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# Prevalence of failed inferior alveolar nerve block in achieving pulpal anesthesia in lower molars

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**Abstract:** Successful anesthesia is essential for performing pain-free dental procedures. The conventional inferior alveolar nerve block (IANB) is the most common technique of local anesthesia used to anesthetize mandibular teeth during surgical procedures. Profound pulpal anesthesia is difficult to be obtained after IANB, especially in inflamed mandibular molars. Even when a proper technique is applied, clinical studies show failure of IANB in approximately 30%-45% of cases. The aim of this review is to prove that IANB alone is not enough to fully anesthetize the pulp and to find solutions and methods to make RCT and restorative work painless for the patients and so the treatment procedure would become easier to the dental practitioner.

**Keywords**: Prevalence; failed inferior; alveolar nerve block; pulpal anesthesia; molar

## Introduction:

Weinstein *et al.* (1) reported in a survey that about one of seven patients experiences pain during treatment. Kaufman *et al.* (2) in a survey of 93 general dentists found that 90% of dentists have had some anesthetic difficulties during restorative work. Anesthetic failure occurs in 13% of injections overall, with the greatest number of failures(88%) occurring with the inferior alveolar nerve block (IANB) In clinical studies, overall failure rates of IANB for healthy lower molars have ranged from 15% to 35% (3-5).

Vreeland *et al.* (6), evaluating the anesthetic efficacy of IANB with different volumes and different concentrations of lidocaine on healthy lower human molars, reported 37%-47% failure In a study by Childers et al. (7), including 40 subjects, anesthetic failure was observed in 37% for the first molar and in 27% for the second molar. Berns & Sadove (8) found that 25% of accurately placed needles resulted in ineffective pulpal analgesia.

## What could be the reason of IANB failure:

Difficulty to anesthetize teeth with inflamed pulp might be explained by a number of suggestions. The classic explanation for this is that the low tissue pH in areas of inflammation affects the activity of the local anesthetic solution. Similarly, vasodilatation in areas of inflammation leads to increased blood supply which might increase wash-out of anesthetic solution. However, these explanations do not explain the failure of IANB where the solution may be deposited 4 or 5 cm from the area of inflammation. The most plausible explanation is that inflammation makes nerves hyperalgesic. Minimal stimulation results in conduction (9).

Nerves at areas of inflammation have low pain threshold (19-20), which explains why the patient still feels pain after local anesthesia.

Tetrodotoxin resistant channels (TTXr) class of sodium channels are resistant to the action of local anesthesia. A related factor is the increased expression of sodium channels in pulp diagnosed with irreversible pulpitis. (21)

## Misunderstandings:

Usually, dental practitioners think that if the lip is numb, the teeth are numb. However, clinicians depend on the sign of lip numbness to confirm that IANB was successful, but it does not guarantee pulpal anesthesia. It does mean the block injection was accurate enough to anesthetize the nerve fibers that supply the lip.

Failure to achieve lip numbness occurs about 5% of the time with experienced clinicians (10,11). The onset of lip numbness occurs usually within 5-9 minutes of injection and pulpal anesthesia usually occurs by 15-16 minutes (6-12). However, pulpal anesthesia may be delayed. Slow onset of pulpal anesthesia (after 15 minutes) occurs approximately 19-27% of the time in mandibular teeth (13) and approximately 8% of patients have onset after 30 minutes (6,13,14).

Lip anesthesia is not a reliable indicator of pulpal anesthesia. The use of DDM (Refrigeant Spray,

dichlor-difluoromethane-DDM) is a reliable method of determining true pulpal anesthesia (24).

Sometimes, clinicians think that repeating IANB injection will help when patients feel pain during dental procedure while there's a profound lip numbness, but the truth is the second injection will not provide pulpal anesthesia (13).

Increasing the dosage of carpules of lidocaine (6,13,15) or increasing the concentration of epinephrine from 1:100,000 to 1:50,000 (16, 17) will not enhance pulpal anesthesia.

There was no significant difference noticed in pulpal anesthesia between using a carpule of plain mepivacaine or prilocaine or a carpule of 2% lidocaine with epinephrine (18).

For mandibular posterior teeth with irreversible pulpitis, neither 4% articaine with 1:100,000 epinephrine or 2% lidocaine with 1:100,000 epinephrine, administered in a conventional IAN block, resulted in an acceptable rate of anesthetic success. There was no significant difference in anesthetic success between the articaine and lidocaine solutions (22).

**Solutions and methods used after failure of IANB:**

**Supplementary buccal infiltration and intraosseous injection:**

IANB injection alone does not always allow pain-free treatment for mandibular teeth with irreversible pulpitis. supplementary buccal infiltration with 4% articaine with epinephrine and intraosseous injection with 2% lidocaine with epinephrine are more likely to allow pain-free treatment than intraligamentary and repeat IANB injections with 2% lidocaine with epinephrine for patients experiencing irreversible pulpitis in mandibular permanent teeth (23).

After a conventional IAN block, giving a buccal infiltration of the lower first molar using 4% articaine with 1:100,000 epinephrine showed a higher success rate 88%, while 2% lidocaine with 1:100,000 epinephrine success rate was 71% (27).

In mandibular posterior teeth with irreversible pulpitis, after failure of IANB, the buccal infiltration of 4% articaine with 1:100,000 epinephrine was successful 58% of the time (28).

For posterior teeth diagnosed with irreversible pulpitis, the supplemental intraosseous injection of 2% lidocaine (1:100,000 epinephrine) was successful when conventional techniques failed (25).

As a supplement to IANB, the intraosseous injection of 1.8ml of 1.5% etidocaine hydrochloride with 1: 200.000 epinephrine, significantly increased anesthetic success in the first molar (29).

A clinical trial concluded that a supplemental intraosseous injection of 1.8 mL of 2% lidocaine with 1:100,000 epinephrine or 2% mepivacaine with 1:20,000 levonordefrin, showed a significant increased anesthetic success rate in first molars and second premolars (30).

**Intraligamentary injection**

Adding the PDL injection to an IAN block increased the incidence of pulpal anesthesia for the first 23 min in the first molar (26).

A clinical study found that a supplemental injection is often necessary in mandibular molars due to failure of IANB to anesthetize the pulp adequately. Periodontal ligament injection should be done under strong pressure to achieve the greatest success rate of anesthesia. If the first injection failed, re-injection is frequently successful. The overall frequency of success of periodontal ligament injection was 92%. Re-injection was included in this rate (31).

**Intrapulpal anesthesia**

There is often a problem in producing a profound anesthesia of the pulp of mandibular posterior teeth with irreversible pulpitis, even after regional blocks or infiltrations with local anesthetic agents. If pain persists when the pulp is entered, an intrapulpal injection is indicated.

The results of these studies (32, 33) show that the success of intrapulpal anesthesia depends on the back pressure transmitted to the pulp by the solution during injection. The anesthesia is profound and immediate when the intrapulpal injection is given under a strong back pressure. Effective intrapulpal injection is independent of the solution injected (32, 33).

**Conclusion:**

The success of inferior alveolar nerve block usually depends on the state of the dental pulp. Mandibular molars with irreversible pulpitis often need supplementary injections after IANB to obtain profound pulpal anesthesia to provide a pain-free dental treatment, to help both the patient and the dental practitioner.

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