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Paper Accepted¹

ISSN Online 2406-0895

Case Report / Приказ болесника

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**Modified mylohyoid nerve anesthesia with 4% articaine with epinephrine
and dexamethasone for mandibular dentoalveolar surgery**

Модификована анестезија милохиоидног нерва са 4% артикаином
са адреналином и дексаметазоном за
мандибуларну дентоалвеоларну хирургију

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Received: September 2, 2025

Revised: March 5, 2026

Accepted: March 6, 2026

Online First: March 10, 2026

DOI: <https://doi.org/10.2298/SARH250902023B>

¹**Accepted papers** are articles in press that have gone through due peer review process and have been accepted for publication by the Editorial Board of the *Serbian Archives of Medicine*. They have not yet been copy-edited and/or formatted in the publication house style, and the text may be changed before the final publication.

Although accepted papers do not yet have all the accompanying bibliographic details available, they can already be cited using the year of online publication and the DOI, as follows: the author's last name and initial of the first name, article title, journal title, online first publication month and year, and the DOI; e.g.: Petrović P, Jovanović J. The title of the article. *Srp Arh Celok Lek*. Online First, February 2017.

When the final article is assigned to volumes/issues of the journal, the Article in Press version will be removed and the final version will appear in the associated published volumes/issues of the journal. The date the article was made available online first will be carried over.

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Modified mylohyoid nerve anesthesia with 4% articaine with epinephrine and dexamethasone for mandibular dentoalveolar surgery

Модификована анестезија милохиоидног нерва са 4% артикаином са адреналином и дексаметазоном за мандибуларну дентоалвеоларну хирургију

SUMMARY

Introduction The use of modified mylohyoid nerve anesthesia (MMA) technique, for dentoalveolar surgery, is uncommon.

Case outline We present a 51-year-old Caucasian female patient experiencing chronic inflammation and pain in the area of the missing lower left second premolar and molars. Cone beam CT imaging of the mandible revealed impactions of the mandibular permanent second premolar. 3,5 mL of 4% articaine and 1:100,000 epinephrine were administered with 0.5mL of dexamethasone, for a MMA technique behind the site of the third molar. The pain was measured through visual analog scale (mm), which recorded values of 8 mm, with durations of anesthesia being 270'.

Conclusion Modified mylohyoid nerve anesthesia, can be utilized independently as a primary anesthesia or as a supplementary option for insufficiently effective or failed Halstead anesthesia.

Keywords: mylohyoid nerve; anesthesia; articaine; dexamethasone; dentoalveolar surgery

САЖЕТАК

Увод Употреба модификоване анестезије милохиоидног нерва (ММА) за дентоалвеоларну хирургију је ретка.

Приказ болесника Приказана је 51-годишња пацијенткиња са хроничном упалом и болом у пределу недостајућег доњег левог другог преткутњака и кутњака. Конусни ЦТ снимак мандибуле открио је лингвалну импакцију мандибуларног сталног другог преткутњака са леве стране. 4 ml анестетичког раствора састављеног од 3,5 ml 4% артикаина са 1:100.000 адреналина и 0,5 ml дексаметазона, је дато. Ефикасност ММА у смањењу интраоперативног бола процењена је помоћу визуелне аналогне скале (*mm*), која је забележила вредности од 8 *mm*, и са трајањем анестезије од 270'.

Закључак Модификована анестезија милохиоидног нерва, може се користити као примарна анестезија или као додатна опција за неуспешну Халстедову анестезију.

Кључне речи: милохиоидни нерв; анестезија; артикаин; дексаметазон; дентоалвеоларна хирургија

INTRODUCTION

Dentoalveolar mandibular surgery frequently considers treatment pathologies, such as impacted teeth, retained roots, and bone cysts [1]. Tooth impaction is described as a tooth that has not emerged into its designated position in the dental arch due to malposition or insufficient space [2], with a fully formed root (closed dental papilla) [3, 4]. Mutations in the parathyroid hormone 1 receptor (*PTHRI*), contribute to primary eruption failure [5]. The retained roots become “forgotten” in the jaws, presenting as dental pain and cystic lesion [6].

The appropriate local anesthesia method for this purpose is the so-called “mandibular nerve anesthesia,” even though it is an inaccurate term, according to Malamed [7]. This is the technique of local direct conduction anesthesia for the inferior alveolar nerve block (IANB), as outlined by Halsted, and the lingual nerve, along with the buccal nerve, when needed. However, there are indications of failure in up to 20% of the cases, or even higher [8, 9].

Sillanpää et al. [10], introduced the mylohyoid nerve mandibular anesthesia (MMA), achieving 21% anesthesia for the first molar. Later, Altug et al. [11], administered 1 mL of 4% articaine

HCl with epinephrine 1:200,000, for a sublingual distal injection into the distal root of the first molar in an effort to attain anesthesia of the mylohyoid nerve, achieving local anesthesia in half of the subjects. Clark et al. [12], reported very limited anesthetic effectiveness for mandibular premolars using MMA. Surprisingly, a recent report [13], emerged regarding the use of 4% articaine with a 1:100,000 adrenaline mixture along with dexamethasone, with the intent of achieving MMA [14], which demonstrated an anesthetic success rate identical to 2% lidocaine with adrenaline 1:100,000, for Halsted's anesthesia for IANB.

The purpose of this research was to present the results of the efficacy of MMA as a primary mandibular anesthesia, utilizing 4% articaine with epinephrine with the addition of dexamethasone, for the dentoalveolar surgery of the impacted mandibular second permanent premolars.

CASE REPORT

The patient's full verbal and signed consent was obtained for all the diagnostic, anesthetic, and surgical procedures in our department (Informed Consent), which were in accordance with the Helsinki Declaration. We received the approval from the Ethical Board at our institutions for the following treatment as well.

Anesthesia variables and protocol

The surgery was performed under local anesthesia, by modified mylohyoid nerve anesthesia. The measured (minutely) variables, were as follows: onset time-the time measured from the moment of injection to the first sign of anesthesia effectiveness represented by numbness on the ipsilateral hemitongue and lip; the patient's intraoperative pain was measured with a visual analog scale (VAS); the effectiveness of administered anesthesia was considered successful, if the measurements were "no pain up to 4 mm, or a pain rating of up to 44 mm", which is considered mild pain [14, 15]; duration of the anesthesia – the time from onset time to the cessation of lip and tongue numbness.

An aseptic plastic 5 mL syringe (Nipro syringe, Shanghai International Holding Corp. GmbH (Europe), Eifestrasse 80, 20537 Hamburg, Germany) served as a container, which consisted of 3.5 mL 4% articaine with 1:100000 adrenaline (Artinibsa, 40 mg/mL + 0.01mg/mL adrenaline; Inibsa Dental S.L.U., 08185 Lliçà de Vall, Barcelona, Spain), along with 0.5 mL dexamethasone (4mg/1mL), and the the sterile needle 21 G x 1½ ", 0.8 x 40 mm (Nipro needle, Nipro Europe N.V., Weihoek 3H, B-1930 Zaventem, Belgium).

A 51-year-old Caucasian female patient was examined, because of a recurring left dentoalveolar abscess (2-3 times), in the region of the missing lower left second premolars and molars, over the past 6 months. Physical examination showed a restriction when opening the mouth (trismus), with two middle fingers barely fitting interincisally. Medical history revealed that the patient had undergone gallstone abdominal surgery 6 months before the episodes of dentoalveolar abscesses.

The X-ray examination, including cone beam computed tomography (CT) (Sirona Galileos 3D Cone Beam Scanner® Germany), was performed. The 3D image revealed, that the second premolar was completely embedded in the mandibular bone, with the middle part of the root and the crown were lingually oriented. The procedure of MMA started with an angulated needle (107°), which was sublingually injected through sublingual mucosa, into the projection of the site missing the third lower left molar. The anesthetic maneuver was performed below the attachment line of the mylohyoid muscle on the mandible, reaching a depth of approximately 15mm. After a negative aspiration test was obtained, approximately 3.5 mL of the anesthetic solution (articaine + dexamethasone) was slowly deposited over 10–15 seconds. The remaining ≈ 0.5 mL of anesthetic solution was buccally injected. With scalpel #15 from the imaginary position of missing tooth #36 (distally), through the sulcular lingual incision encompassing teeth #34 and #33 (medially), lingual mucoperiosteal flap was elevated. With the use of a sterile round carbide-steel burr (# 167-141, Meisinger HM, Neuss, Germany), the crown of impacted #35 was exposed. The successful extraction of impacted tooth #35 was performed (Figure 1 A-D). The elevated mucoperiosteal flap was sutured with single interrupted non-absorbable sutures (Silk USP 4/0 EP 2, SMI AG Steinerberg 8, 4780 St.Vith, Belgium). The measured post-operative anesthesia variables were as follows: onset time of the hemitongue and lip, 1' and 2', respectively; the measured patient's intraoperative pain was 8mm (VAS); duration of the anesthesia was 270'. The operation time was 30'. The sutures were removed on the 8th post-operative day, with an uneventful postoperative course.

Ethics: The patient has been treated in accordance with the Helsinki Declaration. Informed Consent of the patient was received before the operation, and for the following treatment the Ethical Board Approvals of our institutions were received (No.14/16-2019-1 EO dated 28th November 2023, and No.12-16502/2-6 dated 21st December 2023) too.

DISCUSSION

Goldberg et al. [9] in their study of IANB, found that ranges of the success of anesthesia were as follows: Halsted's technique, 25%– 62%; Gow-Gates technique, 16%– 44%; and the Vazirani-Akinosi technique, 13%–50%. Failure of Halsted's technique includes sensitivity of mandibular teeth, such as the molars [16], and the mandibular nerve particularly sensitizes the premolar, canine, and incisor teeth via the accessory foramina on the lingual mandibular plate, with an incidence of 60% [17].

We used the MMA [13], which is categorized by the VAS scale as “no pain-mild pain.” There is evidence that separately used local anesthesia for lingual infiltration with 1.8 mL of 2% lidocaine with 1:100,000 adrenalin, as additional local anesthesia to the standard Halsted's IANB, with 3.6 mL of 2% lidocaine with 1:100,000 epinephrine, showed no contributive effect in increasing the anesthetic success for mandibular posterior teeth [18, 19, 20].

The second reason is the presence of nutritive holes on the lingual side of the mandible, which are “weak anatomical spots,” through which articaine can pass into the bone and diffuse into the IAN [21]. The third reason is the intensification of articaine anesthesia's pharmacokinetic abilities by adding dexamethasone. The fourth reason is the possibility that the articaine and dexamethasone anesthetic mixture, is sufficient for anesthesia success [22]. Stojanović et al. [23], significantly prolonged the anesthetic duration (592.5') of 0.75% ropivacaine, with the addition of dexamethasone for Halstead's IANB. Directly mixing dexamethasone with anesthetic for perioperative analgesia provide neural painful signal transmission in nociceptive C-fibers and blocks the ectopic neuronal discharge [23]. In the presented cases, the VAS scores were of 8mm and 28mm [14], respectively, indicating anesthetic success in providing perioperative analgesia, (VAS = 4mm/ 8mm, no pain, or mild pain= up to 44mm) [24], and prolonging the duration of the anesthesia to 270'.

Other authors who studied the anesthetic efficacy of 4% articaine vs. 2% lidocaine during the surgical removal of the third molar found that the duration of the anesthetic effect of articaine was 231', and that of lidocaine was 174', with Halstead's technique [24, 25]. It is proven that the concentration of articaine in the alveolus of the extracted tooth is 100 times higher than that in systemic circulation [26]. Articaine's is an amide anesthetic, which has a combination of an ester group and a thiophene ring; the thiophene ring enables articaine's very high lipophilicity and rapid diffusion through the bone into nerve cells, by the biochemical mechanism of the chemically induced intramolecular hydrogen bonding of bone tissue [24]. Pathak et al. [27], also found that dexamethasone convincingly prolongs the duration of anesthesia through

blocking vasodilatation induced by bradykinin. Dexamethasone added perineurally to the mylohyoid nerve and upon penetration of the lingual plate of the mandible to the inferior alveolar nerve could act as neuroprotective drug, which is proven in clinical practice [27].

The U.S. Food and Drug Administration recommendation specifies a maximum recommended dose of volume of 7 mg/kg (11.9 mL) of 4% articaine usage per visit, without an established absolute maximum; nonetheless, there is a maximum limit of 11 cartridges of 4% articaine, 1:100,000 epinephrine [28, 29, 30].

In conclusion, the modified mylohyoid nerve anesthesia may have the capacity to act as the main and sole local anesthesia, or as additional anesthesia for the surgery of impacted mandibular second permanent premolars.

Conflict of interest: None declared.

Paper accepted

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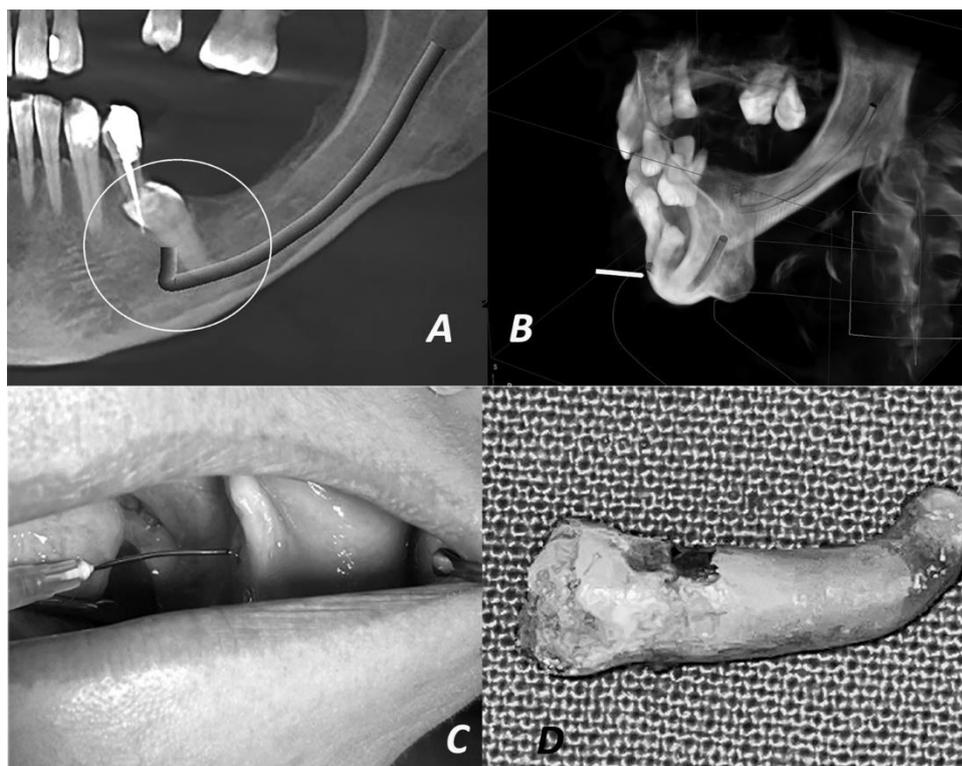


Figure 1. A) Cone-beam computed tomography (CBCT) imaging of the left mandibular side, showing the impacted second premolar (marked with a white circle); B) CBCT shows a “hook-like” angulation of the root apex (indicated by the white arrow); C) intraoral positioning of the needle for mylohyoid nerve mandibular anesthesia; D) extracted lower second premolar in one piece, with the root tip as a “hook”