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ISPITIVANJE STAVOVA STOMATOLOGA O ETIČKIM PRINCIPIMA U SVAKODNEVNOJ PRAKSI

EXAMINING DENTISTS' ATTITUDES ABOUT ETHICAL PRINCIPLES IN EVERYDAY PRACTICE

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Sažetak

Uvod: *Briga o pacijentima, poznavanje medicinskog prava i usklađenost sa zakonom doprinose efikasnijem rešavanju etičkih dilema, sa kojima se stomatolozi danas često susreću. Pored toga, u određivanju "najboljeg" stomatološkog tretmana, izvesnu ulogu imaju i pacijenti. Cilj istraživanja bilo je ispitivanje stavova stomatologa u Srbiji u vezi etičkih dilema u svakodnevnoj praksi, kako bi se utvrdili faktori koji utiču na njihovo rešavanje.*
Materijali i metode: *Rad je realizovan kao studija preseka. Istraživanje je obuhvatilo 88 ispitanika, 42 apsolventa stomatologije Medicinskog fakulteta u Nišu i Stomatološkog fakulteta u Beogradu i 46 stomatologa iz privatne i državne prakse. Prvi deo upitnika obuhvatio je socio-demografske karakteristike ispitanika, a drugi deo, sačinjen od 7 pitanja zatvorenog tipa, bio je posvećen određenim etičkim dilemama. Statistička analiza urađena je korišćenjem Excel programa iz Microsoft Office programskog paketa i SPSS programa u verziji 18.0.*
Rezultati: *Odgovori studenata i stomatologa na pitanja o pojedinačnim etičkim aspektima nisu se znatno razlikovali, osim u domenu 2. pitanja pod b – da li je oralni hirurg trebalo da izvadi oba zuba na zahtev pacijenta, koji je srčani bolesnik. Pronađena je statistički značajna razlika (χ^2= 18,834; p < 0,0001) u odgovorima stomatologa u odnosu na odgovore studenata.*
Zaključak: *Znanje većine ispitanika o etičkim principima bilo je zadovoljavajuće. Manji deo ispitanika nije bio dovoljno svestan važnosti primene etičkih principa u stomatološkoj praksi, tako da je potrebno promovisati programe edukacije o lekarskoj etici za stomatologe i studente stomatologije.*

Ključne reči: *etička pitanja, stomatološka nega, stomatolozi, odnos lekar-pacijent, zajedničko donošenje odluka*

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Abstract

Introduction: *Patient care, knowledge of medical law and compliance with the law contribute to more efficient dealing with the ethical dilemmas often faced by today's dentists. Moreover, when it comes to determining 'the best' dental treatment, patients also play a certain role. The aim of the research was to examine the attitudes of Serbian dentists related to ethical dilemmas in everyday practice, so as to determine the factors that affect solving the dilemmas.*
Materials and methods: *The paper was carried out as a cross-sectional study. The research included 88 respondents, 42 final year dentistry students at the Faculty of Medicine in Niš and the Faculty of Dentistry in Belgrade and 46 dentists from both private and state practice. The first part of the questionnaire included socio-demographic information on the respondents, and the second part consisted of 7 closed-ended questions about particular ethical dilemmas. Statistical analysis was done using Excel from Microsoft Office and SPSS, version 18.0.*
Results: *There were no significant differences regarding the students and dentists' answers about individual ethical aspects, except for the domain of question 2b, whether the oral surgeon should have extracted both teeth on the patient's request, although the patient had a heart disease. A statistically significant difference was found (χ^2=18,834, p<0,0001) regarding the dentists' answers in comparison with the students' answers.*
Conclusion: *The knowledge about ethical principles of the majority of the respondents was satisfying. A smaller proportion of the respondents were not sufficiently aware of the importance of applying ethical principles in dental practice. Consequently, it is necessary to promote education programs about medical ethics for dentists and dentistry students.*

Key words: *ethical issues, dental care, dentists, physician-patient communication, shared decision -making*

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Uvod

Medicinska etika, kao oblik primenjene etike, je nauka koja istražuje smisao i ciljeve moralnih vrednosti u medicini, kao i osnovne kriterijume za vrednovanje moralnih aspekata. Koreni medicinske etike nalaze se u drevnim civilizacijama, tako da Hipokratovu zakletvu i danas polažu lekari širom sveta[1], a poslednjih decenija, značaj etike u medicini sve je veći[2].

Briga o pacijentima, kao najjača etička obaveza zdravstvenih radnika, nalazi se u svim poznatim kodeksima medicinske etike širom sveta[3-5], s tim da su veoma bitni poznavanje medicinskih propisa i usklađenost sa zakonom, gde se posebno ističe bezbednost i poštovanje dostojanstva pacijenata. Ovim se postiže jačanje svesti svih zdravstvenih radnika, uključujući i stomatologe, o ljudskim pravima i etičkim pitanjima, koja su sve složenija i sa kojima se oni sve češće susreću[6,7]. Stomatolozi u Srbiji najčešće imaju dvostruku ulogu, i to kao zdravstveni radnici i kao zaposleni u ordinacijama, koje posluju po tržišnim principima i suočeni su često sa konfliktnim i specifičnim etičkim zahtevima[8]. Osim toga, konkurencija utiče i na odnos između kolega i na etičke postupke među njima.

Takođe, kao i kod ostalih zdravstvenih radnika, razvoj dobrog odnosa između pacijenta i stomatologa je značajna profesionalna veština[9-14]. Stomatološka praksa stvara više straha i anksioznosti u odnosu na druge oblike zdravstvene zaštite, što doprinosi i lošem oralnom zdravlju pacijenata[15]. Shodno tome, odgovarajuće psihosocijalno i etičko ponašanje i efikasna komunikacija sa pojedincima iz različitih populacionih grupa sa kulturološkim razlikama, veoma su značajni u stomatologiji[10,16].

Etičke dileme, u kojima se mora napraviti izbor između alternative, koje su nepoželjne i zbunjujuće[17], česte su u stomatologiji[18], a u okviru klasičnog obrazovanja nisu dovoljno obrađene. Osim toga, poslednjih decenija, pravac donošenja odluka u određivanju "najboljeg" stomatološkog lečenja pomerio se sa isključivo profesionalnog odlučivanja ka autonomnom odlučivanju pacijenata, gde je nadležni lekar obavezan da pacijentu dozvoli da učestvuje u donošenju odluka onoliko koliko mu to omogućavaju mentalne sposobnosti i zrelost[19-21].

Introduction

Medical ethics, as a form of applied ethics, is a science that explores the meaning and aims of moral values in medicine, as well as the basic criteria for evaluating moral aspects. The roots of medical ethics are found in ancient civilizations, so even today the Hippocratic Oath is taken by doctors all over the world[1], and in recent decades the significance of ethics in medicine has grown[2].

Patient care, as the strongest ethical obligation of medical workers, lies in all the well-known codes of medical ethics all over the world[3-5], provided that it is very important to know medical regulations in accordance with the law, where patients' safety and respect for the dignity of the patient are particularly emphasized. This brings to raising the awareness of all medical workers, including dentists, about human rights and ethical questions which are getting more complex and which they are more and more often faced with[6,7]. Dentists in Serbia usually have a double role – as medical workers and as employees in dental clinics which do business according to market principles – and they are often faced with conflicts and specific ethical requirements[8]. Furthermore, competition affects the relationship between colleagues and ethical procedures among them.

Likewise, as well as with other medical workers, the development of a good relationship between a patient and a dentist is a significant professional skill[9-14]. Dental practice causes more fear and anxiety than other forms of health protection, which contributes to poor oral health of the patient[15]. Consequently, appropriate psychosocial and ethical behavior and efficient communication with individuals from different population groups, with cultural differences, are very important in dentistry[10,16].

Ethical dilemmas, where the choice among the undesirable and confusing alternatives has to be made[17], are very common in dentistry[18], and within the framework of classical education they are not covered enough. Furthermore, in recent decades the direction of making decisions about determining the 'best' dental treatment has been changed from entirely professional to autonomous decision -making of patients, where the competent doctor is obliged to let the patient participate in the decision -making process as much as their mental abilities and maturity allow them[19-21].

Cilj istraživanja bilo je ispitivanje stavova stomatologa u Srbiji u vezi određenih etičkih dilema sa kojima se susreću u svakodnevnoj praksi, kako bi se utvrdili faktori koji utiču na njihovo rešavanje.

Materijali i metode

Studija je dizajnirana kao studija preseka uz upotrebu originalno konstruisanog epidemiološkog upitnika, koji je razvijen nakon detaljnog pregleda literature i odabira radova, koji su ušli u uži izbor za dalju diskusiju istraživačkog tima i pripremu upitnika.

Ukupno je distribuirano 100 upitnika, od kojih je 12 upitnika bilo neadekvatno popunjeno. Istraživanje je konačno obuhvatilo 88 ispitanika i to 42 apsolventa stomatologije Medicinskog fakulteta u Nišu i Stomatološkog fakulteta u Beogradu, kao i 46 stomatologa iz privatne i državne prakse. Kriterijumi za učešće stomatologa u anketiranju bili su njihova dobrovoljnost i redovan radni odnos, a za studente upisana 5. godina stomatologije. Upitnik je bio anonimnog karaktera i sastojao se iz dva dela. Prvi deo upitnika obuhvatio je socio-demografske karakteristike ispitanika, kao što su pol, uzrast, ustanova odakle dolaze i mesto boravka. Drugi deo upitnika sadržao je 7 pitanja zatvorenog tipa, koja su se odnosila na različite situacije iz svakodnevne stomatološke prakse, koje su povezane sa etikom. U prvom pitanju, predstavljena je situacija u kojoj je pacijentu, dečaku, stomatolog bez obaveštenja izvadio zub, jer je smatrao da lečenje nema svrhe. Drugo pitanje odnosilo se na starijeg muškarca sa kardiovaskularnim tegobama, kome je oralni hirurg izvadio jedan kutnjak, umesto oba, kako je pacijent tražio. Treće pitanje odnosilo se na pacijenta koji boluje od hemofilije, kome je stomatolog bez konsultacije sa hematologom izvadio zub, koji je bio rasklaćen u znatnoj meri. Četvrto pitanje opisuje situaciju u kojoj stomatolog, u svojoj privatnoj ordinaciji, prvenstvo daje svom prijatelju. U okviru petog pitanja, predstavljen je stomatolog, koji je saznao da je pacijent HIV pozitivan i uskratio mu dalje lečenje zbog toga. U okviru šestog pitanja, prikazan je stomatolog, koji je pacijentu, koji boluje od hipertenzije i dijabetesa izvadio nekoliko zuba, bez propisivanja adekvatne terapije i obaveštenja o mogućim komplikacijama.

Poslednje pitanje opisalo je situaciju u kojoj se pacijentkinja, zbog bola koji se javio u zubu saniranom mesec dana ranije, u odsustvu svog stomatologa, obraća drugom, koji dijagnostikuje hronično zapaljenje periodoncijuma.

The aim of the research was to examine the attitudes of dentists in Serbia related to particular ethical dilemmas which they face in everyday practice, in order to determine the factors that affect their solving.

Materials and methods

The study was designed as a cross-sectional study by using an originally constructed epidemiological questionnaire which was developed after a detailed review of the literature and after the selection of the shortlisted papers for further discussion of the research team and the preparation of the questionnaire.

A total of 100 questionnaires were distributed, 12 of which were inadequately completed. The research finally included 88 respondents, that is, 42 final-year dentistry students at the Faculty of Medicine in Niš and at the Faculty of Dentistry in Belgrade and 46 dentists from both private and state practice. The criterion for the dentists' participation in the survey was their willingness and their regular employment, and for the students to be enrolled in the 5th year of dentistry. The questionnaire was anonymous and it consisted of two parts. The first part of the questionnaire covered socio-demographic characteristics of the respondents such as gender, age, institution where they came from and place of residence. The second part consisted of 7 closed-ended questions which referred to different situations from everyday dental practice, related to ethics. The first question presented a situation in which a dentist extracted a boy's tooth without any previous notice since he considered there was no point in treating the tooth. The second question referred to an elderly man with cardiovascular disorders who had only one of his molars extracted by a surgeon, instead of having them both extracted as the patient had previously requested. The third question referred to a patient suffering from hemophilia, who had a very loose tooth extracted by a dentist without any previous consultation with a hematologist. The fourth question described a situation in which a dentist, in his or her private clinic, gave priority to a friend. In the fifth question, the dentist found out that the patient was HIV positive and denied him further treatment because of that. In the sixth question, a patient suffering from hypertension and diabetes had a few of his teeth extracted by a dentist without being prescribed adequate therapy and given a notice about possible complications.

Ispitanici su birali jedan od ponuđenih odgovora, nakon procene toga koji etički princip je stomatolog prekršio svojom odlukom i kako je, po njihovom mišljenju, trebalo da postupi. Za popunjavanje upitnika dato je vreme od 15 minuta. Istraživanje je sprovedeno od oktobra 2019. do februara 2020. godine.

Deskriptivnom statističkom analizom prikazani su sledeći statistički parametri: aritmetička sredina, standardna devijacija, raspon varijacije, apsolutna frekvencija (N) i indeks strukture (%). Poređenje učestalosti javljanja pojedinih modaliteta atributivnih obeležja između odgovora ispitanika grupa vršeno je Pearson Hi-kvadrat testom i Fišerovim testom tačne verovatnoće. Poređenje srednjih vrednosti numeričkih obeležja između odgovora dve nezavisne grupe ispitanika vršeno je Studentovim t-testom. Statistička analiza urađena je korišćenjem Excel programa iz Microsoft Office programskog paketa i SPSS programa u verziji 18.0. Kao prag statističke značajnosti, korišćen je nivo greške procene manji od 5% ($p < 0,05$). Rezultati statističke analize prikazani su tabelarno i grafički.

Rezultati

U ispitanom uzorku (n = 88) studenti stomatologije činili su nešto ispod polovine uzorka (42 tj. 47,73%). Ostali ispitanici bili su lekari stomatolozi. Prosečna starost ispitanih studenata je 24,38 godina ± 1,65 godina (u rasponu 22 godine – 30 godina), dok su ispitani lekari bili prosečne starosti 35,63 godine ± 10,75 godina (u rasponu 26 godina – 62 godine), te se ispitanici ove dve grupe značajno razlikuju po uzrastu ($t = 7,007$; $p < 0,0001$). Više od polovine studenata bili su muškarci, njih 23 (54,8%), a dve trećine ispitanih stomatologa bile su žene, njih 31 (67,4%). Distribucija rodnog rasporeda po grupama, statistički se značajno razlikuje ($\chi^2 = 4,391$; $p < 0,05$), a distribucija rasporeda mesta boravka po grupama nije pokazala statističku značajnost ($\chi^2 = 1,664$; $p > 0,05$) (tabela 1).

Rezultati rada, koji se odnose na distribuciju odgovora ispitanika i razliku distribucije između njih, prikazani su grafički (figura 1) i tabelarno (tabela 2). Na prvo pitanje, preko polovine (57,10%) studenata odgovorilo je to da je stomatolog prekršio princip istinitosti, a skoro identičan odgovor dali su i stomatolozi (52,20%). Na drugi deo pitanja, 85,70% studenata odgovorilo je to da doktor nije ispravno postupio, sa čime se složila i grupa stomatologa u 89,10%.

The last question described a situation in which a patient, feeling a toothache in the tooth which had been treated a month before, due to the absence of her own dentist, addressed another one who diagnosed her with chronic inflammation of the periodontium.

The respondents had to choose one of the given answers, after estimating which ethical principle the dentist violated by making their decisions and how, in their opinion, the dentist was supposed to act. They had 15 minutes to complete the questionnaire. The research was done in the period from October 2019 to February 2020.

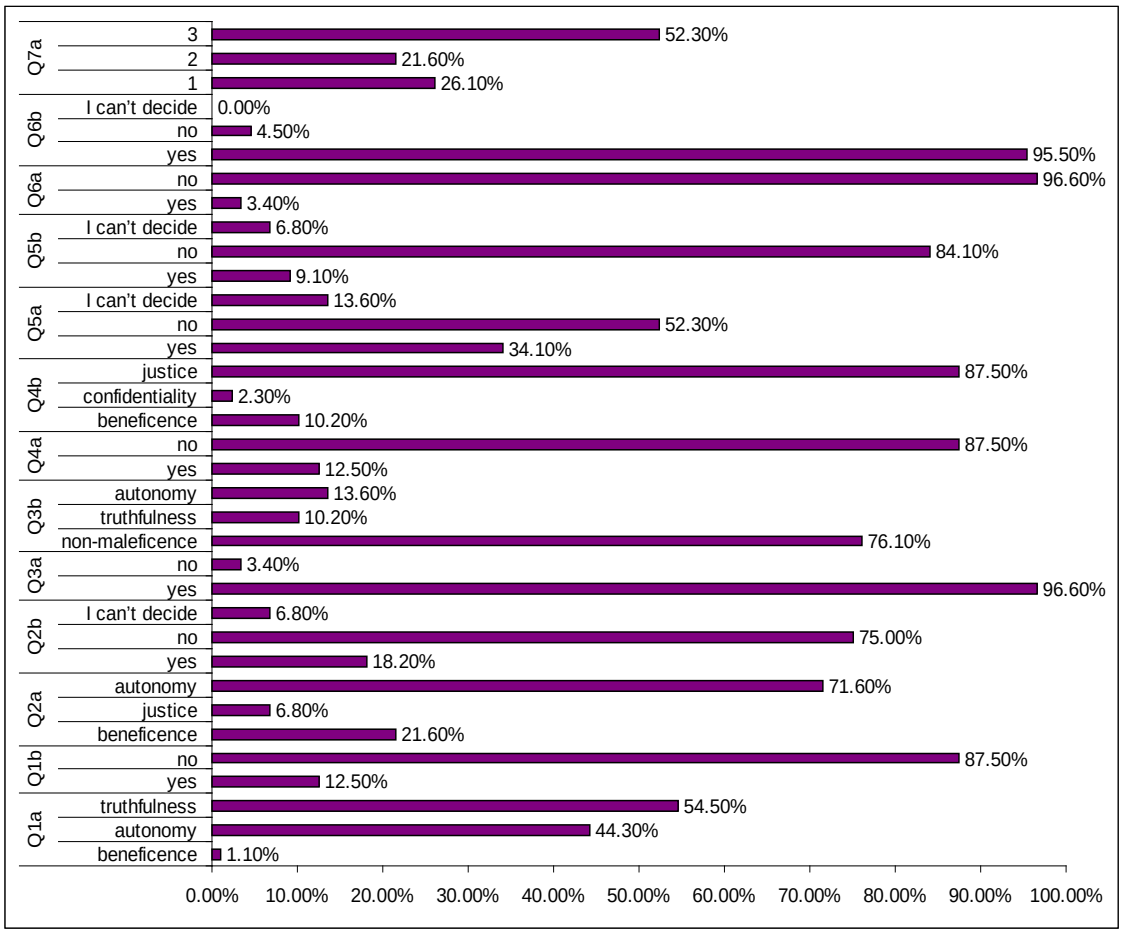
Using descriptive statistical analysis, the following statistical parameters were shown: arithmetic mean, standard deviation, range of variation, absolute frequency (N) and structure index (%). The comparison of occurrence frequency of some attributive feature modalities between the groups was done by using the Pearson Chi-square test and Fisher's exact test. The comparison of mean values of numerical features between two independent groups of respondents was done using the Student's t-test. Statistical analysis was done using Excel from Microsoft Office and SPSS, version 18.0. An estimation error level less than 5% ($p<0,05$) was used as the threshold of statistical significance. The results of the statistical analysis are shown in tables and graphs.

Results

The examined sample (n=88) comprised 42 (47,73%) dentistry students, which was slightly less than half of the sample. The other respondents were dentists. The average age of the surveyed students was 24,38±1,65 (in range 22 – 30), whereas the average age of the surveyed dentists was 35,63±10,75 (in range 26 – 62) and these two groups significantly differed according to age ($t=7,007$, $p<0,0001$). More than half of the students were men - 23 (54,8%), and two thirds of the surveyed dentists were women - 31 (67,4%). There was a significant statistical difference in gender distribution according to the groups ($\chi^2=4,391$, $p<0,05$), and there was no statistical significance in regard to the distribution of the place of residence according to the groups ($\chi^2=1,664$, $p>0,05$) (Table1).

Tabela 1. Demografske karakteristike ispitanika
Table 1. Demographic characteristics of respondents

	Students Studenti (n=42)	Dentists Stomatolozi (n=46)	Total Ukupno (n=88)	Statistics Statistika
Age (yrs) Uzrast (god)				t=7,007
Mean±SDXsr ± SD	24,38±1,65	35,63±10,75	22,55±12,85	p<0,0001
min-max	22 - 30	26 - 62	22 - 62	
Gender (N %) Pol (N%)				
Male Muški	23	15	38	χ^2 =4,391
	54,8%	32,6%	43,2%	p=0,036 p<0,05
Female Ženski	19	31	50	OR=2,502
	45,2%	67,4%	56,8%	CI (1,053-5,945)
City Grad Niš	31	28	59	χ2 =1,664
	73,8%	60,9%	67,0%	p=0,197 p>0,05
Other Ostalo	11	18	29	OR=1,812
	26,2%	39,1%	33,0%	CI (0,731-4,49)



Grafikon 1. Distribucija odgovora ispitanika (n=88) po pitanjima
Figure 1. Distribution of respondents' answers (n = 88) by questions

Tabela 2. Upoređivanje etičkih stavova ispitanika po grupama
Table 2. Comparison of ethical attitudes of respondents by groups

Question pitanja	Answers Odgovori	Students Studenti N	Students Studenti %	Dentists Stomatolozi N	Dentists Stomatolozi %	Statistics Statistika
Q1a	beneficence	0	0,00%	1	2,20%	χ^2=1,051
	autonomy	18	42,90%	21	45,70%	p>0,05
	truthfulness	24	57,10%	24	52,20%	
Q1b	yes	6	14,30%	5	10,90%	χ^2=0,234
	no	36	85,70%	41	89,10%	p>0,05
Q2a	beneficence	10	23,80%	9	19,60%	χ^2=0,268
	justice	3	7,10%	3	6,50%	p>0,05
	autonomy	29	69,00%	34	73,90%	
Q2b	yes	15	35,70%	1	2,20%	χ^2=18,834
	no	23	54,80%	43	93,50%	p<0,0001
	I can't decide	4	9,50%	2	4,30%	
Q3a	yes	41	97,60%	44	95,70%	Fisher exact
	no	1	2,40%	2	4,30%	p=0,534 n.s.
Q3b	non-maleficence	36	85,70%	31	67,40%	χ^2=5,647
	truthfulness	4	9,50%	5	10,90%	p>0,05
	autonomy	2	4,80%	10	21,70%	
Q4a	yes	8	19,00%	3	6,50%	Fisher exact
	no	34	81,00%	43	93,50%	p=0,073 n.s.
Q4b	beneficence	5	11,90%	4	8,70%	χ^2=2,05
	confidentiality	0	0,00%	2	4,30%	p>0,05
	justice	37	88,10%	40	87,00%	
Q5a	yes	13	31,00%	17	37,00%	χ^2=2,037
	no	21	50,00%	25	54,30%	p>0,05
	I can't decide	8	19,00%	4	8,70%	
Q5b	yes	6	14,30%	2	4,30%	χ^2=4,711
	no	35	83,30%	39	84,80%	p>0,05
	I can't decide	1	2,40%	5	10,90%	
Q6a	yes	2	4,80%	1	2,20%	Fisher exact
	no	40	95,20%	45	97,80%	p=0,466 n.s.
Q6b	yes	40	95,20%	44	95,70%	Fisher exact
	no	2	4,80%	2	4,30%	p=0,657 n.s.
	I can't decide	0	0,00%	0	0,00%	
Q7a	1	12	28,60%	11	23,90%	χ^2=0,423
	2	8	19,00%	11	23,90%	p>0,05
	3	22	52,40%	24	52,20%	

P7a
1.da obavesti pacijenta o nepravilnom lečenju prethodnog stomatologa
2.da ponovo popravi zub, ali da ne obavesti pacijenta
3.da porazgovara o problemu i sa pacijentom i sa njegovim stomatologom
Q7a
1. to inform the patient about the improper treatment of the previous dentist
2. to repair the tooth again, but not to inform the patient
3. to discuss the problem with both the patient and his dentist

Na drugi deo pitanja, 85,70% studenata odgovorilo je to da doktor nije ispravno postupio, sa čime se složila i grupa stomatologa u 89,10%.

Kod drugog pitanja, većina studenata (69,00%), kao i većina stomatologa (73,90%) odgovorila je to da je oralni hirurg prekršio princip autonomije ličnosti, poštujući pravila struke, kako ne bi naškodio pacijentu. Statistički značajna razlika pronađena je u odgovorima na drugi deo pitanja (χ^2= 18,834; p < 0,0001), gde je 54,80% studenata izjavilo to da oralni hirurg nije trebalo da izvadi oba zuba, dok su stomatolozi bili izričitiji u tom odgovoru (93,50%).

U odgovoru na treće pitanje, obe grupe ispitanika složile su se oko toga da je stomatolog trebalo da konsultuje hematologa; studenti u 97,60%, a lekari u 95,70%. Najveći broj ispitanika obe grupe, 85,70% studenata i 67,40% lekara, smatrao je da u ovom slučaju nije ispoštovan princip neškodljivosti.

Kod sledećeg pitanja, 81,00% studenata i malo veći procenat doktora, 93,50%, bio je mišljenja da je stomatolog pogrešio, dajući prednost svom prijatelju. Većina ispitanika, 88,10% studenata i 87,00% doktora, odgovorila je to da je prekršen princip pravednosti.

Kod 5. pitanja takođe nije pronađena statistički značajna razlika, u odgovorima. Polovina studenata, 50,00%, kao i 54,30% stomatologa, opredelila se za odgovor da lekar nije trebalo da prećuti. Kada je reč o drugom delu pitanja, 83,30% studenata tvrdilo je da stomatolog nije trebalo da obavesti pacijentove rođake o njegovoj bolesti, sa čim se složilo i 84,80% stomatologa.

Na 6 pitanje, 95,20% studenata i 97,80% stomatologa odgovorilo je to da doktor nije postupio ispravno. Isti procenat, 95,20% studenata smatrao je da je doktor trebalo da obavesti pacijenta o mogućim komplikacijama. Isto mišljenje zastupalo je 95,70% stomatologa.

Na poslednje pitanje, nešto više od polovine ispitanika, 52,40% studenata i 52,20% lekara odgovorilo je to da bi stomatolog trebalo da popriča i sa pacijentom i sa njegovim ordinirajućim lekarom o problemu.

The results of the paper which refer to the respondents' answers and the distribution difference among them are given in graphs (Figure 1) and tables (Table 2). Regarding the first question, more than half of the students (57,10%) said that the dentist violated the principle of truthfulness, and almost an identical answer was given by the dentists (52,20%). In the second part of the question, 85,70% of the students said that the dentist did not do the right thing, and the group of the dentists also agreed with that in 89,10%.

In the second question, the majority of the students (69,00%), as well as the majority of the dentists (73,90%) said that the oral surgeon violated the principle of autonomy, respecting the rules of the profession so as not to harm patient.A statistically significant difference was found in the second part of the question (χ^2=18,834, p<0,0001), where 54,80% of the students said that the oral surgeon should not have extracted both teeth, while the dentists were more explicit in giving the answer (93,50%).

In the third question, both groups agreed that the dentist should have consulted a hematologist, the students in 97,60%, and the dentists in 95,70%. The greatest number of both groups of the respondents, 85,70% of the students and 67,40% of the dentists, considered that the dentist's act did not meet the principle of non-maleficence.

In the next question, 81,00% of the students and slightly higher percentage of the dentists, 93,50% thought that the dentist had made a mistake, giving priority to his friend. The majority of the respondents, 88,10% of the students and 87,00% of the dentists, said that the principle of justice was violated.

In the 5th question, there was no statistically significant difference either. Half of the students 50,00%, as well as 54,30% of the dentists, chose the answer in which the dentist should not have kept quiet. In the second part of the question, 83,30% of the students claimed that the dentist should not have informed the patient's relatives about their disease, and 84,80% of the dentists agreed with that.

In the 6th question, 95,20% of the students and 97,80% of the dentists said that the dentist did not do the right thing. The same percentage, 95,20% of the students considered that the dentist should have informed the patient about possible complications. 95,70% of the dentists had the same opinion.

Diskusija

Na osnovu dobijenih odgovora ispitanika u ovom istraživanju, može se reći da su stavovi apsolvenata stomatologije i stomatologa o pojedinačnim etičkim aspektima uglavnom usklađeni.

Po pravilu, stomatolog je dužan da pruži pacijentu relevantne informacije i to ima etičke i potencijalno pravne implikacije[22,23]. Kako su, kada je reč o prvom pitanju, obe grupe ispitanika imale podeljene stavove, može se reći da u našoj stomatološkoj praksi još nije usvojen definitivan stav u vezi informisanosti pacijenta o lečenju. U ovoj situaciji, u sukobu su princip dobrotvornosti sa principom autonomije i principom istinitosti. Kod uplašenih i kod pacijenata koji ne sarađuju, kako bi obezbedio neophodno lečenje, najbolje je da stomatolog ispoštuje princip dobrotvornosti, što znači da mora narušiti ostala dva principa. Ovo očigledno zbunjuje stomatologe u našoj sredini, te je potrebno razjašnjenje podržano od strane profesionalnih organizacija i strukovnih udruženja.

Manje dilema kod ispitanika, bilo je kod drugog pitanja, budući da se većina ispitanika složila da je doktor ispravno postupio, jer je pacijenta lišio dodatne, bespotrebne intervencije i terapije antibioticima, iako nije ispoštovao princip autonomije ličnosti. U odgovorima na drugi deo pitanja, pronađena je statistički značajna razlika: vođeni većim iskustvom u radu i principom neškodljivosti, stomatolozi su bili izričitiji u tome da oralni hirurg nije trebalo da izvadi oba zuba, već da sačuva zub čija je karijesna lezija mogla da se popravi. Primena nepotrebnih, preteranih ili neefikasnih medicinskih postupaka ili lekova štetna je za mnoge pacijente, naročito za one starije i one koji imaju druga oboljenja, te stoga često predstavljaju etički problem[24,25]. Stomatolog treba da informiše pacijenta o njegovom zdravstvenom stanju i rizicima, razumljivo i jasno, rečima koje će pacijent sigurno shvatiti, u skladu sa njegovim obrazovanjem i uzrastom. Suština informacije je u tome da pomogne pacijentu da samostalno donese pravu odluku, što može da uradi jedino ako zna sve potrebne informacije[26,27].

Stomatolozi se u današnjoj praksi često susreću sa pacijentima, koji imaju različite vrste poremećaja koagulacije krvi , kakva je hemofilija[28].

In the last question, slightly more than half of the respondents, 52,40% of the students and 52,20% of the dentists answered that the dentist should talk to the patient and their attending physician about the problem.

Discussion

On the basis of the respondents' answers in this research, it can be said that the attitudes of final year dentistry students and dentists about individual ethical aspects mostly agree.

As a rule, a dentist is obliged to provide a patient with relevant information and it has both ethical and potentially legal implications[22,23]. As both groups of the respondents had divided attitudes regarding the first question, it can be said that our dental practice has not adopted a definite attitude related to informing patients about their treatment. In this situation, the principle of beneficence is in conflict with the principle of autonomy and the principle of truthfulness. When it comes to anxious patients and patients who are not willing to cooperate, in order to provide the necessary treatment, the best way for the dentist is to adhere to the principle of beneficence, which means that they have to violate the other two principles. This obviously confuses the dentists in our environment, so an explanation supported by professional organizations and associations is necessary.

The respondents had fewer dilemmas in the second question since most of the respondents agreed that the dentist did the right thing as he prevented the patient from an additional, unnecessary intervention and antibiotic treatment, although he did not adhere to the principle of autonomy. In the second part of the question, a statistically significant difference was found in the answers: guided by greater work experience and the principle of non-maleficence, the dentists were more explicit when saying that the oral surgeon was not supposed to extract both teeth, but to save the tooth whose carious lesion could have been fixed. The use of unnecessary, exaggerated or inefficient medical procedures is harmful to many patients, especially to the elderly or those who have other diseases, and it is often considered an ethical issue[24,25]. A dentist should inform a patient about their medical condition and risks, understandably and clearly, using words that the patient will certainly be able to understand, in accordance with their education and age.

Kod trećeg pitanja, većina obeju grupa ispitanika smatra da je stomatolog narušio princip neškodljivosti i da je morao uključiti hematologa u donošenje odluke. Etički princip o izbegavanju nanošenja štete pacijentu potiče još iz Hipokratovog načela primum non nocere, što znači "prvenstveno ne naškoditi". Ako stomatolog unapred predvidi moguće komplikacije, a pri tom je svestan da može naškoditi pacijentu, uputiće ga oralnom hirurgu, koji će sprovesti preoperativnu pripremu i indikovanu intervenciju moći da izvede bezbedno. Ovakav stav karakterističan je za zdravstvene sisteme, koji podrazumevaju dostupnost specijalista i razvijenost, tako da se odgovori smatraju veoma pozitivnim.

Etički stav stomatologa zasniva se na individualnom osećaju odgovornosti prema pacijentu i proceni toga šta je ispravno ponašanje. Zakonske regulative i profesionalni kodeksi lekarske etike ne garantuju primenu etike u praksi. Zato, stomatolozi mora da obrate pažnju na granice odnosa lekar–pacijent, da poštuju pacijenta i brinu za njegovo dobro, u skladu sa naučnim znanjem i etičkim principima[29], mada su u svakodnevnoj praksi, etički aspekti uglavnom pitanja navike[30].

Na četvrto pitanje, većina ispitanika dala je odgovor da je prekršen princip pravednosti. Pravednost je etički princip, koji lekare obavezuje da sve pacijente isto tretiraju, bez obzira na pol, rasu, nacionalnost, veru, socijalnu ili političku pripadnost. Stomatolozi bi trebalo da se trude da zastupaju stav empatije, da poštuju ličnost svakog pacijenta, njihovo dostojanstvo i intimu. Ako pravednost shvatimo kao nediskriminaciju, onda to podrazumeva jednaka prava stomatološke zdravstvene zaštite za sve pacijente[31].

I kod pitanja iz upitnika koje se fokusira na neizlečivu, zaraznu bolest, odgovori ispitanika obeju grupa su homogeni i ukazuju da na to da je kod nas usvojen stav da pacijent ima pravo da bude istinito obavešten o svom zdravstvenom stanju. Uvažavanjem principa adekvatnog informisanja pacijenta i članova njegove porodice, primenjuje se i princip autonomije[26,27]. Ipak, kako je reč o neizlečivoj, ali i prenosivoj bolesti, samo saznanje da je pacijent HIV pozitivan, imaće zastrašujuć i negativan uticaj na njega i otvoriće etičku dilemu – šta će doneti više koristi pacijentu, da li mu odmah reći istinu ili prećutati i uputiti ga infektologu.

The essence of the information is to help the patient make the right decision by themselves, which they can do only if they have all the necessary information[26,27].

In today's practice, dentists often encounter patients who have different kinds of blood coagulation disorders, such as hemophilia[28]. In the third question, the majority of both groups believe that the dentist violated the principle of non-maleficence and that he had to involve a hematologist when making the decision. The ethical principle about avoiding doing harm to a patient originates from the Hippocratic principle 'primum non nocere', which means 'first, do no harm'. If a dentist anticipates possible complications, being aware that they can do harm to the patient, they will refer them to an oral surgeon, who will carry out preoperative preparation and will be able to carry out the indicated intervention safely. This attitude is typical of health care systems which imply the availability of specialists and development, so the answers are considered to be very positive.

The ethical attitude of dentists is based on the individual feeling of responsibility towards the patient and the assessment of what is the correct behavior. The legislation and the professional code of medical ethics do not guarantee the application of ethics in practice. Therefore, dentists have to pay attention to the boundaries in the doctor – patient relationship, they have to respect the patient and care about their well-being, in accordance with scientific knowledge and ethical principles[29], although in everyday practice, ethical aspects are mostly a matter of habit[30].

In the fourth question, most of the respondents said that the principle of justice was violated. Justice is an ethical principle which obliges doctors to treat all of their patients in the same way, regardless of their gender, race, nationality, religion, social or political affiliation. Dentists should put an effort to advocate an attitude of empathy, to respect the personality of each patient, their dignity and intimacy. If justice is understood as non-discrimination, than it implies equal rights to dental health care for all patients[31].

When it comes to the question dealing with an incurable infectious disease, the respondents' answers in both groups were homogeneous and indicate that we have adopted the attitude that the patient has the right to be truly informed about their medical condition.

Savremena medicinska etika potvrđuje to da i HIV pozitivni pacijentiimaju puno pravo na stomatološke usluge, koje se u tom slučaju obavljaju po posebnom protokolu. Što se tiče drugog dela pitanja, odgovor većine ispitanika obe grupe bio je negativan. Princip poverljivosti podrazumeva se u profesionalnim kodeksima etike, a posebno se poštuje u pogledu HIV-a. Sukob se javlja između interesa odnosa lekar–pacijent, u smislu poverljivosti i interesa javnosti za zaštitu od zaraznih bolesti. Pretpostavlja se da samo pacijenti sami mogu znati da li će drugim osobama reći od koje bolesti boluju, zbog rizika i mogućih posledica u njihovom privatnom, javnom i profesionalnom životu[32]. Takođe, pacijenti imaju obavezu da se ponašaju odgovorno i da ne ugrožavaju druge u svojoj okolini.

Odgovori na šesto pitanje usklađeni su sa prethodnim stavovima i naši ispitanici prihvataju princip autonomije, jer je pacijent sa punim pravom trebalo da bude obavešten o mogućim komplikacijama. Bolesti rizika u stomatologiji, gde takođe spadaju dijabetes i hipertenzija, uglavnom zahtevaju drugačiju proceduru lečenja, tj. preoperativnu pripremu i saglasnost lekara pre vađenja zuba. Studenti i stomatolozi, u najvećem procentu, složili su se sa prethodnom činjenicom.

Savremeni kodeksi stomatološke prakse usmeravaju doktore stomatologije ka pružanju svih potrebnih informacija pacijentima, ali i ka izbegavanju kritikovanja svojih kolega pred njima i uopšteno u javnosti[33]. Što se tiče poslednjeg pitanja, najveći procenat ispitanika obeju grupa nije želeo da degradira kolegu, što je etički ispravno, pa je njihov odgovor glasio da stomatolog treba da porazgovara o problemu sa pacijentom i njegovim stomatologom.

Rezultati dobijeni u ovom istraživanju sreću se i u drugim radovima koji se bave sličnom problematikom. Upitnik koji je korišćen u ovoj studiji, prvenstveno je ukazao na osnovna etička načela u svakodnevnoj stomatološkoj praksi. Mnogi istraživači koristili su brojne druge, detaljnije upitnike, kojima se ispituje primena ostalih etičkih principa i to može biti imperativ za naredna istraživanja kod nas. Ograničenje ove studije je to da se korišćeni upitnik zasniva na subjektivnoj proceni, tako da se ne može izbeći pristrasnost odgovora ispitanika.

Respecting the principle of adequately informing the patient and their family members, the principle of autonomy is also applied[26,27]. However, since it is about an incurable, but also transmitted disease, just knowing that the patient is HIV positive, has an intimidating and negative impact on them and it raises an ethical dilemma, should the patient be told the truth immediately or referred to an infectologist?

Contemporary medical ethics confirms that even HIV positive patients have the full right to get dental services, which are, in that case, performed according to a special protocol. In the second part of the question, most of the respondents from both groups had a negative answer. The principle of confidentiality is implied in the professional codes of ethics, and it is especially respected when it comes to HIV. There is a clash between the interests of the physician-patient relationship in terms of confidentiality and the interests of the public to prevent infectious diseases. It is assumed that only patients themselves can decide whether they are going to tell other people about the disease they have, due to the risk and possible consequences on their private, public and professional lives[32]. Furthermore, patients are obliged to behave responsibly and not to endanger the others in their environment.

In the sixth question, the answers are in accordance with the previous attitudes and our respondents accept the principle of autonomy, since the patient should have been informed with the full right about possible complications. Risk diseases in dentistry, which include diabetes and hypertension, mostly require a different treatment procedure, that is, preoperative preparation and the physician's consent before tooth extraction. The students and the dentists agreed with the previous fact in the highest percentage.

Contemporary codes of dental practice direct dentist towards providing their patients with all the necessary information, but they should also avoid criticizing their colleagues in front of the patient or generally in public[33]. In the last question, the highest percentage of both respondent groups did not want to degrade their colleague, which is ethically correct, and they said that the dentist should discuss the problem with the patient and his dentist.

The results obtained in this research can also be found in other papers dealing with similar problems. The questionnaire used in this study primarily pointed out the basic ethical principles in everyday dental practice.

Zaključak

Stomatolozi i apsolventi stomatologije u Srbiji imaju slične stavove u vezi etičkih dilema iz svakodnevne prakse. Znanje, u pogledu poštovanja etičkih principa, uglavnom je zadovoljavajuće. Samo manji deo ispitanika bio je u nedoumici ili nije bio dovoljno svestan važnosti primene etičkih principa u stomatološkoj praksi. To ukazuje na to da treba promovisati programe edukacije o lekarskoj etici i značaju odnosa lekar–pacijent za stomatologe i njihove saradnike, koji će im pomoći da izgrade još bolju profesionalnu komunikaciju sa pacijentom, ali i međusobno i da unaprede ishode lečenja.

Many researchers have used many other, more detailed questionnaires which examine the application of the other ethical principles and it could be an imperative for further research in our country. The limitation of this study is the fact that the used questionnaire is based on subjective assessment, so the respondents' bias cannot be avoided.

Conclusion

Dentists and final year dentistry students in Serbia have similar attitudes related to ethical dilemmas from everyday practice. The knowledge about respecting ethical principles is mostly satisfying. Only a small number of the respondents were in doubt or they were not sufficiently aware of the importance of applying ethical principles in dental practice. It implies that we should promote educational programs about medical ethics and the significance of the physician-patient relationship for dentists and their coworkers, which will help them build even better professional communication with the patient, but also communication with each other, and it will help them improve treatment outcomes.

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PARODONTALNO ZDRAVLJE I DETEKCIJA PARODONTALNIH BAKTERIJA KOD PACIJENATA SA AKUTNIM KORONARNIM SINDROMOM

PERIODONTAL HEALTH AND DETECTION OF PERIODONTAL BACTERIA IN PATIENTS WITH ACUTE CORONARY SYNDROME

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Sažetak

Uvod: *Nedavna istraživanja pokazuju da pacijenti sa parodontopatijom imaju veći rizik od nastanka kardiovaskularnih oboljenja od pacijenata bez parodontopatije. Novija istraživanja otkrila su da upala izazvana parodontopatijom značajno povećava rizik od akutnog koronarnog sindroma (AKS).*
Cilj: *Cilj ove studije bio je istražiti parodontalni status kod pacijenata sa akutnim koronarnim sindromom i proceniti povezanost različitih parodontalnih parametara sa ovim stanjem.*
Materijal i metode: *Prvu grupu činili su pacijenti sa AKS i parodontopatijom. Pacijenti su pregledani 3 dana nakon ishemije. Drugu grupu činili su pacijenti koji su imali samo parodontopatiju. Kontrolnu grupu činili su zdravi pojedinci. Parodontalni parametri mereni su i upoređivani na osnovu karakteristika demografije i procenjivani između grupa. Težina parodontopatije analizirana je u oba slučaja.*
Rezultati: *Analiza parodontalnih paremetara pokazala je da su srednje vrednosti veće kod pacijenata u prvoj i drugoj grupi u odnosu na treću, kontrolnu, grupu, ali značajno veće u grupi sa AKS. Nivoi markera zapaljenja bili su najviši u prvoj grupi, u poređenju sa drugom i kontrolnom grupom. Parodontalni patogeni bili su prisutniji kod pacijenata sa AKS nego kod pacijenata sa parodontopatijom, što ukazuje na ozbiljnu bolest kod ovih bolesnika.*
Zaključak: *Ova studija podržava povezanost parodontopatije i AKS. Teška forma parodontalnog oboljenja prisutna je kod ovih bolesnika, što ukazuje da ono može dalje uticati na razvoj AKS.*

Ključne reči: *akutni koronarni sindrom, parodontopatija, parodontopatogeni, parodontalni parametri, terapija*

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Abstract

Introduction: *Recent studies have found that patients with periodontitis have greater risk of incurring fatal cardiovascular disease than patients without periodontitis. Emerging research has identified inflammation caused by periodontitis as significantly increasing the risk for ACS.*
Aim: *The aim of this study was to investigate a periodontal status in the patients with ACS, and to assess the association of different periodontal parameters with ACS.*
Material and methods: *In the first group, patients both with ACS and periodontitis were enrolled as cases. Patients were examined 3 days after ischemia. The second group consisted of patients who had only periodontitis. The control group consisted of healthy individuals. Periodontal parameters were measured and matched on the basis of demographic characteristics and assessed between the groups. The severity of periodontitis in both cases was analyzed.*
Results: *Analysis of the periodontal parameters showed that median scores were higher in patients in the first and the second group compared to the third control group but significantly higher in group with ACS. Levels of inflammatory markers were highest in the first group, compared to the second group and the control group. Periodontal pathogens were more strongly present in patients with ACS than in the group with periodontitis, indicating that it was a serious illness in these patients.*
Conclusion: *This study supports an association between periodontitis and ACS. Severe periodontitis is present in this patients indicating that periodontitis can further act on the development of ACS.*

Key words: *acute coronary syndrome, periodontitis, periodontopathogens, periodontal parameters, therapy*

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Uvod

Akutni koronarni sindrom (AKS) glavni je uzrok oboljevanja širom sveta[1]. Nekoliko studija sugeriše da je razvoj AKS povezan sa različitim vrstama oralnih infekcija[2,3], dok su drugi autori bili oprezniji[4,5]. Epidemiološke studije pokazale su povezanost parodontopatije i koronarnih bolesti[6,7]. Iz retrospektivnih analiza zaključeno je da bi parodontopatija mogla biti nezavisni faktor rizika za kardiovaskularne bolesti i ishemijski moždani udar[8,9]. Iako su faktori kao što su pušenje, hiper-holesterolemija, gojaznost, hipertenzija i dijabetes dobro utvrđeni faktori rizika za AKS, rezultati ispitivanja ukazuju na to da parodontalno oboljenje može biti povezano i sa AKS, jer su ovi faktori prisutni kod pacijenata sa parodontopatijom.

Parodontopatija je rezultat složene interakcije između hronične bakterijske infekcije i lokalnog i sistemskog inflamatornog odgovora domaćina[10]. Hipoteza je da hronični zapaljenjski teret parodontopatije, kao i odgovor domaćina na ovu upalu, mogu biti uključeni u razvoj kardiovaskularne bolesti[11].

Infarkt miokarda i dentalne infekcije su česte, ali njihov odnos nije dovoljno istražen u srpskoj populaciji. Čini se da parodontalni indeksi pokazuju jaču povezanost, što ukazuje na to da parodontopatija može biti opšti pokazatelj ličnog zdravlja i može uzročno biti povezana sa rizikom od nastanka AKS. Literarni rezultati pokazuju da markeri akutnog zapaljenja i hronične infektivne bolesti mogu povećati rizik od nastanka AKS[12]. Pored toga, prisustvo parodontalnih patogena povezano je sa povišenim markerima zapaljenja i AKS[13,6].

Cilj ove studije bio je da se ispita: I) da li je akutni koronarni sindrom povezan sa tipom i težinom parodontalnog oboljenja kod pacijenata sa prvom epizodom AKS; II) da li parodontalni inflamatorni procesi doprinose riziku od infarkta miokarda i; III) prisustvo parodontalnih patogena (*Porphyromonas-gingivalis – P.g. i Aggregatebacter actinomycetemcomitans – A.a.*) u parodontalnim džepovima pacijenata sa akutnim koronarnim sindromom u srpskoj populaciji u Nišu.

Materijal i metode

Ova studija obuhvatila je 250 učesnika. Svi pacijenti dali su informativni i potpisani pristanak za učešće u studiji. Studiju je pregledao i odobrio Etički odbor Medicinskog fakulteta u Nišu (br: 01-2800-5).

Introduction

Acute coronary syndrome (ACS) is a major cause of morbidity worldwide 1. Several studies have suggested that development of ACS is related to various types of oral infections[2,3], whereas others have been more cautious[4,5]. Epidemiological studies have shown an association between periodontitis and coronary heart disease[6,7].

It was, therefore, concluded from retrospective analysis that periodontitis could be an independent risk factor for cardiovascular disease and ischemic stroke[8,9]. While the factors such as smoking, hypercholesterolemia, obesity, hypertension, and diabetes are well-established risk factors for ACS, studies results suggest that periodontal disease may also be associated with ACS since these factors are present in patients with periodontitis.

Periodontitis results from a complex interplay between chronic bacterial infection and the local and systemic inflammatory host response[10]. It has been hypothesized that the chronic inflammatory burden of periodontal disease and the host response to this inflammation may be involved in the development of cardiovascular disease[11].

Myocardial infarction and dental infections are common, but their relationship is not sufficiently investigated in the Serbian population. The periodontal index seemed to have stronger association, indicating that periodontitis may be general indicator of personal health and may causally related to ACS risk. Markers of acute inflammation and chronic infectious diseases were discussed to increase the risk of ACS[12]. In addition, the presence of periodontal pathogens has been associated with elevated inflammatory markers and ACS[13,6].

The aim of this case-control study was to investigate: i) whether acute coronary syndrome was related to the type and severity of periodontitis in patients with a first episode of ACS, ii) whether periodontal inflammatory processes contribute to the risk of myocardial infarction and iii) the presence of periodontal pathogens (*Porphyromonas gingivalis-P.g. and Agreggatebacter actinomycetemcomitans-A.a.*) in periodontal pockets of patients with acute coronary syndrome in Serbian population in Niš.

Material and Methodology

This study included 250 participants. All patients gave informed and signed consent for study participation. The study

U prvoj grupi bilo je 100 bolesnika sa AKS i parodontopatijom. Pacijenti ove grupe hospitalizovani su na Odeljenju za kardiologiju Kliničkog centra u Nišu, sa prvom epizodom simptoma akutnog infarkta miokarda. Pacijenti su odabrani na osnovu potvrđene dijagnoze infarkta miokarda. Sve ispitanike klinički je pregledao kardiolog. Parodontološki status (klinički parodontalni parametri i prisustvo parodontopatija) ispitivan je 3 dana nakon ishemije, od strane jednog parodontologa.

U drugoj grupi, 100 pacijenata sa parodontopatijom, koji nisu imali istoriju bilo koje srčane bolesti, birano je u Službi za parodontologiju i oralnu medicinu Klinike za stomatologiju Medicinskog fakulteta u Nišu. Ispitanici sa teškom generalizovanom parodontopatijom bili su pozvani da učestvuju u studiji. Sve učesnike pregledao je jedan parodontolog.

Treća grupa (kontrolna grupa) sastojala se od 50 ispitanika, za koje je utvrđeno da nemaju kliničke nalaze AKS i parodontopatije.

Kriterijumi za isključenje pacijenata iz studije bili su trudnoća, nemogućnost davanja saglasnosti ili saradnje pri stomatološkom pregledu u roku od jedne nedelje nakon ishemije, bilo koje poznato stanje u kome je potreban profilaktički antibiotski tretman pre stomatološkog pregleda i istorija i/ili prisustvo drugih infekcija. Prvu posetu pacijentima obavio je kalibrirani ispitivač koji je prikupio kompletnu anamnezu i standardne kliničke parodontalne parametre.

Parodontalna infekcija dijagnostikovana je na osnovu kliničkog pregleda parodontalnih parametara. Umerena parodontopatija dijagnostikovana je onda kada je dubina parodontalnog džepa (DPDž) između 4 mm i 5 mm, a gubitak nivoa epitelnog pripoja (NEP) do 3 mm. Teška parodontopatija dijagnostikovana je onda kada je parodontalni džep bio 5 mm ili više, a gubitak nivoa epitelnog pripoja 3 mm ili veći[14]. Ovi nivoi težine parodontalnog oboljenja izabrani su kako bi povećali verovatnoću otkrivanja sistemskog opterećenja usled lokalne parodontalne infekcije. Za procenu parodontopatije, kao varijable izabrani su NEP, DPDž, inflamacija gingive (GI), krvarenje pri sondiranju (Ikrv) i indeks plaka (PlI). Parodontalno ispitivanje izvedeno je na četiri mesta na svakom zubu (bukalno, mezijalno, lingvalno (palatinalno) i distalno). Srednje vrednosti pojedinačno su izračunavane. Nivoi pripoja analizirani su kao kontinuirana promenljiva (≤ 3 mm).

had been reviewed and approved by the Scientific Ethical Committee of the Faculty of Medicine in Niš (No: 01-2800-5).

In the first group, there were 100 patients with ACS and periodontitis. They were obtained from patients hospitalized to Department of Cardiology, Faculty of Medicine in Niš, with a first episode of symptoms of acute myocardial infarction. The patients were selected on the basis of confirmed diagnosis of myocardial infarction. All subjects were clinically examined by a cardiologist. Patient's periodontal status (clinical periodontal parameters and presence of periodontopathogens) was examined 3 days after ischemia by one periodontologist.

In the second group, 100 patients with periodontitis were recruited from subjects referred to the Department of Periodontology of the Dental Clinic, Faculty of Medicine, but who had no history of any heart disease. Subjects presenting with severe generalized periodontitis were invited to participate in the study. All participants were examined by periodontologist.

The third group (control group) consisted of 50 subjects who were found free from clinical evidence of ACS and periodontitis.

Exclusion criteria for patients from study were pregnancy, inability to give informed consent or to cooperate in the dental examination within 1 week after ischemia, any known condition in which a prophylactic antibiotic treatment before dental examination was required, and history and/or presence of other infections. A baseline visit was conducted by a calibrated examiner who collected a complete medical history and standard clinical periodontal parameters.

Periodontal infection was diagnosed on the basis of clinical examination of periodontal parameters. Moderate periodontitis was diagnosed if periodontal pocket depth (PPD) was between 4 and 5 mm and clinical attachment loss - CAL to 3 mm. Severe periodontitis was diagnosed if periodontal pocket was 5 mm or more, with clinical attachment loss of 3 mm or greater[14].

These levels of periodontitis severity were chosen to increase probability of detection of a systemic burden from the local periodontal infection. For assessment of periodontitis, the CAL, PPD, gingival inflammation (GI), bleeding on probing (BOP) and plaque index (PI) were selected as the variables. Periodontal probe performed at four sites in each tooth (buccal, mesio-lingual, lingual and disto-lingual). Mean values were individually calculated.

Inflamacija gingive i gingivalno krvarenje određivani su Löe-Silnessovim gingivalnim indeksom[15]. Oralna higijena (PlI) procenjivana je Sillness-Löeovim indeksom plaka[15]. Srednje vrednosti pojedinačno su izračunavane.

Sve osobe pregledane su pomoću veštačkog svetla i stomatološkog ogledalca. Sve stomatološke preglede obavio je jedan parodontolog. Nakon određenog parodontalnog statusa, ispitanici su kategorisani prema najgorem parodontalnom stanju u ustima.

Anketirani su svi pojedinci korišćenjem standardizovanog upitnika, koji je bio fokusiran na prethodne bolesti i faktore rizika. Kovarijabilni elementi uključivali su sociodemografske promenljive i utvrđene faktore rizika za kardiovaskularne bolesti (starost, pol, obrazovanje, status pušenja, istorija dijabetesa i indeks telesne mase).

Uzorci subgingivalnog plaka sakupljeni su na početku studije iz najdubljih džepova, po jedan u svakom kvadrantu. Laboratorijska faza uključivala je analizu uzoraka korišćenjem višestrukih PCR metoda, koje uključuju istovremeno amplifikacione sekvence DNK obe bakterijske vrste (*P.g.*, *A.a.*). Uzorci su pripremljeni pre PCR analize, a zatim su davani u odgovarajućoj količini u reakcionoj smeši. Reakciona smeša je korišćena sa zapreminom od 25 µl, koja se sastoji od PCR/Mg++ pufera, 1,5 µl svakog prajmera, 1U Taq DNK polimeraze i 3 µl supernatanta DNK. PCR je izveden na Thermo Hybaid aparatu (Thermo, Valtham, MA), programiranom na unapred definisane parametre. Posle pojačanja, usledila je elektroforeza sa 8% gela poliakril-amida. Pojačani fragmenti vizuelizovani su na ultraljubičastom transiluminatoru, nakon bojenja etijum-bromidom (Slika 1)[33].

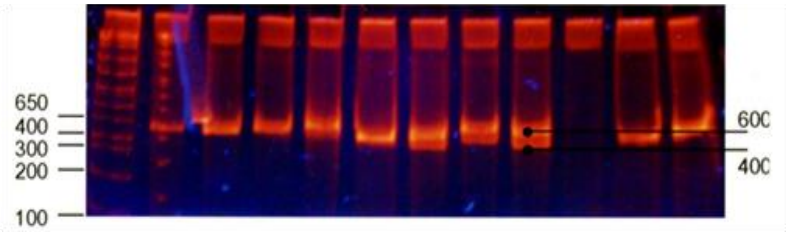
Attachment levels were analyzed as continuous variable (≤3 mm). Gingival inflammation and gingival bleeding were determined by the Löe and Silness gingival index[15].

Oral hygiene (PI) was assessed by the Sillness and Löe plaque index[15]. Mean values were individually calculated.

All individuals were examined using a standard dental light and a dental mirror. All dental examinations were performed by one periodontologist. For periodontal status, subjects were categorized according to the worst periodontal condition in the mouth.

All individuals were interviewed by trained interviewers using a standardized questionnaire that focused on previous diseases, and risk factors. The covariables included sociodemographic variables and established risk factors for cardiovascular disease (age, sex, education, smoking status, history of diabetes, and body mass index).
Samples of subgingival periodontal plaque were collected at baseline from the deepest pockets, one in each quadrant. Laboratory phase included the analysis of samples using multiple PCR method, which involved the simultaneous amplification DNA sequences of both bacterial species (*P.g.*, *A.a.*). Samples were prepared before PCR analysis, and subsequently administrated in appropriate amount in the reaction mixture. Reaction mixture was used with volume of 25 µl consisting of PCR/Mg++ buffer, 1.5 µl of each primer, 1U Taq DNA polymerase and 3 µl of DNA supernatant. PCR was carried out on ThermoHybaid apparatus (Thermo, Waltham, MA.) programmed to pre-defined parameters. After amplification electrophoresis was followed at 8% polyacrile-amide gel. Amplified fragments were visualized on the ultraviolet transilluminator, after staining with ethidium bromide (Fig. 1)[33].

Slika. 1. Amplificirani fragmenti *P.gingivalis* (400bp) i *A.actinomycetemcomitans* (600bp)[33]
Fig.1. Amplified fragments of *P.gingivalis* (400bp) and *A.actinomycetemcomitans* (600bp)[33]



Statistička analiza

Rezultati su izraženi kao srednja vrednost ± standardna greška srednje vrednosti u svakoj grupi. Višestruka poređenja izvršena su korišćenjem ANOVA. Vilijamov test korišćen je za post hoc poređenja. Vrednost verovatnoće p<0,05 smatrana je statistički značajnom.

Results were expressed as mean±standard error of the mean in each group. Multiple comparisons were performed by ANOVA. Williams' test was used for post-hoc comparisons. A probability value p<0.05 was considered statistically significant.

Tabela 1. Polna i starosna struktura ispitanika
Table 1. Gender and age distribution of respondents

Varijable/variable	I (ACS + PD)	II (PD)	III (Control group)	p- value
Pol/Gender (n°,%)				
muški/male	64 (64%)^{c**}	54 (54 %)^{c*}	14 (28 %)	χ^2 = 8.715
ženski/female	36 (36%)	46 (46%)	36 (72%)	p < 0.05
Godine / Age				ANOVA
SV ± SD / Mean ± SD	56.94 ± 13.42^{b**c***}	48.76 ± 15.83	42.80 ± 5.76	F = 9.789 p < 0.001

b–vs II, c–vs III
*–p<0,05; **–p<0,01; **–p<0,001

Tabela 2. Osnovne karakteristike tretirane populacije sa AKS + PD, PD i kontrola
Table 2. The basic characteristics of the treated population with ACS+PD, PD and control

Varijabile/Variable	I(AKS+PD) (ACS+PD)	II (PD) (PD)	III (Kontrolna grupa) (Control group)	p -value
Edukacija / Education (n°, %)				
Srednja škola / High school	58 (58%)^{c*}	64 (64%)^{c**}	16 (32 %)	χ^2 = 7.166 p
Fakultet/Faculty	42 (42%)	36 (36%)	34(68 %)	< 0.05
Socijalni status / Social status (n°, %)				
Loš/Bad	72 (72%)^{c***}	66 (66%)^{c**}	14 (32%)	χ^2 = 14.48 p
Dobar/Good	28 (28%)	34 (34%)	36 (68%)	< 0.001
Pušenje/Smoking (n°, %)				
Da/Yes	46 (46%)	38 (38%)	20 (40%)	χ^2 = 0.692
Ne/No	54 (54%)	62 (62%)	30 (60%)	n.s.
Fizička aktivnost / Phisycal activty (n°, %)				
Aktivan/Active	10 (10%)	30 (30%)	12 (24%)	χ^2 = 6.26 p <
Pasivan/Passive	90 (90%)^{b*}	70 (70%)	38 (76%)	0,05
Upotreba lekova / Drug use (n°, %)				
Da/Yes	100 (100%)^{b,c***}	26 (26%)	6 (12%)	χ^2 = 75.81 p
Ne/No	0 (%)	74 (74%)	44 (88%)	< 0.001
Dijabetes / Diabetes, (n°, %)				
Da/Yes	38 (38%)^{b**c***}	14 (14%)	0	χ^2 = 16.948
Ne/No	62 (62%)	86 (86%)	50 (100%)	p < 0.001
Hipertenzija / Hipertension, (n°, %)				
Da/Yes	68 (68%)^{bc***}	32(32%)^{c**}68	0	χ^2 = 34.333
Ne/No	32 (32%)	(68%)	50 (100%)	p < 0.001

b–vs II, c–vs III
*–p<0,05; **–p<0,01; ***–p<0,001; n.s.-no significant (nesignifikantno)

Rezultati

Karakteristike istraživačke populacije prikazane su u tabelama 1 i 2.

S obzirom na pol i starost pacijenata u obe grupe, parodontopatija i AKS češći su kod muškaraca i starijih osoba. Inače, dobro je poznata povezanost ovih bolesti sa godinama i polom.

Nivo obrazovanja kod većine pacijenata bio je nizak (<12 godina). Parodontalni pacijenti i pacijenti sa AKS+PD nalaze se u grupi nižeg obrazovanja u poređenju sa osobama koje su zdrave (42% i 36% u odnosu na 68%) (p<0,05).

Socijalni status bolesnika iz obe grupe bio je loš (72% i 66%) u poređenju sa kontrolnom grupom (32%). Postoji statistički značajna razlika među grupama (p<0,001).

Pušači u prvoj grupi su bili (46%), u drugoj grupi (38%), a u kontrolnoj grupi 20 (40%). Pušači su češći u eksperimentaloj grupi u poređenju sa kontrolnom grupom, ali nema značajne razlike. Pušenje je inače faktor rizika za obe bolesti.

Fizičku aktivnost ne praktikuje većina ispitanika, u obe eksperimentalne grupe. U prvoj grupi aktivno je samo 10, a u drugoj grupi samo 30 ispitanika (30%). U kontrolnoj grupi je12 aktivnih pacijenata. U PD grupi bili su, statistički dominantno, neaktivni ispitanici (p<0,05), a njihov broj bio je zastupljeniji u grupi AKS+PD (p<0,001). Pacijenti sa AKS rade manje vežbi od ljudi iz drugih grupa. Poznato je da su redovne fizičke aktivnosti povezane sa nižim rizikom od nastanka AKS.

Upotreba lekova primećena je kod svih bolesnika sa AKS+PD (100%), dok manji procenat pacijenata upotrebljava lekove u grupi sa PD (26%). U kontrolnoj grupi samo 12% ljudi koristi bilo koji lek, ali samo kada im je potreban. Grupe se statistički razlikuju u odnosu na upotrebu lekova (p<0,001).

Dijabetes je imalo samo 14 pacijenata od ukupnog broja pacijenata sa parodontopatijom, dok je 38 pacijenata bilo sa dijabetesom u grupi sa AKS+PD. U kontrolnoj grupi nije bilo pacijenata sa dijabetesom. Razlike u postojanju dijabetesa u ovoj studiji odgovaraju činjenici da je dijabetes poznat faktor rizika za nastanak kardiovaskularnog i parodontalnog oboljenja (p<0,001).

Hipertenzija u grupi sa PD zastupljena je u svega 32% pacijenata, dok je u AKS grupi taj procenat 68.

Results

Characteristics of the study population shown in Table 1 and 2.

In terms of gender and age in both groups of diseases, periodontitis and ACS were more common men and the elderly. Otherwise it is well known connection compared to the year and a gender for both diseases.

Level of education was low (<12 years) in most subjects. Periodontal patients and patients with ACS+PD were in the group with lower education compared to the healthy-control persons (42%, 36% vs. 68%) (p<0.05).

Social status in both groups of patients was poor (72% and 66%) compared to the control group (32%). There is a statistically significant difference among the groups (p<0.001).

Smokers in the first group made up 46%, in the second group 38%, and in the control group there were 20 (40%) of them. Smokers were more common among patients of the experimental group compared to the healthy group, but there was no significant difference. Smoking is otherwise a risk factor for both diseases.

Physical activity was not practiced by the majority of respondents in both experimental groups. In the first group, only 10 patients and in the other group only 30 patients (30%) were active. In the control group there were 12 active patients. In the PD group, there were statistically predominant inactive subjects (p<0.05), and even more dominant in the group ACS+PD (p<0.001). Patients with ACS did less exercise than people in other groups. It is known that regular physical activity goes along with a lower risk for ACS.

The use of drugs was observed in all patients with ACS+PD (100%), while a smaller percentage (26%) in individuals with only PD. In the control group only 12% of people were using any medications, but only when they needed them. Groups were statistically different in relation to the use of drugs (p<0.001).

Diabetes had only 14 of the total number of patients with periodontitis, while 38 patients were with diabetes in the group with ACS+PD. In the control group, there were no patients with diabetes. Differences in the existence of diabetes in this study correspond to the fact that diabetes is a known risk factor for cardiovascular and periodontal disease (p<0.001).

Pacijenti u kontrolnoj grupi bili su bez hipertenzije. U grupi sa AKS+PD bilo je statistički više pacijenata sa hipertenzijom u poređenju sa ispitanicima PD grupe (p<0,001). Grupe se značajno razlikuju u pogledu prisustva hipertenzije (p<0,001).

Teška forma parodontopatije bila je značajno više zastupljena kod pacijenata u grupi sa AKS nego kod pacijenata PD grupe (Tabela 3.)

Hypertension among the patients with PD was present in only 32%, and in 68% inthe ACS group. Peoplein the controlgroup were without hypertension. In the ACS+PD group, there were statistically more patients withhypertensioncompared tosubjectswith PD (p<0.001). Groups were significantly differentinterms ofpresenceof hypertension (p<0.001).

Severe periodontitis were significantly greater for cases in group with ACS than for cases with periodontitis (Table 3.)

Tabela 3. Parodontalni indeksi u svim grupama pacijenata
Table 3.Periodontal findings in all groups of patients

Varijabile / Variable	I (AKS + PD) (ACS + PD)	II (PD) (PD)	III (Kontrolna grupa) (Control group)	ANOVA p-value
PlI/PlI	1.90 ± 0.58 ^{c***}	1.64 ±0 .53 ^{c***}	0.52 ± 0.42	F = 58.650 p < 0.001
Ikrv/BOP	1.70 ± 0.46 ^{c***}	1.72 ± 0.45 ^{c***}	0.40 ± 0.38	F = 86.971 p < 0.001
GI/GI	1.76 ± 0.43 ^{c***}	1.76 ± 0.43 ^{c***}	0.40 ± 0.38	F = 103.795 p < 0.001
DPDž mm / PPD, mm mean±SD	5.14 ± 1.04 ^{bc***}	4.68 ± 1.11 ^{c***}	1.90 ± 0.55	F = 94.454 p < 0.001
<5mm	52 (52%)	66 (66%)	50 (100%)	χ^2 = 17.48
≥5mm	48 (48%) ^{c***}	34 (34%) ^{c***}		p < 0.001
CAL, mm	6.28 ± 1.04 ^{bc***}	5.72 ± 0.96 ^{c***}	1.90 ± 0.55	F = 198.557 p < 0.001

b–vs I, c–vs III
*–p<0,05; **–p<0,01; ***–p<0,001; n.s.-no significant
Footnotes: **PI**-plaque index; **BOP**-bleeding on probing:**GI**-gingival index
PPD-periodontal pocket depth; **CAL**-clinical attachment loss

Prevalencija parodontopatije i parodontalnih indeksa bila je veća kod osoba sa AKS+PD u poređenju sa pacijentima drugih grupa (p<0,001). Parodontalni parametri upoređivani su u odnosu na srednje vrednosti između ispitivnih grupa i kontrolne grupe. Pacijenti sa AKS imaju veću količinu dentalnog plaka, dublje parodontalne džepove i veći gubitak nivoa pripojnog epitela (p<0,001).

Mikrobiološka analiza pokazala je prisustvo *P.g.* u 76% slučajeva i *A.a.* u 32% slučajeva u grupi sa AKS+PD, 34% *P.g.* i 16% *A.a.* u grupi sa PD. U kontrolnoj grupi *P.g.* bio je prisutan u 4% slučajeva, dok *A.a.* nije bio prisutan. Prisustvo *Porphyromonas gingivalis* (p<0,001) i *Aggregatibacter actino-mycetemcomitans* (p<0,01) značajno se razlikovalo i bilo je značajno veće u grupama sa AKS+PD i PD nego u kontrolnoj grupi (p<0,001).

Prevalence of periodontitis and periodontal indicators were higher in those with ACS+PD compared with other groups (p<0.001). Periodontal parameters were compared in terms of median values between cases and controls.Patients with ACS had a greater amount of bacterial plaque, deeper periodontal pockets, and greater loss of epithelial attachment (p<0.001).

Microbial analysis showed the presence of P.g. in 76% and A.a. in 32% in the group with ACS+PD, and 34% of P.g. and 16% of A.a. in the group with PD. In the control group, P.g. was present in 4% cases, while A.a. was not present. Presence of *Porphyromonas gingivalis (p<0.001), and Aggregatibacter actinomycetemcomitans* (p<0.01) were significantly different and significantly higher in groups with ACS+PD and PD than in controls (p<0.001).

Diskusija

Rezultati ove studije pokazali su značajnu povezanost lošeg parodontalnog statusa i AKS, korišćenjem parodontalnih indeksa. Podaci pokazuju da su parodontalni parametri bili povezivani sa srčanim udarima kod osoba starih 40 i više godina (Tab.1).

Podaci su pokazali da loše zdravlje zuba i, posebno, parodontopatija povećavaju rizik od pojave AKS, pružajući dokaze da dentalne infekcije imaju niz rizičnih faktora zajedničkih sa AKS. Ova veza pažljivo je kontrolisana za niz kardiovaskularnih faktora rizika kao kovarijanata, uključujući starost, muški pol, pušenje cigareta, dijabetes melitus, gojaznost, hipertenziju, fizičku neaktivnost, socijalni status i obrazovanje, a podaci su u saglasnosti s drugim studijama, koje su pokazale pozitivnu povezanost parodontopatije i rizika od kardiovaskularnih bolesti[16]. Mnogi faktori rizika za nastanak AKS bili su prisutni kod pacijenata sa parodontopatijom (Tab.2).

Parodontalno oboljenje započinje mikrobnom infekcijom. Akumulacije na zubima neophodne su za pokretanje i napredovanje parodontopatije. Kada se bakterijski biofilm na zubima ne uklanja, ekološke promene dovode do pojave određenih bakterijskih vrsta, uključujući *P.g.* i *A.a.*, koji su povezani sa parodontopatijom. Ove bakterije, sa faktorima okoline i genetskim faktorima, ubrzavaju upalne procese u parodontu. Zapaljenje se pojavljuje kao interterativni AKS faktor. Međutim, zabeleženo je da se stepen zapaljenja povećava sa težinom parodontopatije i površinom inficiranog parodontalnog tkiva[17,18].

Parodontopatija, koja se obično javlja kod pacijenata sa AKS, takođe može poslužiti kao kofaktor. U istraživanju je pronađeno da se veća parodontalna infekcija i loše oralno zdravlje javljaju kod pacijenata sa AKS, u odnosu na pacijente samo sa parodontopatijom i u odnosu na kontrolne ispitanike (Tab. 3). Izgleda da su parodontalne infekcije značajno češće i teže među ispitanicima nego među kontrolama, što je u skladu sa ranijom studijom[8].

Sa svakom povišenom kategorijom parodontalnih parametara, rizik od srčanog udara se povećava.

Među osobama sa srčanim udarom bilo je mnogo više ispitanika koji su imali tešku formu parodontopatije od onih koji su imali samo parodontopatiju.

Discussion

The results of the present study showed a significant association between poor periodontal status and ACS regardless of the periodontal index used. The periodontal parameters were associated with a history of heart attack among persons aged 40years and over (Tab. 1).

Data have shown that poor dental health and, in particular, periodontitis increased the risk of occurrence of ACS, providing evidence that dental disease have a number of risk factors in common with ACS. The reported association was carefully controlled for a series of cardiovascular risk factors as confounders, including age, male gender, cigarette smoking, diabetes mellitus, obesity, hypertension, physical inactivity, social status and education, and the data are in agreement with other studies that have shown a positive association between periodontitis and the risk of cardiovascular disease events [16]. Many risk factors for ACS were presents in the patients with periodontitis (Tab. 2).

Periodontitis begins with a microbial infection. Bacterial accumulations on the teeth are essential to the initiation and progression of periodontitis. When bacterial biofilms on the teeth are not disrupted, ecologic changes lead to the bacterial species, including *P.g.* and *A.a.* which are associated with periodontitis. These bacteria with environmental and genetic factors accelerate inflammatory processes in periodontitis. Inflammation has emerged as an interactive ACS factor. It has been reported though, that the degree of inflammation increases with severity of periodontitis and area of infected periodontal tissue [17,18].

Periodontitis, commonly found in patients with ACS may also serve as a confounder. We found greater evidence of periodontal infection and poor dental health among patients with ACS than among patients with periodontitis and controls (Table 3). Periodontal infections seemed significantly more frequent and more severe among cases than among controls, in agreement with earlier study [8]. With each higher category of periodontal parameters, a history of heart attack increased. Among persons with a heart attack, there were much more subjects who had more severe periodontitis than those who had only

To bi se moglo odraziti na razlike u dizajnu studije i merama srčanih bolesti i parodontalnog oboljenja.

Primenom parodontalnih indeksa i parodontalnih patogena, pokazana je značajna povezanost lošeg parodontalnog statusa i AKS. Postojeće studije pružaju dokaze po kojima bi parodontalni indeksi najbolje opisali povezanost infekcije tkiva parodonta i ishemijskog udara. Štaviše, nijedna od većih studija nije proučavala parodontalnu infekciju u trenutku ishemijskog događaja.

Svi parodontalni parametri bili su značajno viši kod pacijenata sa AKS. Prema otkrićima u ovoj studiji, povišeni parodontalni indeksi mogu se smatrati nezavisnim faktorima rizika za razvoj kardiovaskularne bolesti. To je u skladu sa prethodnom studijom, koja je prijavila veći nivo inflamatornih markera kod pacijenata sa teškom parodontopatijom. Inflamacija je prepoznata kao značajan aktivni učesnik, kao i faktor rizika za razvoj mnogih hroničnih bolesti, uključujući aterosklerozu i kardiovaskularna oboljenja i parodontopatiju[19,20,21].

U ovom istraživanju pokazano je da su parodontopatogeni (*A.a, P.g.*) prisutni u velikom porastu kod pacijenata sa AKS, mnogo više nego kod pacijenata samo sa parodontopatijom. Rezultati su pokazali da ti parodontopatogeni mogu biti faktori rizika za budući AKS događaj, jer je veći porast parodontopatije praćen inflamatornom reakcijom tkiva parodonta. Međutim, u skladu sa rezultatima ovog istraživanja, zapažanje je da su nivoi bakterijskog antigen specifičnog IgA antitela niži kod pacijenata sa parodontopatijom nego kod pacijenata sa AKS[22,23].

Ovaj rezultat je, prema jednoj od retkih studija u kojoj su procenjivani uzorci subgingivnih plakova, imao direktnu vezu sa subkliničkom aterosklerozom[24]. Kod nelečene parodontopatije, Gram-negativne bakterije (*P.g, A.a.*) nalaze se u parodontalnim džepovima, ali se mogu naći i u ateromima[25]. U vezi sa aterosklerozom, najčešće proučavani parodontopatogeni su *A.a.* i *P.g.*, koji su serološki heterogene vrste. DNK ovih vrsta pronađen je u ljudskim aterosklerotičnim plakovima.

Bakterije ili njihovi delovi mogu imati pristup cirkulaciji krvi kroz inflamirano parodontalno tkivo tokom svakodnevne rutine.

Jednom kada su u cirkulaciji, bakterijske komponente mogu izazvati i podsticati sistemsku inflamaciju i proaterogeni odgovor[26,27].

periodontal disease.This could reflect on the differences in study design and measures of coronary heart disease and periodontitis.

A significant relationship between poor periodontal status and ACS was demonstrated by using periodontal indices and periodontal pathogens. The existing studies provide evidence of which the periodontal parameters would describe best an association between inflammation of the periodontal tissues and ischemic stroke event. Even more, none of the larger studies have studied the periodontal situation at the time of the ischemic event.

All periodontal parameters were significantly higher in the patients with ACS. According to our findings, elevated periodontal parameters can be considered as the independent risk factors for developing cardiovascular disease. This is in agreement with a previous study, which has reported higher levels of inflammatory markers in patients with more severe periodontitis. Inflammation is recognized as a significant, active participant as well as a risk factor in many chronic diseases, including atherosclerotic cardiovascular disease and periodontitis[19,20,21].

In this study, it was demonstrated that periodontopathogens (*A.a, P.a.*) were present in high percentage in cases with ACS, much more than in cases only with periodontitis. The results demonstrated that these periodontopathogens might be the risk factors for future ACS event because greater percentage of periodontopathogens was accompanied by an inflammatory reaction of periodontal tissues. However, consistent with our data is the observation that levels of bacterial antigen-specific IgA antibody are lower in patients with periodontitis than in patients with ACS [22,23].

This result is in accordance with one of the few studies where subgingival plaque samples have been assessed, periodontal microbiology had a direct relationship with subclinical atherosclerosis[24]. In untreated periodontitis, Gram-negative bacteria (*P.a., A.a.*) are found in periodontal pockets, but they may also be found in atheroma[25]. Concerning atherosclerosis, the most widely studied periodontopathogens are A.a. and P.g., which are serologically heterogeneous species.

DNA of these species has been found in human atherosclerotic plaque. Bacteria or their parts may have an access to circulation via inflamed periodontal tissue during daily routines.

Umerena i jaka parodontopatija povećavaju nivo sistemske inflamacije. Sve hronične zapaljenske bolesti, pa i parodontopatija, povezane su sa povećanom sistemskom inflamacijom merenom biomarkerima.

Ispitivana je povezanost dubine parodontalnih džepova i AKS, jer su duboki parodontalni džepovi posebno održivi portali za ulazak bakterija u sistemsku cirkulaciju krvi. Parodontalni indeksi bili su značajni kod ispitanika sa AKS, nakon korekcije za moguće kofaktore. Parodontopatija se može pridodati sistemskom inflamatornom opterećenju pojedinaca.

Rezultate ove studije treba uzeti u obzir pri planiranju strategija za sprečavanje srčanih bolesti. Stomatološke konsultacije i eliminacija parodontalne infekcije trebalo bi da budu deo sveobuhvatnog lečenja svih pacijenata sa srčanim problemima[1].

Čak i bez podataka iz takvih studija, preporučuje se da se parodontalna infekcija navede kao mogući faktor akutne miokardijalne infekcije, zajedno sa pušenjem, prekomernom težinom, visokom koncentracijom lipida i visokim krvnim pritiskom. Parodontalna infekcija može se javiti i bez većih znakova ili simptoma, čak i ako je zahvaćena velika površina.

Za ulogu parodontopatije u kardiovaskularnim bolestima predloženo je nekoliko hipoteza, zasnovanih na inflamatornim modelima bolesti. Jedna hipoteza govori o tome da neki pojedinci mogu imati fenotip monocita, koji izlučuje viši od normalnog nivoa proinflamatornih medijatora u odgovoru na bakterijske infekcije[28]. Parodontopatija je infektivno oboljenje, a kao odgovor na parodontopatogene i njihove endotoksine, oslobađanje proinflamatornih medijatora dovodi do propadanja parodontalnog vezivnog tkiva i kostiju. Za indukciju sistemske inflamacije predloženo je da bude patogeni mehanizam kojim se može objasniti veza infekcije parodontalnog tkiva i ateroskleroze, gde bakterije i proinflamatorni citokini igraju važnu ulogu[29,30].

Druga hipoteza je da parodontopatogeni mogu sistemski da se šire u krvotok i direktno inficiraju vaskularni endotel, što dovodi do ateroskleroze i ishemije i infarkta miokarda.

U parodontopatiji, porast Gram-negativnih bakterija može izazvati sistemsku inflamaciju koja vodi ka kardiovaskularnim bolestima[31,32].

Lečenje parodontopatije smanjuje sistemske inflamatorne markere, ali ako se ne

Once in the circulation, bacterial components can induce and promote systemic inflammation and proatherogenic responses[26,27]. Moderate to severe periodontitis increases the level of systemic inflammation. All chronic inflammatory diseases, and periodontitis, have been associated with increased systemic inflammation as measured by biomarkers.

Association was observed between periodontal pocket depths and ACS because deep periodontal pockets are especially viable portals for entry of bacteria into the systemic blood circulation. Periodontal parameters were significant in subjects with ACS after correction for possible confounders. Periodontitis may add to the systemic inflammatory burden of affected individuals.

The results of this study should be taken into consideration when planning strategies to prevent cardiac disease. Dental consultations and elimination of periodontal infection should be part of the comprehensive treatment of all patients with cardiac problems[1].

Even without data from such studies, it is recommended that periodontal infection can be listed as a possible contributing factor to acute myocardial infection, along with smoking, overweight, high lipid concentration and high blood pressure. Periodontal infection may occur without major signs or symptoms, even if a large area is affected.

Several hypotheses, based on inflammatory models of disease, have been proposed for the role of periodontitis in cardiovascular disease. One hypothesis is that some individuals may have a monocyte phenotype that secretes higher than normal levels of pro-inflammatory mediators in response to bacterial infections 28. Periodontitis is an infectious disease, and in response to periodontopathogens and their endotoxins, the release of pro-inflammatory mediators leads to periodontal connective tissue and bone degradation. Induction of systemic inflammation has been proposed to be the pathogenic mechanism behind the association of periodontal tissue infection and atherosclerosis, where bacteria and pro-inflammatory cytokines play an important role[29,30].

Another hypothesis is that the periodontopathogens may disseminate systemically through the bloodstream and infect the vascular endothelium directly, leading to atherosclerosis and myocardial ischemia and infarction. In periodontitis,

leči ili neadekvatno kontroliše, umerena i teška forma parodontalnog oboljenja progredira i povećava sistemsku inflamatornu reakciju i tada parodontopatija može biti nezavisno povećan rizik za nastanak AKS. Pacijente sa AKS treba obavestiti da može postojati povećan rizik za AKS ako imaju parodontopatiju. Pacijente sa AKS i parodontopatijom treba podvrgnuti lečenju parodontopatije kako bi se smanjio rizik od pojave AKS.

Zaključak

Zaključno, rezultati ovog istraživanja sugerišu da je parodontalno oboljenje u kombinaciji sa parodontopatogenima povezano sa povećanim rizikom za akutne kardiovaskuarne događaje. Konkretno, visoki parodontalni indeksi u kombinaciji sa nivoima inflamacije parodontalnog tkiva ukazuju na visok rizik od incidenta ishemičnih događaja.

Ova studija potvrđuje nalaze drugih istraživanja, koja sugerišu povezanost lošeg oralnog statusa i AKS i pružaju dokaze da bi inflamatorni i hemostatski faktori mogli da igraju važnu ulogu u ovom udruživanju.

overgrowth of Gram-negative bacteria may cause systemic inflammation leading to cardiovascular diseases[31,32].

Treatment of periodontitis reduces the systemic inflammatory markers, but if left untreated or inadequately controlled, moderate to severe periodontitis increases the systemic inflammatory burden and that periodontitis may be an independent increased risk for ACS. Patients with ACS should be informed that there may be an increased risk for ACS if they have periodontitis. Patients with ACS and periodontitis should be subjected to the treatment of periodontitis in order to reduce the risk for ACS.

Conclusion

In conclusion, our results suggest that periodontitis in combination with periodontopathogens are associated with increased risk for acute ACS events. In particular, high periodontal parameters combined with levels of periodontal tissue inflammation indicate a high risk of incident ACS events.

The present study confirms the finding of recent reports that suggest an association between poor oral status and ACS, and provide evidence that inflammatory and hemostatic factors could play an important role in this association.

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PRIKAZ SLUČAJA
CASE REPORT
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EVAGINACIJA I INVAGINACIJA ZUBA: PRIKAZ DVA SLUČAJA

DENS EVAGINATUS AND DENS INVAGINATUS: A REPORT OF TWO CASES

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Sažetak

Uvod: *Poremaćaji razvoja zuba u fazi morfološke diferencijacije povezani su sa anomalijama u promeni oblika i veličine zuba. Evaginacija i invaginacija zuba razvojne su anomalije u humanoj denticiji. Evaginacija zuba je retka anomalija okarakterisana prisustvom kvržice na okluzalnoj površini zuba i posledica je abnormalne proliferacije i savijanja unutrašnjeg gleđnog epitela i dela zubne papile u reticulum stellatum gleđnog organa; invaginacija zuba javlja se usled savijanja gleđi i dentina u kavumpulpe i nekada može da doseže i do vrha korena zuba.*
Prikaz slučaja: *Ovde smo prikazali slučajeve bilateralne evaginacije drugog premolara donje vilice i invaginaciju lateralnog sekutića gornje vilice.*
Zaključak: *Ovakve razvojne anomalije zuba zaslužuju klinički tretman, jer imaju velike šanse za ranu pojavu oboljenja pulpe*

Ključne reči: *evaginacijazuba, invaginacijazuba, zub u zubu, Leongov premolar*

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Abstract

Introduction: *Developmental disturbances of teeth at the stage of morpho-differentiation have been related to abnormalities associated with changes in the tooth shape and size. Dens evaginatus and dens invaginatus are the developmental variations of the human dentition. Dens evaginatus, a rare anomaly characterized by the presence of a tubercle on the occlusal surface of teeth is seen to occur due to abnormal proliferation and folding of the inner enamel epithelium and part of the dental papilla into the stellate reticulum of the enamel organ; whereas, dens invaginatus is seen to occur due to infolding of the enamel and dentine into the pulp cavity and sometimes extending to the root apex.*
Case report*: We report cases with bilateral dens evaginatus in mandibular second premolars and dens invaginatus in maxillary lateral incisor.*
Conclusion: *Such developmental anomalies of teeth deserve clinical importance, as high chances of early pulpal pathosis.*

Key words: *dens evaginatus, dens invaginatus, developmental abnormalities,*

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Uvod

Evaginacija zuba (EZ), retka razvojna anomalija zuba, okarakterisana je prisustvom kvržice na okluzalnoj površini zuba i najčešće se javlja na premolarima donje vilice i lingvalnim površinama prednjih zuba. Kvržicu u vidu promencije na okluzalnoj površini premolara prvi je zapazio M.O. Leong 1946. godine i ona se od tada zove Leongov premolar. Prevalencija se kreće aproksimativno oko 2% kod ljudi azijskog porekla, sa nešto većom učestalošću kod pripadnika kineske populacije. Obično se primećuje bilateralno, simetrično prisustvo ove anomalije, nešto učestalije kod osoba ženskog pola[1-3]. Invaginacija zuba (IZ) takođe je razvojna malformacija zuba, koja nastaje kao posledica savijanja zubne papile. Radiografski se vidi kao presavijanje gleđi i dentina, koje se proteže kroz kavumpulpe i ponekad ide do korena zuba, sa mogućnošću da dostigne do njegovog vrha[4]. Ovde prikazujemo slučaj bilateralne evaginacije zuba kod muškarca srednje životne dobi i slučaj invaginacije zuba povezane sa periapikalnom cistom na lateralnom sekutiću gornje vilice.

Prikaz slučaja

Slučaj 1

Muškarac starosti 42 godine javio se Odeljenju oralne medicine i radiologije na rutinski stomatološki pregled. Medicinska stomatološka istorija bolesti pacijenta bila je bez osobenosti. Intraoralnim pregledom, otkrivena je anatomska varijacija na drugim premolarima donje vilice. Levi drugi premolar donje vilice imao je izbočine nalik kvržicama na okluzalnom delu, tako da podseća na molar. Nije bilo vidljivog karijesa na zubu i osetljivosti zuba na perkusiju. Desni drugi premolar donje vilice imao je kvržicu na okluzalnom delu. Na osnovu kliničkog izgleda, kod pacijenta je dijagnostikovana evaginacija zuba na levom i desnom premolaru donje vilice (Slika 1). Zatražena je intraolna periapikalna radiografija (IOPAR). IOPAR je pokazala to da su premolari donje vilice imali izmenjene morfologije sa većom širinom krunice, slično susednim molarima. Prisutna je ekstenzija dentina na okluzalnoj površini u formi krvžice. Koreni su takođe pokazali atipičnu morfologiju i dužinu (Slika 2 A i B).

Introduction

Dens evaginatus (DE), a rare developmental anomaly of the human dentition, which is characterized by the presence of a tubercle on the occlusal surface of teeth, are frequently seen occurring on mandibular premolars and lingual surface of anterior teeth. The tubercle like prominence on the occlusal surface on the premolars was first noted by M.O. Leong in 1946 and it has ever since been called Leong's Premolar. The prevalence is found to be approximately 2% in people of Asian descent, with higher rates of occurrence in the Chinese population. It is usually observed as bilateral, symmetric distribution, with a slight predilection for females[1-3]. Dens invaginatus (DI) is also a developmental malformation of teeth seen due to the infolding of the dental papilla. This is seen radiographically as an infolding of enamel and dentine extending into the pulp cavity and sometimes extending to the root and even may reach the root apex [4]. We are reporting a case of bilateral dens evaginatus in a middle aged male and a case of dens invaginatus associated with periapical cyst in the maxillary left lateral incisor.

Case Report:

Case 1

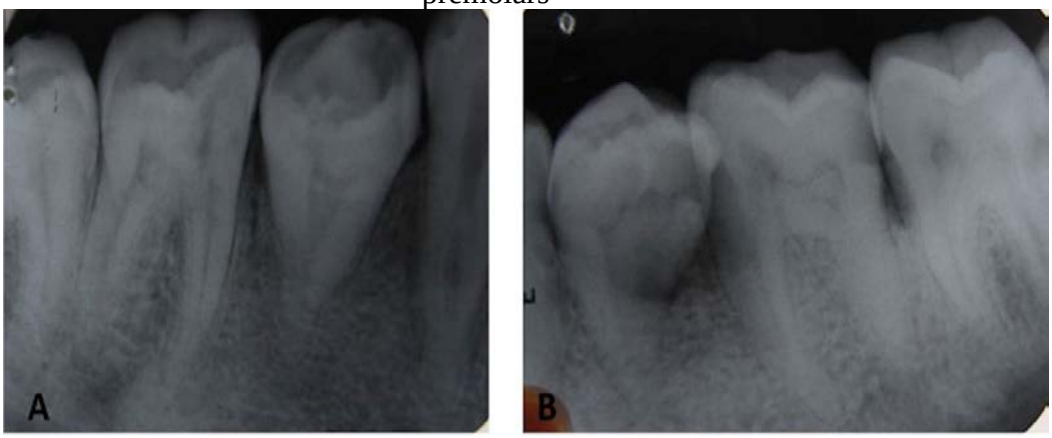
A 42 year- old male patient reported to the Department of Oral Medicine and Radiology for routine dental check-up. Patient's medical and past dental history was unremarkable. Intraoral examination revealed anatomical variation with respect to the mandibular second premolars. Mandibular left second premolar had cusp-like protrusions from the occlusal aspect with varied pattern resembling molar tooth. There was no visible caries associated with the same tooth and no tenderness on percussion. Mandibular right second premolar had tubercle on occlusal aspect. Based on the clinical presentation patient was diagnosed with dens evaginatus with respect to mandibular left and right second premolars (Figure 1). Intra-oral periapical radiograph (IOPAR) was advised for the same. IOPAR revealed lower second premolars to have altered crown morphology and increased width of the crown as that of the adjacent molars. The dentine showed an extension on to the occlusal surface in form of a tubercle. The roots also showed atypical morphology and length (Figure 2 A and B).

Na osnovu ovih nalaza, postavljena je konačna dijagnoza evaginacije zuba na levom i desnomdrugom premolaru donje vilice.

Based on these finding, final diagnosis of dens evaginatus with respect to mandibular left and right second premolars was arrived upon.

Slika 1. Intra oralna klinička fotografija pokazuje kvržice na donjim drugim premolarima

Figure 1. Intra-oral Clinical photograph showing tubercles on the lower second premolars



Slika 2 A i B. Intra olralna periapikalna radiografija koja pokazuje zahvaćenu krunicu i morfologiju korena zuba ukazuje na evaginaciju zuba

Figure 2 A and B. Intra-oral Periapical radiograph showing altered crown and root morphology suggestive of Dens evaginatus

Slučaj 2

Pacijent muškog pola star 30 godina javio se Odeljenju za oralnu medicinu i radiologiju zbog bola u gornjem prednjem zubu, koji je trajao nedelju dana. Bol je bio tup, kontinuiran i lokalizovan, bez olakšavajućih faktora. U istoriji bolesti pacijent je naveo i povremenu supuraciju u ovoj regiji. Medicinska i dentalna istorija bolesti pacijenta bila je bez osobenosti. Intraoralni pregled nije pokazao očigledne promene na levom lateralnom sekutiću gornje vilice.

Case 2

A 30 year- old male patient reported to the Department of Oral Medicine and Radiology for pain in the upper front tooth since 1 week. Pain was dull aching type, continuous and localised with no relieving factors. Patient also gave a history of pus discharge from the same area occasionally. Patient’s medical and past dental history was unremarkable. Intraoral examination revealed no apparent changes with respect to the maxillary left lateral incisor.

Na zubu nije bilo vidljive karijesne lezije, ali je bio prisutan bol zuba provociran blagom perkusijom. Zatražena je intraoralna periapikalna radiografija (IOPAR) levog lateralnog sekutića gornje vilice, koja je pokazala izmenjenu morfologiju zuba i dobro definisanu radiopaknu invaginaciju sa radiolucentnom longitudinalnom ekstenzijom od krunice do vrha korena zuba (Slika 3). Uočen je gubitak lamine dure na centralnim i lateralnim sekutićima gornje vilice. Uočena je i dobro definisana radiolucentna formacija veličine oko 1,5 cm x 1 cm u periapikalnoj regiji, koja se proteže od medijalnog dela levog centralnog sekutića gornje vilice do distalnog dela levog lateralnog sekutića gornje vilice. Na osnovu ovog nalaza, postavljena je konačna dijagnoza periapikalne sekundarne ciste od invaginacije levog lateralnog sekutića gornje vilice. Pacijent je upućen na apikotomiju sa endodontskim tretmanom zuba.

There was no visible caries associated with the same tooth but tenderness on percussion was elicited. Intra-oral periapical radiograph (IOPAR) with respect to maxillary left lateral incisor was advised, which revealed altered tooth morphology and a well-defined radiopaque invagination with a radiolucent interior extending longitudinally from the crown to the root apex (Figure 3). Loss of lamina dura was observed with respect to maxillary left central and lateral incisors. A well-defined radiolucency measuring around 1.5 X 1 cm in size was present in the periapical region extending from medial aspect of maxillary left central incisor to the distal aspect of maxillary left lateral incisor. Based on these findings, final diagnosis of periapical cyst secondary to dens invaginatus with respect to maxillary left lateral incisor was arrived upon. Patient was referred for apicectomy and endodontic treatment for the same.

Slika 3. Intra oralna periapikalna radiografija pokazuje periapikalnu cistu uzrokovanu invaginacijom levog lateralnog sekutića gornje vilice

Figure 3. Intra oral periapical radiograph showing periapical cyst due to dens invaginatus with respect to maxillary left lateral incisor

Diskusija

Poremećaji tokom razvoja zuba u fazi morfološke diferencijacije uzrokuju anomalije u obliku i veličini zuba. Evaginacija i invaginacija zuba spadaju u takve razvojne varijacije zuba[5].

Postoji mnogo sinonima za EZ, kao što su dodatna kvržica, okluzalno tuberkulisani premolar, Leongov premolar, evaginisani odontom i okluzalna perla.

Discussion

Disturbances during tooth development at the stage of morpho-differentiation have been related to abnormalities in the tooth shape and size. Dens evaginatus and dens invaginatus are such two developmental variations of tooth[5].

The many synonyms of DE are tuberculated cusp, accessory tubercle, occlusal tuberculated premolar, Leong's premolar, evaginatus odontoma and occlusal pearl.

Najčešća lokalizacija EZ je drugi premolar donje vilice, kao u slučaju pacijenta koga smo prikazali. Molari, očnjaci i sekutići takođe mogu biti zahvaćeni i promena se pojavljuje kao dopunska kvržica ili protuberancija na okluzalnoj površini. EZ se može javiti na jednom zubu ili dva zuba, odnosno obostrano. Izbačen rog pulpe prisutan je ispod tuberkuluma, stoga je ova kvržica često slaba tačka zuba[6]. Ostali problemi koji se vezuju za EZ su okluzalna interferncija, estetika, sklonost karijesu, atricija, akcidentalna fraktura kvržice i iritacija jezika tokom govora.

Levitan i sar[3]. su EZ podelili na 6 kategorija i to na osnovu faze infekcije pulpe, statusa zatvorenosti apeksa i posledičnog terapijskog protokola za lečenje istih. Tip I i II predstavljaju zube bez patologije pulpe i zrelim i nezrelim vrhom korena zuba. Tipovi III i IV predstavljaju zube sa inflamacijom pulpe, a tipovi V i VI zube sa nekrotičnom pulpom. Ukoliko vrh korena zuba nije zatvoren, kao kod tipova IV i VI, tada se aplikuje mineral-trioksi agregat, sa pulpotomijom ili bez pulpotomije; ako je vrh korena zuba zatvoren, kao kod tipova III i V, onda se savetuje endodontski tretman[3]. Slučaj našeg pacijenta može se okarakterisati kao tip I EZ.

Kod pacijenata sa EZ može se izvršiti selektivno brušenje, kako bi se izbegao prevremeni kontakt uz mogućnost postavljanja zalivača, kako bi se izvršila prevencija pojave karijesa. EZ bi mogla biti izazov za endodontsku terapiju u slučajevima kada je ona indikovana.U slučaju našeg pacijenta, ovakav tretman nije bio potreban, jer je pacijent bio asimptomatski.

Invaginacija zuba je anomalija sa kliničkom i radiografskom prezentacijom. Klinički može biti prisutna kao neobična morfologija krunice sa dubokom lingvalnom jamicom[7]. Lateralni sekutići gornje vilice najčešće su zahvaćeni IZ, kao što je to bilo i u slučaju našeg pacijenta[4]. Kada su zahvaćeni lateralni sekutići gornje vilice, incidencija se kreće u rasponu od 0,25% do 5,1%. Predhodne studije, koje su obuhvatile različite populacione grupe pokazale su to da IZ zahvata maksilarne lateralne sekutiće, centralne sekutiće, premolare i očnjake u opadajućem redosledu[8]. Guttal KS je istakao da se IZ retko javlja na zubima donje vilice[8].

U najvećem broju slučajeva, invaginacija zuba detektuje se slučajno, radigrafskim snimanjem[4]. U slučaju našeg pacijenta, dijagnoza je postavljena zbog prisutnih simptoma. Radiografski, gleđna invaginacija u kanal korena zuba uočava se kao radipakni obod, koji se pruža od cinguluma do kanala korena zuba[7].

Mandibular second premolars are usually affected in DE as in our case. Molars, canines, and incisors also can be affected and it appears as accessory cusp or a protuberance in the occlusal aspect. DE is observed in one or two teeth, on both sides. Projecting pulp horns are present below the tubercles; hence this tubercle is often the weakest spot of the tooth[6]. The other concerns associated with DE are occlusal interference, esthetics, caries susceptibility, attrition, accidental cuspal fracture and tongue irritation during speech.

Levitan et al.[3] have classified DE into6 categories based on the stage of pulpal infection, status of apex closure and the subsequent treatment protocol employed for the same[3]. Type 1 and 2 are teeth with no pulpal pathology and mature and immature apex respectively. Only conservative treatment is required for these teeth. Types 3 and 4 are teeth with inflamed pulp and types 5 and 6 are teeth with necrotic pulp. If the root apex is not closed as in type 4 and 6, then mineral trioxide aggregate with or without pulpotomy is done; if the apex is closed as in types 3 and 5, endodontic intervention is advised[3]. Our case can be classified as typeIDE.

In patients with DE selective grinding of the projection can be done to remove any premature contact and sealants can be placed to prevent caries. DE would pose as a challenge to endodontic therapy in cases where it is indicated. In our case treatment was not required as the patient was asymptomatic.

Dens invaginatus has variable clinical and radiographic presentations. Clinically it may present an unusual crown morphology with a deep lingual pit[7]. Maxillary lateral incisors are most susceptible for DI as in our case[4]. When the maxillary lateral incisors are affected, the frequency ranged from 0.25 to 5.1%. Previous studies among several population groups showed that DI affects maxillary lateral incisors, central incisors, premolars, and canines in decreasing order 8. Guttal KS reported that DI involving mandibular teeth is rare[8].

Dens invaginatus is detected as incidental finding on a radiograph in most of the cases[4]. Our case was diagnosed due to the presenting symptoms. Radiographically, the enamel invaginating into the root canal appears as a radiopaque rim, extending from the cingulum into the root canal. The invagination may manifest in different forms such as loop-like, pear-shaped and tooth within a tooth[7].

Oehler[9] je 1957. godine IZ podelio na osnovu dubine gleđne invaginacije. Kod invaginacije zuba tip I, gleđna invaginacija je ograničena na gornji deo zuba. Tip II pokazuje produženje invaginacije do gleđno-cementne granice. Kod tipa III invaginacija prodire u koren i stvara se dodatni otvor kanala na bočnoj strani zuba. Slučaj našeg pacijenta je okarakterisan kao IZ Tip III[10].

2D radiografije ne mogu dati dovoljne dijagnostičke informacije o složenosti anatomije invaginacije zuba[11]. CBCT obezbeđuje preciznu dijagnozu i tip IZ[12]. Invaginacija zuba može omogućiti ulaz mikroba[7]. Rana dijagnoza je od vitalnog značaja u obezbeđivanju preventivnog tretmana. Prikazani slučaj imao je periapikalnu patologiju zbog IZ.

Iako se ponekad evaginacija zuba može prevideti kod asimptomatskih pacijenata, kod ekstenzivnih invaginacija prisutan je povišeni rizik od nekroze pulpe i periapikalnih lezija, kao što je to bilo u slučaju našeg pacijenta. Ukoliko nema znakova infekcije pulpe, terapija nije potrebna. Ukoliko je potrebno izvršiti ekstenzivni endodontski tretman, on je obično otežan raznolikom morfologijom kanala korena zuba[13,14].

Zaključak

Prikazane su kliničke i radiografske karakteristike evaginacije premolara donje vilice i invaginacije levog lateralnog sekutića gornje vilice. Ovakve razvojne anomalije zuba zaslužuju klinički tretman, jer imaju velike šanse za ranu pojavu oboljenja pulpe.

Sukob interesa: NIL

Izvor finansiranja: NIL

Oehler[9] classified DI in 1957 based on the enamel invagination depth noticed radiographically[9]. In Type I enamel lined invagination restricted to the upper part of the tooth; type II exhibits elongation of the invagination ahead of cement-enamel junction. In type III invagination penetrates the root and an extra canal opening on lateral side of root is created. Our case is categorized as DI type III[10].

2D radiographs may not produce sufficient diagnostic information about complexity of the dens invaginatus anatomy[11]. CBCT allows for precise diagnosis and type of DI[12]. The invagination may allow entry of microbes[7]. Early diagnosis is vital to provide preventive treatment. Presenting case had periapical pathology due to DI.

Although dens invaginatus is sometimes overlooked in asymptomatic patients, with extensive invagination, there is a higher risk of pulpal necrosis and periapical pathology as was seen in our case. If there are no signs of pulp pathology, no treatment is required. If extensive endodontic treatment is required, it is often complicated due to the varied morphology of the root canal[13,14].

Conclusion

Clinical and radiographic features of dens evaginatus affecting the mandibular premolars and dens invaginatus involving the maxillary left lateral incisor is reported here. Such developmental anomalies of teeth deserve clinical importance, as high chances of early pulpal pathosis.

Sukob interesa: Ne postoji

Izvor finansiranja: Ne postoji

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SVOJSTVA I PRIMENA DENTALNIH POLIAMIDA

PROPERTIES AND APPLICATIONS OF DENTAL POLYAMIDES

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Sažetak

Uvod: *Ispitivanjem brojnih termoplastičnih i fleksibilnih materijala koji će estetski i funkcionalno prevazići akrilate koji se koriste za izradu zubnih proteza otkriveni su poliamidi kao materijali sa velikom potencijalnom primenom u stomatološkoj protetici.*
Cilj *rada je bio opis poliamidnih materijala za izradu parcijalnih zubnih proteza.*
Materijal i metode: *Glavni metodološki pristup ove studije bio je sistematska pretraga literature u dve elektronske baze podataka: Google Scholar i PubMed upotrebom prethodno definisanih kombinacija ključnih reči.*
Rezultati: *Prednost poliamidnih proteza je komfornost i lako privikavanje pacijenta, uz očuvana optimalna mehanička i fizička svojstva. Proteze su fleksibilne ali dovoljno rigidne da su otporne na udare i lom. Zbog male specifične težine poliamidne proteze su lake, izuzetno su tanke i ne smetaju pacijentu pri govoru. Odlična estetika obezbeđena je izborom boja i visokom translucencijom materijala što obezbeđuje da se meko tkivo providi kroz protezu i daje prirodniji izgled proteze u ustima pacijenta.*
Zaključak: *Poliamidi, za razliku od akrilata, ne sadrže rezidualni monomer, pa imaju zavidni stepen biokompatibilnosti. Mogu se izrađivati kao totalne ili parcijalne proteze, u kombinaciji sa Cr-Co skeletom ili krunama i mostovima.*

Ključne reči: *proteze, poliamidi*

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Abstract

Introduction: *By examining numerous thermoplastic and flexible materials that would aesthetically and functionally surpass acrylates used for the production of dental prostheses, polyamides were discovered as materials with great potential application in prosthodontics.*
The aim *of this study was to describe polyamide materials used for the production of partial dentures.*
Material and methods: *The main methodological approach of this study was a systematic search of the literature in two electronic databases: Google Scholar and PubMed using pre-defined keyword combinations.*
Results: *The advantage of polyamide dentures is the comfort and ease of accommodation of the patient, with preserved optimal mechanical and physical properties. The dentures are flexible but rigid enough to be resistant to shock and fractures. Due to their low specific weight, polyamide dentures are light, extremely thin and do not interrupt patient speech. Excellent aesthetics are provided by a high choice of working colors and high translucency of the material, which ensures that the soft tissue that's covered by the denture base or clasp is seen through the prosthesis and gives it a more natural appearance in the patient's mouth.*
Conslusion: *Polyamides, unlike acrylates, do not contain residual monomers, so they have an greater degree of biocompatibility. They can be used for the production of both complete and partial dentures, in combination with a Cr-Co skeleton, or crowns and bridges.*

Key words: *dentures, polyamides*

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Uvod

Gubitak zuba je funkcionalni i estetski problem, koji su ljudi kroz vekove rešavali izradom zubnih proteza od različitih materijala. Revolucionarno otkriće akrilatnih polimera tridesetih godina prošlog veka učinilo je pločaste zubne proteze učinkovitim, lakim za izradu i dostupnim svima. Nedostaci pločastih proteza izrađenih od akrilatnih polimera jesu gingivalni prenos pritiska žvakanja, česte frakture, alergija na rezidualni monomer, mehanička iritacija oralne sluzokože rigidnim proteznim sedlom i teško prilagođavanje podminiranim područjima, velika poroznost i adherentnost. Sastav akrilata je vremenom neznatno modifikovan, ali nedostaci u vidu krtosti, rigidnosti, pa samim tim i sklonosti lomu i trošenju, kao i otpuštanja nevezanih komponenti (rezidualnog monomera) nisu prevaziđeni[1,2]. Mehaničke karakteristike akrilata poboljšane su uvođenjem injekcione tehnike polimerizacije pod pritiskom, šezdesetih godina dvadesetog veka. Nova metoda je otvorilila put alternativnim materijalima, koji se mogu aplikovati na isti način.

U svrhu pronalaska materijala koji će estetski i funkcionalno prevazići akrilate, ispitivani su brojni termoplastični i fleksibilni materijali[3]. Materijali koji se danas koriste za izradu fleksibilnih proteza jesu poliamidi i na bazi su najlonske plastike kombinovane sa elastomernim smolama, koje im daju određenu fleksibilnost uz mogućnost ojačavanja vlaknima[4]. Proteze od dentalnih poliamida obezbeđuju optimalne fizičke i mehaničke karakteristike: čvrstoću, fleksibilnost, transparenciju, veliku otpornost na udar, stabilnu boju, nerastvorljivost i neporoznost, prebojavanje organskim bojama, dobru dimenzionalnu stabilnost, a obrađuju se i poliraju jednako lako kao akrilati.

Cilj rada bio je opis poliamidnih materijala za izradu parcijalnih zubnih proteza, uz korišćenje podataka elektronskih istraživačkih baza. Glavni metodološki pristup ove studije bila je pretraga u dve elektronske baze podataka: Google Scholar i PubMed. Kombinacije ključnih reči korišćenih za sistematsko traženje literaturedate su u tabeli 1.

Introduction

Tooth loss is a functional and aesthetic problem that people have solved over the centuries by making dentures using different materials. The revolutionary discovery of acrylic polymers in the 1930s made removable partial dentures effective, easy to make and accessible to all. Disadvantages of removable partial dentures made of acrylate polymers are: gingival transmission of masticatory pressure, frequent fractures, allergy to residual monomer, mechanical irritation of the oral mucosa with rigid denture saddle and difficult adjustment to undercut areas, high porosity and adherence. The chemical composition of acrylates has been slightly modified over time, but the disadvantages in the form of brittleness, rigidity, and thus the tendency to fracture and wear, as well as the release of unbound components (residual monomer) have not yet been overcome[1,2]. The mechanical properties of acrylates were improved by the introduction of injection molding polymerization techniques in the 1960s.This new method paved the way for alternative materials that can be applied in the same way.

In order to find a material that will aesthetically and functionally surpass acrylates, a number of thermoplastic and flexible materials have been tested[3]. The materials that are today in use of making flexible dentures are polyamides, and are based on nylon plastics combined with elastomeric resins that give them some flexibility with the possibility of fiber reinforcement[4]. Polyamide dentures provide optimal physical and mechanical characteristics: strength, flexibility, transparency, high impact resistance, stable color, insolubility and non-porosity, they are stained using organic stains, good dimensional stability, and are processed and polished as easily as acrylates.

The aim of this paper was to describe polyamide materials used for the production of partial dentures using data from scientific research databases. The main methodological approach of this study was to search scientific publication in two electronic databases: Google Scholar and PubMed. The keyword combinations used for the systematic literature search are given in Table 1.

Tabela 1. Kombinacija ključnih reči korišćenih za pretragu baza podataka naučnih časopisa
Table 1. Combination of keywords used to search databases of scientific journals

polyamides + dentistry
polyamides + dental use
polyamides + prosthodontics
polyamides + dentures

Hemijski sastav dentalnih poliamida

Poliamidi, koji se koriste u stomatologiji, nastaju kondenzacionom rekacijom između diamina NH2-(CH2)6-NH2 i dibazične kiseline, CO2H-(CH2)4-COOH[5,6]. Kristalna forma materijala omogućava njegovu slabu rastvorljivost, visoku otpornost na toplotu, visoku čvrstoću i duktilnost (Slika 1)[7,8]. Proteze izrađene od termoplastičnog poliamida su polufleksibilne ipolurigidne nadoknade. Njihove prednosti su, prvenstveno, veliki komfor i lako prilagođavanje pacijenata na nošenje proteze.

Dentalni poliamidi indikovani su u izradi totalnih i parcijalnih proteza injihovom podlaganju. Poliamidne proteze posebno sukorisne u slučajevima podminiranosti grebenova, kada nije preporučena hirurška intervencija. Lako se mogu uključiti u složene protetičke radove i kombinovati sa Co-Cr metalnim konstrukcijama i fiksnim protetičkim radovima[9,10].

Chemical composition of dental polyamides

Polyamides used in dentistry are formed by condensation reaction between diamine NH2-(CH2)6-NH2 and dibasic acid, CO2H-(CH2)4-COOH[5,6]. The crystalline form of the material gives it its poor solubility, high heat resistance, high strength and ductility (Figure 1)[7,8]. Dentures made of thermoplastic polyamides are semi-flexible and semi-rigid restorations. Their advantage is, primarily, in great comfort and easy getting used to this type of dentures for patients.

Dental polyamides are indicated in the production of complete and partial dentures and their lining. Polyamide dentures are especially useful in cases of ridge undercuts, when surgery is not recommended. They can be easily included in complex prosthodontic restorations and combined with Co-Cr metal constructions and fixed prosthodontic restorations[9,10].

Slika 1. Kristalna struktura poliamidnog materijala
Figure 1. Crystal structure of polyamide material

Fizičko-mehanička svojstva

Prednost poliamida, u odnosu na akrilatne materijale, jeste njihova otpornost na lom, zahvaljujući fleksibilnim svojstvima i velikom modulu savijanja, te se lako prilagođavaju podminiranim zonama usne duplje i delovima zuba ispod protetskog ekvatora, dajući parcijalnoj mobilnoj protezi optimalnu retenciju i stabilizaciju . Poliamidi pokazuju veću otpornost na udar i ponavljano naprezanje, kao i veću otpornost na habanje u odnosu na akrilate[11]. Poliamidne parcijalne proteze poseduju veću elastičnu memoriju i otpornost na deformaciju, uprkos cikličkom naprezanju[11,12]. Imaju veću mogućnost savijanja u granicama proporci-onalnosti i nizak modul elastičnosti[13,14]. Poliamidi suhigroskopni materijali, te stoga njihov sadržaj vlage varira u odnosu na uslove okoline. Poseduju nizak koeficijent linearne ekspanzije i galvanske provodljivosti[11,12].

Bez obzira na superiorna mehanička svojstva u odnosu na akrilate , ipak postoje ozbiljna ograničenja, kao što su poteškoće u obradi i dimenzionalna stabilnost[12,15]. Kako se poliamidi ne vezuju za hladno polimerizovane akrilate[16], reparaturei podlaganja su komplikovani i moraju se izvoditi u laboratoriji, mada se intezivno radi na unapređenju ovog svojstva[17,18]. Pored svih pozitivnih efekta, fleksibilnost poliamidnih materijala može dovesti do neravnomernog opterećenja potporne sluzokože i kosti , posebno mandibule[19,20].

Fleksibilnost poliamida, sem otpornosti na prelom, omogućava izradu kukica u boji gingive ili zuba, ugradnju atečmena, čineći parcijalne proteze, izrađene od ovog materijala, estetski mnogo boljim nadoknadama (non-metal clasp dentures). Takođe, moguće je u jednom komadu izraditi sve delove parcijalne proteze (kukice, baza, mala i velika spojnica), što im omogućava kompaktnost, funkcionalnost i trajnost[21]. Superfleksibilna svojstva poliamidnih smola, posebno dolaze do značaja kod slučajeva u kojima imamo podminirana mesta na preostalom bezubom grebenu, čineći stavljanje i skidanje proteze znatno lakšim za pacijenta[22-24].

Estetska svojstva i komfornost

Odličan estetski učinak poliamidnih parcijalnih proteza obezbeđuje visoka translucencija materijala, tako da se boja mekog tkiva providi kroz protezu, što daje

Physical and mechanical properties

The advantage of polyamides over acrylic materials is their resistance to fracture, thanks to their flexible properties and large bending modulus, and the fact that they easily adapt to undercut zones of the oral cavity and parts of teeth below the prosthetic equator, giving partial mobile dentures optimal retention and stabilization. Polyamides show higher impact resistance and repeated stress resistance as well as higher wear resistance compared to acrylates[11]. Polyamide partial dentures have greater elastic memory and resistance to deformation despite being under cyclic stress[11,12]. They have a greater ability to bend in proportional limits and low modulus of elasticity[13,14]. Polyamides are hygroscopic materials and thus its theirmoisture content varies in relation to environmental conditions. They have a low coefficient of linear expansion and galvanic conductivity[11,12].

Regardless of the superior mechanical properties compared to acrylates, there are still serious limitations for their use such as processing difficulties and dimensional stability[12,15]. As polyamides do not bind to cold polymerized acrylates[16], repairs and lining of polyamide dentures are complicated and must be performed in the laboratory, although intensive work is being done to improve this property[17,18]. In addition to its positive effect, the flexibility of polyamide materials can lead to uneven loading of the supporting mucosa and bone, especially the mandible[19,20].

The flexibility of polyamides, apart from their resistance to breakage, enables the making of clasps in the color of the gingiva or teeth, the use of attachments, making partial dentures made of this material aesthetically a much better esthetic denture solution (non-metal clasp dentures). Also, it is possible to make all parts of a partial denture (clasps, base, small and large joint) in one piece, which allows them to be compact, functional and durable[21]. The super flexibility of polyamide resins is especially important in cases where we have undercuts on the remaining edentulous ridge, making the insertion and removal of the denture much easier for the patient[22-24].

Aesthetic properties and comfort

The excellent aesthetic effect of polyamide partial dentures is provided by the high translucency of the material, so that the color of the soft tissue is seen through the

prirodniji izgled u ustima pacijenta. Za njihovo bojenje koriste sepigmenti koji su bez kadmijumovih i ostalih metalnih oksida[25].

S obziromna toda su male specifične težine, izrađuju se u veoma tankom sloju (0,5 mm), pa je navikavanje lako, a pacijentu ne smeteju pri govoru[11,12].

Kukice se ne izrađuju od metala, već od identičnog fleksibilnog materijala, što protezama, pored zavidne retencije, obezbeđuje i lep izgled (slika 2). U cilju postizanja boljeg estetskog učinka,poliamidne proteze mogu sekoristiti u kombinaciji sa skeletiranim protezama.

denture, which gives a more natural look in the patient's mouth. Pigments that are free of cadmium and other metal oxides are used for their dyeing[25].

Since they have low specific weights, they are made in a very thin layer (0.5 mm), so it is easy to get used to wearing them, and the patient is not disturbed when speaking[11,12].

The clasps are not made of metal, but from the same flexible material, which, in addition to enviable retention, gives the dentures a pleasing appearance (Figure 2). In order to achieve a better aesthetic effect, polyamide parts can be used in combination with metal partial dentures.

Slika 2. Transparentnost dentalnih poliamida
Figure 2. Transparency of dental polyamides

Biološka svojstva

Problem upotrebe akrilatnih materijala je i njihovo moguće alergijsko i toksično dejstvo, koje je sve češće, kako kod pacijenata tako i kod medicinskog osoblja koje njime rukuje[26,27]. Kao najčešći uzrok ove pojave navodi se nedovoljna polimerizacija samog materijala i oslobađanje rezidualnog monomera iz proteza izrađenih od akrilata. Kompletna polimerizacija obezbeđuje optimalnu biokompatibilnost poliamidnih proteza, tako da nema alergijskih reakcija.

Mala poroznost poliamidnog materijala sprečava akumulaciju mikroba, posebno kandide[28]. Poliamidni materijal za izradu baze proteze, kada se polira konvencionalnim laboratorijskim tehnikama, postao je glatkiji od akrilata, te se može, sa stanovišta adherentnosti biofilma, smatrati biološki prihvatljivijim[29].

Biological properties

The problem with the use of acrylic materials is their possible allergic and toxic effect, which is increasingly common in both patients and medical staff who handle itthem[26,27]. The most common cause of this phenomenon is insufficient polymerization of the material itself and the release of residual monomer from acrylate dentures. Complete polymerization of polyamide dentures ensures their optimal biocompatibility, and thus there are no allergic reactions.

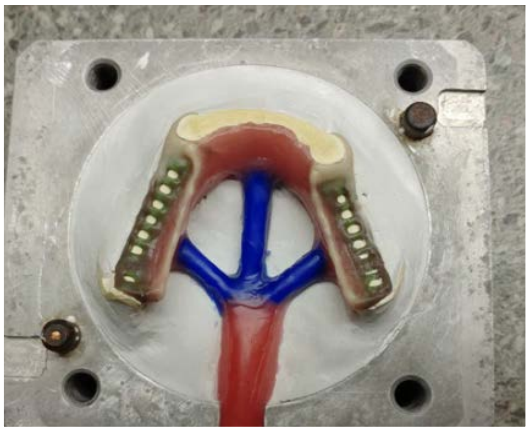
The low porosity of the polyamide material prevents the accumulation of microbes, especially candida[28]. By polishing polyamide materials for making the base of the denture using conventional laboratory techniques, the surface becomes smoother than when applying the same procedure to acrylate dentures, and can, from the point of biofilm adherence, be considered more biologically acceptable[29].

Način izrade poliamidnih proteza

Kliničke faze izrade proteza od poliamida podrazumevaju uzimanje anatomskog otiska i izlivanje radnog modela, izradu skeleta od poliamida, određivanje međuviličnih odnosa, postavu zuba i definitivnu izradu proteze. Razlika je u injekcionom sistemu, odnosno ubrizgavanju materijala u kalup, koji predstavlja negativ buduće nadoknade. Materijal se dobija u vidu solidnih pakovanja, koja se preoblikuju u posebnom sistemu, sa posebnim kivetama. Obrada materijala je laka, a poliranje je identično akrilatnim materijalima. Pojedine faze izrade poliamidnih proteza prikazane su na slikama od 3 do 6.

Methods of fabricating dentures using dental polyamides

The clinical phases of making polyamide dentures include taking an anatomical impression and casting the working model, making a polyamide skeleton, determining intermaxillary relations, tooth placement and definitive denture fabrication. The difference is in the use of an injection system, that is, the injection of the polyamide material into a mold, which represents the negative of the future edentulous compensation.The material is obtained in the form of solid packages that are reshaped in a special system, with the use of special flasks. The processing of the material is easy, and the polishing is identical to acrylic materials. The individual stages of making polyamide dentures are shown in Figures 3 to 6.



Slika 3. Ulaganje voštanog modela poliamidne proteze u kivetu
Figure 3. Insertion of the wax polyamide denture model into a flask

Slika 4. Aparatura za izadu poliamidnih proteza
Figure 4. The apparatus for production of polyamide dentures

Slika 5. Skelet parcijalne polamidne proteze
Figure 5. Skeleton of a partial polyamide denture

Slika 6. Poliamidni skelet i zagrižajni bedemi
Figure 6. Polyamide denture base and occlusal rims

Nedostaci poliamidnih pločastih proteza su gingivalni prenos pritiska žvakanja i loša retencija, ukoliko nema bilateralne podminiranosti vilica ili protetskog ekvatora (priprema zuba krunicama).

Detaljno upoznavanje kliničkih i laboratorijskih faza izrade proteza od poliamida pruža širi dijapazon mogućih izbora u kliničkoj praksi. Da li će i u kolikoj meri fleksibilne proteze zameniti pločaste akrilatne, između ostalog zavisi i od stepena informisanosti o njihovoj nameni i načinu izrade.

Zaključak

Dentalni poliamidi indikovani su za izradu estetskih fleksibilnih parcijalnih proteza, zavidnih mehaničko-fizičnih svojstava, idealnih za primenu kod pacijenata sa alergijom na monomer. Razvoj novih svojstava, kako poliamida , tako i drugih termoplastičnih masa , sigurno će omogućiti nove terapijske indikacije za primenu u terapiji pacijenta sa oštećenim zubima , parcijalnom krezubošću ili totalnom bezubošću.

The disadvantage of polyamide partial dentures is the gingival transmission of masticatory pressure, poor retention if there areno bilateral undercuts of the jaws or the prosthetic equator (restoring certain teeth with crowns).

Detailed introduction to clinical and laboratory stages of polyamides used in prosthodontics, provides a broad range of possible choices in clinical practice. Whether and to what extent flexible dentures will replace acrylic dentures, among other things, depends on the degree of information about their purpose and method of production.

Conclusion

Dental polyamides are indicated for the production of aesthetic flexible partial dentures, with enviable mechanical and physical properties, ideal for use in patients with monomer allergy. The development of new properties, both in polyamide and other thermoplastic materials, will certainly enable new therapeutic indications for use in the treatment of patients with damaged teeth, partial tooth loss or edentulism.

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ZNAČAJ BIOAEROSOLA U STOMATOLOŠKOJ PROTETICI

BIOAEROSOL IN DENTAL PROSTHODONTICS

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Sažetak

Uvod: *U toku mnogih stomatoloških intervencija, koje se sprovode primenom ručnih nasadnih instrumenata i pustera, stvara se aerosol, koji se mešanjem sa česticama različitih organskih komponenti iz usne duplje pacijenta pretvara u bioaerosol (BIOA). Kada se visoko turažna mašina pokrene vazduh postaje trenutno kontaminirani praktično obuhvata čitavu prostoriju. Zagađenje se registruje za sve vreme, kao i posle protetskog tretmana.*
BIOA stvoren za vreme protetskog rada sadrži različite bakterije, gljivice i viruse iz usne duplje pacijenta. Ti mikroorganizmi predstavljaju realnu opasnost po zdravstvene radnike i potencijalni su rizik za nastanak infekcije.
Najčešći patogeni uzročnici uključuju viruse prehlade i gripa, herpes viruse, kao i patogene streptokoke i stafilokoke. Zarazne bolesti, biosinoze, akutne toksične reakcije, alergije, atopijske bolesti, konjuktivitis, kontaktni dermatitis iinfekcije respiratornog sistema, pa čak i neke vrste raka, moguće su manifestacije neželjeno gdejstva BIOA.
Zaključak: *BIOA predstavlja potencijalnu opasnost za kontaminaciju vazduha, radnih površina i predmeta u stomatološkim ordinacijama.*
Direktna i indirektna izloženost BIOA celokupnog stomatološkog osoblja i pacijenata posebno dolazi do izražaja u uslovima COVID-a 19. Iako je nemoguće u potpunosti eliminisati rizik od negativnog dejstva BIOA, od velikog je značaja obratiti pažnju na sve mere prevencije koje mogu smanjiti verovatnoću kontaminacije.

Ključne reči*: bioaerosol, kontaminacija, stomatološko osoblje*

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Abstract

Introdution: *During many dental interventions, performed using handpiece instruments and pusters, an aerosol is created,which is converted into a bioaerosol (BIOA) by mixing with the particles of various organic components from the patient's oral cavity.When the high-speed mashine is started, the air becomes instantly contaminated and practically covers the entire room. Pollution is registered all the times, as well as after prosthetic treatment.*
BIOA created during prosthetic workcontains various bacteria, fungi and viruses from the patient's oral cavity. These microorganisms pose a real hazard to health workers and are a potential risk for infection.
The most common pathogens include influenza viruses, herpes viruses, as well as pathogenic streptococci and staphylococci. Infectious diseases, biosynosis, acute toxic reactions, allergies, atopic diseases, conjunctivitis, contact dermatitis, infections of the respiratory system, and even some types of cancer, are possible manifestations of side effects of BIOA.
Conclusion:*BIOA poses a potential danger to contamination of air, work surfaces and objects in dental offices.*
Direct and indirect exposure of dental staff and patients to BIOA is especially pronounced in the conditions of COVID 19. Although it is impossible to completely eliminate the risk of adverse effects of BIOA, it is important to pay attention to all prevention measures that can reduce the likelihood of contamination.

Key words: *bioaerosol, contamination, dental staff*

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Pojam i izvori bioaerosola

Veliki broj stomatoloških intervencija sprovodi se primenom ručnih nasadnih instrumenata (visokoturažne turbine, ultrazvučni skaleri, hirurški kolenjaci i nasadnici) i pustera, koji prilikom rada koriste vodu ili fiziološki rastvor pod pritiskom. Usled mešanja tečnosti i vazduha, stvara se i rasprskava u okolinu manja ili veća količina vodenih čestica (kapljica) u vidu aerosola. Tako sestvoreni aerosol mešasa česticama različitih organskih komponenti koje čine sadržaj usne duplje pacijentai pretvara u bioaerosol (BIOA). BIOA se definiše kao skupčesticaprečnika manjeg od 50 μм,koje sadrže mikroorganizme i imaju sposobnost dužeg vremenskog opstanka u vazduhu, pre nego se slegnu na površinu okoline[1,2]. Čestice u vazduhu počinju postepeno da isparavaju, što rezultira smanjenjem njihovog prečnika[1]. Čestice prečnika od1 μм do 5 μм nazivaju su jezgra kapljice, ačestice prečnika većeg od5 μм nazivaju se kapljice[3]. Što je prečnik čestica BIOA manji, predstavljaće veći rizik za terapeuta. Tako su čestice prečnika ispod 1 μм potencijalno najrizičnije, jer udisanjem aerosolizovanih mikroorganizama, vrlo lako prolaze alveole pluća, čiji je prečnik oko 5 μм i manji[4,5].Važno je napomenuti da se BIOA stvara i kada se nasadni instrumenti koriste bez vode. Harreli sar.[6] dokazali su da se kapljice BIOA formiraju u značajnoj količini od male količine tečnosti, koja je *in vitro* ostavljana kako bi simulirala pljuvačku.

Izvor BIOA u stomatološkim ordinacijama može biti oprema koja se svakodnevno koristi, to mogu biti i vodovodne cevi, preko biofilma kolonizovanih mikroorganizama nanjihovim unutrašnjim površinama[7,8,9]. Zdravstveni radnici, kao i pacijenti, kijanjem i kašljanjem, razgovorom i disanjem, raspršuju u okolinu čestice nazofaringealnog sekreta i pljuvačke pomešane sa mikroorganizmima. Kada neko kine napravi dva problema: prvo, izbaci veće kapljice, koje se rasprše na malu udaljenost i drugo, aerosolizovane čestice mikro-organizama duže ostaju u vazduhu. Na kraju, ventilacioni i klima uređaji mogu da utiču nastvaranje i distribuciju BIOA u širem vazdušnom prostoru stomatoloških ordinacija. Često se u filterima ovih uređaja, i pored redovnog čišćenja i održavanja, taložе i u dužem vremenskom periodu zadržavaju mikroorganizmi, koji se lako, aktiviranjem aparata, aerosolizuju u okolinu.

Concept and sources of bioaerosols

A large number of dental interventions are performed using handpiece instruments (high-speed turbines, ultrasonic scalers, surgical drills and low-speed handpieces) and air/water syringewhich use water or saline under pressure during operation. Due to the mixing of liquid and air, a smaller or larger amount of water particles (drops) in the form of an aerosol is created and dispersed into the environment. The aerosol thus created mixes with the particles of various organic components that make up the contents of the patient's oral cavity and turns it into a bioaerosol (BIOA). BIOA is defined as a set of particles with a diameter of less than 50 μm that contain microorganisms and have the ability to survive in the air for a long time, before settling on the surrounding surface[1, 2]. Particles in the air begin to gradually evaporate, resulting in a decrease in their diameter[1]. Particles with a diameter of 1 to 5 μm are called droplet nuclei, and larger than 5 μm are called droplets [3].The smaller particle diameter of the BIOA, the greater the risk for the therapist. Thus, particles with a diameter below 1 μm are potentially the most risky for inhalation of aerosolized microorganisms because they easily pass through the alveoli of the lungs with a diameter of about 5 μm and less[4,5]. It is important to note that BIOA are also created when handpieces are used without water.Harrel et al. [6], proved that BIOA droplets are formed in a significant amount from a small amount of fluid left *in vitro* to simulate saliva.

The source of BIOA in dental offices can be equipment that is used daily, as well as water pipes, through biofilm of colonized microorganisms on their inner surfaces[7, 8, 9]. Healthcare workers, as well as patients, by sneezing and coughing, talking and breathing, spray into the environment particles of nasopharyngeal secretion and saliva mixed with microorganisms. When someone sneezes he or she makes two problems. First, it expels larger droplets that are dispersed over a short distance, and second, aerosolized particles of microorganisms stay in the air longer. Finally, ventilation and air conditioners can influence the creation and distribution of BIOA in the wider airspace of dental offices. Often, despite regular cleaningand maintenance, microorganisms deposited and retainedin these devices and filters over a longer period of time easily get aerosolized into the environment by activating the appliance.

Sastav bioaerosola

Na sastav, koncentraciju i distribuciju BIOA utiču brojni faktori kao što su: vrsta i dužina trajanja stomatološkog tretmana, veličina i lokacija stomatološke ordinacije, broj stomatoloških jedinica, način lečenja, karakteristike i opšte zdravstveno stanje pacijenta, kao i sezonalnost godišnje doba[10].

BIOA stvoren za vreme stomatološkog tretmana sadrži različite saprofitne bakterije i gljivice iz usne duplje pacijenta, koje, kada promene sredinu i završe u sluzokoži respiratornog trakta zdravstvenog osoblja, mogu da ispolje patogena svojstva. Međutim, pacijenti mogu biti značajni nosioci i patogenih bakterija (*Staphylococcus aureus*) i virusa (*CoV-2, HIV, VHB iVHC*), koji, preko BIOA, predstavljaju visok rizik od kontaminacije. Dijametar bakterija (dužina od 0,3 μmdo 20 μm, prečnik od 0,5 μmdo 2,0 μm) i virusa (prečnik oko 0,1μм) izuzetno je mali. Pored mikroorganizama, BIOA sadrži i druge organske i neorganske komponente, kao što su: pljuvačka pacijenta, opiljci brušenih zuba, delovi amalgamskih i kompozitnih ispuna, dentalni plak, čestice ulja za podmazivanje rada nasadnih instrumenata, krv, nazofaringealni sekret, kao i ćelije mekog tkiva ledirane gingive gingivalnog sulkusa, koji se često povređuje prilikom subgingivalne preparacije zuba[1]. Sivakumar i sar.[11] navode da prilikom brušenja zuba rotacionim nasadnim instrumentima dolazi do oslobađanja brojnih čestica silicijuma i kompozitnih ispuna, kao i nusprodukata gorućih materija veličine od 2 μmdo 30 μм, što znači da spadaju u čestice opasnog opsega od 2,5 μм.

Za prikupljanje i identifikaciju mikro-organizama, danas se najčešće primenjuju dve metode: aktivna –Andersenovim uzorkom i pasivna –pomoću Petrijevih šolja sa agarima (soptični i krvni)[3]. Pumpom za uzorkovanje, vazduh iz okoline može sevrlo jednostavno usisati u ploče sa agarima. Hallier i sar.[12] ili se ploče sa agarima samo postavljaju na određenu udaljenost od izvora BIOA, tako da su izložene njegovom direktnom dejstvu[13].

Blizu izvora BIOA aerobne i anaerobne bakterije najčešće su podjednako zastupljene, dok se sa povećanjem udaljenosti taj odnos menja u korist aerobnih bakterija, što ukazuje na njihovo nedentalno poreklo[14].

Egusa[15] navodi da su patogeni mikro-organizmi (*Staphylococcus aureus, Actinobacterbaumanii, Capnocytop-hagaspecies, Actinobacillus species, Streptococcus Viridans, Morganellamorganii*)

Composition of bioaerosol

The composition, concentration and distribution of BIOA are influenced by numerous factors such as: type and duration of dental treatment, size and location of dental practice, number of dental units, method of treatment, characteristics and general health of the patient, as well as seasonality [10].

BIOA created during dental treatment contains various saprophytic bacteria and fungi from the patient's oral cavity, which when they change the environment and end up in the mucous membrane of the respiratory tract of health care staff, can exhibit pathogenic properties. However, patients can be significant carriers of both pathogenic bacteria (*Staphylococcus aureus*) and viruses (*CoV-2, HIV, VHB, and VHC*) that pose a high risk of contamination through BIOA. The diameter of bacteria (length 0.3 to 20 μm, diameter 0.5 to 2.0 μm) and viruses (diameter about 0.1 μm) is extremely small. In addition to microorganisms, BIOA also contains other organic and inorganic components such as: patient saliva,shavings of ground teeth, parts of amalgam and composite fillings, dental plaque, oil particles for lubrication of handpiece instruments, blood, nasopharyngeal secretions, as well as soft tissue cells of the led gingiva from gingival sulcus, which is often injured duringsubgingival tooth preparation[1]. Sivakumar et al. [11] state that when grinding teeth with rotary handpiece instruments, numerous particles of silicon and composite fillings are released, as well as by-products of combustible substances with a size of 2 to 30 μm, which means that they belong to particles with a dangerous range of 2.5 μm.

Today, two methods are most often used for collecting and identifying microorganisms: active, Andersen's sample and passive, using Petri dishes with agar (soptic and blood)[3]. With the sampling pump, environment air can be very easily sucked into agar plates [12]. Or the agar plates are only placed at a certain distance from the BIOA source, so that they are exposed to direct effects[13].

Near the source of BIOA, aerobic and anaerobic bacteria are usually equally represented, while with increasing distance, this ratio changes in favor of aerobic bacteria, which suggests their non-dental origin[14]. Egusa[15] states that pathogenic microorganisms (*Staphylococcus aureus, Actino-bacterbaumanii,Capnocytophaga species,*

pronađeni u otiscima nakon brušenja zuba i mogući su činioci BIOA. Iz uzoraka vode i vazduha izolovani su potencijalni uzročnici infekcije (*Pseudomonas, Micrococcus, Staphylococcus, Alternaria, Cladosporium, Penicillium, Aspergillus, Paecilomyces*)[16]. Ricci i sar. prikazuju pacijentkinju sa teškim oblikom respiratornog distresa izazvanog bakterijskom infekcijom (*Legionella pneumophila*), koja je bila zaražena u stomatološkoj ordinaciji za vreme tretmana visokoturažnom turbinom[17], dok Atlas i sar.[18] opisuju vrlo težak oblik pneumonije sa smrtnim ishodom kod stomatologa zaraženog preko BIOA (*Legionella dumoffi*).

Jedna opsežna metaanaliza, proistekla iz sedamnaest studija, analizirala je mikrobni sastav u stomatološkim klinikama i pri tom kumulativno identifikovala[19] bakterija (*Acinetobacter wolffii, Legionella spp, Pseudomonas aureus, Staphylococcus aureus, Staphylococcus capitis, Staphylococcus chromogenes, Micrococcus luteus, Diphteroids, Staphylococcus lentus, Staphylococcus haemolyticus, Micrococcus spp, Corynebacteria, Staphylococcus xylosus, Staphylococcus epidermidis, Micrococcus lylae, Bacillus spp, Staphylococcus fominis, Bacillus pumilus, Actinomycetes*) i [23] gljivice (*Alternaria alternate, Aspergillus flavus, Cladosporium cucumerinum, Geotrichum spp, Stemphylium spp, Alternaria brassicicola, Aspergillus fumigatus, Cladosporium ramotenellum, Monocillim indicum, Stemphylium spp, Alternaria citri, Aspergillus niger, Cladosporium sphaerospermum, Monodictys glauca, Ulocladium alternariae, Arthrinium phaesospermum, Botrytis spp, Cladosporium spp, Pencillium spp, Aspergillus, Cladosporium cladosporiodias, Cladosporium spongiosum, Penicillium chrysogenum*) poreklom iz vode, ljudske kože i usne duplje, koje se mogu naći u BIOA[3].

Ipak, smatra se da najveći deo BIOA (74% – 100%) čine gram pozitivne koke (*Staphylococcus epidermidis* i *Micrococcus*), dok ostatak predstavljaju gram pozitivne bakterije u obliku štapića i one koje stvaraju endospore, kao i neporozne bakterije (*Cladosporium i Penicillium*)[19].

Sumnja se da BIOA sadrži mnogo virusa. Međutim, podaci o unakrsnoj infekciji virusima u potpunosti nedostaju, verovatno zbog ograničenih dostupnih metoda za molekularno tipiziranje virusa[20].

Actinobacillus species, Streptococcus Viridans, Morganellamorganii) were found in the impressions after tooth preparation and are possible factors in BIOA. Potential causes of infection (*Pseudomonas, Micrococcus, Staphylococcus, Alternaria, Cladosporium, Penicillium, Aspergillus, Paecilomyces*) were isolated from water and air samples[16]. Ricci et al. show a patient with severe respiratory distress caused by a bacterial infection (*Legionella pneumophila*) that occurred in a dental office during treatment with a high-speed turbine[17], while Atlas et al.[18] describe a very severe form of fatal pneumonia in a dentist infected with BIOA (*Legionella dumoffi*).

One extensive meta-analysis, derived from seventeen studies, analyzed the microbial composition of dental clinics and cumulatively identified[19] bacteria (*Acinetobacterwolffii, Legionella spp, Pseudomonas aureus, Staphylococcus aureus, Staphylococcus capitis, Staphylococcus chromogenes, Micrococcus luteus, Diphteroids, Staphylococcus lentus, Staphylococcus haemolyticus, Micrococcus spp, Corynebacteria, Staphylococcus xylosus, Staphylococcus epidermidis, Micrococcus lylae, Bacillus spp, Staphylococcus fominis, Bacillus pumilus,Actinomycetes*) and[23] fungi (*Alternaria alternate, Aspergillusflavus, Cladosporiumcucumerinum, Geotrichumspp, Stemphyliumspp, Alternariabrassicicola, Aspergillusfumigatus, Cladosporium-ramotenellum, Monocillimindicum, Stemphyliumspp, Alternariacitri, Aspergillusniger, Cladosporiumsphaerospermum, Monodictysglauca, Ulocladiumalternariae, Arthriniumsphaerospermum, Botrytis spp, Cladosporiumspp, Pencilliumspp, Aspergillus, Cladosporiumcladosporiodias, Cladosporiumspongiosum, Penicilliumchrysogenum*) originating from water, human skin and oral cavity which can be found in BIOA[3].

However, most BIOAs (74-100%) are thought to be gram-positive cocci (*Staphylococcus epidermidis* and *Micrococcus*), while the remainder are gram-positive bacilli and endospore-forming bacteria as well as non-spore bacteria (*Cladosporium*and *Penicillium*)[19].

BIOA is suspected to contain many viruses. However, data on crossinfection with viruses are completely lacking, probably due to the limited methods available for molecular typing of viruses[20].

Koncentracija i rasprostranjenost

Kada se visokoturažna turbina pokrene, vazduh postaje trenutno kontaminiran i praktično obuhvata čitavu prostoriju[21]. Najveće zagađenje registruje se tokom samog protetskog tretmana, da bi se značajno smanjilo na kraju intervencije[22,23]. Na završetku radnog dana, kontaminacija vazduha smanjuje se za 50% – 70% u svim oblastima[24]. Zagađenje vazduha direktno je proporcionalno broju primljenih pacijenata u toku dana[25]. Rautemaa i sar.[21] navode kontaminaciju radne prostorije streptokokama i stafilokokama,na svim udaljenostima od mesta izvora BIOA, kada su se koristili nasadni instrumenti velike brzine u odnosu na stomatološke intervencije prilikom kojih se takvi instrumenti nisu koristili.

Najveća koncentracija BIOA uglavnom se registruje u glavnom području tretmana[11,24]. Dodavanje fluorescentnog kontrastnog sredstva u vodu,koju koristi nasadni instrument, pokazalo je najveću koncentraciju čestica BIOA u predelu glave stomatologa, zatim na nadlaktici, vratu i grudnom košu[25]. Kada govorimo o izloženosti lica stomatologa, najviše je kontaminirano područje nosa i najviše su kontaminirani unutrašnji uglovi očiju, dok je zigomatični predeo najmanje kontaminiran[26]. Interesantno je toda isti autori nisu uočili značajnu razliku u kontaminaciji desne i leve strani lica[25]. Sa povećanjem udaljenosti od mesta izvora BIOA, broj formiranih bakterijskih kolonija po kvadratnom centimetru postepeno sesmanjuje[27,28], ali se njihovo evidentno prisustvo može registrovati i na udaljenosti od 1 m do 1,5m[14,29]. Virusi su mnogo manji od bakterija i verovatno se znatno lakšeprenose u okolinu[20], dostižući veće udaljenosti od tačke svog izvora[14]. Čestice BIOA nekada mogu i satima da opstanu u vazduhu, predstavljajujući realnu opasnost po zdravstvene radnike i potencijalni rizikza nastanak infekcije. Na kretanje BIOA veliki uticaj može imati strujanje vazduha, prouzrokovano primenom ventilatora i klima uređaja za vreme stomatološkog tretmana, tako da se čestice mogu naći i u udaljenim područjima prostorije. Sleganje čestica BIOA na obližnje površine i kontaminacija istih predstavlja potencijalni rizik za prenos transmisionih bolesti (hepatitis B i C, AIDS)[25,30].

Concentration and distribution

When the high-speed turbine is started, the air becomes instantly contaminated and practically covers the entire room[21]. The greatest pollution is registered during the prosthetic treatment itself, to be significantly reduced at the end of intervention[22,23]. At the end of the working day, air contamination is reduced by 50-70% in all areas[24]. Air pollution is directly proportional to the number of patients admitted during the day[25]. Rautemaa et al.[21] indicate contamination of the working room, with streptococci and staphylococci, at all distances from the source site of BIOA when high-speed handpieces were used in relation to dental interventions when such instruments were not used.

The highest concentration of BIOA is mainly registered in the main treatment area[11,24]. The addition of fluorescent contrast agent to the water used by the handpiece showed the highest concentration of BIOA particles in the dentist's head, then on the upper arm, neck and chest[25]. When we talk about the exposure of the dentist's face, the area of the nose and the inner corners of the eyes are the most contaminated, while the zygomatic area is the least contaminated [26]. It is interesting that the same authors observed no significant difference in contamination of the right and left side of the face[25]. With increasing distance from the place of origin, BIOA number of formed bacterial colonies per square centimeter is gradually reduced[27,28], or their evident presence can be registered at a distance from 1 to 1.5 m[14,29]. Viruses are much smaller than bacteria and are probably much easier to transmit to the environment[20], reaching greater distances from their source[14]. BIOA particles can sometimes survive in the air for hours, posing a real hazard to health workers and a potential risk for infection.The movement of BIOA can be greatly influenced by the air flow caused by the use of fans and air conditioners during dental treatment, so that particles can be found in remote areas of the room. Sedimentation of BIOA particles on nearby surfaces and their contamination represent a potential risk for transmission of communicable diseases (hepatitis B and C, AIDS)[25,30].

Potencijalni problem

Kontaminacija i širenje infekcije u stomatološkoj ordinaciji posledica su: a) direktnog kontakta sa krvlju i pljuvačkom inficiranog pacijenta; b) kontakta sa instrumentima i radnim površinama, koje su neadekvatno očišćene, sterilisane i dezinfikovane i c) kontakta sa bioaerosolizovanim česticama prenetih vazduhom. Glavna ulazna mesta infekcije kod stomatologa, za vreme rada, su epiderm ruku, konjuktivalni epitel, oralni epitel, nazalni epitel, epitel gornjih disajnih puteva, epitel bronha i epitel plućnih alveola[31].

Usna duplja je anatomskiu vrlo bliskoj vezi sa gornjim partijama respiratornog sistema, tako da, osim pljuvačke, luči sekrete iz nosa, grla i disajnih puteva. Najčešći potencijalni patogeni uzročnici uključuju viruse prehlade i gripa, herpes viruse, virus SARS, kao i patogene streptokoke i stafilokoke[1]. Zato je BIOA realna pretnja po zdravlje stomatološkog osoblja i mogući je izvor infekcije[32,33]. Zarazne bolesti, biosinoze, akutne toksične reakcije, alergije, atopija i atopijske bolesti, interakcije BIOA sanebiološkim agensima, pa čak i neke vrste raka, moguće su manifestacije neželjenog dejstva BIOA[34]. Permanentni nadražaj respiratorne sluzokože može biti uvod za nastanak alergijskog rinitisa, bronhijalne astme i hroničnog bronhitisa. Ipak, najčešće se javljaju konjuktivitis, kontaktni dermatitis i infekcije respiratornog sistema[26,35,36]. Izloženost BIOA predstavlja veliku opasnost i za pacijente, naročito one sa imunokompromitovanim zdravljem[3,21].

Sa najnovijom pojavom korona virusa 2019-CoV-2 (0,06μм–0,14μм), koji izaziva COVID-19 i pratećeg respiratornog sindroma, opasnost od kontaminacije i širenja infekcije putem BIOA dobija planetarni značaj. Stomatološka profesija je posebno na udaru, tako da je u mnogim zemljama svedena na minimum i praktično prestala sa radom, osim u slučaju hitnih intervencija, koje su sprovođene uz rigorozne mere zaštite.

Mere prevencije

Hirurška maska

Hirurška maska imanizak nivo filtriranja i propustljivost od ≥2 μм. Nosi je stomatolog i služi za zaštitu pacijentaod lekara. Ne prijanja u potpunosti uz lice, tako da BIOA može da prođe oko maske.

Potential problem

Contamination and spread of infection in the dental office is a consequence of: a) direct contact with the blood and saliva of an infected patient, b) contact with instruments and work surfaces that are inadequately cleaned, sterilized and disinfected, and c) contact with bioaerolysed airborne particles. The main entry points for dental infection during treatment are the epidermis of the hand, the conjunctival epithelium, the oral epithelium, the nasal epithelium, the epithelium of the upper respiratory tract, the epithelium of the bronchi, and the epithelium of the pulmonary alveoli[31].

The oral cavity is anatomically very closely related to the upper parts of the respiratory system, so that, in addition to saliva, it secretes secretions from the nose, throat and respiratory tract. The most common potential pathogens include influenzaviruses, herpes viruses, SARS virus, as well as pathogenic streptococci and staphylococci[1]. Therefore, BIOA is a real threat to the health of dental staff and is a possible source of infection[32,33]. Infectious diseases, biosynosis, acute toxic reactions, allergies, atopy and atopic diseases, interactions of BIOA with non-biological agents, and even some types of cancer, are possible manifestations of side effects of BIOA[34].Permanent irritation of the respiratory mucosa may be an introduction to the development of allergic rhinitis, bronchial asthma and chronic bronchitis. However, conjunctivitis, contact dermatitis and infections of the respiratory system occur most often[26,35,36]. BIOA exposure is a major risk for patients, especially those with immunocompromised health[3,21].

With the latest appearance of coronaviruses 2019-CoV-2 (0.06-0.14μm) causing COVIDE-19 and related respiratory syndrome, the risk of contamination and the spread of infection through BIOA receives planetary importance. The dental profession is particularly vulnerable, so that in many countries it has been reduced to a minimum and practically stopped working, except for emergency interventions, which were carried out with rigorous protection measures.

Prevention measures

Surgical mask

A surgical mask has a low level of filtration and permeability of ≥2 μm. It is worn by a dentist and serves to protect the patient from the doctor.

Nije efikasna zaštita od bakterija i, naročito, virusa, jer sitne čestice mogu da prođu kroz materijal od kogaje napravljena. Ako je nosi zaraženi pacijent, maska sprečava kontaminaciju njegove okoline. Nosi se najduže od 3 do 8 sati, jer pri ekspirijumu nastaje kondenzacija vlage na unutrašnosti maske. Služi za jednokratnu upotrebu.

Rautemaai sar.[21] navode podatak da su maske bile statistički značajno bakterijski kontaminirane stvorenim BIOA tokom upotrebe rotirajućih nasadnih instrumenata velike brzine, nakon seanse lečenja od 40 minuta. Druga studija odnosi se na održivost patogenih mikroorganizama, poreklom iz BIOA, u materijalima za filtriranje, od kojih se izrađuje zaštitna oprema (maske) u zavisnosti od količine akumulirane vlage i tipa mikroorganizama. Najpostojanijim pokazala se bakterija *Staphylococcus* aureus, zatim gljivica *Candida albicansi bakterija Escherichia coli, dok su bakterija Bacillus subtilisi gljivica Aspergillus* niger pokazali najmanju postojanost[37]. To znači da posle stomatološkog tretmana hirurška maska, kao potencijalni izvor zaraze, mora adekvatno da se skine sa lica i odloži na odgovarajuće mesto.

Respirator

Respiratorje sličan maski, ali je drugačije dizajniran. Ima visoke nivoe filtriranja i propustljivosti. Nosi ga stomatolog i služi za zaštitu lekara od pacijenta. U potpunosti prijanja uz lice, smanjujući prolazak BIOA oko respiratora. Može biti saventilom i bez ventila. Ventil se otvara pri ekspirijumu i omogućava lakše disanje, stvaranje manja kondenzacije vlagei sprečava zamagljivanje naočara. Međutim, ako je lekar bolestan, vazduh pri ekspirijumu prolazi kroz ventil ka pacijentu, što nije dobro. Može biti za jednokratnu i višekratnu upotrebu (filter se menja). Vrste respiratora:

a) P1 (FFP1) –propustljivost >0.3μм;kapacitet filtera 80%; propustljivost sa strane 22%;

a) N95 (KN95)–propustljivost >0.3μм; kapacitet filtera 95%; propustljivost sa strane 8%;
b) P2 (FFP2)–propustljivost >0.3μм; kapacitet filtera 94%; propustljivost sa strane 8%;
c) N99 (FFP3)– propustljivost >0.023 μм; kapacitet filtera 99%; propustljivostsa strane 2%;
d) N100 (P3) - propustljivost >0.02μм; kapacitet filtera 99,95% (P3) i 99,97% (N100).

It does not adhere fully to the face so that BIOA can pass around the mask. It provides no effective protection against bacteria and viruses in particular, because small particles can pass through the material from which it is made. If the infected patient wears a mask, it prevents contamination of the environment. It is worn for a maximum of 3 to 8 hours because expiration causes moisture condensing on the inside of the mask. It is indicated for single use only.

Rautemaa et al.[21] state that the masks were statistically significantly bacterially contaminated with the generated BIOA during the use of high-speed handpieces after a 40 min. treatment session. Another study refers to the viability of pathogenic microorganisms, originating from BIOA, in filter materials from which protective equipment (masks) are made, depending on the amount of accumulated moisture and the type of microorganisms.*Staphylococcus aureus* proved to be the most persistent, followed by the fungus *Candida albicans* and bacterium *Escherichia coli*, while *Bacillus subtilis* and *Aspergillusniger* showed the lowest persistence[37]. This means that after dental treatment, the surgical mask, as a potential source of infection, must be properly removed from the face and disposed of in an appropriate place.

Respirator

A respirator is similar to a mask but designed differently. It has a high level of filtration and permeability. It is worn by a dentist and serves to protect the doctor from the patient. Fully adheres to the face reducing the passage of BIOA around the respirator. It can be with or without valves. The valve opens during expiration and allows easier breathing, less moisture condensation and prevents fogging of the glasses. However, if the doctor is sick, the air during expiration passes through the valve to the patient, which is not good. It can be disposable and reusable (filter changes). Types of respirators:

a) P1 (FFP1) - permeability ≥0.3 μm, filter capacity 80%, side permeability 22%,
b) N95 (KN95) - permeability ≥0.3 μm, filter capacity 95%, side permeability 8%,
c) P2 (FFP2) - permeability ≥0.3 μm, filter capacity 94%, side permeability 8%,
d) N99 (FFP3) - permeability ≥0.023 μm, filter capacity 99% and side permeability 2%,
e) N100 (P3) - permeability ≥0.02 μm, filter capacity 99.95% (P3) and 99.97% (N100).

O efikasnosti respiratora i hirurških maski u literaturi postoje različiti podaci. Dok jedna *in vitro* studija ukazuje na superiornost filtracije respiratora (94% – 96%) u odnosu na hirurške maske (90% – 92% i 85% – 86%)[38], druga ukazuje na njihovu obostranu sličnu i ograničenu efikasnost[39]. Radonovich i sar.[40] nisu našli statistički značajnu razliku potvrđenih slučajeva influence između zdravstvenih radnika koji su nosili respiratore N95 (8,2%) i onih koji su nosili hirurške maske (7,2%).Isto tako, infekcija gripom registrovana je kod 23,6% medicinskih sestara koje su nosile hirurške maske u odnosu na 22,9% medicinskih sestara koje su nosile respiratore, što, opet, nije imalo statističku značajnost[41]. Obe *in vivo* studije rađene su u bolničkim uslovima. Kada se radi o stomatološkom osoblju (zdravstvena profesija visokog rizika) u uslovima COVID-19 pandemije, čini se razložnim da se prilikom intervencija, pri kojima se stvara velika količina BIOA,savetuje nošenje respiratora N95 (FFP2). Ukoliko se sumnja ili je potvrđena CoV-2 infekcija, rade se samo hitne intervencije, izbegava se primena instrumenata koji proizvode BIOA, uz nošenje respiratora N99 (FFP3) ili N100 (P3) i sprovode sesve ostale visoke mere zaštite.

Kada posle stomatološkog postupka lekar skine zaštitnu masku/respirator i nastavi boravak u istoj prostoriji, izlaže se potencijalnom riziku od negativnog dejstva BIOA, koji i dalje perzistira u vazduhu ili se klima uređajem širi po prostoriji.

Zaštitna kapa i mantil (kecelja)

Kapa služi za zaštitu kose, čela i ušiju od negativnog dejstva BIOA, dok se mantil koristi prilikom dugotrajnih stomatoloških intervencija (brušenje većeg broja zuba).

Vizir i naočare

Oči i konjuktiva su manje izloženi riziku od BIOA u odnosu na usta i nos, preko kojih se čestice direktno udišu u pluća. Vizir čini mehaničku barijeru stvorenom BIOA,ali je otvoren sa strane. Naočare mogu biti bočno otvorene i sa gumenim vazdušnim zaptivačem, što je bolja opcija. Vizir i naočare se mogu međusobno kombinovati i nose se uz zaštitnu masku/respirator.

There are different data in the literatureabout the effectiveness of respirators and surgical masks. While one *in vitro* study indicates the superiority of respiratory filtration (94-96%) compared to surgical masks (90-92% and 85-86%)[38] another, indicates their mutual similar and limited efficiency[39]. Radonovich et al.[40] did not find a statistically significant difference in confirmed cases of influenza between healthcare workers who wore N95 respirators (8.2%) and those who wore surgical masks (7.2%). Also, influenza infection was registered in 23.6% of nurses wearing surgical masks compared to 22.9% of nurses wearing respirators, which again had no statistical significance[41]. Both *in vivo* studies were performed in a hospital setting. In the conditions of COVID-19 pandemic, it is advisablethat the dental professionals (high risk medical profession) wear the respirator N95 (FFP2) during intervention, when a large amount of BIOA is dispersed. If CoV-2 infection is suspected or confirmed, only emergency interventions are performed, the use of instruments that produce BIOA is avoided, along with wearing a N99 (FFP3) or N100 (P3) respirator and all other high protection measures.

Whenthe doctor removes the protective mask/respirator, and continues to stay in the same room after the dental procedure, he or she is exposed to the potential risk of the negative effects of BIOA, which still persists in the air or spreads through the room with air conditioning.

Protective cap and coat (apron)

The cap serves to protect hair, forehead and ears from the negative effects of BIOA, while the coat is used during long-term dental interventions (preparationof a large number of teeth).

Visor and glasses

The eyes and conjunctiva are less exposed to the risk of BIOA in relation to the mouth and nose through which the particles are inhaled directly into the lungs. The visor forms a mechanical barrier to created BIOA but is open from the side.Glasses can be laterally open and with a rubber seal, which is a better option. Visor and glasses can be combined with each other and worn with a protective mask/respirator.

Large volume evacuator (sauger)

The use of these devices contributes to the rapid removal of large amounts of liquid

Evakuator (sauger) velike zapremine

Upotreba ovih aparata doprinosi brzom uklanjanju veće količine tečnog sadržaja usne duplje, iz kog nastaje BIOA i smanjuje zagađenje okoline za preko 90%[42].

Hlorheksidin (0,12%)

Preproceduralno ispiranje usta antiseptičkim rastvorom značajno smanjuje bakterijsku kontaminaciju BIOA[43,44].

Koferdam

Koferdam mehanički izoluje usnu duplju i njen sadržaj od spoljne sredine[1]. Nepogodan je kada se vrši protetski tretman velikog broja zuba.

Dezinfekcija radnih površina i prostorije između tretmana pacijenata

Ova metoda smanjuje mogućnost kontaminacije nataloženim aerosolizovanim mikroorganizama, kako stomatološkog osoblja, tako i pacijenata[21].

Zaključak

BIOA, koji se stvara za vreme stomatološkog tretmana, sadrži različite mikroorganizme (virusi, bakterije, gljivice) i predstavlja potencijalnu opasnost za kontaminaciju vazduha, radnih površina i predmeta u stomatološkim ordinacijama. Direktna i indirektna izloženost BIOA celokupnog stomatološkog osobljai pacijenata posebno dolazi do izražaja u uslovima COVID-19 pandemije. Iako je nemoguće u potpunosti eliminisati rizik od negativnog dejstva BIOA, od velikog je značaja sprovođenje svih mere prevencije koje mogu smanjiti verovatnoću zaraze.

content of the oral cavity from which BIOA is formed and reduces environmental pollution by over 90%[42].

Chlorhexidine (0.12%)

Pre-procedural rinsing of the mouth with an antiseptic solution significantly reduces bacterial contamination with BIOA[43, 44].

Rubber dam–A

Rubber dam mechanically isolates the oral cavity and its contents from the external environment [1]. It is unsuitable when performing prosthetic treatment of a large number of teeth.

Disinfection of work surfaces and room between patients

The method reduces the possibility of contamination from deposited aerosolized microorganisms of both dental staff and patients[21].

Conclusion

BIOA that is created during dental treatment contains various microorganisms (viruses, bacteria, fungi) and poses a potential danger to contamination of air, work surfaces and objects in dental offices. Direct and indirect exposure of dental staff and patients to bioaerosols is especially pronounced in the conditions of COVID 19. Although it is impossible to completely eliminate the risk of adverse effects of BIOA, it is important to pay attention to all prevention measures that can reduce the likelihood of infection.

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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*

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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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UPUTSTVA AUTORIMA

Acta Stomatologica Naissi je naučni časopis Stomatološke klinike, Medicinskog fakulteta Univerziteta u Nišu, koji publikuje radove iz svih oblasti stomatologije i srodnih medicinskih grana.

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Svi predati radovi za štampanje moraju biti napisani na srpskom i engleskom jeziku. Apstrakti treba da budu pripremljeni pored srpskog i na preciznom i gramatički ispravnom engleskom jeziku (US engleski stil) (videti niže). Izbegavati korišćenje latinskih izraza; ako su potrebni staviti ih u zagrade.

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Strukturni apstrakti nisu potrebni kod uvodnika i pisma. Ispod apstrakta stoje ključne reči i to tri do pet. Ključne reči mogu biti uzete samo iz Medical Subjects Headings (MeSH).

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Svaka tabela sa jasnim naslovom na srpskom i engleskom treba da bude otkucana sa duplim proredom na odvojenom papiru. Obeležiti brojevima tabele jednu za drugom kako nailaze posle prvog navođenja u tekstu (obeležavaju se arapskim brojevima). Dati svakoj kolumni kratko ili skraćeno zaglavlje. Staviti objašnjenja u legendama svih nestandardnih skraćenica korišćenih u tabeli. Za jedinice i merenja vidi odeljak niže. Ne koristiti unutrašnje horizontalne i vertikalne linije. Staviti sve tabele na kraju vašeg fajla. Uvek odvojiti posebne kolumne upotrebom tabulatora, a ne upotrebom razmaknice, tabele moraju biti u tekst formatu.

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Priznanja i zahvalnosti prethode literaturi specificirajući generalnu podršku kao i odeljenje i ime šefa odeljenja, priznanja tehničkoj pomoći i konačno finansijskoj i materijalnoj pomoći. Navesti naziv i broj projekta, odnosno naziv programa u okviru koga je nastao članak i naziv institucije koja je finansirala projekat, u posebnoj napomeni pri dnu prve strane članka

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2. Organizacija kao autor: Federation Dentaire Internationale. Technical Report No. 28. Guidelines for antibiotic prophylaxis of infective endocarditis for dental patients with cardiovascular disease. Int Dent J 1987;37:235.

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Knjige ili druge monografije

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8. Novinski članak: Shaffer RA.Advances in chemistry are starting to unlock mysteries of the brain. The Washington Post 1989 Ang 7; Sect. A:2 (col. 5).

Reference-elektronski citati

9. On line časopisi bez podataka o volumenu i strani. Berlin JA , Antman EM. Advantages and limitations of metaanalytic regressions of clinical trials data. Online J Curr Clin Trials (serial online). June 4;doc 134. Accessed July 20, 2000.

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ACKNOWLEDGEMENTS

Acknowledgements are positioned before the reference list specifying general support by department chairman, acknowledgements of technical as well as financial and material support. Acknowledgement includes the title and number of the project, i.e. the title of the programme within which the article was composed and the title of the institution funding the project; it should be written as a separate notification at the bottom of the first page of the article.

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2. Corporate author: Federation Dentaire Internationale. Technical Report No.28. Guidelines for antibiotic prophylaxis of infective endocarditis for dental patients with cardiovascular disease. Int Dent J 1987;37:235.

3. No author given: Coffee drinking and cancer of the pancreas (editorial). BMJ 1981;283:628

4. Volume with supplement: Magni R, Rossoni G, Berti R, BN52021 protect guinea pig from heart anaphylaxis. Pharmacol Res Commun 1988; 20 Suppl 5:75–8.

Books or other monographs:

5. Personal author(s): Tullman JJ, Redding SW. Systemic Disease in Dental Treatment. St. Louis: The CV Mosby Company; 1983:1–5.

6. Chapter in a book: Rees TD. Dental management of the medically compromised patient. In: McDonald RE, Hurt WC, Gilmore HW, Middleton RA, eds. Current Therapy in Dentistry, vol. 7. St. Louis: The CV Mosby Company; 1980:3–7.

7. Dissertations and thesis: Teerakapong A. Langerhans Cells in human periodontally healthy and diseased gingiva. (Thesis). Houston, TX: University of Texas; 1987.92 p.

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8. Newspaper article: Shaffer RA.Advances in chemistry are starting to unlock mysteries of the brain. The Washington Post 1989 Ang 7; Sect.A:2 (col. 5).

References – electronic quotations:

9. Online journals without volume and page information. Berlin JA , Antman EM. Advantages and limitations of metaanalytic regressions of clinical trials data. Online J Curr Clin Trials (serial online). June 4; doc 134. Accessed July 20, 2000.

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