

Should clinicians use infiltration anaesthesia rather than the inferior dental block technique when treating adult patients for safety, effectiveness, and comfort?



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Abstract

Objectives To evaluate buccal infiltration (BI) with any anaesthetic, and the inferior dental block (IDB) with 2% lidocaine, and compare their safety, efficacy, and patients' perception of pain during administration.

Method A systematic search and critical appraisal were completed resulting in five studies, four randomised controlled trials and one systematic review and meta-analysis. Patient safety was measured by adverse effects, efficacy was measured without supplementary anaesthesia, and comfort was measured by patients' perception of pain during

administration.

Results All studies compared the efficacy of BI using 4% articaine versus 2% lidocaine IDB. One study reported a statistical significance of BI compared to IDB ($p = 0.03$), with a success rate of only 40%. Two studies investigated adverse effects, with zero recorded. No studies discussed the pain reported by patients during administration.

Conclusion Four percent articaine BI can be used as an alternative to 2% lidocaine IDB. Further research is required on pain during administration and adverse effects as there is limited evidence.

Introduction

Local anaesthetic (LA) is a drug that can be administered to relieve, or cause temporary loss of sensation, in a specific area of the body. LA works by blocking nerve conduction by inhibiting the influx of sodium ions through the sodium channels, interrupting an action potential, and preventing the transmission of nerve impulses to the brain, blocking pain signals.¹

The most common LAs used are lidocaine, articaine, mepivacaine and prilocaine. They vary in their 'potency, toxicity, duration of action, stability, solubility in water, and ability to penetrate mucous membranes.'² LA is a prescription-only medicine, therefore dental

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therapists (DTs) must have a referral from an approved prescriber to administer LA, unless a patient group direction is in place.³

When treating the mandibular posterior teeth and gingivae, many techniques can be utilised. However, from a DT scope of practice, the infiltration or IDB is used.⁴ For a BI, the syringe is held parallel to the long axis of the tooth and the needle is inserted buccally at a 45-degree angle, into the alveolar mucosa, beyond the mucogingival line.⁵ Successful anaesthesia diffuses through the bone to anaesthetise the tooth, buccal gingiva, and periodontium.⁶

The conventional IDB requires the identification of anatomical landmarks such as the ramus, pterygomandibular raphe, coronoid notch, and retromolar pad. Once the landmarks are located, the syringe is positioned from the opposite side at the premolars, and the needle is inserted into the pterygomandibular depression until tactile sensation detects bone.⁷ After a slight withdrawal and a negative aspiration test, the anaesthetic is administered. An aspiration test is completed to ensure there is no intravascular injection which ‘can lead to palpitations, visual disturbances, headaches, and vertigo’.⁶ A successful IDB will anaesthetise the teeth, buccal gingiva, lower lip, lingual gingivae, the floor of the mouth and the side of the tongue where it was administered.⁶

IDBs have a more complex technique than infiltrations due to the recognition of landmarks. Some clinicians find difficulty in doing so, so they ‘rely instead, on assumptions as to where the needle should be positioned’.⁸ Research has shown that IDBs are commonly related to systemic and local complications, especially nerve injury, and to improve patient safety there is a need for change.⁹ Adverse effects can occur with any technique, and some adverse effects reported with LA include ocular and neurological injury, allergy, haemorrhage/hematoma, needle breakage and non-specified adverse effects such as tachycardia, fainting, trismus, and self-inflicted injury.¹⁰

Despite a high level of good-quality evidence, there is no agreement on what technique is right or wrong and instead, decided by clinical judgement. Recently there seems to be a consensus that more clinicians have been deterred from IDBs due to thoughts on consent from the risks involved, likelihood of trauma, and infiltrations providing sufficient anaesthesia. From this background,

the purpose of this literature review is to study the efficacy of two LA techniques without the need for another supplementary injection: BI with any anaesthetic, and the conventional IDB with 2% lidocaine. Both techniques will be compared to identify if there is a safer and less painful injection, that should be used when treating adult patients.

Methodology

An electronic systematic search was conducted with specific search terms, filters and criteria using the databases PubMed, CINAHL Complete and Medline. Additional hand searching, forward citation, and communication with several authors was performed to obtain additional research.

Five studies included 4% articaine for the IDB technique and consequently were excluded due to the theoretical risk of paraesthesia. A total of five studies met the criteria, one systematic review and meta-analysis (SRMA) and four randomised controlled trials (RCTs). Critical appraisal was carried out using the Critical Appraisal Skills Programme.¹¹

Patient safety was measured by clinical findings of adverse effects and efficacy of anaesthesia was measured by the ability to complete the procedure without a supplementary injection. Comfort was measured by the study’s recordings of the patients’ perceptions of pain during administration, using the visual analogue scale (VAS).

Results

All five studies compared the anaesthesia and techniques of 4% articaine BI with 2% lidocaine IDB, on adult participants over 18 years, requiring endodontic or extraction treatment on the mandibular first or second molars.

Safety

Two studies observed the incidence of adverse effects after administration during the study, with zero recorded. Adverse effects long-term (more than one day) were not discussed.

Efficacy

Four papers concluded no statistical significance ($p > 0.05$) for the comparison of BI and IDB anaesthetic techniques in efficacy. One paper reported a statistical significance ($p = 0.03$) for BI, with a success rate of 40% compared to IDB, 10%.

Comfort

Two papers studied the success of anaesthesia when the patients felt zero pain. No papers studied the pain experienced by patients during anaesthesia administration.

Discussion

The literature within this review carried out treatment beyond a DT’s scope of practice;⁴ however, these procedures are invasive requiring efficient anaesthesia. Of the five studies gathered, four RCTs and one SRMA ranked high on the hierarchy of evidence. From the critical appraisal, three RCTs were of low quality due to identified bias, poor methodology, unclear randomisation, and lack of statistical analysis.^{12,13,14}

Strict inclusion and exclusion criteria for participants were found throughout the studies, with exclusions including allergy to LA, pregnancy, medications that could alter pain perception and systematic disease. The results of the studies are still transferable as it can be understood why the criteria were limited. Certain anaesthetics with epinephrine like 4% articaine 1:100,000 are advised against administering to some patients, such as those with severe hypertension, due to the hazardous risk of hypertension and bradycardia.¹⁵ Limiting

the criteria this way gains a perspective on efficacy and creates a useful starting point for future research on anaesthesia and techniques for more complex patients.

Although all literature had concerns with detection bias, blinding participants and operators to surgical interventions such as the anaesthesia technique is extremely difficult, as the anaesthesia is administered to a site within the oral cavity. Unfortunately, not all studies ensured consistency, as Rajput *et al.*¹⁴ failed to state whether all anaesthesia was administered by one operator, and a difference in epinephrine concentrations was identified within two studies.^{12,14} Fortunately, there is no difference in efficacy with a difference in epinephrine concentrations, so the validity is not compromised.^{16,17.}

most methods are not always 100% effective and sometimes supplementary injections are required.⁶ A great variety of factors that can result in failure include anatomy and position of nerves and foramina, pathology and inflammation, pharmaceutical nature and storage of LA, pharmacological and interaction of drugs, psychology and stress, and technical including operator technique.⁹

One of the issues in efficacy with BI is the mandible and the thickness of the cortical bone.⁷ Two percent lidocaine is known to be the gold standard; however, it is less effective for treatment in the mandible.¹⁹ One may argue that a limitation of this study is that BI was only administered with 4% articaine 1:100,000. Articaine's molecular structure contains a thiophene ring, instead

the SRMA found a statistical significance ($p = 0.02$) in the reduction of pain administering 4% articaine BI, compared to 2% lidocaine IDB.²² Nevertheless, measuring the patient's perception of pain has the potential for response bias. An interesting study by Boring *et al.*²³ found common themes for over-reporting pain such as anxiety and psychosocial. Additionally, it was shown that patients also underreport pain, due to not wanting to inconvenience the clinician, embarrassment, reducing time and the risk of more treatment. Due to confounding factors such as human nature and emotional conflicts, it is difficult to gain accurate results on how patients express pain. Therefore, building a strong clinician-patient rapport is essential to ensure the patient has trust and confidence in communicating with the clinician.

BI and IDB were compared regarding patient safety on the assumption that IDBs have a higher risk of adverse effects. Only two studies investigated this, with zero recorded.^{12,24} Although it was believed that IDBs have more risks and complications, an interesting literature review by Ho *et al.*¹⁰ found from 78 articles, 39.7% had complications through IDBs with a comparable 25.6% from infiltrations. It would be suggested that further investigation was carried out to answer this question.

There are limitations identified within this review. Many articles were inaccessible and despite attempts at communication, limited response was received, reducing the evidence available. Publication bias may be identified within the studies, affecting the strength of evidence to inform recommendations. Paediatric patients were not included in the criteria due to my personal clinical experience with adults requiring more anaesthesia. This had its limitations as several studies identified during the search, compared the techniques on paediatrics, which may have been relevant to address the research question.

Conclusion

Four percent articaine BI can be used instead of 2% lidocaine IDB, as there is no comparable difference in efficacy.

Recommendations

Further RCTs are recommended comparing lidocaine or articaine BI with 2% lidocaine IDB. As pain on administration and adverse effects were not fully explored, there is a need for further research. Published LA guidance on adults would greatly assist clinicians in choosing the appropriate anaesthetic and technique for treatment.

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A variation in volumes of anaesthesia was delivered to the intervention and comparison technique by three RCTs.^{12,13,14} Monteiro *et al.*¹³ administered both 1.8 ml for BI and IDB, however, with the BI, an additional 0.6 ml lingual infiltration was given for the justification of comfortable clamp placement. Administering different volumes consequently means the results of the experiment are invalid, as there is no consistency regarding the intervention and comparison technique. Additionally, some individuals would be at an advantage of anaesthetic efficacy due to a larger volume received. A supporting statement from Badr and Aps¹⁸ found that in 11 studies when larger volumes were administered, the greater the efficacy of anaesthesia.

A statistical significance of efficacy ($p = 0.03$) was found in only one study in favour of 4% articaine BI.¹³ However, a success rate of 40% is still low and when treating patients, a clinician would want a higher or 100% success rate. The success rates extracted from the studies ranged from BI 40–96% and IDB 10–96%. As a clinician, it is known that

of a benzocaine ring found in lidocaine, which increases the lipid solubility, therefore increasing the diffusive penetrability through cortical bone and tissue.²⁰

Injections to some patients can be the source of anxiety, due to the fear of pain, previous negative dental experience, or the fear of injury.²¹ Only two studies identified success when the patient felt zero pain during treatment.^{13,14} Although discussed as a potential limitation of the study, it is hoped that most clinicians would agree that 'it is not acceptable to provide treatment or consider a success case in which a patient reports pain, even when mild, during treatment.'¹³ Identifying whether BI was more comfortable than IDB was a priority of this review, in the hope to propose a change in clinical practice in alleviating pain for the patient. Unfortunately, no study investigated this, concluding the need for future research.

An outcome not investigated in the studies was the pain experienced by patients during anaesthesia administration. However, it is worth noting that one study included in

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