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MODIFIKOVANA MILOHIOIDNA ANESTEZIJA SA 4% ARTIKAINOM I ADRENALINOM I DEKSAMETAZONOM U HIRURGIJI MANDIBULARNIH MOLARA: PILOT STUDIJA

MODIFIED MYLOHYOID ANESTHESIA WITH 4% ARTICAINE AND WITH ADRENALINE AND DEXASAMETHASONE IN MANDIBULAR MOLAR SURGERY: A PILOT STUDY

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Sažetak

Uvod: *Milohioidna mandibularna anestezija nije standardna i samostalna primarna anestezija za izvođenje operacija na mandibularnim zubima.*
Cilj: *Da se ispita uspešnost postignute milohioidne anestezije za hirurgiju mandibularnih molara, ubrizgavanjem anestetika, koji može da penetrira u kost u lingvalnom predelu mandibule, tehnikom za modifikovanu milohioidnu mandibularnu anesteziju.*
Materijal i metode: *U pilot studiji, 10 pacijenata je podeljeno u 2 jednake grupe (5 pacijenata), oba pola i starosti od 18-75g., kojima je zbog hirurgije mandibularnih molara bila neophodna mandibularna anestezija. U I grupi, modifikovanim milohioidnim pristupom ubrizgan je 3,5 ml 4% artikain sa adrenalinom 1:100000 sa dodatkom 0,5ml/4mg deksametazona, u sublingvalni predeo ugla mandibule modifikovanim milohioidnim pristupom; u II grupi je pristupom za standardnu mandibularnu sprovodnu direktnu anesteziju u predeo foramena mandibule, ubrizgano 4ml 2% lidokaina sa adrenalinom 1: 100000. Primenjena je vizuelno analogna skala (VAS) za subjektivnu procenu bola u toku operacije kod pacijenata, beleženo je vreme postignute dužine trajanja postignute mandibularne anestezije, kao i ukupna efikasnost postignutih anestezija, izražena u procentima.*
Rezultati: *Kod svih pacijenata je postignuta uspešna intervencija, sa različitom ocenom VAS-a, ali u vrednostima koje označavaju uspešnu anesteziju (I grupa 17.40±11.10mm; II grupa 12.80±4.55mm). Postignuto je duže vreme trajanja anestezije u I grupi 205,2 min (3h 25'), u odnosu na drugu grupu 182min (3h 2').*
Zaključak: *Modifikovana milohioidna mandibularna anestezija sa 4% artikainom sa adrenalinom i deksametazonom mogla bi da bude, primenjena kao primarna anestezija, za uspešno postizanje standardne mandibularne anestezije.*

Ključne reči: *modifikovana, milohioidna anestezija, artikain, mandibularni molari, hirurgija*

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Abstract

Introduction: *Mylohyoid mandibular anesthesia is not a standard and independent primary anesthesia for performing surgery on mandibular teeth.*
Objective: *The objective was to examine the success of achieved mylohyoid anesthesia for mandibular molar surgery, by injecting an anesthetic that could penetrate the bone in the lingual region of the mandible, using the technique for modified mylohyoid mandibular anesthesia.*
Materials and methods: *In the pilot study, 10 patients were divided into 2 equal groups (of 5 patients each), of both sexes and aged 18–75, who required mandibular anesthesia owing to mandibular molar surgery. In group I, 3.5 ml of 4% articaine with 1:100000 adrenaline, and the addition of 0.5 ml/4 mg of dexamethasone, was injected into the sublingual region of the corner of the mandible using a modified mylohyoid approach; in group II, 4 ml of 2% lidocaine with 1:100000 adrenaline was injected into the region of the mandibular foramen using the approach for standard mandibular conduction direct anesthesia. A visual analogue scale (VAS) was used for the subjective assessment of the pain during surgery in patients, the recorded duration of the realized mandibular anesthesia, as well as the total effectiveness of the achieved anesthesia, expressed in percentages.*
Results: *A successful intervention was achieved in all patients, with different VAS scores, but within the values indicating successful anesthesia (group I: 17.40±11.10mm; group II: 12.80±4.55mm). A longer duration of anesthesia was achieved in the first group—205.2 min (3h 25 min), compared to the second group—182 min (3h 2 min).*
Conclusion: *Mylohyoid mandibular anesthesia with 4% articaine and with adrenaline and dexamethasone could be applied as primary anesthesia for the purpose of successfully achieving standard mandibular anesthesia.*

Key words: *modified, mylohyoid mandibular anesthesia, articaine, mandibular molars, surgery*

Uvod

U svakodnevnoj stomatološkoj praksi, kao i u ambulantnoj dentoalveolarnoj hirurgiji, anestezija za donji alveolarni nerv, kao i za drugu oralnu granu mandibularnog nerva (*n. lingualis*), postiže se sprovodnom direktnom mandibularnom tehnikom anestezije (Halstedova tehnika), kojom se ubrizgava lokalni anestetik u predeo foramena mandibule[1-3]. Iako je Halstedova tehnika lokalne anestezije izuzetno uspešna tehnika (zato se u kliničkoj praksi standardno naziva mandibularna anestezija), u različitim studijama zabeležen je neuspeh od 38% do 75% kod pacijenata kod kojih je primenjena Halstedova tehnika mandibularne anestezije[4,5].

Lokalni anestetik koji se masovno koristi u stomatološkoj praksi i koji može predstavljati „zlatni standard" jeste 2% lidokain sa adrenalinom (1 : 100000); on poseduje dobra farmakodinamska i farmakokinetička svojstva i spada u lokalne anestetike sa srednjom dužinom trajanja postignute lokalne anestezije (190 min). Međutim, lidokain nema svojstvo da prodire u koštana tkiva[6].

Artikain pripada grupi amidnih anestetika (zajedno sa lidokainom, mepivakainom, bupivakainom i prilokainom) i ima estarsku grupu, kao i tiofenski prsten umesto benzenskog prstena. Tiofenski prsten omogućava artikainu izuzetnu lipofilnost i brzinu prodiranja u ćelije kroz lipidnu membranu nervne ćelije, kao i u okolno tkivo[7-9]. Tiofenski prsten odgovoran je za moguću difuziju artikaina kroz kost, odnosno intramolekularna vodonična veza u artikainu može biti povezana sa superiornim koštano-tkivnim prodorom artikaina[10]. Artikain postiže viši anestetički uspeh nego lidokain za mandibularne i maksilarne molare bukalnom infiltracijom[11-13]; upravo je postojanje tiofenskog prstena objašnjenje većeg uspeha artikaina u odnosu na lidokain[14] .

Zabeleženo je i da artikain, kao dopunska infiltraciona anestezija za mandibularne zube, daje bolji anestetički efekat pulpalne anestezije kod neuspešnih mandibularnih anestezija sa lidokainom[15].

Podaci iz literature pružili su dokaze o uspešnoj primeni deksametazona u kombinaciji sa lokalnim anesteticima dugog dejstva u obezbeđivanju perioperativne anestezije / analgezije[16-18].

Jedan od mogućih razloga za neuspeh standardne mandibularne anestezije jeste i dopunska senzitivna inervacija mandibularnih zuba od 10% do 20%, od strane milohioidnog nerva, koji primarno obezbeđuje motornu inervaciju za digastrični mišić i milohioidni mišić[19].

Introduction

In daily dental practice, as well as in ambulatory dentoalveolar surgery, anesthesia for the lower alveolar nerve, as well as for the second oral branch of the mandibular nerve (*n. lingualis*), is achieved with the direct mandibular anesthesia technique (the Halsted technique), where a local anesthetic is injected into the foramen area of the mandible[1-3]. Although the Halsted technique of local anesthesia is an extremely successful technique, which is why it is called mandibular anesthesia as a standard in clinical practice, various studies have recorded a failure rate of 38–75% in patients to whom the Halsted technique of mandibular anesthesia was administred[4,5].

Lidocaine 2% with adrenaline (1:100000) is a local anesthetic widely used in dental practice, which can represent the "gold standard"; it possesses good pharmacodynamic and pharmacokinetic properties, and belongs to a group of local anesthetics with a medium duration of realized local anesthesia (190 min). However, lidocaine does not possess the ability to penetrate bone tissues[6].

Articaine belongs to the group of amide anesthetics (along with lidocaine, mepivacaine, bupivacaine and prilocaine), and has an ester group, as well as a thiophene ring instead of a benzene ring. The thiophene ring enables articaine's exceptional lipophilicity and speed of penetration into cells through the lipid membrane of the nerve cell, as well as into the surrounding tissue[7–9]. The thiophene ring is responsible for the possible diffusion of articaine through the bone, i.e., the intramolecular hydrogen bond in articaine can be connected to the superior bone tissue via articaine penetration[10]. Through buccal infiltration, articaine achieves a higher anesthetic success for mandibular and maxillary molars than lidocaine does[11–13] and the existence of the thiophene ring is the explanation for the greater success of articaine compared to lidocaine[14].

It has also been noted that articaine gives a better anesthetic effect of pulpal anesthesia as a supplementary infiltration anesthesia for mandibular teeth, in case of unsuccessful mandibular anesthesia with lidocaine[15].

Literature data have provided evidence of the successful application of dexamethasone in combination with long-acting local anesthetics for the provision of perioperative anesthesia/analgesia[16–18].

One of the possible reasons for the failure of standard mandibular anesthesia is

U nama dostupnoj literaturi na engleskom jeziku, oskudni su podaci koji ukazuju na to da je uspešno korišćena milohioidna anestezija kao primarna anestezija za hirurgiju mandibularnih molara. Neki autori su zabeležili da je postignut uspeh anestezije u predelu prvog molara sa milohioidnom anestezijom,[20] kod 21% pacijenata. Ayberk i saradnici[21] su sa milohioidnom anestezijom, kod 54,2% pacijenata postigli uspešnu endostealnu implantaciju u mandibuli, koristeći 1 ml 4% artikaina sa adrenalinom 1 : 200000.

Clark i Tebo[22] utvrdili su da u 90% slučajeva postoje dopunski otvori na lingvalnoj strani mandibule iza trećeg molara i u predelu milohioidnog mišića, koji sadrže nervne i vaskularne anatomske elemente[23-25].

Na osnovu ovih podataka, smatrali smo da bi bilo interesantno postaviti kao cilj rada, ispitivanje uspešnosti ubrizgavanja lokalnog anestetika artikaina u sublingvalni predeo mandibule suprakortikalno, modifikovanom tehnikom za milohioidnu anesteziju, kako bi artikain, kao infiltraciona anestezija, mogao da prodire kroz lingvalni korteks mandibule i prodre u predeo molara i da izvrši dovoljno duboku primarnu anesteziju za uspešnu hirurgiju mandibularnih zuba.

Materijal i metode

Kliničko ispitivanje efikasnosti milohioidne anestezije u hirurgiji mandibularnih zuba urađeno je u skladu sa principima Helsinške deklaracije o zaštiti pacijenata kod kojih se primenjuju anestetička sredstva[26], odnosno onda kada je primenjena lokalna anestezija u hirurgiji donjih molara[17]. U ovoj pilot studiji deset pacijenata (ASA I – zdravi pacijenti)[27] podeljeno je u dve jednake grupe (po pet pacijenata). Odabrani su pacijenti oba pola, starosti od 18 do 75 godina, kojima je zbog hirurgije mandibularnih molara bila neophodna mandibularna anestezija. Svi ispitanici su bili zdravi i bez anamnestičkih podataka o hroničnim ili akutnim oboljenjima i alergijama na lokalne anestetike, kao i o drugim bolestima koje mogu biti kontraindikacija za predviđenu operaciju. Takođe, svi ispitanici dali su pismenu saglasnost na prethodno obrazloženu predloženu proceduru i predložene tehnike anestezije sa ispitivanim anesteticima.

Postavljanje definitivne dijagnoze i indikacija za operativni zahvat na mandibularnim molarima rađeno je na osnovu kliničkog pregleda i odgovarajuće rendgen dijagnostike.

the supplemental sensory innervation of the mandibular teeth in 10–20%, by the mylohyoid nerve, which primarily provides motor innervation for the digastric muscle and the mylohyoid muscle[19].

In the literature available to us in the English language, there is not enough information to indicate that mylohyoid anesthesia has been successfully used as primary anesthesia for mandibular molar surgery. Some authors have noted that anesthesia success was achieved in 21% of the patients in the region of the first molar with mylohyoid anesthesia[20]. Ayberk et al.[21] achieved successful endosteal implantation in the mandible with mylohyoid anesthesia in 54.2% of patients, using 1 ml of 4% articaine with 1:200000 adrenaline.

Clark and Tebo[22] found that, in 90% of the cases, there are additional openings on the lingual side of the mandible behind the third molar and in the area of the mylohyoid muscle, which contain nervous and vascular anatomical elements[23–25].

Based on these data, we believed that it would be interesting to set the goal of this work, which would examine the success of injecting the local anesthetic articaine into the sublingual region of the mandible supracortically, using the modified technique for mylohyoid anesthesia, so that articaine would be able to penetrate through the lingual cortex of the mandible in the form of infiltration anesthesia, penetrate the molar area and perform a sufficiently deep primary anesthesia for successful mandibular tooth surgery.

Material and methods

A clinical trial of the effectiveness of mylohyoid anesthesia in mandibular dental surgery was performed in accordance with the principles of the Helsinki Declaration on Patient Safety when anesthetic agents are administered to the mentioned[26], i.e., when local anesthesia is applied in lower molar surgery[17]. In this pilot study, 10 patients (ASA I—healthy patients)[27], were divided into 2 equal groups (5 patients), of both sexes and aged 18—75, who required mandibular anesthesia owing to mandibular molar surgery. All the subjects were healthy, and without anamnestic data on chronic or acute diseases and allergies to local anesthetics, as well as other diseases that could be a contraindication for the intended operation. In addition, all the subjects gave their written consent to the previously explained proposed procedure and proposed anesthesia techniques with the anesthetics tested.

Pacijenti su selektovani u grupe za ispitivanje slučajnim odabirom, tehnikom zatvorene koverte, kako bi primili jedan od ispitivanih anestetika sa određenom tehnikom lokalne anestezije[28] zbog operacija na mandibularnim molarima.

U prvoj grupi, modifikovanom tehnikom milohioidne anestezije, u brizgalicu od 5 ml uvučen je rastvor 3,5 ml 4% artikaina sa adrenalinom 1 : 100000 (Artinibsa, 40 mg/ml + 0,01 mg/ml adrenalina; Inibsa Dental S.L.U., 08185 Lliçà de Vall, Barcelona, Spain), koji je zatim direktno pomešan u brizgalici sa dodatih 0,5 ml / 4 mg deksametazona (4 mg/ml; Galenika a.d., Beograd, Republika Srbija), čime je dobijena ukupna količina anestetičkog rastvora (AaD) od 4 ml za ubrizgavanje u tkivo. Od ove količine anestetičkog rastvora ubrizgano je 3,5 ml u bolusu u sublingvalni predeo mandibule (videti dole opis tehnike), gde je ova količina služila i za anesteziju *n. lingualisa*, dok je preostalih 0,5 ml služilo za anesteziju *n. buccalisa* u bukalni sulkus mandibule. Originalna tehnika milohioidne anestezije opisuje da vrh igle brizgalice sa anestezijom dostiže predeo iza distalnog korena prvog mandibularnog molara ispod milohioidnog mišića[20].

U ovoj studiji urađena je modifikacija opisane originalne tehnike, jer su ubadanje i prodor vrha zakrivljene, angulirane igle (107°) kroz meko tkivo pomereni distalnije od prvog mandibularnog molara, iza distalnog korena trećeg molara u sublingvalnom/suprakortikalnom predelu mandibule, ispod predela pripojne linije milohioidnog mišića na mandibuli, i sa ubadanjem vrha igle nadole i lateralno, u dubini do 15 mm, odnosno do kontakta sa unutrašnjom stranom kortikalne kosti mandibule[22]. U drugoj grupi je takođe upotrebljena brizgalica od 5 ml u koju je uvučena količina od 4 ml anestetičkog rastvora (Lidokain 2% – adrenalin 40 mg / 2 ml + 0,025 mg / 2 ml; Galenika a.d., Beograd) – La. Pristupom za standardnu mandibularnu sprovodnu direktnu anesteziju u predeo foramena mandibule (Halsted tehnika) ubrizgano je 3,0 ml 2% lidokaina sa adrenalinom za anesteziju *n. alveolaris inferiora*, 0,5 ml za anesteziju *n. lingualisa* i 0,5 ml za anesteziju *n. buccalisa*. Primenjena je vizuelno-analogna skala (VAS) za subjektivnu procenu bola kod pacijenata u toku operacije[29], koja predstavlja horizontalnu liniju od 0 mm do 100 mm (10 cm), gde 0 mm označava da nema bolova, dok je 100 mm oznaka za najgori mogući bol; na samoj liniji pacijenti su olovkom povukli vertikalnu liniju da bi označili svoj doživljeni bol u toku operacije.

Establishing a definitive diagnosis and indications for surgery on the mandibular molars was based on a clinical examination and the appropriate X-ray diagnostics.

Patients were selected into study groups, by random selection, using the closed envelope technique, to receive one of the investigated anesthetics with a specific local anesthesia technique[28], for the purpose of undergoing surgery on mandibular molars.

In the first group, employing the technique of modified mylohyoid anesthesia, a solution of 3.5 ml of 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), was injected into a 5 ml syringe, which was then directly mixed in the syringe with added 0.5 ml/4 mg of dexamethasone (4 mg/ml, Galenika a.d., Belgrade, Republic of Serbia), resulting in a total amount of anesthetic solution (AaD) of 4 ml for injection into tissue. From this amount of the anesthetic solution, 3.5 ml was injected, in the form of a bolus, into the sublingual area of the mandible (see below for the description of the technique), where this amount was also used for the anesthesia of *n.lingualis*, while the remaining 0.5 ml was used for anesthesia of the *buccal nerve* in the buccal sulcus of the mandible. The original technique of mylohyoid anesthesia requires that the tip of the needle with the anesthetic syringe reach the area behind the distal root of the first mandibular molar below the mylohyoid muscle[20].

In this study, a modification of the described original technique was performed, so the insertion and penetration of the tip of the curved-angled needle (107°) through the soft tissue was moved distally, behind the distal root of the third molar in the sublingual/supracortical area of the mandible, below and in the area of the attachment line of the mylohyoid muscle on the mandible, and with the tip of the needle inserted downwards and laterally at a depth of 15 mm, i.e., until contact was made with the inner side of the cortical mandible bone[22]. In the second group, a 5 ml syringe was also used, into which a quantity of 4 ml of the anesthetic solution was drawn (2% lidocaine–adrenaline 40 mg/2 ml +0.025 mg/2 ml, Galenika a.d., Belgrade) (La); by using the approach of standard mandibular conduction direct anesthesia in the region of the foramen of the mandible (the Halsted technique), 3.0 ml of 2% lidocaine with adrenaline was injected for the anesthesia of the inferior alveolar nerve, 0.5 ml for the anesthesia of the lingual nerve and 0.5 ml for the anesthesia of the buccal nerve.

Anestezija je smatrana uspešnom ako je zub hirurški izvađen i ako pacijent nije osetio bol (VAS do 4 mm) ili je doživeo umereni bol (VAS do 44 mm)[30]. Dužina trajanja anestezije (u minutima) praćena je od momenta pune utrnulosti donje usne na operativnoj strani i neosetljivosti mukoze u zoni rada, koja se proveravala punktiranjem mukoze sa tupom sondom, do trenutka kada pacijent više nije osećao utrnulost usne na strani operacije.

Pacijentima je naloženo da zabeleže vreme prestanka utrnulosti donje usne na strani prethodno urađene operacije. Takođe, pacijentima je ordinirana i analgetska i antibiotska profilaksa, uz dati specijalistički nalog za svakog operisanog pacijenta, ponaosob. Svi dobijeni podaci beleženi su u istraživački karton.

Statistička obrada podataka

Podaci su prikazani u vidu aritmetičke sredine i standardne devijacije, odnosno u vidu apsolutnih i relativnih brojeva. Poređenje numeričkih varijabli vršeno je T-testom ili Mann–Whitney testom u zavisnosti od distribucije podataka. Nulta hipoteza je testirana sa pragom značajnosti $p<0,05$. Statistička obrada podataka vršena je u programskom paketu SPSS 16,0.

Rezultati

U pilot istraživanje uključeno je 10 pacijenata (5 muškog i 5 ženskog pola). Prosečna starost ispitivane populacije bila je 29,50 godina ± 7,26 godina (minimum 20 godina, maksimum 43 godina). U Tabeli 1 data je distribucija zuba. Prosečna vrednost VAS-a bila je 15,10 ± 8,36 (minimum 0, maksimum 29). Prosečno trajanje anestezije je 193,60 min ± 98,89 min (minimum 70 min, maksimum 410 min). Kod pet pacijenata primenjena je AaD (3,5 D + 0,5 D), a kod pet pacijenata Lid+a anestezija (tabela 1).

Pacijenti su podeljeni u dve grupe (Grupa I i Grupa II). Grupu I činili su muški pacijenti kod kojih je primenjivana AaD (3,5 Aa + 0,5 D), a Grupa II pacijenti ženskog pola kod kojih je primenjivana Lid+a.

Utvrđeno je da ne postoji statistički značajna razlika u odnosu na starost pacijenata po grupama ($p = 0,069$). Prosečna vrednost VAS-a ne razlikuje se statistički značajno u grupama ($p = 0,207$).

Trajanje anestezije ne razlikuje se statistički značajno u ispitivanim grupama ($p=0,754$)(Tabela 2).

A visual analog scale (VAS) was applied for the subjective assessment of pain in patients during surgery[29]. The scale represents a horizontal line from 0 to 100 mm (10 cm), where mark 0 signifies no pain and mark 100 mm signifies the worst possible pain; on the line itself, patients drew a vertical line with a pencil to mark the pain they experienced during the operation. Anesthesia was successful if the tooth was surgically extracted and if the patient did not feel pain (VAS up to 4 mm) or experienced moderate pain (VAS up to 44 mm)[30]. The duration of anesthesia (in minutes) was monitored from the moment of the full numbness of the lower lip at the side which was undergoing surgery and insensitivity of the mucosa in the operation zone, which was checked by puncturing the mucosa with a blunt metal probe, until the moment when the patient no longer felt the numbness of the lip or the oral mucosa around the tooth on the side where the surgery was conducted.

The patients were instructed to record the time when the numbness of the lower lip on the side of the previously performed surgery stopped. What is more, the patients were prescribed analgesic and antibiotic prophylaxis with a referral given for each individual patient who was operated on. All the obtained data were recorded in the research file.

Statistical data processing

The data are presented in the form of arithmetic mean and standard deviation, that is, in the form of absolute and relative numbers. Comparison of numerical variables was performed by t-test or Mann-Whitney test depending on the data distribution. The null hypothesis was tested with a significance threshold of $p< 0.05$. Statistical data processing was performed in the SPSS 16.0 software package.

Results

Ten patients (5 male and 5 female) were included in the pilot study. The average age of the studied population was 29.50±7.26 years (min: 20 years, max: 43 years). Table 1 shows the distribution of teeth. The average value of VAS was 15.10±8.36 (min: 0, max: 29). The average duration of anesthesia was 193.60±98.89 min (min: 70 min, max: 410 min). AaD (3.5Aa+0.5D) was used in five patients, and Lid+a(4) anesthesia in five patients (Table 1). Patients were divided into two groups (Group I and Group II). Group I

VAS skala je pokazala ujednačene rezultate sa prosečnim vrednostima, što je pokazalo da pacijenti ukazuju na bolne senzacije u rasponu od „bez bola do umerenog bola“; prosečan VAS u grupi I bio je 17.40±11.10 mm, dok je u grupi II bio 12.80±4.55 mm. Trajanje anestezije je bilo duže u prvoj grupi, u proseku 205,2 minuta (3h 25 minuta), dok je trajanje anestezije bilo 182 minuta (3h 02 minuta) u drugoj grupi (tabela 1). Primenjene anestezije u obe grupe ispitanika su bile uspešne kod svih ispitanika (100%).

Comprised male patients who received AaD , and Group II comprised female patients who received Lid+a.

It was found that there was no statistically significant difference in relation to the age of the patients by group (p=0.069). The average value of VAS did not differ statistically significantly in relation to the groups (p=0.207).

The duration of anesthesia did not differ statistically significantly in relation to the studied groups (p=0.754) (Table 2).

The VAS scale showed uniform results with average values, which showed that patients indicated a painful sensation ranging from “no pain to moderate pain”; the average VAS in the Group I was 17.40±11.10 mm, while the one in the Group II was 12.80±4.55 mm. The duration of anesthesia was longer in the Group I, with an average of 205.2 min (3h 25 min), while the duration of anesthesia was 182 min (3h 02 min) in the Group II (Table 1). In both groups, the applied anesthesia was successful in all patients (100%).

Tabela 1. Demografske i kliničke karakteristike ispitivane populacije

Table 1. Demographic and clinical characteristics of the studied population

Parametar Parameter	Broj Number	%
Starost† Age	29.50±7.26	20-43
Pol Gender		
Muški Male	5	50.0
Ženski Female	5	50.0
Zub Tooth		
38	3	30.0
46	1	10.0
48	6	60.0
Vas	15.10±8.36min	0-29
Trajanje anestezije (min) † Duration of Anesthesia	193.60±98.89min	70-410
Vrsta i količina anestetika† Type and Amount(ml) of anesthetic		
AaD (**3,5+0.5)**	5	50.0
Lid+a(4ml)	5	50.0

† podaci su prikazani vidu aritmetičke sredine±standardne devijacije, minimalne i maksimalne vrednosti
† data are presented as arithmetic mean ± standard deviation, minimum and maximum values

Tabela 2. Demografske i kliničke karakteristike u odnosu na ispitivane grupe

Table 2. Demographic and clinical characteristics in relation to the studied groups

Parametar Parameter	Grupa I Group I		Grupa II Group II		p
Starost Age	33.60±7.23		25.40±4.93		0.069[1]
Pol Gender					
Muški Male	5	100,0			
Ženski Female			5	100,0	
Zub Tooth					
38	2	40.0	1	20.0	
46	1	2.0	0	0.0	
48	2	40.0	4	80.0	
VAS†	17.40±11.10		12.80±4.55		0.207[2]
Trajanje anestezije (min) † Duration of anesthesia	205.20±139.58		182.00±46.72		0.754[2]
Vrsta i količina anestetika Type and amount(ml) of anesthetic					
AaD (3,5+0.5)	5	50.0			
Lid+a(4)			5	50.0	

[1] t -test, [2] Mann-Whitney test, † podaci su prikazani vidu aritmetičke sredine±standardne devijacije, minimalne i maksimalne vrednosti

t –test[1]’ Mann-Whitney test[2], † data are presented as arithmetic mean±standard deviation, minimum and maximum values

Diskusija

U ovoj studiji postignuta je uspešna anestezija u obe grupe ispitanika i urađene su predviđene operacije (ekstrakcije) na mandibularnim molarima. Od kliničke važnosti je uspešna modifikovana milohioidna anestezija kao primarna anestezija, koja je omogućila privremenu farmakološku desenzibilizaciju molarne mandibularne regije za izvršenje operacija. Smatramo da su ovo prvi originalni pozitivni rezultati koji idu u prilog primeni AaD anestetika za modifikovanu milohioidnu tehniku mandibularne anestezije, s obzirom na to da su u celoj prvoj grupi ispitanici iskazali uniformne pozitivne rezultate.

Nasuprot postignutom uspehu i efikasnoj milohioidnoj mandibularnoj anesteziji sa primenom AaD u ovoj studiji, Clark i saradnici[5] u svojoj studiji nisu dobili rezultate koji pokazuju da milohioidna anestezija može uspešno biti primenjena kao primarna anestezija, odnosno dopunska anestezija kod obezbeđivanja pulpalne anestezije kao test anestezije. Smatramo da se razlog gorih rezultata iz studije Clarka i saradnika[5] može potražiti u činjenici, da su pomenuti autori primenili anestetik lidokain 1,8 ml 2% sa adrenalinom 1 : 100000. Već smo prethodno istakli da lidokain, uprkos tome što ima dobra farmakološka svojstva i daje dobre rezultate u postizanju anestezije kod standardne Halstedove tehnike mandibularne anestezije, ne obezbeđuje potentnost za prodor kroz koštano tkivo, kako bi izvršio desenzibilizaciju molarne mandibularne regije[7,9]. U našoj studiji, uspešni rezultati anestetičkih varijabli postignuti su zahvaljujući izuzetnim farmakološkim svojstvima AaD-a, koji je jedini sposoban da prodre u koštano tkivo i koji je u bolusu ubrizgan sublingvalno u predeo milohiodnog mišića i supraperiostealno/suprakortikalno, u dubinu od 15 mm od površine sluzokože sublingvalne regije. AaD je verovatno na dva načina uspeo da obezbedi uspešnu milohioidnu anesteziju: direktnom difuzijom kroz nutritivne otvore na lingvalnoj strani mandibule prodirao je do nerva i natapao i sledstveno desenzibilisao *n. alveolaris inferior*, kao i direktnim prodorom kroz lingvalni korteks u predeo mandibularnog kanala, odnosno *n. alveolaris inferiora*; u isto vreme je zbog količine anestetika obuhvatio sublingvalno i *n. lingualis*. S druge strane, dodatak deksametazona Aa, nov je način da se poboljšaju farmakodinamska svojstva ovog anestetika. Deksametazon je u prethodnim studijama pokazao izuzetna pozitivna svojstva u podizanju potetnosti lokalnih anestetika.

Discussion

In this study, successful anesthesia was achieved in both groups of subjects, and the planned surgeries of the mandibular molars were performed. The successful modified mylohyoid anesthesia, utilized as a primary anesthesia, which enabled temporary pharmacological desensitization of the molar mandibular region for performing surgery, is of clinical importance. We believe that these are the first original positive results which support the use of AaD anesthetics for the modified mylohyoid technique of mandibular anesthesia, considering the fact that, in the entire first group, the subjects showed uniform positive results.

Contrary to the achieved success and effective mylohyoid mandibular anesthesia with the use of AaD in this study, the study performed by Clark et al.[5] did not yield results that would allow mylohyoid anesthesia to be successfully applied as primary anesthesia, i.e. supplementary anesthesia when providing pulpal anesthesia as a test anesthesia. We consider that the reason for such unfavorable results in the study by Clark et al.[5] can be found in the fact that these authors used 1,8 ml of anesthetic lidocaine 2% with 1:100000 adrenaline. It has previously been indicated that, although lidocaine has good pharmacological properties and provides good results in achieving anesthesia in the standard Halsted technique of mandibular anesthesia, it does not provide the potency for penetration through the bone tissue for the purpose of achieving the desensitization of the molar mandibular region[7,9]. In our study, the successful results of the anesthetic variables are the result of the exceptional pharmacological properties of AaD, which alone has the ability to penetrate bone tissue, and which was injected in the form of a bolus sublingually into the region of the mylohyoid muscle and supraperiosteally/supracortically, at a depth of 15 mm from the surface of the mucosa of the sublingual region. AaD probably managed to provide successful mylohyoid anesthesia in two ways: by direct diffusion through the nutritional openings on the lingual side of the mandible, it penetrated to the nerve and soaked the inferior alveolar nerve, thus desensitizing it, as well as by direct penetration through the lingual cortex into the region of the mandibular canal, i.e. *n.alveolaris inferior*, and at the same time, owing to the amount of the anesthetic, it sublingually included *n.lingualis*. On the other hand, the addition of dexamethasone AaD is a new way to improve the pharmacodynamic properties of this anesthetic. In previous studies, dexamethasone has shown exceptional positive properties in increasing the potency of local

U studiji u kojoj je deksametazon pomešan sa 0,75% ropivakainom postignuta perioperativna anestezija bila je skoro dva puta duža i trajala je 625,5 min (10,4 h); u drugoj grupi, u kojoj je bio primenjen samo 0,75% ropivakain, mandibularna anestezija trajala je 290 min (4,8 h)[17].

U ovoj studiji je klinički značajno produženo vreme trajanja milohioidne anestezije AaD (prosečno 205,2 min, tj. 3 h 25 min) u prvoj grupi, u odnosu na drugu grupu, u kojoj je prosečno vreme trajanja mandibularne anestezije bilo 182 min/3h 2 min), dakle, milohioidna anestezija trajala je 1,12 puta duže od standardne mandibularne anestezije Halstedovom tehnikom sa Lid + a; ovakav rezultat je iznenađenje, jer artikain ima prosečno vreme delovanja maksimalno do 1 h.[6] Ovakvi rezultati upućuju na to da je verovatno došlo do direktnih stimulativnih lokalnih efekata deksametazona, koji je, direktno pomešan sa AaD, na nervno vlakno (*n. alveolaris inferiora*), omogućio efikasnije sprečavanje prenosa bolnog impulsa. Opisani pozitivni efekat deksametazona na intezitet i produženje lokalne anestezije može se objasniti činjenicom da deksametazon direktno utiče na produženje nervne blokade, budući da sprečava prenos nociceptivnih bolnih impulsa duž mijelizovanog C nervnog vlakna kada je perineuralno primenjen, što su i drugi autori zabeležili[18,31-33]. Do dinamičnog i pozitivnog farmakološkog sleda događaja u ovoj studiji, verovatno je došlo kada je deksametazon, koji je sa artikainom direktno pomešan u brizgalici i ubrizgan u ciljno mesto opisanom modifikovanom tehnikom milohioidne anestezije, ispoljio prethodno opisana pozitivna farmakološka svojstva.

Zaključak

S obzirom na jednostavnost opisane tehnike modifikovane milohioidne anestezije sa artikainom i deksametazonom i postignute uspešne anestetičke efekte u hirurgiji mandibularnih molara, ova metoda bi, kao samostalna anestezija ili dopunska anestezija, mogla biti alternativa standardnoj mandibularnoj anesteziji po Halstedu, mada su potrebna dalja dopunska istraživanja anestetičkih varijabli.

Zahvalnica: Nema

Sukob interesa: Nema

anesthetics. In the study where dexamethasone was mixed with 0.75% ropivacaine, the achieved perioperative anesthesia was almost twice as long and lasted 625.5 min (10.4 h), while mandibular anesthesia lasted 290 min (4.8h) in the Group II, where only 0.75% ropivacaine was administered[17].

In this study, the duration of mylohyoid anesthesia was clinically significantly prolonged (average of 205.2 min/3h 25 min) in Group I than in Group II, where the average duration of mandibular anesthesia was 182 min/3h 02 min), that is, modified mylohyoid anesthesia lasted 1.12 times longer compared to standard mandibular anesthesia using the Halsted technique with Lid+a; this result is a surprise, because articaine has an average duration of action of up to 1 hour[6]. This indicates that there were probably direct stimulatory local effects of dexamethasone, which enabled a more efficient prevention of pain impulse transmission by being directly mixed with AaD on the nerve fiber (*n.alveolaris inferior*). Such a positive effect of dexamethasone on the intensity and prolongation of local anesthesia can be explained by the fact that dexamethasone directly affects the prolongation of the nerve blockade, because it prevents the transmission of nociceptive pain impulses along the myelized C nerve fiber, when dexamethasone is applied perineurally, which was also noted by other authors[18,31-33]. Such a dynamic and positive pharmacological sequence of events probably occurred in this study when dexamethasone, which was directly mixed with articaine in a syringe and injected into the target site using the described modified technique of mylohyoid anesthesia, exhibited the previously described positive pharmacological properties.

Conclusion

Considering the simplicity of the described technique of modified mylohyoid anesthesia with articaine and dexamethasone, and the successful anesthetic effects achieved in mandibular molar surgery, as independent anesthesia or supplementary anesthesia, this method could be an alternative to standard mandibular anesthesia acc., to Halsted, with further supplementary research of anesthetic variables.

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