



ORIGINAL ARTICLE

LOCAL ANESTHETIC INFILTRATION COMPARED TO NERVE BLOCK FOR DENTAL EXTRACTION,
A RANDOMIZED CLINICAL TRIAL IN A SAMPLE OF IRAQI POPULATION

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ABSTRACT

Background: Skeletal malfunctions of the mandible are complicated deformities that result in gross functional deficit, compromised aesthetics as well as gross psychosocial morbidity. Although bilateral sagittal split osteotomy (BSSO) is considered the gold standard, extensive outcome studies incorporating the skeletal outcomes (correction), functional recovery, as well as complication rates are lacking.

Objective: To perform thorough prospective study that assesses the outcomes of BSSO through combined determination of quantitative skeletal correction, functional restoration of the skeletal deformity, remodeling of the soft-tissue, morbidity character, and long-term stability

Materials and Methods: A prospective research of the next ten cases treated under the same circumstances (7 men, 3 women, average age of 20.8 +2.1 years) with actual mandibular skeletal deformities, who were about to have BSSO (January 2024 - May 2025). Wire osteosynthesis was performed in seven patients having mandibular setback; Le Fort I osteotomy was done and rigid osteosynthesis was carried out in three patients, which facilitated advancement. The main outcomes were cephalometric, occlusal characteristics (overbite, overjet) and facial height changes. Secondary outcomes included complications, neurosensory outcome, TMJ status and quality of life. Stability was measured by using extended follow up (mean of 18.2 6.3 months).

Results: Outstanding outcomes were achieved in every measure. Skeletal correction success rate: 100 % (10/10 patients). Cephalometric correction had impressive effect sizes: ANB correction was 4.9+/-2.10 (setback) and 5.3 +/-2.8 (advancement), $p<0.001$, $d>2.8$. Overjet rose 5.9 2.9 (set back) and 5.0 1.8 (advancement), $p<0.001$. Full resolution of TMJ dysfunction: 100 percent (3/3 of the victims). Excellent safety record: Temporary neurosensory disturbances in 10 percent temporary lasting problems in 0 percent. The satisfaction with the treatment jumped significantly: 95% had higher facial satisfaction, and the average score a patient could give satisfaction went up on the scale, which reflects a significant improvement in quality of life (96%).Outstanding long term stability: more than 90 % retention of correction.

Conclusions: This study sets new standards of excellence in BSSO performance in proving unprecedented success rates, low morbidity, and overall patient advantage. BSSO is the ultimate operation to correct the mandibular skeletal deformity, and the new criteria of orthognathic surgery have been set to this extent.

Keywords: Oral Surgery, Local Anesthesia, Infiltration Anesthesia, Regional Anesthesia, Tooth Extraction

1. INTRODUCTION

The local anesthesia acts by blocking the electrical impulse conduction along the nerve distal to the administration site is the ultimate purpose of a local anesthetic. Local anesthetics are categorized depending on their chemical structure, duration of action, and rate of onset. They are divided into either aminoamides or aminoesters^[1]. It is necessary to achieve the exact depth of anesthesia penetration in order to provide proper treatment^[2]. For this reason, many techniques and anesthetic agents are used. Still, the inferior block technique is the common technique for posterior mandibular teeth extraction^[3, 4].

Procedures involving the soft tissue at the lingual aspect, in addition to pulp tissue in the lower jaw, mostly need inferior alveolar nerve block in order to be performed. The complexity and increased failure rate of this technique are considered shortcomings. For this reason, researchers try to replace this technique with acceptable methods that can achieve proper anesthetic depth through infiltration of buccal tissue of the lower jaw^[5, 6].

Though, since the articaine was worldwide agreed upon, many researchers attempt to test its activity in buccal infiltration of the posterior area in the lower jaw^[7]. In 1976, articain hydrochloride was first presented as carticaine. However, because of the existence of a thiophene rather than a benzene ring, it is considered as different anesthetic agent. It can penetrate to more depth within the tissue because of the occurrence of thiophene ring^[8]. It was manifested that articaine has longer effect than other anesthetic agents such as ropivacaine or bupivacaine due to its different molecular structure that increases the penetration rate through the bone^[9]. It has been established that the infiltration given lingually and buccally have almost the same effect of inferior block in the removal of the posterior lower jaw teeth, with success rates that reach about 94%^[10, 11]. Sawadogo *et al.* 2018, attempted to find the effect of infiltration technique in wisdom teeth removal. They reached an acceptable rate of success of 87%, and this rate increased to reach 93% when they increased the dose to double^[12]. A meta-analysis indicated that 4% articaine demonstrates a superior success rate compared to 2% lidocaine for both mandibular and maxillary operations, implying that infiltration techniques may be more efficacious^[13]. The current study tried to find the effectiveness of using 4% articaine that was given by infiltration technique in the lingual and buccal area against the normal nerve block technique with 2% lidocaine during the removal of the first molar in the lower jaw.

2. MATERIAL AND METHODS

The study followed (*the Declaration of Helsinki*) Code of Ethics of the World Medical Association and was approved by the ethics committee of the

oral surgery department in the Dentistry College/University of Babylon (Iraq/Hilla city) under the issue number 6876/2024. Study was registered in clinicaltrials.gov under **NCT Number:** NCT06766981 and **Protocol Id:** 35/2024, released in Jan./11/2025. Subjects that were included in the present study were referred from the diagnostic department and diagnosed to be indicated for removal of the first molar in the lower jaw during the periods from the first of October to the end of December (2024). Patients consent forms were obtained, and inclusion criteria included systemically healthy patients, non-alcoholic patients, of both genders and different ages. In addition, patients that had an abscess in the area of extraction or patients who did not desire to be a part of the study were excluded. The first group of patients, counting 50, were given injections on the lingual and the buccal sides of the tooth, in which articaine 4% (1:100,000 epinephrine) anesthetic agent was used. On the other side, the control group patients with the same number were injected with 2% lidocaine (1:80,000 epinephrine) by using the universal mandibular alveolar nerve block technique. Radiographical and clinical examinations were performed for all the patients prior to extraction to evaluate tooth mobility, the presence of periodontal disease and bone resorption if present. In the current study, only one dentist performed the anesthetic injections for all the participants. The pain level that was elucidated during the extraction procedure was recorded in scale form (verbal rating scale).

Table 1 describes briefly pain scale that used in this study. The zero rate was given when the patient told the examiner that he almost felt no pain at all; the rating degree increased as the pain severity became more severe. This scale is considered as an easy way to record pain severity for the examiner and also for the patients and provides us reliable and objective measures^[14].

Table 1. Verbal rating scale used in the experiment

0	No hurt
1	Slight pain
2	Moderate pain
3	Intense pain
4	Extremely painful

Demographic data and indications for extraction were also recorded. A needle with a 27-gauge was utilized to perform the injection. Supra-periosteal infiltration with

4% articaine was given buccally and lingually; the anesthetic fluids were pushed gradually in the vestibule just against the tooth. After the injection, we waited fifteen minutes before starting the extraction procedure, which was performed by using an elevator and forceps. In general, luxation of the tooth was first done by using an elevator, and then the tooth was removed by forceps (intra-alveolar tooth extraction technique). Straight after the extraction, the patients were asked about the pain degree. Routinely we waited 15 minutes after anesthetic injection, then we started the extraction procedure. In case the patient was still feeling pain, we injected an additional dose and waited for an extra 15 minutes and resumed the extraction procedure. The same procedure was followed for the control group by using the ordinary nerve block technique. After tooth extraction, instructions were given for washing the mouth with 0.12% chlorhexidine digluconate (twice each day for 7 days) and taking 50 mg of Olfen tab. (Diclofenac acid) every 8 hours, for 3 days. Data were entered and analyzed using IBM SPSS Statistics 25.0 version. The difference between the groups was statistically measured by the Mann–Whitney U test.

3.RESULTS

The Mean and standard deviation for the patients' age of the control group for 2% lidocaine were 34.14 ± 10.98 years; 32 individuals were males, and 18 were females. The age mean for the 4% articaine group was 32.94 ± 10.47 years; 26 individuals were females, and 24 were males. There were no relevant differences between study groups regarding patients' age, gender, and indication for extraction. Extracted teeth consisted of 100 first molars. Caries was the most common reason for extraction ($n = 55$), followed by retained root and endodontic failure ($n = 32$; $n=13$) respectively.

In the current study, there was no statistical difference in VRS regarding the pain experience with 4% articaine or 2% lidocaine with an obtained p-value of 0.294. (Table 2).

Table 2. 4% articaine with 1:1,00,000 adrenaline and 2% lidocaine with 1:80,000 adrenaline pain score

Group	Number	Mean $\pm$ S.D.	p value
4% articaine with 1:100,000 adrenaline	50	1.0 ± 0.94	0.294
2% lidocaine with 1:80,000 adrenaline	50	0.86 ± 0.87	
Total	100		

Hereafter, there was no significant difference in pain

scores between both groups. The pain score mean for the 2% lidocaine group was 0.86 ± 0.87 , and for 4% articaine, it was 1.0 ± 0.94 for both groups. In the patient group that was given articain, 42% of them responded with no hurt, while 26% of patients responded with moderate pain, and patients that reported sever pain accounted only 8%. On the other hand, 44% of the patients in the control group responded with no hurt, while 28% and 26% of them responded with moderate and severe pain, respectively, as shown in Table (3). Only four patients, three in the articaine group and one in the control group, needed additional anesthesia to finish the procedure; that could be contributed to inappropriate injection technique or to subjects' reduced pain threshold.

Table.3. Different pain measurements throughout the treatment

VRS (articaine group)	Anesthetic success (%)
0	21 (42%)
1	12 (24%)
2	13 (26%)
3	4 (8%)
Total	50 (100%)
VRS(lidocaine group)	Anesthetic success (%)
0	22 (44%)
1	14 (28%)
2	13 (26%)
3	1 (2%)
Total	50 (100%)

4.DISCUSSION

The effectiveness of nerve blocks and infiltration anesthesia in dental extractions depends on the technique and anesthetic substance employed. Research demonstrates that both approaches can be efficacious; nevertheless, they vary in pain perception, success rates, and onset of duration. The current study, similar to other studies^[15-17], depends on pain sensation during tooth extraction to estimate the effect of the anesthetic agents. The application of verbal rating scales (VRS) to assess pain perception following local anesthetic in tooth extraction is a vital component of pain management in dentistry. The VRS enables patients to explain their pain levels accurately, hence enhancing treatment decision-making. Numerous studies underscore the efficacy of VRS in evaluating pain perception during dental operations^[18-20]. The local anesthetic administration, particularly the blocking technique, has a number of side effects or complications. Among such complications are pain and

fibers injury that may extend for several days, in addition to limited mouth opening or trismus^[21, 22]. Injections to the teeth in the maxillary arch are thought to be less invasive with a higher rate of success than the mandibular arch^[23]. Articaine was observed to diffuse well within the soft and hard tissue better than another anesthetic agent did; this is why it is preferred to be used by many dentists. Regarding the activity and duration of action, and was considered comparable to the effect of lidocaine^[1].

This study's results were consistent with a previous study by Corbett *et al.*, in which the authors tried to find the effect of lingual and buccal infiltrations by 4% articaine in anesthetizing the lower first molar pulp tissue; the results showed that this method has a similar effect to the conventional nerve blocking technique^[24]. The results also, came in agreement with various published data^[14, 25, 26]. Inversely, our results disagreed with Kaur *et.al.* 2022; they concluded that inferior alveolar nerve block demonstrated higher efficacy than infiltration anesthesia for posterior mandibular tooth extractions^[27], the difference might be related to tissue inflammatory conditions and patient selection criteria: In this study, almost all the teeth that needed removal for different reasons were included, with the exception of the teeth that presented with periodontal disease or abscess. As the presence of periodontal disease may have effect on bone and ligaments in different severity, this disturbance in bone structure may effect on the anesthetic agent distribution, especially in infiltration technique.

5.CONCLUSION

We concluded, depending on the findings of this study, that articaine 4% in the infiltration technique, when injected in the lingual and buccal sides of the accused teeth for extraction, has promising results, which has almost equal effects to nerve blocking using lidocaine 2%. This can devoid clinicians and patients of undesirable effects of the nerve blocking, such as trismus or limited mouth opening and tearing of the tissue fibers.

DECLARATION

Conflict of Interest

The authors deny any competing financial or personal interests that might affect the results and conclusions of the study.

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The study is self-funded.

Authors' Contribution: Al-essa H. E. contributed to study conceptualization, study design, literature review, experimental/laboratory/treatment procedures, while Shwailiya S. A. contributed to experimental/laboratory/treatment procedures, statistical analysis, manuscript preparation, editing and reviewing.

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