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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

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

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SUMMARY
Introduction The use of the 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 impaction of the mandibular permanent second premolar; 3.5 mL of 4% articaine and 1:100,000 epinephrine were administered with 0.5 mL of dexamethasone using the MMA technique behind the site of the third molar. The pain was measured through the visual analog scale and recorded a value of 8 mm, with the duration of anesthesia being 270 minutes.
Conclusion Modified mylohyoid nerve anesthesia can be utilized independently as a primary anesthesia or as a supplementary option for insufficiently effective or failed Halsted anesthesia.
Keywords: mylohyoid nerve; anesthesia; articaine; dexamethasone; dentoalveolar surgery

INTRODUCTION

Dentoalveolar mandibular surgery frequently involves the treatment of pathologies, such as impacted teeth, retained roots, and bone cysts [1]. Tooth impaction is described as a tooth that has not erupted 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 (PTHR1) contribute to primary eruption failure [5]. The retained roots become "forgotten" in the jaws, presenting as dental pain and a 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 cases, or even higher [8, 9].

Sillanpää et al. [10] introduced the mylohyoid nerve mandibular anesthesia (MMA), achieving anesthesia of the first molar in 21% of cases. 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 IANB.

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

CASE REPORT

The patient's full verbal and signed consent was obtained for all diagnostic, anesthetic, and surgical procedures in our department (Informed Consent), which were in accordance with the Helsinki Declaration. We received approval from the ethics boards of 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 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

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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 to the cessation of lip and tongue numbness.

An aseptic plastic 5 mL syringe (Nipro syringe, Shanghai International Holding Corp. GmbH (Europe), Hamburg, Germany) served as a container, which consisted of 3.5 mL of 4% articaine with 1:100,000 adrenaline (Artinibsa, 40 mg/mL + 0.01 mg/mL adrenaline; Inibsa Dental S.L.U., Barcelona, Spain) along with 0.5 mL of dexamethasone (4 mg/1 mL), and a sterile needle 21 G x 1½ ", 0.8 x 40 mm (Nipro needle, Nipro Europe N.V., 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 premolar and molars, over the previous six 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.

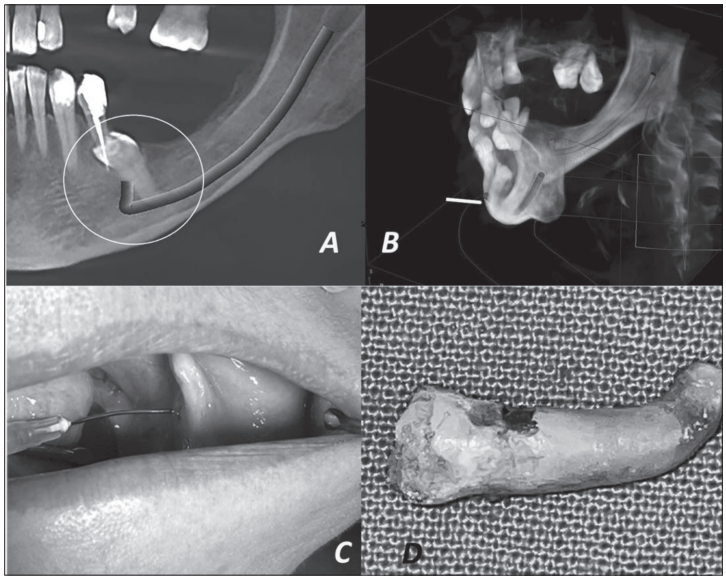

Figure 1. A) Cone-beam computed tomography (CBCT) imaging of the left mandibular side, showing the impacted second premolar (marked with a white circle); B) CBCT shows a "hook-like" angulation of the root apex (indicated by the white arrow); C) intraoral positioning of the needle for mylohyoid nerve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

The X-ray examination, including cone-beam computed tomography (CT) (Sirona Galileos 3D Cone Beam Scanner®) 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 being lingually oriented. The procedure of MMA started with an angulated needle (107°), which was sublingually injected through the sublingual mucosa into the projection of the site of 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 15 mm. 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 a sulcular lingual incision encompassing teeth #34 and #33 (medially), a lingual mucoperiosteal flap was elevated. With the use of a sterile round carbide-steel burr (No. 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 nonabsorbable sutures (Silk USP 4/0 EP 2, SMI AG St.Vith, Belgium). The measured postoperative anesthesia variables were as follows: onset time of the hemitongue and lip, 1 minute and 2 minutes, respectively; the measured patient's intraoperative pain was 8 mm (VAS); duration of the anesthesia was 270 minutes. The operation time was 30 minutes. The sutures were removed on the eighth postoperative day, with an uneventful postoperative course.

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

DISCUSSION

Goldberg et al. [9] in their study of IANB found that the ranges of anesthetic success 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 MMA, which is categorized by the VAS scale as "no pain – mild pain." [13] There is evidence that separately used local anesthesia for lingual infiltration with 1.8 mL of 2% lidocaine with 1:100,000 adrenaline, 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 anesthetic success for mandibular posterior teeth [18, 19, 20].

The second reason is the presence of nutrient foramina 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 properties 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 minutes) of 0.75% ropivacaine with the addition of dexamethasone for Halsted's IANB. Directly mixing dexamethasone with anesthetic for perioperative analgesia provides neural painful signal transmission in nociceptive C-fibers and blocks ectopic neuronal discharge [23]. In the presented cases, the VAS scores were 8 mm and 28 mm [14], respectively, indicating anesthetic success in providing perioperative analgesia (no pain up to 4 mm, or mild pain up to 44 mm on the VAS) [24], and prolonging the duration of the anesthesia to 270 minutes.

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 minutes, and that of lidocaine was 174 minutes, with Halsted'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 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 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 a neuroprotective drug, which is proven in clinical practice [27].

The U.S. Food and Drug Administration recommendation specifies a maximum recommended dose of 7 mg/kg (11.9 mL) of 4% articaine per visit, without an established absolute maximum; nonetheless, there is a maximum limit of 11 cartridges of 4% articaine with 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.

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Модификована анестезија милохиоидног нерва применом 4% артикаина са адреналином и дексаметазоном у мандибуларној дентоалвеоларној хирургији

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САЖЕТАК

Увод Употреба модификоване анестезије милохиоидног нерва у дентоалвеоларној хирургији је ретка.

Приказ болесника Приказана је 51-годишња пацијенткиња са хроничном упалом и болом у пределу недостајућег доњег левог другог преткутњака и кутњака. Конусном компјутеризованом томографијом мандибуле утврђена је лингвална импакција мандибуларног сталног другог преткутњака са леве стране. Апликовано је 4 *ml* анестетичког раствора састављеног од 3,5 *ml* 4% артикаина са 1 : 100.000 адреналина и 0,5 *ml* дексаметазона. Ефикасност модификоване анестезије милохиоидног нерва у смањењу интраоперативног бола процењена је помоћу визуелне аналогне скале (*VAS,* изражена у *mm*), која је забележила вредност од 8 *mm*, док је трајање анестезије износило 270 минута.

Закључак Модификована анестезија милохиоидног нерва може се користити као примарна анестезија или као додатна опција код неуспешне Халстедове анестезије.

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