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KLINIČKI ZNAČAJ INTRAPULPALNE ANESTEZIJE ZA BEZBOLAN STOMATOLOŠKI RAD

THE CLINICAL SIGNIFICANCE OF INTRAPULPAL ANESTHESIA FOR PAINLESS DENTAL PROCEDURE

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Sažetak

Uvod: *Eliminacija odontalgije i svih ostalih formi oralnog bola, koji nastaju u toku stomatoloških intervencija na zubnim tkivima, predstavlja i dalje jedan od glavnih ciljeva stomatološke profesije.*
Cilj rada: *Da se izvrši analiza podataka o primeni dopunske intrapulpalne anestezije u kliničkoj praksi.*
Materijal i metode: *Prikupljani su literaturni podaci o primeni intrapulpalne anestezije, karakteristikama ove tehnike dopunske anestezije, kao i rezultatima njene primene. Različite baze podataka krorišćene su u ovu svrhu, a najčešće su preuzimani digitalni podaci sa Google scholara, Medlinea, Science Directa, kao i podaci drugih biblioteka sa radovima u štampanom obliku.*
Zaključak: *Upotreba dopunske intrapulpalne anestezije u stomatološkoj/endodontskoj praksi, predstavlja praktičan i uspešan vid lokalne anestezije, kada standardna mandibularna anestezija za donji alveolarni nerv ne obezbeđuje dovoljno duboku periintervencionu analgeziju u toku stomatoloških intervencija na zubima.*

Ključne reči:*odontalgija, intrapulparna anestezija, mandibularna anestezija*

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Abstract

Introduction:*The elimination of odontalgia and all other forms of oral pain that occurs on dental tissues during dental interventions is still one of the main goals in the dental profession.*
Aim:*The aim of this paper wasto perform an analysis of the literature data on the use of supplementary intrapulpal anesthesia in clinical dental practice.*
Material and methods: *Literature data on the use of intrapulpal anesthesia, the characteristics of this technique of supplementary anesthesia as well as the results of its application were collected. Various databases were used for this purpose, digital data from Google Scholar, Medline, Science-Direct, as well as traditionallibraries with manuscripts in printed form were most often taken.*
Conclusion:*The use of supplementary intrapulpal anesthesia in dental/endodontic practice represents a practical and successful type of local anesthesia, when standard mandibular anesthesia for the lower alveolar nerve does not provide a deep enough peri-interventional analgesia for dental procedures.*

Key words:*odontalgia, intrapulpar anesthesia, mandibular anesthesia*

Uvod

Poznata je činjenica da neki od glavnih razloga za spovođenje stomatoloških intervencija na zubima, kao što su eliminacija zubnog bola (lat. odontalgia), eliminacija odontalgije i svih ostalih formi oralnog bola, koji nastaju u toku stomatoloških intervencija na zubnim tkivima, predstavljaju i dalje jedne od glavnih ciljeva u stomatološkoj profesiji. Frustrirajuća je činjenica, za stomatološku profesiju, da pacijenti i dalje povezuju bol sa stomatološkom intervencijom i smatraju bol obavezanim događajem u toku stomatoloških intervencija, posebno kada se izvode intervencije na zubnim tkivima zbog karijesa ili zbog endodontskih zahvata[1].

Primena različitih tehnika lokalne anestezije, u cilju sprečavanja nastanka bola u toku stomatoloških intervencija, danas je "zlatni standard"; svakodnevna klinička upotreba Halstedove tehnike sprovodne anestezije za anestezije n.alveolaris inferiora, n.lingualisa, uz dodatnu anesteziju za n.buccalis, doprinela je tome da se ova tehnika naziva standardnom mandibularnom tehnikom anestezije[2-4], sa procentom uspeha od 65% – 88%[6-8].

I pored relativno visokog procenta uspeha sprovodnih blok lokalnih anestezija za eliminaciju bola u toku standardnih stomatoloških intervencija, za vreme endodontskih intervencija nije uvek moguće zubnu pulpu i okolno tkivo uspešno anestezirati (posebno kod inflamacije pulpe – "vruć zub"; eng. "hot tooth"); procenat neuspeha lokalne sprovodne blok ili terminalne anestezije kod pulpitisa je 8 puta veći, nego kod intervencija na zubima bez zapaljenskih procesa[9,10].

U kliničkoj stomatološkoj praksi nema dovoljno podataka o primeni dopunskih tehnika lokalne anestezije, o eliminaciji bola u toku bolnih endodontskih intervencija, kao što je intrapulpalna tehnika lokalne anestezije (direktno ubrizgavanje lokalnog anestetika u telo pulpe)[11]. Stoga, treba prihvatiti kliničke rezultate koji govore o tome da uspešna tehnika lokalne anestezija za ekstrakciju zuba ne znači, po pravilu, i uspešnu anesteziju za bezbolni endodontski tretman zuba sa inflamiranom pulpom[12,13].

Cilj rada je da se izvrši analiza podataka o primeni dopunske intrapulpalne anestezije u kliničkoj praksi, kao i njene efikasnosti u eliminaciji bola u toku stomatoloških intervencija na zubnim tkivima i pulpom zuba.

Introduction

It is a well-known fact that one of the main reasons for performing dental interventions on teeth is the elimination of toothache (lat. odontalgia). The elimination of odontalgia and all other forms of oral pain that occurs on dental tissues during dental interventions is still one of the main goals in the dental profession. The fact that patients continue to associate and consider pain as a mandatory occurrence during dental interventions, especially when interventions are performed on dental tissues owing to tooth decay or during endodontic procedures, is extremely frustrating for the entire dental profession[1].

The application of various local anesthesia techniques for the purpose of preventing pain during dental interventions is the "gold standard" today. The daily clinical use of Halsted's conduction anesthesia technique for the anesthesia of the n.alveolaris inferior and n.lingualis, with additional anesthesia for the n.buccalis, has contributed to this technique being called the standard mandibular anesthesia technique[2-4], with a success rate of 65-88%[6-8].

Despite the relatively high success rate of local conductive block anesthesia in the elimination of pain during standard dental interventions, it is not always possible to successfully anesthetize the dental pulp and surrounding tissue (especially in the case of pulp inflammation/"hot tooth") during endodontic interventions. The failure rate of local conduction block or terminal anesthesia is 8 times higher in pulpitis than in dental interventions without inflammatory processes[9,10].

In clinical dental practice, there is not enough data for the application of additional local anesthesia techniques for the elimination of pain during painful endodontic interventions, such as the intrapulpal technique of local anesthesia (direct injection of local anesthetic into the pulp body)[11].The clinical results which show that a successful technique of local anesthesia for tooth extraction does not always entail achieving successful anesthesia for a painless endodontic treatment of teeth with an inflamed pulp should be accepted[12,13].

The aim of this paper wasto perform an analysis of the data on the use of supplementary intrapulpal anesthesia in clinical practice, as well as its effectiveness in the elimination of pain during dental interventions on dental tissues and the tooth pulp.

Intrapulpalna mreža nerava

Bol (intezivan i oštar), koji nastaje u toku uklanjanja pulpe iz krunice (pulpotomio) i korena zuba (pulpectomio)[14], direktna je posledica nadražaja mijelinskih A-delta i nemijelinskih C aferentnih senzornih nervnih vlakana u pulpi zuba[15,16]; oko 7% A – beta-mijelinskih vlakana ulazi u pulpu premolara[17]. Ova vlakana (mijelinska A-delta), služe kao nociceptori (receptori za bol) i prema svom prečniku služe za brzinu prenošenja bola i služe za određenu funkciju, odnosno percepciju (obradu, organizovanje i tumačenje raznovrsnih nadražaja)[15].

Mijelinska A-delta vlakna imaju biološku sposobnost brzog sprovođenja nadražaja (bola) sa površnih mikroregija pulpe i dentina, kao i nizak prag nadražaja i odgovorna su za prenošenje osećaja bola, koji je oštar i probadajući; ovaj osećaj bola stvara se na krajevima mijelinskih vlakana u talamusu, a klinički nadražaj ovih vlakana nastaje u toku hidrodinamičkih iritacija, kao što su rad sa borerima, osmotski nadražaji (slatko, slano i kiselo), hladan vazduh i kvašenje zuba hipertonim rastvorima, što sve ukupno rezultira kretanjem tečnosti u dentinskim tubulima, koja stimulišu mehanosenzitivne nerve da stvaraju opisani bolni nadražaj[1,18,19]. Bolna iriticaja zubne pulpe, zbog inflamacijie (uzrokovana bakterijama, hemijskim supstancama ili ekstremnim mehaničkim iritacijama), nastaje zbog pretvaranja arahidonske kiseline u medijatore zapaljenja i bola kao što su: leukotrieni, prostaglandini i tromboksan[20]. Nemijelinska C aferentna senzorna nervna vlakna ne reaguju na hidrodinamičke nadražaje kao A-mijelinska vlakna i verovatno su mnogo osetljivija na patološke nadražaje, koji dolaze sa spoljašnje strane i zahvataju pulpu zuba, a karakterističan je nastanak tupog bola zbog termalne ili inflamantorne komponente uzroka bola[18,19].

Mehanizam delovanja intrapulpalne anestezije/intrapulpalnog bloka

U literaturni nema mnogo podataka koji tačno pokazuju mehanizam nastanka intrapulpalne anestezije[15,21]; neki podaci ukazuju na to da pulpa sadrži α adreneričke receptore u krvnim sudovima pulpe[22], koji imaju važnu ulogu u efikasnosti intrapulpalne anestezije, jer izazivaju vazokonstrikciju sa razvojem lokalne ishemije pulpe i smanjenjem nastanka akcionog potencijala nervnih vlakana, koji nastaju pod dejstvom bolnog stimulansa[23].

Intrapulpar net of nerves

The pain (intense, sharp) which occurs during the removal of pulp from the crown (pulpotomy) and the root of the tooth (pulpectomy)[14], is the direct consequence of the stimulation of myelin A-delta and non-myelin C afferent sensory nerve fibers in tooth pulp[15,16]. About 7% of A-betamyelin fibers enter the pulp of the premolars[17]. These fibers (myelin A-delta) serve as nociceptors (pain receptors), and according to their diameter, their purpose is the rapid transmission of pain, although they also serve another specific function – perception (processing, organization and interpretation of various stimuli)[15].

Myelin A-delta fibers have the biological ability to rapidly conduct stimuli (pain) from the superficial pulp and dentin microregions, as well as a low stimulus threshold, and they are responsible for creating the sensation of sharp and stabbing pain. This sensation of pain is formed at the ends of the myelin fibers in the thalamus, and the clinical irritation of these fibers occurs during hydrodynamic irritations, such as during the work with drills, osmotic stimuli (sweet, salty, sour), cold air, or moistening teeth with hypertonic solutions, all of which result in the movement of fluid in the dentinal tubules, which stimulates the mechanosensitive nerves to create the described painful stimulus[1,18,19]. The painful irritation of the dental pulp owing to inflammation (caused by bacteria, chemical substances or extreme mechanical irritations) occurs due to the conversion of arachidonic acid into mediators of inflammation and pain, such as: leukotrienes, prostaglandins and thromboxylic acid[20]. Non-myelin C afferent sensory nerve fibers do not respond to hydrodynamic stimuli in the same way as A-myelin fibers do, and are probably much more sensitive to pathological stimuli coming from the outside, affecting the pulp of the tooth, and are characterized by the development of dull pain due to the thermal or inflammatory component of the cause of pain[18,19].

Mechanism of the action of intrapulpal anesthesia/intrapulpal block

The literature does not contain much information that accurately shows the mechanism of intrapulpal anesthesia[15,21]. Certain data indicate that the pulp contains α-adrenergic receptorsin the pulp blood

Drugi autori smatraju da se uspešno delovanje ove tehnike dopunske anestezije bazira na tehnici ubacivanja anestetika pod pritiskom, kao glavnim faktorom za anesteziju pulpe zuba, jer intrapulpalni pritisak razara nervna vlakna u pulpi, čime se obezbeđuje anestezija pre izvođenja endodontskih procedura[21,24,25]. Međutim, rezultati istraživanja pojedinih autora pokazali su to da efikasnost ove tehnike anestezije može da zavisi i od vrste anestetika koji se koristi[16,26] , odnosno da je postignut određeni stepen anestetičkog intrapulpalnog bloka i primenom fiziološkog rastvora pod pritiskom, umesto lokalnog anestetika[25].

Tehnika intrapulpalne anestezije/intrapulpalnog bloka

Pre početka intrapulpalne anestezije treba anestezirati nervna vlakna u dentinskim kanalima i to je moguće postići lokalnim anestetičkim sprejem, kojim se natopi kuglica od vate i postavi na dno kaviteta, odnosno eksponirane pulpe zuba, u trajanju od 30 sekundi, a zatim se blago pritisne kako bi lokalni anestetik mogao da uđe u dentinske tubule, u trajanju od 2 do 3 minuta. Zatim se malim, sterilnim, okruglim, čeličnim borerom uklanja dentin do pojave pulpe zuba, odnosno pravi se otvor koji omogućava prolazak igle za ubrizgavanje lokalnog anestetika[13]. Ako je dentinski otvor pulpe veliki, onda se koristi tehnika “zaustavljanja” (stoppering technique) izlaska anestetika izvan komore pulpe; za tu tehniku koristi se kuglica vate, voska ili gutaperke, koja se stavlja preko igle na dno kaviteta[25,27]. Za ubrizgavanje lokalnog anestetika može da se koristi standardna brizgalica sa iglama različitog prečnika G (engl. Gauge) od 25 G (0,51 mm), 27 G (0,41 mm) ili 30 G (0,31 mm)[27], koja se uvodi u komoru pulpe, odnosno kanala korena zuba, dok se ne zaustavi u kanalu/komori zuba[29] (Slika 1). Pod pritiskom se polako i kontinuirano ubrizgava 0,2 mL lokalnog anestetika u pulpno tkivo, u roku od 20 sekundi[30] (Slika 2). Važno je istaći da se mora poštovati princip rada “povratnog pritiska” (engl. back-pressure), što označava definitivnu otpornost na klipu brizgalice, kada se primeni umerena sila, kako bi se ubrizgao anestetik u pulpu[25]. Vreme trajanja intrapulpalne anestezije je od 15 do 20 minuta i zato stomatolog mora da ima pripremljene intrumente za brzi endodotski rad[31].

vessels[22],which play an important role in the efficiency of intrapulpal anesthesia, because they cause vasoconstriction with the development of local pulp ischemia, and the reduction of the action potential of nerve fibers that occur under the influence of a painful stimulus[23]. Other authors consider that the successful effect of this supplemental anesthesia technique is based on the technique of inserting anesthetics under pressure as the main factor for the anesthesia of dental pulp, because the intrapulpal pressure destroys nerve fibers in the pulp, which provides anesthesia, before conductingendodontic procedures[21,24,25]. However, the results of the research conducted by some authors have shown that the effectiveness of this anesthesia technique may depend on the type of anesthetic used[16,26], i.e. that a certain degree of anesthetic intrapulpal block is achieved with the use of saline instead of a local anesthetic[25].

Intrapulpal anesthesia/intrapulpal block technique

Before the start of intrapulpal anesthesia, the nerve fibers in the dentinal canals need to be anesthetized, and this can be achieved with a local anesthetic spray used to soak a cotton ballwhich is placed on the bottom of the cavity or exposed pulp of the teeth for 30 s, after which it is gently pressed to insert the local anesthetic into the dentinal tubules for 2–3minutes. Then, the dentin is removed with a small sterile round steel bureuntil the exposureof the pulp of the tooth, i.e. a straight opening that allows the needle to inject the local anesthetic[13]. If the dentinal opening of the pulp is large, then the "stoppering technique" is used to remove the anesthetic out of the pulp chamber. For this technique, a ball of cotton wool, wax or gutta-percha is used and placed over a needle[25,27]. A standard syringe can be used to inject a local anesthetic, using needles of different diameters/gauges (G)of 25 (0.51 mm), 27 (0.41 mm) or 30 (0.31 mm)[27], which is introduced into the pulp chamber or root canal until it stops in the tooth canal/chamber[29] (Fig. 1). Under pressure, 0.2 mL of local anesthetic is slowly and continuously injected into the pulpal tissue for 20 seconds[30] (Fig. 2). It is important to indicate that the principle of work of the "back-pressure" type must be respected, which signifies the definitive resistance of the syringe plunger when moderate force is applied to inject the

Slika 1..Insulinska brizgalica za intrapulparnu anesteziju
Figure 1. Insulin syringe for intrapulpar anesthesia

Slika 2. Ubrizgavanje anestetska u pulpu zuba
Figure 2. Injection of anesthetic into dental pulp

Prednosti i nedostaci intra-pulpalne anestezije

Neke od glavnih prednosti intrapulpalne anestezije su skoro zanemarljiva sistemska reakcija na uneti anestetik preko pulpe zuba, smanjena mogućnost neuspešne anestezije posle neuspešne primene konvencionalnih tehnika lokalne anestezije, mogućnost primene na jednokorenim i višekorenim zubima, tako da nije uvek potrebna prethodna primena konvecionalnih tehnika lokalne anestezije. Nedostaci intrapulpalne anestezije opisuju se u vidu bola prilikom izvođenja ove tehnike anestezije, nepogodnosti kao prvog izbor za

anesthetic into the pulp[25]. The duration of intrapulpal anesthesia is 15–20 minutes, which is why the dentist must have prepared instruments for rapid endodontic work[31].

Advantages and disadvantages of intrapulpal anesthesia

The main advantages of intrapulpal anesthesia are an almost negligible systemic reaction to the anesthetic administered through the pulp of the tooth, reduced possibility of unsuccessful anesthesia after an unsuccessful application of conventional local anesthesia techniques, the possibility of

lokalnu anesteziju i ograničenja njene primena, jer se prvo mora obezbediti ekspozicija vitalne pulpe da bi se intrapulpalna anestezija primenila[29].

Ako je prisutno obilnije krvarenje iz pulpe, onda treba primeniti mehanički vid hemostaze sa kuglicama vate (engl. cotton wool pledge – CWP), a obavezno izbegavati primenu NaOCl (natrijum-hiperhlorita) u kombinaciji sa lidokain-hidrohloridom; utvrđeno je, u ovoj kombinaciji, stvaranje 2,6-xylidina, koji je mogući karcinogen[32,33].

Zaključak

Upotreba dopunske intrapulpalne anestezije u stomatološkoj/endodontskoj praksi, predstavlja praktičan i uspešan vid lokalne anestezije, kada standardna mandibularna anestezija za donji alveolarni nerv ne obezbeđuje dovoljno duboku periintervencionu analgeziju u toku stomatoloških intervencija na zubima.

application on single-rooted and multi-rooted teeth, and the fact that the prior application of conventional local anesthesia techniques is not always necessary. The disadvantages of intrapulpal anesthesia are the occurrence of pain when performing this anesthesia technique, the anesthesia'sunsuitabilityfor the first local anesthesia choice, and limited application, because vital pulp exposure must first be provided for intrapulpal anesthesia to be administered[29].

If more profuse bleeding from the pulp is present, then a mechanical type of hemostasis with cotton wool pledges (CWP) should be used, while the use of NaOCl (sodium hyperchlorite) in combination with lidocaine hydrochloride must be avoided; the formation of 2,6-xylidine, is a possible carcinogen[32,33], in this combination.

Conclusion

The use of supplementary intrapulpal anesthesia in dental/endodontic practice represents a practical and successful type of local anesthesia, when standard mandibular anesthesia for the lower alveolar nerve does not provide a deep enough peri-interventional analgesia for dental procedures.

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