in the posterior mandible,

- A. An accessory innervation anesthetic device (AIAD) that anesthetizes all the accessory nerves must be devised.
- B. An accessory innervation anesthetic protocol (AIAP) that anesthetizes all the accessory nerves must be devised.
- C. An accessory innervation anesthetic software (AIAS) that anesthetizes all the accessory nerves must be devised.
- D. None of the above.

8. Which anesthetic technique below blocks the auriculotemporal nerve?

- A. Cervical plexus anesthetic technique.
- B. Gow-Gates.
- C. Mental nerve.
- D. Intraligamentary.

9. Which nerve arises from the spinal cord?

- A. Trigeminal.
- B. Facial.
- C. Cervical plexus.
- D. None of the above.

10. The intraoral cervical plexus anesthetic technique utilizes:

- A. A short/30-gauge needle and 45 degrees angulation.
- B. A long/30-gauge needle and 45 degrees angulation.
- C. A short/30-gauge needle and 30 degrees angulation.
- D. A long/30-gauge needle and 30 degrees angulation.

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