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# Efficacy of buccal infiltration anaesthesia with articaine for extraction of mandibular molars: a clinical trial☆

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**Abstract**

It is hard to provide adequate anaesthesia by infiltration of lidocaine into the mandible because of the thick buccal cortex. An inferior alveolar nerve block is often used but has a high failure rate, which has led research workers to look for an anaesthetic agent that will anaesthetise the lower teeth by buccal infiltration alone. We have assessed the efficacy of buccal infiltration anaesthesia with articaine by designing a double-blind controlled clinical trial in 133 patients who required extraction of mandibular molars. They were randomly divided into two groups and given infiltration anaesthesia with either 4% articaine or 2% lidocaine by a single injection deep into the mucobuccal fold at the site of the tooth. After five minutes the mesial, distal, buccal, and lingual sides of the tooth were probed. Pain at this time or later during dissection of soft tissue by periosteal elevator was considered as failure, and an inferior alveolar nerve block was given. The amount of pain, and the number of patients who developed pain, were significantly greater in the group given 2% lidocaine ($p < 0.001$). The two groups did not differ significantly in age or sex. Articaine is more successful in providing adequate depth of anaesthesia, but its efficacy was not sufficient to replace an inferior alveolar nerve block for extraction of mandibular molars (Registration code: IRCT2016062627111N2).


*Keywords:* Articaine; Carticaine; Infiltration anaesthesia; Tooth Extraction

## Introduction

Providing adequate depth of anaesthesia is one of the most important factors in the success of treatment.[1] It is hard to achieve this by infiltration anaesthesia in the mandible in adults, presumably because of the thick buccal cortical bone.[2] Anaesthesia of the pulp and lingual soft tissue in the mandible therefore, often requires an inferior alveolar nerve block. This technique is relatively complex and has drawbacks, including a high failure rate (15%–20%), and complications such as trismus, haematoma, and paraesthesia.[3] Another shortcoming is the unnecessary anaesthesia of all branches of the nerve in cases in which only a small area needs to be anaesthetised. In some patients clinicians also prefer not to anaesthetise the lower lip to prevent accidental biting (as in children and the elderly). Research workers have therefore been in search of effective anaesthetic agents to provide adequate depth of anaesthesia by mandibular buccal infiltration.[3,4]

Articaine hydrochloride was first introduced as carticaine in 1976, and marketed in Germany.[5] It is an amide anaesthetic agent and has a thiophene ring instead of a benzene ring, which is the reason that it differs from other anaesthetic

☆ Registration code: IRCT2016062627111N2.

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agents. It penetrates the tissues to a greater depth, which is thought to be the result of its thiophene ring.[6] The molecular structure of articaine allows it to be metabolised by both the cholinesterase in the tissue and hepatic microsomal enzymes. Its clinical advantages include the fact that its effect is longer-lasting than that of bupivacaine, etidocaine, or ropivacaine, and its superior penetration into bone.[5] Because of these, some think that articaine may be used for mandibular buccal infiltration anaesthesia as an alternative to an inferior alveolar nerve block.

Although some evidence supports this hypothesis not everyone agrees.[3,7–10] Haas et al[3] reported that the success rate of articaine was similar to that of other anaesthetic agents and that it was no better than other agents, either in the maxilla or the mandible. Nydegger et al[8] reported that although articaine was significantly more successful than lidocaine and prilocaine for infiltration anaesthesia of mandibular first molars, it could not be regarded as an alternative to an inferior alveolar nerve block, and Maruthingal et al[7] showed that although articaine was more effective than lidocaine in anaesthesia of the pulp and lip, it was not significantly better in anaesthesia of the lingual tissue of the mandible.

In contrast, Kannaa et al[9] showed that 4% articaine was more effective than 2% lidocaine for anaesthesia by buccal infiltration of mandibular molars. Robertson et al[11] also showed that articaine was significantly more efficient and faster than lidocaine for infiltration anaesthesia of mandibular molars. In a systematic review, Meechan stated that mandibular infiltration anaesthesia may be successful in adults depending on the dosage and type of anesthetic agent used.[10] He concluded that infiltration anaesthesia by 4% articaine was an efficient technique for anaesthesia of mandibular incisors. Betaineh and Alwarafi also indicated that 4% articaine provided adequate infiltration anaesthesia for extraction of mandibular molars without the need for a block.[12]

Because of the continuing controversy and the fact that we could not find a previous study on extraction of mandibular teeth after buccal infiltration anaesthesia with a single injection, we have assessed the efficacy of buccal infiltration anaesthesia with articaine for extraction of mandibular molars.

## Patients and methods

We organised a double-blind, parallel, randomised clinical trial of 133 patients who presented to the Oral and Maxillofacial Department of the School of Dentistry, Qazvin University of Medical Sciences during the period January–August 2016 with severe caries and periodontal problems that required extraction of mandibular molars. The study protocol was approved by the Independent Ethics Committee of Qazvin University of Medical Sciences (code:IR.QUMS.REC.1395.24) and registered at www.irct.ir (code: IRCT2016062627111N2). Sample size was calculated to be 65 in each group according to the following calculations:

$$N = \frac{\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2 * \left(S_1^2 + S_2^2\right)}{D^2}$$

$$Z_{1-\alpha/2} = 1.96 \quad Z_{1-\beta} = 0.84$$

$$S_1 = 19.19 \; S_2 = 21.6 \quad D = 10$$

The inclusion criteria were: age 20–60 years; need for extraction of at least one mandibular molar; American Society of Anesthesiologists grades I and II; and the ability to fill out the questionnaire. The exclusion criteria were: the presence of an abscess or any other lesion at the injection site; advanced periodontitis causing grade III mobility of the tooth; history of diabetes mellitus, cardiovascular diseases, hypertension or renal diseases; pregnancy or nursing; allergy to local anaesthetics; consumption of alcohol or analgesics, inability to give an informed consent; and unwillingness to participate in the study.

Patients had the study explained to them, and gave their written informed consent. Data recorded included age and sex, and the type of tooth to be extracted. A periapical radiograph was taken of the respective tooth.

The study had a double blind design so the clinician and the patient were not aware of the contents of the cartridges. One 1.8 ml cartridge of 4% articaine with 1:100,000 epinephrine (posicaine 100, Novocol Pharmaceutical of Canada Inc) was used in the articaine group and one 1.8 ml cartridge of 2% lidocaine with 1:100,000 epinephrine (Zeyco Laboratories) was used in the lidocaine group. The cartridges were the same size and shape, assigned a special code, covered with thin, adhesive tape by the distributor, and put into one box for articaine and another box for lidocaine. For each patient, a dental assistant (who was unaware of the contents of each box) selected a box by tossing a coin, gave a randomly chosen carpule to the clinician, and wrote down the code.

A 27-gauge needle was used for buccal infiltration in each case. The injection site was first cleaned with sterile gauze. The lips and cheek were retracted by a dental mirror to apply slight tension to the tissue, and the needle inserted into the tissue at the depth of the mucobuccal fold between the mesial and distal roots of the respective tooth. The bevel of the needle was held towards the bone, and the syringe was parallel to the longitudinal axis of the tooth with the tip of the needle inserted into the depth of the buccal vestibule. After aspiration, the contents of the whole cartridge were injected within one minute.

Five minutes after the injection, the buccal, lingual, mesial, and distal areas around each tooth were probed with a disposable dental explorer. Any sensation of pain at this point was considered as a failure of the infiltration technique. Patients who felt no pain during probing were subjected to soft tissue

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